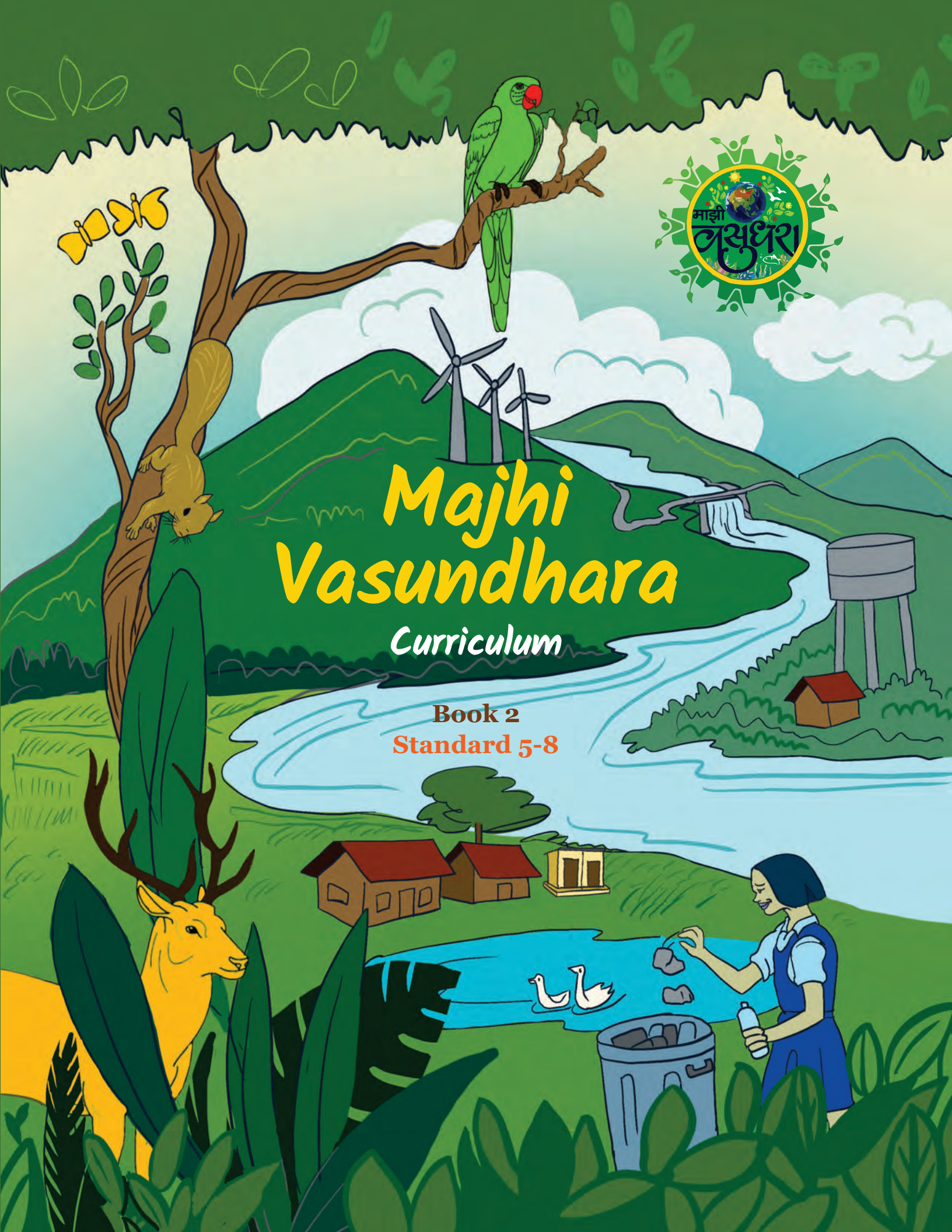




Majhi Vasundhara

Curriculum

Book 2
Standard 5-8





सत्यमेव जयते



Government of
Maharashtra



Majhi Vasundhara

Curriculum

This environment curriculum is developed with a focus on practical and joyful learning to develop 'green habits' in the students of Grade 1st to Grade 8th

with an inspiration and encouragement from

Honourable Minister, Environment and Tourism, Government of Maharashtra

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Under the Guidance of

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Core Group and Working Group for development of Majhi Vasundhara (MV) Curriculum were formed by the Department of Environment and Climate Change, Government of Maharashtra, as per its Letter No. Mission 2021/CR-34/TC 1 dated 23rd February 2021.

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Designing

Watershed Films

Introduction

Under the guidance of Hon'ble Minister of Environment and Tourism, Government of Maharashtra, the Department of Environment and Climate Change (DoE-CC) has launched 'Majhi Vasundhara' (My Earth) based on the theme of five elements of nature- Bhumi (Earth), Jala (Water), Vayu (Air), Agni (Energy), Akash (Enhancement), aims to support the state in the implementation of climate change mitigation and adaptation measures. To achieve this, Majhi Vasundhara (MV) targets to engage stakeholders from different sectors and age groups through six initiatives. 'Majhi Vasundhara- Curriculum' is one of the six initiatives under 'Majhi Vasundhara' that aims to inculcate green values in future generations of Maharashtra by developing environment curriculum for school going children.

The existing state curriculum focuses on the basic sciences and its applications whilst the 'MV Curriculum' particularly sheds light on environment education for standards 1st to 8th. Environmental issues and climate change are application-based subjects that require mindfulness from young age. These miscellaneous issues are global to local that necessitate comprehensive understanding of the topic along with traditional and local knowledge. As a result, MV Curriculum is taking roots with manifold projects and activities to develop environmental system understanding among the children. Active learning pedagogy through this curriculum booklet will help in imbibing the subject knowledge as life skills rather than mere information. The four themes of this Curriculum are:

- a. Biodiversity Conservation**
- b. Solid Waste Management and Personal & Community Health**
- c. Water Resource Management**
- d. Energy, Air Pollution and Climate Change**

The process of development of this activity-based learning curriculum was initiated on 3rd December 2020 in the august presence of Hon'ble Minister of Environment and Tourism, Government of Maharashtra, the partner organisations including United Nations Children's Fund (UNICEF) Maharashtra, Regional Centre for Urban and Environmental Studies (RCUES) of All India Institute of Local Self Government (AIILSG), Mumbai and the domain experts. Core Group- to conceptualise and structure the MV Curriculum and Working Group – to draft the lesson plans were formed, represented by the DoE-CC, GoM, its partner organisations and the domain experts.

This curriculum has been developed in the form of activity-based lesson plans. The process of development of 'MV Curriculum' involved the stages of – assessment of existing curriculum, development of framework for the lesson plans and development of the lesson plans, complimenting the existing curriculum. The focus of the lesson plans has been on learning pedagogy and enhancing cognitive skills of the students.

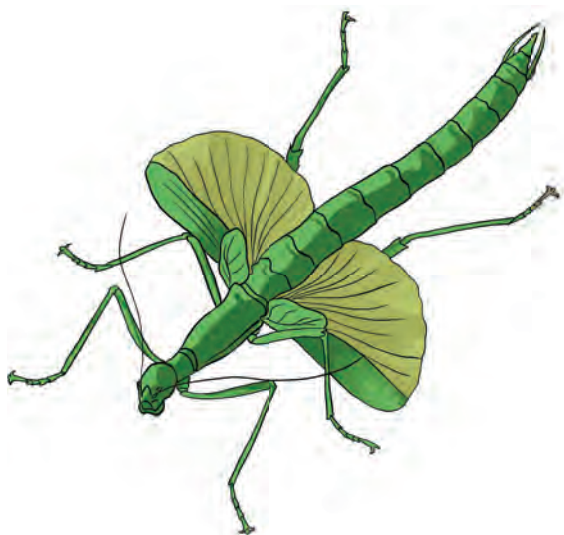
Every lesson plan has been structured to incorporate Activity or Project Plan with a focus on- concept, key questions to address, curriculum links, activity timing and duration, material and preparation needed, approach, method and the learning outcome/ green habit to be inculcated. It also includes frequently asked questions (FAQs), references and additional resources that can be used as guide notes by the teachers as well as children, while implementing the activities.

The 'MV Curriculum' is developed to enhance existing school curriculum and is being handed over to the School Education and Sports Department, Government of Maharashtra for appropriate adoption.

This book (MV Curriculum- Part II) presents the lesson plans for the Grades 5th to 8th. While Part-I of the book presents the lesson plans for the Grades 1st to 4th.

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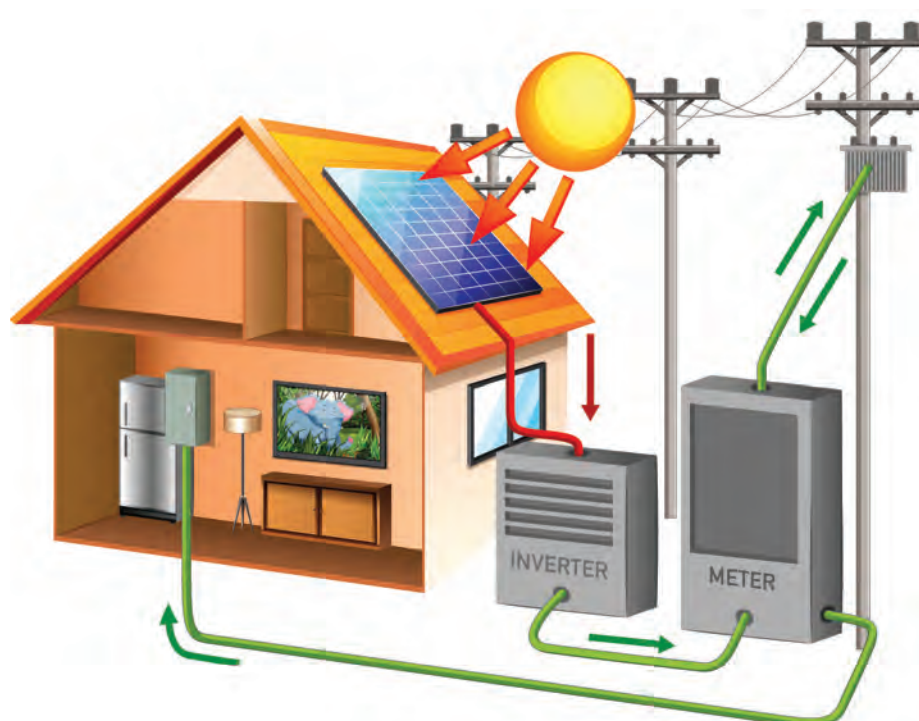
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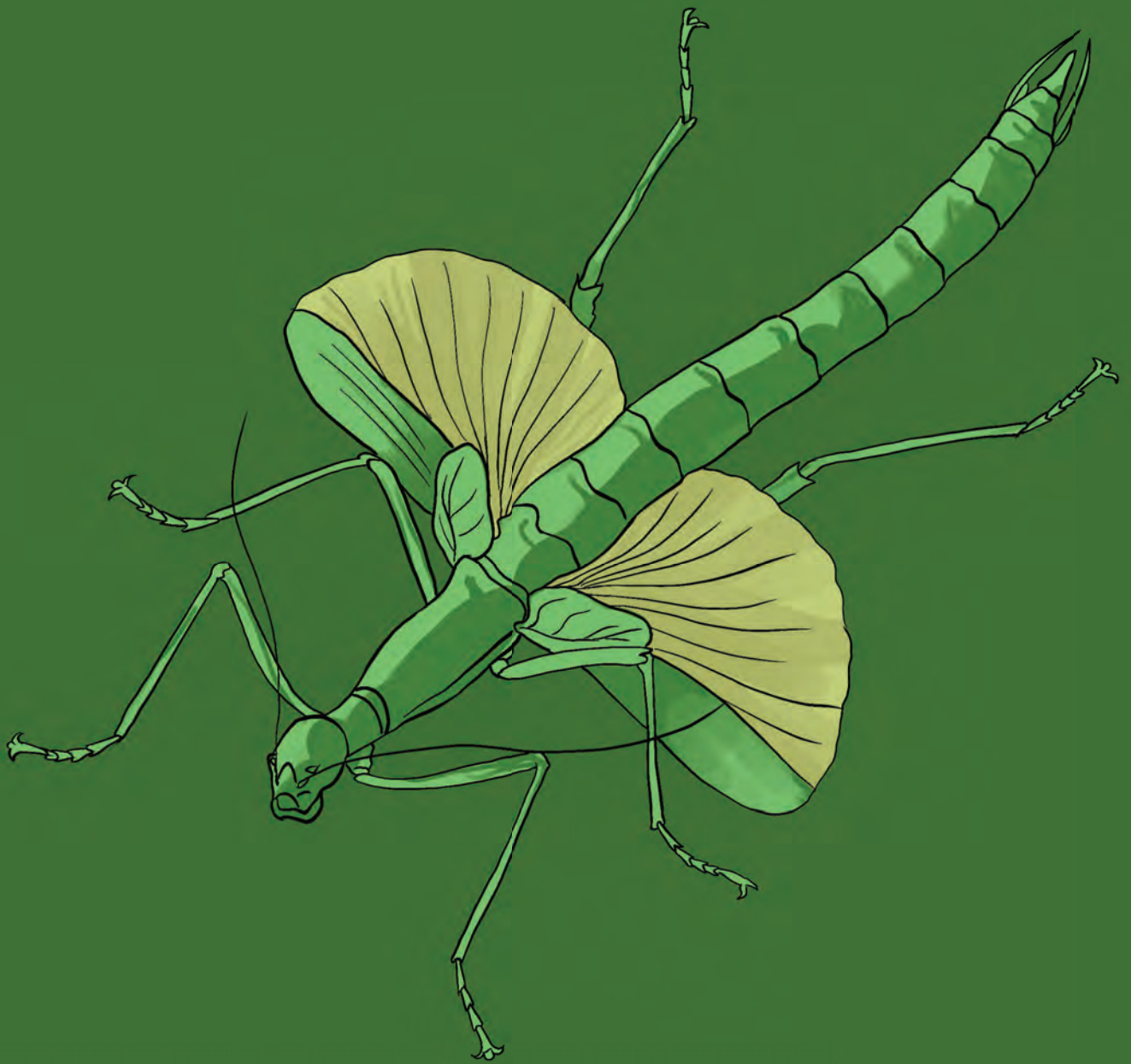
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Section 1:

Biodiversity

1.1. Introduction

1.1.1. Overview

We are a part of biodiversity, the variety of life. We depend on the benefits from nature, for our basic needs of food and clothing, for a large proportion of livelihoods and the economy, and for our spiritual and cultural well-being.

The biosphere and its myriad constituent life forms have a functional role of cycling nutrients, chemicals, materials, waste and energy through the Earth system. The biosphere removes pollutants from the water and air, regulates the climate, and nourishes soils.

Biodiversity helps to adapt to the changing planetary conditions.

Unfortunately, biodiversity degradation and loss interfere with these functions. Helping students learn about biodiversity and the need for its conservation is among the most needed actions today.

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

1.1.2. Rationale and expected learning outcomes

It is expected that school students would understand what biodiversity is and how biodiversity sustains our life; further, what is causing the destruction and degradation of biodiversity. Importantly, it is expected that teachers and students know what is being done, and what more needs to be done to conserve biodiversity.

The expected learning outcomes for Standards 5 to 8 are:

- Appreciate wild and domesticated biodiversity.
- Recognize different ecosystem services provided by biodiversity.
- Understand that human lifestyles, production and consumption have an impact on the environment.

- Understand the threats to biodiversity.
- Develop skills to study biodiversity.
- Recognize fake news and the problems it can cause.
- Appreciate natural heritage at various levels and encouraging its protection.
- Understand the need for conservation of biodiversity, and develop skills and attitudes for the same.
- An idea about the richness of biodiversity in the oceans as compared to land based biodiversity is provided.
- A number and range of activities is included in the textbook itself.

Opportunities for co-curricular programmes

- Real life explorations in and around the school, which would complement the numerous images and descriptions in the textbooks.
- Integrative activities that help build an understanding of ecosystems, ecological interrelationships, and social-ecological systems.
- Content and activities on threats to biodiversity.
- The need for biodiversity conservation and practical projects.

Topics

Students often have a ready interest in activities related to animals, birds, small experiments and explorations in patches of wilderness around the school and neighbourhood. The content, exercises, examples, related to the theme 'Biodiversity' are plentiful and very creatively included in the textbooks of almost all the subjects from standards 1 to 8.

Strengths

- There is a considerable volume of content on biodiversity in Bal Bharati textbooks for standards 1 to 8, across almost all subjects.
- In the higher classes, the treatment is of introducing a variety of living things and interrelationships of humans with other species. The species introduced include those that the students are likely to see around them, as well as species from other regions. The portrayal is both scientific as well as creative and whimsical.
- Habitats and ecosystems are also introduced from an early age, and are addressed in more detail in the higher classes.
- A range of benefits that humans derive are introduced, including, food, fibre, raw materials, cultural and recreation values etc

Keeping in view the strengths of the textbook content and opportunities for co-curricular leaning about Biodiversity, certain key topics are selected for the preparation of activities and projects. The selection has been done given the importance of the theme, and the possibility of complementing the existing rich curricular content.

The critical topics suggested to be covered through co-curricular activities, complementary to the core syllabus and textbook contents are:

1. Behaviour, characteristics, interdependence, interrelationships.
2. Benefits - aesthetic benefits; cultural, spiritual; provisioning (food, fibre, medicines, timber); supporting role (nutrient cycling); economic value, livelihoods.

3. Conservation by communities; government and laws.
 4. Diversity – Agrobiodiversity; ecosystems, species, varietal.
 5. Habitats and ecoregions.
 6. Seasons - weather, natural cycles.
 7. Threats to biodiversity- climate change, destruction, land conversion, fire, poaching, pollution.
 8. Other.
- This list is suggested based on two perspectives:
- Most important topics in the domain of biodiversity that the author consider that students must be exposed to, considering the status of this area of sustainable development, as well as considering the age-appropriateness of these topics.
 - The need to complement the existing curriculum in relation to the theme, identified through a review of the textbooks for standards 1 to 8.

1.1.3. Activity Framework

Curriculum-mapped Activity and Project Plan for Biodiversity

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities / Projects
1	Introduction to Biodiversity	Standard 1 Marathi, Math, English Standard 2 Maths, English Standard 3 EVS, Marathi Standard 6 Hindi, Pla do and learn Standard 7 General Science Standard 8 Science (Ecosystems)	Understand and observe various types of leaves and tree bark, understand the purpose served by modifications in leaves	Std 6 My Bird book
2	Living things around us	Standard 1 Marathi, Math, English Standard 2 Maths, English Standard 5 - Marathi Standard 6 Science	Awareness of living things around us, their colours, and parts, calls, habits and habitats	Std 7 Seasons of Trees
3	Co-existence with wildlife	Standard 2, 3 and 4 - English, Marathi, Math	Conserve and co-exist with wildlife	Std 3 Animals in our lives

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities / Projects
4	Food	Standard 4, 5 - EVS	To observe and appreciate nature and express oneself	Std 4 Poet in every child
5	Adaptation	Standard 7 - General Science	How animals have adapted to survive in the environment	Std 6 Now you see me, now you don't
8	Studying biodiversity	Standard 6 Science	Morphology of plants and animals Quadrats and transects to study biodiversity	Std 5 Seed to seed – Project Std 6 The height of it Std 8 Shivarferi and Measuring the Biodiversity around us
9	Ecosystem Services	Standard 2 - English Bal Bharati Standard 5 - Marathi Sugam Bharati Standard 6 Geography Standard 8 Science	Different ecosystem services provided by biodiversity	Std 8 Ecosystem Services: Much more than food and wood
10	Threats to Biodiversity	Standard 6 – Science Standard 6 Geography Standard 8 - Science	Awareness on threats to biodiversity and fake news	Std 8 Guess Who Is Threatened? Biodiversity and Fake News
11	Conservation of biodiversity	Standard 3 Marathi, English Standard 8 Marathi	Developing a plant nursery, planting trees Developing empathy Developing practical skills for conservation	Std 5 Seed to seed - Project Std 6 Making Bird Baths - Project Std 7 School Nursery and plantation - Project Std 8 Shivar Feri and Measuring the Biodiversity around Us Making safer herbal pesticides - Project

1.2. Activities / Projects

Std.
5

1.2.1. Our Natural Heritage

Level/ Class: 3 to 8

Curriculum links: Marathi
Bal Bharati cover page has a picture of the state bird of Maharashtra

Activity duration: 45 minutes inside classroom and longer for various group projects and school exhibition

Activity timing: Any time, in case of exhibition preferably avoiding rainy season

Materials needed: Poster papers, pen, pencil, small storage boxes/pouches, any locally available exhibition set up

Approach: Classroom session, further built up with Field Visit and Exhibition

Topic: Biodiversity

Concept:

Heritage sites are generally understood as man made structures such as forts, old houses and temples or archaeological sites. Maharashtra has many such heritage sites such as Salher-Mulher forts in Nashik dist., Manikgad fort in Chandrapur dist., Ambabai temple in Kolhapur, Phule Wada in Pune, Ajanta and Verul Caves in Aurangabad dist., Prakashe archaeological site in Nandurbar dist. But heritage, which is something valuable that is inherited from generation to generation, also includes natural elements such as hills, rock formations, forests, sacred groves, waterbodies, a traditional variety of crop or animal breed and so on. Often this heritage is represented by various symbols such as State Tree, State Animal, State Butterfly and so on. Familiarizing about these state symbols and exploring local natural heritage and awareness of them can strengthen protection and conservation of it.

Aims:

To appreciate natural heritage at various levels and encouraging its protection.

Key Questions to address:

- What is natural heritage?
- How can we protect them?

Preparation

- Decide the scope of the activity and accordingly discuss it with all concerned teachers, head teacher about the plan.
- In case an exhibition is planned, then preparations would be needed for site, display, announcement to parents and local community and any guests to be invited; do invite local news reporters/media persons to cover the exhibition.

Method/Guide:

Level 1

- Ask students if they know about State Flower, State Tree, State Animal, State Bird, State Butterfly of Maharashtra?
- Have they seen any of them? Do any of them exist in their neighbourhood?
- Show them the poster like one below, and ask students to come up with unique features, significance behind choosing them as state symbols and list them on board.
- Now ask them to nominate such natural symbols to be elected for your school and reasons behind it.
- Conduct a poll to choose the School Tree, School Bird, School Butterfly, School Animal, School Pet and any other school mascot that students may come up with!
- This activity can be planned at class level to start with and in all classes to finalize School Symbols.
- This activity can be built up at Village, Taluka, District levels as well in a democratic way.



Level 2

- Form students' groups to do projects on following ideas in age-appropriate manner and following broad framework for study and presentation which include minimum.
 - Heritage – location
 - Key Significance
 - Popular Stories associated with these heritages
 - What are the threats and why to protect?
 - How can we protect it?/contribute to its protection?
- Students can make illustrations, paintings, take/use available photos for poster presentation on their project topics

- Discuss with students about different methods to find information - from books, internet, by talking with knowledgeable people.
- Discuss importance and ways of verifying information received from one source by cross checking with other sources or by asking logical questions.

- **Project Topics**

- Sahyadri (Western Ghats) – A World Natural Heritage Site by UNESCO.
- Sacred Groves.
- Ramsar Sites in Maharashtra - Wetlands of Global Importance.
- Fossil Sites in Maharashtra.
- Plants, Animals, Trees, Food Recipes, Rocks-minerals which are either only found in Maharashtra or part of State's identity.
- Neighbourhood Natural Heritage.
- Plants, Animals, Trees, Food Resources and Recipes, Rocks-minerals, fish, Varieties, water bodies in our village/ neighbourhood. Ask students to collect display samples of some of these aspects such as local varieties of rice or Jowar or beans, rock and soil types, wild food plants and so on.



Blue Mormon Butterfly



Fossil of Ammonite



Level 3

- Plan, design and organize an exhibition on the theme of 'Our Collective Natural Heritage' with sections on national, state level heritage as well local heritage. Ensure that students are involved in all the stages of planning and execution and allocated various responsibilities.
- Ask students to prepare posters and display material and present it during the exhibition.
- You can also organize a heritage walk along with this exhibition.

Learning outcomes:

- Students learn about the natural heritage, significance and types.
- Students learn about how to communicate and organize exhibition.

Green habit:

Caring for natural heritage.

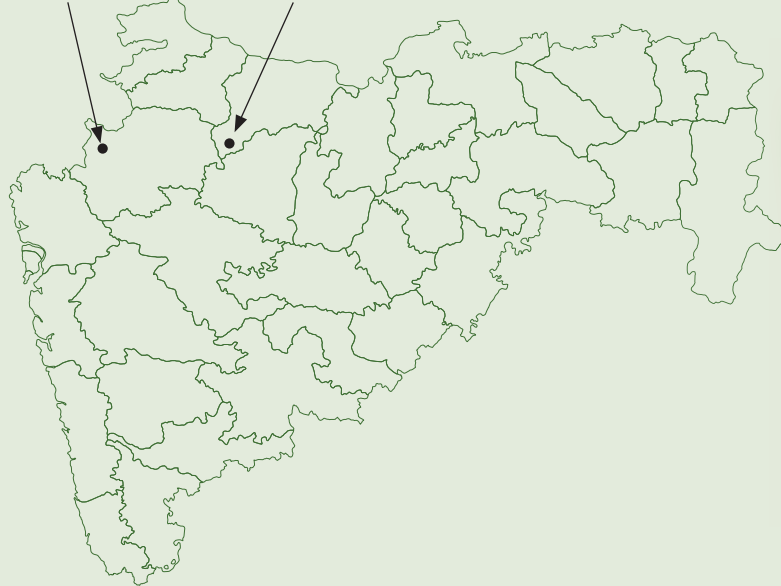
FAQs

Q – What are Ramsar Sites in Maharashtra?

A – Lonar Lake and Nandur Madhmeshwar Bird Sanctuary are 2 Ramsar Sites in Maharashtra.

Nandur
Madhmeshwar

Lonar



Lonar Lake



Nandur Madhmeshwar
Bird Sanctuary



1.2.2. What is on my plate?

Level/ Class: 5 to 8

Curriculum links: Science, Environmental Education, Language

Activity duration:

Classroom Session 1: 20 minutes for pre-discussion

Home Assignment: 1 week or more to fill out the information

Activity timing: Anytime or before summer vacations

Materials needed:

- # Book
- # Pen/Pencil
- # Chart Paper
- # Scissors
- # Sketch Pen
- # Project Paper

Approach: Indoor

Topic:

Biodiversity

Concept:

Production diversification plays a crucial role for the dietary diversity of farm households. These interventions can contribute to the improvement of the food and nutritional security of households and dietary diversity. Food is also an important part of culture. It also operates as an expression of cultural identity. Food consumption and production have a considerable impact on the environment. Food needs to be responsibly sourced and consumed, as well as should be healthy. Food production contributes, for example, to climate change, eutrophication and acid rain, as well as depletion of biodiversity.

Aims:

- Explore food diversity, food cultivation and changes in diets over the years.
- Understand the types and number of food items that are locally grown and imported.

Key Questions to address:

How has the food diet changed over generations?

Preparation

Teacher needs to research nutritional requirements for appropriate age groups and the sources of those nutrients (with appropriate examples).

Method/Guide:

Classroom Session 1

1. In class, ask students to list different food items, including any varieties they know of. Here is a list to get started:
 - Bread / Chapati types and varieties
 - Rice and varieties
 - Amti, varan, liquid curries of different types
 - Vegetables, usual of different types
 - Pulses, legumes or dals of different types
 - Tubers and their names

- Different types of chutneys and pickles
- Different types of salads
- Different types of papads
- Different types of drinks such as buttermilk, panha
- Fruits
- Meat and its types e.g. mutton, chicken, fish, crab
- Snacks



2. Ask students if their parents, uncles and aunts, grandparents or other elders used to eat the same types of food in their childhood as they do?
3. Explain that the students have to 'fill up' three different plates: a plate of their own, one for their parent, or aunt, or uncle, and one for their grandparent or other elder person.

Home Assignment

For this, they should make three paper plates with chart paper. They have to take a white chart paper and draw or trace the outline of a food plate onto it, and then cut it out.

1. On the top or bottom of the plate, students should write the full name of the person whose plate is to be filled, their age (approximately) and the place they grew up in, on the side of the village plate.
2. Students should then start recording their own diet on their own daily diet throughout the year, including the above ingredients and any other ingredients. Students have to keep in mind that their daily diet is not just about one day's meal, but about what they eat throughout the year.





5. Students have to remember to talk to everyone differently and individually as much as possible and ask them to remember the details of their childhood. If you conduct the interview when others are around, then they will also participate in the discussion, and the interview is likely to be interrupted.

6. When the three plates are full, students should put them all together, side by side and read them.

Classroom Session 2

Engage the students in a discussion:

- Can they see any changes in the food items, dishes, and ingredients?
- What has changed in the food habits over the generations? What has vanished? What is new? What is still the same?
- Do these changes have anything to do with changes in agriculture, the landscape, or movement from the village to another village or town? Are there any good or bad consequences of these changes?
- Are all the things grown in the village, or nearby regions? In which seasons are they grown? When are they included in the daily diet?
- What do you get in the forest, in the orchard, what is their value in the form of money?
- What is the importance of the food items that are available in the forest or common lands which are simply collected or harvested, and which are included in the daily diet.
- Is it possible to conserve the food ingredients that are declining in the diet according to the generations?



3. On one side of the plate, after writing down the variety of daily food items, students should write down what is in the food at special times of the year, such as festivals, remembrance of ancestors, mhai, urus, jatra.

4. Just as the students fill their own plate, they should also talk to their parents or uncle or aunt, to fill another plate, and then to their grandparents or other elders, by discussing with them what was in their meal when they were a child.

- What are the changes in eating habits, good and bad?

Students should make notes of the responses from these discussions.

Extension / Variation

- Collection of songs, sayings, phrases, things related to the components of daily diet, foods (grains, vegetables, oilseeds, oil, ghee, salt, bread, seasonings, etc., kitchen and cooking utensils (cooking, pickles, forks, pans, etc.).
- Write down recipes for different foods from all three generations of your home.

- If students fill in all three plates in a way that is understandable to others, they can use the same plates as a way of presentation and display in the classroom.

- List the changes that have taken place in the diet of the three generations and the reasons behind it, local and non-local in the diet. They may highlight the items that have disappeared from the food of the present generation and their recipes.
- Celebrate the traditional food festival at school.

Learning outcomes:

Awareness on the variety in food through generations and the appropriate substitutes for modern day food products.

Green habit:

Valuing and promoting local and diverse foods.



Students from Kamargaon organizing wild vegetable festival

1.2.3. Food for life / Prey Predator

Level/ Class: 5

Curriculum links: Science, Craft

Activity duration: 45 minutes

Activity timing: Anytime

Materials needed:

For teacher - A large display board

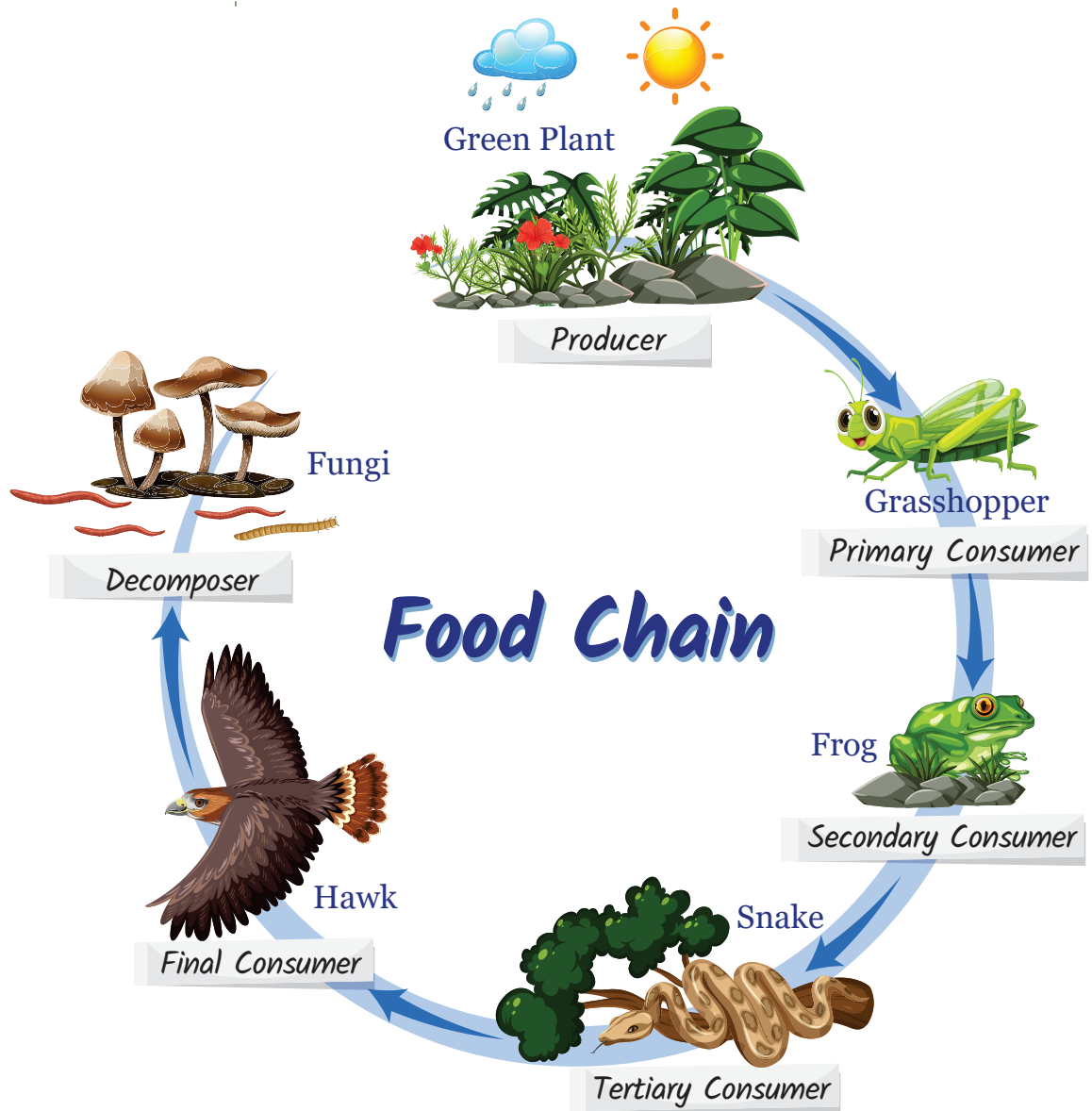
For students - Pencil, Scissor, Painting material

Approach: Field Visit

Topic: Biodiversity

Concept:

The food that you eat gives you energy to play, grow, and do all of the things that you need to do throughout the day. Every living thing needs energy to live and grow. A food chain describes how organisms get energy from eating other organisms. Food chains describe the feeding relationship between the organisms of an ecosystem. The flow of energy from one species to another at various biotic levels forms a food chain. Food chain helps us to know energy flow from one trophic level to another trophic level. Presence of a complex food web increases the stability of the ecosystem.



Aims:

- To communicate the concept of predator and prey.
- To highlight the aspect of time stress in feeding.
- To highlight the situation in which the predator can become the prey of another species.

Key Questions to address:

What is interdependence and how does it work in nature?

Preparation

Collect necessary material needed for activity. Make 3 groups of students to play the game.

Method/Guide:

1. Make two groups of at least 10 students each. The members of the two groups are identified by tying ribbons of two different colours around their wrists.
2. Draw two lines 50 metres apart and let each group stand, side by side behind each line. In the centre is a feeding circle of about 5 m diameter. 50 matchsticks (5 matchsticks per member) are spread in this circle.
3. Students of one team are designated frogs, while students of the other team are snakes. At the first call or whistle, the frogs come to feed on the matchsticks. Each frog must collect as many insects (matchsticks) as possible.
4. After 15 seconds or so, the second call or whistle releases the snakes to hunt their food (frogs). The frogs try to escape back to the safety of their 'home'. Any frog caught on the way is out.
5. Blow the whistle again after 15 seconds. Frogs with less than three matchstick insects die of hunger and are 'out.' Snakes who have not caught any frogs are 'out.'
6. Continue the game for one more round.
7. Now form a third team of eagles from members who are 'out.'
8. Start the game with the frogs feeding. Quickly release the snakes and then the eagles which eat snakes.



Learning outcomes:

Eating habits of various organisms and energy flows in the environment.

Green habit:

Appreciate food chains in nature and avoid interfering in wild food chains based upon human emotions and values such as kindness, love for animals and such. Give considerations to various possibilities and listen to what science and community wisdom may be saying.

FAQs

Q - What will happen if predators vanish?

A- If the predators vanish, then depending on the ecosystem, different things may happen:

- The number of the prey may increase, and in turn they may eat up the plants or primary producers. That may lead to soil erosion.
- The prey numbers may increase and they may spread out to other areas, including nearby villages; the interaction with domesticated animals may cause disease outbreaks.

Q - What will happen if prey vanishes?

A- Similarly, if prey vanishes, then different things may happen depending on the local situation:

- Predators may die out
- Predators may raid nearby villages and attack domestic animals
- With herbivores gone, grasses and plants they grazed on may increase, changing the ecosystem type from wetland to grassland or grassland to scrubland.

At Keoladeo National Park, Bharatpur, Rajasthan when cattle grazing was banned by the Government in 1982, it became filled with vegetation. The grasslands would repeatedly catch fire. This reduced the suitable habitat for the birds such as the Siberian crane. The Siberian cranes that migrate every year from Siberia to Bharatpur stopped visiting. The last visit was in 2002.

In this case, the cattle were not prey and the grazing ban was made without understanding science of ecological balance and by ignoring local communities' needs, but the effect was that the herbivores were removed from the ecosystem which kept grass and other plants growth under control.

<https://www.currentconservation.org/cattle-and-conservation-at-bharatpur/>



1.2.4. Seed to Seed

Level/ Class: 5

Curriculum links: Science, Social Studies

Resources and preparations needed: Stationary

Project timing: Half a day, twice a year (Suitable Time - Whenever farming activities take place)

Project plan and schedule

- # Classroom Session 1 - 30 minutes to discuss about various agricultural concepts, important seasons, local varieties of crops
- # Group/Home Assignment: 40 minutes to make a visit to the farm and interview the farmers

Topic:

Agricultural Biodiversity

Concept:

Agriculture is the process of cultivation of land or soil for production purposes. Agriculture plays a very vital role for the economy. It forms the basis for food security. It helps human beings grow the most ideal food crops and raise the right animals according to environmental factors. The role of farmers and people associated with the sector is very crucial. Through an understanding of ecosystems, water, soil, weather, chemistry and plant & animal biology, they provide us with the things we need to survive on.

Learning objectives:

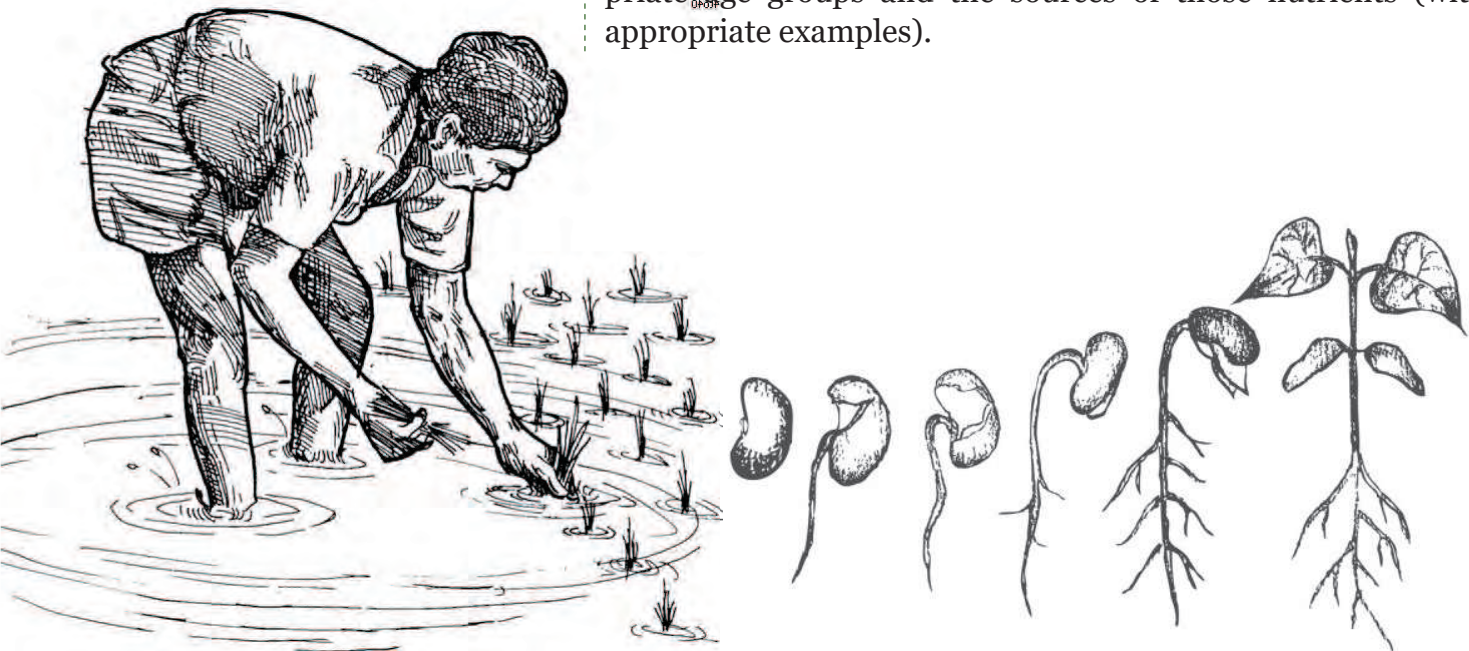
Students develop skills of observation and information-gathering

Action objectives

Students collect information about farms and crops, and learn about where and how food is grown

Preparation

Teacher needs to research nutritional requirements for appropriate age groups and the sources of those nutrients (with appropriate examples).



Project Steps

1. Take the students to nearby farms in different agricultural seasons. Let the students observe each farm and what is growing on it.
2. They should try and collect as much information as possible by talking to the farmer/owner. This information would include:
 - What is the crop that is planted?
 - Why is a particular crop planted?
 - What else could have been planted?
 - When is the crop planted (season, months, etc.)?
 - What preparations are necessary before planting the crop?
 - What is the crop used as (cereal, fodder, oilseed, etc.)?
 - Where are the seeds obtained from?
 - What part of the crop is useful?
 - What do the farmers do with the remaining parts of the plant?
 - Where does the water needed for the crop come from?
 - What fertilizers are used (natural or chemical), and how often?
 - What are the crop's major pests?
 - What pesticides are used? Is any other method of pest control used?
 - When is the crop harvested?
 - How much yield is expected per hectare or part thereof?
 - Students should find out the complete cycle, from seed to seed, of the crop.

Variation / Extension

- The complete cycle of the crop from seed to seed may be shown as a chart with samples (or appropriate sketches or pictures) and displayed in the school for the benefit of other students.
- Other crops may be studied in the same way. Problems of chemical fertilizers and pesticides may be discussed.



Rice Crop



Wheat Crop



Jowari Crop



Bajri Crop

Learning Outcome:

Exposure to agricultural practices, cultivated biodiversity and crop cycles.

Green habit:

Appreciate process of food production and value efforts by farmers.

Case Story: The Seed Keepers

Learning objectives

Help students become aware that

- # Some farmers, often women, have been preserving traditional seeds of many crop varieties. While a few have got recognition, hundreds others are maintaining their community's seed heritage on their own – silently, without much support or recognition.
- # Students and community members can identify and meet farmers who are seed savers, appreciating their contribution to society, and help to conserve agricultural biodiversity by supporting and joining the effort of maintaining the varietal diversity of crops.

Mamata Devram Bhangare, in Devgao village, Akole taluka, Ahmednagar district is among many women farmers painstakingly cultivating and preserving traditional seeds.



Rahibai Popere is a celebrated seed keeper, awarded the Padmashri for her work in seed keeping. Mamata Tai lives in a village hardly 10 km away from Rahibai's village, Kombhalne.



Mamata Tai, like most women in her area, takes an active part in all agricultural activities. The most important perhaps is sowing tens of traditional seed varieties every year. She selects the best seeds and stores them safely in earthen pots, often mixed with ash to protect from insects for the next season. She not only sows these on her own farm, but also generously shares these seeds with other farmers near and far! She is keeping traditional seeds of different varieties of rice such as Kalbhat, Jirvel, Raybhog, AmbeMohor and many more, and of finger millets, yams, chilly, gourds, pumpkins and many more. She has a remarkable collection of over 20 varieties of bean seeds.

Amidst fast vanishing traditional varieties, it is the passion and hard work of hundreds of women seed keepers like Mamata Tai that has saved a large part of this heritage.

Different varieties of crops have different properties. For example, some varieties of rice are more tolerant to droughts, others to floods, while some others are more resistant to certain pests and disease attacks. Thus, in a year with less rainfall, if a farmer has sown a plot with a

drought-tolerant variety, then at least that plot will have a yield. Certain varieties have a more appealing natural scent, while others have higher micronutrients like iron. Preserving different varieties of crops is important for food and nutrition security.

Explore, Learn and Act

1. Discuss in groups and try to name the varieties seen in the poster below.

Generally, most outstanding and distinguishing feature is considered by communities to name besides some associations of place names, uses etc are also considered e.g. Kalbhat indicates black colour of paddy, Jirga or Jiresal indicate resemblance with Jira (cumin), Javayachi Gundi variety is named so since culturally it was the special variety meant to prepare feast for Javayi i.e. son-in-law! Construct or use names that are easy to remember and relate to.

2. Try and save at least 2-3 traditional varieties by cultivating them every year in your



farm, kitchen garden or even pots. And do actively exchange seeds among interested ones. Students and their families in Odisha have come up with an idea to adopt one variety each and thus they are able to save hundreds of rice varieties!

3. Create Your Own Story

Find out who are the seed savers like Mamata Tai around you in your village or nearby one. Know which all crops and varieties she/he is protecting and make a story on them for school magazine/notice board or local newspaper! Volunteer to help them in their work of seed keeping.



Documenting Bean Diversity

A young woman-conservationist and biodiversity educator from Akole taluka, Vijaya Padekar has documented eighteen varieties of beans through their different stages of growth from flowers, pods to seeds. A fascinating variety of beans of different colours, shapes, sizes and textures can be seen in this collage.

Credit: Vijaya Padekar and CEE (available for use under Creative Commons: CC BY NC -SA 4.0)

Level/ Class: 6

Curriculum links: Science, P.T.

Activity duration: 30 minutes

Activity timing: Anytime

Materials needed:

Strips of paper approximately
6-cm x 3-cm

Pottery pieces from pots or
matka may also be used

Paints / colour pencils or
crayons

Approach: Field Visit

Topic: Biodiversity

Concept:

Camouflage is a way that animals blend into their environment so they can't be seen. Colour is a good way to help them hide, or disguise, themselves. This allows prey to avoid predators, and for predators to sneak up on prey. It teaches children how to understand the world around them, as well as to understand how animals have adapted to survive in the environment.

Aims:

Students understand the concept and principles of camouflage.

Key Questions to address:

- What does camouflage mean?
- How does camouflage benefit species in nature?

Preparation

None



Method/Guide:

1. Divide the students into 2 teams. Give each student a strip of paper. Ask them to wander around and decide on a place where they would like to place their paper strip so that it is not easily noticed. Students may colour the paper in such a way that it merges with the background and becomes hard to distinguish from the object, on or near which the paper strip is placed. For example: A student may place her strip on the bark of a mango tree. How would she make her paper look like mango bark?
2. Ask the students to write their team number on the back of the strip of paper.
3. Ask Team A to place their strips of paper on the object or place they have chosen and return. The strips may not be easily noticeable but must be visible.
4. Ask Team B to go and find Team A's strips of paper. How many did they find? If some are still not found, hints may be given about their location to make it easier to find.
5. Next, Team B 'hides' the paper strips and Team A has to find them. The team which finds the most paper strips wins.
6. Towards the end discuss with students whether and how camouflage is useful for humans as well. How it is important to wear cloths which help in camouflage or avoiding noise while going for nature watch or forest trek?

FAQs

Q - How does camouflage benefit species in nature?

A - Camouflage helps animals blend into their environment so they can't be seen by predators.

Learning Outcome:

Camouflage is a natural phenomenon used by plants and animals to blend into their environment cycles.

Green habit:

Respect wildlife; avoid disturbing wildlife during nature walk or on a trek by avoiding bright and disturbing clothes and noisy behaviour.

1.2.6. The height of it

Level/ Class: 6

Curriculum links: Science, Maths

Activity duration: 30 minutes

Activity timing: Anytime

Materials needed:

For teachers and students -
A ruler or a measuring tape,
a pencil or a stick

Approach: Field Visit

Topic: Biodiversity

Concept:

Tree height is an important ecological trait, as the competition for sunlight determines which trees flourish, and which trees become suppressed and eventually die out. It also influences shade in streams, changes in understory vegetation over time and cover for wildlife. Properties of trees can support progression in numeracy and mathematical skills in particular but can also support many other aspects of the curriculum and secure the added benefits associated with learning outside the classroom.

Aims:

- Learn to estimate the height of a tree.
- Implementation of maths concept in field.

Key Questions to address:

- How to measure the height of an object in nature?
- How to apply theoretical mathematical skills and learning for practical purposes?

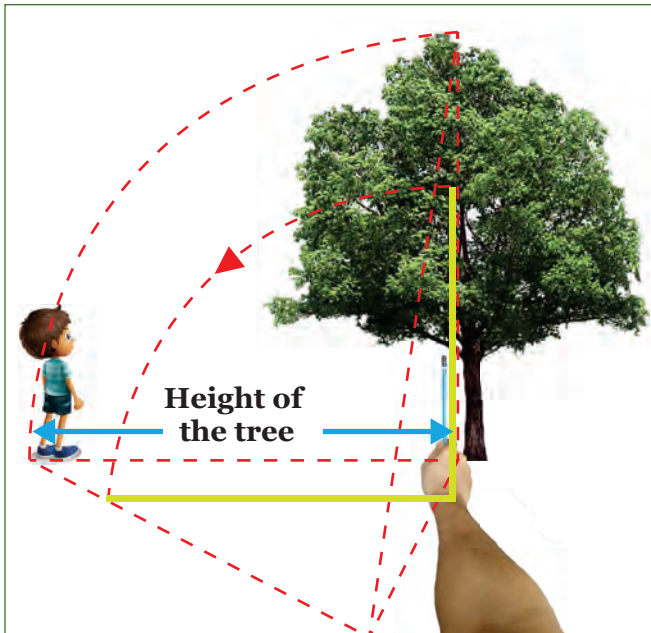
Preparation:

Select a place where students will get a tree to implement the activity.



Method/Guide:

1. There are various ways of measuring the height of a tree. One of these is suggested here.
2. Give the students the following instructions:
 - Select a tree whose height you would like to measure.
 - Walk away from the tree being measured so that the full height of the tree is visible.
 - Take a pencil, stick or scale in your hand and hold it upright with your arm fully outstretched.



- Now hold the stick so that the upper end is in line with the top of the tree.
- Slide your thumb downwards on the stick until it lines up with where the tree meets the ground.
- Keeping your thumb firmly in place, turn the stick through a right angle i.e. from a vertical to a horizontal position.

- Keep your thumb in line with the base of the tree and with the upper end of the stick note the distance it appears to cover on the ground.
- Ask a friend to walk from where you are standing to the base of the tree, dragging a foot if possible to mark a line on the ground.
- Now ask him to walk at right angles to this line. When he appears lined up with the end of your stick ask him to stop and to make a mark on the ground at the point.
- Measure the distance from the mark to the base of the tree to get the approximate height of the tree.

Extension:

Using maths to find out more about plants and animals around us such as in a 100 gm packet what will be the number seeds for different plant species, finding out spread of different plants to inform plantation and pit digging; how much grass/feed is needed for one buffalo in a year?

Learning Outcome:

Develop and use simple tools for measuring tree height using angles and simple formulae. This creates opportunities for discussions on the accuracy of their measurements and how they might be used in real life situations.

Green habit:

Going beyond names/ species recognition and use measurement skills to improve our understanding and plan conservation activities.

Level/ Class: 6

Curriculum links: Science, Craft

Activity duration: 30 minutes

Activity timing: Throughout different seasons

Materials needed:

Bird Guide – Teacher

A notebook (blank paper), pencil, crayons (if available) – Students

Approach: Field Visit

Topic: Biodiversity

Concept:

Bird watching and experiencing nature are recognized as powerful approaches for environmental education and its imperative to aware citizenry of the value of nature and biodiversity. Various bird behaviours, interesting facts, as well as techniques of how to observe birds along with ecological concepts and roles of different elements, notes about trees, bird games and the importance of wetland ecosystems in an urban context, etc... would be some of the concepts to be introduced to the children.

Aims:

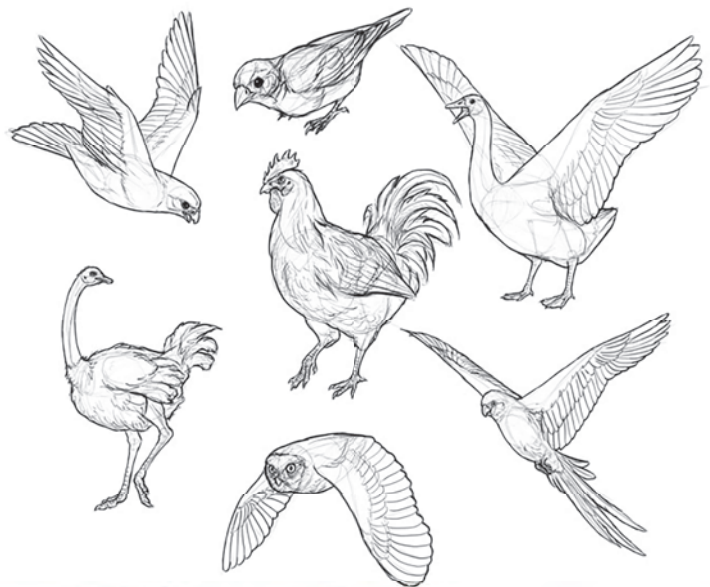
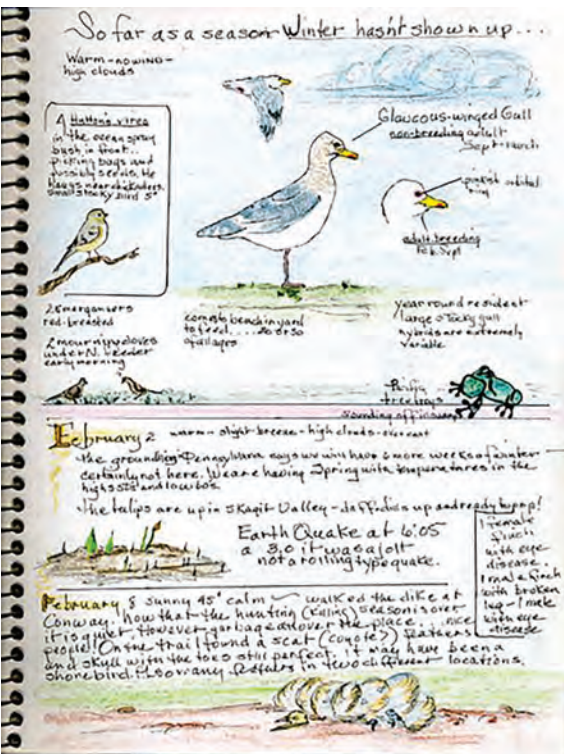
- Enable students to identify the external features of a bird.
- Identify different types of birds by observing the external features.
- Develop in students the skills of observation, recording and illustration.

Key Questions to address:

- What are the different types of birds and how can they be identified?

Preparation:

Prepare a format for students to record their observations related to birds.



Method/ Guide:

1. Let the students go out and observe a few birds. Let them identify the different basic features of a bird, such as:

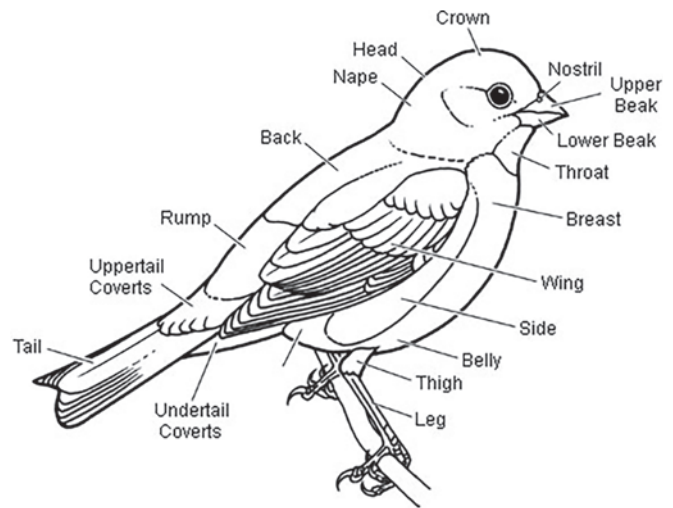
- Beak
- Wings
- Tail
- Body
- Head
- Feathers
- Neck
- Feet
- Eyes

2. Teach the students how they can draw these different features (separately) using simple form diagrams.

3. Ask the students to go out and observe different birds and note the variations in colour, size and other external features and record them.

4. The students should sketch the birds they observed using the form patterns and also colour them.

5. With initial practice and skill development, ask the students to distribute different species and develop a folio repository of birds in the neighbourhood. This can be published as a book, as an exhibition during annual day or any environmental day and converted into greetings which contain illustrations, names and some key information about them.



Learning Outcome:

Bird watching helps students be aware about different types of birds present around us and enhances their observation skills. Over time students learn to identify birds by different features as well as to record their bird observation.

FAQs:

Q – What are some of the bird guides to use?

A - Book of Indian Birds by Bombay Natural History Society.

Dosti karu ya pakshyansi by Kiran Purandare, published by Centre for Environment Education.

Green habit:

Going beyond names/ species recognition and use measurement skills to improvise our understanding and plan conservation activities.



Case Story: On the trail of the Pied Cuckoo

Many of you must have heard the stories of Pavasha bird or the mythical Chatak, called the harbinger of the monsoon rains. Now no one knows exactly what is the truth, whether the bird indeed arrives just before start of monsoon rains, or is it just an amusing story, a myth!

This is the story of chasing that myth, tracking the trail of the Pied Cuckoo to see if there is some truth in the popular story, that we are hearing generations after generations.

Let's first be familiar with this bird which is popularly called Pavasha in Maharashtra. This bird is resident in South India, that is, it can be seen throughout the year in that part of the country. But in central and northern India, it is a seasonal migrant and is popularly associated with the arrival of the Indian Monsoon. It is understood that these birds migrate from South Africa crossing the Arabian Sea. That means a bird has to travel almost 8000 km to arrive in Maharashtra! It is super exciting to find out the truth of such an amazing feat by a small bird, isn't it?

So taking advantage of internet-based connectivity, bird watchers from across India planned a collective study to record the arrival dates of the Pied Cuckoo in their respective regions and take photographs as evidence. They did this for five years between 2009 to 2013 and some 200 bird watchers recorded over 600 sightings! And then they tried to analyse their record to find out if there is any pattern and association emerges between arrival of the bird and the monsoon rains.

They did find some interesting associations. The Pied Cuckoo arrivals in central and northern India are generally followed by monsoon rains. While we do not know exactly how this bird is able to cross the Arabian Sea but it is reasonable to think that the monsoon winds which flow from the tip of Africa towards the

Indian subcontinent may be helping the bird to make this long journey possible.

Once the migrating birds reach the Indian land mass, they are not dependent on the winds to make their further northward journey. Thus, it was observed that if the monsoon is delayed in its progress over the Indian land mass, then there is larger gap between the arrival of the Cuckoo and the monsoon in central and northern India. The cuckoo continues its journey northwards, not waiting for the monsoon winds.

Inspired by this fascinating voluntary work by bird watchers, and to further study the bird journey across the Arabian Sea, the Wildlife Institute of India and Indian Institute of Remote Sensing in 2020 have begun a new study. They have attached satellite transmitters to two Cuckoos named Megh and Chatak and they will be tracking their journey to solve this mystery.

Coming back to the story of the bird watchers coming together, making observations and sharing information to analyse and find out result is among few early initiatives now popular as Citizen Science Initiatives. It is indeed possible for citizens to contribute in generating knowledge and aiding conservation.

School students and local communities can design and work on such initiatives.

One such example is the initiative by students, teachers and local community members from over 90 villages in Sahyadri region (Western Ghats) in Maharashtra to document over 200 different Mango varieties with unique names!

Plan your own Citizen Science project and do share stories of success as well as challenges and failures, as those too are valuable learning!



To know more about the citizen science study on the Pied Cuckoo, see the webpage <https://www.migrantwatch.in/blog/2013/04/04/does-the-pied-cuckoo-herald-the-monsoon/>

1.2.8. Making Bird Baths

Level/ Class: 6

Curriculum links: Science, Craft

Activity duration: 30 minutes

Activity timing: Throughout different seasons

Materials needed:

- # Clay pans or metal pans
- # Strong wires
- # Large nails
- # Hammer

Project timing:

Preferably before onset of summer season

Project plan and schedule:

Classroom Session 1: 30 minutes to explain the importance of the project

Group/Home Assignment: 1 week to make the bird baths



Topic: Conservation, Wildlife

Concept:

Birds need water for two reasons: drinking and preening. Water helps keep a bird's body cool both from the inside and outside. Water baths can also remove dust, loose feathers, parasites and other debris from a bird's plumage. Birdbaths are the fastest, easiest way to add water to your backyard bird habitat.

Aims:

Learning objectives

- To encourage students' interest in birds.

Action objectives

- To provide water for birds and an observation spot for better understanding.

Project Steps

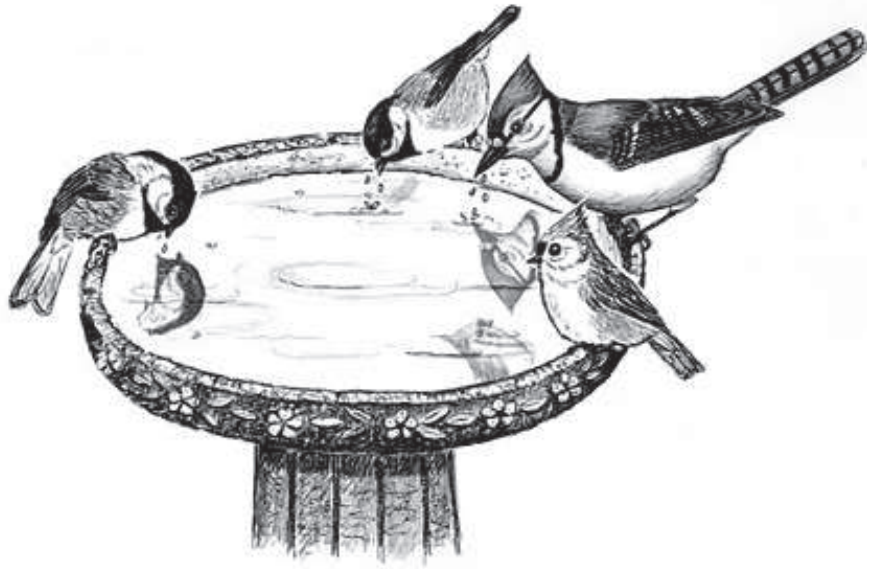
1. Let students take a shallow clay pan.
2. Using the nail and hammer make holes in the pan.
3. Tie lengths of wire through these holes and hang up the birdbath in a tree or from a rafter of the veranda. This will keep them safe from cats which might kill the birds coming to drink and bathe.
4. Ensure that the pan is cleaned every morning and kept filled.
5. Students should observe the birds visiting the bird-bath and make notes of their sizes and shapes.
6. Along with the bird-bath, a feed-place can also be constructed to watch what food the bird takes.

Variation/Extension:

Ask students to draw birds, noting the important features, e.g. size, colour, shape of bill, etc.

Notes may be made of which species raise their heads to drink and which suck up the water.

Further Reading: Look up bird books to identify the bird species visiting the bird-bath and the feeding station.



Learning Outcome:

Exposure to agricultural practices, cultivated biodiversity and crop cycles.

Green habit:

Caring for wildlife.

1.2.9. Ecosystem Services: Much more than food and wood

Level/ Class: 7, 8

Curriculum links: Science

Activity duration: 1 hour
(excluding any field visit undertaken, interactions with knowledgeable members of local communities)

Activity timing: Anytime

Materials needed:

Project timing:
Preferably before onset of summer season

Approach:
Classroom activity for whole class, Field Visit and Community interactions

Topic: Biodiversity

Concept:

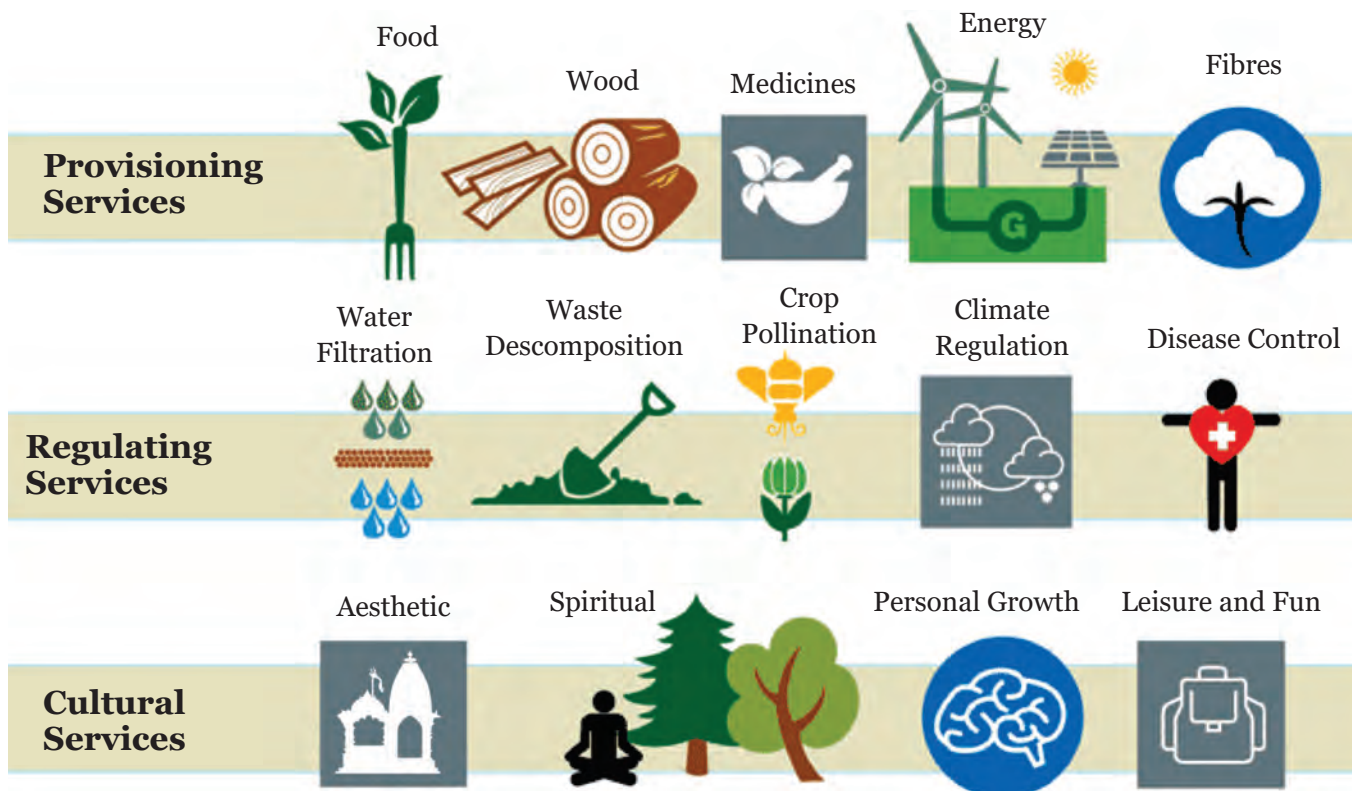
We humans are able to survive because of various benefits extended by farms, grasslands, forests, lakes and rivers. These benefits are referred to as Ecosystem Services. And these services are not just food, fodder or medicines these ecosystems provide but also cultural services, recreation, sacred places and also often not well recognized services which contribute to waste decomposition, pollination and nutrient cycling!

Aims:

Understand the ecosystem services.

Key questions to address:

Which are the different ecosystem services provided by biodiversity?



Method/Guide:

Let us know some generic examples of these three types of Ecosystem Services.

1. Provisioning Services: These are among most recognized services. These include

- A.** Food – crops, cattle, fish, tubers, wild food etc and water
- B.** Raw materials – timber/wood, fodder, leather, fiber
- C.** Medicines
- D.** Energy – from water, coal, sun, biomass

2. Cultural Services

- A.** Nature tourism, parks and playgrounds
- B.** Sacred places – trees, animals and groves, and historical places such as hill forts, river bank ghats
- C.** Science and education –ecosystems offer opportunities to do scientific exploration, experiments and also school excursion

3. Regulating and supporting services: are often not obvious to us but are fundamental in maintaining ecological balance and favourable conditions for our survival and well being

- A.** Purification and storage of water and purification of air
- B.** Climate regulation and carbon sequestration/storage in the form of plants, animals, algae and microorganisms
- C.** Pollination services by not only honey bees but many other insects such as flies, moths & butterflies, bumblebees, wasps, ants and also birds and bats

D. Biological control of pests and diseases e.g. control of aphid pests by lady bird beetles or fish controlling mosquito population by eating mosquito larvae

E. Controlling of floods by plants including mangroves

F. Supporting services such as formation of soil, providing plants as primary food source so herbivores, carnivores, detritivores populations can be supported. Nutrient recycling such as nitrogen and carbon is another example of supporting services which are essential for functioning of any ecosystem. These ecosystems also provide support to plants and animals and other life forms as their habitat.

Ask students to

1. Draw village/town/city map especially focusing various ecosystems in it. Alternatively, you can get an outline map and mark ecosystems or use google earth image of your village/town/city.

2. Form groups and allocate ecosystems

3. Try to find information on various ecosystem services, groups/communities who are significantly dependent upon and other associated information on ecosystem status. You may use following suggestive format for finding out and documenting ecosystem services

Place name: (village/town/city) _____ Date: _____

Group Name: _____

Students' names: _____

Ecosystem: write chosen one as Agro-ecosystem, Grassland, Forest, River/ pond/ water-tank/ creek/ beach/ mangrove or any other

No	Ecosystem Services	Dependent communities	Any additional details
1	Provisioning Services		
1.1	Wild vegetables as food during monsoon season	All, but its more important for poor families.	There are 23 different wild vegetables available in and around Waghjai hill of our village. These are becoming rare and only old generation people esp. women can recognize and know how to prepare.
1.2	Firewood
1.3	Fruits
	Add as many as you can find		
2	Cultural Services		
2.1	Hill has Waghjai and Mhasoba temples	All communities	There is one old pipal tree near it which is sacred to community
2.2	Recreation	All communities but especially boys and girls	Girls play Jhula during Nag Panchami on Kusum tree and boys use nearby area for playing cricket and kabaddi
	Add as many as you can find		
3	Regulatory and Supportive		
3.1	Hill has perennial spring and forms a watershed for village lake/pond	14 families depend upon this spring for pure drinking water and also its source of water for birds and animals as well	Over the year spring water flow is declining because of tree cover loss on hill
3.2	Home for many bee hives	Pipal tree has 6 large bee hives and many trees have smaller honey bee hives. 3 families collect honey and sell it.	There are only 2 people who are experts in harvesting large honey bee hives. They use smoke and some secret herbs to protect from bee stings.
3.3	Nutrient for village lake/pond and nearby farms	6 Fishing and 8 farmer families benefit from this	My grandmother says fish from our village lake/pond is tastier because it gets nutrients from hill
	Add as many as you can find		

4. Some of these services you may be aware of yourself and you can find more by talking to family members, village elders and knowledgeable persons.
5. You can also go for a walk to selected ecosystems during non-schooling time/day, observe and interact with anyone working there/using any ecosystem services.
6. Make group presentations in the classroom.
7. A Village/town/city ecosystem services map can be developed as an extension activity.
8. Display key findings from all groups, study projects and map on notice board.
9. You can also write an article for a local newspaper or school magazine.

Level/ Class: 7

Curriculum links: Science, Arts, Geography, Maths

Activity duration: 1 hour
(excluding any field visit undertaken, interactions with knowledgeable members of local communities)

Activity timing: Anytime

Materials needed:

- # Drawing paper
- # Colour pencil
- # Notebook, Pens
- # Chart paper
- # Measure bar
- # Camera
- # Recorder

Project timing:

Monitor throughout the different seasons

Approach:

Classroom activity for whole class, Field Visit and Community interactions

Topic: Biodiversity

Concept:

Learning about the seasons helps children understand the passage of time and teaches them about change. While some seasonal changes are more obvious (like changes in the weather), there are many important subtle differences related to each season. Students could be made aware of these changes by observing plants/trees through different seasons. Plants can sense changes in the seasons. Leaves change colour and drop each autumn in some climates. Leaves changing color is a response to the shortened length of the day in autumn and in the spring, the buds on the trees break open, and the leaves start to grow.

Objectives:

Learning objectives:

- Familiarising students with the seasonal changes in trees
- Understanding the importance of a tree in its surroundings
- Understand the changes that take place in the life cycle of a plant

Action objectives:

Observe trees and document findings



Preparation:

1. Understand the project, purpose, method by reading in groups.
2. To determine if there are other purposes besides this.
3. Everyone in the group should discuss exactly what they will do.



Project Steps

1. If the project is to be done in a group, then two to four different types of trees should be selected in the suburbs which should be monitored throughout the year.
2. Students may choose a single tree if it is to be done individually.
3. Whether working individually or in a group, as a first step, students should make a note of the location of the selected tree, its height, trunk girth, branch structure, approximate age, etc.
4. Ask the students to draw rough sketches of trees growing either in the school garden or in their home backyards or any other familiar place. They should each select a few different types of trees to add variety to the project. Students draw a complete tree, leaf, twig, flower and fruit. They also observe what other living things, including humans use this plant for and record bird nests, cocoons, etc. on trees, leaves, trunks.

The sketches and pictures of the trees should be prepared and put up on the display board. If possible, printed pictures of particular trees should accompany the sketches.

5. The trees should be visited and sketched at intervals of two months. The sketches made on subsequent visits should be displayed alongside the first ones for comparison. The seasonal differences should be explained as a note under each sketch and could also be graphically represented.

6. Students should observe leaf flush, flowering and fruiting:
 - Do the leaves of the tree fall off? On what day of the month do they fall?
 - When does the tree get new leaves?
 - On which day does the tree bear fruit? How many days are there on the fruit tree?
7. Are there other plants around the tree? How many other plants are there?
8. Are there other living things on the tree, in the depths of the tree, on the trunk, on the branch, on the leaf, on the flower? What are they doing there? What other creatures were found on the tree for what purpose?
9. Ask elders in the neighbourhood if they have noticed any changes in the last 5 years in the flowering period, fruit bearing period, etc.
10. Make additional nature paintings or write an essay on the environment of the place where the tree is and the relationship of the tree to people living or working around the tree.

The plant should be monitored for a short period of time every day for a year or till it is submitted. It will be noticed that some of the trees may have leaves throughout the year i.e. they are “evergreen” while others change leaf colour and drop their leaves and they are “deciduous”.

The flowering period and subsequent fruiting time should be noted. Discussions on possible influence of seasons on periods of leaflessness and flowering should be held.



Variation / Extension

Students should observe life on and around their trees and explain seasonal differences if any.

Learning Outcome:

Trees and seasonal cycles of trees.

Green habit:

Periodic monitoring and documentation of biodiversity.

Case Story: Mango Survey

Location: Karmala Taluka

- # More than 250 local mango species found in the Sahyadri region of the state of Maharashtra were studied by students who were part of the Western Ghat Special Eco-club Scheme of the Government of Maharashtra Environment Department, implemented by Centre for Environment Education (CEE). The main purpose of the project was to understand the various varieties of mango and document the traditional knowledge available with the local people and thus help in conserving the species in the region.
- # The study was conducted between 31 May and 3 June 2016. Six villages in Karmala taluka, were selected for the project study. About 60 varieties of local mango species were studied. The local names of the mangoes were very difficult to find out, as the villagers used their characteristics as names. Hence particular names were not readily available, for example, crooked mango, stone mango, sugary mango, mastani mango, etc. A special questionnaire was designed to document the traditional information available about the local mango varieties.
- # In an earlier study, students from school-eco-clubs in the Sahyadris had also tried to document mango varieties in their region. Students had visited farms, explored village, and nearby areas. They interviewed elders. Students recorded over 200 varieties of mangoes from about 60 locations in the Western Ghats.
- # These include varieties with unusual tastes – can you imagine a mango tasting like a bed bug, or like curd, or shepu (dill leaves). Some trees and varieties have a historical significance. Babasaheb Ambedkar is believed to have camped below a particular mango tree named Madhgoti in Uravade village not far from Pune and enjoyed its fruits.
- # A study of these varieties has been done by Centre for Environment Education with Indian Institute of Science Education and Research, Pune, to understand how distinct these popular varieties are at the genetic level. Having large varietal diversity in a crop makes it possible to choose or develop varieties that can withstand climate change impacts. Different varieties are able to tolerate drought, high rainfall or extreme heat conditions, or pest attacks.



Photo Credit – Satish Awate

Level/ Class: 7 & 8

Curriculum links: Science,
Environment science

Activity timing: Anytime

Materials needed:

- # Seeds of local/ localized trees like neem, lemon, tamarind, mango, jackfruit, pongamia, gulmohur, copper pod, rain tree etc., are to be collected during the appropriate season.
- # Seeds which have a thick coat need to be soaked in water overnight before planting. Seeds like that of cassia need to be activated by placing them in hot water for about three minutes.

Project timing:

Sometime before the start of monsoon

Project plan and schedule:

1-2 years to grow and maintain the plantation

Topic: Biodiversity

Concept:

Gardening is a healthy, fun activity for children. Children develop new skills and learn about science and nature from growing plants. Children can play and develop self-confidence by spending time in the garden tending plants. A garden is an interactive playground that engages all the senses. Nursery raising can be an important activity in places where there is a shortage of space. Sale of saplings could also generate income.

Objectives:

Learning objectives:

- Students learn about plants, plant nutrition, and growth in different seasons and weather conditions.
- From observing how the sunshine affects the growth of plants, watching the important role insects play in the garden, students gain an appreciation for nature and the circle of life.

Action objectives:

Students are encouraged to start a nursery.

Project Steps:

Seedlings should be sown in plastic bags, of about 20-30 cm in length and 10 cm in diameter, which may be purchased or collected.

To sow the seeds

- Mix equal proportions of red earth, manure, garden soil and sand, from which larger stones have been removed.
- Fill three-fourths of the plastic bag with this mixture.
- Place one or two seeds in each bag, inserted to a depth which equals the size of the seed.
- Keep the bags in a shady place away from direct sunlight.
- Sprinkle with water regularly to keep the soil moist, preferably in the mornings and evenings.
- Wait for the tiny seedlings to sprout. Weeds should be removed as and when they appear.

Prepare for Tree Plantation

- Tree planting should be done at the beginning of the rainy season, with pre planning and preparing the area/ soil for plantation.
- While planting, the following points should be kept in mind:
 - Trees should be planted at a distance of at least eight metres from buildings.
 - When planting more than one tree, usually a distance of at least one tree length, in other words the height the tree is expected to attain at maturity, is to be maintained between two trees.
 - This could be determined either by observing other full grown trees of the same species in the locality, referring to a book, or asking local gardeners.
- Gardens should not be placed under the shade of tall buildings or trees.
- If a large area is to be planted, preferably it should be laid out in small beds of nine m², with small irrigation channels. This makes it easier to tend the beds without trampling over the plants, and to drain off the excess water.

Plantation

Obtain saplings from the neighbourhood nurseries. Forest Department Nurseries also supply saplings, usually free of cost.

1. Dig a pit 120 cm by 120 cm by 120 cm.
2. Carefully place the sapling in the pit. The tap root should be upright in the pit.
3. Before filling, part of the pit (preferably one third) should be first filled with compost manure. Then the soil should be put in and pressed down tightly.

4. Young trees need a large amount of water once a week, rather than frequent surface sprinklings.
5. Saplings would be sufficiently protected with tree guards, rather than fencing off the entire area as required for a garden.

One of the most popular tree guards is a used coal-tar drum with the base and top removed, and with big holes cut on the drum's surface. Tree guards should be at least 0.6 m by 0.6 m, or approximately 2 m in diameter, if a round guard is used, with a height of 2.25 m.

Thorny twigs may also be placed around saplings to prevent grazing, but these are less effective. Thin bamboo poles surrounded with mesh is another option.

Protect and Maintain Plants

For the saplings to survive and grow into healthy plants, they need to be protected from being uprooted, trampled or eaten by animals. This can be done in several ways.

Maintenance

Once plantation has been carried out, the following activities should be carried out on a regular basis. Groups of students can be assigned specific tasks along with the schedule.

Watering

- Trees = Copious watering once a week
- Grasses = Watering frequently enough so that the area does not dry up.
- Vegetable garden = Regular watering once every three to four days including wetting of the leaves.
- Flower garden = Sprinklers may be used to avoid water logging.

Weed Control

Weeds are unwanted plants that utilize the water and nutrients in the soil, thereby affecting the growth of other plants. These should be regularly removed either by hand or by using simple implements.

Applications of Nutrients

- Some of the nutrients which support efficient plant growth may be lacking or in insufficient quantities in the soil, and may be supplied through addition of fertilizers.
- Compost manure is beneficial for all plants. Other materials that may be used as manure are cow, horse, sheep and goat dung, leaf mould, green manure, oil cake, night soil and chemical fertilizers. Always mix the manure with soil first before applying to the plant.

Learning Outcome:

Learn about and implement greening and tree plantation activities.

Green habit:

Learning about seed germination and nursery technique and planting trees.

Case Story: School Parasbaug/ Kitchen Garden

School Name: Pragati Vidyalaya

Location: Rahatgaon, Amravati

A plot of agricultural land of around 1500 square feet within the school campus was prepared as a parasbaug or a kitchen garden.

The teacher's intention was to strengthen the students' knowledge about local food varieties and provide them hands-on experience about cultivation from sowing of seeds to nurturing plants and harvesting the produce.

Students asked elders in the village about creating a parasbaug and the cultivation of fruits and leafy vegetables. The students tried to grow the seeds available in the market as well as those locally sourced from homes. They also tried several other crops. The students were able to grow garlic, lady finger, brinjal, fenugreek, onion, spinach and coriander. They protected the plants with a fence made from bamboo and twigs to prevent animals from grazing at the kitchen garden.

The study was presented to the rest of the school.

Discussion was loss of local seed variety, increase in the market value of agricultural seeds, farmer exploitation, etc.

The knowledge thus gained would help students as well as their families to develop better and more scientific understanding of the local food biodiversity and earn a sustainable living.

1.2.12. Biodiversity and Fake News

Level/ Class: 7 & 8

Curriculum links: Science, Civics, ICT

Activity duration: 60 minutes

Activity timing: Anytime

Materials needed: Copies of IEC material in a size that is easy for students to see

Approach: Classroom activity for whole class with assignment

Topic: Biodiversity, Digital Media

Concept:

These days we often come across the issue of fake news especially on social media like WhatsApp. Is it something new? If we think and search for evidence in history or peoples' memory and even in literature, we come to know that fake news is not a new phenomenon.

As child we are introduced to a folk tale of 'Landga ala re ala' (Hey beware fox has arrived and attacking our herd of sheep) where a sheep herder boy perhaps just out of fun of fooling people raises false alarms and eventually he pays heavy price when fox actually attacked, and no one comes to help the boy thinking that he must be pranking as usual!

While it is said that fake news is as old as news is, what has concerned everyone is the increased power of the media to spread the fake news in a short time. Fake news idols drinking milk spread widely because of the power of television in 1995 and today we see even faster and wider transmission of fake news with the advent of the internet and social media.

Objectives:

To be able to identify and verify Fake/ Hoax and the credibility of the message and stamp it either genuine or fake.

Key Questions to address:

- What is the source of this information?
- Is this information real or fake?
- What should I do, if I received fake information?

Preparation:

Teachers to facilitate this fact check if students are unable to do on their own in their exercise.

Method/ Guide:

Let us learn about fake news/ misinformation associated with plants and animals and how to deal with it.

Given below are some of the ways misinformation about plants and animals are spread.

A. Exotic and rare species passed off as divine species with fake names and wrong information.

- a.** 'Rare 'Nag-pushpam' which takes 36 years to flower.' This is actually a deep sea animal called as 'sea pen'.



- b.** 'A bird called 'Suraga' in Tamil and it took 19 photographers 62 days to capture this video'. The viral video was actually that of an Australian bird called Lyrebird, known for its mimic abilities.' This video was actually taken from a zoo.



- c.** 'Very rare species called Mahameru flower that blooms once in 400 years, in the Himalaya. Our generation is very lucky to see it, even if only in photographs. Wishing good luck to everyone.' Actually, a desert flower from Arizona, USA.



B. Local species and false claims

- a.** 'Swami Samarth Audumbar's (cluster fig) rare flower'. In one such misleading post an image of Cycus plant was used while in another photo of a fungus/mushroom was passed off as flower. The fact is that the flower of the umbar/cluster fig is not rare but different from most of the flowers we are familiar with. What we call fig fruit is when its green is a cluster of tiny flowers inside.



- C. Morphed images
 - a. Five hooded cobra.



- b. Alien and dangerous creature out in the fields.



Such posts are morphed or as popularly known as photoshopped using image editing software.

You may come across many such fake posts spreading misinformation and rumors.

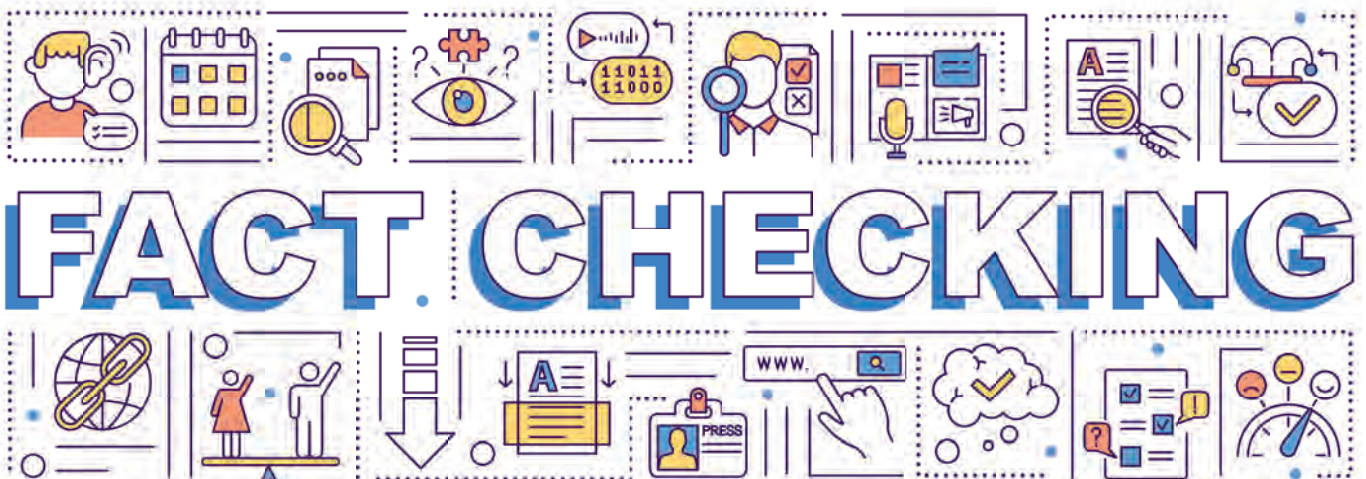
How to deal with this?

1. If any strange message or news appear, which is not seen or known by anybody in your family and around, and the source of that information is not mentioned then do not blindly believe it to be true. In most of the cases it is likely to be fake. And more importantly, do not forward it without verification.

2. Let's understand how we can verify such posts.

a. Do an internet search with keywords in such posts such as Five Hooded Cobra, Nag Pushpam, Suraga birds etc. and keywords like fact check, fake news. There are chances that someone else has verified the facts about it.

b. Try to check with any botany, zoology, ornithology experts in your area. There are many plants/ animals/ birds/ mushrooms expert groups available on social media where you can post your queries. You may also call college professors in your area.



- c. There are specialized websites who do fact check in case of such doubtful, viral posts. Some of such websites are mentioned below for you to explore.
- i. SMHoaxSlayer
 - ii. Altnews
 - iii. Boomlive
 - iv. Webqoof on Quint,
 - v. Hoaxposed on The Print
 - vi. Times of India's Times Fact Check initiative that includes a video series Fake Bole Kaua Kaate),
 - vii. India Today's Anti Fake News War Room



Exercise

Look into various social media platforms you are familiar with or your family members use and find strange, doubtful, sensational posts and try to verify them.

Present such examples – verified by you or still doubtful – in the classroom and discuss with teacher and classmates.

Green habit:

Do not believe or propagate fake news about nature, Always verify information shared on social media.

FAQs

Q – Is it a crime to spread fake news?

A- Do You Know

It is a crime to spread fake news, rumors and is punishable with jail term and fine under different laws of our country.

Every citizen should report fake news or rumours to the nearest police station or at the National Cyber Crime Portal at <http://www.cybercrime.gov.in>

One can report such rumors at twitter handle of Maharashtra Police Cyber Cell - @MahaCyber1

Some Acts and provisions against fake news and spreading rumors

*As per Disaster Management Act (DMA), 2005, Section 54: Whoever makes or circulates a false alarm or warning as to disaster or its severity or magnitude, leading to panic, shall on conviction, be punishable with imprisonment which may extend to **one year or with fine.***

And as per Indian Penal Code (IPC), 1860, Section 505: Statements conducting public mischief.

Section 505 (1)(b): with intent to cause, or which is likely to cause, fear or alarm to the public, or to any section of the public whereby any person may be induced to commit an offence against the State or against the public tranquility.

1.2.13. Guess Who is Threatened?

Level/ Class: 7 & 8

Curriculum links: Science

Activity duration: 30 minutes

Activity timing: Anytime

Materials needed: Blackboard, chalk, Threatened Species' cards (see below)

Approach: Classroom activity for up to 30

Preparation: Teachers to facilitate this fact check if students are unable to do on their own in their exercise.

Topic: Threats to biodiversity

Concept:

Biodiversity, or the biological diversity of life, refers to the range of life forms on earth. These include millions of plants, animals and micro-organisms, the genes they contain, and the intricate ecosystems of which they are a part.

Loss of biodiversity takes place when unique habitats or ecosystems are reduced or degraded, and when species become extinct in the wild, and when many varieties of crops and animal breeds are lost because of increasing monoculture. Some famous examples of Indian animal species that have become extinct are the Cheetah and the Pink-headed Duck. Vultures are on the verge of extinction and possibly hundreds of traditional varieties of rice are lost.

There are manifold causes for the loss of biodiversity. Among these are the rapid growth of industry; the intensification and expansion of agriculture; urbanization; large scale development projects like mining, dams, and highways; and other human activities. These activities have led to the destruction of habitats, pollution and overutilization of biological resources, which have resulted in the rapid erosion of India's biodiversity.

Poaching and illegal trade of wildlife products have also severely threatened many wild species.

Garbage in the environment is yet another cause of loss of wildlife.

Aims:

To help participants become aware of the threats to biodiversity.

Key Questions to address:

- What are the main threats to biodiversity?

Preparation:

Threatened species cards: For making the threatened species cards you need old visiting cards or paper cut to the size of ordinary visiting cards. On one side of each card/ paper write the following information on the threats faced by different species (use one card for one species):

Elephant: Faces threat due to poaching for ivory and decrease in forest area due to conversion of forest lands into plantations.



Tiger: Faces threat due to poaching for bones, body parts, etc., which are used in traditional medicine in far-Eastern countries. Also faces threat due to loss of habitat



Musk deer: Faces threat due to poaching for 'musk' which is used in making perfumes.



Sandalwood tree: Faces threat from demand for its fragrant wood.



Lion {Asiatic}: Faces threat because the entire population of the species exists in only one forest—the Gir forest of Gujarat. A single epidemic or any other disaster may wipe out the entire species. Decisions may be based on sense of pride than science and species survival.



Lesser Florican: Vanishing Grasslands, pesticide pollution and lack of adequate understanding about bird's ecology.



Blackbuck: Hunting for sport, flesh and skin, and habitat destruction are major threats to the blackbuck.



Local varieties of Mango: Cutting of old wild and semi-wild trees, large plantations of handful of commercial varieties as monoculture, lack of awareness among plantation owners and consumers of their significance



Turtles: Face threat from egg collection, killing for turtle meat, demand for their shells for decorative purposes and pollution of the coastal areas and the seas.



Pangolin: Hunting is the main threat. It is hunted for its scales which are illegally exported to China and other East Asian countries where scales are believed to have medicinal properties.



Indian Rock Python: Poaching for illegal trade of its skin is a major threat to this snake.



Vulture: Main threat is veterinary drug Diclofenac found in carcasses which vultures feed on.



Sea turtle: Facing threats along with hundreds of other marine life forms due to increasing levels of plastic pollution.



Method/Guide:

Write the names of the animals given in the threatened species cards on the blackboard (write only the names, and not the information on the threats).

Ask for a volunteer from the participants. Give a threatened species card to the volunteer.

Ask the volunteer to read the card to himself/herself and keep it with her/him in a way that others will not be able to see what is written on the card.

Tell the participants that the volunteer represents one of the threatened species of plant/animals whose names are written on the blackboard. The task for them is to guess which the threatened species is. They can ask the volunteers questions about the threats that face her/him. Questions not pertaining to threats should not be asked, except for the first question: 'Are you an animal?' (see examples below). The volunteer will answer the questions with only a YES or a NO.

The maximum numbers of questions that can be asked are seven. As the game progresses reduce the number of questions that can be asked to five. If the participants are not able to guess correctly even after asking their allotted number of questions, the volunteer can give them a clue, and two extra chances to make a guess.

Example for 'Elephant'

Q: Are you an animal?

A: Yes.

Q: Are you killed for your meat?

A: No.

Q: Is disappearance of forests a threat to you?

A: Yes.

Q: Is poaching a threat to you?

A: Yes.

Q: Are you killed for your fur?

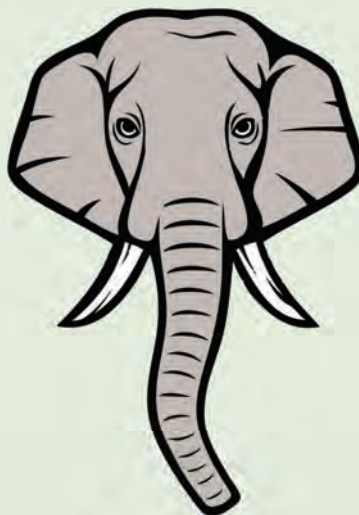
A: No.

Q: Are you killed for ivory?

A: Yes!

Q: You are an elephant!

A: Yes!



Example for 'Sandalwood Tree'

Q: Are you an animal?

A: No.

Q: Are you threatened because your habitat is getting lost?

A: Yes.

Q: Are you cut down for your wood?

A: Yes.

Q: Are you a teak tree?

A: No.

Q: Do you have medicinal value?

A: Yes.

Q: You are a sandalwood tree!

A: Yes!

FAQs/ Discussion

Q- What are the kinds of threats to biodiversity?

A- Threats to biodiversity include habitat destruction, over-harvesting, pollution and the introduction of foreign plants and animals. Destruction of habitats such as forests, wetlands, grasslands, etc., are a major threat to biodiversity. Overexploitation of biodiversity is another area of grave concern. For example, if medicinal plants are collected beyond a point from which they can recover, the species are gravely threatened. Pollution of habitats is an increasing threat. A well-known example of this is the accumulation of DDT across the levels of the food chain, gravely affecting species at the higher end of the food chain. Introduction of foreign species is also a significant threat. Exotic species of plants and animals compete with local species for food, space, etc. As they may not have any natural predators in the area in which they are introduced their numbers multiply rapidly, threatening local species.

Q- What is being done in India to safeguard biodiversity?

A- India has a long history of in-situ conservation that is conservation in the natural habitat. Communities which are dependent upon wetlands, grasslands and forests have rich knowledge about these ecosystems, species and varieties. They traditionally have evolved systems of sustainable use and protection. Like in other states Maharashtra too is promoting participation of user communities in conservation of biodiversity, e.g. Phase Pardhi community in Akola and Washim region has rediscovered Lesser Florican bird after more than 100 years and are protecting it using their experiential knowledge about the bird and its habitat. Traditional fishing communities in Gondia and Bhandara region are reviving water bodies and conserving local fish species. Village community and especially youth in Pachgao in Chandrapur district are managing bamboo production, sustainable harvesting and auction on their own and many farmers are conserving local varieties of rice, jowar, emmer wheat, beans and bananas.

Wild species of animals and plants are conserved also by establishing protected areas throughout the country. India has a protected area network covering about 5 per cent of the total land area. There are 566 sanctuaries and 104 national parks which shelter varied and representative ecosystems. India has 7 natural world heritage sites and 42 wetlands of international importance, including Lonar Lake and Nandur Madhmeshwar Bird Sanctuary in Maharashtra. Other conservation initiatives include biosphere reserves, marine reserves, gene conservation centres, and the preservation of wetlands, coral reefs and other natural habitats.

The ex-situ conservation of plants and animals (that is, preserving them away from their natural habitat) is being carried out in several kinds of institutions such as zoological parks, botanical gardens, forestry institutions and agricultural research centres.

India has several Acts in force which have a bearing on the conservation of biodiversity. Some of these Acts are:

Biological Diversity Act, 2002, Environment Protection Act, 1986; Fisheries Act, 1897; Forest Act, 1927; Forest (Conservation) Act, 1980; Wildlife (Protection) Act, 1972 and Wildlife (Protection) Amendment Act, 1991.

There are a number of NGOs in the country ranging from national agencies to local groups; from research organizations to field organizations. Many of these are involved in biodiversity conservation through activities such as eco-development, forest conservation, eco-friendly technologies in industry and agriculture, etc.

Actions needed to conserve and maintain biodiversity include:

- # Assessing the state and importance of biodiversity through collaborative research involving dependent communities, ecologists, plants and animal specialists, industry, government departments among others.
- # Developing a strategy to conserve and sustainably use biodiversity.

Encouraging traditional methods of agriculture, agro-forestry, forestry and wildlife management which conserve biodiversity.

Creating awareness about the importance of conserving biodiversity.

Involving communities in conserving and managing biodiversity.

Implementing fair and equitable sharing of benefits from the use of biodiversity.

Protecting natural habitats.

Promoting rehabilitation of damaged ecosystems, and the recovery of threatened and endangered species.

Biodiversity Loss Causes



Swamp Drying



Deforestation



Steppes
Plowing



Grazing



Urban
Construction



Pollution



Poaching



Dams
Construction



Hunting



Overfishing



Animal
Skins



Tropical Fish
Trade



Climate
Change



Death From
Vehicles



Wild Animals
Trade



Bird Trade

Extended Exercise

Time needed - minimum 3 hours (suggested to be done on a holiday)

1. Through neighborhood walks and talking to knowledgeable individuals from the local community identify various threats to biodiversity in your area.
2. Find out whether your gram panchayat or city municipality/corporation has established a Biodiversity Management Committee (BMC) as mandated under Biological Diversity Act, 2002, and whether it has developed People's Biodiversity Register (PBR). If yes, try to get a copy and learn about it.

The Wildlife Map of India



Green habit:
Be aware of threatened life forms around you and extra careful, be aware of local governance and its roles and responsibilities in protecting biodiversity.

A Spot-billed Pelican tries to swallow a plastic bottle

Ameenpur Lake, Hyderabad

08 May 2021

I shot this sequence over some time. I am not sure whether the pelican finally gulped the bottle or discarded it, as it went behind some

trees with the bottle in its beak. But before that it tried twice to swallow it. Initially even I thought the pelican was catching a fish.



Photographs and report by Veerabhadra Rao Kalakonda, Hyderabad

1.2.14. Shivarferi & Measuring the biodiversity around us!

Level/ Class: 8

Curriculum links: Math, Science, Geography, WE & ICT

Activity duration:

- # Understanding, preparation of activities in class - 45 minutes
- # Seasonal Shivarferi – neighbourhood walks for 3 to 4 hours on holidays, minimum once in summer, rainy season and winter
- # Actual study, measurements, analysis of selected element/ topic– 2 hours

Activity timing: In all seasons. Depending on the selected study elements, for example, July to November is a good period for butterflies or crop-insects observation, April-May is a good period to observe seeds of different plants.

Also decide about good day time e.g. for bird observation one needs to start early in the morning or towards sunset. While for many moths night time observation around a light bulb would be beneficial.

Materials needed: Rope or pipe/ wooden frame, forks/flags, measuring tape, weighing scale/machine, (if available binocular for bird observations during Shivarferi), notebook, pen/pencil, cap, shoes, water bottle, some light snack such as pea-nuts-jaggery, any fruit or any home-made food.

Approach: Field visit

Topic: Threats to biodiversity

Concept:

Conservation planning and effective implementation need local data on its status, uses and threats. It is not possible to create a good quality database of an entire state or country without participation of local community and user groups. For this to happen it is important to have required skills among local communities to conduct systematic studies of local biodiversity. Apart from identification of plants, insects, birds or other life forms it is important to have skills to conduct measurements and find out how many, how much of a particular species of variety, how long/heavy and so on, on any important element. Real life, problem solving based learning helps in better comprehension of abstracted mathematical concepts such as area, frequency, dominance. With hands-on experience during school years, youth ahead can better understand development and sustainability challenges with their context, details and data and positively influence, contribute to community development.

Aims:

Student should be able to undertake various measurement-based projects on biodiversity elements/ ecosystems of their interest.

Key Questions to address:

How can we observe, measure and study different biodiversity elements in a scientific way?

How to develop School Biodiversity Register between smaller groups focussing on specific elements like medicinal plants, grasses, birds, butterflies, crops, insects or wild fruit trees etc ?

How to build up and update biodiversity register?

Preparation:

How to choose what to study?

- Discuss with students' group about what they would like to study in their group project
- If you feel or come to know that some important elements are diminishing and want to find out how much of it is left. For example, If the villagers say that the quantity of wild grass is decreasing in their grassy common lands or malraan, then this can be a topic to study and find out whether there is a change in the availability of the grass.
- For School Biodiversity Register, the schools may want to study the types of birds, butterflies, grass, or gum-giving trees, such as mohua and bibba are present in the village common or shivar. Doing these types of studies and methods in the right way and smartly, in a short time is important for us. At the same time, there are many other questions: how much fruits do small and large trees hold; how many of the newly planted saplings survive, and what changes do they have in different seasons – such as when do the fruits ripen, when do fish lay eggs, are their numbers changing? What is changing, what are the nature of the changes, and what are the reasons behind the changes are some of the questions we can ask when thinking about what to study.
- Students in the upper classes can choose more complex subjects for study as per their requirement. e.g. Whether to protect some lakes or parts of the collective forest area in a big way, and decide to what extent and where to make their efforts. Some interventions (e.g., regulation of how much harvesting, or cultivation of new plants) will increase, or reduce obstacles. Who will benefit and or lose?

How to choose where to study?

- Of course, according to the selected study subject in the field, in the Malrana, in the forest, on farm, pond etc.
- According to that method, some things need to be taken care of while choosing a place to be accurate. e.g. If you want to choose the diversity of grass in the village grassland common or trees in the forest. How many plots to choose in the study is to be decided in accordance with the size of the grassland or forest. Also, if the soil, water in the grassland or forest is very different, then if you study only in a place, the real picture will not be clear for all the sections of the grassland or forests. So one needs to do sample study in all those different zones.
- Unsafe places to study have to be avoided.
- Preferably go for field visits as a group of students, ideally with the teacher and knowledgeable person from the local community accompanying.

Method/Guide:

Stage -1

Shivar Feri

Conduct Shivarferi – neighbourhood walk to familiarize with various ecosystems and various life elements.

Ask students to form groups and choose/assign various ecosystems (Farm Group, Grassland Group, Pond Group etc) or biodiversity elements (Wild Fruit Trees Group, Birds Gr., Butterflies Gr., Grass Gr, Millets Gr, Vegetables Gr. Etc) for focussed observations and documentation during the Shivarferi.

Let them choose these as group projects to be evaluated as part of a formal scheme. (Refer to one such example of project design, 'Season of Tree' included ahead in this booklet which will help you to design similar seasonal monitoring projects for other topics as well)

Conduct Shivarferi in all 3 seasons to understand seasonal variations in biodiversity elements. Discuss and document seasonal variations.

These elements can be added to a village map as an assignment/project work under geography or WE-ICT.

Stage-2

Considering Shivarferi observations, decide upon topics of in-depth measurement using the following methods.

Random Sampling Method (Shitavarun Bhatachi Pariksha)

Just by looking at something closely, one can identify and understand certain aspects of reality. However, it may be necessary to do a sample survey/ study to conduct a disciplined, numerical study. If there is time and a large number of students, you may visit as many places as possible and study as many types of butterflies, birds and trees as you want to. However, there may be some practical difficulties in studying the whole forest or grassland in the short time.

Instead, the entire number can be estimated from a random sampling method as per saying in Marathi shitawarun bharachi pariksha. In a short time, when there are fewer people, some methods based on the mathematics of studying correctly have been made. Let us learn two of these methods directly.

1. Transect Method

The transect method is useful for conducting surveys at long intervals. This method is mainly used to study animals and trees. In this method, the individuals seen at a certain distance are counted.

Line Method:

In this survey method, one has to walk in a straight line. All the species seen by the flying, runaway creatures, such as birds and butterflies on the left or right, are measured while walking. That is, 30 different birds, 23 types of butterflies are recorded. Or the total number

of the same species determined for your study is recorded. For example, we saw a total of three black winged kites or total 38 Parakeets walking along the line.

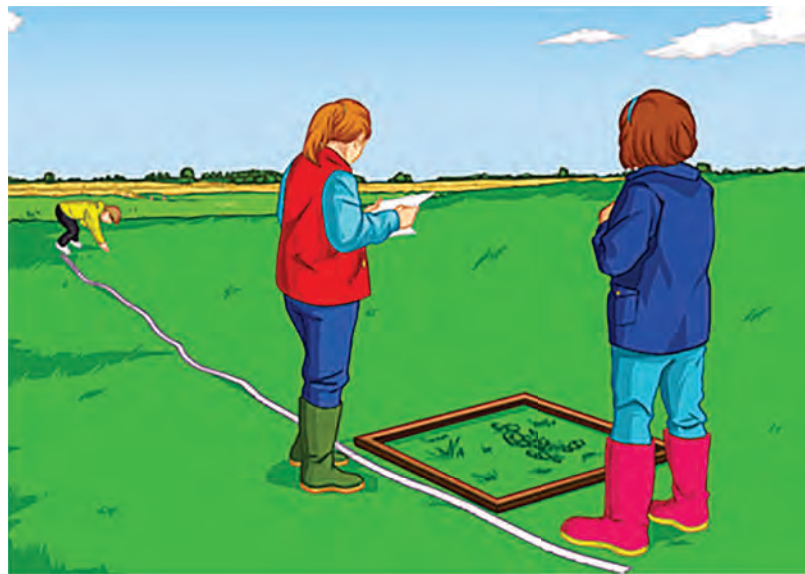
For this survey, we can study approximately 100 meters to 1000 meters (i.e. 1 kilometer) of the study area. Considering that it is not always possible to find a straight path in the landscape, we should divert a little direction as per the convenience of the difficulty while walking. However, while walking mainly, make sure that we walk in the same direction and as straight as possible.

Butterflies/ birds fly because they have wings, so if species on both sides are recorded, the species on the right can be counted twice as it flies to the left, and if this happens, the wrong number can be found in the numerical survey. Therefore, any single side should be studied in the numerical study of flying organisms.

Observation of butterflies

The line method is useful in studying butterflies from July to November. It is suitable for surveys from 8 am to 10 am or 5 to 6:30 pm when butterflies fly more. To study the total number of species of butterflies, use it as a trail line through the forest/malran to search for butterflies as far as you can see from the right or left hand.

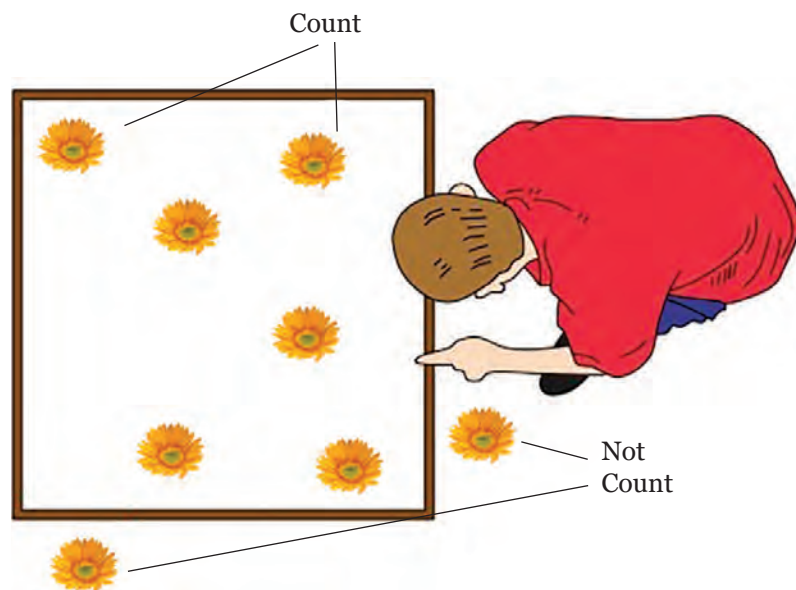
Even if every species name is not known, if you notice that it is a new butterfly, it should be recorded as New-1, New-2 so that we can finally tell you the total number of butterflies you see. The names of the flower birds that could not be identified can be traced later by using a booklet or asking a knowledgeable person.



2. Square Method

Quadrat Method

- A quadrat is used to study plants (grass, shrubs, trees, honeycombs etc) or slow-moving animals/insects in a square area of a certain size. In the square method, the selected species of square sized squares are counted. Such as 1 x 1 mtr or 10 X 10 mtr or 20 X20 mtr
- At least 1% of the area to be estimated for drawing a square will have to be studied squarely. An example of this is given to understand this.



Quadrat sizes and numbers to study

No.	Quadrant Size	Study Group
1	1 mtr X 1 mtr	Grass
2	5 mtr X 5 mtr	Shrubs, vines, small insects (e.g. spiders, millipedes), flow moving animals (e.g. earthworms, snail)
3.	10 mtr X 10 mtr (and area greater than that)	Large trees, animals or bird nests

Suppose we want to estimate the number of Moha trees in 50 hectares or about 123 acres (1 hectare =2.47 acres or broadly 2.5 acres) of forest in the village, we can use the quadrat method. To study a sample area of 1% of the total area of the forest, we will have to study 0.5 hectares of forest area using quadrat.

0.5 hectares = 5000 sq. m.

We can measure the number of Moha trees in it by covering 2 squares of 50 x 50 meters.

Suppose a total of 7 Moha trees are found in these two squares, the total number of Moha trees in total 50 hectares of the forest can be estimated by extrapolating.

A similar study can be done on grasslands or lake for estimating aquatic plants.

An illustrative chart given below can be used with relevant modifications as per chosen study topic.

Place name:		
Study Group/Member Name:		
Date:		
Quadrat No:		
Quadrat area: e.g. 1 sq. mt		
Name of plant species	Number	Other organisms
1) Marvel	4	Insects, ants, etc
2) Pandhari Kusal	5/	
3) Tarota	7	
4) Pawanya	50	
5) Nagarmotha / Lavhala	29	
6) Unknown -1/ Grass-1/G-1	2	

Now think about how to do the analysis of study data?

In the illustrative table above A total of 6 different grass species were recorded in the 1 sq.mt. quadrat with one non-familiar species. Among 6 species, Pawanya grass with 50 stumps/clusters is the dominant species.

(Sometimes it is difficult to count every single stump of grass. In such cases may go for noting approximate % of quadrat area occupied by those species.)

How to study a large area of grassland?

Considering the approximate total area of grassland and % of area to be covered in sample study, decide about the number of 1 x 1 m quadrats. Let us suppose 10 quadrats of 1x1 m are to be studied as samples.

Now ensure that you plot these quadrats in all the directions/ quarters/sections of the grassland and also ensure that all variations such as different soil profiles, moist patches are covered in sampling.

Now the total number of species documented in 10 quadrats would represent species richness of the entire grassland.

If a particular species e.g. Pawanya is found in most of or all the quadrats then it is most frequently prevailing/ widespread species.

Any species which is found in largest numbers/ quantities/weights is considered as the dominant species.

You may find important correlations through such studies. For example, if you find that out of 10, in 3 quadrats Nagarmotha/Lavhale (taxonomically which is not a grass species) is the dominant species, and if you observe those quadrats carefully, you will certainly find that soil there is much moist/wet.

So you can infer that though Pawanya is the most frequent and overall dominant species of the grassland, moist portions of the grassland are dominated by Lavhale.

How to find out quantity of grass from sample study?

To find out the quantity of specific grass species/only highly nutritious species like Pawanya, one needs to cut all the Pawanya grass from all the sample quadrats where it is found, in our example it's all 10. Weigh it and extrapolate to the entire area of the grassland. If you want to estimate dry weight, then weigh it after drying and do a similar calculation.

For overall grass quantity, cut all the grass in sample quadrats, weigh it green (and dry) and extrapolate to find out total quantity of grass available in the grassland.

Some useful formulas

Species Density = Total number of species found / sample area

Frequency = how many squares a species was found in / Total number of squares studied

Richness of biodiversity = total number of species found

Learning Outcome:

Students are able to think about the biodiversity studies they would like to conduct, design them with the guidance of the teacher and resource persons, and conduct the studies. The results of the studies should be analysed with the teacher and resource persons.

Green habit:

Periodic monitoring, generating data and knowledge about biodiversity.

Case Story: Anuradha – A Nature Steward

- This is a story of an 8th standard student from Lal Bahadur Shastri Vidyalaya, Taluka Karmala, District Solapur. Anuradha Thombare is an active member of the Environment Service Scheme (ESS) unit in her school.
- ESS is a programme of the Environment Department of Maharashtra. Schools that apply and are selected to participate in the scheme take up small projects to understand their local environment and ecosystems. Students take up a range of activities depending on the needs they identify through a village or area level study. For example: plant trees and other vegetation, conserve water and energy, help to reduce pollution, and celebrate cultural activities in an environment-friendly manner, etc.
- Anuradha developed a keen interest in observing birds, butterflies, and honey bees. Her mentor, Shri Ganesh Satav, ESS Coordinator in Solapur district encouraged Anuradha to observe birds and butterflies. But it was Shri Satav who was surprised when Anuradha told him that she can identify over 300 different grasses and herbaceous plants. Anuradha asked Shri Satav if he knows about these grasses. The mentor humbly said no and requested her to teach him!
- Anuradha's knowledge is gained from the traditional knowledge that her pastoral family possesses. She is herself a proud carrier of it and is happy that a platform like ESS appreciates such knowledge. Anuradha wants to learn more from her father who knows about some 400 grasses and other plants.
- Anuradha has started to make notes about her observations in her neighbourhood and farm. She has even motivated her father and mother to note the observations regularly. Her father has 5 notebooks and her mother 3 notebooks full of such observations.
- Once Anuradha was about to cut and clean the shrubby thickets near their house. Her father showed her the plants that attract many butterflies. She kept those plants and started to keep a watch out for butterflies. Soon she could recognize more



- than 30 different butterflies like Tigers, Lime butterfly, Mormons, Castor and Grass Yellow. Anuradha is fascinated with the lifecycle of butterflies, observing eggs, larvae, pupae and witnessing the stunning and colourful changes a butterfly goes through!
- Her small kitchen garden has plants like Peru (Guava), Chikoo and Kadipatta (curry leaves) and she has fresh, aromatic herbs for cooking every day. One day she found some dirt on some leaves she wanted. First she thought it must be some bird droppings, but when she observed it carefully, she realized that it is actually a butterfly larva! She observed it daily and found that the larva voraciously ate Kadipatta leaves and was becoming fatter with every passing day. Eventually it started to slow down. One day it stopped eating and developed into a pupa. Anuradha eagerly waited for the butterfly to emerge. Exactly on the 13th day she found that the butterfly had emerged and vanished without letting her know!
 - She felt sad, but for moments only. She started looking at every black-red coloured Common Mormon butterfly in her neighbourhood as the one which she was caring for!
 - This experience made Anuradha interested in not only butterflies but also dragonflies, bees and birds! She also inspires other children and elders to observe and care for different life forms around them.

1.2.15. Making Safer Herbal Pesticides

Level/ Class: 7th and 8th Standard

Curriculum links: Science, Environment science, WE

Resources and preparations needed:

- # Drum/container 200 litres (or whatever available size, but remember quantity of herbs will change accordingly)
- # Talk to parents/farmers so you have someone who is willing to use the herbal pesticide and may provide a large drum/container. If the school has a food production garden it can be used there as well.
- # Discuss the list of suggested 10 plants/herbs with knowledgeable persons from the community to confirm if all are available locally and in which particular area. If not all 10 are suggested available, you may go for any other alternative herbs with strong smell, ones which are not eaten by cattle, goats or increase quantity of available herbs.

Project timing: Whenever herbal ingredients are available

Project plan and schedule:

After preparation it takes 1 month to be ready for application in crops

Topic: Threats to biodiversity

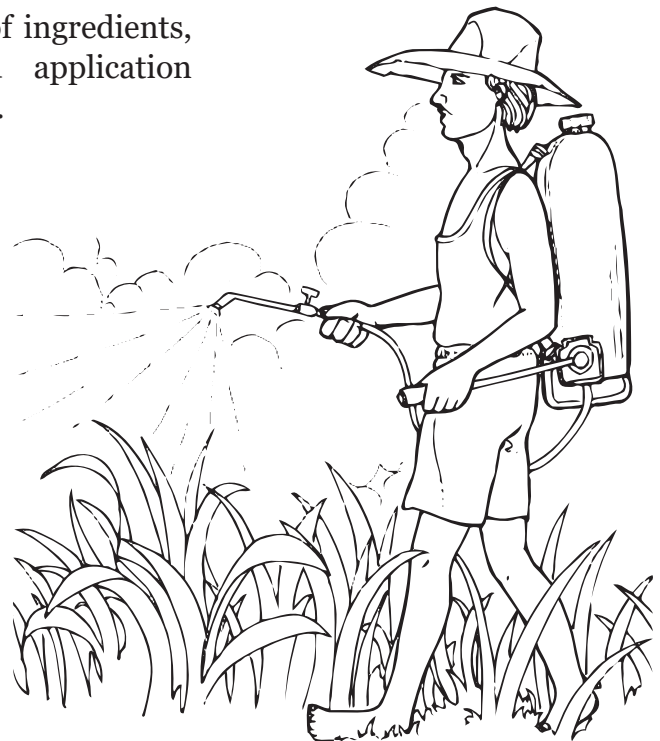
Concept:

Increasing use of synthetic pesticides has emerged as a major polluting agent leaving poisonous residues in food and killing bees, butterflies and birds all over the world. In turn, harming agricultural productivity due to vanishing pollinators. It is also polluting water resources- both above ground and underground and adversely impacting aquatic life forms as well as human health. There is a need to find better alternatives to address this problem and herbal pesticides are one of the option, and these can be prepared by using local plant based resources and with increasing demand it offers entrepreneurship opportunities as well.

Aims:

Learning objectives:

- Students learn about hazards of synthetic pesticides and pollutions.
- Students learn about plants with insecticidal/repelling properties those are locally available.
- Students learn about proportions of ingredients, dilution and application requirements.



Action objectives:

- Students are able to prepare herbal pesticides and apply to crops.
- Avoid land and water pollution by appropriate disposal of used synthetic pesticide packets and reducing their use by using safer herbal alternatives.

Project Steps

Understand and create awareness on pollution hazards of pesticides.

- Find out from various news reports on pesticidal pollution of water and food and its effect on human and other life forms.
- Talk to doctor, teacher to find out more on this topic.
- Conduct a rapid survey to find out whether synthetic pesticide packages/bottles are safely disposed off or they are thrown away on fields, near wells or other water bodies. Do not handle or smell these packets/bottles as you may poison yourself.
- Use that information to create awareness among family and community members and conduct drives with community members to remove openly thrown pesticide packets, esp.



from near wells and water bodies. Remember, this handling should be done by elders safely. Be messengers of safe disposal for elders.

Making safer herbal pesticide

- There are different traditional methods to prepare homemade pesticides. Discuss with elders if they know any and about your plan to learn how to make Dashparni Ark (Leaf Extract of 10 different plants) and where these plants can be found locally.
- Use this suggestive list of 10 plants to collect leaves in the given quantity. Remember quantities given are for mixing in a large drum with 200 litre capacity. If you want to use a smaller drum/container, reduce leaves quantities proportionately.
 1. Neem leaves – 5kg
 2. Kaner Leaves – 2kg
 3. Gulvel – 2kg
 4. Dhotra/Datura – 2kg
 5. Karanj – 2kg
 6. Papaya – 2kg
 7. Rui- 2kg
 8. Van Erand/Chandrajyot- 2kg
 9. Sitafal – 2 kg
 10. Nirgudi- 2 kg

- You may substitute with any locally available alternatives such as Ghaneri, Besharam, Raan Tulas/Bhoot Ganja. Beware of insects and snakes while extracting some of these leaves from wilderness areas. Do this in groups accompanied by teacher/elders.
- Adaptations and experimentation

Preparation method

- Mix all these quantities of crushed leaves with crushed 2 kg green chilly and 250gm of Lasun/garlic and 3kg buffalo/cow dung and 5 litres of buffalo/cow urine.
- Add above mixture quantity to 200 litres of water kept ready in a drum and keep it covered by gunny bag cover for fermentation for 1 month. Remember not to cover it tightly as gas may accumulate. It is important to stir the mixture in the drum 3 times a day.
- After one-month Dashparni Ark is ready. Filter it and store in a different container.
- Dilution for Application
 - 1 litre of Dashparni ark is diluted in about 80 litres of water.
 - Generally for 1 acre crop 2.5 litres of ark diluted in 200 litres of water is applied by way of spray.
- It is important to know that traditional methods are generally not tested in a rigorous scientific manner so there is much scope and need for encouraging trials and testing of ingredients, quantities and concentrations. It is advised to encourage students in this direction.
- With increasing demand for residue free, organic food products herbal pesticides use also is increasing, creating small business opportunities as well. Discuss these possibilities, implications for large, commercial production and distribution with students.



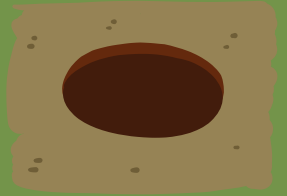
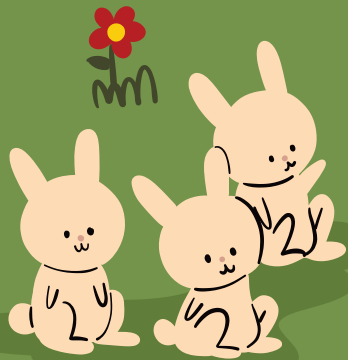
Learning Outcome:

- # Learning about pesticides, hazards and importance of safe disposal.
- # Learning to identify local plants and safer herbal pesticide preparation.

Green habit:

Awareness about pesticidal pollution of land and water resources, Cooperation for making and promoting safer herbal alternatives to hazardous synthetic pesticides.

Help the small bunnies to
find their mum!





Section 2:

**Solid Waste
Management
and Personal
and Community
Health**

2.1. Introduction

2.1.1. Overview

We are a part of biodiversity, the variety of life. We depend on the benefits from nature, for our basic needs of food and clothing, for a large proportion of livelihoods and the economy, and for our spiritual and cultural well-being.

The biosphere and its myriad constituent life forms have a functional role of cycling nutrients, chemicals, materials, waste and energy through the Earth system. The biosphere removes pollutants from the water and air, regulates the climate, and nourishes soils.

Biodiversity helps to adapt to the changing planetary conditions.

Unfortunately, biodiversity degradation and loss interfere with these functions. Helping students learn about biodiversity and the need for its conservation is among the most needed actions today.



2.1.2. Rationale and expected learning outcomes

The activities and projects included in this section of the resource book primarily focus on personal and community hygiene and solid waste management. The aim is to help students understand the basic concepts of the theme, and acquire positive attitudes and values towards addressing the issues related to the theme. The suggested projects ideas for grades 5 to 8 are expected to engage the students in actual actions that contribute to a better environment.

The link of Solid Waste management to Biodiversity, and to Climate Change is discussed in some of the activities. We hope this will establish the importance of learning about these themes in a focused manner, as well as in an integrative manner

Topics

1. How to maintain personal health and hygiene.
2. Menstrual health and hygiene, including understanding menstruation as a natural physiological process, the need to maintain hygiene, methods of menstrual hygiene, criteria for choosing menstrual hygiene products, need for change of traditional mindsets about menstruation, water and sanitation facilities.
3. Covid appropriate behaviour.
4. Source segregation of waste at home.
5. Biodegradation and natural cycling of nutrients.
6. Non-biodegradable materials and need for recycling.
7. Why we need to adopt Reduction, Reuse, recycling of waste and how this can be done.
8. Setting up and following waste management systems at school, including for litter, compost unit, avoiding plastic and thermal use in craft and other activities.
9. Adverse impact of improper waste management on humans and the environment.
10. Laws and rules on waste management.
11. Understanding and supporting public solid waste management systems.

The Origin of Waste



Mining



Agriculture Forestry



Industry



Household and Commercial



Construction Demolition



Wastewater Treatment

1.1.3. Activity Framework

Curriculum-mapped Activity and Project Plan for Personal and Community Hygiene, and Solid Waste Management

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities / Projects
1	Importance of handwashing	Standard 1st - Math Standard 2nd - English, Math Standard 4th & 5th - EVS Standard 6th, 7th - Science	<ul style="list-style-type: none"> Washing hands with soap helps to keep their hands clean Handwashing keeps them healthy Monitoring of Handwashing 	<p>Std 5</p> <ul style="list-style-type: none"> Game – Wash your hands with soap at critical times <p>Std 7</p> <ul style="list-style-type: none"> Self-survey: Hand wash behaviour Survey of hand washing behaviour – Project Poster making – hand wash reminders – Project
2	Waste Management at the School & Home	Standard 1st – Marathi, English Standard 8th - Science	<ul style="list-style-type: none"> To develop a sense of ownership and pride in the school campus, home and maintain it neat and clean. 	<p>Std 5</p> <ul style="list-style-type: none"> Rhymes on waste Home waste audit <p>Std 6</p> <ul style="list-style-type: none"> Waste Survey
3	Segregation	Standard 3rd - Marathi Standard 8th - Science	<ul style="list-style-type: none"> Understanding about waste types and segregation 	<p>Std 5</p> <ul style="list-style-type: none"> Types of waste
4	Recycling	Standard 3 - Marathi Standard 2 - Marathi Standard 8 – Science	<ul style="list-style-type: none"> Use of waste materials to create useful items 	<p>Std 5</p> <ul style="list-style-type: none"> New notebooks from old – Project <p>Std 6</p> <ul style="list-style-type: none"> The Five Rs Make cloth bags – Project
5	Handling drinking water	Standard 3 – Marathi Standard 4th, 5th - EVS Standard 8th - Science	<ul style="list-style-type: none"> Appropriate methods of handling drinking water 	<p>Std 8</p> <ul style="list-style-type: none"> Quiz time

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities / Projects
6	Germs	Standard 2nd - English Standard 4th, 5th - EVS Standard 6th, 8th - Science	<ul style="list-style-type: none"> ● Germs are everywhere, and understand how easily germs can spread from people to people 	Std 5 <ul style="list-style-type: none"> ● Role play – Tale of Germs Std 6 <ul style="list-style-type: none"> ● Game – Catch and Soap
7	Transmission of Diseases	Standard 5th – EVS Standard 8th - Science	<ul style="list-style-type: none"> ● Understand the transmission of disease from faecal matters and identification of various protective measures for preventing faecal-oral transmission 	Std 5 <ul style="list-style-type: none"> ● F Diagram ● Role Play – Transmission of Diseases
8	Decomposition	Standard 8th - Science	<ul style="list-style-type: none"> ● Understand the degradability of wet waste 	Std 5 <ul style="list-style-type: none"> ● Decomposition Experiment Std 7 <ul style="list-style-type: none"> ● Set up a compost pit- Project
9	Waste management at community level	Standard 8th - lesson Standard 8th - Geography Standard 5th– EVS	<ul style="list-style-type: none"> ● Ill-effects of open dumping of waste on other living creatures ● Understanding how the road gets dirtied ● Makes students realize their own role as citizens. ● Understand the role of formal and informal sectors and the challenges faced in managing waste in the city and town 	Std 5 <ul style="list-style-type: none"> ● Skit – ‘A City Street’ Std 6 <ul style="list-style-type: none"> ● Interview with a government official ● Interview with a Safai Mitra ● Using public facilities Std 8 <ul style="list-style-type: none"> ● Write a Letter ● Waste Rules – Project ● Visit a primary health centre - Project
10	Packaging	Standard 8th – Science	<ul style="list-style-type: none"> ● Plastic packaging waste is dependent on how we buy and is reflected in the shopping choices of every household 	Std 7 <ul style="list-style-type: none"> ● Packaging Problems Std 8 <ul style="list-style-type: none"> ● Plastic bags Survey

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities / Projects
11	Needs and Wants	Standard 5th – EVS Standard 8th - Science	Understanding the impact of our needs and wants	Std 7 ● Needs and Wants
12	ORS	Standard 4th– EVS	Oral Rehydration Solution helps the human body in maintaining electrolyte balance	Std 8 ● Prepare Oral Rehydration Solution
13	Pet animal care and disease	Standard 8th - Science	How to be protected from infections from pet animals	● Std 8 ● Pet animals care and disease
14	Waste Disposal Methods and Its Impact	Standard 2nd - English Standard 7th - History Standard 8th - Science	Understanding the various types of disposal methods	Std 7 ● Landfills Std 8 ● Where does waste go ● No Burning
15	First Aid Kit	Standard 2nd - Marathi Standard 4th - EVS	Importance and understanding of immediate aid even before medical treatment becomes available	Std 8 ● Make a First Aid Kit
16	Safe disposal of menstrual hygiene products	Menstrual hygiene does not feature anywhere in the textbooks	<ul style="list-style-type: none"> ● Personal hygiene practices to follow during menstruation ● How to handle different situations that might arise during menstruation ● Learning about menstrual cycles 	Std 8 <ul style="list-style-type: none"> ● Use and safe disposal of menstrual hygiene products ● The right choice ● Card game – Good and not-so-good practices ● Helping Out ● Me, the Advisor - comprehension on menstruation ● Pairing solutions ● Menstrual Hygiene Practices Science behind Menstruation ● Seeking solutions for challenging scenarios

2.2. Activities / Projects

Std.

5

2.2.1. Rhymes on waste

Level/ Class: 5th Standard

Curriculum links: May be used to promote imagination and reflection on any topic.

Activity duration: Classroom
Session 1: 15 minutes to make a cinquain

Activity timing: Anytime

Materials needed: Dictionaries, Stationary

Approach: Indoor activity with whole class

Topic:

Solid Waste Management

Concept:

Teacher briefs the students about what a cinquain is and how it is created. The students then attempt to make a cinquain relating to littering or any other daily habit they can follow.

A cinquain poem is a type of poem that is classified by the number of syllables each line in the poem has. It was created by an American poet, Adelaide Crapsey in the early twentieth century.

The poem typically consists of five lines, using the following structure:

Line 1: One word - The title of the poem (2 syllables)

Line 2: Two words - Adjectives that describe the title (2 syllables each)

Line 3: Three words - Usually action words, ending in 'ing', Tells the reader more about the subject. (2 syllables each)

Line 4: Four words - Show emotions about the subject (8 syllables)

Line 5: One word - A Synonym of the title (2 syllables)

Aims:

Language use to focus attention on the topic of waste.

Key Questions to address:

What are some words and concepts associated with 'waste'?



Preparation:

Teachers should try preparing a few rhymes themselves before trying out the activity with students.

Method/Guide :

Explain the formula for the poem. Provide an example, and then encourage each student to write and recite their own cinquain poem on litter, waste, compost, dust bin, etc. Example:

*Butterfly
Bright, Lovely
Falling, dancing, drifting
Joy, colour, visual poetry
Flutter by*



Learning Outcome:

Students improve their vocabulary and cognition about the chosen topic.

FAQs

Q – Can we use Cinquain for any topic

A – Yes, this method may be used for developing the students vocabulary and grammar, as well as their imagination and thinking skills about any topics, such as waste, water, nature, energy etc.

2.2.2. Decomposition Experiment

Level/ Class: 5

Curriculum links: Decomposition, waste disposal appears briefly in class 8 in a lesson on pollution.

Activity duration:

- # Classroom Session 1: 30 minutes for briefing students about the activity and assignment
- # Outdoor Session 1: 30 minutes
- # Outdoor Session 2: 30 minutes
- # Outdoor Session 3: 30 minutes
- # Activity timing: Anytime

Materials needed

- # 1 cup of fruit, vegetables, egg shells and other organic food waste from the kitchen
- # A few fallen leaves
- # A few pieces of shredded paper
- # Some human or animal hair
- # Some plastic wrappers (chocolate, biscuits, etc.)
- # Some pencil shavings
- # A spade or trowel to dig holes
- # Pot with soil / small corner in the garden if available
- # Cardboard tags tied to twigs to label each hole

Approach: Outdoor

Topic: Solid Waste Management—concept of biodegradation

Concept

Nearly 50 percent of the total waste generated in India is wet waste which is biodegradable in nature. In the absence of segregation practices, this compostable waste is dumped in landfills or even on the road side. Instead the wet waste should be kept separately and converted into manure. Organic materials such as leaves and vegetable peels are broken down by insects, worms, and microorganisms in the presence of air and water into a soil like material, called compost. Compost can be added to soil in gardens and farms to provide nutrition to plants.

This lesson plan helps students to understand the degradability of wet waste. The learning process includes an experiment, and classroom discussions on segregation at school and home. Later on, if the students are interested, a project to set up a compost pit may be taken up, especially with senior students.

Aims:

- Introduction to bio-degradation of organic matter and persistence of plastics..
- Introduction to the benefits of sustainable waste management practices by learning the process of composting.
- Acquire skills related to methods of composting at school and household level.

Key Questions to address:

- What is decomposition?
- What is landfill?
- What is the degradability of waste?

Preparation: None

Method:

Ask students to list different types of waste materials.

Ask where each item comes from, going back to the original raw materials that each item is made of. What happens to the leftover materials of each of these items after they have been used or consumed?

What happens to leaves and other parts shed by trees? Do they get piled up around the trees? Do they remain piled up forever or do they slowly disappear? What could be happening?

Do all things that we throw or discard degrade and get assimilated into the soil? And if at all they degrade how long do they take to degrade? Explain that some items naturally become a part of the soil, while others do not.

Explain that different processes act upon different materials to transform them. For example, ants or other insects may eat leftover food, and when the insects die then microorganisms may act upon their bodies and break them down. Pieces of bricks may slowly break off as they get weathered with rain and sun.

The processes of change of materials may be due to living creatures as well as non-living elements such as water, wind, sun and other materials and chemicals in the soil.

Explain that students could do an experiment to see which items change rapidly. Step 1 of the following could be done in the classroom, while the other steps are to be done outdoors. Step 6 is to be done after 1, 3 and 5 weeks.

Step 1 - Create name tags for all the items collected. Use twigs to tie the tags to.

Step 2 - Using a hoe (kudal) or trowel (khurpi) or spade (favda), dig a few holes in the pot / garden (as many items as you have collected). Place the items - shredded paper, leaves, hair etc.- into the holes.

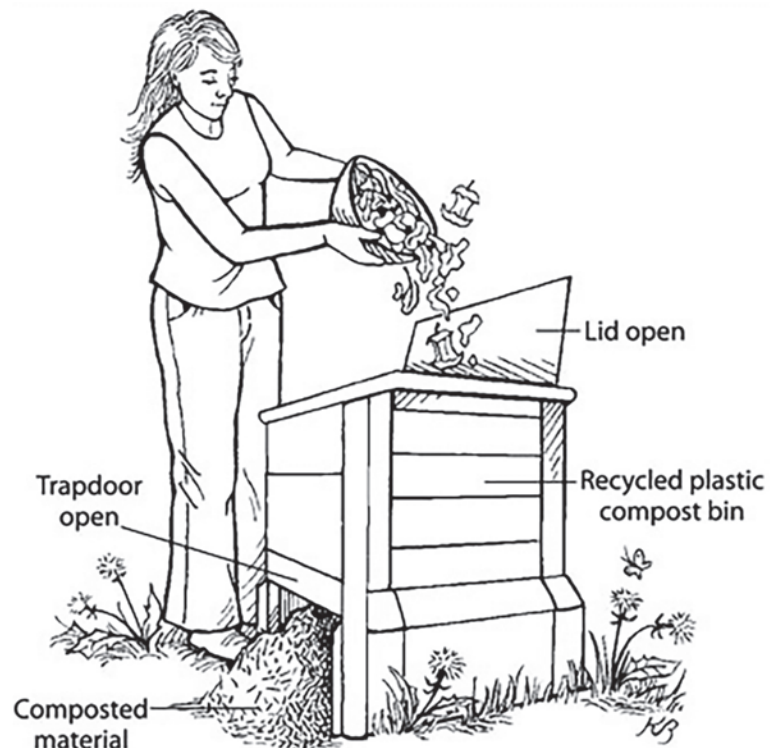
Step 3 - Place the tag stands of the items in their respective holes. Layer the items with soil and cover the holes.

Step 4 - Moisten the soil with one to two cups of water.

Step 5 - Mark the area or the pot with the title 'Decomposition Lab' name tag.

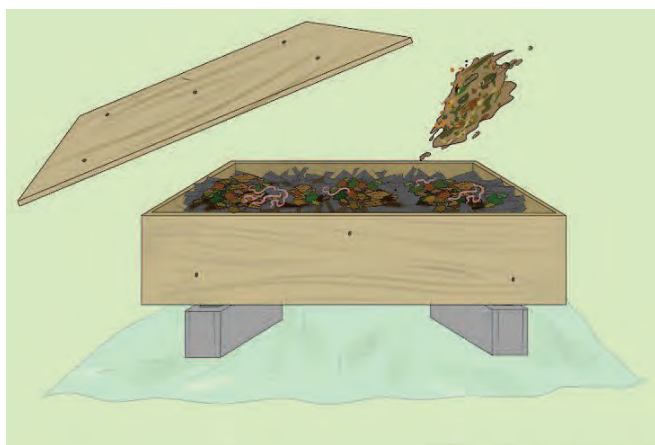
Don't forget to take a Selfie with the lab.

Step 6 - After a week, dig up the holes and take notes to track the decomposing levels. Make observations for three to five weeks.



It is easy to see that the organic matter has started to decompose. Fruit peels shrivel up, and turn brown or black. Paper has begun to break down, though not as much as peels. However, plastic, glass, metal objects remain intact.

During the composting process, different microorganisms (bacteria, fungi, protozoa)



<i>How long does it take for the materials to degrade?</i>	
<i>Materials</i>	<i>Time taken to degrade</i>
Traffic ticket	2-4 weeks
Cotton Rags	1-5 months
Banana peel	Three to four weeks
Rope	3 - 14 months
Paper bag	One month
Cotton bag	Five months
Woollen sock	1 year
Bamboo pole	1-3 years
Wood	10-15 years
Leather shoe	40-50 years
Tin can	50-100 years
Aluminium can	200-500 years
Plastic bag (6 pack cover - tetrapack)	450 years
Styrofoam container	Eternity
Glass	Unknown

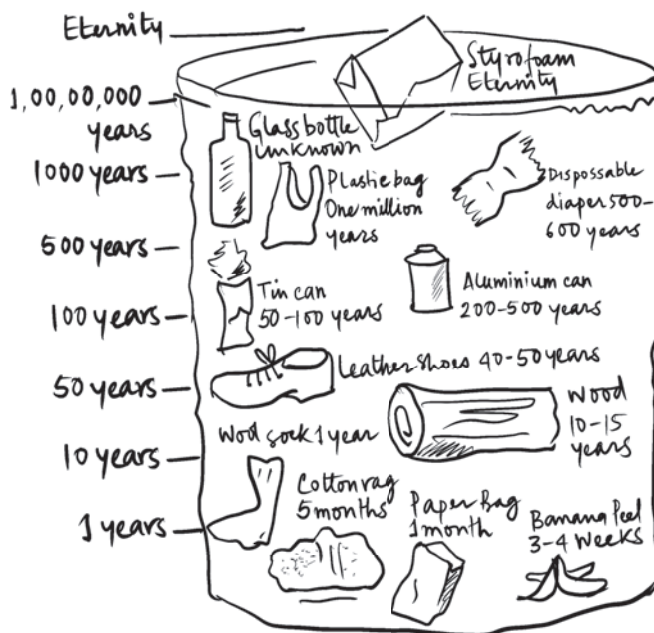
decompose the organic matter. The microorganisms break down the organic food items to produce a simpler substance called compost. While composting is a great way to reduce the amount of food waste, it alone will not eliminate all food waste; however, it will help our planet by reducing methane gas emissions and lessen the number of materials sent to landfills.

Learning Outcome:

Students understand that materials are part of natural cycles. Some materials break down quickly while others take many years.

Depending on the age-group, further discussions can be done, such as:

- *Useful materials can remain locked up in waste items if they are not broken down and re-cycled.*
- *On the other hand, living trees, as well as durable wooden items like furniture can keep carbon trapped or sequestered. This is one way of capturing carbon and storing it out of the climate system. This explanation can link to lessons on climate change.*



FAQs/ Discussion

Q - What is decomposition of waste?

A - The process by which a material is broken down into the components or elements that the material is composed of. Decomposers are organisms such as bacteria and fungi that break down the cells of dead plants and animals into simpler substances.

Q - What is the degradability of waste?

A - Degradability refers to the ease by which a waste material can be broken down into simpler substances that can then become part of other natural cycles. For example, a banana peel in the soil is more easily degradable than a plastic bag in the soil.



Green habit:

Think about disposal, before you buy.

2.2.3. Home waste audit

Level/ Class: 5

Curriculum links:

This activity synthesizes understanding about waste developed in lower classes, and uses arithmetic and language to focus students learning on the type and quantity of waste generated

Activity duration:

- # Classroom Session 1: 30 Minutes for pre-audit briefing session
- # Group Assignment: 1 Week (30 minutes per day) for the waste audit
- # Classroom Session 2: 40 minutes post audit session to share findings
- # Activity timing: Anytime

Materials needed:

- # Writing materials (notebook, pen, pencil), colour charts, colour pens/sketches
- # Home garbage survey worksheet
- # Gloves and masks

Approach: Indoor, group size: Individual / 3-4 students

Topic: Solid Waste Management - types and quantities of waste at home

Concept:

Right from our homes, schools, overflowing bins on the streets, water bodies - there is waste everywhere. Waste has now become a part of our lives. It is present everywhere - on our streets, in farms and fields, in our forests, rivers and seas. It is so evident that we have stopped noticing it. Whether we want to notice it or not, waste has become a huge problem for us and for nature. It is said, “you can’t manage what you don’t measure.”

Tracking the amount and type of wastes we generate is the first step towards waste management. In this lesson, students will be collecting information about the type of waste generated from various sources in their homes by conducting a waste audit survey. A waste audit is an effective tool to help students to learn about the types of waste produced and also identify the type of waste that is most commonly found. This will further help students think about ways to reduce waste. Students will also be involved in group work and will be able to communicate their findings about the topic by creating informative posters.

Aims:

- Identify and classify the types of waste generated at their homes.
- Develop skills to conduct a waste audit survey.
- Analyse, interpret and record data from the waste audit survey.
- Document and share their findings from the survey with family members and their class.

Key Questions to address:

- How does a waste audit help us in managing waste?

Preparation:

Teachers may inform other teachers and parents that the students would be conducting a waste survey.

Method/Guide:

Classroom Session 1

Initiate a discussion in the class on types of wastes generated at students' homes and school. Ask students if they can guess approximately how much waste is generated every day. Now tell the students that they will conduct a waste audit survey in the school to know more about the type and amount of waste generation.

For conducting the survey, the teacher can divide the class into 4 to 5 groups to conduct the audit survey at different places. Ask the students to note down their findings in the worksheet (Worksheet A). Do go through the table with the students before they audit to ensure that they have understood the process and the contents of the table. Discuss with them the unit of measurement for each item such as for paper where they can count, while for waste generated from the kitchen or the garden, it could be weighed or measured in a standard

measure such as mug or bucket. As this task may involve students picking up items from the bin or outside of the bin for effective identification of the type of waste, it is important that they are provided with gloves and masks as a safety measure.

This waste audit would be conducted for the Activity duration of one week. This will help in assessing the total quantity of waste generated.

Home Assignment

Ask students to conduct a garbage survey in their homes as an assignment. A sample worksheet for collecting information is given below.

Classroom Session 2

After completion of the survey, ask each group to calculate the total quantity and the type of waste generated in a week from each source. Encourage the students to add their observations about waste related behaviour of others during the survey in the findings. Invite each

Home Garbage Survey Worksheet									
Material	Source	Quantity of waste							Total quantity (gm)
		Mon	Tue	Wed	Thur	Fri	Sat	Sun	
Paper									
Kitchen Waste									
Plastic									
Glass									
E-Waste									
Domestic Hazardous Waste									
Medical Waste									

group to share their findings from the survey. Get each group to compare their findings and also identify the type of waste that is most commonly generated across all areas.

After each group has presented their findings, ask the students to discuss the following points:

- What would be the average waste generated by their home/school on a daily basis?
- What would be the quantity of wet and dry waste generation based on their findings?
- What could be the different ways to reduce waste?

Students should prepare posters/charts presenting their overall findings. Their posters covering their findings from the waste audit survey and their ideas on ways to reduce waste in school can be displayed on the school bulletin board or presented in their school, homes, societies.

Recycle

Put recyclables in the recycling bin



Glass



Metal and Cans



Plastics



Cardboard and Cartons



Paper and Newspaper

Trash

Put non-recyclables in your trash or compost



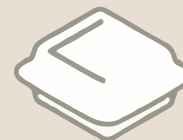
Film Plastic



Yard Clippings
(If not composting)



Dirty Diapers
or Cat Litter



Foam



Food
(If not composting)

Learning Outcome:

The findings of the survey and the experiences shared and reflected on by the students will help in evaluating whether they have understood the sources and types of waste generated in their school and home.

FAQs

Q - How does a waste audit help us in managing waste?

A - A waste management audit can help students understand the type and volume of wastes produced in the school or home, and check what happens to the different waste items. This information can then be used to find ways to reduce waste, avoid littering, improve recycling etc.

2.2.4. Types of waste

Level/ Class: 5th Standard

Curriculum links:

Standard 2 has an image and Standard 4 has a lesson about waste segregation. This activity helps enhance understanding of types of waste.

Activity duration:

For preparation: 1 day

Classroom Session 1: 20 minutes to play the game and 20 minutes for discussion after the game

Activity timing: Anytime

Materials needed:

6 empty bins/cardboards labelled with categories of waste

Paper for preparing 20 Waste Item Cards

Bowl

Sketch pens

Approach: Indoor

group size: 5-15 students

Topic:

Solid Waste Management -types of waste in the city or village

Concept:

Segregation of waste at source is critical to its recycling and disposal. Lack of segregation, and collection and transportation of un-segregated mixed waste to the landfills has an impact on the environment and human health. When we segregate waste, it becomes possible to compost the organic waste easily, and give paper, plastic, glass, metal for recycling. This helps to reduce the quantity of waste that reaches landfills and therefore it needs less space in the landfill. Pollution of air and water can be considerably reduced when hazardous waste is separated and treated separately. It is essential that the waste is segregated at source which is appropriately colour coded or labelled.

This lesson helps students to understand how segregation of waste at source could be an effective way to manage waste. It aims to teach students the right way of disposing different types of waste. The learning process includes playing a game, and classroom discussions to suggest ways to adopt segregation at the school and household level.

Aims:

- Understand the ways in which waste is categorised and why these categories are useful to initiate waste segregation at source.
- Learn skills related to segregation of waste at the individual level and practise it at the household level.

Key Questions to address:

- What are different categories of waste?
- Why is it important to understand different types of waste?

Preparation:

The teacher should prepare cards with the names of different degradable and non-biodegradable waste items as shown in the table or image. Write down the names of 10 items on pieces of card paper, with only one item per card. Put both team cards (10

each) into a common bowl. You should have a total of 20 paper cards with one item of waste written on each of them. Arrange six empty boxes (cardboard boxes or containers for example) and label them according to the six waste categories shown in the table or image.

Method/Guide:

- The teacher will introduce the topic to the class and show them the six boxes or bins and explain each category of waste and which kind of waste will go into the bins. You may encourage the students to play the online segregation game. (<https://kids.national-geographic.com/games/action-and-adventure/recycle-roundup-new/>)
- After the topic has been introduced, the teacher will divide the class into two teams. Each team will get a chance to choose 10 cards. Then ask each team to send one member to pick one card from the bowl and place it into the right waste container.

- The teacher will moderate this and for every correct answer each team gets to score a point. The teams will alternate in picking up the cards and the game ends when there are no more cards in the bowl. The group with the most points at the end of the game wins.
- After the activity has been completed, the teacher should discuss what mistakes each team made in selecting the category of the waste. The teacher should also discuss the results of the school and home audit with this game. The following questions could be discussed after the game:
 - Why do we need to categorise waste?
 - What is the most common type of waste found in your school campus? Is it the same at home? If not, what kind of waste is most common in your home?
 - Why is it important to segregate our waste?



- Can we segregate our waste into WET and DRY in our school or at home? If yes, what steps do we need to follow?
- What will happen if different types of waste get mixed like biomedical and hazardous wastes?
- Would it have an effect on human health and environment?
- What is biodegradable waste? What actions can we take with this type of waste?

Assignment:

The teacher should ask the students to find out which categories of waste are generated from their home. Ask them to initiate segregation of waste at home by labelling dustbins with the category of waste.

Learning Outcome:

The students would have understood the concept of segregation and the categories into which it needs to be segregated.



Category of Waste	Description	Ideas for Cards
Dry / Recyclable Waste	Includes mostly man made products that cannot be broken down or decomposed by natural organisms but can be recycled.	E.g. Glass, tetra packs, aluminium foil, paper, chip packet, chocolate wrapper, polythene bag, plastic water bottle, plastic soft drink bottle, U pins, can, metal clips
Wet / Biodegradable Waste	Includes organic waste made up from natural materials which can degrade or be broken down by microorganisms and fungi into carbon dioxide, water, methane or simple organic molecules.	E.g. Vegetable and fruit peels, leaves from garden, cooked food, flowers, used tea leaves, pencil shavings
Construction / Demolition Waste	Includes waste produced during construction or demolition.	E.g. Old tiles, cement, rubble, broken toilet seats
Biomedical Waste	Includes waste that is medical in nature, comes from a medical facility or lab or contains infectious materials.	E.g. Used syringes, used bandages, band aid, cotton, sanitary pads
Hazardous (Chemical) Waste	Includes waste that is a threat to public health or the environment.	E.g. Pesticide, acids, cleaning liquids like bleach, phenyl, batteries, broken thermometer
Electronic Waste or E-Waste	Includes discarded electrical products or electronic devices.	E.g.: SIM cards, old TVs, wires, mobile chargers, old remote

FAQs

Q – What are the different categories of waste?

A – There are different ways to categorize waste. One way is

- # Organic waste: kitchen waste, vegetables, flowers, leaves, fruits.
- # Toxic waste: old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.
- # Recyclable: paper, glass, metals, plastics.
- # Soiled: hospital waste such as cloth soiled with blood and other body fluids.

(From <http://edugreen.teri.res.in/explore/solwaste/types.htm>)

Q – Why is it important to understand different types of waste?

A – Understanding different types of waste helps us plan how we will manage them better.



2.2.5. Skit – ‘A City Street’

Level/ Class: 5 and above

Curriculum links: Waste disposal and ill-effects of pollution are covered in class 8th through a lesson.

Activity duration:

- # Classroom Session 1: 15 minutes for background briefing
- # Group Assignment: 2 weeks to practice
- # Classroom Session 2: 40 minutes for performance

Activity timing: Anytime or during annual day celebration

Materials needed: Scripts to each actor, Name tags for roles

Approach:

Indoor, group size: 14-16 students

Topic: Solid Waste Management

Concept:

Role play is an important part of child development, as it builds confidence, creativity, communication, physical development and problem solving attitude. Along with being a fun activity, it also allows children to get into character and act out real life roles or fictional performances. Skits are a powerful medium of communication. Through skits, role plays, they learn to express their views, they develop emotionally, develop their communication skills, presentation skills etc. Role plays on topics related to behaviour, habits, etc, help develop sensitivity and awareness among students.

This role play is about the harmful practice of dumping waste in the open, and the possible ill-effects on animals. Sharp objects, toxic materials can hurt animals as well as human beings. We have to manage waste materials so that the impacts of pollution and injuries are avoided.

Aims: Help students learn about the ill-effects of open dumping of waste on other living creatures.

Key Questions to address:

- In what way can waste harm animals?
- How can we avoid the harmful impacts of open dumping of waste?

Preparation: None

Method/Guide:

Classroom Session 1

Teacher encourages students to talk about an early morning scenario on a street near their homes. Teacher asks them what they see, who they meet, what activities are usually going on in the morning, etc. Then the students receive the script and 14-16 students are chosen for different roles.

Group Assignment

Script provided to students, and asked to memorize their respective lines.



Classroom Session 2

The day for enacting the play. The stage is prepared with requisite props. Students are asked to use the name tags prepared for each role.

Skit– The City Street

A city street, early in the morning

(The street is littered with plastic bags, cartons, tins, cans, broken glass, old tyres, waste paper balls, balls, bags and other garbage. Enter Mr. Desai.)

Mr Desai: *(looking out into the distance) Why hasn't the newspaper been delivered on time today? It's nine o'clock. Almost time to leave for my office. (looks out again) Let me ask the Patels if they have received their copy.*

(Goes into the Wings and returns with Mrs Patel.)

Mrs Patel: *No Mr Desai, the newspaper boy hasn't delivered the papers as yet. Nor has our milkman turned up! Mr Patel is so grumpy. He is waiting for his morning cup of tea.*

Mr Desai: *Very strange! And look! The state the street is in, is simply shocking.*

Mrs Patel: *My word! What's this? Where did all this litter and garbage come from?*

(Enter Mrs Joshi with her daughters.)

Mr Desai: *I returned rather late from the office last night and the street was bare then. How did all this rubbish gather here overnight?*

(Suddenly, Madhu falls and injures her foot-gives out a cry of pain.)

Madhu: *Oooh! Ouch! My foot! It hurts!*

Mrs Joshi: *Oh dear! Madhu, are you alright? Oh, no, her foot is bleeding so much! Somebody help, please!*

Mrs Patel: *Nidhi, run and fetch Dr Mrs Sawant. Request her to come quickly, Your sister has cut herself on a broken glass bottle.*

Mr Desai: *I'll get some ice at once.*

Mrs Joshi: (almost in tears) My poor child! How did all this broken glass happen to be here?

Mrs Patel: Look around. It's not just broken glass, but....

Mrs Joshi: Dear me! What nonsense this is! Unbelievable! Where has all this rubbish come from?

(Dr Sawant enters with Nidhi. She has a doctor's kit.)

Dr Sawant: Let me see the wound.

Mr Desai: Here's some ice to stop the bleeding.

Dr Sawant: What presence of mind! Good! (Applies ice on the wound.) There now! It has stopped bleeding. It's a deep cut. I'll dress the wound and she will be fine.

Mrs Joshi: Thank you, Doctor. So kind of you to come at once. But I am going to complain to the Mayor. Have you seen the rubbish and the litter on the road?

Dr Sawant: Oh, it's a mystery. All this garbage was not there yesterday. And now..... just look!

(Enter newspaper boy, milkman, hawker, etc.)

Mrs Patel: The Mayor must not have seen..... Look, the newspaper boy! He is limping. And the milkman at last! (To the milkman) Why, where's your bicycle and why are you so late?

Milkman: The tyres were punctured. I had to come walking all the way with this heavy milk can.

Newspaper boy: And I tripped over an old tyre and sprained my foot. It was quite dark early this morning. I did not expect an old tyre right in the middle of the road.

Mr Desai: I see! Something must be done.

(Bus driver enters carefully avoiding the litter.)

Bus driver: Mrs Joshi, Mrs Joshi, I'm sorry. I can't drive the school bus today. On every road and street there is nothing but litter. It looks like an obstacle race course.

Mrs Joshi: *I know! I'm going to send for the Mayor at once. He must see this. Our children are not safe with all these dangerous broken objects around.*

Hawker: *No one is safe. Let's request the Mayor to come and see for himself.*

Mr Desai: *I'll fetch him. (Exit)*

(Enters again with the Mayor and his retinue.)

Mayor: *(Annoyed) Unbelievable! Shocking! How do you expect people to walk through all this rubbish? Why don't you all dispose of the garbage properly?*

Mrs Patel: *But we do, Mr Mayor. We give our garbage to the garbage collector.*

Mrs Joshi: *Yes, we don't litter our streets like this.*

Mr Desai: *Or we take it to the dumping ground near the river-side - away from here. The rains then wash it away.*

Mrs Patel: *Or the winds blow it away.*

Mayor: *Then how did it come back into the town overnight?*

Bus driver: *That's the problem! Nobody knows how it got here. It's a mystery.*

Newspaper boy: *It looks like someone has done it purposely to spoil our town.*

Mrs Joshi: *And endanger our children.*

Milkman: *And hinder our daily work.*

Mayor: *We will not tolerate this! I must look into this. I will not spare anyone. Who has done this? Who is responsible for this mess?*

(Enter animals who have been hiding - deer, hare, birds, squirrel, bear, etc. Each one comes out from its cover turn by turn, saying)

Animals: *We are responsible! We have brought in all the litter. We have spread the garbage all over the town.*

Deer: *Yes! We confess we did so.*

Mayor: *What? You! How dare you?*

Mrs Joshi: What right do you have to spoil our town and make it unsafe to move around?

Bear: (comes forward) We have only brought back to you what belongs to you. Tell me, what right do you have to dump all this in the forests? The forest is our dwelling place.

Birds: Our trees are dying and vanishing because of you. Where can we roost or build nests?

Squirrel: And where can we live?

Hare: You are worried about Madhu being injured because of sharp broken glass - Don't our young ones get injured too?

Deer: Yes ! And we have no doctor to dress their wounds. Our young ones simply die.

Madhu/Nidhi: Oh, no! How shocking! Terrible!

Tortoise: All the fish in the rivers and lakes die because of the waste dumped in water. How we suffer because of the chemicals and poisons!

Bear: And so many animals who drink the polluted water fall ill and die.

Dr Sawant: Yes. It is unfortunately true.

Peacock: So we called a meeting and decided to return all your dangerous stuff back to you. We don't need it.

Bear: Anyway, we were not as cruel as you are! We have only returned the garbage. We have not poured chemicals and poisons onto your settlements.

Mayor: I see. You animals and birds do have a point. You are right.

Mr Desai: You have opened our eyes. We should not dump rubbish in the forests or rivers or lakes.

Mrs Patel: But where can we dispose it of?

Mayor: If you all agree to sort out the litter, I will arrange for it to be collected separately. Then, some of it can go for processing and some, for recycling.

Mrs Joshi: Good idea! Let's do just that.

Mayor: *Let us save our mother earth from further harm. (To the animals) Thank you, dear animals for teaching us a lesson so effectively. We assure you, we will not pollute or spoil your homes. I shall even warn those who go there for picnics.*

Some animals: *Thank you, Mr Mayor! Thank you. (They return.)*

Mayor: *Self-help is the best help. Let's clear this up. (All including the Mayor start picking up the litter.)*

-Curtain-

Learning Outcome:

Students understand why they should not dump waste in the open.

Green habit:

Do not dump waste materials in the open.

FAQs

Q – In what way can waste harm animals?

A- Waste is harmful to animals in many ways

Poisonous chemicals and sharp objects causing injuries can harm animals just as humans are harmed. Animals often ingest plastic bags when they eat leftover food thrown in plastic bags in garbage dumps which get collected in the stomach, interfering with food intake and digestion. Plastic string, nets can get

entangled in wings or limbs, beaks, claws etc. Birds are known to make their nests with scraps of plastic which may make nests more visible to predators.

Q – How can we avoid the harmful impacts of open dumping of waste?

A –The best way is to have no open dumping of waste.



Case Story: Nirmalya Collection

Location: NutanGyanmandir, Adavad, Nashik

Students conducted a rapid study of the nearby villages in the cluster where the school is located. They found that around 47 villages did not segregate their waste. There was no provision for waste collection. Waste items made of plastic and thermocol have accumulated in large quantities in dump spots and scattered around the landscape due to the lack of a proper management system. Often, the waste is either burned or thrown in the open, disposed of on the side of the road in all the villages. Garbage was present in all the rivers and streams in the area.



A major component was Nirmalya disposal leading to lake, reservoir and river pollution. The students took up an awareness campaign in the villages. Students took a pledge to use shadu mud idols, and collect the flowers and fruit offerings made to the deity. They met different youth groups and Mandal organizers and asked them to collect the nirmalya separately. At the end of the festival, all the nirmalya was collected and used to make compost within the school campus. The compost thus prepared was put into the soil around trees in the village and school. The project received good support at the community level.



2.2.6. F Diagram

Level/ Class: 5 and above

Curriculum links: EVS Standard 5 covers spread of infections by food and water; Science class 8 mentions infections transmitted via animals, types of disease, causes, symptoms, treatment etc. The Oral-faecal transmission route is absent. This activity helps students become aware of the most common infections and their spread.

Activity duration: 60 minutes

Activity timing: Anytime

Materials needed:

Chalk

F- charts (copy from unicef booklet) or NCERT

Picture cards OR chart papers

Approach: Indoor activity groups of student (7-8 students in each group)

Topic: Personal & Community Hygiene – Faecal – oral route of disease transmission

Concept:

Divide the children into groups of equal numbers (8-10 per group). Ask the children to form teams. Explain to them that they will be playing a game to understand the transmission of disease from faecal matters and identification of various protective measures for preventing faecal-oral transmission. Provide an introduction to disease caused by faecal and faecal-oral transmission of disease. After the children have understood the faecal-oral routes of disease transmission, introduce the protective measures we can take to prevent disease transmission. Provide each team a set of cards containing names of various faecal-oral routes and barriers. Cards which have pictures can also be used

Aims:

Understand the faecal – oral routes of disease transmission and how to protect oneself.

Key Questions to address:

- What is the faecal-oral route?
- Which of our actions cause the spread of diseases?
- What are the barriers to faecal-oral route?

Preparation: None

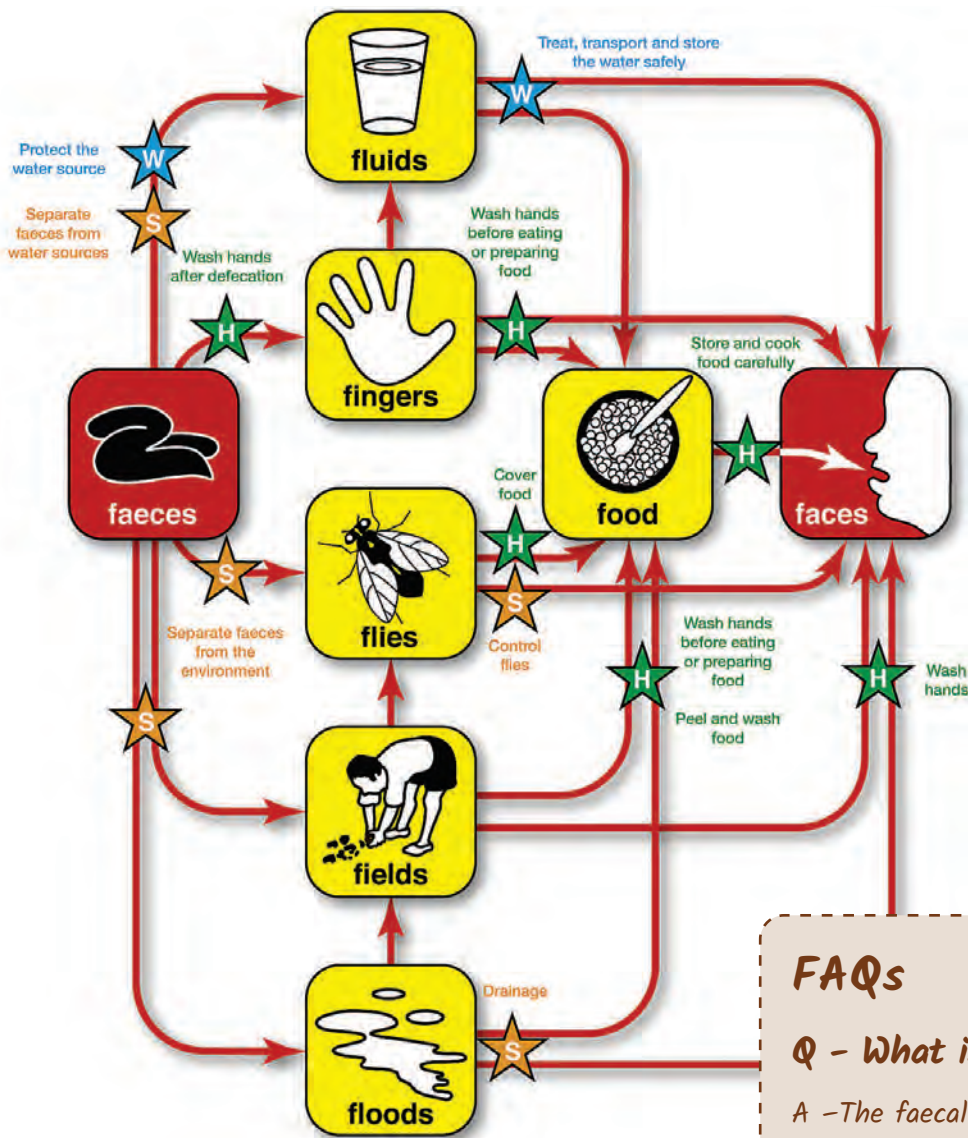
Method/Guide:

Explain and demonstrate that this is a competition between teams to draw the faecal- oral route of disease transmission and place the right barriers to prevent them.

Allot adequate and appropriate space to every team.

Marking powder/ chalk can be used for connecting various transmission routes.

The group activity continues till all the teams have finished the task of constructing the faecal- oral routes of disease and placing the right barriers. Verify this for every team and explain



the correct method. Award points to the teams based on their performance. Repeat the group activity and challenge the teams to complete it in shorter duration.

Learning outcomes:

Students understand about the faecal-oral routes of disease transmission, important barriers to prevent disease transmission, importance of adopting important barrier practices, and adopting hygiene behavior so that we can effectively prevent bacteria and other pathogens entering our bodies and others' bodies through us.

FAQs

Q - What is the faecal-oral route?

A - The faecal-oral route means that disease-causing germs from the faeces of an infected person reach the mouth of another person. E.g. open defecation by an infected person, may attract flies, that then sit on uncovered food, eaten by another person.

Q - Which of our actions cause the spread of diseases?

A - Poor hygiene (e.g. not washing hands with soap, not keeping food covered), poor water and sanitation management (e.g. open defecation) causes spread of diseases.

Q - How can we break faecal-oral transmission chain?

A - Using toilet for defecation, washing hands with soap after defecation, keeping the food covered, handling water carefully, overall cleanliness.

2.2.7. Game – Wash your hands with soap at critical times

Level/ Class: 5

Curriculum links: Handwashing gets introduced in class 1 in Math textbook with before and after action images, followed by hand wash images in class 2 and 3. Standard 7 has an activity of making charts about maintaining good health.

Activity duration:

Classroom Session 1: 20 minutes

Classroom Session 2: 20 minutes

Activity timing: Anytime

Materials needed:

2 Picture cards (copy from unicef booklet)

Chalk

Paper ball

A4 paper/ drawing paper

Colours/ crayons

Approach: Indoor activity with whole class

Topic: Personal & Community Hygiene – Wash your hands

Concept:

Having and encouraging good hygiene practices in early childhood is essential for reducing the risk of cross infection. Helping children to develop appropriate personal hygiene habits will become embedded as they grow and develop.

Aims:

Washing your hands during critical times and not forgetting about it.

Key Questions to address:

- What are hygiene practices and why are they important?
- What are the critical times for handwashing?

Preparation: None

Method/Guide:

Classroom Session 1

Children are asked to sit facing the board.

The teacher draws a number of circles on the board and writes phrases/words relating to critical times of handwashing inside the circle like e.g. handwashing with soap/ash, handwashing after play, handwashing after defecation, etc.

Now, draw a circle on the ground about 2-3 metres away from the board.

Ask a student to stand in the circle drawn and with a ball in hand try to hit the circles on the board with the message that relates to critical times of handwashing mentioned inside the circle.

Each student is given three chances.

The student reads out the message he/she has hit on the board and explains it to the class.

Classroom Session 2

Now, instruct the students to sit in groups of 8-10. Explain to the students that they will be participating in a drawing activity. Each group will be required to draw the occasions that call for handwashing with soap. Once the groups

have finished, they display their art to the others.

The best drawings are chosen (one of each occasion of handwashing) and put up in the class in a creative manner.



Learning outcomes:

Students learn that critical times to stress on for handwashing with soap is before eating food and after defecation.

FAQs

Q - What are hygiene practices and why are they important?

A - Hygiene refers to a person's behaviour for personal cleanliness and health. Hygiene practices are those practices that prevent the spread of disease-causing organisms, commonly known as germs. Hand washing with soap helps to remove disease-causing germs (as well as other germs), mud.

Q - What are the ill effects of not following hygiene practices?

A - You can fall ill if the germs go into your body through your mouth, eyes, skin etc.

2.2.8. Role play – Tale of Germs

Level/ Class: 5

Curriculum links: EVS textbook for class 5 mentions Infections, diseases and how to prevent them while Science textbook for class 8 mentions infections transmitted by animals, types of disease, causes, symptoms, treatment etc. This activity is introduced at lower classes with a role-play to introduce the topic of infections and their spread.

Activity duration:

Classroom Session 1: 60 minutes for role play

Classroom Session 2: 20 mins for poster making and discussion

Activity timing: Anytime

Materials needed:

- # Coloured chart paper, Scissors, Tape, etc to make props, costumes [Crown for a king, Scary mask for the germ/monster, Cape for queen, etc..]
- # Chart paper/A4 paper
- # Crayons
- # Pencil/eraser
- # Illustrations

Approach:

Indoor activity with whole class

Topic:

Personal & Community Hygiene–Germs are invisible but can make us ill

Concept:

It's hard for children to understand that something they can't see can actually make them sick. Even though they can't see germs, children need to know how to protect themselves from them by using healthy habits. Role plays on topics related to behaviours, habits, etc, help develop sensitivity and awareness among students.

Aims:

Able to visualize that germs are everywhere, understand how easily germs can spread.

Key Questions to address:

What are germs and how do they spread?

Method/Guide:

Classroom Session 1

Role play of the following story by a few selected volunteers who need to be briefed and then given props, costumes accordingly.

Story

Once upon a time there was a king and a queen who lived on the hilltop. They had a very big palace with 10 doors to enter their house. The palace was filled with their families and relatives from faraway lands. There lived Princess Keya and Prince Bhunar. They used to play inside the palace. They had 4 horses and 2 big elephants. Inside the palace there was a beautiful garden where Keya and Bhunar played with the birds. They often lied down under the big Neem Tree and drank from River Swaasti which flowed inside the palace boundaries. One day when Keya and Bhunar went outside to meet their friend, who lived in the nearby farm, Jontu, a monster, saw them crossing the road. He wanted to hurt Keya and Bhunar. But both of them were very brave. They asked Jontu what they want and Jontu replied that he will beat Keya and Bhunar so that they can never come out to play. Keya was shocked and she stood still. Bhunar told Jontu that their father was a king and he will never spare Jontu for this atrocity. He said

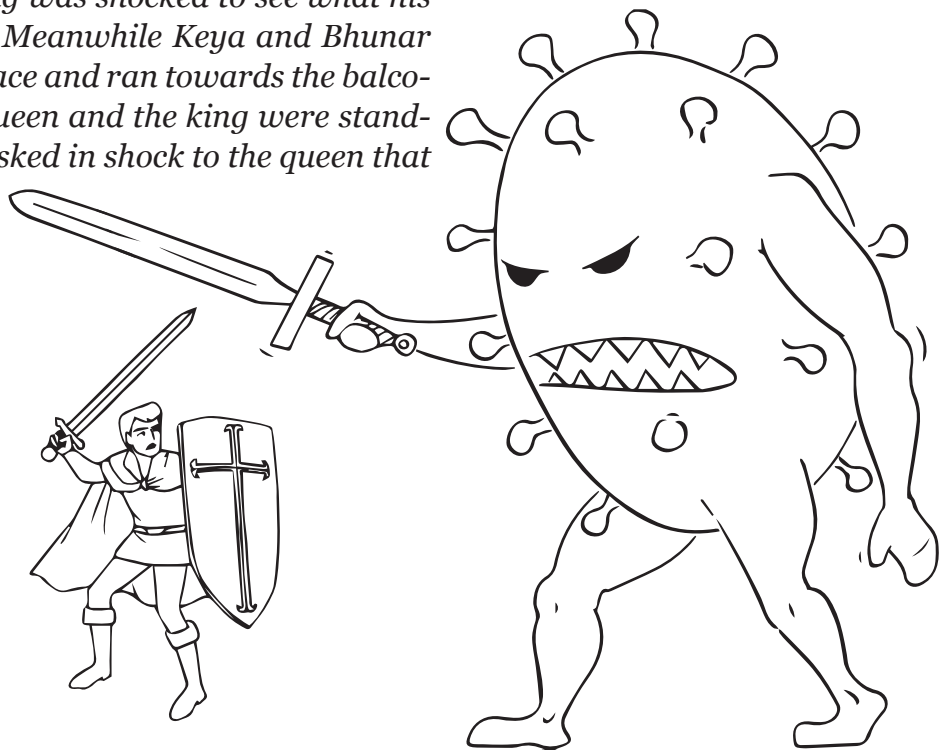
their mother was the queen of magic and she will be very angry to hear this. But Jontu was completely out of his senses. He only had bad thoughts. He laughed at them and said that let's see how they escape him. Once he said this, Jontu started growing in height till he became a huge giant. Keya and Bhunar knew that they would be killed if Jontu attacked them. Keya and Bhunar started running towards their palace screaming out for the King and the Queen.

The King and the queen were having tea in the balcony when they saw their little Princess and Prince running towards the palace. Then they saw that Jontu is chasing them and he has transformed himself into a monstrous giant. The king called the guards in a thunderous voice and asked them to quickly close all the doors. The queen panicked and she thought that Keya and Bhunar would not be able to escape inside the palace. So she did a spell and gave Jontu a curse of "Adrishyatam", As soon as she spelled it out Jontu turned into small Jontus in innumerable numbers. It was like stream of ants and then finally it disappeared. The king was shocked to see what his wife had done. Meanwhile Keya and Bhunar entered the palace and ran towards the balcony where the queen and the king were standing. The King asked in shock to the queen that

how could she do this as now Jontu will be not seen with bare eyes and will try to attack Keya and Bhunar. The queen was horrified as she understood her mistake and she fell down. Keya quickly held up her mother and made her seat while Bhunar clutched his father's hand in horror.

The King then called all the people from the village, the soldiers and the merchants from all over the world and told them that Jontu is an Invisible Monster who wants to harm humans especially the children. He asked everyone to stay cautious as Jontu can be anywhere and no one will be able to see it.

Meanwhile Jontu found his body so small that he couldn't do much alone. So he called all the other parts of his body which looked similar to Jontu. Jontu was very angry and he couldn't think straight. He screamed and jumped around wanting to take revenge. Slowly after that Jontu started plotting how he will harm Keya and Bhunar again. That's how Jontu was there everywhere, making more Jontus and plotting the final attack.



Classroom Session 2

Give drawing sheets (white) to groups of children to draw the various kinds of germs (pictures copy from unicef booklet). They can draw a hand first and then draw germs on them, or put cut outs of different coloured germs on the image of the hand (illustrations copy from unicef booklet) Posters can also be made and can be put up in the class, also in the wash basin areas of the school or even at their homes.

Discussion:

Students could be debriefed about who might Jontu in the role-play be, in our everyday life? Who does Jontu depict? How to get rid of germs on their hands?



Learning outcomes:

Students learn about Germs, how they affect our health and because they are not seen, it becomes more important to wash hands always and during critical times.

FAQs

Q - What are germs and how do they spread?

A - "Germs" refers to very tiny living organisms such as bacteria, viruses, fungi, and protozoa. Different types of germs live in the soil, air, water, and even on and in our bodies. Some of them cause diseases.

Q - How can we prevent spread of germs?

A - If we follow appropriate hygienic behaviour like hand washing with soap at critical times, we can easily prevent germs spread.

2.2.9. Self-survey: Hand wash behaviour

Level/ Class: 5 and above

Curriculum links: Math Standard 1 introduces handwashing with images. Standard 2, 3 also have hand washing images. Standard 7 has an activity of making charts on good health.

Activity duration: 20 minutes

Activity timing: Every day during lunchtime

Materials needed: Time table format, Chalk and board

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene- Washing hands at critical times

Concept: Hand Washing helps prevent us from getting sick and making other people sick. Children need to learn the steps of proper hand washing because poor hand washing technique does not remove germs. Children need to know the important times to wash their hands and follow simple hygiene rules by incorporating good hygiene methods so handwashing becomes routine. Monitoring the critical times of handwashing in school could check the spread of germs and keep the premise safe and hygienic.

Aims: Understand when to wash hands. (Critical times of handwashing)

Key Questions to address:

Why and when to wash hands?

Preparation: None

Method/Guide:

Classroom Session 1 = Get students to draw the table in their notebooks by drawing the table on the black board.

Week	Before eating/ touching food	After using toilet	After play- ing outside/ playing with pets	After sneezing/ coughing	Before touching babies	Before handling drinking water
Mon	N	Y	N	Y	Y	N
Tue	Y	N	Y	N	N	N
Wed						
Thur						
Fri						
Sat						
Sun						

When to Wash Your Hands



After attending school



After coughing or sneezing



After playing with friends

After using toilet



After touching animals



Before eating



FAQs

Q - Why and when to wash hands?

A - Hand must be washed:

- # Before eating/ touching food
- # Before handling drinking water
- # After using toilet
- # After playing outside/ playing with pets
- # After sneezing/ coughing
- # Before touching babies
- # Before and after handling the mask

Learning outcomes:

Children use a timetable for self-monitoring of handwashing and correct their habits whenever required.

Green habit:

Self-monitor or observe your own handwashing behaviour.

2.2.10. New notebooks from old

Level/ Class: 5

Curriculum links: Class 2 English and class 7 English and Marathi textbook has a card making and best out of waste activity. This activity strengthens the concept of 3Rs.

Resources and preparation needed:

- # Used notebooks with some empty pages left in them
- # Chart paper or cardboard to make a cover
- # Scissors and paper cutter
- # Eraser
- # Big needle and thread

Project timing:

Preferably after the academic year ends, during summer vacations

Project plan and schedule:

Classroom Session 1: 15 minutes for pre-discussion and demonstration

Home Assignment: 1 week for collection of material and creating a new notebook

Topic:

Solid Waste Management

Project Concept:

School notebooks have a number of pages that remain empty at the end of the school. Learning to reuse the remaining pages is a skill and personalizing a notebook can really make it our own.

Objectives:

- Learning objectives - Learn to recycle old notebooks, Develop creative skills
- Action objectives - Reducing paper waste

Project Steps

Explain the steps to make a new notebook from left over blank pages of used notebooks:

1. Remove blank pages from the used notebooks, taking care not to rip the pages.
2. Trim the torn edges
3. Fold the pages and the cover paper in half and stitch the pages together in the centre to the outer cover. This will give you a half sized notebook. If you prefer to have a full sized notebook, then carefully stitch the pages on the left margin side.
4. Students can decorate the cover of their new notebook.

Learning outcomes:

Students learn the concept of conserving resources and practice re-use and recycling in their own lives.

Green habit:

Make new notebook from old.

Case Stories: Paper Bank

School name: Pune Municipal Corporation School No. 39 B

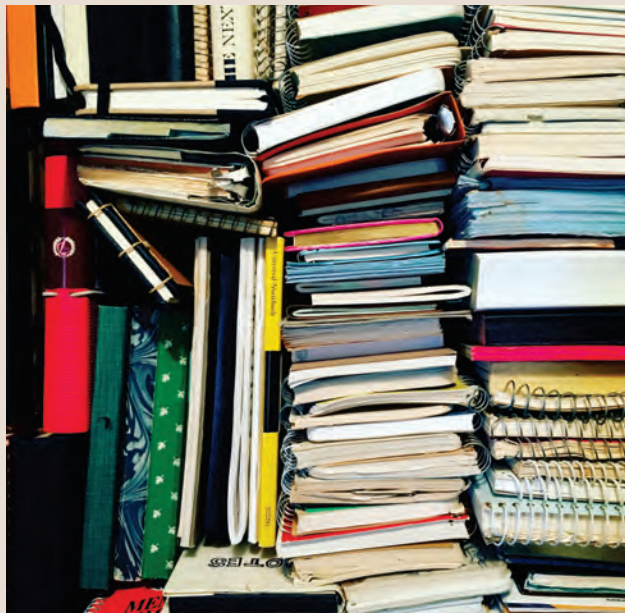
Location: Pune

Paper waste generated in the school premises was a major concern for the Swachhagraha Dal. The members realized this waste included unused or one-sided paper, especially from notebooks. Collection of this unused paper was important as it would considerably reduce the waste.

The Swachhagraha Dal came up with a unique idea of a 'Paper Bank' wherein students could deposit unused, one-sided paper, or loose papers of the notebook into the bank. At the end of

the year the Dal prepared different useful items from them, and scrap/rough books and they were provided for the use to students. The awareness generated considerably reduced the paper waste in school. The Swachhagraha Dal could also take up reduction of food wasted during lunch break.

The cleaning staff as well as Cleanliness Active students were felicitated during national events to encourage others to perform well on the cleanliness front.



2.2.11. Interview with a government official

Level/ Class: 6

Curriculum links: Standard 8 Geography introduces how to conduct interviews. This activity helps build the skills for conducting interviews.

Activity duration: 20 minutes for briefing and to conduct talk / interview and discussion.

Activity timing: Anytime

Materials needed: Questionnaire

Approach: Indoor activity for the group size of 2-5 students.

Topic:

Municipal systems for waste management.

Concept:

Sanitary standards play an important role in our day to day lives. Sanitary inspectors play an important role in prevention and control of diseases from spreading in the community. They initiate the proper implementation of environmental sanitation. They are entrusted with the responsibility of ensuring the functioning of a public place in a hygienic environment. Students should understand the role of local authorities and officials, and the rules related to Solid Waste Management implemented by the local government. Interviews are a good way to meet officials and learn from them. This also makes students realize their own role as citizens.

Aims:

- Understand how garbage is managed in the area.
- Identify people in the waste management sector.

Key questions to address:

- What is an interview and how is an interview conducted?
- What is the role of a sanitary inspector in Solid Waste Management?
- How can citizens work with the government authorities in waste management?

Preparation:

Teachers should help students to request for an appointment with the government official for an interview.



Method/Guide:

Arrange for a talk or request an interview with the local area corporator, Chairman of the Health Committee or Sanitary Inspector or gram sevak or the Commissioner of the Corporation to help the children understand how garbage is cleared in the town/city, what are the problems faced by the corporation in clearing the garbage? How garbage segregation is being done? What is disposable mechanism and reuse/recycle policy? Ask students to prepare a questionnaire for the interview. Give two or more children the responsibility of taking notes from the speakers' talk.

Learning outcomes:

- # Students are exposed to the idea of municipal services and the role of public in the same.
- # Students learn practical skills of conducting interviews.

FAQs

Q - What is an interview and how is an interview conducted?

A - Interviews are of different types, such as for gathering information in a study or research, or a job interview. In a study, the students conducting the study can interview different individuals, such as officials, people within the community, etc. The interviewer, who conducts the interview, has to prepare questions, and coordinate with the interviewee, that is the person who is to be interviewed, for a suitable time. When setting up the appointment and at the start of the interview, the students should speak about their study (in this case, on solid waste management), and the purpose of the interview (e.g. to understand the role of the local government and the public in SWM) and then ask questions. If the interview is to be recorded, then the interviewee's permission should be taken before recording.

Q - What is the role of a sanitary inspector in Solid Waste Management?

A - Sanitary health inspectors are professionals who are focused on prevention, consultation,

investigation, and education of the community regarding health risks and maintaining a safe environment. Public health is an important matter of concern for the municipal bodies in various states. (From Ministry of Health and Family Welfare, Govt of India, https://main.mohfw.gov.in/sites/default/files/Short%20Term%20Training%20Curriculum%20Handbook_Sanitary%20Health%20Inspector_1%20June%202017_0.pdf)

Q - How Citizens are responsible for garbage and how can they work with the government authorities in waste management?

A - Citizens have a crucial role in waste management. As generators of waste, they can help in waste management by ensuring they themselves follow the rules about segregating waste at source, not littering, burning or dumping waste, setting up a compost facility, and ensuring recycling and that they give waste to authorized waste collectors, if these have been appointed. Citizens can also work with their neighbourhood community and the government to set up or improve waste management systems as per the need.

Level/ Class: 6

Curriculum links: The role of the formal and informal sector in waste management is not covered in any of the classes. This activity makes students aware about the safai karmacharis and their role in keeping our surroundings clean while building empathy towards them.

Activity duration:

- # Classroom Session 1: 45 minutes for background discussion and briefing
- # Group Assignment: 1 week to conduct interviews and analysis of information
- # Classroom Session 2: 30 minutes for each group to present their findings

Activity timing: Preferably at the start of the academic year

Materials needed:

- # Stationary
- # Resource A - Sample Interview Questionnaire

Approach: Outdoor activity with whole class

Topic:

Waste management efforts

Concept:

Recycling of material is one way of economic use of resources. Waste collectors render a great service to society as they help in retrieving recyclable materials from waste. However, often the conditions of work of waste collectors is dangerous or unhygienic because the village or town has not set up proper waste management systems, or the generators of waste (such as individual households) are not keeping different types of waste separate or segregated.

In this lesson, students will interact with some of the stakeholders to get an in-depth understanding of how these sectors work on a day to day basis. This interaction will help them understand the role of formal and informal sectors and the challenges faced in managing waste in the city and town.

Aims:

- Help students identify the different stages of work in managing waste and the difficulties faced by waste workers due to improper systems of waste management.
- Help students think about how these difficulties may be reduced, including through segregation of waste at source.



Key questions to address:

- What happens to recyclable material lying outdoors?
- What are the difficulties in picking up recyclable materials from heaps of mixed waste?
- What should be done to keep recyclable materials separate and how can these materials be given in a neat condition to waste collectors for recycling?

Preparation:

Identify and contact the individuals to be interviewed, brief them about the purpose of the students' interview, and request for their time and support.

Method/Guide:

Classroom Session 1

Teachers may ask students:

- Who are the key stakeholders involved in running the waste management system?
- Who are the formal and informal workers involved in the various steps of the waste management system?
- What are the differences between the two sectors?

Now you can brief students that they will be conducting interviews of selected people from the formal and informal sectors to get an in depth understanding of their work and the differences in their role in waste management. Invite a rag picker to visit the students. Let children interact with him/her. Students could refer to Resource A - Sample Interview Questionnaire.

Resource A - Sample Interview Questionnaire

Date: _____

Name/s of student: _____

Name of the interviewee: _____

1. How long have you been working for waste collection and recycling?
2. What time do you leave for your job of waste picking and when do you return?
3. Are you self-employed or contracted with a company or the municipal corporation?
4. How do you collect the waste and from where? (houses/ residential/ commercial complexes/ landfill/ dump site, etc.)
5. What materials are separated out?
6. Where do you take the separated materials?
7. What happens to the material after you sell it?
8. What kind of changes have you observed in the type of waste generated?
9. According to you, what type of waste cannot be recycled?
10. What can schools and homes do to make recycling better?
11. What are your suggestions to improve the waste management system of your area?

Group Assignment

Now students in groups can conduct the interviews. Responses from the interviews can be discussed by each group and key points from the interview could be highlighted for the presentation.

Classroom Session 2

The teacher can invite each group to make a presentation and share their findings from the interview and their observations. After each group has presented, the teacher could conduct an overall analysis of the findings gathered from each group. The teacher may encourage the students to write an essay or a short report based on their reflections on their findings. They can add a few lines about any one major challenge faced by waste collectors and suggest some possible solutions to address the challenge.

FAQs

Q - What happens to recyclable material lying outdoors?

A - Recyclable material lying outdoors may just lie there, unless someone collects the material and takes it to a recycling plant. If any waste collectors are present in the town or village, they may be able gather the recyclables, categorize them by type, pack and transport the materials to the recycling units.

Q - What are the difficulties in picking up recyclable materials from heaps of mixed waste?

A - Waste collectors who pick up recyclable materials face difficulties such as:

- 1. Injuries and illnesses due to sharp objects, broken glass, and disease causing germs*
- 2. Extra time has to be spent in separating and cleaning the different types of materials, especially if rotting organic waste has to be washed off, which is unpleasant and time taking.*
- 3. Difficulty in recycling if different types of materials contaminate the recyclable materials, e.g. if certain chemicals are present in a glass bottle, then the bottles have to be washed properly otherwise impurities will be present in the recycled material*

- 4. Lower value is obtained when recyclable material is sold to traders, if they are not clean and free of other materials*

Q - What should be done to keep recyclable materials separate and how can these materials be given in a neat condition to waste collectors for recycling?

A - Set up a system to collect and process three types of materials :

- 1. Organic waste to be taken to the compost unit - this can be done at least once a day and the container can be washed every day.*
- 2. Recyclable materials such as paper, plastic, glass, metal can be stored in cartons or sacks; if glass is broken, then it should be put in a separate bag and given separately to the waste collector so that it is handled carefully.*
- 3. Hazardous and biomedical wastes may be kept in separate containers or bags and marked; with blood soaked napkins or cottons in a separate bag, injection needles cut off from the syringe and stored in a bottle or box.*

Learning outcomes:

Students would have understood the enormous human effort needed in waste management and recycling, and that source segregation can help to stream line the work of waste management. The work conditions of informal waste collectors should be improved. This can be done by source segregation, arranging door step collection of segregated waste and payment of fees for the work of waste collection.

Green habit:

Respect workers who help to keep our surroundings clean and healthy.



Case Story : Sugandha bai

Kagad Kach Patra Kashtakari Panchayat established SWaCH, the country's first fully owned cooperative of waste pickers, to integrate waste pickers into Pune's MSWM systems. This involved two types of transformations: the waste picker changing from a "woman with a sack" (waste pickers are largely women) to that of a service provider with a uniform and push cart; and SWaCH changing the union's more combative approach to one of collaboration with the Pune Municipal Corporation. Today, SWaCH has 2,700 registered members. With the strong support of the Municipal Commissioners and the PMC's second-line leadership, and due to its innovative model, the SWaCH pilot phase (2005-07) achieved coverage of 150,000 households. The SWaCH model combined multiple benefits of sustainability, inclusion, and efficiency. While SWaCH provided the workers, the PMC provided the equipment and bore the administrative costs. SWaCH members collected waste door-to-door, recovered recyclables, and disposed remaining waste at designated points of the PMC secondary waste collection system. Prabhag (ward) level coordinators ensured that user fees were collected, complaints were redressed, and value-added services (like composting, e-waste collection) were offered. Many of these coordinators were the children of waste pickers.

SWaCH members have right to collect user fees for doorstep collection of segregated waste. The model thus allowed environmentally essential recycling and reuse, and enhanced waste pickers' dignity by treating them as valuable service providers.

The SWaCH model has been efficient and replicable. The head of the MSWM Department has acknowledged that the PMC saves Rs 160 million (\$2.46 million) each year in transportation costs due to recyclables retrieved by SWaCH members, savings that can be utilized for other developmental works. Furthermore, between 2012 and 2013, SWaCH has cost the PMC a total of Rs. 36.3 million (\$619,500), which amounts to Rs. 2 per household per month, the lowest spent by any municipality in the country. The initial success of the SWaCH pilot project led to signing a Memorandum of Understanding (MoU) with SWaCH in 2007. From an initial 150,000 households, SWaCH thus expanded its coverage of the city to 550,000 households (approx. 50 percent coverage of the city). Can you think of a similar model in your locality? What can your village and city learn for this case story?

You would like to know a routine day of a SWaCH Member? Sugandh is a mascot representing SWaCH Waste pickers: Follow this link to know more:

<https://swachcoop.com/sugandhabai/>



2.2.13. Waste Survey

Level/ Class: Standard 6

Curriculum links: Science
Standard 8 mentions types of waste.

Activity duration:

- # Classroom Session 1: 30 Minutes for pre-survey briefing session
- # Group Assignment: 30 minutes for the waste survey and analysis of data
- # Classroom Session 2: 40 minutes post survey session to share findings

Activity timing: Anytime or every 6 months

Materials needed

- # Stationary
- # Observation sheet

Approach: Indoor, Group size: 5-6 students per group



Topic:

Solid Waste Management– Litter worry spots

Concept:

Students develop an understanding of the waste management system at the school. Having enough visible, accessible bins in the school campus helps students develop good habits of using them. Students should be able to locate the bins and also understand what goes where.

Aims:

To help students:

- Understand the type of litter found at school, most littered places, finding litter ‘worry spots’.
- Develop skills to conduct a survey at school.
- Express their findings from the survey.

Key Questions to address

What is a waste survey and how does it help in waste management?

Preparation:

Inform other teachers and school management about the survey activity and that your students would check each classroom and office to mark the presence and location of dust bins. If there is a shortfall of dustbins then additional bins may need to be placed. You could request them to provide their suggestions to the students for the exact locations for placement of additional dustbins, if these are required. You may also request other teachers to discuss the findings of the survey with their own students and guide them to not to litter.

Method/Guide

Classroom Session 1

Initiate a discussion on the types of wastes generated in the classroom. Now tell the students that they will conduct a waste survey in the school to know more about the type and amount of waste generation and also map the locations and conditions of dustbins.

Group Assignment

Students may conduct a waste survey covering all the classrooms and other facilities of the school where waste is generated. The worksheet below may be used by students to record observations.

<i>Observation sheet to Identify waste worry spots in school</i>					
<i>Time and Date</i>	<i>Where do you see litter in school</i>	<i>Number of dustbins at that location</i>	<i>Condition of the bins</i>	<i>Type of litter in and around the bins</i>	<i>Why is this spot littered?</i>
<i>12.30pm 17-03-2021</i>	<i>1st Standard classroom</i>	<i>1</i>	<i>unused</i>	<i>Paper, plastic, wrappings, food</i>	<i>Waste being dumped outside, near study tables</i>

Classroom Session 2

Ask students to take a large sheet of paper and draw a map of the school campus. Now they have to use their observation sheet and mark all the places they saw that were littered. Also they mark the bins, the types of litter observed. Ask students to use a different colour code for each marking. For e.g.: Green = Food waste, Blue = Plastic waste, Brown = Paper waste.

The map will show the most littered places in the school and the different kinds of litter found in their investigation. Students can make a presentation in the assembly and share the findings and put their map on the display board.

Learning outcomes:

Students acquire skills for Solid Waste Management planning.

FAQs

Q - What is a waste survey and how does it help in waste management?

A - A waste management survey or audit can help students understand the type and volume of wastes produced in the school or home, and check what happens to the different waste items. This information can then be used to find ways to reduce waste, avoid littering, improve recycling etc.

2.2.14. The Five Rs

Level/ Class: 6

Curriculum links: Recycle and reuse concepts are introduced in class 3, 7, 8. This activity dwells further on the topic and helps develop a deeper understanding of waste segregation.

Activity duration:

- # Classroom Session 1: 15 minutes for pre-discussion
- # Group Assignment: 1 week to collect discarded materials in dry waste
- # Classroom Session 2: 20 mins for students' brainstorming about alternatives

Activity timing: Preferably before the start of summer vacations

Materials needed: Chalk and writing board, Dry items from waste

Approach: Outdoor, group size: Whole class

Topic:

Refuse, return, reuse, recycle, redesign

Concept:

Write the word 'recycle' on the board or a large sheet of paper. Next to it, draw a picture of a bicycle wheel. Point out to the children that both the figures end with the word 'cycle'. The bicycle wheel goes round and round. The word 'recycle' means to use something over and over again. Show the children the recycling symbol and explain to them that the three arrows represent the three stages involved in recycling materials - collect, remake and reuse.

Aims:

- Understand disposable and non-disposable items in waste / Understand recyclable and non-recyclable items in waste.
- Build awareness about self-consumption patterns.

Key Questions to address:

- What is the meaning of recycling?
- What are the advantages and challenges of recycling?

Preparation:

None

Method/Guide:

Classroom Session 1

Point out that when we recycle a product, it does not add to our garbage, but goes back around as something new. Just as the leaves go back into the soil to help a new tree grow, man-made materials can also be broken down to make new material. Old cans and glasses can become new cans and glasses.

Call on some students in the class to list on the board, a few disposable items they have used. Ask students to give specific reasons as to why they choose those disposable items.

Group Assignment

The students are asked to collect some items in dry waste from their homes. Now they make a chart with a list of items collected, their classification as to which category they belong to, based on the 5R principles.

Classroom Session 2

Each student presents the chart and for each item, they are asked to provide a solution in way that the item does not go into garbage. The students have to categorise their items as to which can be reduced, which can be put to better use, etc.

♻️ THE 5 R'S OF ZERO WASTE ♻️



FAQs

Q - What is the meaning of recycling?

A- Recycling is the process of collecting and processing materials considered as waste and preparing new products. Recycling helps the community and the environment.

Q - What are the advantages and challenges of recycling?

A- Advantages: save natural resources, reduce waste

Challenges: collection of recyclable materials, processing of combined materials (e.g. multi-layered plastic, such as used to package branded chips packets, has layers of plastic and aluminium which are difficult to separate.

Learning outcomes:

Students become aware of the consumption patterns and learn to think about minimizing their wants.

Green habit:

Students acquire skills for Solid Waste Management planning.

2.2.15. Using public facilities

Level/ Class: 6

Curriculum links: Standard 5 EVS 5 introduces students to public facilities and their usage. Standard 8 has an activity to record sound pollution at public places. This activity aids students in appropriate use of public facilities.

Activity duration: 40 minutes to set context, brainstorm and develop the handprint action ideas.

Activity timing: Anytime

Approach: Outdoor group activity for whole class

Topic:

Waste management – responsible behaviour

Concept:

Living in a community means we have to share a number of facilities with others. The teacher could initiate the session by recapturing the concept of footprint and handprint. Briefly discuss the various handprint actions citing examples. The teacher could explain further how they can implement these learnings towards increasing the handprint and decreasing the footprint at the community level.

Aims:

Help students plan and implement handprint action ideas on waste management in the community.

Key Questions to address:

- What is a 'public facility', and to who does such a facility belong?
- Why should we be concerned about the condition of a public facility?

Preparation: None

Method/Guide:

Ask the children to list some of these facilities. Beside each facility they can list how these facilities are used collectively and list how each could do their bit to keep the facilities in good condition. The teacher can divide the students into 3-4 groups and each group could be assigned one area of handprint action for the community like Clean up Drive, Spread the Word, Awareness Drive.

Facilities	Uses	Actions
Children's park / garden	Playing games, picnic, walking	Should not throw chocolate wrappings/waste, find dustbin, do not pluck flowers
Road	Commuting from and to school	Should not litter, spit, paint with chalk, not play
Museum		



FAQs

Q - What is a 'public facility', and who does such a facility belong to?

A - Public facilities relate to our basic needs and are services provided by the government to citizens. Some of the important public facilities include schools, hospitals, parks and gardens, public toilets etc.

Q - Why should we be concerned about the condition of a public facility?

A - Public facilities are for use by all citizens. It is each person's responsibility to maintain these in good condition and not cause damage.

Learning outcomes:

Students think about positive actions which can be taken up collectively to solve the problem of waste management in the community.

Green habit:
Keep public places clean.

2.2.16. Game – Catch and Soap

Level/ Class: 6

Curriculum links: EVS Standard 4, 5 have images and lessons on microbes in water and food. Science Standard 6 and 8 mention useful & harmful living things, disease, their spread, symptoms and cures. Standard 2 English mentions use of soap. textbook of class 7 has an activity on soap making. This activity necessitates the need to use soap due to the presence of microbes.

Activity duration: 45 minutes

Activity timing: Anytime

Materials needed: Water bottle, Soap

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene – using soap for washing

Concept:

The most critical aspect of making children aware of the hygiene standards is to make them knowledgeable about the health scenario. Children need to be made aware of how the environment works and how the wellbeing of the human body remains closely connected with it. Children should be given the knowledge that germs get passed onto them and/or from them to others and use of soap helps stop the spread of germs.

Aims:

Understand germs are invisible and harmful for children, water along with soap can save children from germs.

Key Questions to address:

Why is it important to use soap and water for washing?



Preparation:

None

Method/Guide:

Explain to the students that they are playing a game called Catch and Soap.

Select three students as germ, soap and water. Students selected as Water should hold a water bottle, and Soap should hold soap to identify them. The germ starts chasing the children. To tag a child, the germ has to touch their palm. Once the germ tags a child, the child has to freeze into a squat and cannot move. Only the soap and water can save the child.

The soap and water can rescue the tagged/frozen child. To do this water has to hold one hand and soap has to hold the other hand. Only once soap and water are holding the child's hand can he/she get up and resume running away from the germ.

Soap and water have to make sure there is no child squatting. When there are no children squatting, the soap and water can run after the germ to catch it.

FAQs

Q - Why is it important to use soap and water for washing?

A - Germs that can cause diseases get lodged on our hands, especially in the natural oil present in our skin. Washing with water alone does not remove the germs. These remain on our skin. Using soap helps to break down the oils and wash off the germs.

Learning outcomes:

Ask students what happened when the germ tagged a child, how could the child move again. Students recollect that germs are invisible and regularly washing their hands with soap and water is important to wash away germs. Both Soap and Water can only destroy germs.

2.2.17. Make cloth bags

Level/ Class: 6

Curriculum links: Class 2 English and class 7 English and Marathi textbook has a card making and best out of waste activity. This activity strengthens the concept of 3Rs.

Resources and preparation needed: Old cloth, some new cloth, sewing machine or other sewing material

Project timing: Anytime

Project plan and schedule:

- # Classroom Session 1: 15 minutes to explain the concept of recycling
- # Home Assignment: 1 week to collect materials and sew a cloth bag



Topic:

Recycling and avoiding plastic bags

Project Concept:

Students should be able to reduce, reuse and recycle and be able to adopt sustainable lifestyles. Making cloth bags from used cloth helps students understand recycling and re-using in a practical way, and learn sewing skills. It is likely they would develop a sense of ownership for a cloth bag they themselves make and would use it. They may also present cloth bags they make to their friends and family, and spread the message of avoiding plastic bags. Students can develop creative designs in a style they like.

Objectives:

- **Learning objectives** - Learn to recycle materials, Develop creative skills
- **Action objectives** - Use alternative of plastic bag, make cloth bag from used cloth

Project Steps:

1. Ask students to draw on a paper the pattern of the bag they want to make. They should draw both sides on paper, then cut and hold them together to plan the design and pattern. They can plan the design and pattern with paper first so that they can avoid mistakes wastage of the fabric. They should make a pattern for the straps, pocket, and a top flap, if desired.
2. Show the students how to place the two pieces together, with the “right” sides inside and the “wrong” sides (the side of the fabric that should finally be on the inner side of the bag) visible on the outside.
3. Demonstrate how to make a strap and to attach it to the sides to create volume inside the bag.

Learning outcomes:

Students learn how to make cloth bags. They learn that taking along their reusable bags when they go shopping helps to avoid plastic and paper waste.

Green habit:

Make and use cloth bags.

2.2.18. Paper soap

Level/ Class: 7

Curriculum links: Science textbook of class 7 has an activity on soap making as well as use of ritha pod as a natural cleanser. This activity enhances the process of soap making as it is easy and fun

Activity duration: 30 minutes for demonstration of paper soap making

Activity timing: Anytime

Materials needed: Brush, Butter paper, Scale, Liquid soap or dissolve solid soap in water to make a soap paste, Scissor

Approach: Indoor activity for group of 10 students

Topic:

Personal & Community Hygiene – making soap strips

Concept:

Having and encouraging good hygiene practices in early childhood is essential for reducing the risk of cross infection. This will help in embedding appropriate personal hygiene habits in children as they grow up.

Aims:

Make sure each child has a constant supply of soap with him/her.

Key Questions to address:

- What are germs and how do they spread?
- How to make a paper soap?

Preparation:

None

Method/Guide:

Divide the class into groups of 5 to 6 students and each group is given butter paper, scissors, brush and liquid/left over soap bar soap for this activity.

Take a brush, paper, scale and liquid soap or dissolve solid soap in water to make a soap paste.

Take butter paper and draw a rectangular table on the paper using scale and pencil.

Apply liquid soap/ solid soap paste on the paper using the brush.

Dry the paper under the fan or sunlight.

Cut paper strips along the table drawn and staple/tie 7-10 paper piece together to make a soap strip pack.

Take 1 soap strip use it in water to check if u can get enough soap lather to wash your hands.

Learning outcomes:

Students learn to wash hands at critical times as well as to do it in the right manner. Children carry this soap strip pack DAILY to school to wash hands at critical times.

FAQs

Q - How does soap help in removing germs?

A - Soap helps to dislodge germs from our skin and be washed away. In the Corona virus pandemic, using soap for hand washing is very important to avoid infections.

Green habit:

Carry your soap.



2.2.19. Role Play–Transmission of Diseases

Level/ Class: 6, 7, 8

Curriculum links: EVS Standard 5 mentions diseases spread by food and water. Science Standard 8 mentions spread of infections by animals, types of disease, causes, symptoms, treatment etc. The Fecal–oral transmission route is not included in any textbook. This activity helps students become aware about the most common infections and their spread.

Activity duration: 45 minutes

Activity timing: Anytime of the year

Materials needed: Background picture of slum/shanty and figures (UNICEF booklet), 3 Illustrative pictures (UNICEF booklet)

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene – Transmission of diseases

Concept:

Infectious diseases can spread through direct or indirect contact, everyone is at risk of illness. We have a higher risk of becoming ill when we're around sick people or in areas susceptible to germs. Schools and teachers play a vital role by sharing accurate information and science-based facts and help diminish students' fears and anxieties around diseases and support their ability to cope with infections.

Aims:

Understand transmission of disease.

Key Questions to address:

Which are the daily tasks we do that spread diseases?

Preparation:

None

Method/Guide:

Once upon a time there was a boy named Sanju.

(Facilitator put the figure of the boy on the poster)

One day he went outside of the village, and he walked up the side of a small hill. He felt like relieving himself. He defecated (pooped) in the open area.

(Give the picture of the squatting boy to a child to place on the poster)

After he went away from that place a dog came.

(Give the picture of the dog to a child to place on the poster)

This dog is called Gullu and likes the smell of faeces, so he puts his nose and foot in it. You know what the dogs like. He walked around the hills for a while, but he missed the company of the children in the village, so he went back.



(Ask a child to move the dog to the village)

He walked down the street, sniffing at the ground. He couldn't find any children so he went on looking for another place. Soon after, a little boy and a little girl came out of their house to play.

They were Viju and Reena, brother and sister. Reena is older and Viju is younger. Viju and Reena sat down right where Gullu, the dog had passed by sniffing.

(Give the picture of the boy and girl to a student to place on the poster)

They played until their mother called them. Then they went into the house to eat. They wanted to eat fast so they could go out to play again. Do you usually like to play all day long?

Reena dashed to wash her hands with soap. As Viju was feeling very hungry he just couldn't wait to eat when he saw his mom's delicious food and he started to eat immediately. And he forgot to wash his hands with soap!!!

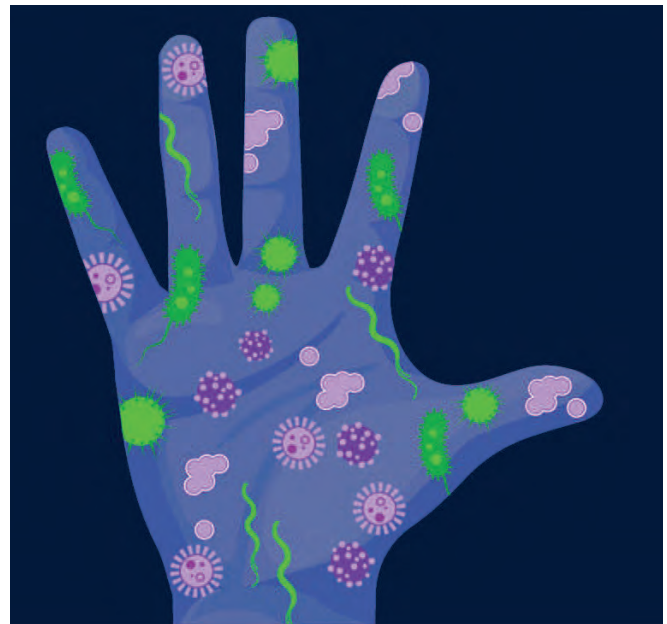
What did he forget?

Later both of them went back to play and had fun playing all day long. The next day, when Viju woke up in the morning, Viju was sick with diarrhoea.

(Give the picture of a sick child to a student to place on the poster.)



Hand Wash With Soap



Hand Wash Without Soap

Discussion

After the role play students could be asked the following questions:

- Do we like to fall sick? What are the good things we miss if we fall sick?
- What happened to Viju? What made him sick? (*Answer: Germs*)
- Where are the germs? (*Answer: inside his body*)
- Can we see germs? (*Answer: No, germs are invisible; even hands that do not smell may have germs from faeces on them*)
- How did they get there? (*Answer: he swallowed them*)
- How did the germ get into his mouth? (*Answer: eating without washing his hands.*)
- How did the germs get on his hands? (*Answer: from playing on the ground*)
- How did the germs get to the ground? (*Answer: the dog walked there*)
- How did the germs get on the dog? (*Answer: from faeces on the hill*)
- How did the faeces get on the hill? (*Answer: Sanju put it there*)
- Where will Sanju's faeces go?
- What will happen if his germs get carried to another place?
- How can we prevent diarrhoea? (*Answer: by washing hands and using latrines!!*)

Learning outcomes:

Students understand the fecal-oral routes of disease transmission and importance of adopting hygiene behavior.

FAQs

Q - Which daily and regular tasks should we adopt that can avoid the spread of diseases?

A - Here are some important practices to avoid spread of diseases:

1. Wash hands before preparing and taking food
2. Wash hands after defecation
3. Keep your nose and mouth covered with a mask during Covid 19
4. Cover the food
5. Control flies
6. Clean vegetables and fruits before use
7. Avoid open defecation
8. Keep water sources clean
9. Treat and store water safely
10. Proper drainage system
11. Treatment of water

Level/ Class: Standard 7

Curriculum links: There is no mention of landfills in the textbooks from Standard 1 to 8. Standard 8 Science mentions soil pollution due to waste dumps. This activity introduces a sanitary way of disposing of waste and to reduce waste going to landfill.

Approach: Indoor

Group size: Individual / group

Activity duration:

- # Classroom Session 1: 20 minutes for a background discussion and briefing on the activity
- # Home/Group Assignment: Create a model of sanitary landfill using waste materials
- # Classroom Session 2: 30 minutes to discuss the learning of students

Activity timing: Anytime

Materials needed: Glass bottomed box/container; Soil (shoebox full); Clay (handful); Plastic sheet; Gravel (shoebox full), variety of wastes (metal, food, paper, plastic, etc.)

Approach: Classroom discussion and model preparation at home, individually or in groups

Topic:

Solid Waste Management – Waste dumping and landfills

Concept:

A sanitary landfill is a place to bury waste consisting mainly of soiled and toxic wastes in a systematic and hygienic way without causing any nuisance or hazard to public health or safety. The biodegradable portion of the refuse undergoes anaerobic decomposition over a relatively long period of time and produces gases such as methane (CH₄) and Carbon dioxide (CO₂). The process of decomposition also produces a liquid termed “leachate”. This is highly toxic and can poison the soil and the underground water in the area. It is important to see that this leachate does not reach the soil or groundwater. For this reason, landfills are lined with special liners which are impermeable, forming a barrier between the leachate and the land. The wastes which may be disposed of by the sanitary landfilling method are soiled and toxic municipal wastes, demolition and construction wastes, industrial wastes, dead animals, hospital wastes, animal husbandry wastes and such other material.

Aims:

- Understand what a landfill, its purpose is.
- Learn about waste at the landfill sites and its impact on the environment and humans.

Key Questions to address:

- What are landfills and sanitary landfills?
- What is leachate?
- What is groundwater?

Preparation:

None

Method/Guide:

Classroom Session 1

Draw the figure of a landfill on the board and explain that this is an example of one of the more protective landfill designs. The process basically consists of laying the waste material in

a planned and methodical manner, then compacting the layer and finally covering it with layers of soil, clay, gravel. This tends to remove the odour and keep away flies, rats and other vectors from thriving on waste.

Home/Group Assignment

A Model Sanitary Landfill

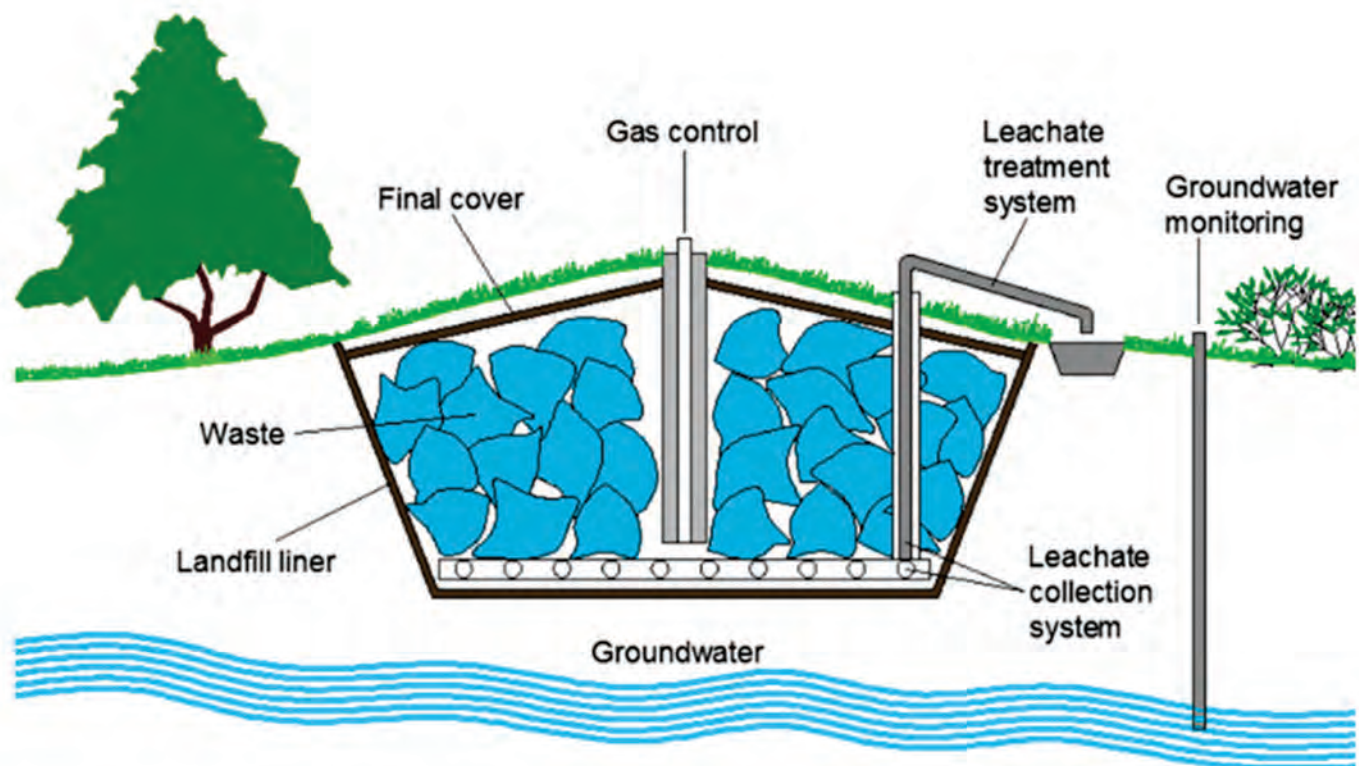
Construct a mini sanitary landfill in a large glass bottomed box/container. Line the bottom with a thick layer of soil, above place a layer of clay, plastic sheet and a layer of gravel. Next, place a variety of wastes (metal, food, paper, plastic) into the gravel layer and cover with a light layer of soil. Occasionally sprinkle water to simulate rainfall

Classroom Session 2

Students are asked to observe changes in the waste material over time and watch for “leachate” collected at the bottom. The students can also discuss which items in their daily household garbage would be put into landfill and brainstorm about problems associated with open dumps and sanitary landfilling.

Learning outcomes:

Students learn to observe the waste they generate and understand the process of disposal of certain waste.



FAQs

Q - What are open dumps, landfills and sanitary landfills?

A - Deposition of organic waste in small quantities such as in the corner of the yard or garden, or at an Ukirda for a group of houses at a neighbourhood level is a common practice. This practice at a small scale is not a problem.

Open dumps and landfills - In many villages, towns and cities, large quantities of mixed wastes are dumped in open areas as a final disposal site. These dumps have no provision for preventing pollution. Such dumps may catch fire due to presence of large number of materials like plastic and paper that burn easily. In such dumps, organic waste may get decomposed under layers of other waste materials. Decomposition in these conditions can cause production of methane gas which also catches fire easily. Since the waste is directly dumped on open grounds, decomposition in these conditions can cause production of methane gas which also catches fire easily.

Sanitary landfill - These are constructed with a provision to 'contain' the waste. Before any waste is deposited, a floor or liner is constructed at the site that would prevent any seepage from the waste to go into the ground below. Pipes and channels are constructed in order to collect the leachate so that it does not contaminate ground water.

Q - What is leachate?

A - When water (such as rainwater or spring water) falls on deposited waste, and percolates through a number of things can happen such as: increased rate of decomposition of organic wastes leading to rise in temperature and increase in acidic substances. This causes chemical reactions between different substances present in the waste. The water dissolves some of these chemicals while other substances are just carried along in the resultant liquid, which is called leachate. In a sanitary landfill, a system is built in to collect such leachates and dispose of them safely.

See also:

Chapter 17 Landfills [http://cpheeo.gov.in/upload/upload-files/files/chap17\(1\).pdf](http://cpheeo.gov.in/upload/upload-files/files/chap17(1).pdf)

Swachh Bharat Mission - Municipal Solid Waste Management Manual Part II, by CPHEEO, Ministry of Housing and Urban Affairs, Govt of India, published in 2016 and available at <http://mohua.gov.in/upload/uploadfiles/files/Part2.pdf>



2.2.21. Packaging Problems

Level/ Class: 7

Curriculum links: Science

Standard 8 has an activity to list packaging materials for biscuits, chocolates. This activity links packaging to accumulation of waste materials in the environment and helps reflect on the need for alternatives.

Activity duration:

- # Classroom Session 1: 20 minutes for a background discussion and briefing on the activity
- # Home/Group Assignment: A day to fill Resource A and discuss with groups
- # Classroom Session 2: 45 minutes to discuss the results and conclusion

Activity timing: Anytime

Materials needed: Worksheet and stationery

Approach: Indoor, group size: Individual / group

Topic:

Packaging waste

Concept:

Plastic packaging is becoming an increasingly large part of the total waste generated. Nearly half of the plastics that are produced are used as packaging materials with a short shelf life as they are redundant once the package is opened. Plastic stays in the environment between 450 years to forever, causing environment related problems which affect human health as well. The amount of plastic packaging waste is dependent on how we buy and is reflected in the shopping choices of every household.

This lesson will help students to understand how much packaging waste is generated through their own household shopping choices and how much scope there is for reduction. Students will be encouraged to collect different materials from their home to understand excessive and minimal packaging and they will also re-design a product that comes with excessive packaging.

Aims:

- Identify issues of packaging waste and its impact on the environment and humans.
- Analyse different types of packaging used at home.
- Share ideas and ways of making smart shopping choices and reducing packaging waste.



Key Questions to address:

- What is packaging waste?
- What are the pros and cons of packaging?
- How can we reduce packaging waste?
- Do you know what material has been used for packaging?
- How many layers of packaging are there?
- What happens to the packaging once we open the product?
- In what way is the current method of packaging products impacting the environment?
- Can you think of any alternative materials, which could be used for packaging and is safer for the environment?

Preparation:

A day before you intend to conduct this session, briefly brainstorm with students on what they know about packaging and ask them to give a few examples of it. Ask students to bring two or three items from their home that they think has excessive or minimal packaging for the next day's class.

Method/Guide:

Classroom Session 1

The teacher can start by talking about the problems caused by plastic packaging waste and ask the following questions to trigger a discussion:

1. Why do we need packaging of products? To protect the product - from breaking, getting spoilt or from contamination
2. Take the example of a few products which students use in daily life (juice carton, chips/ biscuit packet, gift packs, etc.) and discuss the following points about packaging.
 - Do you buy any product because its packaging looks nice? or it is easy to open? Or easy to carry?

Share a few examples of how some of the things are packaged by nature such as banana skin. Can we use similar methods for packaging other products, which are eco-friendly in nature?

Ask students to fill in the worksheet by selecting any six products, three each with minimum and maximum packaging, used in their home. Make sure to go through the worksheet with the students to ensure that they have understood the process and contents in it. Ask them to also pick any one product of their choice and develop a plan for redesigning its packaging with a more eco-friendly and less waste generating material. Refer to the Annexure page.

Resource A

Name of product	Purchased from street vendor / grocery shop/ supermarket / online	Packaging material used	Is packaging minimal/ excessive	If excessive, how can it be reduced?

Home Assignment

Ask students to review various products being purchased by their parents from different sources such as the street vendor, local grocery store, supermarket, online, etc. Ask them to select any six products - three each with maximum and minimum packaging - to fill in the survey sheet. Once they have filled in the sheet, they can pick up any one product of their choice and develop a plan for redesigning its packaging. While re-designing the packaging, the students must keep in mind that the product remains protected and easy to store and transport.

Classroom Session 2

After completion, students can form groups and share their survey results and discuss ways to reduce packaging. For example: Grains can be brought in bulk or get it from stores that sell them loose by carrying their own container from home. You can carry your own cloth bag to buy fruits or vegetables rather than taking a plastic bag from the vendor. Students in groups can present any one item with their idea or suggestion on how packaging can be reduced for it.



Learning outcomes:

Students reflect on their own choices of products purchased, and think about ways of reducing plastic packaging waste.

FAQs

Q - What is packaging waste?

A- A number of items we use come to us from factories and food processing units. The products are packed in boxes, cartons, bottles, bags etc. These may be made of cardboard, glass, tin, plastic, cloth, paper etc. The products are packed for transportation from the factories or production units to cities, towns and villages for sale as individual packages.

Q - What are the pros and cons of packaging?

A - Packaging helps to maintain the quality of goods and products from their point of production to the point of consumption. Packing also helps to identify the product clearly, and provide information on ingredients, date of packing, date of expiry, weight and volume, etc.

However, once the goods or products reach their point of consumption, the packaging material is often discarded, adding to the quantum of solid waste.

See also

Plastic Waste Management Issues, Solutions & Case Studies, by Ministry of Housing and Urban Affairs, published in March 2019, available at:

<http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Plastic%20Waste%20Book.pdf>

Green habit:

Avoid single use plastic.

Level/ Class: 7

Curriculum links: EVS Standard 5 mentions need for environmental balance. Standard 8 has an activity on empathy for the environment. The concepts of use and consumption have little or no mention. This activity helps students to differentiate between wants and needs and ill-effects of overconsumption.

Activity duration: 45 minutes of background discussion and present their learnings

Activity timing: Anytime

Materials needed: Stationery

Approach: Indoor group activity for group size of 5-6 students / whole class

Topic:

Over-consumption produces more waste

Concept:

Humans have many needs and wants and these differ from person to person. Our needs and wants affect the environment. The impact of our needs and wants usually causes depletion of natural resources and this greatly affects the poor and vulnerable.

Aims:

- Understand the difference between needs and wants.
- Understand the concept of sustainable development.

Key Questions to address:

- What is the difference between need and wants?
- Why may overconsumption be a problem?

Preparation:

None

Method/Guide:

- Tell the players that they are escaping from their home town because of sudden floods that have hit the town.
- Each team represents a family and each family can only take up to 20 things from their home before they leave their town. They cannot take money, and they don't know where they are going and if at all they will ever be able to return. Give the teams 5 mins to discuss and make a list of 20 things.
- Once they have finished, tell them the truck that was to carry them has already overloaded so they have to drop 5 items from the list of 20.
- After a while, the truck they are travelling in, breaks down and they have to walk. They have to let go of 5 more items to reduce the weight.

- Once they do that, tell them their truck has been attacked by dacoits and they need to give away 5 more items from their list. Finally each team will have only 5 items left in their list.
- Ask them to read out their initial 20 item list and then the final 5 item list.

Reflections:

Discuss and Write

- List the five things your team selected
- List the 20 items in the earlier list
- Are the five things the team listed, the things that they needed the most?
- What is the difference between needs and wants?
- How does your consumption affect the environment?

Learning outcomes:

Students understand that reducing consumption is not necessarily reducing one's 'needs', but it is about reducing one's 'wants'.

FAQs

Q - What is the difference between needs and wants?

A - 'Needs' are things that people depend on for their survival, such as food, water, shelter.

'Wants' are items, or goods and services that people desire to have but which are not essential for basic survival.

Q - Why is over consumption a problem?

A - Overconsumption is a problem because the production of goods and services uses natural resources and energy for manufacturing and transport. More and more of such activity is producing more pollution and degradation of natural resources. The amount of pollution and waste from industrial and agriculture activities is already more than what can be naturally recycled by local ecological cycles and the earth's planetary systems. Overconsumption is thus degrading environmental quality, which in turn has an adverse impact on human beings and their health and wellbeing.



2.2.23. Set up a compost pit

Level/ Class: 7

Curriculum links: Geography Standard 7 has an activity on composting. English Standard 8 has a lesson on vermicomposting. Science Standard 8 has an activity on observing composting.

Resources and preparation needed:

- # Earthen pot or bin
- # Wet waste from the kitchen
- # Dried leaves from the garden

Project timing: Anytime

Project plan and schedule:

- # Classroom Session 1: 30 minutes for briefing students about the activity and assignment
- # Home/Group Assignment: Around 3/4 months
- # Classroom Session 2: 30 minutes for sharing the results of home composting



Topic:

Composting

Project Concept:

Nearly 50 percent of the total waste generated in India is wet waste which is biodegradable in nature. In the absence of segregation practice, this compostable waste is dumped in landfills or even on the road side. By practicing segregation of waste, we can convert wet waste through composting into manure. Through the composting process, organic matter in the waste breaks down in the presence of air and water, using microorganisms and other small animals. As an end product, we receive nutrient rich compost which can be used in our garden to make our soil healthy.

Objectives:

Learning objectives

- Understand the benefits of sustainable waste management practices
- Acquire skills related to methods of composting at school and household level

Action objectives

- Reducing wet waste
- Learn to segregate waste
- How to make compost

Project Steps:

Classroom Session 1

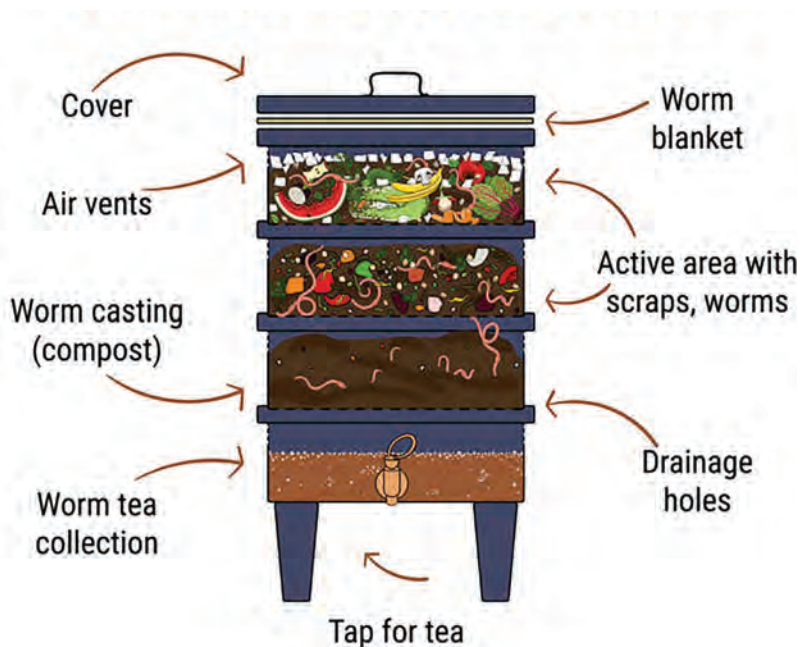
The teacher should explain the composting process in the classroom referring to the cycle in nature and emphasising the roles of decomposers. Brief the students about their home assignment and explain the process of composting.

Home assignment

Tell students how they can start composting at their home. The following instructions could be provided to them; they could also refer to the videos provided in the resource section.

- Start by collecting biodegradable waste at home separately in a different container or bin, which is nitrogen rich content known as green material. Dried leaves from potted plants or garden may be also collected in a bin as brown material to bring carbon rich material.
- Compost can be made in a container or outdoors at a suitable place in the campus or yard.
- Students should choose a shady spot, or can take a bucket or large earthen pot (matka) or a dustbin. For aerobic composting, holes should be drilled at different levels (4-5) in the container to allow air or oxygen to go inside. They can also buy readymade compost containers or take plastic crates which already have holes.
- The first layer in the container / pit will be of brown material including dried leaves, soil, and cow dung, dry grass or straw.
- The next layer is of wet waste such as vegetable and fruit peels. After 3-4 inches of green waste have been added, a layer of brown waste is to be added and the process is repeated.
- Keep the compost container in shadow in an airy space to prevent direct sunlight and rain.
- Water once or twice a week to keep it moist. Every 15 days or so turn the contents of the container / pit.
- Once the pot is filled, leave it for about 3-4 months.
- If a compost pit is made in the ground, then a fence can be made around it to keep larger animals from digging it.
- When the compost is ready it will be dark brown in colour, crumbly and smell like the earth.

Vermicomposting



Classroom Session 2

After students have started their compost pit, they should be encouraged to share their experience of and learnings from composting. Students can compare the growth of the plants supplemented with compost and one which is not.

Learning outcomes:

The students would have understood the concept of bio-degradation and how wet waste could be recycled by adopting composting.

Green habit:

Compost your wet waste daily.

2.2.24. Survey of hand washing behaviour

Level/ Class: 7

Curriculum links: Handwashing gets introduced in class 1 in Math textbook with before and after action images, followed by hand wash images in class 2 and 3. Class 7 given an activity of making charts about maintaining good health.

Resources and preparations needed:

Time table format

Chalk and board

Project timing:

Every day during lunchtime

Project plan and schedule:

Classroom Session 1: 20 minutes to brief about the activity

Classroom Session 2: One week to conduct the survey and present the findings

Topic:

Personal & Community Hygiene

Project Concept:

Infectious diseases continue to be a health challenge and economic burden within our communities. Effective hand hygiene education is critical, as the impact of poor hand hygiene habits is linked to increased occurrences of illness, absences, and their associated costs. Hand hygiene at home, school and within our communities plays an essential role in helping to reduce the spread of infectious diseases. However, there has been a steady decline in the promotion of hygiene practices in modern homes, mainly due to changing family demands and structure. Children are usually taught to wash their hands when they are young, but reinforcement of hand washing by parents often decreases when children reach school. It is critical to promote education on proper hand washing to improve health and Learning outcomes.

Objectives

- Learn to monitor critical times of handwashing practice.
- Understand the table/graph making process and Conduct survey and analyze data.



Project Steps:

Classroom Session 1

Get students to draw the table in their notebooks by drawing the table on the black board.

Week	Before eating/ touching food	After using toilet	After playing outside/ playing with pets	After sneezing/ coughing	Before touching babies	Before handling drinking water	Before after handling mask
Mon	N	Y	N	Y	Y	Y	Y
Tue	Y	N	Y	N	N	Y	Y
Wed							
Thur							
Fri							
Sat							
Sun							

The teacher appoints a hand wash monitor each week. He/she is given the formats for monitoring and are required to fill the table daily and submit it at the end of each week.

Monitoring of hand washing at School			
Name and Class of the Monitor			
Total Students			
Sr. No	Date	How many students washed hands before MDM	How many students washed hands after MDM
1	12-3-21	12 out of 20	15 out of 20
2	13-3-21	10 out of 19	16 out of 19
3			
4			
5			
6			
7			

Learning outcomes:

Children work the timetable for self-monitoring of handwashing and correct their habits whenever required.

2.2.25. Poster making—hand wash reminders

Level/ Class: 7

Curriculum links: Math Standard 1 introduces hand washing with before and after action images. Hand wash images also appear in Standard 2, 3 textbooks. Creating cognitive reminders for handwashing help reinforce the importance of the practice.

Resources and preparations needed:

Drawing sheets / A4 paper

Colours

Project timing: Anytime

Project plan and schedule:

Classroom Session 1: 20 minutes to brief about the importance of handwashing

Classroom Session 2: 20 minutes for students to prepare cognitive reminders and place it around the school/classroom/house

Topic:

Personal & Community Hygiene

Project Concept:

Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases. Personal hygiene refers to maintaining the body's cleanliness. Many people equate hygiene with 'cleanliness,' but hygiene is a broad term. It includes such personal habit choices as how frequently to take bath, wash hands, trim fingernails, wash clothes, keep surfaces clean and pathogen-free, etc. Regular hygiene practices may be considered good habits, while the neglect of hygiene can be considered disgusting, disrespectful, or threatening. Hand hygiene is central to prevent the spread of infectious diseases at home and in everyday life. Students create cognitive reminders relating to these daily habits and these can then be used to help raise awareness about handwashing.

Objectives

- Understand the importance of handwashing with soap at critical times
- Increase, improve and/or sustain good hand washing behavior and form good handwashing habits

Project Steps:

Classroom Session 1:

1. Ask students to recollect the critical times when hand washing with soap is a must.
 - Rub hands with soap for at least 1 minute and then wash hands
 - Before eating
 - Before feeding children
 - Before handling drinking water
 - After using the toilet
 - After sweeping or handling garbage
 - After playing
 - After laboratory work
 - After washing clothes / cleaning utensils
 - After grooming pets/stray animals
 - Before and after handling mask

2. Now ask students to think of possible places where they feel a need to place the reminders

- Near the midday meal cooking area
- Outside and Inside the toilets
- Near washbasin
- Place where all cleaning equipment is kept
- At the laboratory door

3. Let students brainstorm and each student select a reminder to create.

Classroom Session 2:

1. Hand over the drawing / A4 paper to students and ask them to draw / write reminders

Extension:

Students could be encouraged to create reminders about personal hygiene practices as well.

Learning outcomes:

Students create reminders about personal hygiene practices as well.



Before preparing food



Before eating food



After coughing or sneezing



When to Wash Your Hands



After playing with animals



After playing with friends



After disposing of garbage

2.2.26. Prepare Oral Rehydration Solution

Level/ Class: 7, 8

Curriculum links: ORS solution is very briefly mentioned in EVS Standard 4; however importance of ORS and how to make it are not covered.

Activity duration: Classroom
Session 1: 45 minutes for the experiment

Activity timing: Preferably at the start of the academic year

Materials needed: Clean glass, 2-3 Spoons of sugar, 2-3 Spoons of salt, Drinking water

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene - ORS

Concept:

Oral Rehydration Solution helps the human body in maintaining electrolyte balance. Consumption of ORS helps the intestines to absorb H₂O. ORS is cheap, effective, and easy to administer.

Aims:

Prepare Oral Rehydration Solution.

Key Questions to address:

What is ORS, how to prepare and use it?

Preparation:

None

Method/Guide:

Ask students to wash their hands and the glass

Now, ask them to take a glass half full of water and add a spoonful of sugar to it and stir it

Students are asked to observe the difference in water

Now, ask students to clean the glass again and take a glass half full of water

Ask them to add a spoonful of salt to it and stir it

Students are asked to observe the difference in water

Explain to the students that the substance that dissolves in water spread throughout the water. The term is called 'solution'. When a substance dissolves in water, a mixture of that substance and water is formed. This mixture is called the solution of that substance. There are several useful solutions such as Oral Rehydration Solution. ORS is prepared by making a solution of salt and sugar in water.

Making ORS / preparing 1 Litre solution using Salt, Sugar and Water

- Wash your hands with soap and water before preparing the solution
- In a clean container, take 1 litre of clean drinking or boiled water and then cooled



- Add 6 teaspoons of sugar and stir the mixture
- Now, add $\frac{1}{2}$ teaspoon of salt and stir till the salt and sugar dissolve



- Using a clean spoon, feed sips of the liquid slowly
- This is given to someone who has loose motions. A person put on saline is also a solution of salt in water.



Learning outcomes:

Students learn to prepare ORS and understand that ORS is given to someone who has loose motions.

FAQs

Q - What is the importance of ORS?

A -The human body is made of 75% water. Water is necessary for the human body to function. Water is lost while breathing, sweating, urinating and passing stools. It is recommended that we should drink 8 glasses of water every day. However, when a person is ill with Diarrhea, it is difficult for the body to retain water. Oral Rehydration Solution is a mixture of salt and glucose in water in a certain proportion. A person having Diarrhea can sip ORS and slowly replenish the water and salt necessary for the functioning of the brain, nervous system and other organs.

See also 'Oral Rehydration Salts: A miracle cure' available at

https://www.who.int/about/bugs_drugs_smoke_chapter_2_oral_rehydration_salts.pdf

Level/ Class: 7, 8

Curriculum links: Science textbook for class 8 mentions infections transmitted via animals.

Activity duration: Classroom
Session 1: 20 minutes for pre-discussion

Home/Group Assignment: 1 week to research on diseases from animals, especially cats and dogs

Classroom Session 2: 20 minutes for presentation of research

Activity timing: Anytime

Approach: Indoor activities with whole class

Topic:

Personal & Community Hygiene

Concept:

Caring for a pet is a great learning experience for children, teaching them responsibility, gentleness, and respect for other living beings. Like adults, children can benefit from the companionship, affection, and relationships they share with their pets. But animals and pets can spread infections to humans, especially kids. So if you're thinking of buying a pet, or already have one, it's important to know how to be protected from infections.

Aims:

Understand germs are invisible and harmful for children, water along with soap can save children from germs.

Key Questions to address:

- What are the different infections that spread via animals?
- How to take care of ourselves as well as our pets/animals so as to avoid getting sick?

Preparation:

None

Method/Guide:

Classroom Session 1

Ask students to discuss their pets and how they care for them. Now let the students think whether pets can make them sick. The teacher can then start by mentioning the fact that:

There are a minimum of 39 diseases that people catch directly from animals, 42 diseases that people get by eating or touching food or water contaminated with animal faces, and at least 48 diseases that humans can get from the bite of bugs that feasted on an infected animal.

Teacher could ask students to research diseases from animals and prepare a presentation.



Home Assignment

Form groups of 2-3 students and each group would read about 3 diseases passed on by animals to humans. Students will take online research and read library books to collect information

2-3 students would be asked to research about precautions to be taken when adopting or buying a Pet

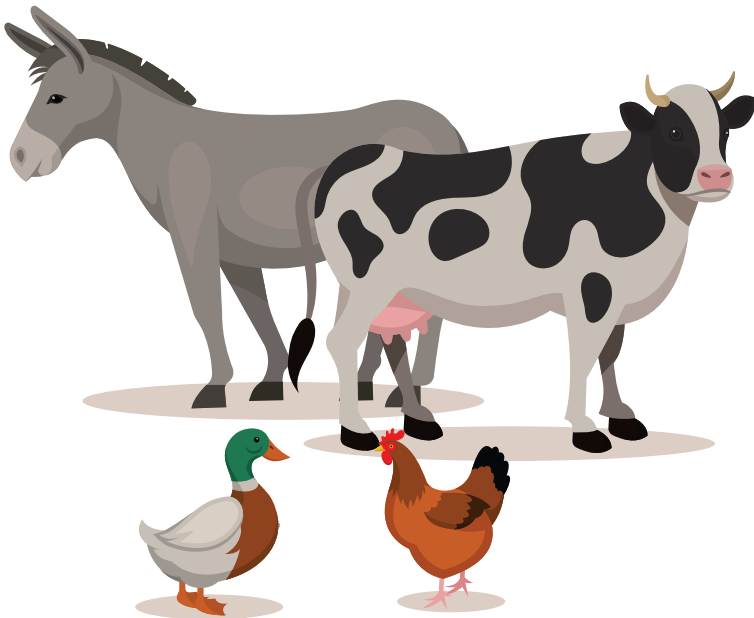
Another 2-3 students would be asked to research about safely caring for their pet, what would be the dos and don'ts while playing or caring for animals

After completing their research, groups could list out their key findings and prepare a poster or can make a PowerPoint presentation.

Classroom Session 2

Invite each group to make a presentation and share their findings.

Summarize the presentations by reinforcing the methods by which pets and domestic animals are to be kept healthy, and how people have to practice good personal hygiene while maintaining pet and domestic animals.



Learning outcomes:

Students would have understood the care to be taken while handling animals.

FAQs

Q - What are the different infections that spread via animals?

A - Sixty per cent of known infectious diseases and 75 per cent of emerging infectious diseases are zoonotic.

Q - How to take care of ourselves as well as our pets/animals so as to avoid getting sick?

A - Keep pets and domestic animals health

- # *Animals should get a proper diet, clean fresh drinking water, shelter, and exercise.*
- # *Regular veterinary care including routine vaccinations, de-worming, and removing lice, ticks and fleas*

Practice good personal hygiene

- # *Wash hands with soap before and after feeding*
- # *Wash hands with soap after cleaning up after your pet.*
- # *Keep pets away from the kitchen*
- # *Always clean up dog faeces from public areas to avoid spreading of germs*
- # *Pregnant women should not interact with cats.*

See also
<https://www.cdc.gov/healthypets/health-benefits/index.html>

2.2.28. Quiz time

Level/ Class: 7, 8

Curriculum links: Marathi Standard 3 has a story on sanitation, cleanliness, personal hygiene feature in several text-books. This quiz helps reinforce the need for sanitation and maintaining cleanliness.

Activity duration: 60 minutes

Activity timing: Anytime or repeated every few months through the academic year

Materials needed: Soaps, Nail cutters, Combs, Eco Friendly Toothbrushes in sufficient quantity as gifts, Question Bank (UNICEF booklet, Given in Annexure)

Approach: Indoor activity with whole class. Prepare a question bank based on the said subject before the activity.

Group size: 3-5 groups with 7-10 students each (depending on strength of the class)

Topic:

Personal & Community Hygiene – Good practices

Concept:

Clean drinking water, hygiene, and sanitation play an important part in maintaining health. Contaminated water causes many water-borne infections and also serves as a carrier for vectors such as mosquitoes spreading epidemics. Students learn about hygiene and sanitation and thus develop habits that aid their overall development.

Aims:

Assess knowledge on hand washing and sanitation.

Key Questions to address:

- What does 'sanitation' mean?
- How to maintain hygiene and sanitation?

Preparation:

Inform the students that they will be having a quiz on WASH well in advance. Prepare a question bank based on the said subject before the activity.

Method/Guide:

Select three students from each group and ask three questions to each student. If the student is not able to answer any question, announce the right answer.

Most importantly, supplement the answer provided by the student with additional information on the topic. Every participant should get something as a reward.

If the student is able to answer only one question correctly, give him/her a comb; if two questions are answered correctly by a student then he/she gets soap as a reward; in case a student answers all questions, he/she will be rewarded with a nail cutter. If a student is not able to provide any accurate answers to any of the questions, he/she will be given a small token to appreciate the participation and motivate better learning in the future. Prizes to be distributed immediately after the questions are administered.

FAQs

Q - What does 'sanitation' mean?

A - Sanitation refers to provision of clean and safe drinking water, adequate treatment and disposal of human excreta and sewage. Sanitation includes infrastructure for safe water and toilets as well as knowledge and appropriate behaviour for safe water and sanitation. Proper hygiene and sanitation helps avoid the spread of diseases.



Q - How to maintain good hygiene?

A -Regular hygiene routine includes

1. hand washing with soap at critical times
2. anal cleansing after every defecation
3. cleaning the teeth and mouth
4. bathing to take care of the skin, arm pits, and genital area
5. face, ears, finger nails and toe nails hygiene
6. foot hygiene
7. clean clothes
8. menstrual hygiene among girls and women



Learning outcomes:

Students are asked how they would implement the practices they have learnt, what will they do to spread the knowledge gained?

Level/ Class: 8

Curriculum links: English Standard 2 mentions throwing of rubbish is unacceptable behaviour. History Standard 7 mentions river pollution due to plastic waste. Science and Geography Standard 8 textbooks mention pollution due to inappropriate disposal of waste. This activity introduces appropriate methods of disposal according to the waste generated

Activity duration: 30 minutes

Materials needed: Stationery

Approach: Indoor activity for group of students / whole class

Topic:

Solid Waste Management – a systemic understanding of waste

Concept:

A set of questions and answers may be used to conduct a participatory discussion, such as What is waste? Do we all create waste? Can't waste generated by people be recycled in the same natural way, so why is the waste generated by us a problem? Is the garbage problem getting worse? What can we do about waste? What is reduction at source?

Aims:

Learn about various disposal methods.

Key Questions to address:

- What are various types of disposal methods?
- How to choose appropriate disposal methods?

Preparation:

None

Method/Guide:

Ask students if they can think of any products or items they use that do not come from the earth. The students may name some things, but on close examinations, it will be found that these things do also come from the earth.

For example,

- Organic wastes such as food scraps (renewable)
- Glass bottles from sand, soda ash and limestone (non-renewable, but in plentiful supply)
- Plastic Container or bags from petroleum. (non-renewable)
- Tin plated steel cans from iron and tin. (non-renewable).

Explain to students that when products are discarded, resources are wasted.

(The poster on Segregation may be used by the teacher)



Appropriate methods of disposal of different categories of garbage:

	Categories of Garbage	Appropriate method of disposal
a)	Organic Waste: Leaves, fruits, flowers, vegetable peels, cooked food, other kitchen wastes and garden litter, all form organic wastes.	Must be collected separately and converted to compost either using decentralised or centralised option
b)	Recyclables: Paper, plastic, metal, glass etc. are dry and called recyclables because these materials are processed and are used to make more materials of the same kind. e.g. Waste paper, rags and agricultural wastes is pulped and used to manufacture more paper.	Must be collected separately in a basket and handed over to the ragpickers or Kabadiwalas.
c)	Soiled: Materials that are blood stained or stained with other body fluids are categorized as soiled.	These wastes must be collected separately, securely tied and left for the Corporation to dispose of in sanitary landfills.
d)	Toxic: Chemicals, paints, broken tube-lights	These wastes must be collected separately and left for the Corporation to dispose-off in sanitary landfills. Bulbs, old medicines, spray cans, containers of fertilisers and pesticides are hazardous to health if dumped simply in the garbage bin.



Learning outcomes:

Students develop an understanding about different types of waste materials and that they can become resources and input materials for other uses. Students understand the need for recycling of products and materials.

FAQs

Q- What are various types of disposal methods?

A - Refer to the poster on Segregation.

Green habit:

Recycle and Reuse whenever you can.

2.2.30. Plastic bags survey

Level/ Class: 8

Curriculum links: English Standard 2 presents an image of a girl collecting plastic bottles in a dustbin. History Standard 7 mentions river pollution due to plastic waste. Hindi Standard 7 has an activity for students to construct sentences using the words 'plastic bag'. Science, Geography Standard 8 have activities, exercises on plastics use.

Activity duration:

- # Classroom Session 1: 15 minutes of briefing about survey
- # Home/Group Assignment: 1 week for survey
- # Classroom Session 2: 15 minutes of debriefing

Activity timing: Anytime

Materials needed: Stationary, Resource A - Plastic bag survey worksheet

Approach: Indoor and Outdoor Activity



Topic:

Solid Waste Management – reducing plastic bags in our lives

Concept:

Plastics have become so much a part of our daily life that we do not even realize how much we use them and how to reduce their use. Nor do we realize the harmful impact of this on the environment. Use this activity to motivate the students to become change agents and convince their friends and families about the benefits of banning plastic bags which are less than 40 microns in thickness and considering environment friendly alternatives.

Aims:

- Generate awareness about the use of plastic.
- Plan and run a campaign to reduce the use.

Key Questions to address:

- What are the advantages and disadvantages of plastic and plastic bags?
- What are some ways to avoid using plastic bags?

Preparation:

None

Method/Guide:

Classroom Session 1

Ask each student to fill in the questionnaire. You can either photocopy it or display it for students to copy it. After all the students have filled in the questionnaire, calculate how many plastic bags are used by your class. For example:

- Plastic bags used by a class of 30 students/day = 90
- Plastic bags used by the class in one month = 2700 (90 x 30)

Based on this average, calculate how many plastic bags would be used by all the classes in the school in one month.

Home/Group Assignment:

Students should identify one routine use of plastic bags at home that can be reduced or stopped. For example, buying vegetables in plastic bags, taking lunch boxes in plastic bags.

Survey

Name of Student:

Class:

- # For what purposes do you use plastic bags?
- # Do you bring plastic bags to school?
- # List down things that you bring to school in plastic bags.
- # Approximately how many plastic bags do you throw away in one day?
- # Did you reuse the plastic bag which you got during your last shopping trip? How?
- # Can you think of three ways in which you can reduce your use of plastic bags?



Classroom Session 2

Discuss how they should plan a campaign to share this information with the rest to reduce the use of plastic bags in the school. Students should develop and plan the strategy and the materials they need for this (develop posters, skits, talks in the assembly etc). Let students draw up a list of actions which can help to reduce this plastic use. Do the students think that it is alright to use plastic bags if you can pay for these?

Learning outcomes:

The students should be able to achieve a 'plastic bag free' classroom over a period of time.

Green habit:

Carry your own cloth bags when you go shopping.

FAQs

Q - What are the advantages and disadvantages of plastic and plastic bags?

A - Advantages: very light and handy, water proof, wide spread availability, very cheap

Disadvantage: does not degrade easily, its light-weight, even a small breeze can pick it up and deposit it far away, polluting other areas as well.

Q - What are some ways to avoid using plastic bags?

A - Some ways to avoid use of plastic bags

- # Carry your own cloth bag
- # Plan your shopping in advance so impulse buys are reduced
- # Take your own containers to buy rations

Case Story: Plastic Free Kankavli

School name: Vidyamandir Madhyamik Prashala

Location: Kankavli, Maharashtra

The use and disposal of plastic bags poses a serious challenge while addressing solid waste management issues. Under the ESS project it was decided to provide a solution for this problem. Forty-eight ESS groups in different parts of Maharashtra distributed over 6000 cloth bags and over 5000 paper bags in villages.

Vidyamandir school in Kankavli conducted a study in the region to understand the

usage of plastic bags. A campaign 'Plastic Free Kankavli' was run by the students to generate awareness about the issue. A rally was supported by local authorities and led to a complete stop on use of plastic in the village. The students were able to collect around 1 ton of used plastic bags during the rally which was done every week in the weekly market. The impact of the awareness programmes was such that the area was declared plastic free.



Level/ Class: 8

Curriculum links: Class 8 Science textbook has a lesson on pollution due to burning of waste. History textbook for class 7 introduces eco-friendly celebrations.

Activity duration: 30 minutes

Activity timing: Anytime

Materials needed: Stationery

Approach: Indoor group discussion activity for whole class

Topic:

Solid Waste Management – burning waste is not a solution

Concept:

Burning of unsorted waste is bad for the environment and bad for human health as the smoke causes air pollution. Burning of plastics is especially harmful as it generates a hazardous chemical known as Dioxin. The chemical goes up in the air with smoke and comes down to earth with rain, and contaminates soil and water. This chemical passes to cereals and vegetables grown in the soil and thus enters the human body when we eat these. Dioxins are toxic and can lead to serious health problems.

Aims:

Learn about harmful effects of burning waste.

Key Questions to address:

- What are the harmful effects of burning waste?
- Why is waste burnt?
- What are safe ways of managing waste instead of burning waste materials?

Preparation:

None

Method/Guide:

Ask students if they have come across waste (in schools, institutions, gardens and parks, and garbage dumping grounds) being burnt. Let students list out reasons why waste is burnt. Their answers may include some of these reasons:

- There is no assigned place to dispose of solid waste.
- There is no solid waste collection system.
- The waste need not be carried long distances for disposal.
- Solid waste can spread and scatter around and make surroundings look dirty.



- Burning waste helps prevent scavenger birds and animals congregating at the garbage dump.

While burning of waste helps address some of these, it is important to understand the fact that burning solid waste merely converts solid waste into gaseous waste, and that it still remains a waste, and is the cause of another form of pollution – air pollution.

Discuss with the class some problems with open burning of waste by examining and find answers to these possible effects:

- When we burn our garbage, where does the smoke go? Is that air pollution?
- What happens when too much smoke and particulates get into the air? What will be the impact on human health? Does it impact the visibility in these areas?
- What happens to the ash left after burning the waste? Could the heat given off while burning, be put to better use?

Explain one of the options for burning waste safely, and thereby reducing harmful effects on the environment, is to use properly constructed and operated waste combustors. These combustors have special controls to avoid air pollution and the ash that remains is disposed of in a specially constructed sanitary landfill. Modern combustors also create energy through the heat given off when waste is burned. This energy can be used to heat homes or provide electricity.

Learning outcomes:

Student understand a hierarchy of management of waste materials and that burning of materials is generally a less preferred option.

FAQs

Q - What are the harmful effects of burning waste?

Burning wastes causes air pollution, release of greenhouse gases like carbon dioxide, formation of tiny particles such as soot, and release of toxic chemicals.

Q - Why is waste burnt?

A - Sometimes people burn waste in order to reduce the quantity, especially if there is no proper collection and waste management system.

Q - What are safe ways of managing waste instead of burning waste materials?

A - Source segregation, composting, giving recyclables to waste collectors for recycling are all helpful in reducing the quantity of waste to be managed by the civic authorities. Leftover inert waste may be sent to the landfill. It is not advisable to burn household waste at all.

Green habit:

Do not burn any kind of waste.

Level/ Class: 8

Curriculum links: Conducting interviews and surveys has been introduced in class 5 and 8 through various activities.

Activity duration:

- # Classroom Session 1: 30 minutes of classroom session
- # Group Assignment: Field trip to a nearby park/playground and filling up the questionnaire
- # Classroom Session 2: 20 minutes to discuss observations from the field trip and share some action ideas

Activity timing: Anytime

Materials needed: Stationery, Resource A - Litter Survey Worksheet

Approach: Outdoor activity for whole class

Topic:

Solid Waste Management–Litter and waste management in public places

Concept:

Littering is any kind of trash thrown in places where it does not belong (e.g. anywhere other than the bin). Practices like throwing trash from vehicles, placing waste bags near an overflowing bin or throwing them on streets and water bodies is considered littering. Such actions/behaviour must be taken seriously as they can have a negative impact on the environment, animals and humans. When litter gets washed away by rains or blown away by wind, it enters water bodies or forest lands and eventually pollutes them. It is important to reduce waste generation, and responsibly dispose of.

In this lesson, students will get to know about littering through observation, interaction with people and also by watching videos. This will help them to understand the impact of littering on our environment. It is suggested that the teacher also conducts a field trip to a nearby park or playground, or their neighbourhood to help students to explore and discover the littering behaviour of people.

Aims:

- Identify and define litter.
- Understand the impact of littering on the environment.
- Explore and discover reasons for the littering behaviour in people.

Key Questions to address:

- How to do a critical formal communication with local bodies and authorities regarding the community Solid Waste Management issues?
- What are the roles and responsibilities of local bodies and authorities?

Preparation:

None

Method/Guide:**Classroom Session 1**

Initiate the activity by asking questions such as: What is 'litter'? Why does litter appear? Why should we be worried about litter? What could be some of the possible impacts of litter? What can be done with trash if there are no dustbins around?

Form student teams to conduct litter surveys near the school or neighbourhood. Later, students should discuss their findings. They should write a letter to the ward office or

gram-panchayat, describing their study and findings, offer their support in waste management, and request help in addressing the issues they find.

Group Assignment

Students survey their neighbourhood or a park or playground near their houses. Ask them to request an adult family member to accompany them for the survey. Ask the students to fill out the litter survey questionnaire and note down the answers to the questions given in Worksheet A. They could also carefully observe the littering behaviour of people and also speak to a few people where possible and note down their points.



Resource A - Litter Survey Worksheet

Name of the location visited: _____

Date: _____

Timing: _____

Name/s of Survey Team members _____

1. Select one option for the visited area in terms of cleanliness and litter?
 - a. Very clean with no litter around and dustbins are properly used
 - b. Moderately clean with a little amount of litter around with dustbin usage
 - c. Dirty with lot of litter spread around and overflowing dustbins
2. Are there dustbins placed nearby? Yes/No
If yes, how many and what types? (E.g.: Blue-Green Dustbins for Dry and Wet Waste collection)
3. Is waste spread around dustbins? Yes/No
If yes, what could be the reasons?
 - a. Bins are overflowing with garbage Yes/No
 - b. Bins are not at convenient locations to throw garbage Yes/No
 - c. Bins are broken/damaged Yes/No
 - d. Any other reason
4. Do you see litter spread around on the ground? Yes/No
If yes, what are the five most common types of litter found?
5. Did you see any animal/bird feeding on the litter? Yes/No
If yes, state names of animals/birds found feeding on the litter.
6. Observe and mention what could be the reason for littering in the area? (tick all that you think are appropriate)
 - a. Inconvenience
 - b. Habit
 - c. Attitude that someone else will clean it up
 - d. Lack of awareness
 - e. Other (please specify)
6. How many houses are there on your street?
7. How many people live in each house?
8. Can you approximate the amount of waste generated on your street per day?
e.g. If the population of your street or block of apartments = P
and the amount of garbage generated per person per day = 0.3 Kg
the amount of garbage generated by your street would be = $p \times 0.3$ Kg

**Students can speak to a few visitors to ask about their observations on littering in the area and possible reasons for it. They can note down key points from the discussion. Students use the data they collected and make a brief presentation for the Ward Officer with a request to check such activities in those areas.*

Classroom Session 2

After completion of the survey, discuss with the students what they saw in their neighbourhood and ask questions around what the students think could be the effect of littering on animals and the environment based on their observations.

What happens to the litter and where does it end up if unattended? Discuss with them what could be the most effective way to reduce/control litter, such as education and awareness campaigns, volunteer litter-pick, punishment and any other ideas.

Learning outcomes:

Students will get an experience of conducting a survey, interacting with people and analyzing the information gathered and presenting the study findings to the authorities. The findings from the litter survey will help in assessing students' understanding about littering and its impacts on the environment and animals.

FAQs

Q - What are the roles and responsibilities of local bodies and authorities in waste management?

A - Local Authority/Panchayats shall prepare Solid Waste Managements (SWM) plan with time line and its implementation, segregate, adopt 3-Rs, material recovery, processing/ disposal of Waste, user fee and levy spot fine.

For more information see this short note by Central Pollution Control Board

Salient Features of Solid Waste Management Rules, 2016

See https://cpcb.nic.in/uploads/MSW/Salient_features_SWM_Rules.pdf

Green habit:

Keep public places clean.

2.2.33. Make a First Aid Kit

Level/ Class: 8

Curriculum links: Marathi Standard 2 mentions first aid use in outdoor activities. EVS Standard 4 mentions need for a first aid kit. English Standard 8 has images of items to be placed in the kit. However, some important ingredients/ items are not included. This activity helps introduce necessary items and equipment for first aid boxes, and their use.

Activity duration: Classroom
Session 1: 40 minutes

Activity timing: Preferably at the start of the academic year

Approach: Indoor activity for whole class

Materials: A ready-made First Aid kit or the materials to prepare one:

- # Band Aid
- # Antiseptic towelettes
- # Medicated ointment
- # Sterile gauze
- # Medical tape
- # ACE bandage
- # Thermometer
- # Eye wash
- # Calamine lotion / aloe Vera gel
- # Cough drops
- # Sterile cotton balls and cotton-tipped swabs
- # Small, sharp scissors with rounded tips
- # Tweezers, for removing splinters and such
- # Non-latex gloves
- # Instant cold compress
- # Instant hot pack
- # Hand sanitizer
- # Masks
- # Antiseptic wipe packets or antiseptic spray (for external cleaning only)
- # Zip-lock plastic bags (to dispose of medical waste)

Topic:

Personal & Community Hygiene

Concept:

While enjoying an outdoor adventure, there are inherent risks. Children playing outside are running, jumping, climbing, riding cycles and countless other amazing activities. These things foster creativity, independence, self-esteem as well as mental and physical health. Yet, injuries do happen. In day-to-day life, sometimes we have to face disasters or accidents of varying proportions. On such occasions, it is necessary to give some immediate aid even before medical treatment becomes available.

Aims:

- Identify the content of a first aid kit.
- Identify disasters and understand the remedial measures to be adopted.

Key Questions to address:

- What is a first aid kit and what are the essentials of the kit?
- Why is it important to have a first aid kit in every house and school?

Preparation:

Teacher should familiarize herself with the purpose and use of each item in the first aid kit.

Method/Guide:

A ready-made first aid kit may be brought to the class.

Ask students to go through its contents. The students can then be explained about each item and its uses. Alternatively, buy the materials separately and prepare the First Aid kit with the class.

Here are some remedial measures for various mishaps

External bleeding - If a person is bleeding, make him/her sit or lie down comfortably. Keep the bleeding part of the body above the level of the heart. Wash your hands and clean the wound with water. Apply available ointment and a fresh bandage over the affected part.

Burns and scalds - for minor burns - The injured part should be washed with water or held under water. Give the victim water to drink. Clean the wound using cotton swab soaked in an antiseptic solution. Do not apply oily ointments. Cover the wound using dry dressings. For serious burns - Give emotional support. Cover the wounds with sterilized cloth. Do not touch or burst the blisters on the skin. Do not try to remove the cloth if it is stuck to the burnt skin. If the patient is conscious, give water to drink.

Sunstroke - Take the patient to a cool place or in the shade. Sponge the whole body with cold water. Place a cloth soaked in cold water on the neck. Give plenty of water to drink.

Snake bite - Wash the wound with water. Give emotional support to the patient. Tie a cloth tightly above the wound. Get immediate medical help.

Dog bite - Wash the wound with a solution of potassium permanganate or other antiseptic. Cover the wound with a clean and dry cloth. Get the doctor's help and an injection of the anti-rabies vaccine.

Extension:

SOP / handbook - First aid remedies could be created.



Learning outcomes:

Students learn to prepare a first aid kit and use it wisely.

FAQs

Q - Why is it important to have a first aid kit in the school and at home?

A - Minor injuries and health issues can be handled easily at home or school with the help of a first aid kit. Providing first aid helps to reduce the severity of the health issue and bring relief to the affected individual. Preparing and maintaining a first aid kit is useful to teach students about safety.

2.2.34. Use and safe disposal of menstrual hygiene products

Level/ Class: 8

Curriculum links: Menstrual hygiene does not feature anywhere in the textbooks. This activity helps fill the gap in providing information about menstrual hygiene and different products.

Activity duration: Classroom
Session 1: 30 minutes

Activity timing: Anytime or start of academic year

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene – Menstrual hygiene products

Concept:

There are taboos around natural process of monthly periods. Finding ways to talk about it in an open and confident manner will make all the difference to experience of menstruation, hygiene and safe disposal of menstrual hygiene products. But how can you introduce the subject and get over the awkwardness that surrounds a girl's period.

Aims:

Learn about use and safe disposal of cloth and disposal sanitary napkin/pad.

Key Questions to address:

- What are personal hygiene practices to follow during menstruation?
- How to choose a pad/ cloth that is right for you and know its use?
- What are the disposal methods for sanitary pad/cloth disposal?

Preparation:

Teacher should familiarize herself with different menstrual products.

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity/Reproduction system).

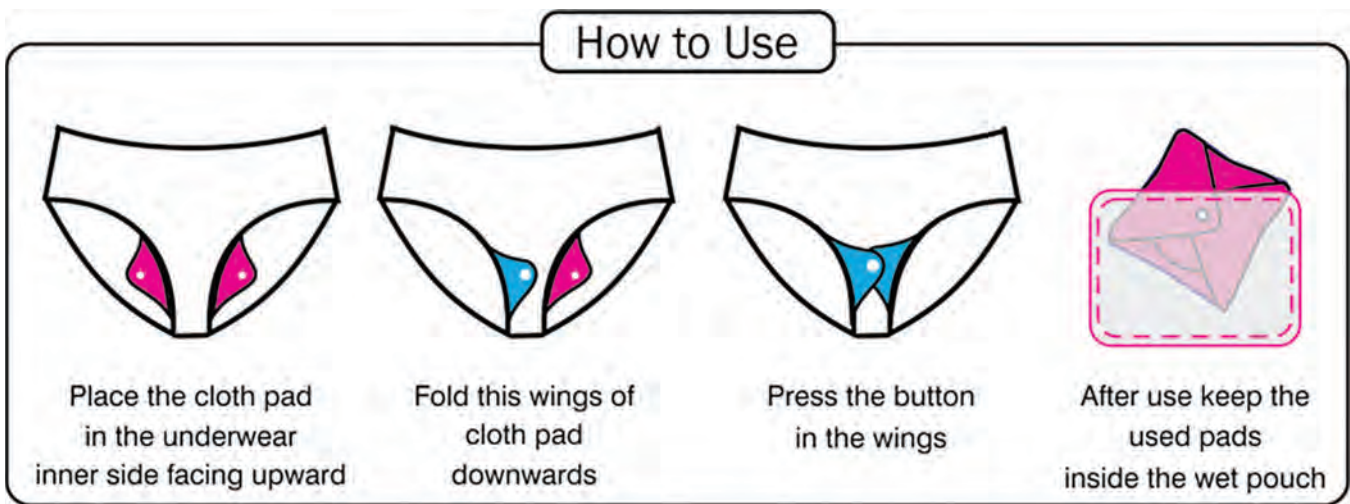
Method/Guide:

Classroom Session 1

Initiate a dialogue with the students using reference to the movie 'Padman'. You could start by asking generic questions such as, whether anyone has seen the movie. Who starred in it? What did you like and did not like about the movie? Do they think there was a message given through it and if yes, what could that be?

Once the initial awkwardness wears off, the teacher can get into more intimate questions relating to the feelings they have before and during their periods. The questions could be, what are your thoughts about why women have periods? How do they start? Do you feel that we go through any physical changes before and during our periods? Encourage students to write about their feelings and their bodily changes during the periods.

Now the teacher could take help of Menstrupedia) and explain the process of initiation of menstruation. (It is important at this stage to not mention baby and birth, as this might scare the students. Also make sure to point out that just like girls, boys too undergo natural physical changes and hence there is no need to feel different or low about your body).



The discussion can then proceed to the available resources in the market and their individual use. When it comes to feminine hygiene and intimate care, your V-Zone refers to the area of skin that begins under your belly button where your pubic hair growth starts and ends between your thighs (but not inside the vagina)

Hygiene during menstruation could be discussed at this stage by stating the following -

- Wash twice a day.
- Wipe yourself clean after each toilet visit. Make sure you go from front to back to avoid transferring harmful bacteria to your vagina.
- Keep your pubic hair trimmed.
- Regularly change the panties as well as pads, four to five times a day or as per requirement.

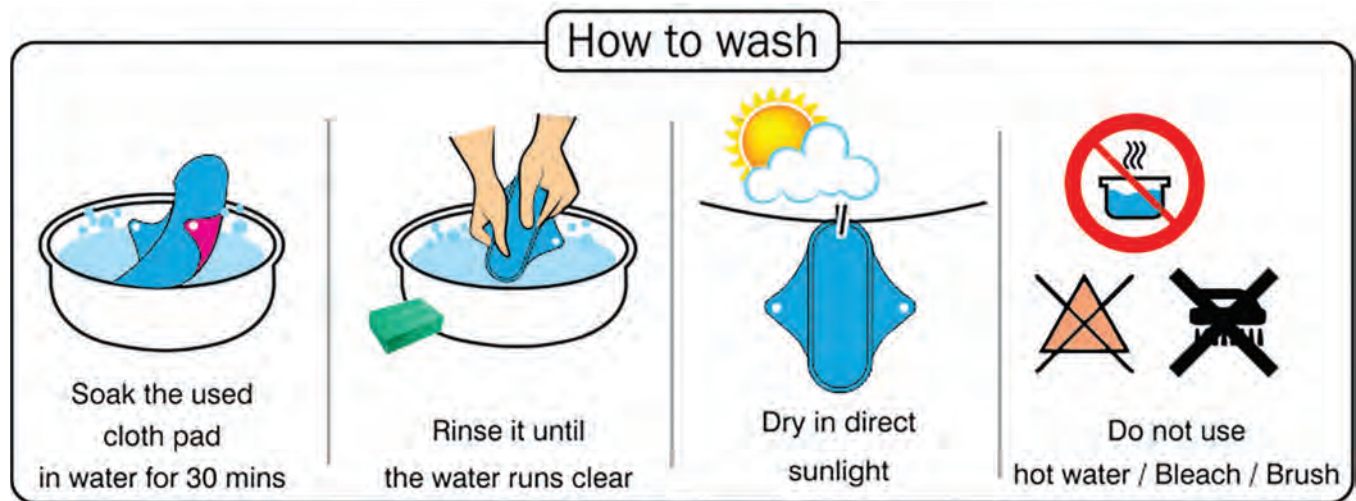
- Eat a healthy, balanced diet and drink plenty of water.
- Avoid tight clothing or fabrics.
- Wash hand with soap before and after handling any absorbent

The teacher can then move on to explaining the poster – Menstrual Hygiene, relating to the use and disposal of sanitary waste. The session would end with a review of what was learned and whether the students feel confident and comfortable with discussing the topic in the next session.

Extension:

Films could be showcased for students or websites featured for students to browse.

<https://www.menstrupedia.com/>
<https://www.thepadproject.org/>



Learning outcomes:

Girls understand that menstruation is normal and talking about it will empower them to handle the situation well.

FAQs

Q – What are some options of menstrual products, and what are the advantages and areas to take care?

A – Refer to the poster or chart below.

Product	Advantage	Need to take care
Washable, reusable cloth/ cloth sanitary pads	Ease of use, comfort No environmental impact of disposal	Wash and dry in sunlight properly
Menstrual cup	Ease of use Cup is durable and reusable for several years with proper care	Wash thoroughly and sanitize regularly
Tampon	Ease of use Relatively lower environmental impact if no plastic is used in the product	
Sanitary pads with cotton, lined with plastic	Ease of use, comfort	Disposal by composting after removal of plastic, or by deep burial or incineration
Sanitary pads with Super Absorbent Polymer	Ease of use	Disposal by deep burial or incineration (facilities do not exist in most cities / towns)

Q – What are the methods of disposal of menstrual products?

A – As per the Solid Waste Management (SWM) Rules, 2016, waste should be segregated as wet, dry and domestic hazardous waste. Sanitary napkins should be properly wrapped and should be handed over separately. This is important to protect the waste collectors from possible infection.

In Pune, a Red Dot campaign has been initiated. Used napkins and diapers are supposed to be wrapped properly with paper and a large red dot at least 1.5 to 2 cm diameter made using a sketch pen on the wrapping paper. This helps waste collectors to easily identify sanitary waste and to keep it separate from recyclable materials. The separated out sanitary waste is given by the waste collectors to the municipal waste collection vehicle for transport to the landfill or further processing and disposal.

Q – What is the system for disposal of used sanitary napkins waste after the waste is collected from households?

A – According to the Central Pollution Control Board's guidelines on Management of Sanitary Waste, 2018, deep burial, composting, pit burning and incineration (low-cost, small-scale, electric and high temperature biomedical incinerators) are some of the methods that should be adopted to dispose such waste.

As per the Solid Waste Management (SWM) Rules, 2016, the manufacturers or brand-owners of sanitary pads are expected to work with local authorities to set up waste management systems for sanitary waste.

If incinerated, the waste should be burned at the correct temperature at 800 degrees Celsius. Small scale sanitary incinerators used in schools and colleges may not reach this temperature.

2.2.35. The right choice

Level/ Class: 8

Curriculum links: Menstrual hygiene does not feature anywhere in the textbooks.

This activity helps fill the gap in providing information about menstrual hygiene and different products

Activity duration: Classroom
Session 1: 60 minutes

Activity timing: Anytime

Materials needed: Samples of the sanitary napkin, cloth, Chart papers, Marker / sketch pens

Approach: Indoor activity for 2-3 groups of 7-10 girls in each group

Topic:

Personal & Community Hygiene - Menstrual hygiene products

Concept:

It's important for girls to understand the changes they can expect from puberty, including how to manage menstruation, before they begin puberty. Educating girls about pads and other supplies, before they need them helps them adjust more comfortably to the changes and remain confident during what can be a difficult phase of growing up.

Aims:

- Learn to deal with menstrual bleeding using cloth/cloth pad as well as sanitary napkin/pad.
- Learn about the use and safe disposal of cloth and disposal sanitary napkin/pad.

Key Questions to address:

- What are the different materials or products available for use during menstruation?
- How to decide which product is right for you?
- How to safely dispose of the used pad/cloth?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Divide the participants into 2-3 groups. One group will discuss in detail on SANITARY NAPKIN/PAD and the other on CLOTH/CLOTH PAD. The discussion points to include use, handling, storage, disposal, accessibility, dos and don'ts, etc in relation to the particular absorbent. The teams are given 15-20 minutes to discuss and prepare a presentation.



Classroom Session 1

The teams use samples of absorbents, and use stationary like chart paper, sketch pens, marker pens, etc. to create pictorial representations or props for presentation. They can also create role play and other creative items in their presentations. Each team gets 5-7 mins to present.

Facilitator to discuss in detail about both the absorbents further after the presentations are over and fill in any gaps or correct any inaccurate information (if any) brought forth in any of the presentations.

Learning outcomes:

Students learn about various pads/napkins available for use, their usage and proper disposal methods.

FAQs

Q - What factors may be considered in selecting menstrual hygiene products?

A - Some of the factors that can help a person decide the right menstrual hygiene product are:

- # Comfort*
- # Availability of water and space for washing and drying the product (e.g. cloth or cup)*
- # Price*
- # Environmental impact of manufacture and disposal*

2.2.36. Card game – Good and not-so-good practices

Level/ Class: 8

Curriculum links: Menstrual hygiene does not feature anywhere in the textbooks.

This activity helps fill the gap in providing information about menstrual hygiene.

Activity duration: Classroom
Session 1: 20 minutes

Activity timing: Anytime

Materials needed: Cards with good and not-so-good practices, Chalk

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene Menstrual hygiene practices

Concept:

Good personal hygiene is one of the best ways to protect oneself. Nurturing good hygiene practices in child care is necessary for a child's development. Learning self-hygiene tasks helps to stop the spread of disease and encourages children to develop lifelong positive hygiene habits; an essential aspect of early education and care services.

Aims:

Learn about hygiene practices.

Key Questions to address:

What are hygiene practices to be adopted during menstruation?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

- Draw by chalk (or marking powder) two adjacent squares on the floor or paper, and mark (√), (×).
- Distribute the cards with dos and donts during menstruation to the group – each girl gets one card.
- Each participant has to read out the hygiene practice and choose the right box to put it in and specify reason for the said choice of box.
- The hygiene practice can be further discussed with the larger group by the facilitator.



Learning outcomes:

Girls learn about the good hygiene practices to be followed during menstruation.

FAQs

Q - What are the hygiene practices to be adopted during menstruation?

Ans: Hygiene practices to be followed:

1. Hand hygiene before and after changing the menstrual absorbent.
2. Hygiene of vaginal area after urination by clean water only.
3. HWWS (Hand-washing with Soap) after handling/disposing menstrual waste.

Level/ Class: 8

Curriculum links: Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration: Classroom
Session 1: 20 minutes

Activity timing: Anytime

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene Menstrual hygiene practices

Concept:

Role play is an important part of development, as it builds confidence, creativity, communication, physical development and problem solving. Along with being a fun activity, it also allows children to get into character and act out real life roles or fictional performances. Skits are a powerful medium of communication. Through skits, role plays, they learn to express their views, they develop emotionally, develop their communication skills, presentation skills etc. Role plays on topics related to behaviours, habits, etc, help develop sensitivity and awareness among students.

Topic:

Personal & Community Hygiene

Aims:

Learn skills required to handle different situations that might arise during menstruation.

Key Questions to address:

- What are the various challenges that may occur on and during menstruation?
- What can be the possible steps to face such challenges?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

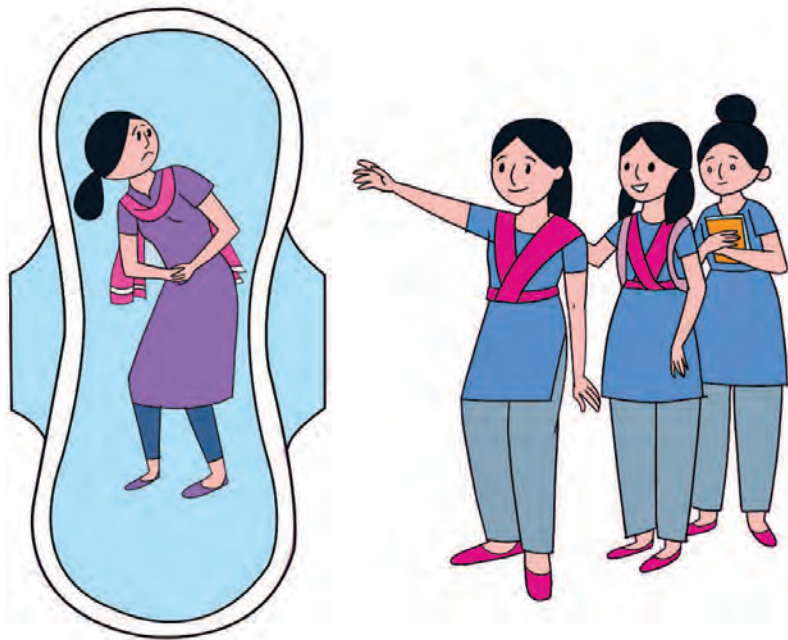
Method/Guide:

Divide the participants into groups and give each of them one of the following case scenarios to role play and enact skits:

- A teenage girl who is at school and needs psychological support
- A teenage girl has her period at school and needs some sanitary material

- A young girl who is worried about pubertal changes taking place in her body and needs counselling.

Each group should then perform a role play and share their points of view after identifying the specific requirement in each case scenario. Emphasis should be placed on the skills that are relevant for resolving the scenario at play.



Learning outcomes:

Emphasis is placed on the skills that are relevant for resolving the scenario at play.

Green habit:

Share and listen to menstrual health concerns among friend, and challenge taboos.

FAQs

Q - What are the various challenges that may occur on and during menstruation?

Ans : Challenges related to menstruation:

1. Due to hormonal changes during menstruation, mood swings may occur.
2. Balanced diet during menstruation may not be provided.
3. Access and availability to menstrual absorbents.
4. Availability of infrastructure for hygiene. (Gender separated wash rooms, water availability, privacy, dustbin with lid for disposal of soiled absorbent, Handwashing station, soap availability etc)

Q - What can be the possible steps to face such challenges?

Ans: Possible steps to deal with challenges:

1. All information about `what is menstruation and its management` should be provided before menarche to the girl and family members (specially with parents).
2. Information about `balanced diet and its relation with development` should be shared with students and parents.
3. Affordable and reliable source of menstrual absorbents should be provided.
4. MHM (Menstrual Hygiene Management) friendly wash infrastructure should be developed and maintained for adolescent girls in the school.

2.2.38. Me, the Advisor-comprehension on menstruation

Level/ Class: 8

Curriculum links: Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration: Classroom
Session 1:45 minutes

Activity timing: Anytime

Materials needed: Paper and pens

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene—understanding menstruation

Concept:

Girls experience many changes around the time they get their first period (Menarche). It's really helpful if girls learn about menstrual cycles, so they can physically and mentally be ready for it.

Aims:

- Assessing the girls' comprehension on menstruation and MHM.
- Encouraging peer to peer communication.

Key Questions to address:

How to encourage talk about menstruation?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Each girl writes a letter to her younger sister (imaginary or real) who has not yet entered puberty (or even a younger friend) Through the letter, the girl is required to explain to her younger sister/friend the kind of changes she can expect in the coming days/months. The facilitator is required to read the letters carefully. Those that have good / interesting content are to be read out so all can hear. Inaccurate content to be corrected by further discussion or a revision session.

Caution:

The facilitator must not reveal the name of the girl.



Learning outcomes:

Ask participants to create a poster on solutions for a healthy and happy menstruation and stick it in the ladies toilet block.

FAQs

Q - What are solutions for a healthy and calm menstruation?

Ans: Free and frank discussion about menstruation with access to affordable menstrual absorbents to manage menstruation with proper disposal options everywhere in the society is necessary for healthy and calm menstruation.

2.2.39. Pairing solutions

Level/ Class: 8

Curriculum links: Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration: 45 minutes

Activity timing: Anytime

Materials needed: Chart papers, Markers, Pre-hints

Approach: Indoor activities with whole class

Topic:

Personal & Community Hygiene—challenges and support for safe menstruation

Concept:

Menstruation frequently poses psychological, social, and health challenges for young women. On the individual level, young women lack knowledge about menstruation. In the social sphere, young women experience stigma around menstruation, lack of opportunities to discuss menstruation, and experience limitations around mobility and other activities during menstruation. At the institutional level, there are few resources to support menstruating young women as toilets are dirty and doors are broken. Therefore, it is important for menstruating adolescents and young women to better understand the experiences with menstruation.

Aims:

Understand the challenges related to menstruation and the management of these challenges.

Key Questions to address:

What are the different challenges faced during menstruation?

Preparation:

Pre-hints - Prepare chart that depicts all the solutions to challenges faced during menstruation and makes various chits consisting of one challenge faced during menstruation.

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Ask the participants to list the possible questions that young girls may have regarding challenges and problems faced menstruation.

Make a list of their questions on a chart. These chits are distributed to the participants.

Each girl gets a turn to read out the challenge and match it to the remedy/solutions written on the chart paper.

The content can be done vice versa (challenges on the chart paper and solutions on chits). In whatever order, each matched solution and challenge should be discussed with a bigger

group in detail once all the chits are matched. There will be challenges that will have multiple solutions/remedies to it that would need to be pointed out by the facilitator.

Lack of information

Poor access to safe tools for menstrual management

Lack of functional toilets

Absence of support from families

Learning outcomes:

Students understand that there will be challenges during menstruation and solutions/remedies to it could be found through thought and discussion.

FAQs

Q - What are the different challenges faced during menstruation?

Ans : Challenges related to menstruation:

1. Due to hormonal changes during menstruation, mood swings may occur.
2. Balanced diet during menstruation may not be provided.
3. Access and availability to menstrual absorbents.
4. Availability of infrastructure for hygiene. (Gender separated wash room, water availability, privacy, dustbin with lid for disposal of soiled absorbent, Handwashing station, soap availability etc)
5. Timely availability and access to WASH infrastructure.

2.2.40. Menstrual Hygiene Practices

Level/ Class: 8

Curriculum links:

Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration:

Classroom Session 1: 45 minutes

Activity timing:

Anytime or at start of the academic year

Materials needed:

Chart papers, Markers

Approach:

Indoor activity with whole class

Topic:

Personal & Community Hygiene – menstrual hygiene practices

Concepts:

Personal hygiene routines aid in protecting our immune system from being overcome by harmful germs. Germs, both bacterial and viral can spread through touch or as airborne particles. However, by teaching children the importance of personal hygiene, we can help reduce disease.

Aims:

Gain understanding regarding appropriate menstrual hygiene management.

Key Questions to address:

What are the appropriate hygiene practices to be followed during menstruation?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Ask participants to work in their groups on the following questions:

1. How they think hygiene should be maintained by young girls (including genital hygiene)
2. Health risks if appropriate hygiene is not maintained during menstruation?
3. Possible barriers that they may face to adopt and maintain appropriate hygiene practices and what could be done about it
4. How can the adolescent girls push for change that would eliminate these barriers at the home, village, and school levels?
5. Once the group finishes their group work ask them to present their chart.

Learning outcomes:

Each hygiene practice is discussed in detail in an interactive manner and leads to girls understanding the hygiene practices in a better way.

FAQs

Q - What are the appropriate hygiene practices to be followed during menstruation?

A - Hygiene practices to be followed:

1. Hand hygiene before and after changing the menstrual absorbent.
2. Changing absorbent after every 6 Hrs.
3. Hygiene of vaginal area after urination by clean water only.
4. HWS (Hand-washing with Soap) after handling/disposing the menstrual waste.

Q - What are some physical facilities at school and community level necessary for safe and appropriate menstrual hygiene practices?

A - MHM (Menstrual Hygiene Management) friendly wash room (Gender separated, with sufficient water availability with mug/bucket, with locking arrangement for doors to maintain privacy, paper availability for wrapping the soiled absorbent, hook to hang up clothes while changing the absorbent, dustbin with lid to dispose the wrapped absorbent, with light arrangement in night) in school premises and at various public places is must to follow all hygiene practices during menstruation.

Q - How should the community support the creation of supportive facilities and social environment that enables healthy menstruation?

A -

1. Education department should conduct the MHM sessions in each school as given in the GR (Government resolution) related to MHM guidelines of the state.
2. School management committee and teachers can arrange awareness session for parents.
3. SMC (School Management Committee), GP (Gram Panchayat) can support school, public places to provide MHM friendly wash room for women.
4. Social norms related to menstruation need to change.

Level/ Class: 8

Curriculum links: Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration:

Classroom Session 1: 20 minutes

Classroom Session 2: 20 minutes to be creative about menstruation

Activity timing: Start of the academic year

Materials needed: Stationary

Approach: Indoor activity

Topic:

Personal & Community Hygiene

Concept:

The onset of periods is one of the biggest changes puberty brings for girls. Not talking about menstruation contributes to the ignorance and illiteracy of menstrual hygiene management. Being open about the process of periods and how to manage them helps develop more confidence about it in girls.

Aims:

Understand the science behind menstruation.

Key Questions to address:

- What is menstruation?
- How to initiate a conversation around the topic?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Divide the participants into groups. They are given the following questions to discuss and come up with presentations.

Ask the participants to write down a word that comes to mind when one says menstruation (it can be positive or negative).

Ask them to list the changes that take place in the body once a girl starts menstruating (See annexure).

Once they complete this activity, ask each group to present and note down the important points to summarize.

Next put up the chart that depicts the menstrual cycle. (The facilitator to keep the chart ready for use; can be drawn in colour by hand or printed). Using the chart explain how menstruation occurs, the changes that take place inside the female body. Encourage the participants to try and answer the questions.

Science behind menstruation - Females are born with a uterus. This gives them the special ability to produce children. The Ovaries produce eggs that start their journey through the fallopian tubes to reach the uterus, where they will meet the man's sperm to produce a baby. During this time the lining of the uterus increases in thickness making a place for the egg to connect with the mother, to grow. If the egg does not fertilise, it does not attach to the wall of the uterus. When this happens, the uterus sheds the extra tissue lining. The blood, tissue, and unfertilised egg leave the uterus, going through the vagina on the way out of the body. The first menstruation – menarche – occurs between 9 and 16 years. Fight back the taboo. Menstruation is a natural process and the taboos like not touching food, not taking bath, not going to temples etc need to be addressed.

Try to encourage the participant to find thoughts behind the superstition and demystify the misperception through scientific knowledge.

Classroom Activity 2:

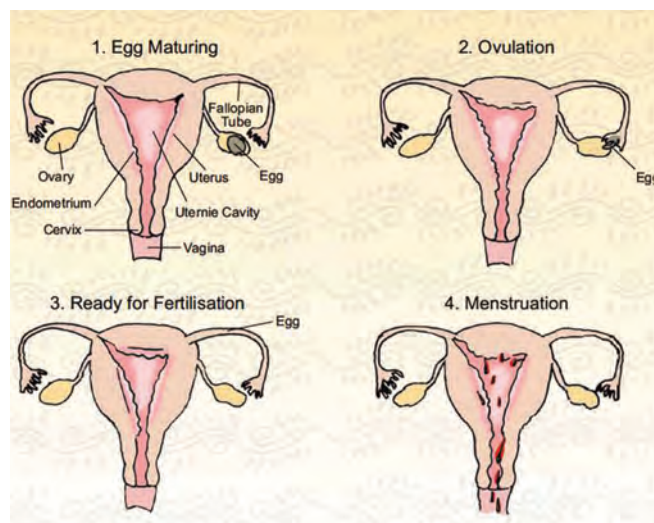
Make a jingle/song/poem

Divide the participants into groups of 6-8.

The groups are to be instructed to prepare and develop a jingle/song on MENSTRUATION. They will be required to select a theme (can be on the scientific awareness or to fight the taboos and myths) related to the topic and present it before the remaining groups. The groups will be given 20 mins for discussion and preparation.

Learning outcomes:

The participants learn to break the shame and silence around menstruation.



FAQs

Q – Traditionally, in our societies it is considered shameful to talk about menstruation. Why should we change this?

A – Menstruation is a normal and natural process. Girls need not be shy to discuss it anymore. They can break the silence on menstruation, and talk about it. This will help to improve their own confidence, provide support to each other. Discussing the challenges around menstruation and provision of appropriate water, sanitation facilities in many schools and communities is necessary to help change the situation.

2.2.42. Seeking solutions for challenging scenarios

Level/ Class: 8

Curriculum links: Menstruation and menstrual hygiene do not feature in any textbooks.

Activity duration: Classroom
Session 1: 20 minutes

Activity timing: Anytime

Materials needed: None

Approach: Indoor activity with whole class

Topic:

Personal & Community Hygiene – challenges and support needed for safe menstruation

Concept:

Girls at their first period have a lot of emotions that they need to express: about their developing body, complex moods and their changing place in the world. By providing accurate information, real-life experience and practical advice, girls can learn to view their menstrual cycle in a totally different way: as an important element of their female nature and as a key sign of coming adulthood.

Aims:

Understand the challenges behind menstruation and brainstorm about possible solutions.

Key Questions to address:

What are the challenges before and during menstruation and how to deal with them?

Preparation:

You may conduct the session only with girl students; in that case another suitable activity may be designed for boy students (such as on gender sensitivity).

Method/Guide:

Storytelling

Challenges at school:

Prepare and present an imaginative case history, e.g. “Naina has soaked her sanitary pad/cloth. The boys in class start laughing and making remarks at her. She goes to the toilet to change, but there is no water, nowhere to throw the pad, there is no emergency towel to use in the school. In order to avoid further embarrassment, she disappears from school without telling anybody”.

Ask the class to discuss three questions:

What does Naina feel?

What does this story tell you about the school?

What could have helped Naina cope up with the situation?

Facilitate the discussion and help girls to share their experiences.

Challenges at home:

Also make or invite stories that relate to conditions and problems at home. Ask the class to use the case study to build a problem tree. Write the central theme on a slip of paper or card and stick this on the wall or place it on the floor: “Inappropriate housing conditions for the hygiene of adolescents in the family” Invite children to write related problems and consequences on other slips or cards, giving one message per slip/card. Help children to work in groups to identify solutions for the identified problems.

Help the groups to prepare jointly a final list of possible actions, for example on the blackboard.



Learning outcomes:

Students prepare list of possible actions for various challenges faced before, during and after menstruation.

Level/ Class: 8

Curriculum links:

Science Standard 8 mentions law on air pollution, biomedical waste and other solid wastes, however the actual law has not been given. This activity helps students become familiar with the rules for Solid Waste Management.

Resources and preparation needed:

- # Computer/Laptop (optional)
- # Projector (optional)
- # Resource A - Information on Solid Waste Management Rules and Laws <https://indiawastemanagementportal.org/> (In annexure)

Project timing:

Anytime

Project plan and schedule:

- # Classroom Session 1: 30 minutes for background discussion
- # Group Assignment: 1 week of research (online and newspaper reading)
- # Classroom Session 2: 10 minutes for each group to present their slides

Topic:

Legislations and rules for waste management

Project Concept:

In India, the principles of waste management rules are based on precautions, polluter pay and sustainable development. Various bodies are mandated to apply these principles to responsibly manage waste. Understanding that waste is a potential resource, effective waste management laws and their implementation is fundamental to a country's development. India has formulated several laws to manage waste in the country; however, they all come under the umbrella law of Environment Protection Act, 1986 (EPA). Swachh Bharat Mission is a government initiative that aims to create a Clean India movement. One of the goals of the mission is to provide an effective Solid Waste Management system in every town in the country.

In this lesson, students will learn more about the waste management laws and government initiatives of the country by referring and analysing information through online research. Students will analyse the effectiveness of the implementation of the laws and initiatives by looking at case stories.

Objectives:

Learning objectives

- Understand various waste management laws in the country
- Analyze the effectiveness of the law looking at a few examples and also review some of the challenges in the implementation of these.

Action objectives

- Review the government's waste management initiatives and programmes

Project Steps:

Classroom Session 1

Teachers can ask the students:

- Why is waste management crucial to any country?
- How do you think waste management laws and their implementation can impact the growth of the country?

- Do you know of any existing waste management laws/ programmes in the country?

Form 3-4 groups of the students and provide each group with one law or initiative to do online research or review newspapers for waste management related coverage. Inform students that in groups they will be reading about various waste management laws and waste management initiatives and programmes of the government in the country.

Group Assignment

- Each group will read up about selected waste management laws and initiatives in the country.
- Students will take up online research and read newspapers to collect information.
- After completing their research, groups could list out their key findings from the analysis of information.
- Students can prepare a poster or can make a PowerPoint presentation based on their findings. They can add pictures and excerpts from newspapers as well.

Classroom Session 2

The teacher could invite each group to share their findings through 10 minutes of poster or PowerPoint presentation. After all the groups have presented, the teacher can conduct a discussion to draw the attention of students on how legal instruments help in the implementation of waste management systems.

Learning outcomes:

Students become aware of the laws on waste management, different roles and responsibilities, and some important programmes in the country to set up and run proper waste management systems.

2.2.44. Visit a primary health centre

Level/ Class: 8

Curriculum links: Science
Standard 8 has an activity to visit a health care centre, and to study the vaccination chart; Geography Standard 8 has a lesson on how to write reports and conduct interviews.

Resources and preparations needed: None

Project timing: Anytime

Project plan and schedule:

Classroom Session 1: 10 minutes for pre-discussion

Home/Group Assignment: 1 week to identify and interview doctors in the area

Classroom Session 2: 20 minutes for post-discussion

Topic:

Personal & Community Hygiene

Project Concept:

Public health is concerned with disease prevention and control at the population level, through organized efforts and informed choices of society, organizations, public and private communities and individuals. It is important for students to understand the role played by the health department and interviews are the best medium to gather as much information as possible and also gives students a chance to seek out different perspectives. This also makes students sensitive towards the challenges faced by the work force and realise that their actions have a major impact onto others.

Objectives

- Identify vulnerable group of people suffering from respiratory or other ailments
- Understand the nature of ailment and measures adopted by doctors to treat it
- Developing awareness activities in the community

Project Steps:

Classroom Session 1

Identify general practitioners in your area and make a list.

Classroom Session 2

Fix a date in consultation with the doctor and conduct the interview, using the following.

Students could also make a graph based on the data collected.

- Name of the doctor
- Area of expertise
- Any patient with respiratory illness (Y/N)
- If Yes, what was it?
- Age of the patient
- Area of work/occupation/profession of the patient, if known
- Gender of the patient
- Advice provided
- Would you like to be part of AQ information dissemination programme by PMC and IITM
- Phone no
- Email id



Learning outcomes:

Students develop research and interviewing skills and understand the nature of ailment and measures adopted by doctors to treat it; they develop awareness activities in the community.

For Activity 21- Packaging Problems**Let's Remake****Project plan and schedule:**

The design process (Every step given below must be carried in your designated groups)

Step 1: Define the problem

- What is the problem at hand? (e.g., if students choose to make a product using plastics, then they must talk about the impacts of plastic pollution)
- Who is affected by the problem?
- What can be done to address the problem?
- How can I contribute to the problem?

Step 2:

Discuss possible solutions - Brainstorm possible ideas/solutions to address the problem.

Step 3: Design

- Design the product using the best idea of your choice based on the 'product design requirements' given below.
- Make sure to think about how the designed product will solve the problem mentioned in Step 1.
- Product design requirements:
 - Must be created from materials that are recyclable, biodegradable or compostable
 - Must be useful and serve a purpose
 - Easy to recreate
 - Can be reused again
 - Can be deconstructed to create something new

Step 4: Demonstrate

Once the design is complete, each group gets a chance to show their product. Keep in mind the following while presenting:

- Name of the product.
- Purpose of the product. (e.g. used as a pot to grow plants)
- Explain how the designed product follows the principle of the circular economy (Make>Use>Remake>Reuse)
- Materials used and the quantity of materials used.
- Time taken to create the product.



For Activity 27- Pet animals care and disease

How Pets Spread Infections

Like people, all animals carry germs. Pets carry certain bacteria, viruses, parasites, and fungi that can cause illness if transmitted to humans. Humans get these animal-borne diseases when they're bitten or scratched or have contact with an animal's waste or saliva. Dogs and cats are popular pets but can carry infections such as:

Campylobacter infection: can be spread by household pets carrying *Campylobacter jejuni* bacteria, which cause Diarrhoea, abdominal pain, and fever in people. A person can become infected through contact with contaminated water, faeces, undercooked meat, or unpasteurized milk.

Cat scratch disease: can happen when a person is bitten or scratched by a cat infected with *Bartonella henselae* bacteria. Symptoms include swollen and tender lymph nodes, fever, headaches, and tiredness, which usually ease without treatment.

Rabies: a serious illness caused by a virus that enters the body through a bite or wound contaminated by the saliva from an infected animal. A vaccine is available for treatment following a bite from a potentially rabid animal.

Rocky Mountain spotted fever: spread by ticks infected by the *Rickettsia rickettsii* bacteria. These ticks are frequently carried by dogs. Symptoms include high fever, chills, muscle aches, and headaches, and a rash that may spread across the wrists, ankles, palms, soles, and trunk of the body.

Ringworm: a skin infection caused by several types of fungi found in the soil and on the skin of humans and pets. Kids can get ringworm from touching infected animals such as

dogs and cats. Ringworm of the skin, or *tinea corporis*, usually is a dry, scaly round area with a raised red bumpy border and a clear centre. When the scalp is affected, the area may be flaky, red, or swollen. Often there are bald patches. Ringworm is treated with antifungal medicines including shampoo, cream, or oral medicine.

Toxocariasis: an illness caused by the parasitic roundworm *Toxocara*, which lives in the intestines of dogs and cats. The eggs from the worms are passed in the faeces of dogs and cats, often contaminating soil where kids play. When a child ingests the contaminated soil, the eggs hatch in the intestine and the larvae spread to other organs, an infection known as visceral larva migrans. Symptoms include fever, cough or wheezing, enlarged liver, rash, or swollen lymph nodes.

Toxoplasmosis: contracted after contact with a parasite found in cat faeces. In most healthy people, toxoplasma infection causes no symptoms. When symptoms do happen, they may include swollen glands, tiredness, muscle pain, fever, sore throat, and a rash.

Dog and cat bites: may become infected and cause serious problems, particularly bites to the face and hands. Cat bites tend to be worse, partly because they are deeper puncture wounds. Significant bites should be washed out thoroughly.

Cryptococcosis: a fungal disease contracted when someone inhales organisms found in bird droppings, especially from pigeons, which can cause pneumonia.

Psittacosis: also known as parrot fever, a bacterial illness that can happen from contact with infected bird faeces or with the dust

that builds up in birdcages. Symptoms include coughing, high fever, and headache. It is treated with antibiotics.

Salmonellosis: Reptiles and amphibians shed Salmonella in their faeces. Touching the reptile's skin, cage, and other contaminated surfaces can lead to infection. Salmonellosis causes symptoms such as abdominal pain, diarrhoea, vomiting, and fever. Young children are at risk for more serious illness, including dehydration, meningitis, and sepsis (blood infection).

Mycobacterium marinum: This infection may happen in people exposed to contaminated water in aquariums or pools. Although mycobacterium marinum infections are generally mild and limited to the skin.

Precautions When Adopting or Buying a Pet

- As soon as you choose a family pet, take it to a local veterinarian for vaccinations and a physical exam
- Don't forget to routinely vaccinate your pet on a schedule recommended by your vet — this will keep your pet healthy and reduce the risk that infections will spread to your kids
- Regularly feed your pet nutritious animal food (ask your vet for suggestions) and provide plenty of fresh water. Avoid feeding your pet raw meat because this can be a source of infection, and do not allow your pet to drink toilet water because infections can be spread through saliva, urine, and faeces.

Safely Caring for Your Pet

- Always wash your hands, especially after touching your pet, handling your pet's food, or cleaning your pet's cage, tank, or litter box. Wear gloves when cleaning up after an animal's waste, and if you have a bird, wear a dust mask over your nose and mouth when cleaning the cage to prevent inhaling urine or faecal particles.
- Wash your hands after handling your pet — especially before eating or preparing food.
- Avoid kissing or touching your pet with your mouth because infections can spread through saliva. Also, don't share food with your pet.
- Keep your pet's living area clean and free of waste. If your pet eliminates waste outdoors, pick up waste regularly and don't allow kids to play in that area.
- Don't allow pets in areas where food is prepared or handled, and don't bathe your pet or clean aquariums in the kitchen sink or bathtub. Wash your pet outdoors or talk to your veterinarian about professional pet grooming.
- Control flea and tick problems in your pet. Fleas and ticks can carry diseases that may be easily passed to kids. Oral and topical medicines are available for flea and tick control. Check your pet regularly for fleas and ticks, as well as bites and scratches that may make them more open to infection.
- Spay or neuter your pet. Spaying and neutering may reduce your pet's contact with other animals that may be infected, especially if your pet goes outdoors.

For Activity 28- Question bank for Quiz

1. **What are the steps of hand washing with soap?**
 - Wet hands with water
 - Apply enough soap to cover the entire surface of the hands
 - Rub hands palm-to-palm
 - Right palm on left with interlaced fingers and vice versa
 - Palm to palm with fingers interlaced
 - Rubbing, backwards and forwards with clasped fingers of right hands in left and vice versa
 - Rubbing of left thumbs clasped in right hand and vice versa
 - Rinse hands with water
 - Dry thoroughly with a clean towel or dry hands in the air
2. **What are the different organisms that cause Diarrhoea ?** Organisms like bacteria, virus and parasites cause Diarrhoea
3. **What is faecal- oral transmission?** It refers to the entry of excreta into a person's body through his/her mouth
4. **What is the quantity of pathogens present in one gram of human excreta?**
 - 1 crore viruses, 10 lakh bacteria, 1000 parasite cysts and eggs
5. **What are the routes through which pathogens are passed from one infected person to another?** Pathogens in excreta are passed via various routes like flies, finger, fluids, feet and surfaces such as fields
6. **How can the transmission of Diarrhoea be prevented?** By interrupting the pathogens transmission routes like flies, finger, fluids, feet and surface such as fields.
7. **Which are the critical times for hand washing?** Before eating, before cooking, before feeding the baby, before handling water, after defecation, after handling child excreta, after playing
8. **What things are required to wash hands?** Water and soap are required to wash hands.
9. **Please sing the hand washing song -** "First of all you should... wet your hands, Then on your hands... the soap does a dance, One hand thenmeets the other, The hand then does... a front-back number. Then it's time to play...between the fingers, And make the nails...move around in circles. Then the water splashes on your hands, 'Cause clean hands are strong hands."
10. **Name two diseases caused if hands are not washed with soap?** Diarrhoea, Pneumonia, Worm infestations
11. **What are germs?** A group of tiny invaders / organisms or living things that can make our bodies sick by causing disease
12. **How do germs get on our hands?** Touching unclean surfaces, while playing, after using the toilet or changing a diaper, after handling raw meats or animal poop, etc
13. **How do germs get into our food and then our stomach?** Eating without washing his hands.
14. **How do germs from our hands affect others?** When germs get onto hands and are not washed off, they can be passed from person to person and make people sick.

For Activity 35 - The right choice

Cloth/Cloth pad

A pad made of cloth is folded and placed within the underwear, or passes over the private parts by means of a string tied around the waist. This cloth is washed and reused. If you use cloth to absorb the bleeding, use a clean soft cotton cloth. Thick or heavy cloth will cause friction and irritation in the thighs and genitals.

The cloth should be washed and dried in sunlight properly. If you want to use cotton wool, it should be placed between the folds of the cloth and not on top in a way that it comes in direct contact with the genitals.

The cloth should be changed at least every 5 hours. The string used to fasten the cloth should be tied properly around the waist so that the cloth does not slip out of place. Never use moist cloth as it will make you feel uncomfortable and increases the chances of infection.

Wash the used cloth, wrap it in paper and put it in the dustbin. Do not throw it in a river or pond.

Make sure you wash the used cloth even if you are not going to use it again. Never dispose of the cloth with blood stains on it. If you are going to reuse the cloth the subsequent month, wash it separately and thoroughly with water and soap and then it should be dried in the sun.

After drying it completely, keep it in a plastic bag. Use can add some Neem leaves into the bag as Neem is a good antiseptic. Keep the bag in a safe place. Do not put it on the rooftop or in other unclean storage areas, as it may attract insects leading to infection. Try not to reuse the cloth more than three times.



Sanitary napkin/pad

These are disposable and should be discarded after being used once. These are designed to fit the panty area close to the body. . Some sanitary napkins/pads are made with removable strips of paper that reveal adhesive tape that is made to stick to your panties. Other pads have wrap-around “wings” that wrap under your panties to keep it from moving. Some may prefer the belt model where the napkin is held using the belt. Pads have a plastic lining to minimize the spill of blood. Sanitary napkins manufactured by multinational companies like Stayfree, Carefree, Whisper, Kotex are available in the market. In recent times, SHGs have also started manufacturing sterile, low cost sanitary napkins which can be purchased locally even at the village level. Women SHG members themselves sell these products and so adolescents and rural girls may feel comfortable purchasing them. Some schools have installed sanitary napkin dispensers for easy access.

Points to keep in mind while choosing a napkin:

- Quality of the napkin
- Cost
- Pattern of flow
- Number of menstruation days

Selecting a napkin depends on individual needs and convenience. You may want to try a few brands and types and choose the one that most suits you

Menstrual flow differs from individual to individual. For some, the flow is heavy only on the first day, for others it's for 2 to 3 days. Similarly for some the flow is heavier during the day and for some in the night. Some napkins may absorb blood well and prevent leakage, but cause irritation and itching in the thighs and genitals. If that's the case, you may want to change the napkin till you find a comfortable one. If the problem persists, consult a physician.

How to use a napkin?

Wash hands with soap. Remove a napkin from the pack. Most napkins are individually wrapped. Do not throw away the wrapper. You can use it to dispose of the napkin

Peel the sticker on the napkin and place it correctly in the panty. If the napkins have wings, spread them, remove the sticker and stick them under the sides of the panty.

Wear the panty. If it's uncomfortable, remove it and adjust the napkin accordingly. But you can't change the placement too many times, as it will lose its adhesiveness.

It's important that the panty you are wearing is of the correct size and comfortable, especially during menstruation. If the panty is too loose, the napkin wouldn't stay in place. If it's too tight, you will feel uncomfortable. The frequency of changing the napkins depends on the flow. If the flow is high, you can change it once in 3 hours, otherwise you can keep it on for up to 5-6 hours. It's quite common for girls to not change the napkins frequently in order to save money. However, keeping a napkin on for a long time may cause infection or at least irritation. Each time you urinate and wash your genitals with water, the napkin absorbs the water and eventually it loses its shape. This may lead to overflow, discomfort and bad odour. Change the napkins regularly to keep yourself dry and comfortable. Wash hands with soap after changing and disposing the absorbent.

Safe disposal of used napkins: The manner in which you dispose the napkins depends on the facilities available. She needs to do any of the below:

For disposal one can create a sanitary pit in the backyard -

Dig a pit in the backyard

Keep dropping the newspaper wrapped used napkins in the pit

Cover the pit to stop animals from pulling it outside

Keep dropping ash after use

Once the pit is filled up, close the pit completely and use another pit

One can wrap the napkin in an old newspaper/waste paper and drop it in the dust bin. If there are no bins, then drop it in the general waste bin. Some toilets have incinerators that will burn the napkins.

Sanitary napkins / cloths should be stored in a clean, safe and dry place. Never flush a sanitary or cloth pad down the toilet as they will cause blockage. They should not be left in the garbage pile



For Activity 36- Card game – Good and not-so-good practices

List of hygiene practices to be covered while conducting activity and discussion

- Bathe at least once daily
- Ensure that undergarments and sweat drenched clothes are changed regularly
- Cotton panties are preferable to synthetic ones as the latter holds in moisture and heat making it a breeding ground for bacteria
- Change napkins and cloth periodically at least 3 to 4 times per day (preferable, after every 6 hours). Most importantly, once wet, the napkin/cloth should be changed immediately
- Cloths should not be shared with others
- Wash the genital area after each use of the toilet, also after urinating. Cleaning of genitals and wiping from front to back after using toilet and after urinating
- Keep the area between the legs dry otherwise soreness and chafing may develop
- Some amount of body odour is natural but regular bathing, washing and changing of cloths/napkins will ensure that it is not noticeable
- During menstruation, the outer genitals should be washed from time-to-time to remove any blood that is left
- Girls should wash their hands every time they change the napkin
- If the underwear is soiled, it must be changed. Otherwise this makes bacteria to grow and cause infection
- Use of toilets is very essential

If a girl's panties or clothes get stained with blood, she can soak them in cool, mildly salty water before washing. Hot water will cause the blood to set and remain as a permanent stain

Discussing the health impact of unhygienic practices is mandatory to create linkages to health. To be simplified while explaining.

Hygiene Practice	Health Risk
<i>Unclean sanitary pads/cloths</i>	<i>Bacteria may cause local infections or travel up the vagina and enter the uterine cavity.</i>
<i>Changing pads</i>	<i>Wet pads can cause skin irritation which can then become infected if the skin becomes broken.</i>
<i>Insertion of unclean material into the vagina</i>	<i>Bacteria potentially have easier access to the cervix and the uterine cavity.</i>
<i>Wiping from back to front following urination or defecation</i>	<i>Makes the introduction of bacteria from the bowel into the vagina (or urethra) more likely.</i>
<i>Lack of hand washing with soap after changing an absorbent</i>	<i>Can facilitate the spread of infections such as Hepatitis B or Thrush.</i>

For Activity 39 - Pairing solutions - list challenges and solutions

Ensure that all the following points are covered during the activity and/or discussion. Some challenges and solutions that may be shared with the participants are:

- Fill a plastic bottle with hot water, wrap it in a towel and place it on the abdomen massage the abdomen.
- Local remedies such as ginger or any herbal teas can be taken eating a diet that is low in salt.
- Eat food high in calcium like dairy products; eat foods like leafy green vegetables and fruits, which are high in fibre.
- Do not skip meals.
- Take a brisk walk.
- Mild exercises or yoga.
- A warm water bath would for some relief for aches and pains.
- Immersing feet in warm water for pain relief.
- Breathing exercises and meditation could also help in pain management.
- The pelvic bone needs calcium and iron to get stronger. Intake of black gram dhal, red rice, gingelly oil, eggs and drumstick leaves is recommended for young girls when they attain puberty.

Anxiety about unexpected onset of periods - Knowing when your period will arrive will enable you to be prepared so it's not a surprise. Keep a calendar and mark the first day of your period. A normal period cycle is 28-33 days, but in your first few years, it is normal for the

menstrual cycle to be more unpredictable. Be prepared for it. Keep a sanitary napkin with you in your bag especially around the time when your periods are due.

Stomach ache - Hot fomentation can be used if the pain is unbearable. Take rest. Try meditation, yoga and breathing exercises.

Cramps - Some girls have cramps during their periods. Cramps are actually uterus contractions. The uterus, which is like a pear-shaped muscle, helps get rid of the endometrium, or lining of the uterus. These contractions that sometimes feel like cramps are the body's way of shedding, or getting rid of the lining of the uterus, through the vagina, and out of the body, as the lining is no longer needed in that cycle.

Excess flow and fatigue

- Follow a balanced nutritious diet, drink plenty of water. Have a bath with lukewarm water.
- Itching in the genitals.
- Wash and keep your genitals clean. Change the sanitary napkin or cloth 5-6 times a Day.
- Irritation and blisters in the thighs.
- Apply coconut oil or spray talcum powder. Use cotton undergarments of correct size.

Blood flows in clots - Mild exercise will regulate the flow.

Feeling fat - Just before and during the period, the body may tend to retain water. This added fluid might make you feel fat or make your breasts feel tender. Actually, it is normal to gain a couple of kgs. during this time of the month – and lose them right after your period.

If one feels bloated, she may feel better wearing loose comfortable clothing. Immediately before and during the period less amount of salt to be consumed because salt intake increases water retention.

PHYSIOLOGICAL DIFFICULTIES A GIRL MAY ENCOUNTER DURING MENSTRUATION

The difficulties that girls may experience during menstrual on are:

- Irregular periods
- Heavy periods
- Painful periods

Irregular Periods: For the first few years of menstruation, cycles are often irregular. They may be shorter (3 weeks) or longer (6 weeks). A young girl may even have only three or four periods a year. A girl's cycles will usually become regular within two to three years after menarche.

Heavy periods: A heavy period is one which lasts longer than eight days, saturates the napkin within an hour or includes large clots of blood in the menstrual flow. This is common in adolescents because of slight imbalance in chemical hormones secreted by the body. However, if this happens regularly, it leaves the girl feeling exhausted; which means that the body is losing more blood than it is producing. The girl should then consult a doctor immediately.

Painful period: Slight pain during periods is quite normal. This is due to the secretions of a chemical called prostaglandins in larger quantity than normal. This leads to nausea, headaches, diarrhoea and severe cramps. Usually, this lasts only for a day or two.

To get relief from these symptoms, a girl should try the following methods:

- Fill a plastic bottle with hot water, wrap it in a towel and place it on the abdomen.
- Massage the abdomen.
- Local remedies such as ginger tea can be taken

Premenstrual Syndrome (PMS): This refers to a combination of physical and emotional symptoms experienced by all women during the menstrual cycle, usually just before bleeding begins. These symptoms include:

- Temporary weight gain and a feeling of heaviness due to accumulation on of water in the body.
- Headaches and cramps.
- Painful or heavy feeling in the breasts.
- Feelings of irritability.
- Sometimes emotional changes are experienced like short temper, aggression, anger, anxiety or panic, confusion, lack of concentration, irritability, nervous tension, fatigue, or depression around the time of her period. Not everyone has these feelings – some do not feel anything.

Nutritional Needs

- A balanced diet is essential for proper growth, development and functioning of the body and this remains true even during the years of menstruation. A balanced diet containing lots of fresh fruits and vegetables should be taken. Consuming a diet rich in Iron is extremely important. Iron is required by the body to make haemoglobin, an important component of blood. During the

years of menstruation, body's requirement for iron increases as it needs to create more blood to make up for the loss of blood during menstruation. A deficiency of iron in the body can cause anaemia.

- Some of the food products rich in iron are: lean red meat, dark poultry, lentils, spinach, almonds and iron fortified cereals. Citrus fruits or vegetables should be consumed before taking iron rich food.

Vaginal Discharge

Vaginal discharge may be thin and clear, thick and mucous-like, or long and stringy. A discharge that appears cloudy white and/or yellowish when dry on clothing is normal. The discharge will usually change appearance at different times during the menstrual cycle, and for a variety of other reasons, including emotional or sexual arousal, pregnancy and use of oral contraceptive pills.

The following can be a sign of abnormal discharge and could indicate a health problem:

- Discharge accompanied by itching, rash or soreness.
- Persistent increased discharge.
- White, lumpy discharge. (like curds)
- Grey/white or yellow/green discharge with a bad smell.

For Activity 43 - Waste Rules

Acts and Rules related to Solid Waste Management

Regulatory instruments for Solid Waste Management under the Environmental Protection Act:

The Solid Waste Management Rules, 2016 applies to Municipal areas, urban agglomeration and institutions. The rule has made source segregation of waste mandatory to channelize the waste to wealth by recovery, reuse and recycle. The rule also states that no person should throw, burn, or bury the solid waste generated by him, on streets, open public spaces outside his premises, or in the drain, or water bodies.

The Plastic Waste Management Rules, 2016 and amended in 2018, is applicable to every waste generator, local body, gram panchayat, manufacturer, importer and producer. The minimum thickness of plastic carry bags made of virgin or recycled plastics shall be 50 microns. Carry bags or products made of recycled plastic shall not be used for storing, carrying, dispensing or packaging ready to eat or drink food stuff. As part of Extended Producer Responsibility (EPR), the primary responsibility for collection of multi-layered plastic sachets or pouches or packaging is of producers, importers and brand owners; they are required to establish a system for collecting back the plastic waste generated due to their products. The carry bags or recycled plastic bags or multi-layered packaging can be manufactured only by registered manufacturers/producers/recyclers.

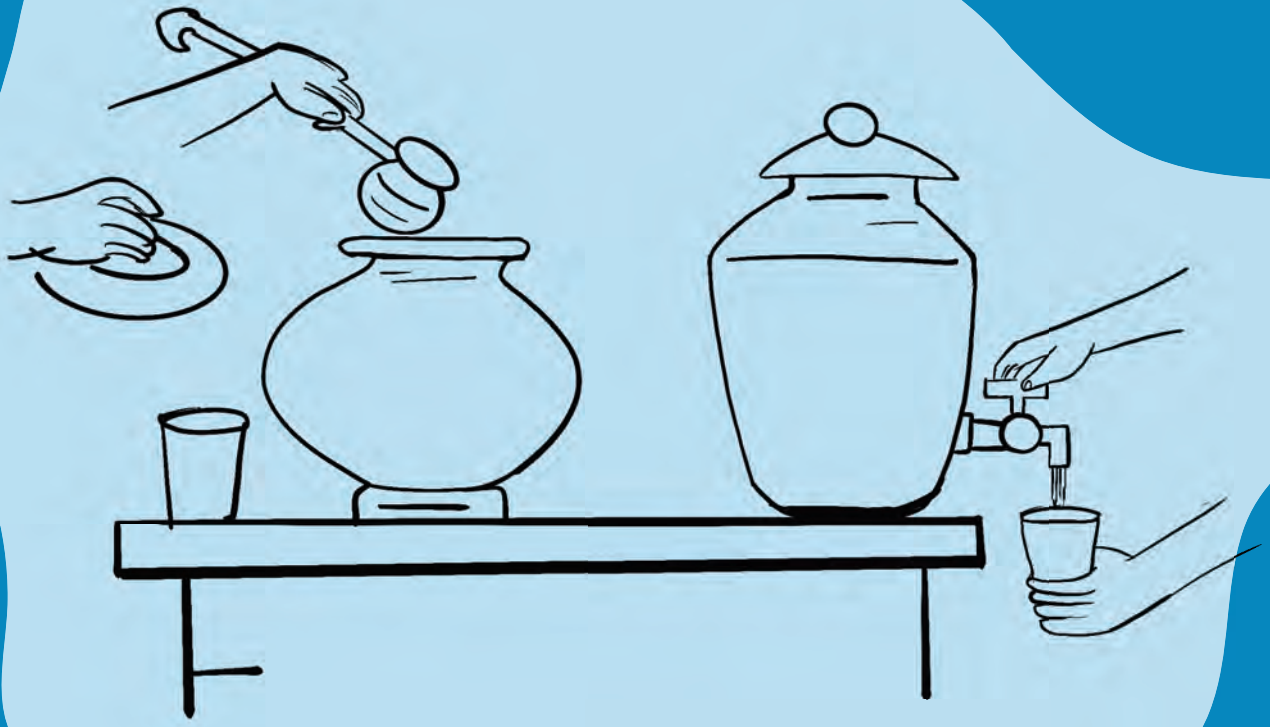
The E-waste (Management) Rules, 2016 and amended in 2018, has been formulated to channelize the E-waste generated in the country towards authorised dismantlers and recyclers in order to formalise the e-waste recycling sector.

The Bio-Medical Waste Management Rules, 2016 and amended in 2018, is a legal binding on the health care institutions to streamline the process of proper handling of hospital waste such as segregation, disposal, collection and treatment. The rule has introduced more stringent standards for incinerators to reduce the emission of pollutants in the environment; inclusion of emissions limits for Dioxin and furans.

The Hazardous Waste Management Rules, 2016 is to control generation, collection, treatment, import, storage and handling of hazardous waste.

The Construction and Demolition Waste Management Rules, 2016 applies to every waste generator who needs to segregate construction and demolition waste and deposit it at collection centres or hand it over to the authorised processing facilities. Generator needs to ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains.

Large generators need to have an environment management plan and also submit a waste management plan to get appropriate approvals from the local authority before starting construction or demolition or remodelling work. They also need to pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities.



Section 3:

Water Management

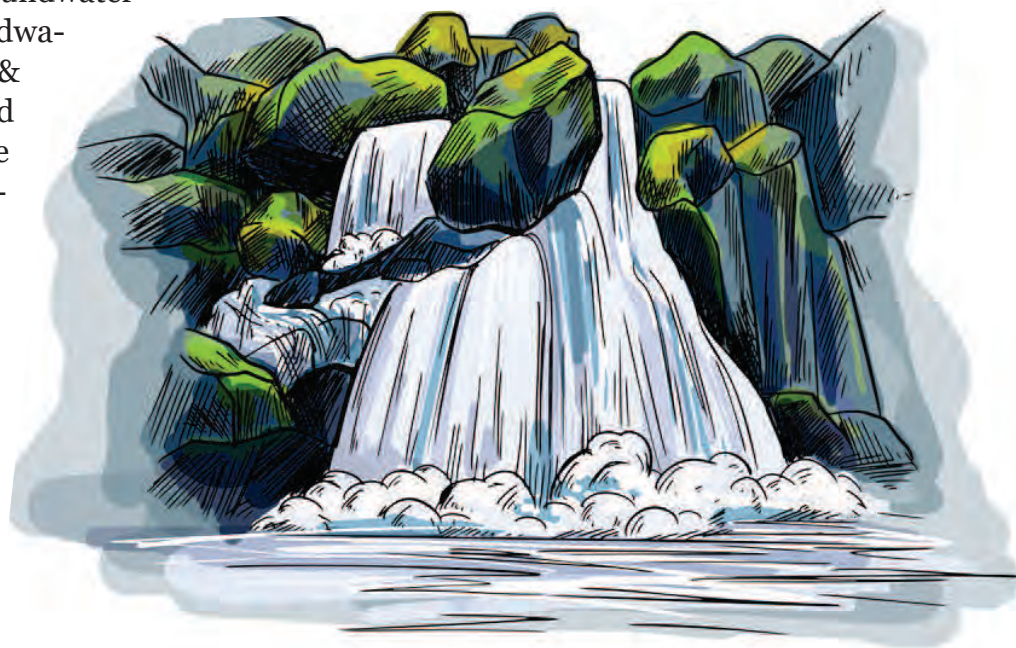
3.1. Introduction

3.1.1. Overview of the theme

Water is one of the most important substances on earth. Water is life. All plants and animals require water to survive. If there is no water, there would be no life on earth. As on today Water is the God's gift. Rainfall is the only source of water. Surface water and groundwater are two interchangeable phases of water. Hence, their availability and use have to be managed together.

Apart from drinking it to survive, people have many other uses for water. Water is the most important resource of development. In this theme, we have introduced basic concepts of water, its importance & properties, Water Quality and Water as a life skill for healthy life of human beings.

Water is a subject which need to be understood in phased manner. The students from 1st to 4th standards have learned about the basics, need, use & importance of clean and pure water in day today life. The students from 5th to 8th standards will learn about the important source of water i.e. rainfall & its measurement, traditional methods and measures for water storage and their use for various purposes. As they advance in the standards they will learn in depth about various components of hydrological cycle, the rocks where groundwater occur & their types, use of groundwater, importance of water quality & its monitoring, water safety and security planning etc. These are integral part of the SDG6 (Sustainable Development Goal), GoI and GoM's flagship programs.



3.1.2. Rationale and expected learning outcomes

The theme seeks to help the students understand human life experiences related to water. The students need to be informed about the Safe Drinking Water right of every human being. This will help the students to make aware of values of water, judicious use of Water. Reading about the ill effects of drinking of bad quality water can be an eye opening to the students who have never had to experience the water borne diseases. This will help them to know the factors (natural and manmade) responsible for the deterioration of water quality. The activities and projects will help the students to get a real life feel of what exactly is the situation and what happens if the water is not saved. To capture the student's attention poems, short films, real life activities have been proposed. These will certainly help in making him a water sensible citizen of India. By inculcating the life skills related to water we hope the children to become the water warriors. The students should learn saving of water resource is nothing but increasing the resource.

Summary of Curriculum Analysis

Active Learning pedagogy states that any subject should be introduced in graded manner and child should acquire this knowledge, with his/her experience. Water is not topic which will be covered in just Science or Geography. Water is part and parcel of everybody's day to day life. Water has Language, Maths, Historical and most importantly Social angle. In MSCRT syllabus, the water is in Environment Science subject of fifth standard. Later on, it comes in Geography and General Science in these subjects. To understand Water in detail, a child should understand why is he/she learning this topic and what is its real-life application. To fulfil this, from fifth standard focus is shifted from individual to social aspect, understand locality and problem specific to child's geographical location. Field visits, Group activity and Surveys will help to understand the real time problems people are facing. Group activities will help to develop skills to work as team and solve the problem. Project works and lesson plans are designed in such way to fill the gap between theory and real life problem statements.

3.1.3. Activity Framework

Std	Related subject and topics in MSCERT curriculum for relevant standard; key gaps addressed	Learning outcomes Knowledge, skills, values expected to be developed for the topic	Pedagogy/ Activities & projects in brief (use templates below for details)	
5	Prepare rain gauge	Students will get hands on rain gauge and measurement of rainfall.	Using questionnaire	
5	Who does measure the Rain?	Students will understand the awareness about rainfall measurement.	By preparing the rain gauge using waste plastic bottle	
5	Do you fetch the Water?	Students will understand the gender bias while fetching water in rural as well as urban area.	Using questions	
6	Why to study rocks?	Students will understand where we use rocks in our house.	With the help of day today use of rock at home	
6	Rock museum at School	Students have already knowledge of rock types; collection will help others students to handle the rock specimen.	Identification of specimen in the field	
6	Where does rainwater go?	Students will understand the role of rocks as Aquifer. Rock properties which help to store water even after rains.	With the help of an experiment or classroom activity	
6	Are our seasons changing?	This is a little introduction to the impact of climate change on our seasons.	Classroom activity	
6	How to get potable water during disasters?	Due to climate change, floods, cyclones are increasing disasters. Students should be ready to deal with such situations.	Learning exercise	
6	Fresh Water Distribution	Students will understand what is the percentage of Fresh Water.	Classroom activity	
7	What are Water borne Diseases?	Water Quality is directly linked to health. What are the factors affecting Water Quality?	With the help of group project on water quality testing	

	Sustainable Development Competences (see Box on Pg 4)	What is to be assessed, and methods of assessment	Teachers' ESD Competences	Backward/ forward links with other activities/ projects, if relevant
	Collaboration Competency			
	Critical Thinking Competency	Based on how each group prepares the rain gauge		
	Collaboration Competency	Based on the charts		
	System Thinking Competency	Based on correct identification of rocks		
	Collaboration Competency			
	Normative Competency	Based on the answers to the primary questions		
	Critical Thinking Competency	Based on the observations		
	Strategic Competency	Asking few questions		Standard 3: Can we get clean water?
	Normative Competency	Asking few related questions		
	Anticipatory Competency	Confirming results with the tests carried out by school staff		Standard 3: Can we get clean water? Let us understand Water

Std	Related subject and topics in MSCERT curriculum for relevant standard; key gaps addressed	Learning outcomes Knowledge, skills, values expected to be developed for the topic	Pedagogy/ Activities & projects in brief (use templates below for details)
7	Water Storage Structures	Students will understand the importance of Water Harvesting and what are structures being used in traditional as current scenarios.	Using small questionnaire
7	What causes Water Pollution?	Students will understand any addition to water that damages the water quality, making the water undrinkable and dangerous for organisms.	Using questionnaire and survey formats
8	Rate of Evaporation	Students will understand how to measure rate of evaporation and how it changes as per day night.	With the help of an experiment or classroom activity
8	Water leakages	It is estimated that around 40 per cent of piped water in India is lost to leakage. Student should be very conscious towards leaks and importance of maintenance distribution system.	Using questionnaire and survey formats
8	Water Safety and Security Plan	To understand Water as whole system	With the help of the project

3.1.4. Activity Plans

1. Standard 5:

- ii. Prepare Rain gauge
- iii. Do you fetch Water?
- iv. Rain Gauge Preparation (Project)

2. Standard 6:

- i. Why to study Rocks?
- ii. Rock museum at School
- iii. Where does rain water go below the ground?
- iv. Are our seasons changing?
- v. How to get potable drinking water, use toilets during disasters?
- vi. Fresh Water Distribution

	Sustainable Development Competences (see Box on Pg 4)	What is to be assessed, and methods of assessment	Teachers' ESD Competences	Backward/ forward links with other activities/ projects, if relevant
	Self-Awareness Competency	Based on the evaluation of the questionnaire		Standard 4: Changes in Water Storage methods
	Integrated Problem-Solving Competency	Asking few related questions		Standard 6: How to get Potable water during floods, cyclones?
	Normative Competency	Based on the answers to the primary questions		
	Integrated Problem-Solving Competency Critical Thinking Competency	Evaluation of the survey formats		Standard 4: How does water come to your place?
	Integrated Problem-Solving Competency Critical Thinking Competency Strategic Competency	Outcome the project		Gist of all the information studied in earlier standards.

3. Standard 7:

- i.* What are Water borne diseases?
- ii.* Water Storage Structures
- iii.* Water Quality Testing

4. Standard 8:

- i.* What causes Water Pollution?
- ii.* Rate of Evaporation
- iii.* Water Leakages
- iv.* School Water Safety and Security Plan

3.2. Activities / Projects

Std.
5

3.2.1. Where the Rainfall is measured?

Level/ Class: Standard 5

Curriculum links: Environmental Science

Activity duration: 1 day

Materials needed: Questionnaire

Approach: School & adjoining areas, house and adjoining areas

Topic:

Water Management

Concept:

- Children should be made aware of how & where rainfall is measured.

Aim:

- To know whether rain gauge is installed in the vicinity of a school or a house.

Key Questions to address:

- How to measure rain?
- What is the need to measure rain?

Preparation:

NA

Method/Guide:

1. Divide the students into groups based on the total students.
2. Each group will have two students.
3. Allot the work area to each group based on their residence (maximum up to 1 sq. km). Also allot the school area to some groups (maximum up to 1 sq. km).
4. The teacher will explain how to fill the questionnaire.
5. The group of students will randomly visit five houses/ buildings/ societies within their own residential area.
6. The students will ask the questions to the owner or head regarding the rain gauge.
7. Based on the answers received the children will know whether the community knows about the rainfall measuring instrument and where it is installed.



Self Recording Rain Gauge

Questionnaire	
Name of the School	
Name of the Area where school is located	
Name of the area where students visited	
Name of the House/ Society/ Building Owner	
Which instrument is used for the measurement of rainfall?	
Whether such an instrument is installed in the premises of the building?	Yes / No
If Yes, who is measuring the rainfall? Please write the name of the person.	
Is the rainfall recorded in a register?	Yes / No
How much was the last year's annual recorded rainfall in mm	
Name of the Students	

Learning outcome or Green Habit:

Children will come to know where and how rainfall is measured nearer to my residence or school. Child will always opt for greener mode of transportation i.e. bicycle while carrying out this project.

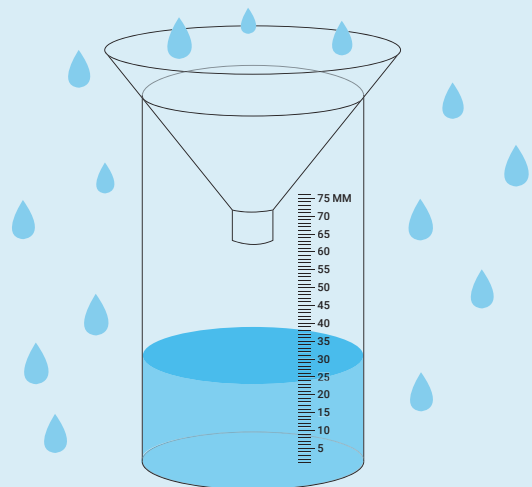
FAQs

Q - What is a rain gauge?

A - The instrument used to measure the rainfall is called a rain gauge.

Q -Is the rain gauge highly mechanized?

A - No



3.2.2. Do you fetch Water?

Level/ Class: Standard 5

Curriculum links:

Environmental Science

Activity duration: 60 min

Materials needed:

Chart paper, Coloured sketch pens

Approach: Classroom

Topic:

Water Management

Concept:

To create awareness on who usually draws or fetches water at household level.

Aim:

To make them aware about the bitter truth that only girls or women have the responsibility of drawing or fetching water in rural as well as urban areas.

Key Questions to address:

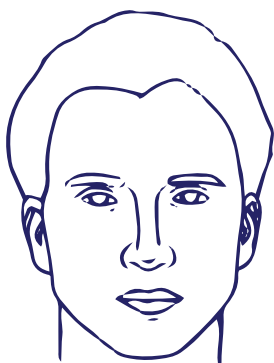
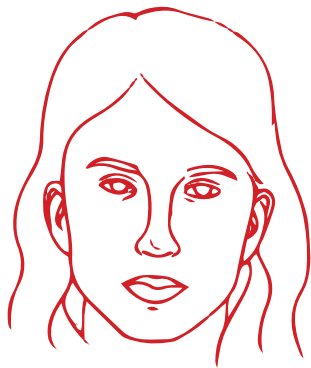
Gender inequality in Water Sector

Preparation:

NA

Method/Guide:

1. Teacher will ask the students to observe at their home who fetch domestic water in their house.
2. Teacher will ask this question to each student.
3. Over the year who fetches domestic water in your house?
4. Based on the answer of each student either the teacher or a class monitor will draw a female or male face on the chart paper.
5. The female face will be drawn using red colour and the male face using blue colour.
6. Once this exercise is over, the teacher will ask someone to count the number of females and males.
7. Based on the count, the teacher will discuss the dominance and explain gender equity.
8. Teacher will ask students are you ready to fetch water instead of your sister or mother?



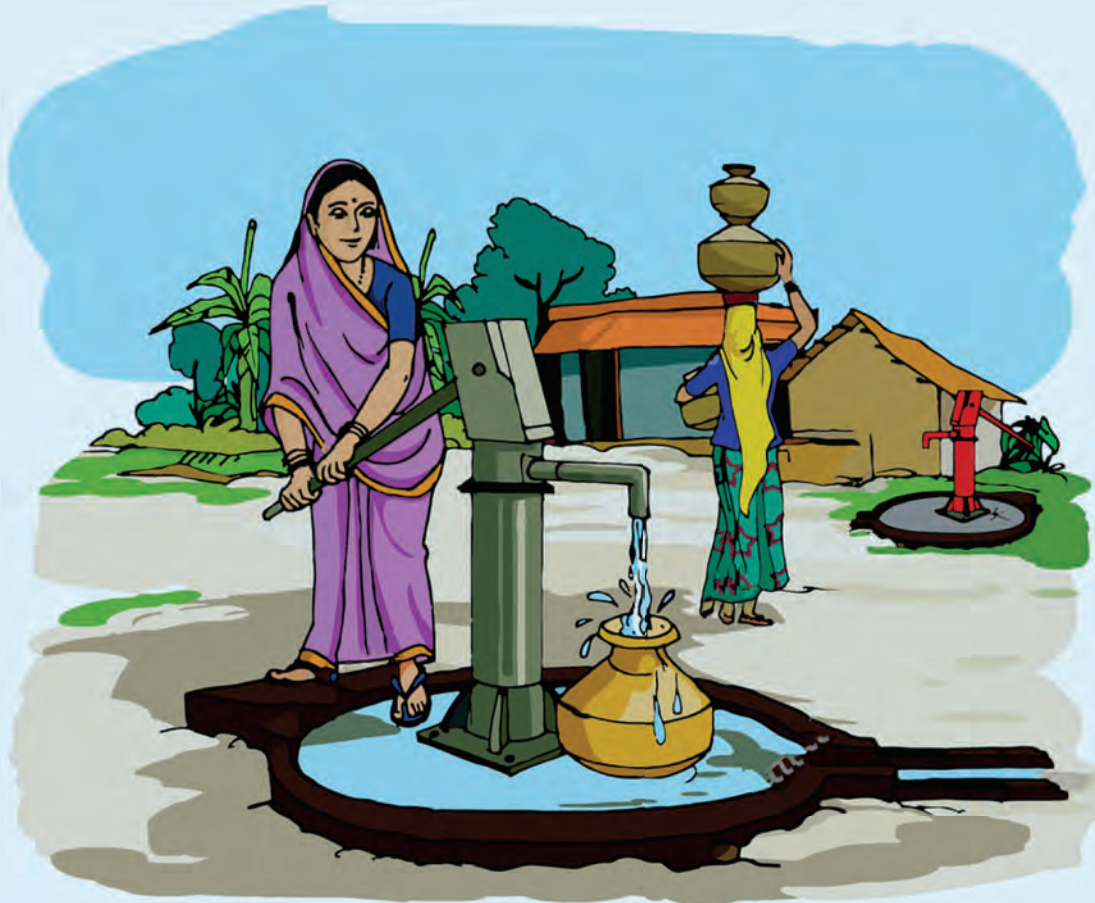
FAQs

Q - What is the predominant use of water?

A - Water is used mainly for drinking, domestic, irrigation, industry, and recreation.

Q - Who fetches domestic water in rural areas of Maharashtra?

A - Usually, girls or women fetch water for domestic purpose.



Learning outcome or Green Habit:

The students will understand gender equity and will start assisting in fetching water at home. They will insist their parents to use metal utensils instead of plastic.

3.2.3. Rain gauge preparation (Project)

Level/ Class: Fifth Class

Curriculum links: Environmental Science

Topic:

Prepare Rain gauge using waste plastic bottles and measure rainfall

Project Concept:

Rain gauge is the instrument used for the measurement of rainfall. There are two types of rain gauges, manual and automatic. Under the climate change scenario, along with variability, regional variation is also observed. Nowadays the big dry spell is being observed. The rainfall quantity is almost normal but the number of rainy days are reducing. The non-monsoon rainfall has drastically reduced. With this background, the students should know how to measure the rainfall in the School or at home using waste plastic bottles.

Objectives:

- **Learning objectives-** To know how to measure the only source of water i.e., rainfall
- **Action objectives-** Every user of water i.e., the community must know how much is the annual availability of water through rainfall as it is the only source of water resource. Students from their childhood should know how to measure. Based on the annual availability they will know the importance of water management.

Resources and preparations needed:

- Empty plastic bottle of any cold drink of 2 litres or above capacity
- Fevi quick tube (10 mg)
- 100 gm white cement & one mug of water
- Plastic Bowl for making cement slurry.
- Long handle steel spoon to pour cement slurry
- Transparency sheet – A4 size
- Scissor / Cutter
- Marker pen of Red colour
- Waste cloth
- 15 to 20 good quality bricks
- half bucket of fine sand

The teacher will make the groups based on the number of students. Teacher will request all the groups to bring one empty cold drink bottle on the day of exercise. The support staff will make photocopies of the cm side of small plastic scale with double enlargement on the transparency sheet. The support staff will cut that xeroxed scale into small strips having 0 to 10 cm markings. The support staff will make it one for each group.

SOPs and background preparations:

In Maharashtra two important flagship programs are being implemented by GoM through Water and Sanitation Dept. They are Jal Jeevan Mission and Atal Bhujal Yojna. In both the programs, village level water budget is must which requires village level measurement of rainfall. Hence this project will be a boon for the Gram-panchayat and they will get the actual measured rainfall figures for their water planning. IMD (India Meteorological Dept, GoI) has issued the standard guidelines for the installation of manual rain gauge.

Project timing:

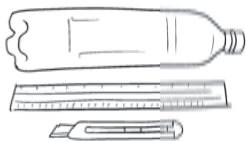

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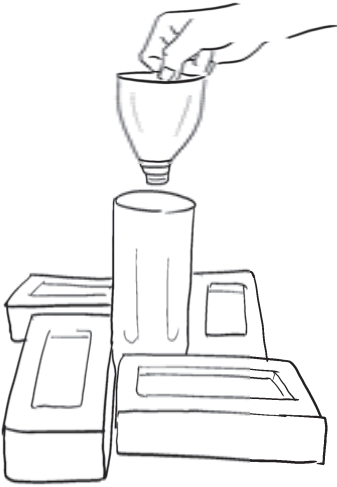
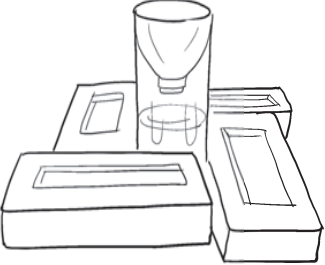
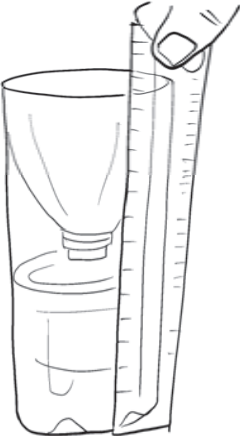
Project plan and schedule:

The project should be initiated in the month of June as soon as school opens. During that time, rainy season will be on and the students should be taught to observe the season carefully. May be by January first week this activity should begin. This project requires at least two days i.e., 180 mins for its preparation. The project should end by January so that the non-monsoon rainfall can be measured. In Maharashtra the non-monsoon rainfall comes in the months of March to May.

Project Steps:

The expected steps and duration for each step is given below.

Step		Location	Duration
<ul style="list-style-type: none"> The teacher will show the video of Arvind Gupta Students will see the video carefully. Write the number of the group on the lid and at the bottom most part of the bottle using marker pen. 		School	30 minutes Day 1
<ul style="list-style-type: none"> Carefully cut the upper section of bottle from the neck i.e., tapering point using scissor. It looks like a funnel. The group will keep it in the safe custody. Take the cut lower part of the bottle for next preparation. Measure 1½" to 2" distance in the upward direction from the bottom most level of the bottle and put 4 marks on the bottle. Join those points to make circular line using red colour marker pen 		School	30 minutes

<ul style="list-style-type: none"> • Make a thick cement slurry using water of appropriate proportion in the plastic bowl. • Slowly pour the cement slurry using steel spoon in the lower part of the bottle. While pouring take all the precautions so that the cement slurry will not touch or stick in the middle part of the bottle. • Fill the cement slurry up to the circular red line. Slowly shake the bottle so that the top layer of cement become plain & even. • Clean or wipe the sticked drops of cement using waste cloth. • Allow the cement to settle and dry for over-night. Cement is put in the bottle to give sturdiness to the bottle. 		<p>School</p>	<p>30 minutes</p>
<ul style="list-style-type: none"> • Take out the lower part of bottle and confirm with the help of fore finger that the cement is completely dried up. Still if cement is wet then allow the bottle to dry for one more day. • Take the lower part of the bottle and paste the xeroxed plastic strip using feviquick in the reverse direction. Zero of the scale should touch the red colour circular line. • Take the funnel like upper part of the bottle and remove the lid. Invert it and insert the bottom part i.e., lid portion should go down in the bottle. • By using the feviquick stick the top part of the funnel to the bottom part of the bottle. • Allow the feviquick to dry. Wait for half an hour. 		<p>School</p>	<p>30 mins of Day 2</p>
<ul style="list-style-type: none"> • Now the rain gauge is ready. • Rain gauge should be installed in a ground at least 100' away from big trees or tall buildings. • Choose a corner in the school playground which is free from all disturbances. • Put four bricks very close to each other and make two such layers. Arrange a third layer of four bricks in such a way that the rain gauge can be put in the space in between. • Put one inch layer of sand in the space. • Put the rain gauge in the sand. • During the rainy season start measuring the rain falling over it on a daily basis. 		<p>School</p>	<p>60 mins of Day 2</p>

FAQs

Q - What is the name of the instrument used to measure rainfall?

A - Rain gauge

Q -How much rainfall can be measured in the plastic bottle rainfall?

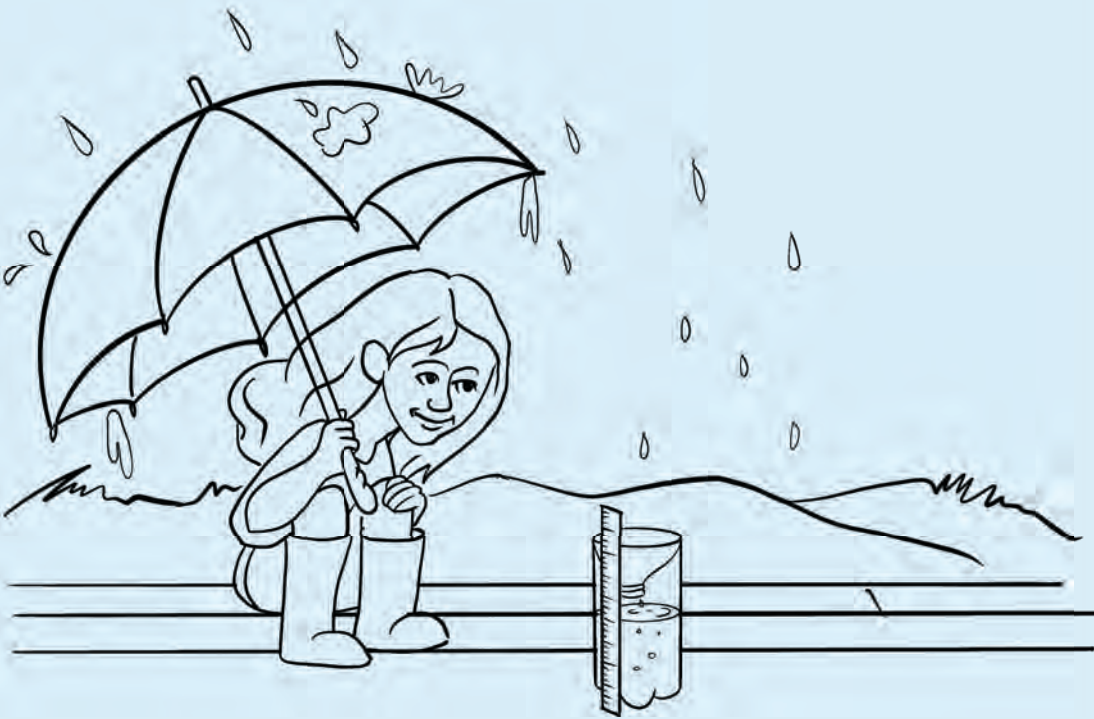
A - May be up to 100 mm in a day.

Q - Who should measure the rainfall?

A - The students should measure the rainfall.

Q - Where can be these rainfall figures used?

A - The annual rainfall figures are necessary for Grampanchayats for water budget under various GoI and GoM flagship programs.



Learning outcome or Green Habit:

The students will come to know how the rainfall is actually measured locally. They can prepare the rain gauges using waste plastic bottles.

3.2.4. Why to study Rocks?

Level/ Class: Standard 6

Curriculum links:

Geography, Day to day life

Activity duration: 1 day

Materials needed:

NA

Approach: Classroom

Topic:

Water Management

Concept:

To make aware about usage of rocks & importance for ground-water storage.

Aim:

Real time usage of rocks

Preparation:

NA

Method/Guide:

1. Discuss with the children about various rock types they have studied such as Igneous rock, Sedimentary rock and Metamorphic rock.
2. Ask them where we see rocks.
3. Prepare a list of items which are present in their house and made of these various rocks.
4. Create a chart or bring small items and arrange exhibitions of these items. Such as खलबत्ता, सहाण
5. Ask the students to remember what they have learnt in 4th standard about wells or borewells or springs. Give them a clue for discussions: what happens when rainfall infiltrates in the ground and get stored in the rocks. Whether they have seen dug wells or borewells? If yes then how they give water to us?



Igneous Rocks



Granite



Basalt

Sedimentary Rocks



Sandstone



Limestone

Metamorphic Rocks



Marble



Slate

FAQs

Q - What are rocks?

A - They are naturally occurring substances, usually hard, solid material that form a part of the surface of the earth.

Learning outcome or Green Habit:

The students will understand the importance of rocks & why rocks were used traditionally in their homes traditionally. They will insist their parents to use such eco-friendly materials in their houses.

Level/ Class: Standard 6

Curriculum links:

Geography

Activity duration: Yearly

Materials needed:

NA

Approach: School, Field Visit

Topic:

Water Management

Concept:

To increase knowledge about rocks

Aim:

Collection and observation of rocks at school level

Preparation:

NA

Method/Guide:

1. Discuss with children about various rock types they have studied such as Igneous rock, Sedimentary rock and Metamorphic rock.
2. Ask students to collect various samples.
3. Label these rocks.
4. Arrange these rocks as per the type such that every student can visit and show the specimen of rock types.

Learning outcome or Green Habit:

The students will get familiarised with rocks. For museum, the students will pursue to use wooden trays prepared out of waste wood.



3.2.6. Where does rainwater go below the ground?

Level/ Class: Standard 6

Curriculum links:

Geography

Activity duration: 1 hour

Materials needed:

Clay, Soil, Gravel, Stones, 2 lit bottle, Fine Sand, Cutter, Plastic Cup

Approach: Classroom or Lab

Topic:

Water Management

Concept:

To make them understand importance of rocks.

Aim:

- Importance of rocks
- Introduction to term Aquifer

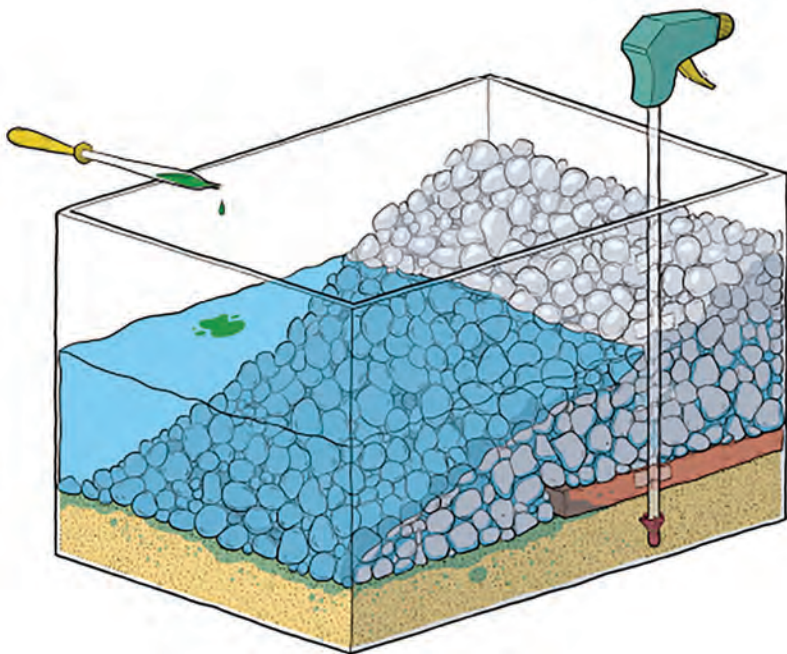
Preparation:

NA

Method/Guide:

- Ask students where rainwater goes once it reaches ground.
- Discuss the concept of Groundwater.
- Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures, joints of rock formations.
- AQUIFER (In Greek) = AQUA (water) + FERRE (to bear)

- An aquifer is a rock formation that is saturated with water. An aquifer is able to store and transmit reasonable quantities of water to sources such as springs and wells.
- The different rock types which we study hold rainwater below the Earth's surface.
- How much water the rock will store depends on its property called Porosity. The material that contains voids or openings is said to be porous. This rock property is called POROSITY.
- Now we will build our own aquifer model.
- Take a 2-liter bottle and cut the lid with the help of a cutter.



- Add a layer of clay which will act as an impermeable layer.
- Then add a layer of stones.
- Pour one cup of gravel on top of the rocks or sand.
- Pour one cup of soil on top of the gravel.
- Take a plastic cup with the help of a pin create small holes in the base.
- Fill this plastic cup with water and hold our model.
- Water among soil pores, gravels is Groundwater and that rock formation is Aquifer.
- Discuss water availability is only dependent on geological formation, that's why it is important to study rocks.

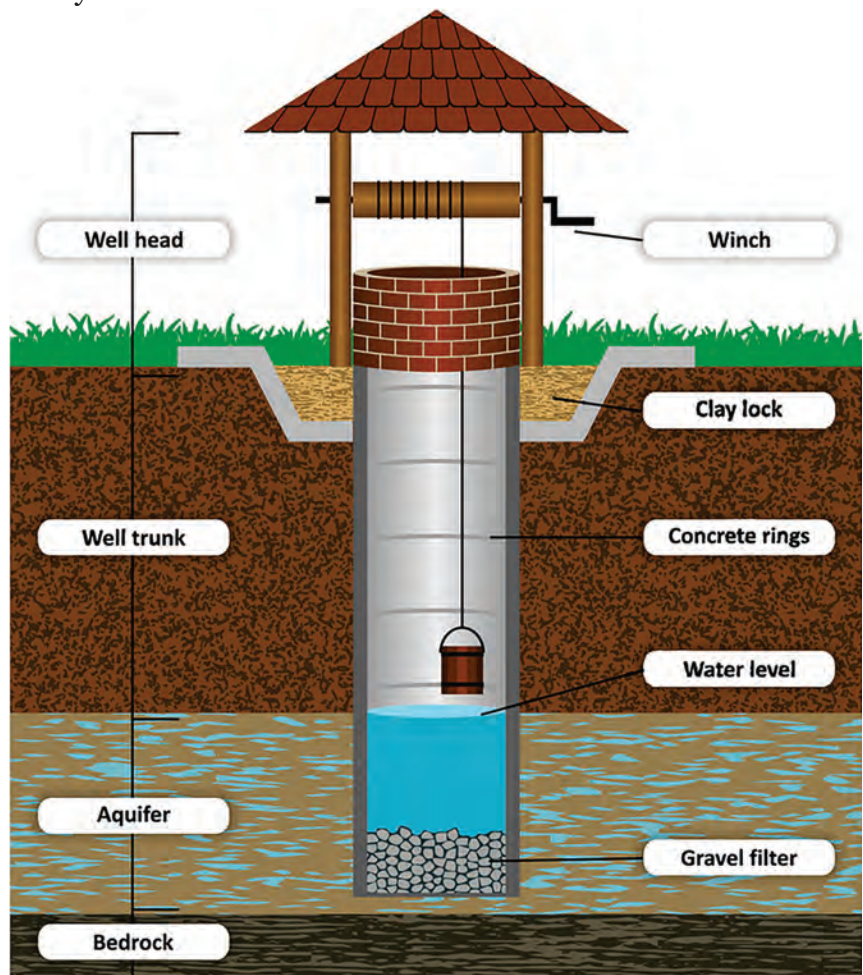
FAQs

Q - What is aquifer?

A - Aqua means water and fer means bearer. It is a rock which holds and gives groundwater.

Learning outcome or Green Habit:

The students will come to know that the rock is a house of groundwater. They will come to know the limitations of groundwater occurrence within a rock. They will try to introduce rain water harvesting system to their residential buildings to increase groundwater level.



3.2.7. Are our seasons changing?

Level/ Class: Standard 6

Curriculum links:

Geography

Activity duration: 1 year

Materials needed: NA

Approach: School

Topic:

Water Management

Concept:

To make them understand impact of Climate Change on Seasons.

Aim:

How is Climate change affecting our seasons?

Key Questions to address:

- What is Climate Change?
- The effect of climate change on our life.

Preparation:

NA

Method/Guide:

1. Discuss with children about the seasons observed in India.
2. **Summer:** February to May
Rainy: June to September
Winter: October to January



3. Climate change is affecting the seasons such as delayed monsoon, heat waves and drought.
4. Ask students to notice these changes at the start and end of these seasons for a year.
5. Prepare a chart and display it in front of the class.



Learning outcome or Green Habit:

The students will understand visible changes in seasons. They will also understand reasons behind these changes and will try to reduce or stop greenhouse gas emissions.

3.2.8. How to get potable drinking water, use toilets during disasters?

Level/ Class: Standard 6

Curriculum links:

Geography

Activity duration: 45 min

Materials needed:

Coloured sketch pens, Chart Papers

Approach: Classroom Activity

Topic:

Water Management

Concept:

To make them aware how to get potable drinking water, use toilets during floods, droughts and cyclones.

Aim:

To get a response and build confidence in the students on how to get potable drinking water, use of toilets during floods, droughts and cyclones.

Key Questions to address:

- How to build the capacity of the students during natural calamity?
- Is climate change affecting our life?

Preparation:

NA

Method/Guide:

1. The teacher will explain the standard guidelines regarding getting potable drinking water, use toilets during floods, droughts and cyclones.
2. The teacher will write these four topics on four different chart papers.
3. Based on the responses from the students, the teacher will go on listing them subject wise.
4. After receiving responses from all the students, the teacher will brief them about missing or important provisions for getting potable drinking water supply, use of toilets during floods, droughts, and cyclones.
5. Display the completed charts in the classroom.



FAQs

Q - What is drought?

A - When any area receives rainfall lesser than the average and there is a shortage of water for usages.



Q - What is flood?

A - When there is heavy rainfall / downpour within a short period of time, the excess water that spreads from a river is called flood.



Learning outcome or Green Habit:

The students will learn how to get potable drinking water, use toilets during floods, droughts and cyclones. They will spread the message of saving & judicious use of potable water during natural disasters.

Level/ Class: Standard 6

Curriculum links:

Environmental Science

Activity duration: 60 min

Materials needed:

1 litre bottle (waste bottle),
Measuring Cylinder

Approach: Classroom

Topic:

Water Management

Concept:

To make aware of the freshwater availability on Earth with the help of small experiment

Aim:

To make them aware about distribution of water on the Earth and what is the amount of fresh water available for our use.

The distribution of water on the Earth's surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps.

Key Questions to address:

Why is fresh water limited and precious?

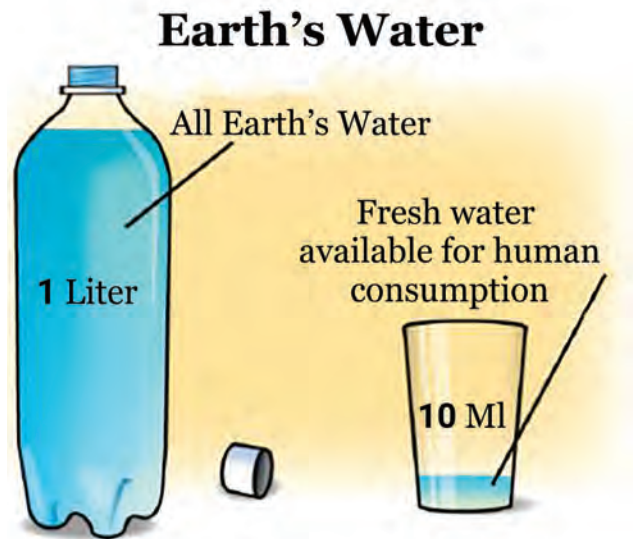
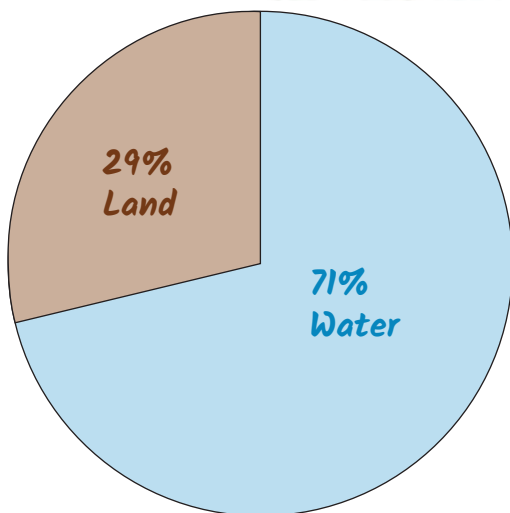
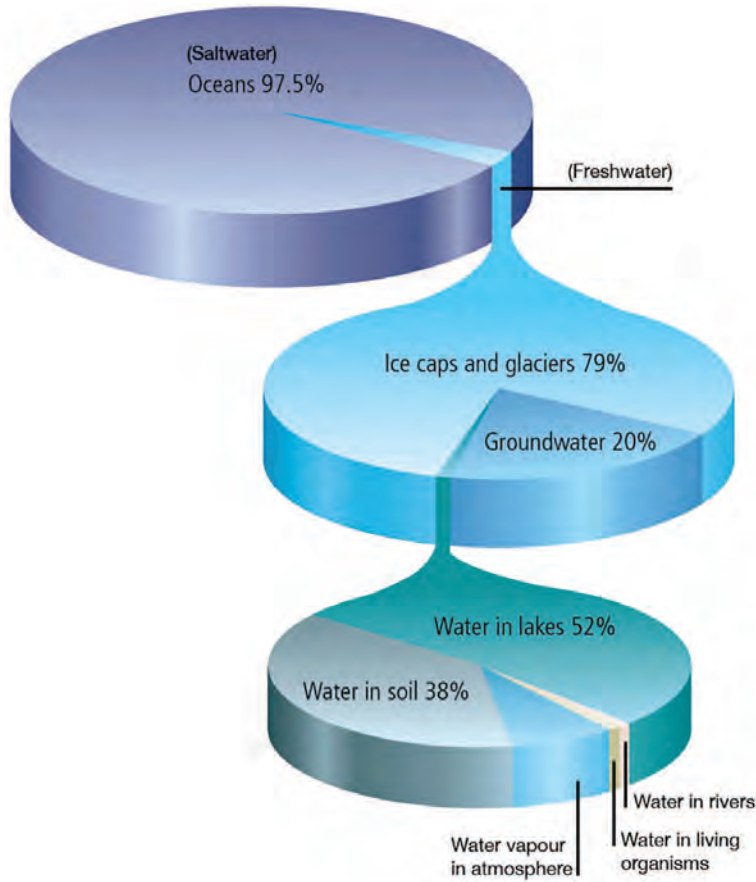
Preparation:

NA

Method/Guide:

1. Teacher will discuss about the percentage of land and water coverage on earth.
2. Water makes up about 71% of the Earth's surface, while the other 29% consists of continents and islands.
3. Take 1 litre plastic bottle and fill it up with water.
4. From that water, measure and take out 970ml of water. 97% of water is sea water which is not suitable for human use. Ask students to discard it & request to water it to the nearby plants.
5. From the remaining water, measure and take out 2% i.e., 20ml of water. 2% of this water is in glaciers which can't be used.

6. Out of total fresh water on the Earth, 68.7% is trapped in glaciers, 30.1% in groundwater & only 0.26% in lakes.
7. The remaining 1% i.e., 10ml is available as fresh water that can be used. Ask the students to measure this quantity using a spoon. Approximately it is equivalent to two tea spoons only.
8. Demonstrate to the students, only 10 ml out of 1000 ml is available for our use. Every living thing has equal right on this fresh water.
9. Thus, at global level, the freshwater availability is very limited and hence we should use water judiciously and carefully.



Learning outcome or Green Habit:

The students will come to know the limited availability of fresh water on the earth. They will try to propagate the message to save the freshwater water as much as possible.

3.2.10. What are Water borne Diseases?

Level/ Class: Standard 7

Curriculum links:

Geography

Activity duration: 1 week

Materials needed:

Print out of Questionnaire

Chloroscope with test tubes,
Ortho Tolodine Solution

Approach: Survey, Group Activity



Topic:

Water Management

Concept:

- To make them aware that many diseases are spread through water.
- Water Quality is a very important aspect of it.

Aim:

- To make them aware about quality aspect of water
- Diseases that can occur due to poor quality of water

Key Questions to address:

- What is Water Quality?
- What are the types of diseases spread due to poor quality of water?

Preparation:

NA

Method/Guide:

1. Safe drinking water is a right of every human being.
2. Water is called the “universal solvent” because it is capable of dissolving more of the substances than any other liquid. This is important to every living thing on earth. It means that wherever water goes, either through air, ground, or through our bodies, it takes along valuable chemicals, minerals, and nutrients.
3. That means, there is also high risk of water getting contaminated or polluted which leads to water borne diseases.
4. Create a group of three students each and ask them to do a survey.
5. The purpose of the survey is to find out in the nearby localities how many people are affected by water borne diseases, type of water resources used for drinking water.

6. Use the Water Quality Survey Form for collecting the information.
7. Ask a few groups to carry out using the Chroscope O.T Test for water provided in the school.



Diarrhoea



Vomiting



Typhoid



Diphtheria



Hepatitis



Kidney Damage



Nerve Disorders



Skin Lesions

FAQs

Q - Why water is called universal solvent?

A - Because it is capable of dissolving more substances than any other liquid.

Q - What is TDS?

A- Total dissolved solids present in water.



Parameter	Desirable Limit	Permissible Limit (पिण्यायोग्य)	Risks (धोका)
pH (सामू)	6.5-8.5	No Relaxation	Low – Corrosion, Metallic Taste High- Bitter taste, deposits
Total Dissolved Solids (TDS) Max	500 mg/l	2000 mg/l	Hardness, Cloudy coloured water, corrosion
Iron, Fe	0.3 mg/l	1.0 mg/l	Bitter, Metallic Taste, Stomach Problems
Fluoride, F	1.0 mg/l	1.5 mg/l	Dental Fluorosis – yellow or brown patches on teeth, Crippling Fluorosis – weakening and bending of bones
Total Arsenic, As (Max)	0.01 mg/l	0.05 mg/l	Skin and nervous system Toxicity, Weight Loss
Lead, Pb (Max)	0.01 mg/l	No Relaxation	Mental Retardation, blood disorders, hypertension, hearing loss
Nitrate, NO ₃ (Max)	45 mg/l	100 mg/l	Blue baby disease in infants
Residual Chlorine	>1 mg/l in storage tank	0.5 to 0.2 mg/l in the tail end water connections or stand posts	Susceptible to water borne diseases
IS Standard – IS10500-2012 (https://law.resource.org/pub/in/bis/IS06/is.10500.2012.pdf)			

Learning outcome or Green Habit:

The students will understand the importance of pure drinking water for human beings and animals. They will develop the habit of not contaminating water bodies or groundwater by any means.

Water Quality Survey form / Questionnaire

1. नाव / Name: _____
2. पत्ता / Address: _____
3. वॉर्ड क्रमांक / Ward Number: _____
4. What is the main Water source? पाण्याचा मुख्य स्रोत कोणता?

5. What is the average frequency and duration of water supply in a week? आठवड्यातून किती वेळा आणि किती वेळ पाणी मिळते?

6. Is the storage tank different for drinking water and other usage? What is the tank capacity? पिण्याच्या पाण्याची आणि वापराच्या पाण्याची टाकी वेगवेगळी आहे का? साठवणूक क्षमता किती?

7. For how many days drinking water in the tank lasts? पिण्याचे पाणी किती दिवस पुरते?

8. Generally, how does water smell? पिण्याच्या पाण्याला वास असतो का?

9. Generally, does water have a different taste? पिण्याच्या पाण्याला वेगळी चव जाणवते का?

10. Generally, what does water look like? 1- Clear 2- turbid? पिण्याचे पाणी स्वच्छ दिसते का गढूळ?

11. At what frequency water quality of the main source is being tested? Which are the important parameters tested? पिण्याच्या पाण्याची गुणवत्ता कधी तपासली आहे का? कोणते घटक तपासले होते?

12. Measure the TDS (Total Dissolved Solids) of water being used for drinking using handy TDS meter. The digital TDS meter is like a pen. As per the instruction manual perform the test. पिण्याच्या पाण्यातील विद्राव्य क्षार तपासण्यासाठी पेनाच्या आकाराचे डिजिटल टीडीएस मीटरचा वापर करायचा. त्यासोबत आलेल्या पुस्तिकेतील सूचनांनुसार तपासण्या करायच्या.

Location of Sample / पाणी नमुना कुठून घेतला	TDS Result / निष्कर्ष	Potable or Non-potable पिण्यायोग्य आहे की नाही

13. Do students face diseases like jaundice, gastro, Diarrhea, Cholera? Please mention months as well. काँलरा, कावीळ, हगवण, जुलाब, अतिसार यातील कोणते आपल्याला झाले होते? हो असल्यास कोणत्या महिन्यात?

Disease/ आकाराचे नाव	Month / महिना

14. Do you observe any teeth problems on any of the students such as yellow to dark brown stains on them? Does the bending of leg or finger bones observe in old age people? मुलांच्या दातांवर पिवळसर किंवा गडद चॉकलेटी ठिपके दिसतात का? वयस्क व्यक्तींच्या पायांची हाडे किंवा पायाच्या बोटांची हाडे वाकडी झालेली आहेत का ?

15. Carry out the O.T. Test as per the steps given below in the instructions to know the dissolved Chlorine (Cl) in the drinking water sample. Please check at least five samples from different locations. पिण्याच्या पाण्यात विद्राव्य क्लोरीनची मात्रा किती आहे हे तपासण्यासाठी सोबत दिलेल्या सूचनांप्रमाणे ओ. टी. चांचणी घेण्यात यावी. किमान पाच वेगवेगळ्या ठिकाणचे नमुने तपासण्यात यावेत.

Location of Sample / पाणी नमुना कुठून घेतला	Result / निष्कर्ष

16. General Comments सर्वसाधारण अभिप्राय

3.2.11. Water Storage Structures

Level/ Class: Standard 7

Curriculum links:

Geography

Activity duration: 1 month

Materials needed:

Print out of Questionnaire

Small seed packets of various vegetables

Approach: Survey, Group Activity



Topic:

Water Management

Concept:

To make them understand the importance of water storage structures present or any traditional/monumental rainwater harvesting structure/s, kitchen gardening, composting

Aim:

- To make them aware about why water storage structures are needed.
- To make them aware about traditional/monumental rainwater harvesting structures.
- To imbibe the concept of kitchen gardening & composting.

Key Questions to address:

Are water structures maintained?

Preparation:

NA

Method/Guide:

1. For kitchen garden, the teacher will prepare a small piece of land within the school premises. The teacher will ensure water availability (waste) throughout the project period.
2. We receive water via rainfall during June to Oct. This needs to be stored on the ground or underground for beneficial use of living beings throughout the year.
3. Traditionally, water is stored in Tanks, Ponds, various water conservation structures over the ground like Check Dam/ Cement Nala Bund, Percolation Tank, K.T. Weir, Gabion Structure, Loose Boulder Structure etc.
4. It is also stored in the underground tanks to avoid evaporation.

5. Each group will carry out a small survey within their residential/School area and based on the type of water body present, they will write a short report giving their details.
6. The report will include Name of the structure present, Purpose, Year of construction, reported quantity of water stored, Usage of water, scenario during drought year, Present status - clean/ partially silted/ fully silted
7. The group of students shall prepare a compost pit at their house. Initially, they will put household level wet garbage like vegetable waste, stale food, dry fallen leaves, etc (as per the Local Body norms). Add little soil and earthworm culture. Go on putting such layers till the pit gets filled. Every day add little water just to keep it moist. Leave it for a month. After one-month, good quality manure can be taken out and after sieving can be used as a fertilizer.
8. In rural areas, mostly kitchen water or bathroom water goes out of the house and creates problems. To overcome these, students will be asked to prepare a kitchen garden at their home. If space is not available at home, then this can be developed in the School premises. They can grow vegetables like tomatoes, brinjal, Colocasia leaves, beans etc. By this, the students will get nutritious vegetables and their family will also get small income.

FAQs

Q - What is silting?

A - During rainy season the runoff water carries silt load and deposits it into the tanks/ponds. This is known as silting of tanks/ponds.

Q - What is kitchen garden?

A- In rural areas, kitchen/bathroom wastewater is used to grow vegetables within house premises.

Q -Why kitchen garden is useful?

A- Kitchen/bathroom wastewater is properly & locally managed and nutritional fresh vegetables are also made available to the family. In some cases, it generates little income at family level.



Additional Resources:

Shivkalin Water Storage Structures: https://youtu.be/UUqMoy_1Qnk

Survey Form for listing various Water Storage Structure/ Traditional / Monumental Rainwater Harvesting Structures

1. Name of the Student/s - _____ Group No: _____
2. Address: _____
3. Village / Ward No./Locality: _____
4. Name of the Water Storage Structure observed: Please put \checkmark mark In Front of the structure
 - a. Gaon Talon (Village Tank)
 - b. Pond
 - c. Minor/Medium/Major Irrigation Dam
 - d. Check Dam/Cement Nala Bund
 - e. Earthen Nala Bund
 - f. Percolation Tank
 - g. Gabion Structure
 - h. K.T. Weir
 - i. Doha
 - j. Other – Please write names.
5. Name of the Traditional/ Monumental Rainwater Harvesting Structure observed: Please put \checkmark mark In Front of the structure.
 - a. Rainwater storage underground tank
 - b. Step or any other type old well
 - c. Rainwater recharge structure
 - d. Any other – please write name
6. Presently the structure is in use: Yes / No
7. If yes for what purpose: _____
8. Is it silted? Yes/ No
9. If Yes then – Fully or Partially
10. Whether de-silting is possible? Yes / No
11. The Traditional or Monumental structure is operational. Yes/No
12. If Yes then for what purpose its water is used? _____

3.2.12. Water Quality Testing (Project)

Level/ Class: Seven

Curriculum links:

Resources and preparations needed:

- # TDS Meter
- # Chloroscope with test tubes & Ortho Tolodine (O.T.) Solution
- # Distilled water
- # Water samples

The teacher will make groups based on the number of students. Teacher will arrange TDS meter and Chloroscope.

Project timing:

Every month for both Residual Chlorine and TDS in a year.

Project plan and schedule:

The project needs to be initiated every month. During the rainy season, the frequency of monitoring the residual chlorine can be increased to once in a week and can be increased to daily based on the requirement. The TDS measurement can be carried out along with residual Chlorine.

Topic:

Measure the residual chlorine and total dissolved solids (TDS) of school/home drinking water

Project Concept:

Water quality is most important for human health. Each day, nearly 1,000¹ children die in the World due to contaminated water and poor sanitation, which are linked to transmission of diseases like cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio. Globally, 1.8 billion people use a source of drinking water that is fecally contaminated. SGG 6 is Clean Water and Sanitation. One of the Goal 6 targets is “by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”. In search of clean drinking water many essential minerals are removed from water by R.O. Hence measurement of Residual Chlorine & TDS is of utmost importance for knowing the risks of contamination.

Objectives:

- **Learning objectives-** To know how to measure the Residual Chlorine and TDS
- **Action objectives-** Chlorine is the most powerful disinfectant used worldwide. Every user of water i.e., the community must know how to prevent bacterial contamination. The drinking water must have minerals in dissolved form which develops immunity, and its presence can be measured using TDS. The user of water must know what quality water they are drinking. To imbibe this, student from their childhood should know how to measure the TDS and residual chlorine.

SOPs and background preparations:

In Maharashtra the important flagship program being implemented by GoM through Water and Sanitation Dept is Jal Jeevan Mission. Under this program, water quality of all the drinking water sources is being regularly monitored. It is the responsibility of the Grampanchayt (GP) to take appropriate decisions if the source is quality affected.




¹ <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-6-clean-water-and-sanitation/targets.html>

Each GP has been given the water quality testing kit. However, it is not being commonly used due to lack of awareness.

The Residual Chlorine is tested using the Chloroscope and TDS is measured using TDS meter. Both instruments give immediate results.

Project Steps:

The expected steps and duration for each step is given below. The students can test various water samples.

Steps	Location	Duration
<ul style="list-style-type: none"> Residual Chlorine Use the Chloroscope for measurement of Residual Chlorine. Clean the test tubes with distilled water before use. Take a sample of chlorinated water supplied to the school in the test tube. Fill it up to its 3/4th portion. Add one to two drops of O.T. solution in the test tube and shake it carefully. 	School	30 minutes 
<ul style="list-style-type: none"> If the colour of water changes and becomes yellowish, this means residual chlorine is present in the drinking water. Put the test tube in the Chloroscope as shown in the picture below. Compare the colour of water in the test tube with colour discs in the Chloroscope. Please check which colour disc matches with the colour of the test tube water. Note down the figure shown on the disc. This value is nothing but the quantity of residual chlorine present in the drinking water. If this value is more than 0.2 ppm this means the chlorination has been properly carried out in the storage tank. If there is no change in the colour after adding O.T. solution, this means the O.T. test is negative. This indicates that there is no residual chlorine in the drinking water. This means chlorination has not been properly carried out and the water is not properly disinfected. This can cause water borne diseases. 	School	# 30 minutes  

Steps	Location	Duration
<ul style="list-style-type: none"> ● Total Dissolved Solids (TDS) ● Use TDS meter to measure TDS. ● Press the On/Off button of the TDS meter. 0 ppm will be displayed on the digital display screen. This means the meter is ready to take readings. ● At the bottom of the TDS meter a small cap cum cup is attached, which also act as cover for the electrodes. Remove that cap & the electrodes can be seen. ● Take a 50 ml of beaker. Fill it up to half with the water sample. ● Dip the TDS meter in the beaker and note down the reading. Measure the TDS of all the sources existing within the school or near the residence of the students. ● Note down the readings month wise and try to plot the graph of TDS vs Moths. This will give the idea how the TDS behave from post-monsoon to pre-monsoon. ● If field measurements are to be taken, then use the cap for taking the sample. ● Fill the cap up to half to 2/3 with the water sample and dip the TDS meter in it. ● Immediately reading will appear on the screen. This is the TDS of the water in mg/l. Carefully note down the reading. ● If the TDS is more than three digits i.e., 1000 or more then, then on the right side of the reading with 100 x 101 will appear. This has to be read accordingly. ● As per the IS Standard – IS10500-2012 (https://law.resource.org/pub/in/bis/IS10500-2012.pdf) if the values are up to 500 mg/l means it is within the acceptable limit and if it is between 500 to 2000 then it is within the permissible limit in the absence of alternate source (desirable limit). If it is within the desirable limit means it is potable or non-potable. 	School	30 mins

FAQs

Q - What is the name of the instrument used to measure residual chlorine?

A - Chloroscope

Q - What is the common name of the test?

A- O.T. Test

Q -What is the full form of the O.T. Test?

A- Ortho Tolodine Test.

Q - After adding O.T. solution if the colour does not change, then what should we do?

A- If yellow colour doesn't appear in water, that means the chlorination has not been properly carried out in the storage tank. Immediately add bleaching powder into the storage tank as per the norms.



Q - What is the standard norm for chlorination?

A- 5 gm bleaching powder for 1000 litres.

Q - During an epidemic, how many times the O.T. should a test should be carried out?

A- At least 5 to 6 samples should be taken from different parts of the village/area.

Q - Which instrument is used for measuring total dissolved solids?

A- TDS meter.

Q - What is the range TDS for potable water?

A- It should be between 200 to 500 ppm.

Q - Is R.O advisable for TDS up to 500 ppm?

A- No

Q - If TDS is more than 2000 ppm then what should be done?

A- Use R.O. with proper sized membrane which will bring the TDS around 500 ppm.

Learning outcome or Green Habit:

The students will learn how to measure the total dissolved solids in water and whether it is potable or not. They will assist the staff of the Grampanchayat or Urban Local Body in monitoring the residual chlorine and TDS.

3.2.13. What causes Water Pollution?

Level/ Class: Standard 8

Curriculum links:

Geography, Science

Activity duration: 1 Week

Materials needed:

Print out of Questionnaire

Approach: Survey, Group Activity

Topic:

Water Management

Concept:

To make them aware about any addition to water that damages the water quality, making water undrinkable and dangerous for organisms to live in is called water pollution.

Aim:

- To make them aware factors which cause water pollution.
- Any actions done by us which cause pollution?
- To find out various ways out to deal with it.

Key Questions to address:

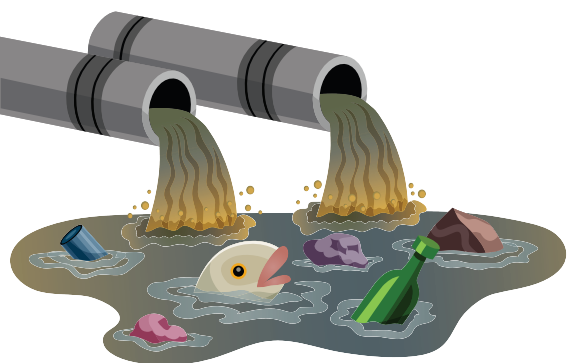
- What is Water Quality?
- What are the types of diseases spread due to poor quality of water?

Preparation:

NA

Method/Guide:

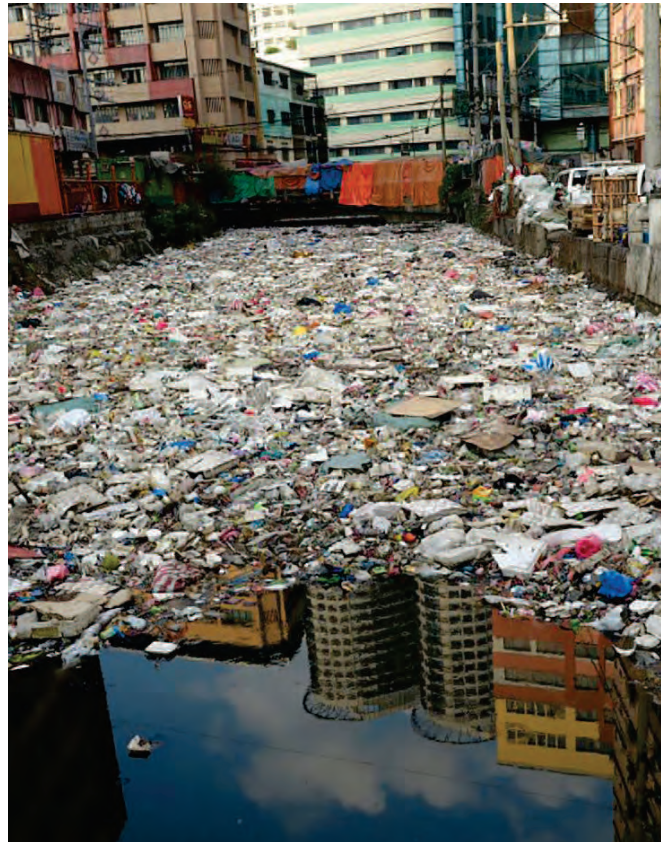
1. Any addition to water that damages the water quality, making the water undrinkable and dangerous for organisms to live in is called water pollution.
2. Water can be contaminated through various ways. Main type of pollutants are – Organic and Chemical.
3. Organic Pollutants are:
 - A. Faecal Contamination due to Open Defecation
 - B. Direct dumping of untreated Domestic Sewage into water sources
 - C. Corroded piping allowing bacterial growth in pipes
 - D. Ways to treat can be Boiling or Chlorination
 - i. Ill Effects: E. Coli bacterial infection causes Diarrhoea, Gastro



4. Chemical Pollutants are:

- A. Discharge of industrial effluents
- B. Leaching of pollutants from Waste dumping sites
- C. Runoff of insecticides and fertilizer applied to the land leaching into groundwater or entering into a surface water source
- D. It is difficult to treat, and requires technical processes.
- E. Ill Effects: Harmful to all animals, plants, fishes, increase in algae plants which reduces water's oxygen supply, cancer

- 5. Discuss all these points with children and ask them have you observed or read about it in the newspaper?
- 6. Tell them we will do a similar type of survey in our area.
- 7. Divide the students in groups of four and allocate areas near school and ask them to fill the questionnaire below:



Learning outcome or Green Habit:

The students will know which objects cause water pollution. They will consciously practice and promote reusable things so as to reduce pollution.

Questionnaire:

1) Is there anything unwanted floating on the surface? How dirty are the banks?

2) Do people dump garbage around water?

3) Do they bathe or wash clothes there?

4) Do you observe any open defecation?

5) Do they bathe their livestock there?

6) Do they wash trucks or tractors there?

7) Are there factories around water? Where does waste from the factories go?

8) Where does the sewage from the nearby houses go?

9) List 10 unwanted materials/pollutants you find in and around the water body.

10) Who is responsible for the pollution?

11) What else do you observe?

12) What can we do to reduce the pollution?

3.2.14. Rate of Evaporation

Level/ Class: Standard 8

Curriculum links:

Science

Activity duration: 90 min/week
for at least four weeks (one each
in May, Aug, Oct, Dec)

Materials needed:

Good quality Plastic Tub/
tray of 2 to 3 litre capacity,
Measuring Cylinder, Water

Approach: Classroom

Topic:

Water Management

Concept:

To understand the process of evaporation and how to measure it.

Aim:

- To understand that Evaporation is a process by which water changes from a liquid to a gas or vapor.
- The process to measure rate of evaporation.
- Compare the rate of evaporation in morning and evening.

Key Questions to address:

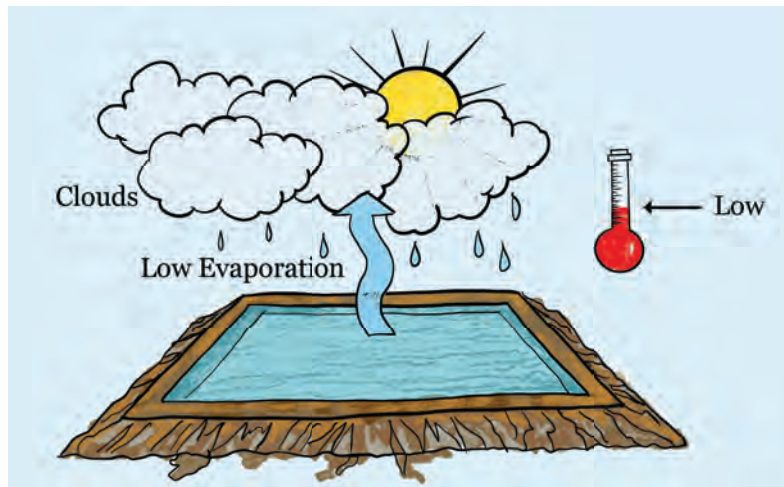
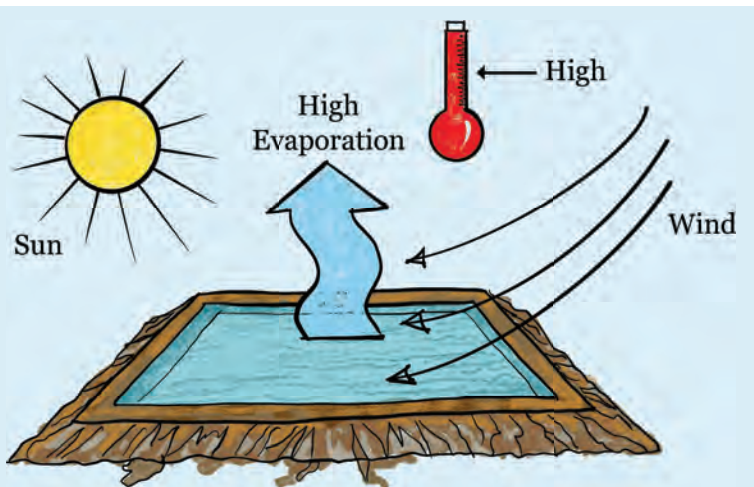
Why is it important to measure rate of evaporation?

Preparation:

NA

Method/Guide:

1. Teacher will discuss the process of evaporation. Evaporation is a process by which water changes from a liquid state to gas or vapour state.
2. Ask the students when the rate of evaporation will be higher in day or at evening.
3. Take a plastic tub and fill it with water. Put a mark of the water level using water proof ink on the tub.
4. Measure the amount of water present in the tub and note it in the notebook.
5. Keep the tub in the direct sunlight in the morning. Avoid keeping it below a tree or building or any other object etc.
6. After 2 hours, measure the amount of water in tub.
7. Is it equal to the water filled in the tub in the morning?
8. Repeat the same procedure while leaving the school.



9. Measure the water level and note down the reading.
10. Ask the students to measure the water level in the tub next morning at the same time.
11. Compare the three readings and repeat the same procedure for 3 days.
12. Take average of all the readings after 2 hours, after 5 hours and overnight readings.
13. What is the rate of evaporation?
14. Discuss whether change in season can affect the rate of evaporation.
15. In which season it will be high?
16. Does evaporation happen during rainy season? Based on the actual measurement the students should satisfy themselves.

FAQs

Q - Why it is important to measure evaporation?

A - To know how much we receive through rainfall and how much we lose through evaporation.

Q - What is the name of the instrument?

A- Evaporimeter.

Q - Does evaporation take place during rainfall?

A- Yes. E.g. our clothes dry up during rainy season.



Learning outcome or Green Habit:

The students can compare the actual received rainfall and evaporated water. This will trigger them to hide water below the ground to avoid evaporation. This will help in saving water.

3.2.15. Water leakages

Level/ Class: Standard 8

Curriculum links:

Geography

Activity duration: 1 week

Materials needed:

Print out of Questionnaire

Approach: Survey, Group Activity

Topic:

Water Management

Concept:

To make them understand, Water losses are the main problem area in water distribution as well as water usage.

Aim:

To make them aware about the responsibility while handling water and take action accordingly.

Key Questions to address:

What is Water Loss?

Preparation:

Questionnaire

Method/Guide:

1. Water leakage is one of the important reasons for water loss and it's everybody's responsibility to take action on it.
2. Whenever we see any tap open or any leakage, we should fix it immediately at our home, school or any public space.
3. Take a school visit and make students understand the Water Distribution System of school.
4. Now divide the students in the group of four and they will do the audit of the Water Distribution System, each and every tap of school for water leakage.
5. Group will measure the rate of leakage if any and demonstrate in front of the class, how much water will be lost if they don't fix the leakage.
6. We buy 1 litre bottle of water at 20/-. How much is financial loss when we don't fix the leakage?
7. Each student will perform a similar audit for her/his house and present in front of the family members as well as class.





Questionnaire:

School Water Leakage Audit

1. नाव / Name: _____
2. पत्ता / Address: _____

3. वॉर्ड क्रमांक / Ward Number: _____
4. विद्यार्थीसंख्या / Number of Students: _____
5. शिक्षकेतर कर्मचारी संख्या / Staff: _____
6. शाळा माध्यमिक आहे का प्राथमिक? / School Type:

7. शाळेसाठी पाण्याचा मुख्य स्रोत कोणता? Main Water source:

8. आठवड्यातून किती वेळा आणि किती वेळ पाणी मिळते? What is the frequency and duration of water supply?

9. साठवणुकीसाठी पाण्याच्या किती टाक्या किंवा हॉद आहेत? Number of tanks in the school:

10. पाण्याच्या टाक्या किंवा हॉदाची साठवणूक क्षमता किती आहे? Capacity of tanks:

11. टाकी किंवा हॉदात साठविलेले पाणी किती दिवस पुरते? For How many days water in the tanks is sufficient?

12. पिण्याच्या पाण्याची आणि वापराच्या पाण्याची टाकी वेगवेगळी आहे का? साठवणूक क्षमता किती? Are there different tanks for drinking water and usable water? What is the tank capacity?

13. शाळेत पाणी गळती आहे का? असल्यास ताशी किती पाणी वाया जाते? Does main water source have any leakages? If yes, how many litres per hour?

Serial Number	Location of leakage	Rate of leakage in litre per hour	Daily Loss in litre per day	Yearly loss in litres	Yearly loss in Rupees
1	Kitchen Tap	2	48	$48 \times 365 = 17,520$	$17,520 \times 20 = 3,50,400/-$
			Total Loss=	Sum of all Yearly Losses	Sum of all Yearly losses in Rupees

- Rate of leakage= Water collected in bottle or bucket in one hour from leaked tap / connection in litre / hour
- Yearly Loss = Rate of leakage X 365 X 24
- Yearly Loss in Rupees = Yearly Loss X 20/-

Learning outcome or Green Habit:

The students will come to know how to measure & stop the water leakages. They will help the school or the local administration in identifying the leakages so as to get it repaired without wasting much water.

3.2.16. School Water Safety and Security Plan (Project)

Level/ Class: Eight

Curriculum links:

Project timing:

During Diwali vacations

Project plan and schedule:

The project needs to be initiated during Diwali vacations. It is simply a compilation of various activities conducted by the students of various standards till that time.

Topic:

Preparation of school water safety and security plan

Project Concept:

Since water is the most important resource, it is necessary to know the annual availability and use. For water, it is must to know the quantity and quality at any point of time. The sustainability of both quantity and quality can be addressed through the Water safety and security planning. It has to be prepared for the local self-government i.e., for the Gram panchayat or village or school, provided independent water supply system is available for them.

The potable drinking water quality, sustainable availability and supply of drinking water throughout the year and year after year are the basic components of water safety and security plan.

Objectives:

- **Learning objectives:** To understand the process of preparation of school water safety and security plan.
- **Action objectives:** Water Safety and Security Plan is the crux of any flagship program for water supply at institution level. This will give a long vision & build confidence in the students about the importance of water quantity and quality. It will help them to participate in the process of preparation of village or GP level water safety and security plan. Though the plan uses the word security, in practical sense it is the sustainability of the water resource, which will be imbibed in the minds of the students and community as well.

Resources and preparations needed

If the school has independent domestic water supply system, then the water safety and security plan has to be prepared for it. If the school is receiving water supply from the GP/Village level water supply system, then the plan has to be prepared for the GP/Village. Accordingly, permissions need to be taken from the appropriate authorities. Community should be necessarily involved in its preparation.

Various types of surveys/ traverses are to be carried out, which will require printing of appropriate questionnaire, format template etc. The school /GP staff will help them in carrying out various tests and making available the instruments required. Else, if the readings are being taken regularly, then at GP or village level the same may please be made available to the students while preparing the plan.

If it has to be prepared for a society or a ward, then the parents should make available the relevant support from their officials.

SOPs and background preparations:

Jal Jeevan Mission envisages mandatory preparation of Village/ GP level Water Safety and Security Plans for each village for domestic water supply. The basic prerequisites like figures of rainfall measurement, water quality monitoring, school water leakage audit, water availability in the source etc will be captured through various survey formats & templates in different standards. The same should be used in drafting the water safety and security plan.

Project Steps:

Step	Location	Duration
<ul style="list-style-type: none"> • <i>Introductory activity – Collection of rainfall data, various survey reports like water quality, school water leakage etc</i> • <i>If the school has its own water supply system, then try to collect the details of one-time investment cost on the source development and water infrastructures created within the school.</i> 	<i>School</i>	<i>30 minutes</i>
<ul style="list-style-type: none"> • <i>Based on the water audit survey forms assess the annual water availability.</i> • <i>Assess or estimate water used for various purposes like drinking, toilet, gardening, washing, cleaning, laboratory use, etc.</i> • <i>If there is shortage of water supply from the source then for how many days the water is being purchased and assess the expenditure incurred on it.</i> 	<i>School</i>	<i>30 minutes</i>
<ul style="list-style-type: none"> • <i>Calculate the annual recurring expenditure by adding annual water cess paid (if source is not owned by school), electricity charges, annual operation and maintenance cost, maintaining water quality (RO or Purifier), cost incurred for purchase of water etc.</i> 	<i>School</i>	<i>30 minutes</i>
<ul style="list-style-type: none"> • <i>Based on the water quality survey forms the assess the sustainability of quality of water supplied throughout the year.</i> • <i>Fill the format based on the data available.</i> • <i>Based on the School water safety and security format draw the conclusions and recommendations.</i> • <i>Submit it to the school authorities for appropriate action.</i> 	<i>School</i>	<i>60 minutes</i>

<i>School water safety and security format</i>			
<i>Name of the Student/s:í</i>			
<i>Name of the School:</i>			
<i>Water Quantity</i>			
<i>Annual Water Available</i>	<i>In M3</i> <i>(1 M3 = 1000 litres)</i>	<i>Annual Water Used</i>	<i>In M3</i>
<i>From school owned source</i>		<i>Drinking</i>	
<i>Water purchased/ borrowed due to shortage from source</i>		<i>Cooking & Washing</i>	
		<i>Toilets</i>	
		<i>Gardening</i>	
		<i>Cleaning</i>	
		<i>Laboratory use</i>	
		<i>Any other use</i>	
<i>Total water available (A)</i>		<i>Total Water Used (B)</i>	
<i>Deficit or surplus (A-B)</i>		<i>If surplus then there is no need for any measures.</i>	
<p><i>Note: If deficit then the source strengthening measures need to be proposed. Consult or take the support of water management related department to overcome this. If the source is groundwater based then artificial recharge structures like percolation tank, check dam, earthen nala bund, etc can be taken up.</i></p>			
<p><i>Water Quality:</i></p> <ul style="list-style-type: none"> ● <i>Is water tested for chemical parameters & bacterial parameters: Yes/ No</i> ● <i>Is water potable: Yes/No</i> ● <i>If not potable, then what are the remedial measure as suggested by the competent authority.</i> ● <i>R.O. or De-fluoridation or water softener etc-----</i> ● <i>If storage tank is available, then what is the Residual Chlorine level in it? ---- ppm</i> ● <i>What is the minimum Residual Chlorine value from different points? ----- to ----- ppm</i> ● <i>If the value is less than 0.2 ppm then immediately check the chlorination method. If it is bleaching powder check whether it is properly stored as per norms? i.e. in the big plastic bucket with gunny bag. Get the chlorination level tested from the laboratory and take appropriate corrective measures.</i> 			

O & M

Are there any leakages in the rising main (pipeline which brings water from source to storage tank)?
Yes/ No

If yes, then please try to estimate the quantity of water getting wasted by using a simple method of actual measurement. Take a plastic jar of known capacity. Put below the leaking point. Measure the time required to fill the jar. Based on that calculate the quantity getting leaked. ----- litres/day

Estimate the leakages in the distribution system as given in the School Water Audit Report.
----- litres/day.

Total water leakage = (2) + (3) = ----- litres

Cost of water getting wasted = (4) * ----- Rs/lit = -----

Discuss this cost with the school administration and request them to reduce as much as possible.

Expenditure Incurred for purchase of Water in Rs	Recurring Expenditure in Rs	Expenditure incurred for Water Quality Maintenance in Rs	Total Annual Expenditure in Rs.
Funds Allocated by School annually in Rs (C)			
Annual Expenditure in Rs (D)			
Deficit or surplus			
(C-D)			

FAQs

Q - Why is it called as water safety and security plan?

A - As it includes sustainability of water quality and quantity related aspects.

Q - What is the unit of its preparation?

A- Any institution having independent water supply scheme.

Q -Does it include Operation & Maintenance aspects?

A- Yes.

Learning outcome or Green Habit:

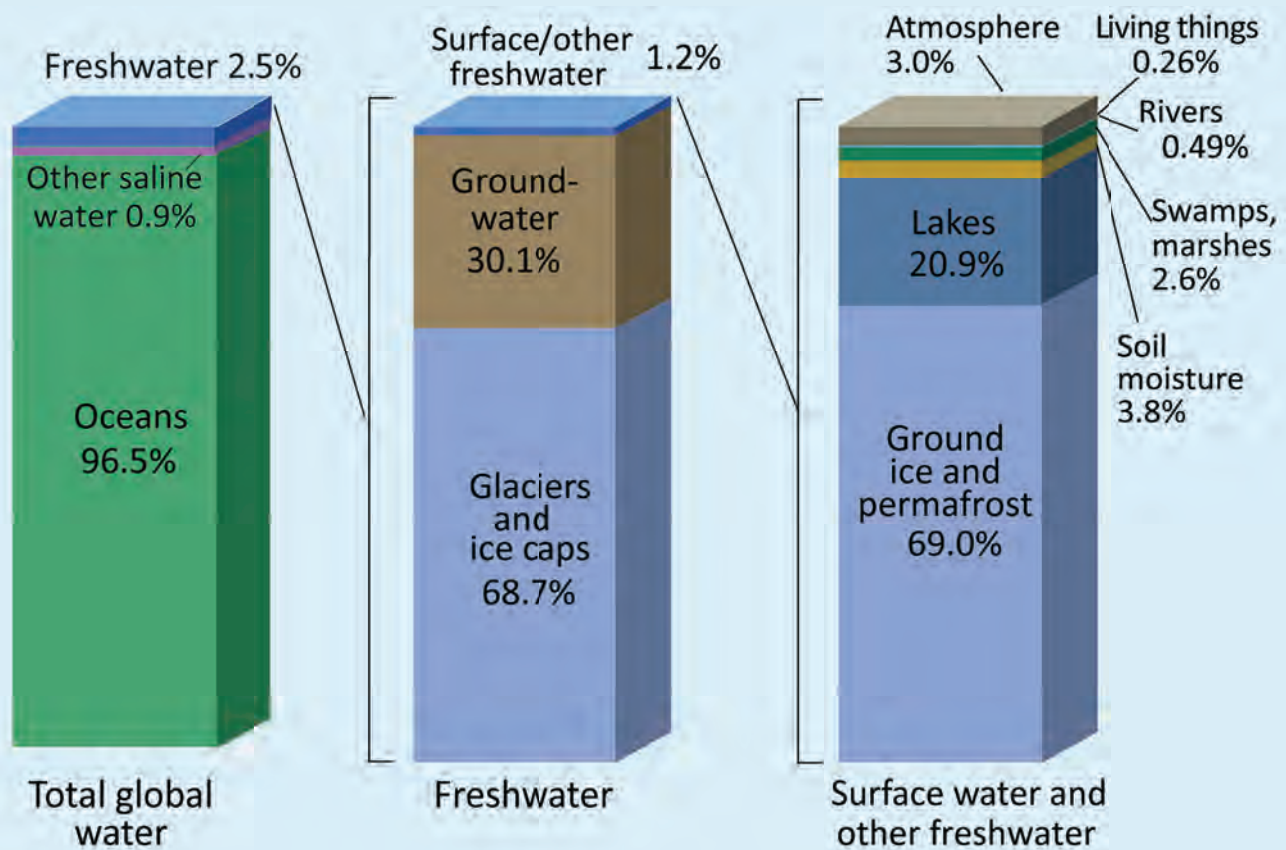
The students will learn the process of preparing the water safety and security plan. They can become Jaldoot for the local self government in implementing the flagship programs.

CRAZY FACTS OF WATER

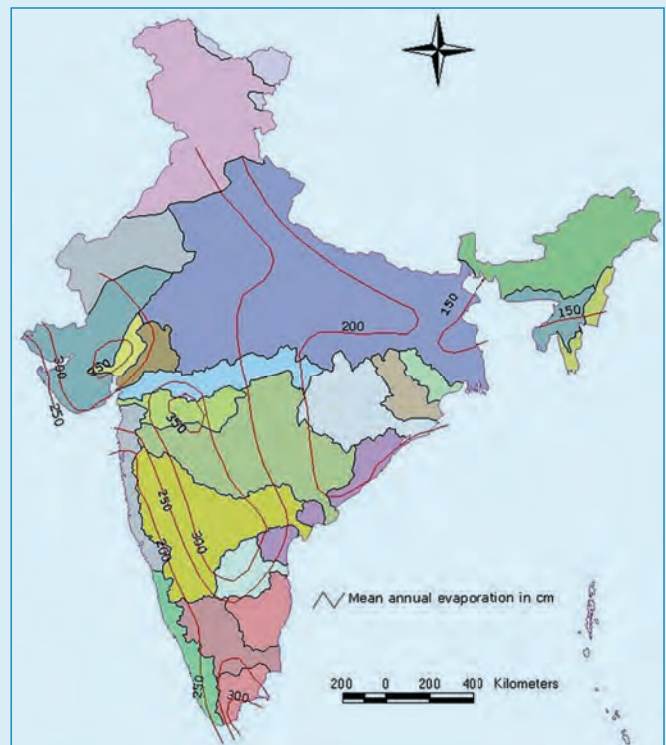
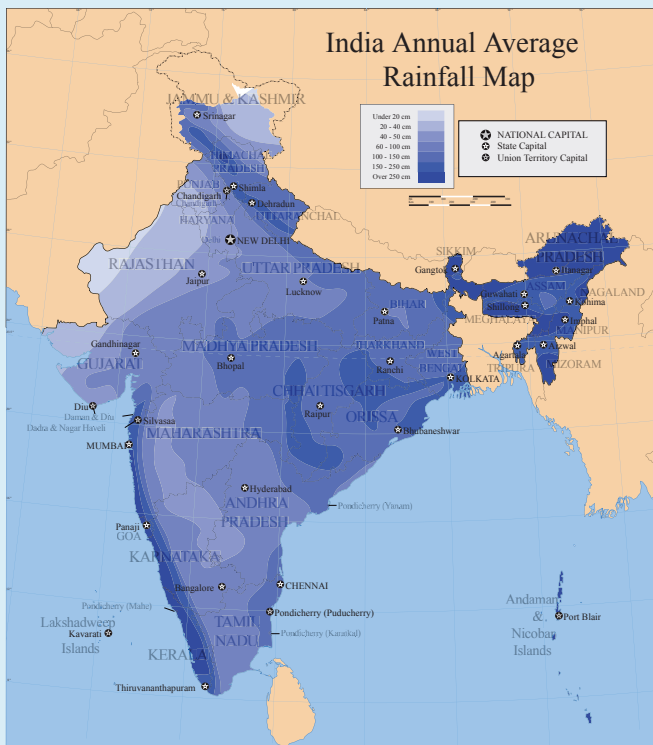
1. About 70% of Human Adult body contains Water.
2. 70% of the human brain is water.
3. Out of total fresh water on the earth 68.7% is trapped in glaciers, 30.1% in groundwater & only 0.26% in lakes.
4. Nearly 97% of the world's water is saline or otherwise undrinkable.

Water Source	Water volume in Cubic Km	Percent of Fresh Water	Percent of total Water
Oceans, seas & bays	1,338,000,000	--	96.54
Ice caps, glaciers & permanent snow	24,064,000	68.7	1.74
Groundwater	23,400,000	30.1	1.69
Soil Moisture	16,500	0.05	0.001
Ground ice & permafrost	300,000	0.86	0.022
Lakes	176,400	0.26	0.007
Atmosphere	12,900	0.04	0.001
Swamp Water	11,470	0.03	0.0008
Rivers	2,120	0.006	0.0002
Biological Water	1,120	0.003	0.0001

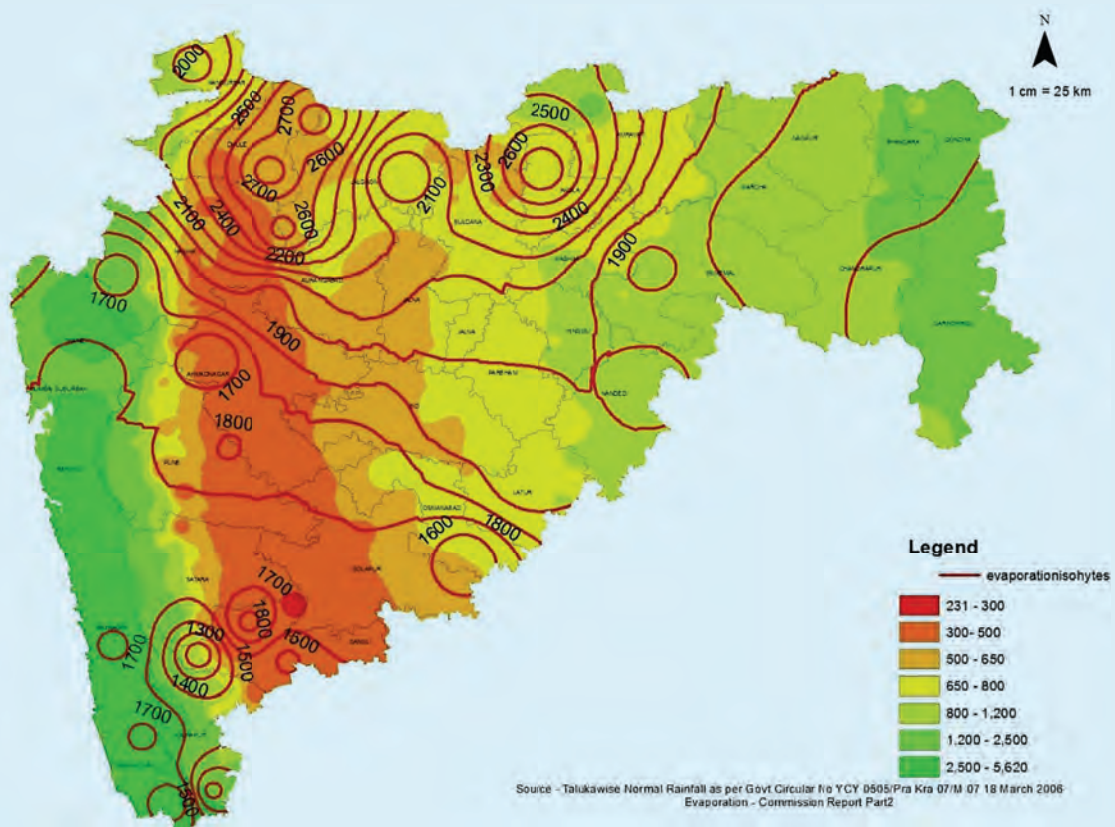
Source: https://www.usgs.gov/special-topic/water-science-school/science/how-much-water-there-earth?qt-science_center_objects=0#qt-science_center_objects



5. Frozen water is 9% lighter than water, which explains why ice floats.
6. On average, women in Africa and Asia have to walk 3.7 miles to collect water.
7. 80% of all illness in the developing world comes from water borne diseases.
8. Groundwater irrigation has been expanding at a very rapid pace in India since 1970s and now accounts for over 60 percent of the total area irrigated in the country.
9. About 85% of the rural drinking water supply is also met from ground water sources in India. (<http://cgwb.gov.in/AQM/NAQUIM.html#:~:text=Groundwater%20is%20an%20important%20natural,area%20irrigated%20in%20the%20country.>)
10. Rainfall and Evaporation Map of India & Maharashtra.



Source: https://commons.wikimedia.org/wiki/File:India_annual_rainfall_map_en.svg

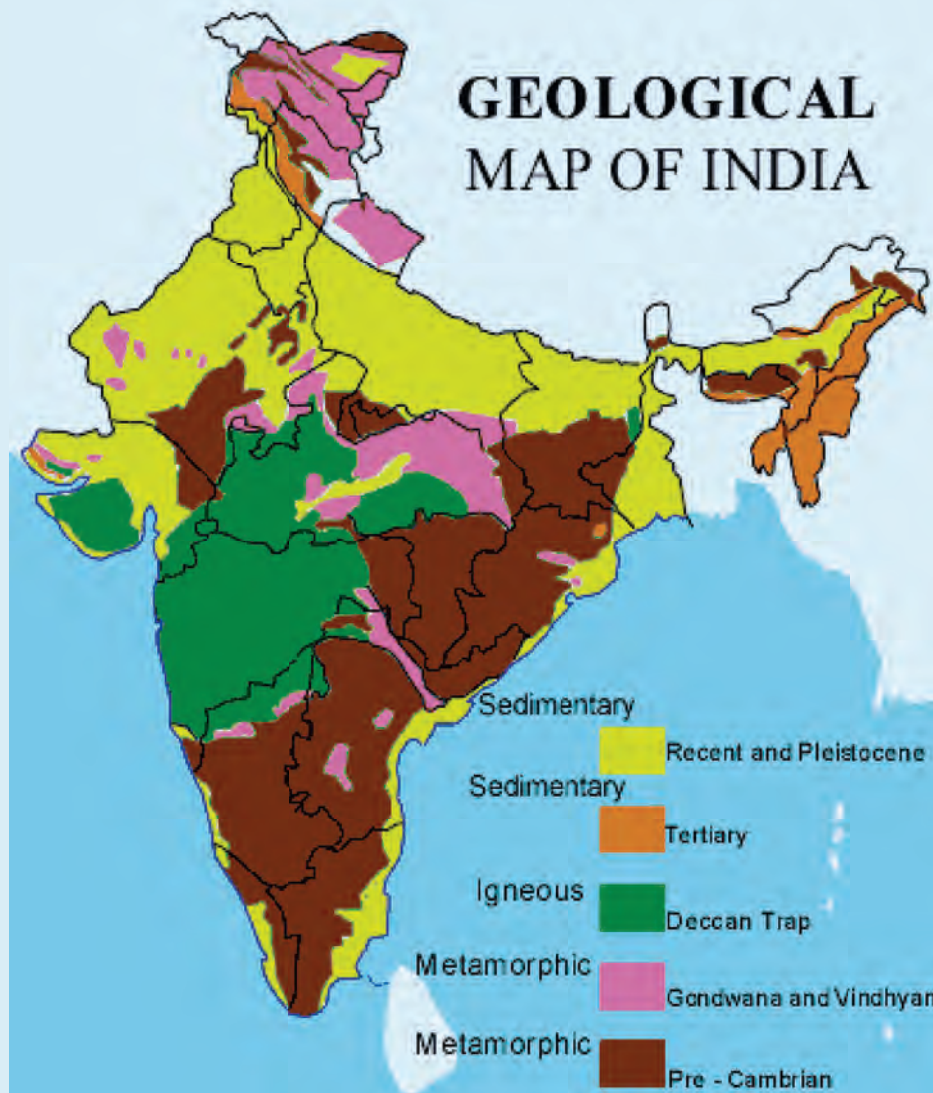


Source: Groundwater Surveys and Development Agency, Pune

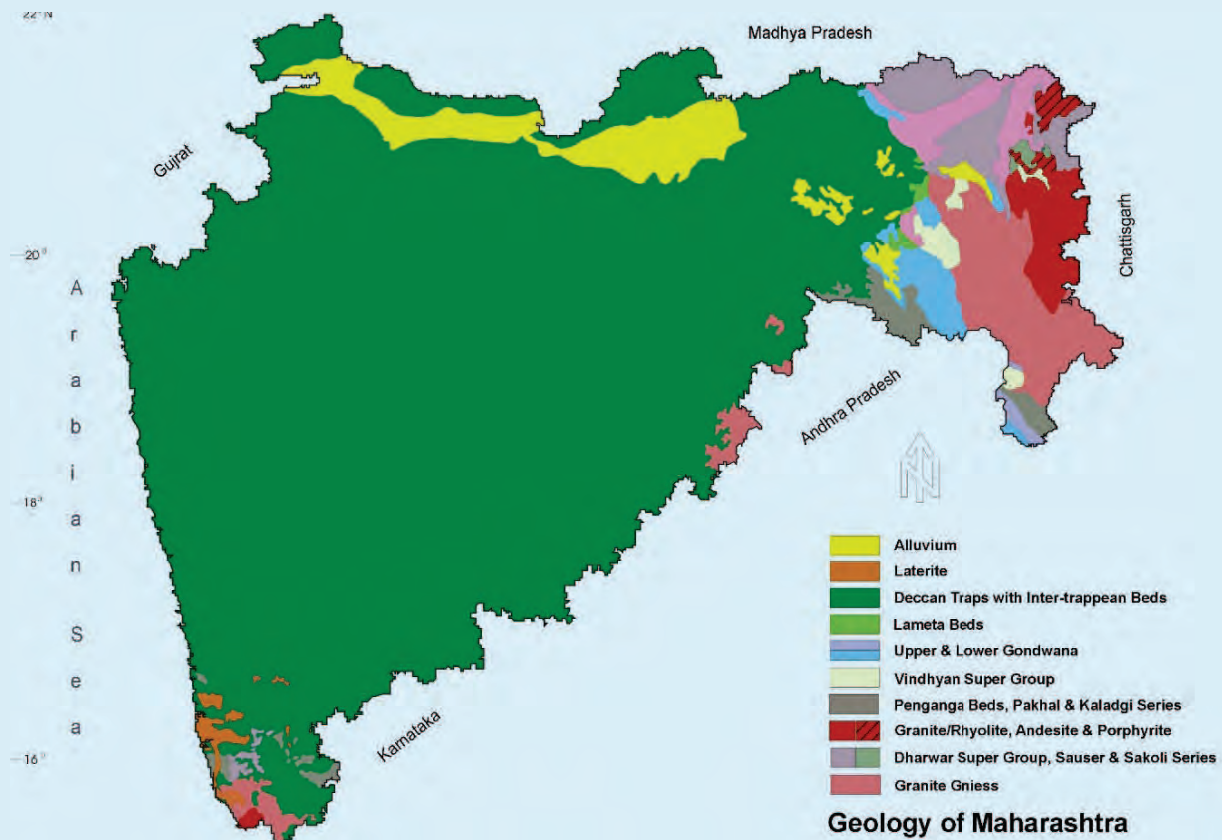
11. Water Consumption of what we eat:

Name	Water in Litres
1 Kg of Wheat	1500
1 Kg of Rice	2500
1 Kg of Sugar	2515
1 Litre of Milk	625
1 Page of Book	2 Glass

12. Map showing Geology of India and Maharashtra.



Source: Geological Survey of India & Limaye, Shrikant. (2011). Importance of Percolation Tanks for Water Conservation for Sustainable Development of Ground Water in Hard-Rock Aquifers in India. 10.5772/30568.



Source: Geological Survey and India & Groundwater Surveys and Development Agency, Pune

13. Water holding capacity of various rock types occurring in Maharashtra

Type and Important Name of rock	Water holding capacity in %
Igneous rock – Basalt/ Granite	Up to 4% of total volume of rock
Sedimentary rocks – Sandstone/ Limestone	8 to 10% of total volume of rock
Sedimentary rocks – Alluvium or loose sand	10 to 20% of total volume of rock
Metamorphic rocks – Marble/ Gneiss	Up to 2% of total volume of rock

14. The Dead Sea is a Salt Lake bordered by Jordan to the east and Israel and the West Bank to the west. It lies in the Jordan Rift Valley, and its main tributary is the Jordan River. The saline water has a high density that keeps bathers buoyant. The lake's extreme salinity excludes all forms of life except bacteria. Fish carried in by the Jordan or by smaller streams when in flood die quickly.

SAVE OUR WATER



Take a shower of 5 minutes or less



Install a water-saving toilet flush system



Turn off water when brushing teeth



Turn off the tap while washing dishes/clothes



Close tap properly and fix leaking taps and pipes



FACTS AND FIGURES

76 million people in india do not have access to safe drinking water

54% of India faces high to extremely high water stress

ADDITIONAL RESOURCES

- # *Water cycle for kids by USGS*
https://www.usgs.gov/special-topic/water-science-school/science/water-cycle-schools-and-kids?qt-science_center_objects=0#qt-science_center_objects
- *Toys from Trash*
<https://www.arvindguptatoys.com/air-and-water.php>
- *Book: Our Water Resources*
<http://arvindguptatoys.com/arvindgupta/water-resources-rama.pdf>
- *Book: Simple Water Experiments*
<http://arvindguptatoys.com/arvindgupta/water-paddle-boats.pdf>
- *Book: Water, Stones, Fossils and Bones*
<http://arvindguptatoys.com/arvindgupta/cesi-1.pdf>
- *Book: Experimenting with Water*
<http://arvindguptatoys.com/arvindgupta/water-dover.pdf>
- *Book: Children and Water*
<http://arvindguptatoys.com/arvindgupta/childandwater.pdf>
- *Creative Lesson Plans on Water*
<https://archive.org/details/CreativeLessonPlansOnWater-Drcsc/page/n9/mode/2up>
- *Book: Our Water Our Life*
<http://arvindguptatoys.com/arvindgupta/vp-water.pdf>
- *Book: SODIS*
<http://arvindguptatoys.com/arvindgupta/sodis.pdf>
https://www.sodis.ch/methode/index_EN.html
- *Book: Water, Water*
<http://arvindguptatoys.com/arvindgupta/water-eng.pdf>
- *UNICEF: Flood Hygiene Promotion*
<http://bvsper.paho.org/share/ETRAS/AyS/texcom/desastres/washpflo.pdf>
<http://bvsper.paho.org/share/ETRAS/AyS/texcom/desastres/waswrflo.pdf>
- *Book: Ground Water Project*
<https://gw-project.org/books/wally-and-deannas-groundwater-adventure-to-the-saturated-zone/>
- *Maps: Iso-hyetal & Iso-evaporation Map of India*
https://commons.wikimedia.org/wiki/File:India_annual_rainfall_map_en.svg
http://117.252.14.242/rbis/india_information/evaporation.htm (National Institute of Hydrology)
- *Maps: Iso-hyetal & Iso-evaporation Map of Maharashtra*
Groundwater Surveys and Development Agency, Pune
- *Bio indicators*
<https://upsbdb.org/pdf/Souvenir2010/8.pdf>

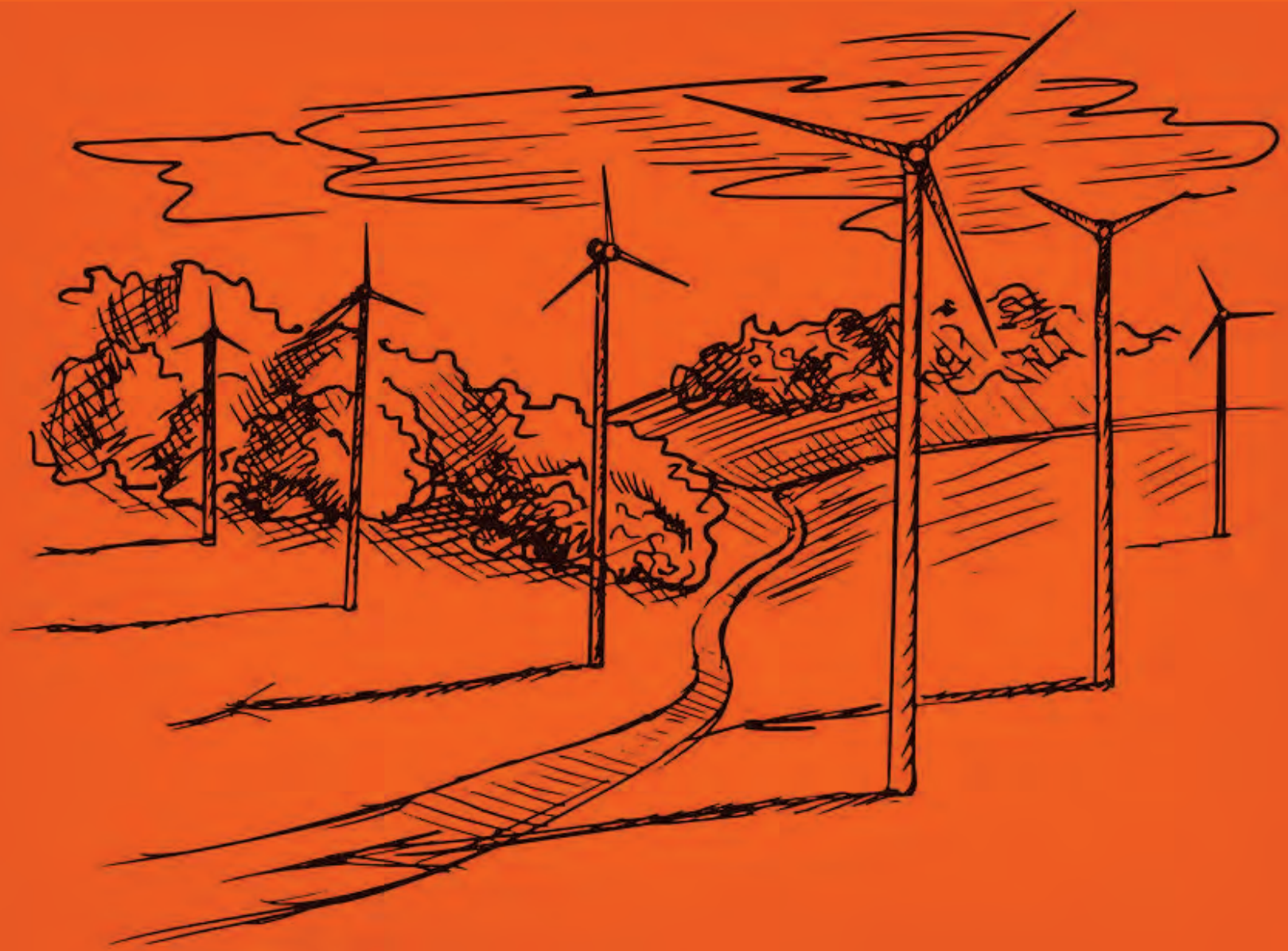
MSCERT CURRICULUM ANALYSIS FOR WATER

SN	Topics and subtopics	Presence in syllabus (mention std, sub)	Presence in textbooks (mention std, sub)	Comment on adequacy of treatment, gaps, biases etc.
1	Topic	Standard 5, Environmental Studies		
1.1	Water	Standard 5, Environmental Studies Chapter 3. The Earth and its Living World	This chapter explains the spheres such as lithosphere, hydrosphere, biosphere. Land and water distribution and various landforms as well. It has also introduced terms such as Surface Water, Groundwater and Water cycle.	A quiz or in 'Use the Brain Power' section, what is the distribution of surface and groundwater can be added to understand which is more and why? In the water cycle description, the chapter talks about all the processes such as evaporation, condensation. Perhaps, a diagram that shows flow of water in all the spheres can add more significance to the existing theory. An activity to prepare a rain gauge and to measure rainfall can be added.
1.2	Water	Standard 5, Environmental Studies Chapter 5. Family Values	This chapter talks about family values such as honesty, gender equality and tolerance. Men and women are equal. It is not right to discriminate between them.	In the last section, "What's the solution", there is a list of examples which talks about Gender Equality. In this list, gender biases that exist in the society can be added. Mostly in the rural areas it is the duty of women and girls to draw or fetch water from wells from a long distance.
1.3	Water	Standard 5, Environmental Studies Chapter 10. Getting to Know India	This chapter has various maps of India such as rivers, mountains, political map, fruits.	A map of rainfall spread across India can be added.
1.4	Water	Standard 5, Environmental Studies Chapter 12. Food for All	This chapter talks about the basic of agriculture such as seasons, seeds, fertilizers	Small activities such as compost creation in school and in the house can be added.
1.5	Water	Standard 5, Environmental Studies Chapter 16. Water	This chapter talks about the Water Pollution, Water Purification System and Rainwater Harvesting, CCT and Bunds.	The measures taken by Jalsevak at Gram Panchayat level as well can be added.

2	Topic	Standard 6, Geography		
2.1	Water	Standard 6, Geography Chapter 4. Weather and Climate	This chapter explains the important attributes of weather such as temperature, moisture, wind, precipitation.	June, July, August and September is the rainy season, October to January is winter and Feb to May is summer. Changes are visible in these seasons. An activity to notice the changes at the start and at the end of these seasons can be added. Also, an activity to observe the changes in wind patterns as per the season can be added.
2.2	Water	Standard 6, Geography Chapter 7. Rock and Rock Types	This chapter talks about the different types of rocks and how they are formed.	Importance of rocks, their role in water cycle and properties of rocks storativity and transmissivity can be introduced. The term Aquifer and the significance of rocks can be added as well. The map of Maharashtra as well as India showing Geological distribution can be added. An activity to make a list of items that are present in their house and made of these various rocks can also be added.
3	Topic	Standard 6 Science		
3.1	Water	Standard 6, Science Chapter 1. Natural Resources - Air, Water and Land	This chapter talks about the natural resources such as air, water and land. What is land and water distribution? What is the proportion of various gases in air? What is the distribution of water?	An activity to make students understand the availability of freshwater can be added. Take 1 lit water bottle and fill it with water. From that water, measure 970ml of water i.e., 97% of water which is se water which can't be used. 2% i.e., 20ml is in glaciers which can't be used. Thus remaining 1% i.e., 10ml is available fresh water that can be used. Thus, should be used judiciously. This fresh water is recycled in the various forms and through various spheres.

3.2	Water	Standard 6, Science Chapter 4. Disaster Management	This chapter talks about the natural disasters such as storms, flood, earthquakes and fire.	In the flood, excessive rain and river overflow are the given reasons. Details on human encroachment which lead to narrowing the banks of rivers or naalas can be added as well. In cities, excessive use of plastics blocks the drainage holes which leads to overflow of water on the roads. In reference to this, Aambil Odha case study of Pune can be discussed and likewise for various other cities can be given.
4	Topic	Standard 7 Geography		
4.1	Water	Standard 7, Geography Chapter 11. Winds	This chapter talks about various types of breeze such as Mountain breeze, Land breeze, Seasonal breeze.	An activity to make students understand about the wind effect on the rate of evaporation can be added. The rate of evaporation is highest at night and can very well be explained through this. Inclusion of exercises for Rural and Urban areas asking the students to put water on the open surfaces in the night to witness the effect of evaporation can be added.
4.2	Water	Standard 7, Geography Chapter 11. Contour, Maps and Landforms	This chapter talks about what are the contour maps and how to create them.	Children can be asked to draw an approximate contour map of their school.
5	Topic	Standard 7 Science		
5.1	Water	Standard 7, Science Chapter 1. The Living World: Adaptations and Classification	This chapter talks about various types of adaptation in plants such as thorns in case of deserted plants.	Children can be asked to identify natural indicators of plants which will show bad water quality such as water hyacinth or presence of Black Winged Slit i.e Shekatya in marathi.
5.2	Water	Standard 7, Science Chapter 3. Properties of Natural Resources	This chapter talks about various properties of air, water and soil as well as about soil testing.	Water Quality is a very important aspect of potable water. Knowledge on the harmful factors in water and what is their potable range can be added. Also, along with World Soil Day, World Water Day i.e., 22 March can be included.

5.3	Water	Standard 7, Science Chapter 5. Food Safety	This chapter talks about the factors which can be responsible for food to be unsafe.	Focus on use of chemical fertilizers; pesticides can be added as these products affect food as well as water quality. Children can be asked to perform home audits to check the polluting factors released from the house and ways to overcome it.
5.4	Water	Standard 7, Science Chapter 10. Disaster Management	This chapter talks about disasters such as famine, volcano and cloud burst, drought.	Famine, drought and the various ways at personal level for effective water management i.e., 3R Reuse, Recycle and Reduce can be added.
6	Topic	Standard 8, Geography		
6.1	Water	Standard 8, Geography Chapter 3. HUMIDITY AND CLOUDS	This chapter talks about various processes such as evaporation, condensation, humidity. Moisture and types of clouds.	Methodology to measure Rate of Evaporation, instruments used to do the same can be added. An activity on how to create clouds in a bottle can be added. https://www.youtube.com/watch?v=V76-55WFvhQ
6.2	Water	Standard 8, Geography Chapter 11. Population	This chapter talks about the changes occurred in the population and how land cover, basic infrastructure changes are happening.	An activity to understand a load of population on water resources can be added. Take a small glass with one straw and a child, and ask him/her to sip water. Keep on adding a greater number of children and notice the change in water resources.
7	Topic	Standard 8, Science		
7.1	Water	Standard 8, Science Chapter 2. Health and Diseases	This chapter talks about various diseases and reasons for it.	Diseases such as Fluorosis, Blue Baby etc. which occur due to poor quality of water can be added.
7.2	Water	Standard 8, Science Chapter 8. Pollution	This chapter talks about various types of pollution such as air, water and sound.	Our role in these pollution types and ways to overcome it can be added. For e.g., reduce use of chemicals An activity to collect news about water pollution that caused sudden deaths of fishes can be included. An activity to observe fresh tap water and water from Nala or gutter under microscope to notice the differences can be added. Children can be asked to perform school audit to check what polluting factors are released from school and ways to overcome it.



Section 4:

Energy, Air Pollution and Climate Change

4.1. Introduction

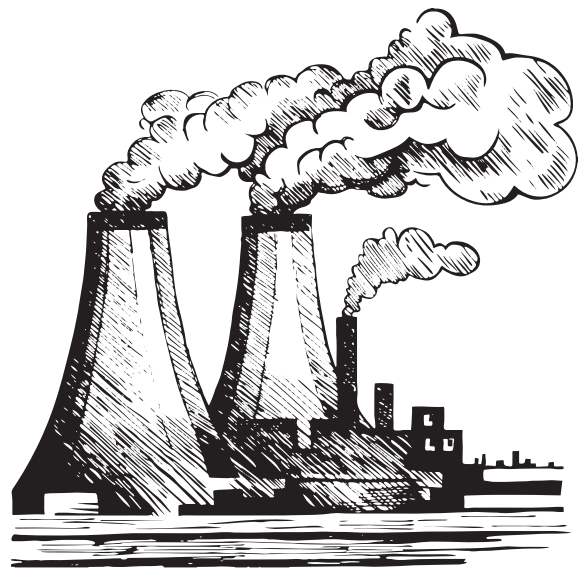
4.1.1. Overview of the theme

Energy is an abiotic component of the environment. It is an integral part of the living systems on earth. It supports all forms of life. At the same time, energy is also an important component and input for all the processes and activities happening on the earth. It is part of natural systems as well as anthropogenic systems. It is important for life support as well as all the developmental processes in the society.

Pollution is an undesirable by-product of deriving energy from different sources. Pollution has negative impacts on the living systems and environment.

Climate change is one of the unintended consequences of certain air pollution emissions and gases released in the atmosphere. Processes of deriving energy are a major source of such pollutants and gases. Climate change poses unprecedented risks and stress on all human and natural systems.

Energy in the present system is predominantly derived from natural resources. Although some renewable alternatives are being developed and brought into use very recently. Though in smaller proportions, these are promising. It further needs to make the energy uses super-efficient and progressively shifting towards renewables for a sustainable future.



The United Nations identifies seventeen Sustainable Development Goals (SDG) for the planet to be achieved by 2030. Goal 7 and goal 13 can be achieved through this theme of energy, air pollution and climate change.

***Goal 7:** Ensure access to affordable, reliable, sustainable and modern energy for all*

***Goal 13:** Take urgent action to combat climate change and its impacts*

These goals are targeted to be achieved collectively by 2030.

4.1.2. Rationale, expected learning outcomes and summary of curriculum analysis

Energy is consumed by all of us in different forms. All human processes and development activities utilise energy. All these processes and activities cause pollution and lead to different impacts. It is also responsible for climate change and associated risks. The choices made by the humans and societies about their lifestyle, systems they design and development processes has its direct bearing on the energy intensity, resources used and the consequences of these.

Therefore, it is important to raise a world population aware of these aspects as well as also looking forward to the choices and solutions that are sustainable in the long run for the environment and societies. They should be competent to understand the interconnectedness of systems and processes and capable of thinking of innovative solutions that are fulfilling the need of safeguarding the natural systems. They should know the importance of energy in their life, consequences of its uses, the alternatives available and the kind of systems that should be created and promoted to achieve sustainability in energy exploration and uses. They should experience the sustainable practices and are able to assess them in order to make their choices.

Students are exposed to these concepts with the aim of building their understanding through environment education methodology of activities and projects. They are encouraged to think and express, and consolidate their learnings through observations from the

field, interactions, explorations, surveys, studies, demonstrations and discussions. They will learn about different concepts related to energy, air pollution and climate change themes such as renewable energy, energy efficiency, types, sources and impacts of air pollution, sustainable transport modes, weather and climate and impacts of climate change at the basic and local level.

Topics

The three topics are integrated in this theme i.e., energy, air pollution and climate change.

The topics covered under this theme for the secondary standards of grade 5 to grade 8 are following:

- Energy for life support
- Uses and sources of energy
- Sources of air pollution
- Impacts of air pollution
- Weather and climate
- Impacts of climate change
- Renewable energy
- Energy conservation
- Energy efficiency
- Control of air pollution
- Sustainable transportation – energy efficient, pollution free, green modes
- Climate change mitigation and adaptation

These topics are introduced in the primary standards of grade 1 to grade 4 at a very basic level of their understanding. The topics introduced in primary standards are:

- Energy for life support
- Renewable energy—solar energy, wind energy, food and muscular energy
- Uses and sources of energy
- Energy conservation
- Sources of air pollution
- Weather and Climate

In the primary standards it was introduced at a basic level not going into the complexity of the concepts. In the secondary standards these will be further enhanced by building upon those and introducing more complex concepts with a higher level of understanding.

Energy, air pollution and climate change are complex concepts. These concepts are introduced in textbooks of secondary level of grade 5 to grade 8. These concepts are introduced in Std 5 and discussed with some length in Std 6, 7 and 8. In Std 5, it is introduced in EVS and languages like Marathi and Hindi. In Std 6, 7 and 8, these are mostly covered in the subjects of Geography and Science.

The contents are provided in the form of text notes with some illustrations and images. Some activities are also given for the students to further explore the topic. Questions based on the text are there to evaluate the understanding gained by students.

Energy is dealt in all the standards of 5 to 8 with more details in Geography and Science of Std 6, 7 and 8. There is a chapter Energy Resources in Geography of Std 6, which discuss-

es in detail about different concepts of energy including usages and source of energy, renewable energy. But not in detail about energy conservation and energy efficiency. The Work and Energy chapter in Science of Std 6 gives an introduction about energy and its importance. Energy is also covered in the Natural Resources chapter of General Science in Std 7.

Basics of air is covered in chapter Air in Geography of Std 8. Air pollution is covered in chapter Energy Resources of Geography in Std 6 and Natural Resources chapter of General Science in Std 7. It is also covered in the Pollution chapter of Science in Std 8. It covered what is air pollution and its sources, but the impacts of air pollution are not covered in detail. It doesn't cover in detail the control measure and protection from air pollution either. However, mentions about avoiding pollution in Directive Principles of State Policy and Fundamental Duties chapter of Civics in Std 7 and provision of law for control and prevention of air pollution in Pollution chapter of Science in Std 8.

Climate change is covered in the Air chapter of Geography in Std 6, where greenhouse gas, climate change and its effects are explained. In the Pollution chapter of Science in Std 8, the greenhouse effect and global warming is explained. However, the impacts of climate change, climate change mitigation and adaptation are not mentioned enough.

The activities and the projects suggested here will build upon the concepts present in the textbook by further strengthening those. Some new aspects are also introduced in an interesting environment education methodology. Teachers will find it interesting to engage students through these indoor and outdoor, hands-on activities and projects that can be done individually or in groups.

4.1.3. Activity Framework

Curriculum-mapped Activity and Project Plan for Energy, Air Pollution and Climate Change

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
1.	Energy <ul style="list-style-type: none"> • What is energy • Energy as life support on earth 	<p>Standard 5, EVS-I, Lesson 24, Substances, Objects and Energy, energy and other form of energy</p> <p>Standard 6, Science, Lesson 11, Work and Energy, energy sources, energy from actions</p> <p>Standard 6, Geography, Lesson 9, Energy Resources, difference in substance based and process based energy resources</p>	<ul style="list-style-type: none"> • Sun is the ultimate source of energy. Energy from the sun comes to earth in the form of solar radiation. This solar energy can be utilised for different purposes. • Energy is essential for the existence and functioning of all life forms and systems on the earth. It is integral to both biotic and abiotic components and processes on the planet. Flow of energy across trophic levels is one of the basic ecological principles and connects biotic and abiotic elements. Energy is not just an input for development processes. 	Std 5 <ul style="list-style-type: none"> • Solar energy we can use Std 7 <ul style="list-style-type: none"> • Web of Life (Energy Flow)
2.	Energy <ul style="list-style-type: none"> • Uses of energy • Source of energy • Types of fuel 	<p>Standard 6, Geography, Lesson 9, Energy Resources, different cooking fuels, types and alternative sources of energy for cooking, map of major coal and mineral oil fields in India, concepts of biogas, energy from waste, hydel and atomic power and energy sources</p> <p>Standard 6, Science, Lesson 11, Work and Energy, energy sources, energy from actions</p> <p>Standard 7, General Science, Lesson 16, Natural Resources, What is meant by fuels? Which natural resources do we use as fuels? Various substances are used in day-to-day life for generating energy. Discussion: Why is natural gas an eco-friendly fuel?</p>	<ul style="list-style-type: none"> • Sunlight is a source of energy that can be converted into heat and utilised to do work. • Energy is used for cooking and other heating purposes at home. Various types of fuel are used as sources of energy for cooking, heating and lighting at home and in the community. • Use of cleaner fuel and smokeless Chulha for protection from indoor air pollution. • Compare various sources of energy and types of fuel based on their environmental cost and impacts. Environmental disruption caused by exploration and development of fossil fuels. 	Std 5 <ul style="list-style-type: none"> • Solar energy we can use Std 6 <ul style="list-style-type: none"> • Energy for Food • Kick the Habit and Pick Right! Std 7 <ul style="list-style-type: none"> • Web of Life (Energy Flow)

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
		<p>Standard 8, Science, Lesson 5, Inside the Atom, nuclear energy, collect and show working information of atomic reactor</p> <p>Standard 8, Science, Lesson 10, Cell and Cell Organelles, Which type of energy is required to run fans, computers and electric bulbs? Where is this energy produced?</p>	<ul style="list-style-type: none"> ● Sun is the source of energy for all life forms. Energy is captured by producers and passed to primary, secondary and tertiary consumers through the food chain. Food is the source of energy for all the living organisms to carry their life functions. 	
3.	<p>Air pollution</p> <ul style="list-style-type: none"> ● Air in atmosphere ● Air pollution 	<p>Standard 5, EVS-I, Lesson 3, The Earth and Living World, The Earth's Atmosphere</p> <p>Standard 5, Hindi Sugam Bharati, Lesson 2, Hava, nature of air</p> <p>Standard 5, Marathi Sugam Bharati, Lesson 9, Varyala Chuk Kalali, air</p> <p>Standard 6, Science, Lesson 1, Natural Resources-Air, Water and Land, air pollution, pollution status, description of Ozone layer and its importance</p> <p>Standard 6, Geography, Lesson 8, Air, air is a resource, we need air for different purposes, air quality can change</p> <p>Standard 7, General Science, Lesson 3, Properties of Natural Resources, air composition, air pressure, temperature</p> <p>Standard 8, Science, Lesson 8, Pollution, proportion of gases in atmosphere, Air Quality Index</p> <p>Standard 8, Geography, Lesson 3, Humidity and Clouds, Smog</p> <p>Standard 8, Science, Lesson 8, Pollution, air pollution</p>	<ul style="list-style-type: none"> ● Burning of any substance in open air releases smoke and gases. This causes air pollution and might be harmful for human health. 	<p>Std 5</p> <ul style="list-style-type: none"> ● Where there is fire there is Smoke!

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
4.	Air pollution <ul style="list-style-type: none"> Sources of air pollution 	<p>Standard 6, Geography, Lesson 9, Energy Resources, substance based and process based energy resources, generation of energy leads to pollution with substance-based energy resources, while process-based energy resources are pollution-free, industrialization led to environmental degradation and pollution</p> <p>Standard 8, Science, Lesson 8, Pollution, vehicles with two stroke engine cause more pollution than four stroke engine, how does pollution occur due to vehicles, give names of vehicles causing least pollution, visit heavy traffic junction and report pollution at different times and find out duration of maximum pollution</p> <p>Standard 8, Geography, Lesson 8, Industries, industries and environment note, box on pollution</p> <p>Standard 8, Science, Lesson 17, Man Made Objects, Plastic and Environment</p> <p>Standard 8, Science, Lesson 15, Sound, measure sound level of a loudspeaker at a public place, observe relation between distance and sound level</p>	<ul style="list-style-type: none"> Practices of burning any substance cause air pollution. Air pollution inside a building is indoor air pollution and when outside is outdoor or ambient air pollution. Vehicular transport is one of the sources of air pollution. It emits smoke, gases and particles after burning fossil fuel in their engines. Indoor air pollution is caused due to use of solid fuels and biomass for cooking and heating purposes inside homes. Exploration, mining, transportation, refining and generation of energy are also responsible for air pollution. Levels of air pollution might vary in different areas based on types of activities and sources. Changing nature of activities and their level over the decades are responsible for poor air quality. Air pollution was not natural but a problem caused by human activities. Crackers are one of the major sources of toxic gases in the air. A campaign to stop the use of crackers can check this undesirable air pollution. Fuel used in vehicles and in transport systems cause air pollution. Personal modes cause more air pollution per person per km travel compared to shared modes. Automobiles cause pollution as opposed to walking and cycling. 	<p>Std 5</p> <ul style="list-style-type: none"> Where there is fire there is Smoke! Facial Dirt and Air Pollution <p>Std 5 Project</p> <ul style="list-style-type: none"> Green Travel-Walking and Cycling <p>Std 6</p> <ul style="list-style-type: none"> Energy for Food Kick the Habit and Pick Right! Cello Tape Sampler Grand-parents Stories <p>Std 6 Project</p> <ul style="list-style-type: none"> Emission Inventory

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
			<ul style="list-style-type: none"> ● Emission inventory is identifying and listing all the activities and sources of air pollution in an area. It is useful to plan control measures. 	Std 8 <ul style="list-style-type: none"> ● No Crackers Campaign ● Fuel Saving Drive ● Wise Traveller
5.	Air pollution <ul style="list-style-type: none"> ● Impacts of air pollution 	Standard 5, EVS-I, Lesson 11, Our Home and Environment, how environmental pollution affects us Standard 8, Science, Lesson 8, Pollution, collect information about effects of air pollution on human health from large cities and villages in Maharashtra	<ul style="list-style-type: none"> ● Air pollutants such as tobacco smoke or toxic gases from burning of garbage cause harmful health impacts. Some products used at home can cause emissions that affect human health. ● Inhaling air pollution emitted by vehicles and transport affects human health. ● Air pollution in the form of smoke and dirt enters our body while breathing when we travel in traffic and affect different parts of our body. ● Effects of COVID19 virus can worsen if air quality is poor. A weak lung because of poor air quality is more susceptible to the worsening effect of the infection. ● Use of solid fuel and old Chulha cause indoor air pollution that impacts the health of women, children and elderly inside the home. ● Crackers produce toxic gases and fumes that have the worst effects on the health of living things. ● Air pollution has different health related impacts on human beings. It affects many other systems other than the respiratory system. Children, elderly, pregnant women and sensitive people are more vulnerable to the health impacts of air pollution. 	Std 5 <ul style="list-style-type: none"> ● Where there is fire there is Smoke! ● Facial Dirt and Air Pollution ● Wet Cloth Filtration Std 6 <ul style="list-style-type: none"> ● Energy for Food Std 7 Project <ul style="list-style-type: none"> ● Health Impacts of Air Pollution Std 8 <ul style="list-style-type: none"> ● No Crackers Campaign

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
6.	Weather and Climate <ul style="list-style-type: none"> Climate change 	<p>Standard 6, Geography, Lesson 5, Air, effects of greenhouse gases, climate change, greenhouse gases explanation</p> <p>Standard 8, Science, Lesson 8, Pollution, greenhouse effect and global warming, relation between greenhouse effect and global warming</p>	<ul style="list-style-type: none"> Exploration, mining, transportation, refining, development, generation and uses of fossil fuel based energy are causes of release of greenhouse gases responsible for climate change. Transportation sector is one of the major contributors of GHG emissions. Use of personalised and inefficient modes of transport systems cause release of higher amounts of GHG compared with shared modes. Energy used at home and schools in the form of electricity contributes to the release of carbon dioxide, a major GHG. Energy audits of school and home identifies the utility and wastage of electricity. Climate of a place is the long term average of its weather parameters like temperature, precipitation, humidity, etc. Climate of a place depends on many factors and geographical location is one of them. Presence of water bodies, hills and vegetation cover has a major effect on the climate of a place. Climate of a place does not change whereas the weather can change. Human induced change in climate is a long term and irreversible process. 	<p>Std 6</p> <ul style="list-style-type: none"> Kick the Habit and Pick Right! <p>Std 8</p> <ul style="list-style-type: none"> Wise Traveller Energy Audit at School and Home Weather Clues

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
7.	Impacts of climate change	Absent Absent	<ul style="list-style-type: none"> The impacts of climate change are experienced differently at global and local levels. Much of the studies on climate change impacts are of global level. Whereas, local level impacts are not studied extensively. However, people are already facing the impacts of climate change locally. Unfortunately, climate change affects people differently. Those who are more dependent on nature for their livelihood are more vulnerable to climate change. Farmers and tribals dependent on agriculture and forest are more impacted by the effects of climate change. Hence, there is a need to study the climate change impacts on them and understand their needs for adaptation. 	Std 7 and 8 Project <ul style="list-style-type: none"> Farmers Story
8.	Re-newable energy <ul style="list-style-type: none"> Wind energy Solar energy Tidal energy Geothermal energy 	Standard 6, Geography, Lesson 9, Energy Resources, difference in substance based and process based energy resources, generation of energy leads to pollution with substance-based energy resources, while process-based energy resources are pollution-free	<ul style="list-style-type: none"> Sunlight has energy that can be used by converting into heat energy. Solar energy is a renewable form of energy. Solar cookers and other solar heating devices utilize renewable energy from the sun. Principle of solar heating devices can be used to make such similar devices and use them for various work. Solar water purifiers are based on solar heating principles. Such devices can be developed to harness solar energy for the purpose of water purification. 	Std 5 <ul style="list-style-type: none"> Solar energy we can use Std 7 <ul style="list-style-type: none"> Making a Solar Cooker Making a Solar Water Purifier

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
		<p>Standard 6, Geography, Lesson 9, Energy Resources, concept of wind energy, solar energy, tidal energy, geothermal energy, classification of energy resources and comparing environment friendliness, solar devices (lantern, solar panel), identify energy source</p> <p>Standard 7, Hindi, Lesson 8, Jivan Nahin Mar Sakta Hai (Poem), make a note on solar energy its importance and uses</p> <p>Standard 7, Geography, Lesson 3, Tides, collect information about how electricity is generated from weaves, find places where electricity is generated by tides</p>		
9.	Energy Conservation	Standard 5, Marathi Sulabh Bharati, Lesson 11, Indhan Bachat, about energy saving behaviour	<ul style="list-style-type: none"> ● Bicycling is a non-energy consuming mode of transport. It can be used for conservation of energy consumed in the transportation sector. ● Using solar cookers can save cooking fuel and conserve conventional energy. Such solar heating devices can be used for different heating purposes like solar water heater, solar dryer, etc. at home. ● Huge amount of energy is utilized for water purification. Using solar energy for the same will save conventional energy. ● Adopting good driving practices and vehicle maintenance can save fuel and energy. ● Using an energy efficient system of shared public transport modes like buses will make travel energy efficient and conserve energy. 	<p>Std 5 Project</p> <ul style="list-style-type: none"> ● Green Travel-Walking and Cycling <p>Std 7</p> <ul style="list-style-type: none"> ● Working of a Bicycle ● Making a Solar Cooker ● Making a Solar Water Purifier

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
			<ul style="list-style-type: none"> Green and non-energy consuming modes like walking and cycling can save energy required for travelling the same distance by motorised modes. 	Std 8 <ul style="list-style-type: none"> Fuel Saving Drive Wise Traveller Energy Audit at School and Home
10.	Energy Efficiency	Absent	<ul style="list-style-type: none"> Vehicle maintenance and correct driving practices increases the fuel efficiency of the drive. Energy audits at school and home identify the wastages and areas to improve the efficiency of electricity and other energy uses. Increasing the share of green modes of travel like walking and cycling increases the energy efficiency of transportation systems at city level. There are Star Rated energy efficient equipment and appliances available in the market for the ease of consumers. But people seldom purchase them due to upfront cost. Study of their actual gains by comparing and promoting the same through a policy to purchase will increase the reach of energy efficiency devices and the idea. 	Std 5 Project <ul style="list-style-type: none"> Green Travel-Walking and Cycling Std 8 <ul style="list-style-type: none"> Fuel Saving Drive Energy Audit at School and Home Std 8 Project <ul style="list-style-type: none"> Energy Efficient Equipment and Appliances
11.	Air pollution <ul style="list-style-type: none"> Control of air pollution Protection from air pollution 	Standard 7, History and Civics, Lesson 6 Civics, Directive Principles of State Policy and Fundamental Duties, celebrate festivals by avoiding pollution	<ul style="list-style-type: none"> Use solar energy, a non-polluting form of energy. Proper ventilation may help in reducing the harmful effects of indoor air pollution. 	Std 5 <ul style="list-style-type: none"> Solar energy we can use Where there is fire there is Smoke!

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
		<p>Standard 8, Science, Lesson 8, Pollution, mention of existence of law on air pollution and prevention, suggest four preventive measures for air pollution, construct two slogans on air pollution</p> <p>Standard 8, Hindi Sugam Bharti, Lesson 1, Hrudya ka Ujala, message, do not shine sparklers neither burst crackers</p>	<ul style="list-style-type: none"> ● Avoiding certain practices that are not essential or adopting their alternatives can protect from impacts of air pollution. ● It needs to safeguard health from air pollution in the event of poor air quality. Persistent poor air quality affects the capability of human beings to fight the COVID19 pandemic and recovery from its infection. Proper use of a mask can provide protection to a great extent. 	<ul style="list-style-type: none"> ● Wet Cloth Filtration <p>Std 5 Project</p> <ul style="list-style-type: none"> ● Green Travel-Walking and Cycling
		<p>Standard 8, Hindi Sugam Bharti, Lesson 1, Hrudya ka Ujala, message, do not shine sparklers neither burst crackers</p>	<ul style="list-style-type: none"> ● Use of cleaner fuel and smokeless Chulha to control indoor air pollution can help safeguard the health of women, children and elderly at home. ● Changing the nature of activities can control air pollution. Good air quality was observed during the period of national lockdown for COVID19 pandemic. ● Bicycling is a non-polluting, cleanest mode of transport. It consumes very less space on road and clear congestion, requires less infrastructure and helps conserve green areas in the city. ● A solar cooker is pollution-free. Using it can help reduce the indoor air pollution from cooking fuel. ● Solar water purifiers will reduce the energy utilised for water purification and hence reduce the air pollution caused by the same. ● Stopping the bursting of crackers and celebrating festivals in an eco-friendly manner will check the toxic pollution going into air. 	<p>Std 6</p> <ul style="list-style-type: none"> ● Energy for Food ● Grand-parents Stories <p>Std 6 Project</p> <ul style="list-style-type: none"> ● Emission Inventory <p>Std 7</p> <ul style="list-style-type: none"> ● Working of a Bicycle ● Making a Solar Cooker ● Making a Solar Water Purifier <p>Std 8</p> <ul style="list-style-type: none"> ● No Crackers Campaign ● Fuel Saving Drive

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
			<ul style="list-style-type: none"> ● Lower fuel consumption in vehicles due to good driving behaviour and maintenance will reduce the emission of vehicular pollution. Also using a shared vehicle of public transport will generate much less emission per person per km travelled. ● Reducing the electricity use through energy audits will reduce the air pollution caused in electricity generation. ● Promoting and using green modes like walking and cycling will have no air pollution at all. ● Making an inventory of air polluting activities and sources will help in planning and implementing the control measures. 	<ul style="list-style-type: none"> ● Wise Traveller ● Energy Audit at School and Home
12.	Sustainable transport	Standard 5, EVS-I, Lesson 14, Transport, advantages of using a bicycle	<ul style="list-style-type: none"> ● Bicycling is a sustainable mode of transport adopted by many developed countries. It provided mobility for short distance travels. ● Good and defensive driving habits, maintaining the vehicles and practices like pooling are beneficial in many ways. It reduces road crashes, congestion and is helpful for modes like walk and cycle. ● Preferring use of public transport buses over personal modes increases the demand for improving public transport infrastructure and services, reduces congestion on road, improves space and safety for green modes apart from reducing the fuel consumption, air pollution and GHG emissions. ● Increasing use of modes like walk and cycle will increase the demand for their safety on the road. 	<p>Std 5 Project</p> <ul style="list-style-type: none"> ● Green Travel-Walking and Cycling <p>Std 7</p> <ul style="list-style-type: none"> ● Working of a Bicycle <p>Std 8</p> <ul style="list-style-type: none"> ● Fuel Saving Drive ● Wise Traveller

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
13.	Climate change mitigation	Absent	<ul style="list-style-type: none"> ● Switching to renewable energy like solar energy mitigates GHG emissions responsible for climate change. ● Bicycles are a climate friendly mode that can be used to mitigate GHG emissions. It can be integrated with public transport modes and also an appropriate mode during pandemic. ● Solar energy devices like solar cookers, solar water heaters, etc help mitigate GHG emissions. ● Using solar energy for water purification has high potential to reduce GHG caused if switched from fossil fuels. ● Conservation of fuel by vehicle maintenance, good driving habits and use of shared modes like public transport buses are the ways of reducing emissions of GHG from the transportation sector. Similarly, the use of green modes, walk and cycle, help mitigate GHG. ● Electricity is one of the major carbon dioxide emitters, plugging the wastage and conserving electricity at home and schools through energy audits and use of energy efficiency devices and appliances will reduce the GHG emissions from the thermal power plants. 	<p>Std 5</p> <ul style="list-style-type: none"> ● Solar energy we can use <p>Std 5 Project</p> <ul style="list-style-type: none"> ● Green Travel-Walking and Cycling <p>Std 7</p> <ul style="list-style-type: none"> ● Working of a Bicycle ● Making a Solar Cooker ● Making a Solar Water Purifier <p>Std 8</p> <ul style="list-style-type: none"> ● Fuel Saving Drive ● Wise Traveller ● Energy Audit at School and Home <p>Std 8 Project</p> <ul style="list-style-type: none"> ● Energy Efficient Equipment and Appliances

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
14.	Climate change adaptation	<p>Standard 5, EVS-I, Lesson 11, Our Home and Environment, regions and type of homes, as time passed, humans went on making suitable changes in their shelter, eco friendly houses</p> <p>Standard 5, EVS-II, Lesson 7, From Shelter to Village Settlements, moved camps to different places according to seasonal changes</p>	<ul style="list-style-type: none"> ● Adapting cleaner cooking fuel and smokeless Chulha will improve the community's health. ● A safe bicycle infrastructure can provide an affordable and environment friendly mobility option for all in the community. ● Solar energy based devices can be promoted to areas where access to clean fuel is not available. Solar cookers and water heaters will benefit the community by reducing their dependency on other sources. ● Climate change will impose water stress on a large part of the country. Decentralised solar water purifiers can be a viable solution for water purification and reuse. This will be helpful for many communities facing water stress. ● Water stress is one of the great risks posed to many communities by climate change. Rooftop rainwater harvesting (RWH) will help dealing with the water stress caused by climate change for the local community. Estimating the potential of rainwater that can be harvested will help in making a case for investment. ● Improving the demand and infrastructure for an efficient public transport system based on buses will improve the mobility services and accessibility for all in the community. It will also safeguard them from climate risk of energy prices. 	<p>Std 5 Project</p> <ul style="list-style-type: none"> ● Green Travel-Walking and Cycling <p>Std 6</p> <ul style="list-style-type: none"> ● Energy for Food <p>Std 7</p> <ul style="list-style-type: none"> ● Working of a Bicycle ● Making a Solar Cooker ● Making a Solar Water Purifier ● Measurement of Rain water <p>Std 7 and 8 Project</p> <ul style="list-style-type: none"> ● Farmers Story <p>Std 8</p> <ul style="list-style-type: none"> ● Wise Traveller

SN	Topics and subtopics	Presence in textbooks	Concepts	Activities
			<ul style="list-style-type: none"> ● Green travel modes like walking and cycling helps the community by improved mobility, improved air quality and reduced community health burden due to diseases. ● Farmers experience the impacts of climate change due to their dependence on natural resources. Although they have little contribution to GHG emissions. They need to be supported in order to adapt with regard to the risks posed by climate change to them at the local level. 	

4.2. Activities / Projects

Std.
5

4.2.1. Solar energy we can use

Level/Class: 5

Curriculum links: Science

Activity duration: 30 minutes

Materials needed:

- # Objects made up of metals such as steel, aluminum, copper or tin like plates, keys, spoon, box, etc.
- # Pieces of cloth and sheets of paper of black and white colors

Approach: Outdoor activity with whole class

Topic:

Energy, solar energy

Concept:

Energy from the sun comes to the Earth in the form of solar radiation. This energy can be experienced as light and heat. Solar radiation contains infrared, visible and ultraviolet rays. Sunlight is a portion of the solar radiation that is visible rays. Light and heat are forms of energy. When solar radiation falls on any object it converts into heat energy. If we can capture this energy, we can utilize this for different purposes.

Aims:

- Sunlight has energy that can be converted into heat.
- Observe energy aspect, energy in sunlight and its uses for different purposes.

Key questions to address:

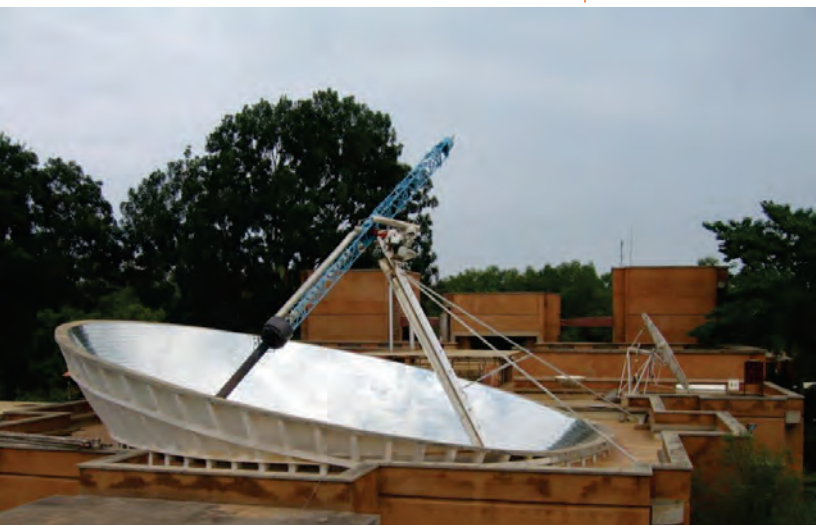
What is solar energy? How can we use it?

Preparation:

Collection of required materials

Method/Guide:

1. Make two sets of different materials.
2. Keep one set under the sunlight and another in the shade.
3. Observe the difference in the temperature after 20 to 30 minutes.
4. Take temperature readings using a 0°C to 110°C thermometer and record (optional).



Parabolic dish produces steam for cooking, in Auroville, India

Observation Table:

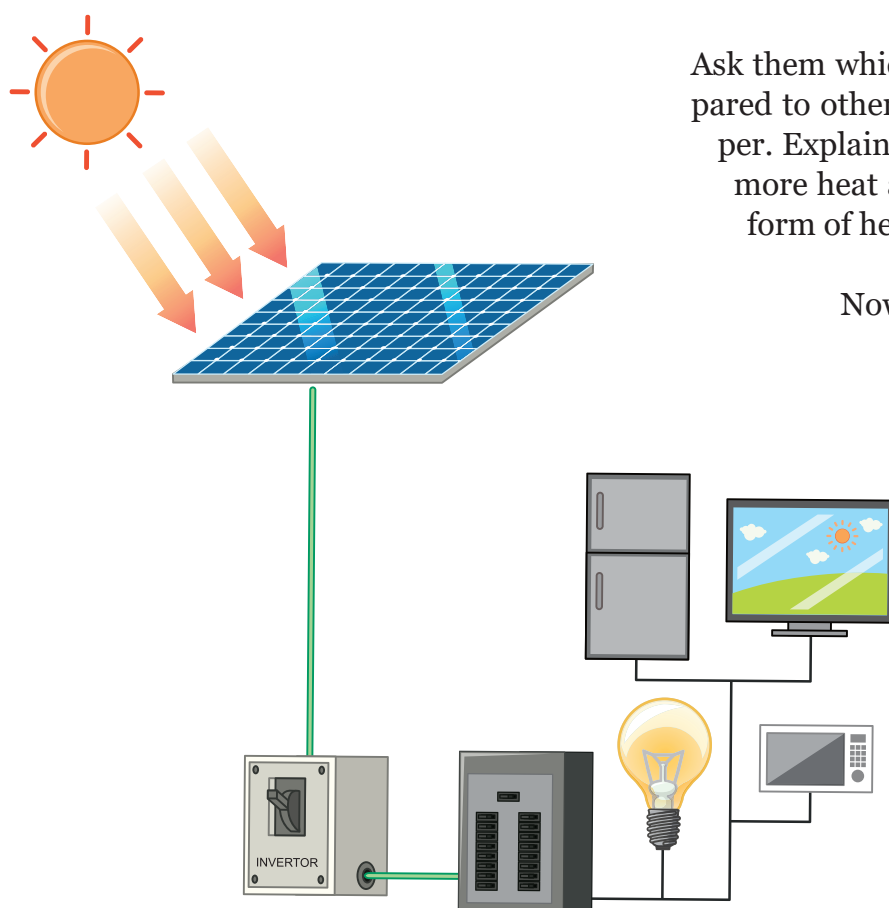
Sl No	Material	Color	Duration	Temperature

Teachers should check the objects before children touch them as they may be too hot to touch at first. Ask the students to touch the objects kept in the sunlight and in the shade and feel the difference in their temperature. Note down the temperature of these objects using the thermometer, if available.

After the students feel the objects, discuss what happened and why. The teacher should lead them to understand that the objects in the sun were warmer because the sun radiates energy; the solar energy gets converted to heat energy after falling on an object which makes things warmer. If we can capture this heat, we can utilize this energy for different purposes.

Ask them which material became hotter compared to others from the metal, cloth and paper. Explain to them that metals can absorb more heat and can retain the energy in the form of heat too for longer duration.

Now, ask them whether they think black color paper will absorb more heat or become hotter than white color paper and why. Explain that the black color absorbs more sunlight or solar radiation. Hence, become hotter.



Learning outcomes:

Sunlight has energy and this energy gets converted into heat. The black color absorbs more heat and light energy from the sun because it does not reflect light like the white color. This energy, if trapped as heat, can be utilized for different purposes.

Green habit:

Use dark colour clothes in winter and light colour clothes in summer to reduce need for heating and cooling.

FAQs

Q - Why do things heat up when kept in sunlight?

A - The Sun radiates its energy in the form of electromagnetic waves. This electromagnetic wave carries energy radiated from the Sun to the Earth. Radiation from the Sun has infrared, visible and ultraviolet rays. When it falls on an object its energy gets converted into heat that increases the temperature of the object.

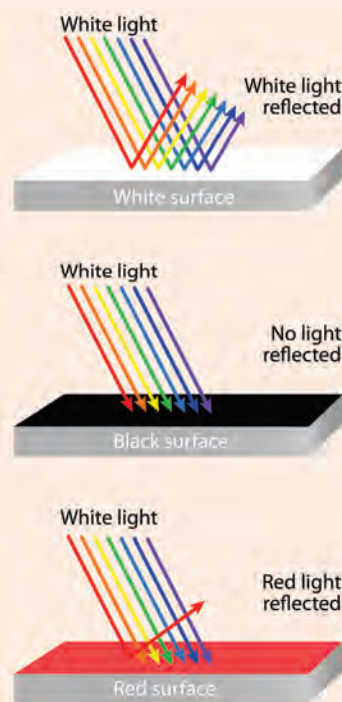
Q - Why do metals heat up more than clothes or paper?

A - Metals are good conductors of heat. It transfers the heat absorbed on the surface to other parts of the metal quickly. Also, the specific heat of metals is higher, so it can absorb and store more heat compared to nonmetals. Therefore, the temperature of metals can go much higher than the non-metals.

Q - Why do we wear dark color clothes in winter and light color clothes in summers?

A - The visible part of the sun light contains seven colours. When all these seven colours are mixed it

makes white colour. Human eyes see the object by the light colour which are reflected back from the object after light falls on it. When all the visible light is reflected back by an object it looks white in colour to us. But when all the visible light is absorbed by the object it looks black in colour to us as no visible light is reflected back. That also means that the black colour object absorbs all the sunlight. Contrary to that, white colour object reflects all the visible light. Therefore, the object which absorbs maximum sunlight will become hotter i.e. black coloured objects. Whereas the object which reflects maximum colour will be less hotter i.e. white coloured objects. In winter we need maximum heat to keep us warm so we prefer to wear black coloured cloths. In summer we need to keep ourselves cooler so we wear white colour clothes that reflect maximum heat and protect us from heat.



4.2.2. Where there is fire there is Smoke!

Level/Class: 5

Curriculum links: Science

Activity duration: 35 minutes

Materials needed: Writing material

Approach: Outdoor activity with whole class

Topic:

Air pollution, sources of air pollution, effects of air pollution

Concept:

When anything is burnt in the open atmosphere or in the presence of air, it produces smoke. The smoke is a mixture of various gases, particles, shoots, carbon black, moisture and smell. The nature of these gases, particles, soot and smell depends on what substance or material is being burnt. These gases can be toxic in nature. Gases produced from burning plastics and tires are very poisonous. The particles, soot, carbon black can also be harmful if inhaled. Smell can also cause sickness. Carbon monoxide (CO) produced during burning due to insufficient supply of oxygen and poor ventilation of indoor areas (house, kitchen, factories) can cause unconsciousness and death of people present inside.

Aims:

To help students understand:

- Burning of any substance emits smoke that may be harmful to human health.
- Proper ventilation may help in reducing the harmful effects of smoke.
- Efforts should be made to avoid certain practices that are not essential and cause harm.

Key questions to address:

What is air pollution? How is it caused?

Method/Guide:

Brainstorm and ask students to observe which activities produce smoke in different indoor and outdoor situations. Ask them to prepare a list of these activities and share. For example:

- **Indoor:** Burning of wood for cooking, sawdust for water heating, Agarbattai, Dhup, mosquito coil, cigarette, beedi or hukka smoking.





- **Outdoor:** Vehicle tailpipes (burning of petroleum products inside the engine), burning of leaves, burning of garbage, cigarette, beedi or hukka smoking

Explain that smoke is composed of tiny particles that can enter our lungs when we breathe. The hair in our nostrils is able to prevent larger particles, such as sand or pollen from entering our lungs. However, certain particles in smoke are much smaller, and they may enter our body, and can make us sick. Smoke also contains harmful toxic chemicals or gases which can affect us. Smoke from burning of garbage, plastics, tires, chemicals, etc. contains poisonous chemicals and gases.



Smoking tobacco in beedis, cigarettes and hukka

- Smoke is especially harmful for babies and young children. Smoking beedis, cigarettes and hukka cause dangerous diseases and must not be done.
- Passive smoking is also harmful. Passive smoking is indirect inhaling of tobacco smoke by a person near another person who is smoking directly and exhaling the smoke in the air we breathe.
- If appropriate, explain to students that smoking can cause cancer, heart disease, lung disease and affect our brain. Short-term effects include coughing, throat and eye irritation.



Garbage burning

- Ask students if they have observed open burning of garbage or fallen leaves in the neighborhood
- Explain that open burning of garbage is illegal and there is a fine for this
- Ask students why garbage is burnt, and what can be done about it. You may continue the discussion about garbage burning in a separate activity
- Ask them to find out where can one report about the burning of garbage



Mosquito coils and agarbatti

Many households use mosquito coils, the smoke produced from this is very harmful for health. They should use mosquito nets while sleeping at night.



Pollution from vehicle

Tailpipes of motor vehicles produce smoke which is very harmful due to very fine particles and toxic gases in it. Petroleum products are burnt inside the engine of the vehicles and smoke is emitted into the atmosphere through its tailpipes.

- Ask students to observe smoke coming from the tailpipes of motor vehicles
- Ask them to identify the modes of travel which are not polluting or less polluting
- Tell them maintaining a vehicle, correct tyre pressure, and doing the Pollution Under Control (PUC) checks helps in reducing the pollution from vehicles.



Learning outcomes:

Certain human activities such as burning of substances causes air pollution. Air pollution is harmful for human health. Avoiding certain non-essential practices are good for protection of health.

Green habit:

- Never smoke tobacco.
- Do not burn any garbage or waste.

FAQs

Q - What are natural ways of air pollution?

A - There are some natural sources of air pollution. These are the pollen grains from the plants, spores of fungus, dust, etc. These can cause effects like allergies and aggravate existing respiratory diseases in children and sensitive people.



Q - What is indoor air pollution? How to reduce indoor air pollution?

A - Air pollution caused inside any building where people live or work such as home, school, office or factory is called indoor air pollution. This affects people more severely due to proximity and longer hours of exposure. Restricting the indoor air pollution source, switching to cleaner fuel and smokeless cooking stove, avoiding use of air polluting products and increasing ventilation can help reduce indoor air pollution.



4.2.3. Facial Dirt and Air Pollution

Level/Class: 5

Curriculum links: Science

Activity duration: 35 minutes

Materials needed: One clean, white cloth or handkerchief for each student

Approach: Outdoor activity with whole class

Topic:

Air pollution, exposure to air pollution

Concept:

We face pollution and dirt, it gets deposited on our face and skin when we are travelling in traffic on roads. Inhaled air pollution is harmful for living things including human beings especially children. The pollution and dirt deposited on the face of the students can be shown to demonstrate the amount of pollution and dirt present in the air around us. This can be observed as the amount of dirt and dust collected from the students' faces on a white cloth.

Aims:

To demonstrate the amount of air pollution one is exposed to on a typical day.

Key questions to address:

How does air pollution affect us?

Method/Guide:

1. Students should be asked to bring a clean cotton white cloth or handkerchief with them. The cloth should be kept clean to get a clear result.
2. On the day of activity, students should wash their faces in the morning with soap before leaving for school.
3. Upon arrival at school, students should dampen the clean cloth and wipe their faces carefully. They should observe the color of the cloth and compare the amount of dirt or dust coming on the cloth.
4. Students can then discuss different routes they took to school and compare which routes and which modes of travel like bus, car, cycle, motorcycle, walk resulted in more dirt on the face.
5. They should discuss if the dirt from the air deposited on the face is such, what could be the quality of the air they are breathing and what would be the status of the surface of the lungs.

Extension/Variation:

This activity can be conducted on specified routes and at different times during the day to test for varying amounts of dirt in the air.

Learning outcomes:

The amount of dirt and dust present in the air as pollutants and the quantity of air pollution that can be faced and observed on various roads they travel.

Green habit:

Use public transport buses.

FAQs

Q - How can students protect themselves from such dirt?

A - Students can take the routes which have lesser polluting sources like vehicles emitting air pollution to protect from dirt. They can also use public transport or school buses which are higher from the road surface and to a smaller extent protect from the dirt and pollution coming from the tailpipe of the vehicles. They can also use green modes and green corridors and promote people to use them which are non-polluting modes like bicycles and cycle lanes through vegetation areas.

Q - How can dirt or dust from the air be prevented?

A - Thick and tall plantations of local tree species with dense canopy of leaves can act as a barrier to filter out the dirt and dust particles from the air. It works as a barrier between a polluted area separating the residential area. Ground vegetation like shrubs and grasses help suppress the dust arising from the open space by holding the soil through its root and by increasing the moisture in the soil.

4.2.4. Wet Cloth Filtration

Level/Class: 5

Curriculum links: Science

Activity duration: 35 minutes

Materials needed: A clean cloth mask, Chemical balance and Desiccator

Approach: Outdoor activity with whole class

Topic:

Air pollution, sources and exposure to air pollution

Concept:

Pollution in the air can be inhaled while breathing. If the particle size is very fine, it can reach inside the lungs and other parts of the body through blood thus, affecting them. If the chemical nature of the particle inhaled is harmful it will have adverse effects on different parts of the body. Children are one of the most vulnerable groups to the effects of air pollution. Best option is to control the air pollution. We need to protect ourselves from the health impacts of air pollution by the time we achieve good air quality in our village or city. COVID19 pandemic can have a worsening effect combined with poor air quality.

Aims:

- Dust and soot breathed in while travelling on busy roads.
- Importance of using pollution masks.

Key questions to address:

How does air pollution enter our body and affect our health?

Method/Guide:

1. Place the cloth mask in a desiccator/dry in hot sun for 2 to 4 hours to remove the moisture content of the cloth.
2. Weigh the cloth on a chemical balance and note down the reading in your notebook. Take three minimum measurements and find out the average.
3. Plan a route of travel on busy roads; perhaps the route to school.
4. Dampen the mask with clean water, put on and drive/walk the first route. Record the length of time the route took.
5. Remove the mask and dry it in the desiccators/dry in hot sun for 2 to 4 hours, then weigh and record the weight in milligrams.

6. Students should compare results with classmates and plot a chart of the routes to school that seem to have more dust pollution.
7. Discuss the results with the class. Discuss causes of pollution and preventative measures to limit dust intake. Tell them that children are one of the most vulnerable groups to the impacts of air pollution.
8. Discuss what can be done by them to prevent and reduce the air pollution and its effects on them.
9. Explain to children that they can choose the travel modes which are green or less polluting and reduce the activities causing air pollution. They should protect themselves from going into more polluted areas and reduce their exposure to air pollution by using masks when the air quality is poor.



Learning outcomes:

The amount of dust and soot they breathe while travelling in traffic on roads and the preventive measures during episodes of poor air quality.

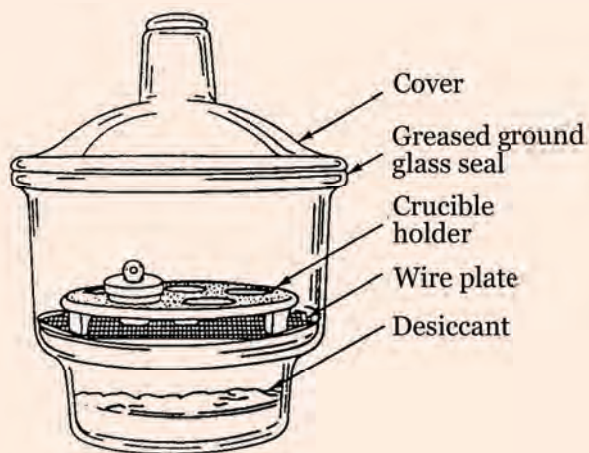
Green habit:

Wear a pollution mask in poor air quality.

FAQs

Q - What is a desiccator?

A - Desiccator is a glass container which has a drying agent for removing moisture from specimens and protecting them from water vapor in the air. It removes moisture as it may affect the weight of the sample when the difference is minor in milligrams. The sample/specimen should be dried to remove the moisture to get the correct weight over a chemical balance. If the desiccator is not available it can be sun dried. One can also make a desiccator by putting anhydrous lime (calcium oxide, CaO) in a glass jar.



Q - Which type of mask will help keeping out dust and soot?

A - The masks made up of materials or cloths with very fine pores can filter out the pollutants or fine dust particles causing air pollution. The masks made up of N95 filter material/cloth are capable of filtering the fine dust particles or particulate matter from the air we breathe. But it may not be that effective for gaseous air pollutants.



Level/Class: 5

Curriculum links: Science, Mathematics, Social Studies

Resources and Preparations needed: stationary, worksheet, calculator, pen, pencil, colour pens and pencils

Project Timing:

- # *Project Allotment and Team Formation - start of the academic year*
- # *Preparation of project plan and work distribution - before the semester examination*
- # *Fieldwork and Survey - Holidays after semester examination*
- # *Data Collection, Analysis and Report - Before the final examination*
- # *Presentation - Before the end of year*

Topic:

Energy, air pollution, climate change, sustainable mobility, energy conservation

Concept:

Transport plays an important role in the overall development of the nation. Transport sector in India is a major energy consuming sector, particularly petroleum products. Almost half of the total petroleum products of the country are consumed by the transport sector alone in the form of diesel and petrol.

Energy consumption in the transport sector has increased at the rate of 3.1 percent per year between 1970-71 and 1980-81. It grew at a much faster rate of 4.9 percent per year between 1980-81 and 1990-91, and at 5.6 percent per year during 1990-91 to 1997-98. Higher rates of growth of energy consumption can be attributed to the shift that has occurred from a rail dominant economy of the 1950s to a road dominant economy in the 1980s. Also, there has been a sharp increase in the use of personalized modes of transport, partly due to inadequate public transport systems.

With the increase in diesel and petrol consumption and the limited resources available to us, there is a need to look at alternative ways of transportation. Small changes in our habits like cycling and walking for short distances instead of taking a vehicle and creating a demand for improved public transport can help to save a lot of fossil fuel and emission of pollution.

Objective:

Learning objectives:

- Become aware of various types of transportation and how much fuel is consumed by each.
- Calculate and compare the energy efficiency of a variety of automobile models in the market.

Action objectives:

- Students should be able to adopt sustainable transportation.

Project Plan and Schedule:

Step	Location	Duration
Project Introduction	School	30 minutes
Project Allotment and Team Formation	School	30 minutes
Preparation of project plan and work distribution	School	30 minutes
Interview questionnaire preparation	School	30 minutes
Interviews in the field	Community	Holidays
Data Collection, Analysis and Report	School	30 minutes - 3 week
Presentation	School	30 minutes

Project Steps in Detail:

1. The students should ask their local bus station or any bus driver the following questions:
 - What fuel is used?
 - What is the cost of the fuel per litre?
 - What is the average distance (in kilometres) the vehicle travels per litre of fuel?
 - How many people can ride in the vehicle?
 - How many people usually (at least on 50 percent of the occasions) ride in their vehicle?
2. The students should interview a couple of drivers of cars, auto rickshaws, motorcycles, scooters and other vehicles to get the above details for their vehicles. Record all the data in the “Transportation Chart”.
3. The students should calculate the fuel used per person if he/she goes the same distance by bus, car, motorcycle, bicycle, and other forms of transportation.



<i>Vehicle</i>	<i>Fuel Used</i>	<i>Average No. of Passengers</i>	<i>Fuel Efficiency km/l</i>	<i>Litres per Kilometre per Person</i>	<i>Cost per Person per Kilometre</i>
<i>Moped</i>					
<i>Scooter</i>					
<i>Motorcycle</i>					
<i>Autorickshaw</i>					
<i>Car</i>					
<i>Jeep</i>					
<i>Van</i>					
<i>Mini Bus</i>					
<i>Bus</i>					
<i>Bicycle</i>					
<i>Cycle Rickshaw</i>					

Discussion

Ask the students the following questions:

- Which form of transportation do you choose most often, and why?
- What other factors are considered in choosing a mode of transportation?
- Which form of transportation is most energy efficient?
- What is the challenge in using the most efficient mode of transportation?

Extension/Variation:

- Ask the students to collect brochures of different models of any one type of vehicle (say a car, SUV, scooter or motorcycle).
 - Let them mark the salient features of each model that are used for promoting its sales.

- Let them find out efficiency in km per litre of fuel.
- Ask the students to also compare walking and bicycling with these options.
- Ask the students to put together a “Transportation Guide of the Year” that advertises a current model of the type of automobile that is most fuel efficient and energy conserving. Throughout the year, more drawings, pictures and information about transportation can be added.
- Ask them, if given an option (assuming that they know how to ride/drive all the vehicles), which model and brand would each student select for his/her personal use and why? What criteria did they consider in making their selection?
- Ask them to plan and organize a “Wise Traveller Campaign” for the school, aimed at cutting down use of personal vehicles, encouraging use of bicycles, public transport and pooling.

Learning outcomes:

- Awareness of various types of transportation options and how much fuel is consumed by each vehicle.
- Calculate and compare the energy efficiency of a variety of automobile models available in the market and their per capita per km energy consumption.

Green habit:

Promote and use green modes like walking and cycling when you can.

FAQs

Q - How can we promote green travel?

A - Making walking and cycling convenient, safe and pleasant will invite more and more people to choose green modes. It needs to design road spaces in a way that it provides safe space and infrastructure for the green modes. Further the space should be designed to make it a seamless experience for the users. For that it requires giving priority to green modes and people over other modes. Construct wide and maintained encroachment free pedestrian paths and cycle paths as well as crossing facilities with traffic signals for pedestrians and bicycles.

Thus, as a citizen we need to demand for implementation and execution of such safe and convenient infrastructure and services for people as prescribed in the transport policy of India as well as push for not implementing projects which are taking away space for such modes on road or make them inconvenient and unsafe for green modes. Older models of transportation, such as the higher level of motorization and infrastructure to promote them, negatively impact the green modes of travel.

Q - What can be done with this information of the Transportation Chart?

A - The information compiled as the Transportation Chart can be used to inform the commuters, potential users and decision makers in the community and local government through parent teacher's meetings, in Ward or Gram Sabha or exhibitions on days like environment day, earth day, science day and in festivals, etc. Discussions can be organised to make people aware of the choices they are making and the collective impacts of their choices on the coming generation of students. This information can be presented with the help of visuals, posters, slide show, video, art and craft, poem, slogan, play and other interesting ways.



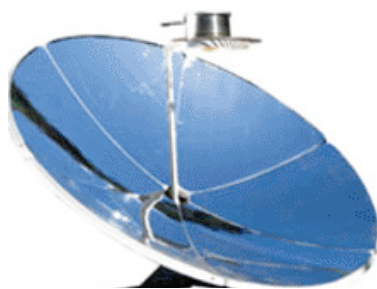
Level/Class: 6

Curriculum links: Science, Social Studies

Activity duration: 30 + 30 minutes in classroom and other for information collection at home.

Materials needed: Writing material.

Approach: Outdoor activity with whole class done individually.



Topic:

Energy, indoor air pollution, cooking fuel, smokeless Chulha

Concept:

Indoor air pollution is one of the major causes of health impacts especially on women, children and elderly living in the house. The fuel used for cooking is a major reason for the indoor air pollution. Solid fuels like biomass when used produce a lot of smoke. These generally are wood, firewood, crop or agriculture residues, dung cakes (upale), etc. Sometimes they also use coal or sawdust for heating water at home.

Old Chulhas (cooking stoves) are poorly designed which do not burn fuel properly and also produce lots of smoke inside the kitchen. Smokeless briquettes and improved smokeless Chulhas with proper ventilation and Chimneys (stacks) are developed and being promoted by the government and nongovernment organizations for replacing old polluting cooking stove technology. These improved smokeless Chulhas can easily be adopted with support from these organizations to reduce the burden of diseases due to indoor air pollution on women and other family members at home. LPG is being promoted as a pollution free fuel for cooking. Adopting a clean fuel and smokeless Chulha saves the cost of medical expenses and helps in improving the health of family members.

Aims:

- Understand various fuels used as source of energy for cooking in the community.
- Analyze the rate of various energy resources on the basis of their environmental impacts.
- Know importance of using improved smokeless Chulha and cleaner fuel to reduce indoor air pollution.

Key questions to address:

What is indoor air pollution? What fuels and cooking stove/Chulha are used for cooking food at households?

Method/Guide:

1. Ask students to do a quick survey in their community or neighborhood to find out about the types of fuels used for domestic purposes like cooking, water heating and other uses at home. They should also find out about the type of Chulha, cook stoves or other mechanisms, if any, they use for these purposes.
2. They should talk to some 10 to 20 households in their community or neighborhood to find out about this. If possible, they should try and talk to people living in the village or rural area, in the communities of the economically weaker sections. They can also talk to people coming to work in their house or society like Moushi (domestic help), Watchman Kaka, Mali Kaka (gardener), Safaiwale Kaka (waste collector), Dhobi Kaka (laundry person), etc. They can talk to some informal workers like auto drivers, hawkers and vendors, etc. from their area.
3. They should find out following aspects from them:
 - a. How do they cook food at their home?
 - b. What fuel do they use for cooking?
 - c. From where do they bring or buy the fuel or refill if it is LPG
 - d. About how much do they spend on buying fuel every month?
 - e. What cooking stove/Chulha do they use for cooking?
- f. If not LPG stove, is it a smokeless Chulha?
- g. Do they use some other methods for heating water for bathing or other purposes?
- h. What fuel they use for heating water?
- i. From where do they bring or buy the fuel?
- j. What method do they use to heat water (bumb, etc.)?
- k. About how much do they spend on buying fuel every month?
 - l. Do they use fuel for any other purposes like heating in winter nights?
4. Students can also ask about the health related aspects from them; like if they are using solid fuels at home do they face any problem. For example:
 - a. Is there anyone at home facing problem due to smoke in the home?
 - b. Is there anyone at home have any respiratory or breathing problem?
 - c. Is there anyone at home with asthma, or other allergy-related problem?
 - d. How is the ventilation in the home or kitchen?



5. Students should note basic information about the household like economic status, number of members in the household, earning members and address of the place where they live.
6. They should also ask if they are willing to have any cleaner source of energy.
 - a. For cooking.
 - b. For heating water or other purposes.

Observation Table:

Address/location of the household	
Number of members in the household	
Number of earning members in household	
Approx. monthly income of the household	

Information required	Cooking	Water heating and other
Fuel Used (LGP, Kerosene Oil, Biogas, Coal, Wood, firewood, sawdust, Crop/ agriculture residue, Briquette, Dung cake, Other, please mention)		
From where fuel is brought or bought		
Amount spent on fuel per month		
Stove or heating method		
Smokeless stove, Chulha, Chimney, Bumb		
Any other uses - home or winter heating		

Problem faced due to indoor smoke	
People facing health problem due to indoor smoke	
People having respiratory, allergy or asthma problem	
Quality of ventilation	
Need clean fuel / Chulha for cooking	
Need clean fuel for water heating / other purpose	

7. They should compile their information and analyze it.
 - a. What all types of fuels are used by the household in the area?
 - b. How many of them use clean fuel like LPG or other solid fuel?
 - c. How many household do not have clean fuel?
 - d. How many of them use different fuels and methods for cooking, water heating and other household uses?
 - e. How many of the households use solid or polluting fuel for heating and other purposes?
 - f. How much money do they have to spend on an average to buy fuel for cooking and other uses?
 - g. How many households face health related issues?
8. Discuss the outcome of the study in the class. Explain the problems associated with the indoor air pollution and accessibility of energy by all in the country. Discuss the problem of use of solid or polluting fuel for cooking. Ask students what can be the solution for this problem. Can a solar cooker or a community solar water heater be the solution?

Learning outcomes:

Indoor air pollution and one of the major sources of it. Cooking fuel and stove used by different households, especially economically weaker sections, challenges, impact of indoor air pollution and possible solutions for it.

Green habit:

- Promote and use clean fuel and smokeless Chulha for cooking.
- Soak pulses (Dal) and rice before cooking to reduce fuel usage.

FAQs

Q - What is the calorific value of a fuel?

A - Calorific value of a fuel is the amount of energy produced after burning a unit quantity of the fuel. Different fuels vary in the amount of energy produced from it. This also depends on the level of purification and carbon content of the fuel. Some fuel has presence of other minerals or content in it which does not give energy rather give residues like ash or produce smoke due to presence of other volatile material or moisture. For example, methane gas has a higher calorific value than coal.

Q - What is a cleaner fuel?

A - The fuel that generates a lesser amount of smoke or pollution is comparatively a cleaner fuel. For example, LPG generates less smoke compared

to coal. Similarly, a briquet generates less smoke compared to fuelwood. Briquet is made after a process to remove its smoke producing content. Bio gas or Gobar gas is one form of cleaner fuel produced from animal dung and leftover food items. It can be used for cooking, heating and lighting purposes without any smoke.

Q - How does improved smokeless Chulha work?

A - Improved smokeless Chulha reduces smoke produced by burning of the fuel. It combines two - three technologies including a cleaner fuel. It increases the air flow so a fuel is burnt completely in the presence of oxygen and lesser smoke is produced due to unburnt fuel. It also provides a Chimney or stack that releases the remaining smoke produced, outside of home at a height. There are many models and varieties of smokeless Chulha available with varying prices which can be used at home.

Case Story: Promotion of smokeless chulha

Many households use biomass or crop residue as fuel for cooking or heating water in villages and cities. The chulha (cookstove) used to burn this fuel is often of an old design and produce lot of smoke. This results in indoor air pollution and impacts health of women, children and elderly at home.

Smokeless Chulha is a simple design and technology innovation that benefits the poor families who do not have access to clean fuel like LPG. It is beneficial for them as it mitigates the health impacts caused by the indoor air pollution. Improved models of smokeless chulha are now available. They cause much lesser smoke, and that is also guided out of the kitchen area through a chimney.



The cost of a smokeless chulha is not too high, compared to its benefit. However, many are not aware about improved smokeless chulha, its uses, costs, benefits, and financial support to buy one.

Ms Anita Gurnule took the initiative to promote the improved smokeless chulha in Jarur village in Nanded District. She went household to household and spoke to both men and women to invest in smokeless chulha for the health of the women members in the family. She organized demonstrations of how to use the smokeless chulha and spoke about the benefits. She helped to get the stove installed for those who decided to buy one. She suggested that the women's self-help group (SHG) provide financial support for whoever needed it.

Many households have adopted the smokeless chulha. Ms Anita also trained the self-help group members to talk about the smokeless chulha among the people they know.

Ms Anita Gurmule's work was recognized and honoured with the Srushti Mitra Award by the Environment Department, Government of Maharashtra.

4.2.7. Kick the Habit and Pick Right!

Level/Class: 6

Curriculum links: Science, Social Studies

Activity duration: 30 minutes

Materials needed: Writing material

Approach: Outdoor activity with whole class done individually



Coal



Pellet



Briquette

Topic:

Energy, pollution and environment impacts of fuel explorations

Concept:

Wood, crop wastes, coal, dung and charcoal are the most widely used cooking fuels. But when they burn, they all can cause pollution and breathing problems. Many people are turning to other cooking fuels such as sunlight, processed plant wastes (rice husks and other crop wastes made into pellets or briquettes), and biogas (a gas produced by rotting plant matter and human and animal waste). Use of solid fuel to meet energy needs causes indoor air pollution posing a significant public health hazard, particularly to the poor and vulnerable women and children. Wood and charcoal are scarce resources and mining these causes an extreme impact on the environment.

Aims:

- Understand various fuels used as source of energy for cooking in the community.
- Analyze the cost of various energy resources on the basis of their environmental impacts.

Key questions to address:

What are the different sources of energy? What are the environmental impacts caused by exploring these fuel sources?

Method/Guide:

1. Let students list all the sources of energy required to heat a bucketful of water for a hot bath. (Please note that electricity is a form of energy and not an energy resource.)
2. Ask students to think of various steps involved in converting different sources of energy into a source of usable energy. Some resources like firewood may not need any conversion for direct use. But many other resources like coal, natural gas, petroleum products and nuclear material have to be mined in the first place and transported for refining and enriching to allow further use. This and energy generation require large infrastructure. This will help them realize that all energy resources must be processed and converted by

machines and other kinds of equipment into usable energy for end use. This would involve many steps and stages.

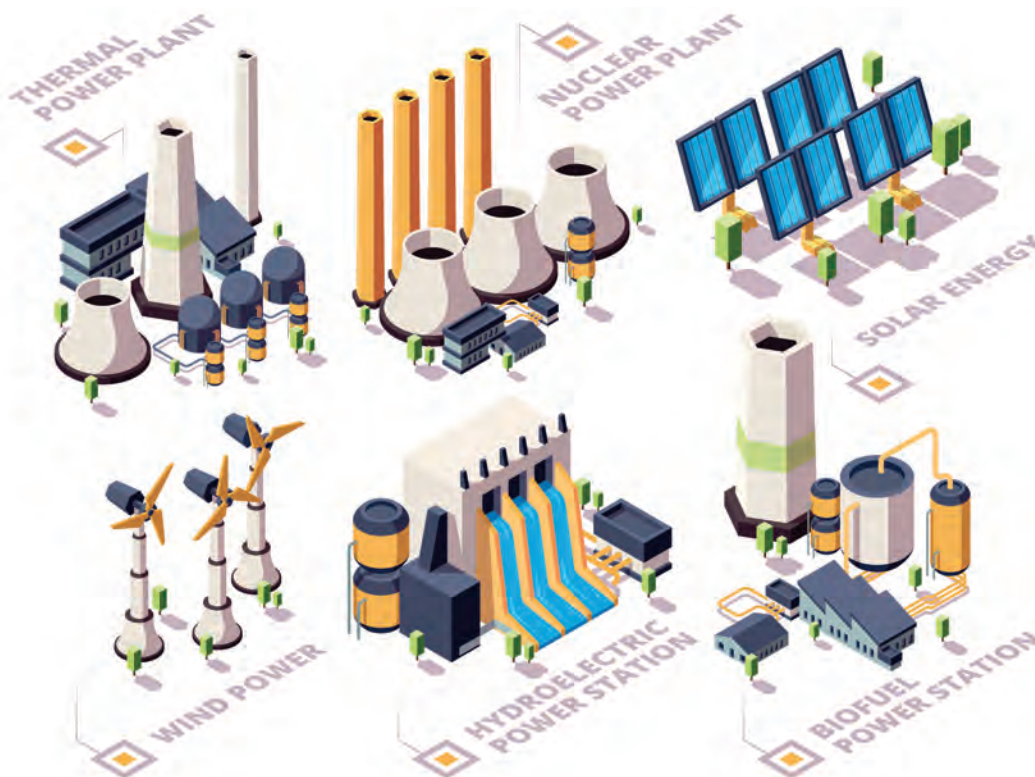
3. Help students list the ecological and other consequences of various stages of energy production which are seldom taken note of. Some of these are:

- Energy itself is consumed in each stage of energy production (e.g. mining coal requires equipment that runs on diesel, petrol and electricity).
- Also, these activities pollute natural resources like air, water, soil and the constituents of the natural environment. Waste is generated in large quantities in this process. The pollutants and wastes affect human health too.
- Energy generating set-ups and may be sources of potential hazard. For instance, a nuclear plant is a threat to the area around; a dam impounding huge amounts of water could breach and inundate low lying areas.

4. Now, draw the Energy Source-Steps-Consequences matrix on the black board. The columns represent energy sources, while the rows discuss associated factors. Assign one energy resource to each group.

5. Let them discuss within the group which of the steps and consequences identified and listed in the matrix are applicable to the energy resource given to them.

6. After 10 minutes, one from the group could come to the board and put a cross mark against each applicable stage and consequence. Tally the number of crosses. The number of crosses for an energy source is indicative of its degree of deviation from an ideal source.



Energy Source-Steps-Consequences Matrix

Steps	Source steps/ consequences	Coal	Oil	Natural gas	Hydro-electric	Wind	Fire wood	Bio gas	Geo-thermal	Solar	Nuclear
	Mining/ Harvesting										
	Transporting										
	Enriching/ refining										
	Generation										
	Transmission										
	Large infrastructure requirement										
	Waste generation/ disposal										
	Pollution										
	Greenhouse gas emission										
	Disruption of ecosystems										
	Human health										
	Potential hazards/ risks										

Discussion

Discuss why in spite of having energy sources that are dependable, renewable, safe and environmentally sound, today's primary sources are natural gas, oil and coal which are non-renewable sources. What are the barriers to using renewable sources like wood, biogas, and water with potential energy, geothermal sources, solar energy and wind energy?



FAQs

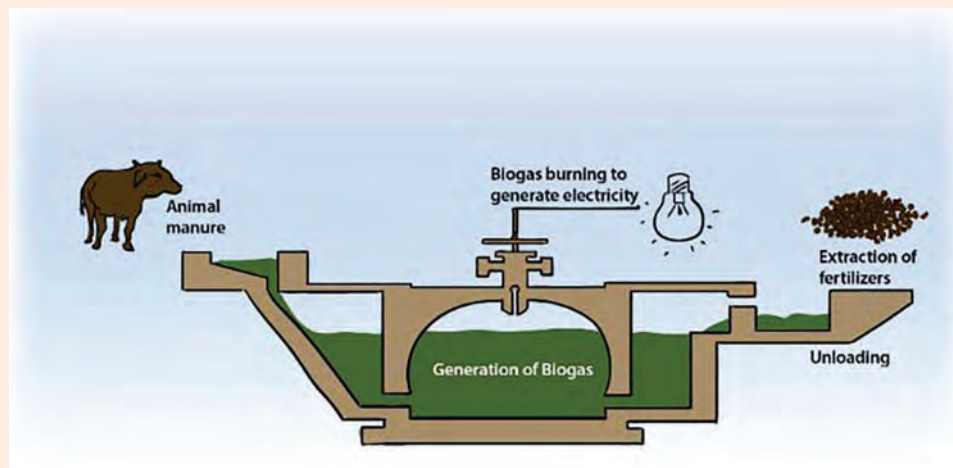
Q - Can energy be produced from waste?

A - Some waste like animal dung or food waste from restaurants can be used to produce gobar gas or biogas. This gas, having higher methane content can be used to produce energy by burning for cooking or running a generator to produce electricity.

Some agricultural residues are also used through certain technologies to produce gas and then electricity. There are some technologies like gasifiers which are used to convert biomass into gas to run electricity generators. Briquets made from biomass charcoal can also be used for cooking purposes.

However, municipal waste cannot be used to produce energy. For producing energy from municipal waste, it needs to burn it. But the calorific value of the municipal waste is low and it cannot produce energy. This is because municipal waste does not contain things which will give a higher amount of calorific value after burning. It also contains a higher amount of moisture, 40 to 60 percent and inert dirt materials. Usually, net energy is consumed in order to burn municipal waste when calorific value is less and energy is not produced. Also, this process is very polluting and produces toxic and obnoxious gases like dioxane due to the presence of various materials in waste like plastics, tyre, rubber, synthetic materials, other chemicals at degraded stage like paints, medicines, home chemicals, etc. It is strictly prohibited to burn municipal waste.

Waste to energy plants for municipal waste have failed and incurred losses around the world including many cities in India.



Incineration is the process where waste is burnt at higher temperature to dispose of the waste. But this process causes release of toxic and obnoxious gases in the atmosphere which are harmful for living things and the environment. This process is very polluting and banned in India.

Q - Is nuclear energy a clean energy?

A - Many times, nuclear energy is suggested as a solution to mitigate climate change as short sightedness. Because it does not produce carbon dioxide (CO₂) responsible for global warming. But nuclear energy poses a very long lasting

threat of radioactive nuclear waste generated in nuclear power plants and mining activities in higher amounts. It also possesses the risk of nuclear accidents that can wipe out the populations and affect generations. In reality, it is much more hazardous for civilisation compared to other sources of energy.



Learning outcomes:

The key elements related to sustainability of energy resource extractions and uses such as mining, refining, transportation, generation, transmission and by-products like waste and pollution.

Green habit:

Conserve energy at all places and use renewable energy.

4.2.8. Cello Tape Sampler

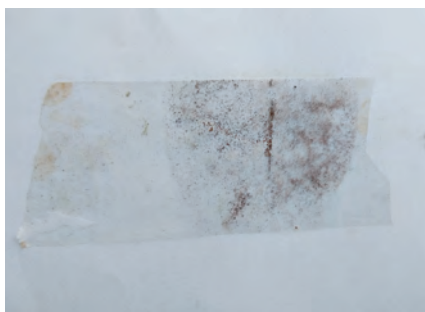
Level/Class: 6

Curriculum links: Science, Social Studies

Activity duration: 35 minutes

Materials needed: Transparent Cello tape, A4 size plain white paper sheets, pen or pencil

Approach: Outdoor activity for Individual student



Topic:

Air Pollution, sources of pollution and polluted areas

Concept:

This activity shows the amount of dirt and dust gathered on the leaf surface near a polluted area. It can be performed in different areas such as roadside, traffic junction, near any garden, near school, near any residential area or house of the students. This will give an understanding of the amount of air pollution in that area.

Aims:

To understand the amount of air pollution in any area of the village or city.

Key questions to address:

How to compare air pollution from different areas? Which area is more polluted?

Method/Guide:

1. Ask students to pluck one leaf from different areas including near a garden, near school, near their home or any residential area, from roadside and traffic junctions, near any industrial area, a construction site or power plant.
2. Place the leaf carefully on a flat surface, without turning the leaf upside down. They should then put a fresh transparent Cello tape on the upper surface of the leaf. The Cello tape piece taken for it should be about half to one inch longer to the leaf blade/surface size from both the sides.
3. They should then gently press the Cello tape so that all the dirt and dust deposited on the leaf surface get stuck to the Cello tape. They should carefully remove the Cello tape and paste it on a clean plain white paper sheet of A4 size and stick to it.
4. They should write the place from where the sample was taken on the paper using a pencil or pen.

5. Students should bring this Cello tape sampler to the classroom and compare which Cello tapes are darker and which ones are less dark.
6. Students should then discuss the different places from where they have collected the samples. Draw the inference, the samples of which places seem darker and hence more pollutant.
7. The sample from the places where there is traffic, construction and other activities; sources of pollution and dust might be darker than at places like garden, forest, hills or places away from roadsides, etc.
8. What is the color of the samples collected from near to school?

Learning outcomes:

The intensity of air pollution in different areas and ability to compare the activities and sources with the level of pollution in that area.

Green habit:

Conserve and plant more indigenous trees.

FAQs

Q - Is there a difference in pollution levels in different months?

A - The air pollution decreases in rainy seasons and air becomes cleaner. It is because the air pollutants present in air get washed away with rains. Therefore, we experience cleaner air in monsoon or rainy seasons. Though, this might produce acid rain if acid is present in the atmosphere and gets dissolved in rainwater. Acid rain can cause harm to plants, agriculture, soil fertility, properties and heritage.

In winters, the wind is comparatively cold and calm. This reduces the mixing of air and restricts dispersion of air pollutants in the atmosphere to a lower height. The concentration of air pollution gets built up in the atmosphere near to the ground surface. Therefore, in winter months people experience higher levels of pollution and pollution related diseases. It is also advised to people, especially to elderly citizens and sensitive

people, that they should not go for morning walks till morning Sun has risen up and heated up the atmosphere to some extent.

At many places, fog and air pollution form smog i.e., smoke (pollutants) and fog. In the presence of sunlight, it reacts and produces harmful pollutants called photochemical smog. It is very harmful and sometimes becomes hazardous for human beings.

Q - What effect on air pollution was experienced during lockdown?

A - During the national lockdown of 2020 we have experienced that the air quality has improved to a great extent. This is experienced in all highly polluted (non-compliant) cities in India due to closure of the activities that cause release of air pollution in the atmosphere. This showed that if we close or change the activities that are causing air pollution, we can easily achieve a healthy level of air quality. It is possible to achieve this if we take the public health impact of poor air quality seriously to save the lives of people in a similar way as we have taken the pandemic.

4.2.9. Grandparents Stories

Level/Class: 6

Curriculum links: Science,
Social Studies

Activity duration: 35 minutes

Materials needed: Writing
material

Approach: Indoor activity for
individual, interview

Topic:

Air pollution, sources of air pollution

Concept:

Air pollution has increased severely in recent years due to changing nature or activities, increasing number of vehicles, construction and reducing vegetation cover in the cities. Air in the cities was not that polluted some 2-3 decades back. But for the present students it sometimes becomes unimaginable that there was cleaner air in cities or villages. Students can take a recent historical perspective of the city talking with the grandparents or elderly people in the society.

Aims:

To get an understanding of changing perception of air quality in our villages and cities.

Key question to address:

Is air pollution a persistent problem? Or is it due to present day activities?

Method/Guide:

1. Explain to students that they have to find out whether their village or city has always had poor air quality, or is it a more recent phenomenon. Ask them how they will be able to find this out. In fact, it is important to monitor air quality over a number of years to establish a trend. While there is data for a few years already available, it is not yet adequate in terms of both quality and the number of years, to establish trends accurately.
2. One way to find out a qualitative perception about air quality is to ask elderly people about the changes they have observed over, say, the last 30 years. Students would have to interview their own or friend's grandparents who have been long-time residents of their village or city about the weather and quality of the air.
3. Ask students what kind of questions they will ask when they interview grandparents or elderly people. Questions may include:

- What was the climate like during the summers in your youth?
- How often did you need to use the fan?
- Approximately, for how many days summer season was observed during that time?
- What do you feel about the present climate?
- What about the amount of air pollution in the village/city in general when you were youth?
- Which parts of the village/city had bad air pollution, say 30 years ago? Which parts of the village/city are polluted now?
- What do you see has changed from then that has caused the increase in air pollution in the village/city?

5. All interviewers should note down the answers. Let students present and compare interview notes in class. Is there a general similarity in responses?

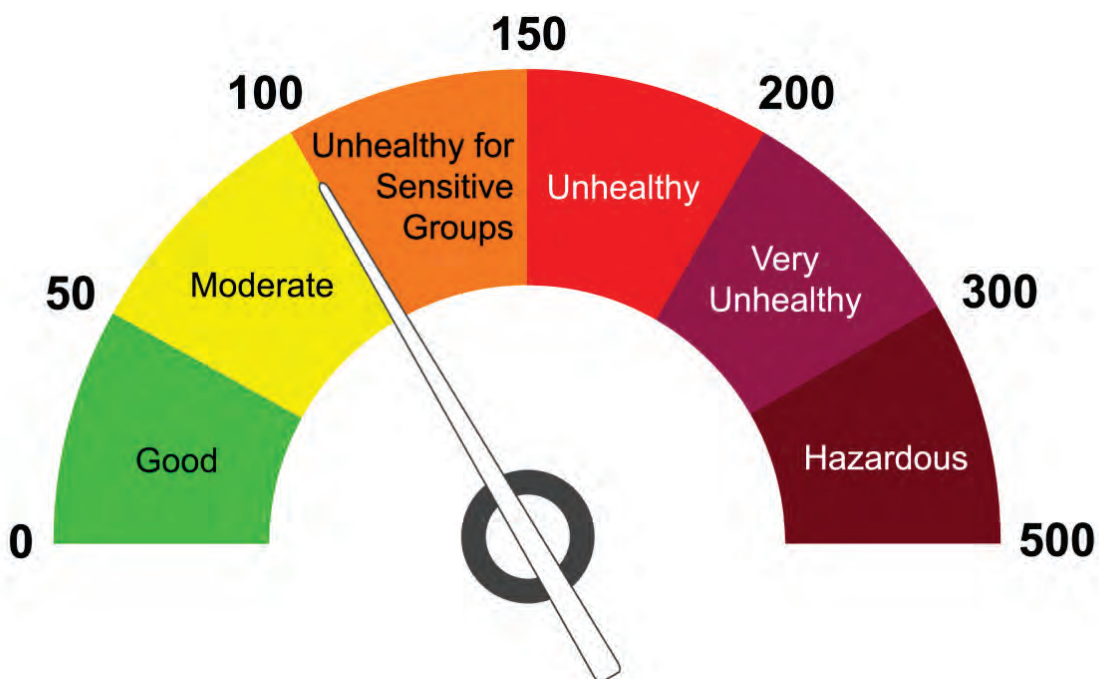
Discussion:

- What major changes have grandparents seen that have resulted in poor air quality?
- Have students experienced bad air quality?
- On which occasions did they feel that air quality in the village or city is not good?
- In which parts of the village or city do people feel that air pollution is the worst? Are crowded or congested parts more polluted?

Prepare a list of such experiences:

4. Students can use this opportunity to share with their elders what they have learned about the quality of air in their village/city. Elders will be surprised and delighted that the younger generation is both informed and concerned about the increasingly poor quality of the village/city's air.

- 1.....
- 2.....
- 3.....
- 4.....



Learning outcomes:

The changing perspective of air pollution in their villages or cities and how the quality of air is changing with the changing activities.

Green habit:

Adopt and promote green and eco-friendly lifestyle.

FAQs

Q - What is slash and burn agriculture practice? How should it be changed?

A - Slash and burn is an agricultural practice that involves cutting and burning of plants in forest to create a field. The practice begins by cutting down trees and plants in an area. The slashed vegetation is left to fry. This is then burned to give a nutrient rich layer of ash which makes the soil fertile and temporarily eliminates weed and pest species. In about three to five years the land productivity decreases due to depletion of nutrients and farmers abandon the land and move to a new area. The time it takes the land to recover varies from five to twenty years depending on the location, after which the land can be slashed and burned again repeating the cycle. It is called jhum or jhoom in local terms.

This used to happen in earlier days but now it is restricted to very small proportions in some remote or interior parts due to non-availability of land and changing farming methods of manually enriching the soil nutrition by the use of manure

or fertilizers. If it still persists in some areas the community practicing jhum can be supported to shift to other farming methods by hand holding them with training and communication.

Q - Why is crop residue or stubble burning done, is it useful?

A - Stubble, the remains of the crops after harvesting are burnt in the field. It is probably an old practice with the belief to enrich the soil with the nutrients and minerals from the ash of the crop residues required to grow the crop. It might be relevant in older times when nutrients were not added externally to enhance soil fertility. It is also practiced in order to clear the land.

Crop residue or stubble burning is one of the major sources of air pollution. Burning of farm waste causes severe pollution to land, water and air on local and regional level. When crop residue is burnt, the existing minerals and supporting microbes present in the soil get destroyed which adversely hamper the soil fertility and cultivation of the next crop. In the present time, when nutrients are provided externally by adding compost and manures it is not required to follow this practice of burning the crops.



Level/Class: 6**Curriculum links:** Science, Social Studies**Resources and Preparations needed:** Worksheet, pen, pencil, colour pens and pencils, map of the village or city or the neighbourhood area of the school**Project Timing:**

- # Project Allotment and Team Formation - start of the academic year
- # Preparation of project plan and work distribution - before the semester examination
- # Observation and Record - continue activity over the academic year
- # Data Collection, Analysis and Report - before the final examination
- # Presentation - before the end of year

Topic:

Air pollution, sources of air pollution

Concept:

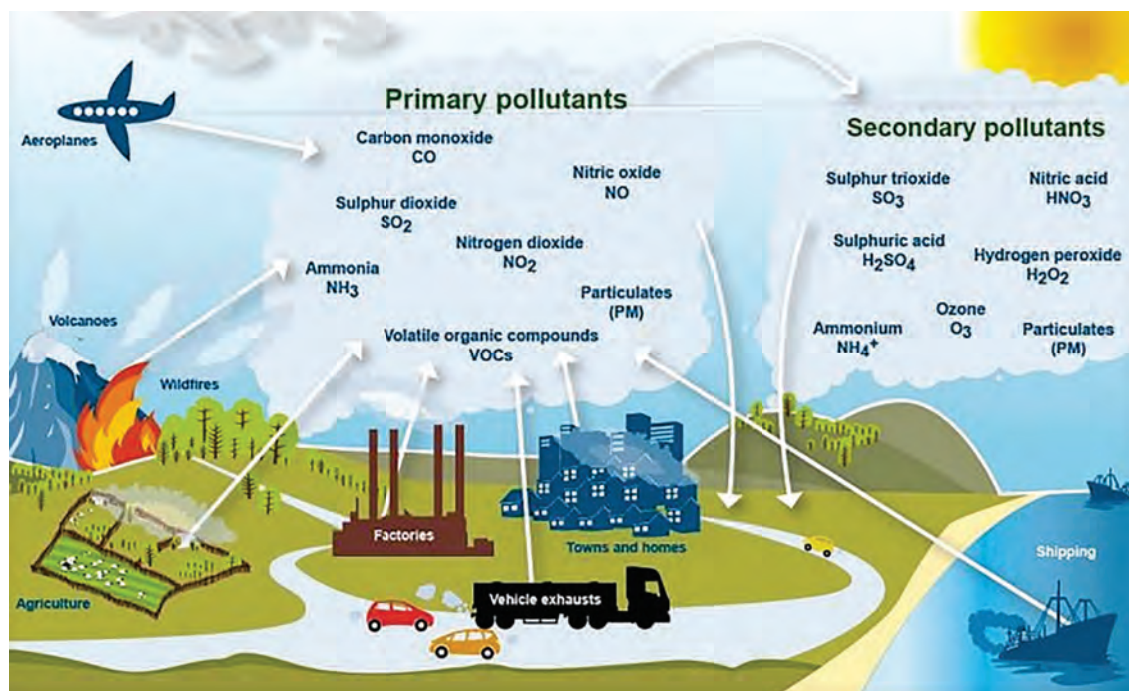
Identification of activities and sources in our surroundings that emit air pollution and creating a list of activities with site locations and its classifications according to source types such as power plant, industry, waste burning, transportation, construction, road dust, agricultural burning, household or residential, etc. Identify the possible action to control the emission of air pollution and inform the agency responsible for the local area.

Objective:**Learning objectives:**

- To help students understand various activities that lead to emission of air pollution and the sources of air pollution in their village or city.

Action objectives:

- Students can try to think on the role they could play in improving the air quality of the village or city and act on that.



Project Plan and Schedule:

Step	Location	Duration
Project Introduction	School	30 minutes
Project Allotment and Team Formation	School	30 minutes
Preparation of project plan and work distribution	School	30 minutes
Observation and Record	Community	Continue activity over the academic year
Data Collection, Analysis and Report	School	30 minutes - 3 week
Presentation	School	30 minutes

Project Steps in Detail:

Ask the students to list down various activities and the sources that they observed emitting air pollution in the surroundings. This can be in the neighbourhood of their school, home or society. They can also look at these while travelling in their village or city. They can keep their observations on for a week or two. They should note down the information gathered through their exploration in an observation table, given below.

Students should be observing the activities and sources of air pollution as mentioned below, classifying broadly under the following categories:

- Power Plant (find out the fuel used - coal, petroleum, gas, etc)
- Industry or factory (find out and mention their type)
- Transportation - road section or junction having vehicular or traffic related pollution
- Burning of waste, garbage or trash
- Burning of fallen leaves, grasses or garden waste

- Street sweeping
- Road Dust (resuspended by the movement of vehicles)
- Construction of buildings (including digging and movement of construction materials)
- Agricultural burning (clearing of land, residue burning, slash and burn, etc)
- Forest fires (if observed)
- Household cooking or heating (using solid fuel like coal, wood, sawdust, dung cake, etc.)
- Commercial cooking or heating (using solid fuel like coal, wood, sawdust, dung cake, etc.) like bakery, restaurant, etc.
- Diesel Generator Sets
- Other (the activities and sources which cannot be classified in above categories)

They should note down the date, time or duration, location and place and details of the activity in the observation table (see example below).

If possible, they should do a photo or video documentation of such incidents.

They should prepare a map of the area and mark the location on it. They can make a map using Google Earth or Map for the area. They can make a legend on the map and use differ-

ent colours or symbols for marking different categories of activities or sources.

They can also talk to some people around, shopkeepers, vendors or hawkers to find out about the activity or source, such as if it is a daily or regular activity or one-time activity, etc.

<i>Sr No</i>	<i>Date</i>	<i>Timing or Duration</i>	<i>Location and Place</i>	<i>Details of Source and Activity</i>	<i>Category of Source</i>
1.	1.4.21	9.30 am to 11 am	In front of xx society, DP Road, Aundh	Burning of leaves by PMC road sweeper	Burning of garden waste

Students should prepare a record of the activities and such incidences for two to four weeks.

At the end of the inventorization i.e., preparing the list, they should analyse the information gathered.

- List of sources
- Categorization as point and nonpoint sources
- Map of locations of sources
- Table of sources with the number of occurrences

Students can think of interesting ways to present their information, such as graphs, maps, charts, photo panels etc.

Discuss with students the possible solutions for preventing air pollution. Based on their observations of the data, can they think of the role they could play in improving the air quality in their village or city?

Ask students to write a letter to the local newspaper, head of the Panchayat or the Nagar Nigam of their village or city. Mention about their project and the findings of their project in the letter. Request to take actions inclusive of their suggestions and recommendations.

Discussion

Ask the students what are the activities and sources of pollution they have observed and found out in the neighbourhood of their village or cities. They should categorize these sources and activities broadly according to the sector like Power Plant, Industries, Transport, and Road dust, Waste, Agriculture, Construction and Generators. They should try to quantify the sources according to these sectors and find out which one is contributing more. Ask them about the solutions for controlling and reducing the air pollution from that sector. What can students do to reduce the emissions from that sector at their level?

Learning outcomes:

Observe, identify and classify the activities and sources of air pollution. Analyse information gathered and think of solutions. Participate at local government level asking for actions and make recommendations for prevention of air pollution.

Green habit:

Never burn leaves, garbage or waste and use bicycle or buses.

FAQs

Q - What is emission inventory?

A - Emission inventory is the exercise of finding and listing down all the activities in an area that are causing or emitting air pollution. One can find out the sources of pollution causing emission of air pollutants. They can also identify the processes that are causing generation of pollutants like use of fossil fuel in a factory, burning of waste or leaf litters, etc. This helps in understanding the sources, amount and types of pollution, the impact it might cause. This information is used by scientists in making the plan for mitigation of air pollution. This exercise can be done with the "Citizen Science" approach wherein citizens from the area are involved to observe and gather the information about the sources of air pollution in their area.

Q - How can the information of emission inventory be utilized?

A - Gram Panchayat, Nagar Panchayat and municipal corporations are responsible for the civic issues in villages, towns and cities respectively. Police, district collector office, Maharashtra Pollution Control Board (MPCB) and Environment Department, Government of Maharashtra are responsible to ensure clean air for the citizens. The information for the sources and activities causing air pollution can be shared with them for further study and action. The information can also be shared with the local civil society groups and organisations working on social and environmental issues with a request to guide and support the actions to mitigate air pollution in the villages or cities. Citizens can also be made aware using this information to take actions both at their level as well as at the governance level to change those activities in order to mitigate air pollution locally.

Level/Class: 7

Curriculum links: Science

Activity duration: 45 minutes

Materials needed: A ball of string, chart paper or unused visiting cards with one blank side, colour pens, scissors, safety pins

Approach: Outdoors activity for entire class

Topic:

Energy, flow of energy in a food web

Concept:

Energy and its flow through the trophic levels is the basis for life support on earth. The energy from the sun is captured by the chlorophyll bearing plants through the process of photosynthesis. Photosynthesis happens in the green chlorophyll present in the leaves of plants in the presence of sunlight. In this long biochemical process carbon dioxide is absorbed and carbohydrate (starch or sugar) is produced by the chlorophyll in the leaves and oxygen is produced as a by-product. In this process, one percent of the solar energy is converted into chemical energy. The carbohydrate produced in the process stores the solar energy into chemical energy which is used as food by the plants and animals.

The plants and its parts which contain this food are eaten by the herbivorous animals which in turn are eaten by carnivorous or omnivorous animals. In this process, ten percent of the energy is transferred from one trophic level to another trophic level as material, which is from plants to herbivorous animals and in turn to carnivorous animals. This transfer of energy can happen up to three to four trophic levels. Transfer of energy from producer to consumer is one of the principles of ecology.

Aims:

- To develop the understanding about the transfer of energy from producer to consumer across different trophic levels in a food web.
- To demonstrate the flow of energy as an ecological principle and interconnectedness of various elements in the environment.

Key questions to address:

How important is energy to support the living systems on earth? How energy is being transferred between the organisms and utilized?

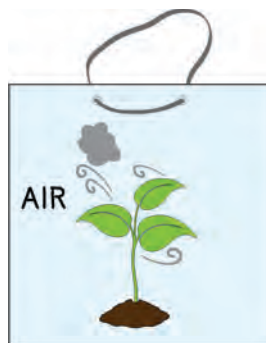
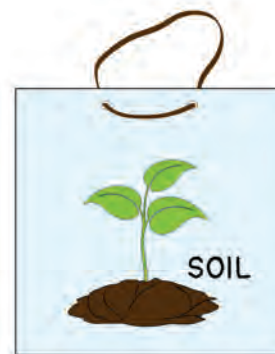
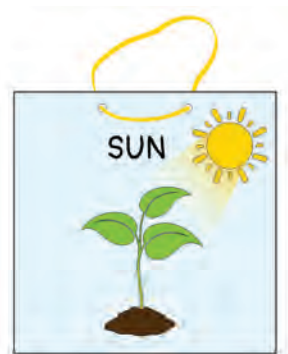
Preparation:

Web of Life Cards to be prepared.

Method/Guide:

1. Based on the list provided alongside, make a set of cards with the names of the animals, birds, plant, resource, etc. The students

can illustrate these cards. There should be as many cards as there are students in the class. Cards can be made of chart paper cut into rectangular pieces of about 5 by 8 cm. Else, it can also be made on one side of an unused old visiting card. A safety pin can be put through the top of each card.



2. Ask students to sit in a circle. Make sure to include and distribute cards depicting the four main elements of nature, 'Sun', 'Soil', 'Air' and 'Water'. Take a ball of string about 250 m long and give it to the Sun. It is appropriate to begin with the Sun because all life is made possible by it. Let the Sun wind one end of the string around its finger and throw the ball to any aspect of nature it feels is related to it. For example, the 'Sun' may pass it on to 'Tree' because the 'Sun' gives energy to plants or trees. Let the student state the reason why it feels related to this element. The 'Tree' then winds the string once or twice around its finger after

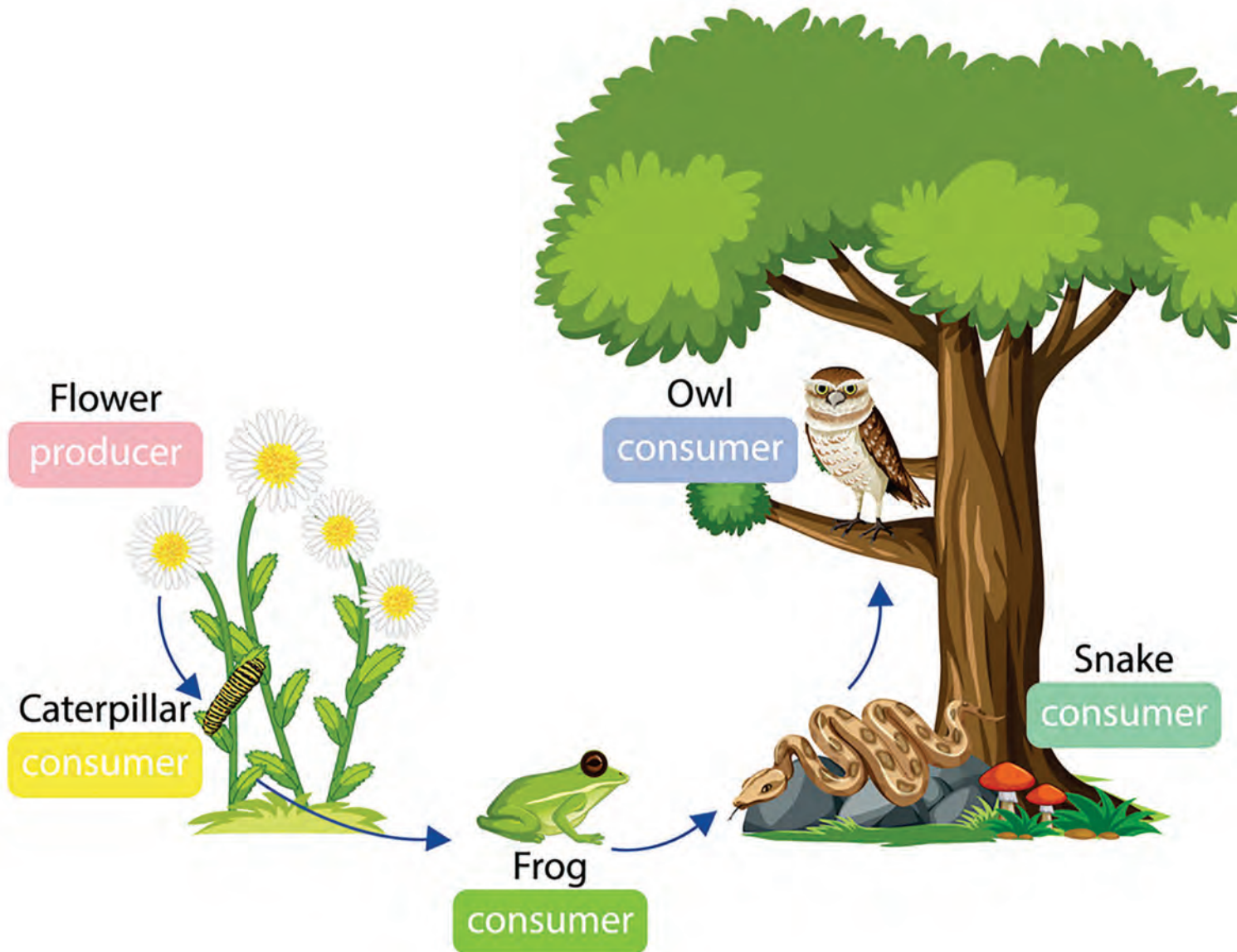
ensuring that it is not loose between the 'Sun' and him. It then passes it to another aspect he feels related to, e.g. 'Fruit'. So, the line of relationships continues as the string unwinds and begins to form a pattern which the students hold together. The ball of string is thus completely used connecting all the aspects present in the group.

3. Ask the students to see the web-like effect formed by the string. Then ask them to raise the web chest high. Let them hold it tightly so that if the web is pressed down it does not sag and touch the ground. Ask the students to note this.

4. Ask the students what would happen if some of these elements were destroyed. Let the student representing these elements drop the string. Notice the visual effect. More elements may be dropped to dramatize the effect, one by one. Now press the web down. It would probably touch the ground because it is loose.
5. Ask the students what would happen if the Sun or the other three major elements of

nature were disturbed. Conclude the game by explaining to the students how inter-relationships exist and why they are important.

6. Explain that the flow of energy from one organism to another organism is like a food chain. This happens when one organism feeds on another. Energy flows from the Sun to the producers (plants) to the consumers (animals). Many food chains woven together form a food web.



1	Sun	16	Leaf	31	Snake
2	Air	17	Rat	32	Mongoose
3	Water	18	Butterfly	33	Kingfisher
4	Soil	19	Ant	34	Washerman
5	Tree	20	Student	35	Woodcutter
6	Fruit	21	Grass	36	Buffalo
7	Parrot	22	Dead leaf	37	Honey
8	Algae	23	Earthworm	38	Honeybee
9	Fish	24	Roof	39	Squirrel
10	Eagle	25	Shrub	40	Moss
11	Turtle	26	Seed	41	Grasshopper
12	Insect	27	Fungus	42	Plastic bag
13	Frog	28	Dragonfly	43	Dead wood
14	Mosquito	29	Monkey	44	Paper
15	Lizard	30	Spider	45	Crocodile

Learning outcomes:

Flow of energy is the basic principle of ecology. Energy flows across different trophic levels in a food web.

Energy from the sun is used by plants to make food. Energy is stored in different parts of plants, such as leaves, fruits, seeds, stems and roots. Animals that eat plants gain energy from plants. In turn they may be eaten by other animals that get their energy from their prey.

Green habit:

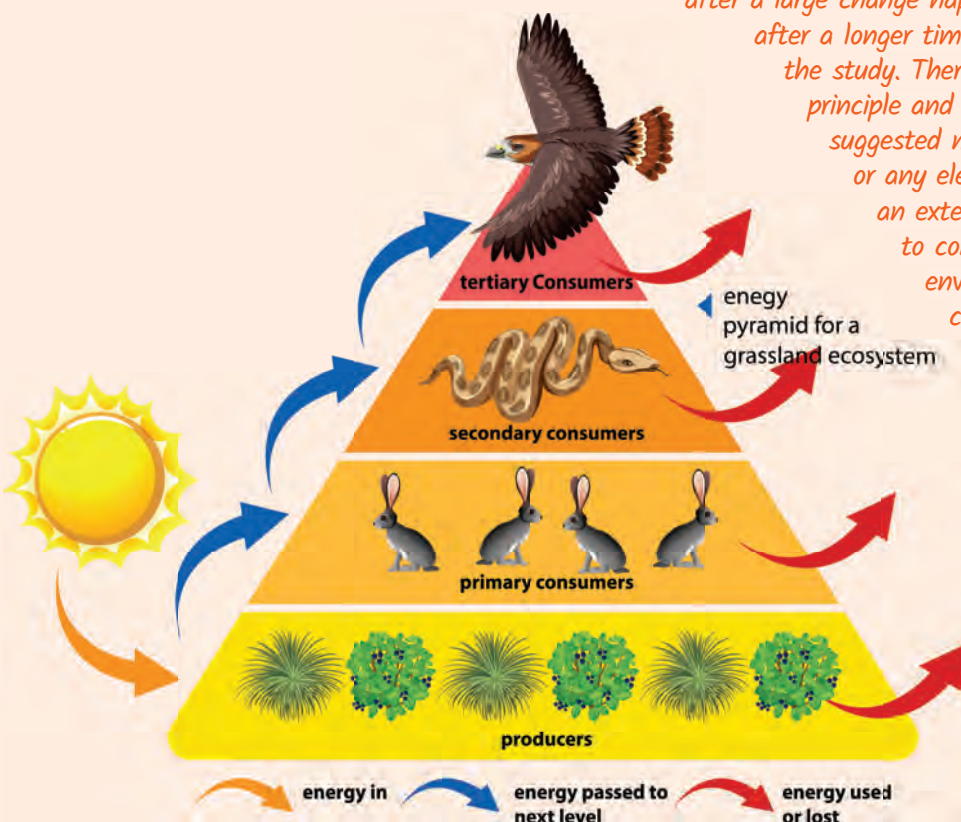
Do not destroy any biotic and abiotic element in environment.



FAQs

Q - What is the ecological principle of energy flow?

A - The sun is the ultimate source of energy for most ecosystems. The producer or plants can convert only 1 percent of the solar energy received into food or biomass through photosynthesis. This energy is transferred in the form of food or biomass to the higher trophic level of consumers in the food chain. It is transferred from the primary consumers to the secondary and the tertiary consumers. At each trophic level there is a loss of energy and only 10 percent of the energy gets transferred to the next trophic levels. Rest of the energy gets dissipated into the environment in the form of heat. This energy cannot be captured and utilized. The transfer of energy can happen maximum up to four trophic levels. This is called the food chain. Many food chains combined together form a food web. This flow of energy happens as part of a material cycle also called the bio-geo-chemical cycles.



Q - What happens when any element or component of the food web is removed?

A - There are different elements or components that exist or present in an ecosystem. These are interconnected through specific roles and functions. There are more than one element or component present to carry certain functions or roles. But most have some specificity and their role cannot be exactly replaced by another element. If one element or component is lost, it affects the ecosystem and makes it imbalanced. If more such elements are removed, the ecosystem becomes imbalanced and cascades its effects on other elements which can turn into large change or loss in the ecosystem. It can sometimes be irreparable or irreversible.

The interconnectedness between various elements of the ecosystem is very complex and there may be many such connections and dependencies. These relationships between each element are not yet well studied and understood. There are many hidden links that are yet to be explored, some would get revealed after a large change happens in the ecosystem or after a longer time frame beyond the scope of the study. Therefore, by the precautionary principle and principle of uncertainty, it is suggested not to disturb the ecosystem or any element of the ecosystem to an extent that it is not possible to come to its original. In the environment everything is connected to everything else. Human beings are just one of the elements among many.

Level/Class: 7

Curriculum links: Science, Social Studies

Activity duration: 45-60 minutes

Materials needed: Bicycles, tools, grease and lubricating oil.

Approach: Guest resource person session and interaction in an outdoor activity for entire class.

Topic:

Energy, kinetic energy, air pollution, climate change, sustainable mobility

Concept:

Bicycles are used as a modern mode of transportation in many of the cities around the world. Many cities in the developed countries like Copenhagen in Denmark, Amsterdam in Netherlands, Portland in Oregon, Montreal in Canada, Tokyo in Japan, Rio de Janeiro in Brazil, Strasbourg in France, Barcelona in Spain, Austin in Texas, Paris in France, Berlin in Germany are bicycle capitals of the world. In India as well, cities like Pune, Mumbai, Indore, Bhopal, Delhi, Ahmedabad, Bangalore, New Raipur and many more are encouraging the use of bicycles by creating better infrastructure for cycling. Bicycles are increasingly being used and promoted as innovative integrated transport solutions in India and worldwide in the backdrop of poor air pollution in the cities and the challenge posed by global climate change. In the present time of pandemic, bicycles provide a safe and convenient mode of transportation while maintaining the physical distance for all.

Aims:

To develop an understanding of the working of a bicycle, the principles used for converting muscular energy and transferring it into kinetic energy of motion, knowing friction as a cause of unintended waste of energy and bicycle as a sustainable mode of mobility.

Key questions to address:

How can bicycles be used as a clean and climate friendly mode of transport and mobility for all in the present challenge of pandemic?

Preparation:

Identify and invite an experienced cycle mechanic, cycle repair shop owner or cycle shop owner as a guest resource person. Discuss the session plan in advance to be clear on the content that the teacher would present, and the technical content, skill development aspects the resource person would present. Request him to demonstrate the working of a bicycle explaining its principles. Ask him to touch and cover the following aspects

in discussion with the students (as explained in 'Method' below).

Method/Guide:

Ask students which of these are comparatively a modern and newer invention - railway or bicycle? Share with them that the bicycle is a newer invention which was invented after the railway. Bicycles were invented in 1817, whereas railways are older, invented in 1804.

Tell them that bicycles are being used worldwide as a mode of transport in many of the cities from developed countries. These cities have either conserved bicycle infrastructure for many decades or invested a lot in the recent decades in retaining and creating newer and safer bicycle infrastructures. Furthermore, they have innovatively integrated bicycles with the public transport systems. There are many cities in developed countries known as the bicycle capitals. In India also cities like Pune, Mumbai, Ahmedabad, Indore, Bhopal, Delhi, Bangalore, New Raipur, etc. create safe and convenient infrastructure for the use of bicycles. Bicycles have also become a safer mode of transportation in the present scenario of pandemic while following the physical distance. Moreover, bicycles are forward looking solutions for the challenge of urban air pollution faced by many cities in Maharashtra and India and the global climate change caused due to the emission of carbon dioxide, a greenhouse gas (GHG) responsible for rise in global mean temperature causing global warming.

Tell them that the school has invited a guest resource person to explain the working principle of a bicycle and how interestingly it was designed and works as a machine converting the potential energy into the kinetic energy of motion.

Explain working of the bicycles, how the energy from the pedal is transferred to the rear wheel of the bicycle by the arrangement of the chain and freewheel or gear. The muscular energy is converted into the kinetic energy which pushes the bicycle. Nowadays bicycles are also available with multiple gears that reduce the effort applied by the rider and increase or decrease the speed on the same amount of peddling.

Some energy also gets converted into heat and cannot be used for movement of bicycles. This happens due to the friction. Friction is applied in the moving parts of the bicycle as well as between the tyre and the surface of the road. Friction is actually required for the movement of the bicycle on the road and stopping it from slipping. But more friction means more energy and effort will be required.

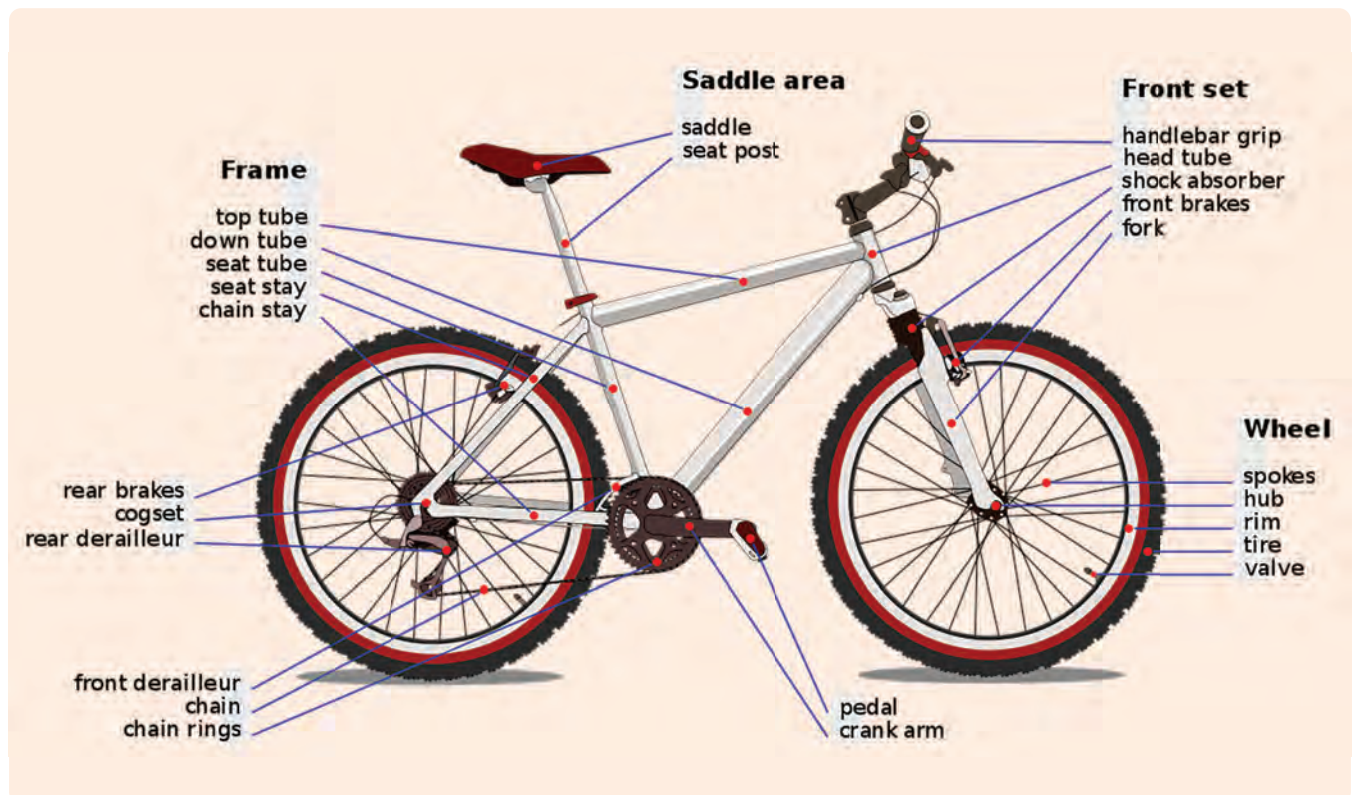
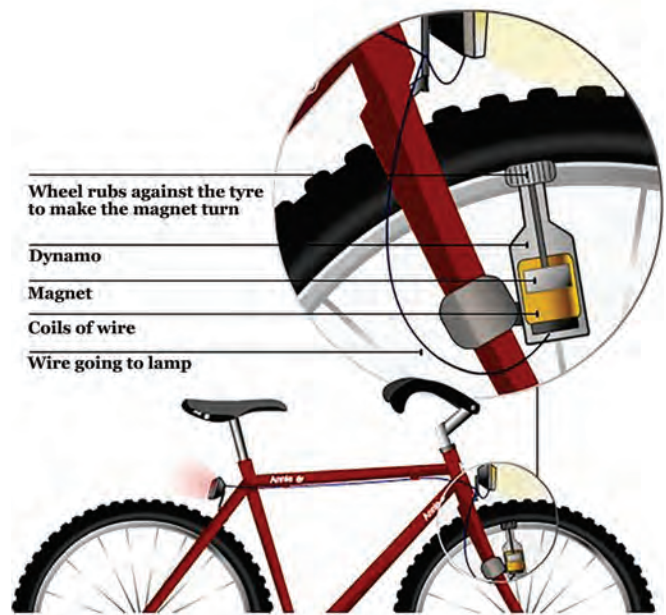
Friction between the moving parts of the bicycle is reduced by using ball bearings. This is the simple arrangement of small metal balls in the moving parts of the bicycle that move in a circular way. You can see these where pedals and pedal arms are joined, at the centre of the wheels and at the handle joint. The friction between moving parts is further removed by application of grease and lubricating oil. This also reduces the friction and wearing of the ball bearings.

The friction of the tyre and the road can be minimized by maintaining correct tyre pressure. You might feel when the air pressure in the tyres is low, it needs more effort whereas when the tyre pressure is high you feel a bumpy ride. It needs to maintain correct pressure to reduce the effort as well as also get effective braking when applied.

The cycle maintenance expert should explain

1. The main parts of the bicycle.
2. Care and repair work required to maintain the bicycle.
3. Correct tyre pressure.
4. How to add lubricants on the moving parts from time to time.
5. How to repair a puncture, if students are interested to learn.
6. If possible, demonstrate and explain the working principle and use of a dynamo. He can demonstrate how a dynamo works. How smartly it is designed that it can be used at night time to power and light the bulb fitted on front and kept unengaged during the day.

7. Ask him to explain that the dynamo receives energy from the circular motion of the moving tyre which rotates the coil fit inside it and “dynamo generates the electricity” to power the bulb in the front light.



Tell students that a similar principle is used to rotate huge turbines with the help of flowing water in the rivers of mountains or from high Dams in hydro power or by very high pressure steam generated in a boiler by burning fossil fuels like coal, petroleum or natural gas in thermal power plants. Isn't it amazing to know

similar technology is fitted in such a small dynamo and you can generate electricity by moving the tyre of the bicycle?

Students can also try hands-on for using the bicycle, pumping air, maintaining, oiling or repairing it. Thank the resource person and let the students ask questions, if they have any.

Learning outcomes:

Working of a bicycle and how to maintain or repair the bicycle. The importance of bicycles as a sustainable mode of transportation in the scenario of air pollution, climate change and pandemic.

Green habit:

Use a bicycle to travel for a distance of up to five km.

FAQs

Q - What is a bicycle capital city or bicycle friendly city?

A - A city that preserves its bicycling culture and infrastructure and invests further and innovates to keep on improving it and promoting the bicycle culture is considered as the bicycle capital city. Such a city gives priority to bicycles over other modes of transport and it is treated equally or sometimes given more weightage than automobiles. Bicycles are given preference in budget allocation, planning policies, space on road and infrastructure designs. They innovate to orient and design systems to integrate bicycle users equally everywhere. They consider bicycles as a modern mode of transport which is good for public health, climate change mitigation and a safe and sustainable mode of travel for elderly, children, women and the rich.

Q - What is a public bicycle share system? How does it work?

A - The Public Bicycle Sharing (PBS) scheme where local governments invest and manage bicycle infrastructure and service which is for the public. Bicycles are placed at many places across the city within the reach of about 500

meter for people. People can access these bicycles through a mobile app and use them for their trip. They can leave the bicycle at or near to their destination at another cycle stand or docking station. Payment is made by the payment app. In PBS, bicycles are shared by many people as public infrastructure and it has the facility of picking from one place and depositing at another place. One need not bring it back to its original place. So it is easy to use in combination with other public transport modes at any place within the city limits



4.2.13. Making a Solar Cooker

Level/Class: 7

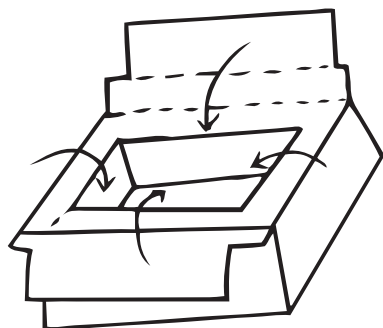
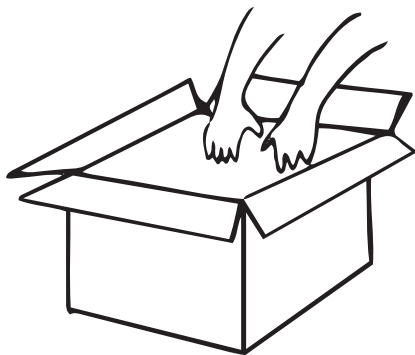
Curriculum links: Science, Art and Craft, SUPW

Activity duration: 60 minutes and time for cooking

Suitable time: Preferable to do in a sunny day

Materials needed: Two boxes of dimensions 38 cm x 38 cm x 25 cm and 31 cm x 31 cm x 22 cm, glass sheet (34 cm x 34 cm), foil, black paper, corrugated sheet, cutter or scissor, gum or glue, raw material (ingredients) for Khichdi (rice, moong dal, salt, water, spices, etc.)

Approach: Indoor activity done with whole class together or in groups, cooking done in outdoor



Topic:

Energy, climate change, renewable energy, solar energy

Concept:

Sun is a source of renewable and non-polluting energy. You can use the sun's heat to cook in solar cookers. Solar cookers require changing your regular cooking habits, and many solar cookers cook more slowly than a fire or a stove. But by using the solar cooker when the sun shines brightly, and using the regular household stove at night or when the weather is cloudy, you can save fuel. Some solar cookers can pay for themselves in just a few months because they reduce expenses for gas, kerosene oil, charcoal or firewood. Solar cookers can also be used to disinfect water for drinking. You can use this in combination, for a slow cooking requirement to save nutrients and taste of some food items.

This model of solar cooker is based on having one box inside the other. The larger box of dimensions 38 cm x 38 cm x 25 cm will serve as the outer box, and the box of dimensions 31 cm x 31 cm x 22 cm will serve as the inner box.

Aims:

Learn to make a solar cooker and test the principle of solar cooker.

Key questions to address:

What is the principle for making a solar cooker? How to make a solar cooker?

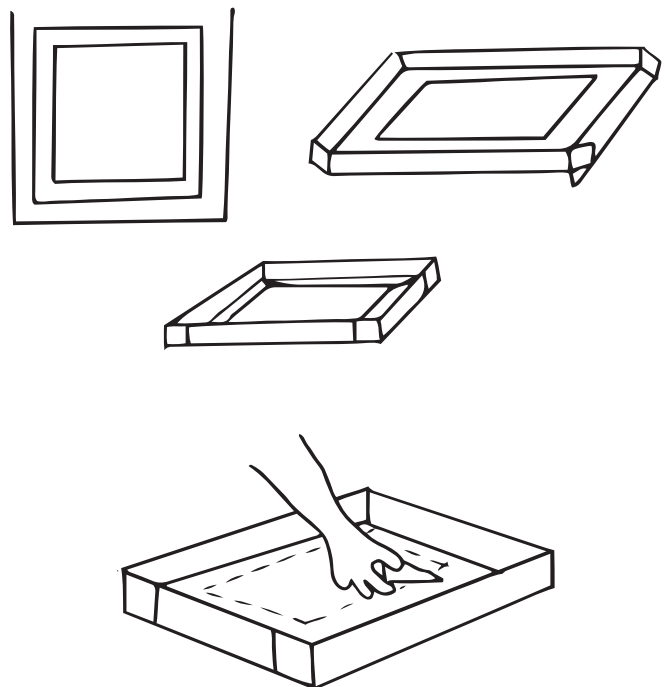
Method/Guide:

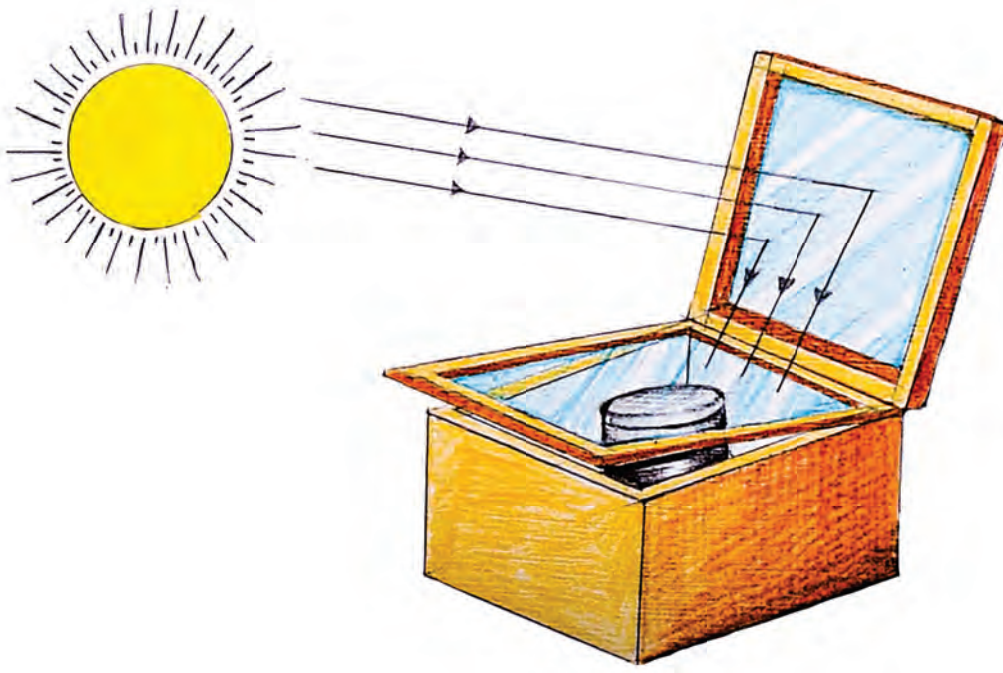
Explain to the students the principles of a solar cooker that it captures and retains the heat from the sunlight in the solar cooker. This heat cooks the food. Give them the instructions for making the solar cooker, explaining the dos and don'ts and the procedure. A demonstration of making the solar cooker can be given to the students.

Steps for making the solar cooker:

1. Paste silver foil on all the inner surfaces of the larger box.
2. Also paste foil on the inner and outer surfaces of the flaps (lid) of the outer box.

3. Paste black paper on the bottom of the inner box. On all the other inner surfaces of this box, paste silver foil.
4. Cut off the flaps of the inner box.
5. Make four 'legs' for the inner box by folding four pieces of corrugated sheet and pasting near the four corners at the bottom of the box. The height of the legs should be about 3 cm.
6. Place the smaller box inside the larger one. If the height of the inner box is more than that of the outer box, trim as necessary to bring them to the same height.
7. Fold the flaps of the outer box such that they cover the gap between the outer and inner boxes and can be folded down 2 cm in the inner box.
8. Hold tight and tape down securely, so that there is no gap. If there is extra length, trim it.
9. Now, cut a piece of corrugated sheet (approx. 42 cm x 42 cm) large enough to make a tight fitting lid for the outer box (38 cm x 38 cm).
10. Cut out a window of the size of the inner box (31 cm x 31 cm) from this piece of the sheet. Tightly tape a piece of a transparent glass sheet (34 cm x 34 cm) over this window.
11. Paste silver foil on the inside of the lid (except where there is the glass sheet).
12. Now fold and tape the edges of the corrugated sheet to make a tight fitting lid.
13. Take a piece of cardboard of 43 cm x 43 cm size to make a reflector. Paste silver foil on the inside
14. Make hinges of cardboard and attach with flower clips to the lid and the reflector.
15. Take a piece of cardboard of 15 cm x 12 cm and make serrations as shown in the illustration.
16. Tape securely, at the angle shown, to the outside of the box.
17. Make a firm prop using a folded piece of cardboard or a stick. The prop should be long enough to hold up the reflector at 90 degrees angle. The solar cooker is ready to use.
18. Cook Khichdi. Take rice and moong dal in a 2:1 ratio, wash them clean, and add five measures of water and some salt. Put these in an aluminum container with a lid, painted black on the outside. Place the container in the inner box and cover tightly. For fast cooking, put rice and dal soaked in water for 2 hours before cooking or the previous night.
19. Set up the solar cooker where there would be no obstruction of sunlight throughout the day. You may have to turn the cooker to allow a continuous stream of sunlight while cooking.





Learning outcomes:

A solar cooker helps reduce the use of conventional fuel, it is pollution-free and preserves the nutritional value of food. The use of renewable energy from the sun for cooking and the principles of making a solar cooker.

Green habit:

Use solar energy devices like solar cookers, water heaters, chargers, etc.

FAQs

Q - What is a solar water heater? How does it work?

A - Solar water heater is another device that utilizes the heat energy of sunlight to heat water required for different purposes. This helps in reducing the consumption of electricity required for the same purpose. Solar water heater is a household device which is installed on the rooftop. It captures the solar energy and heats up the water that can be utilized directly to fulfill the need for hot water for different purposes at home. The device has two parts, one glass panel with copper pipes to circulate water that captures the heat. Second is the insulated water tank that stores the heated water which can be utilized when needed. It can also be used at community or housing society level to fulfill the hot water needs of the community.



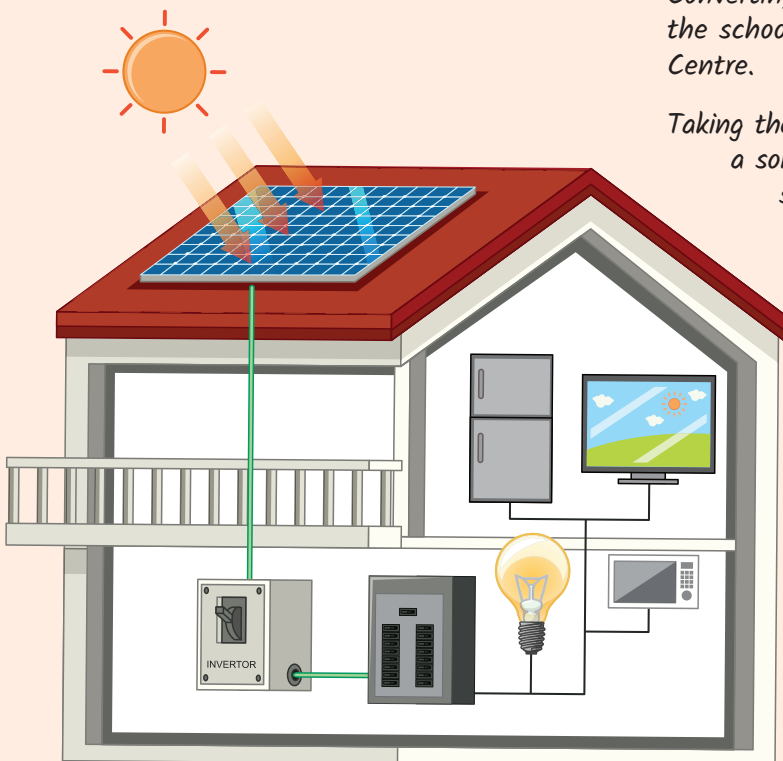
Case Story : Learning about and switching to solar energy use

Shri Mangesh Dighe is the Environment Officer at Pune Municipal Corporation and is conscious about protecting the environment. He always looks for innovative ideas that can help reduce the impact on the environment and tries them out.

Shri Mangesh Dighe has tried to reduce the use of petrol, diesel and electricity from the grid and shift to solar energy at his home, office and at Indradhanushya, which is an activity centre in the city of Pune for the public to learn about the environment.

He first explored how much electricity is used at his house and office. He conducted a rapid audit of his energy requirements. He also started to think about essential activities in daily life at his home and office are, which require electricity or energy in another form.

He learned about the solar photovoltaic (PV) cell panel used for generating electricity from sunlight, batteries for storing electricity, inverter for charging and the electrical circuit and connection required for the same.



Fans, lights, water pumps, and computers are the major appliances at his office. Realizing that visitors come to Indradhanushya at certain hours, Mr Dighe thought about turning lights and fans off when there are no visitors. After manually turning the lights off and on for a few days, Mr Dighe decided to experiment with a 'motion sensor'. A motion sensor detects heat waves (infrared waves) when a person reaches the visitor area. It then sends a signal to the main switch of the room, which turns on the lights. Later, after the visitors leave and infrared rays are no longer detected, the lights are turned off automatically.

He also arranged to install solar panels at Indradhanushya and shifted the energy use in the building to solar energy in phases.

Indradhanushya is a Citizenship and Environment Education Centre where people come to learn about the environment of Pune and the role of citizens to conserve it. It has exhibitions, panels, and working models on various themes for learning about environment-related issues. Converting the building to solar-powered inspires the school students and citizens visiting this Centre.

Taking the experiment further, Mangesh ji installed a solar-powered system at his home and switched to all the domestic uses of electricity on solar power. He has shifted a complete off-grid lifestyle and also charges his electric motorbike on solar power thus becoming carbon neutral for his energy needs. Shri Mangesh Dighe talks passionately about his experiment with solar power and shares his experience and learning with people visiting Indradhanushya.

4.2.14. Making a Solar Water Purifier

Level/Class: 7

Curriculum links: Science

Activity duration: 45-60 minutes

Suitable time: Preferable to do in a sunny day

Materials needed: Glass or metal dish, water, black ink, transparent glass sheet

Approach: Outdoor activity done with whole class individually or in groups



Topic:

Energy, renewable energy, solar energy

Concept:

The sun warms water in a bowl until the water evaporates and becomes water vapor. When the vapor rises and hits the sheet, it condenses there in droplets (just like in clouds). The droplets roll down and eventually fall into the glass (like rain falling from the sky). Water is purified by using the heat converted from sunlight. Solar energy, a non-polluting and renewable form of energy, is used for cleaning water.

Aims:

To demonstrate how the renewable and non-polluting solar energy can be utilized for the purpose of cleaning water.

Key questions to address:

How to promote use of renewable and non-polluting solar energy?

Method/Guide:

- Put some water in a glass or metal dish and place it in the sunlight.
- Add a few drops of black ink to the water.
- Cover the dish with a transparent (washed and clean) glass sheet.
- Leave it in the sunlight for 30 minutes.
- You will see droplets of water condensing on the inner surface of the glass sheet.
- Note the color of the condensed water drops. Students may taste these water drops.
- Repeat the experiment using salt water. Does the condensed water taste salty?

Extension/ Variation:

Ask the students how they can obtain drinking water from the sea water.

Learning outcomes:

Renewable and non-polluting energy from the sun can be utilized for cleaning water. Correlate formation of water droplets on the glass sheet related to formation of clouds.

Green habit:

Conduct experiments to learn more about solar energy.

FAQs

Q - What is water stress?

A - When the requirement of water increases, the amount of water available to fulfill that need it can be called water stress. It can be experienced in a fixed period like during a year. Water stress can be experienced due to reduction in water availability because of low rainfall or drought. It can also be experienced due to increase in demand caused by rising population, agricultural or industrial uses.

Climate change is forecasted to cause severe water stress in many areas. It pushes to manage water resources highly efficiently, as a climate change adaptation measure. It further forces a shift to renewables as a climate change mitigation measure.

Q - What is activated charcoal? How is it used in water purification?

A - Activated charcoal is a form of carbon that has numerous minute pores that increases the surface area available for adsorption of chemical reactions. It is used for filtration and purification of water for drinking purposes. Activated charcoal adsorbs the chemical impurities, toxins, colors and odors present in the water on its surface and helps in removing those making it fit for drinking purpose after disinfection. It does not remove the important salts and minerals present in the water. Activated charcoal is used as a filter in water purifiers. It needs to be changed after some months as the effectiveness of activated charcoal decreases significantly after being used for some time.

Water needs to be disinfected before consumption. Chlorine and Ozone gas and UV rays work as disinfectants by killing microbes present in the water.

Level/Class: 7

Curriculum links: Mathematics, Science, Social Studies

Activity duration: 30 minutes

Materials needed: Measuring tape, writing material

Approach: Outdoor activity for entire class in groups or individual.

Topic:

Climate change, adaptation, water availability

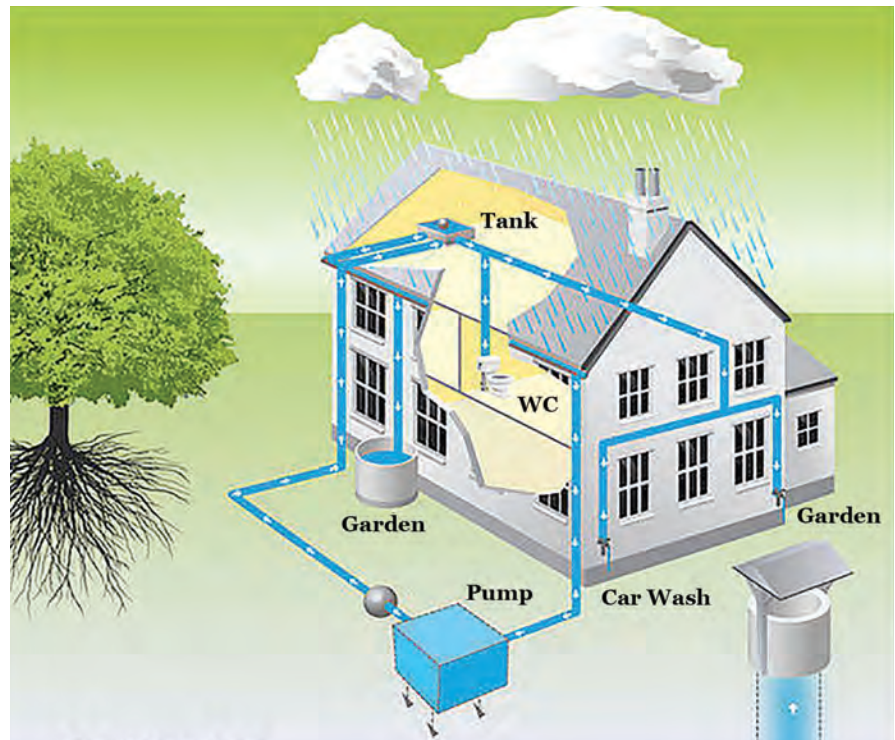
Concept:

Rooftop rainwater harvesting (RWH) is a method of collecting and storing rainwater that falls on the roofs of houses, schools and other buildings. The water collected from the roof is of good quality. It can be stored in tanks or sumps, either for direct use or can be diverted to an existing borewell, open well or percolation pit for groundwater recharge.

Rainwater is a cleaner form of water and when added to relatively poor quality of groundwater, in some places, the quality of that water will improve due to dilution. Rainwater harvesting replenishes groundwater tables. It avoids subsidence and saltwater intrusion in coastal areas, makes dug wells and borewells sustainable. Flooding of low lying areas during rains can be avoided to a large extent.

Aims:

To appropriate the potential of rainwater harvesting to help mitigate water shortage problem.



Key questions to address:

How to estimate the amount of rainwater that can be harvested over a rooftop?

Method/Guide:

1. Ask students to measure the length and breadth of the school roof or roof of any building accessible for use.

2. Using the measurements, calculate the area of the roof.

$$\text{Area of roof} = \text{length} \times \text{breadth}$$

(measured in meters)

3. Find the average rainfall that your city, town or village receives annually (in millimeters). If this data is not available, refer to the table given to carry out this activity.

4. Volume of rainfall that can be collected over the roof =

$$\text{Area of roof} \times \text{Average rainfall}$$

(Average quantity of rainfall in meters:
Average rainfall in mm/1000)

5. All the rain that falls on the roof cannot be collected due to seepage or spillage. Therefore, it is normally assumed that about 40 percent of the rain goes as runoff and about 60 percent of it can be effectively harvested.

$$\text{Volume of the water harvested} = \text{Volume of rainfall} \times 0.6.$$

6. Help students calculate the amount of rain that can be harvested from the school and home roof.

Extension/Variation:

1. Find out from your elders how they stored water in the earlier times.

2. Find if your area has any traditional water conservation systems or structures like the stepwells, bunds or tanks, etc.

3. Calculate the area of the roof at home and based on that; calculate the amount of rain that can be harvested.

4. Considering the average water requirement as 10 litres for drinking and cooking, let the students find out the number of days their family will be served with the amount of water harvested.



<i>Average Annual Rainfall of Districts/Cities in Maharashtra</i>		
<i>Sr.</i>	<i>Name of the station</i>	<i>Mean rainfall (in mm)</i>
1.	Mumbai	2184
2.	Pune	1200
3.	Nagpur	1064
4.	Nashik	1134
5.	Aurangabad	725
6.	Solapur	835
7.	Kolhapur	900
8.	Amravati	1052
9.	Jalgaon	833
10.	Latur	801
11.	Akola	988
12.	Nanded	900
13.	Chandrapur	1249
14.	Yavatmal	911

Learning outcomes:

The potential of rainwater harvesting and estimation of the amount of water that can be harvested by this method.

Green habit:

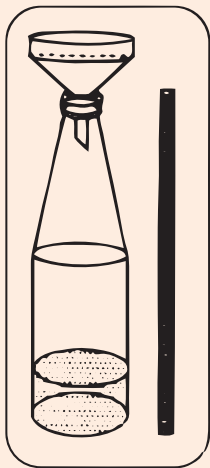
Harvest rainwater and recharge groundwater.

FAQs

Q - How does climate change affect the water availability of the area?

A - Climate change affects the rainfall pattern of the area. It might either increase or decrease the rainfall. It might affect the rainfall by altering its time, amount, intensity or duration. Rains become erratic, more rain might fall in shorter duration resulting in higher runoff, changing the natural cycle of rainfall, decreasing or increasing the rainfall. It might cause frequent floods, severe droughts and other meteorological events like cyclones. Higher temperature and increased hotter days also reduce soil moisture and increases the need for water. These will further impact agriculture and crop yields.

It needs to capture and keep a maximum amount of rainwater to increase the water availability. Conservation of water and stopping wastage will also be helpful in the water stress areas.

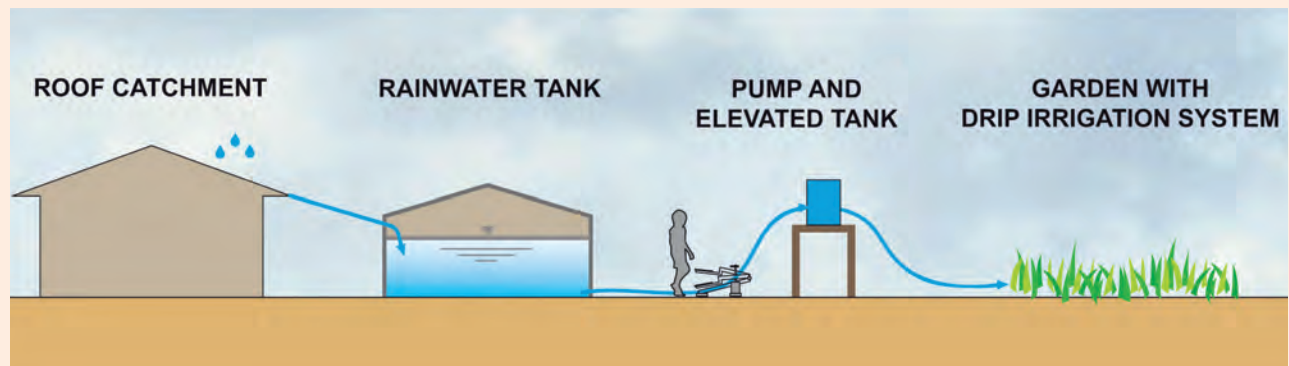


Q - What is rainwater harvesting?

A - Rainwater is the cleanest form of water that earth receives. This water gets stored in lakes, ponds and wetlands. These are natural freshwater holding water bodies. These hold rainwater and also recharge groundwater. But due to encroachment of lakes, ponds and wetlands, the natural freshwater holding water bodies are being lost. It also reduces the natural recharge of groundwater.

Due to construction and concretization, the nature of land gets changed. It increases the rainwater runoff and reduces the recharge areas affecting the percolation of water in the ground. A major proportion of rainwater gets lost and is not available.

Rainwater harvesting is a method to stop and collect the rainwater received over an area. There are different methods of rainwater harvesting. It can be done over an open land or on the rooftop of a building. Rainwater thus received can be collected and stored in natural or artificial storage. It can also be used to recharge the groundwater. Groundwater remains available for a longer duration and is free from pollution. Groundwater recharge depends on the type of geology of the area. Appropriate methods can be selected based on area.



4.2.16. Health Impacts of Air Pollution

Level/Class: 7

Curriculum links: Science, Social Studies

Resources and Preparations needed: Stationery, worksheet, pen, pencil, colour pens and pencils

Project Timing:

- # Project allotment and team formation – start of the academic year
- # Preparation project plan and work distribution – before the semester examination
- # Questionnaire design – before the semester examination
- # Assembly quizzes, questions and announcements – daily/ weekly activity for Assembly
- # Data Collection, Analysis and Report – before the final examination
- # Presentation – before the end of year

Topic:

Air pollution, health impacts of air pollution

Concept:

Air pollution has many health-related impacts on people, especially the sensitive and vulnerable population. It includes children, elderly people as well as people with respiratory or heart diseases. Like asthma, bronchitis, blood pressure, heart problems, diabetes, allergies, etc. Also include those who work in polluted environments like traffic police personnel, auto rickshaw (intermediary public transport) drivers, street vendors and hawkers and people working in the polluting industries like mining, or in factories with poor ventilation, etc. It needs to create awareness among them about air pollution and its health impacts and help them safeguard their health during poor air quality events.

Objective:

Learning objectives:

- Help students understand air quality and impacts of air pollution on their health.
- Identify vulnerable students, staff, parents suffering from respiratory or other ailments.

Action objectives:

- Reach out to the sensitive and vulnerable group and create awareness about the air quality impacts and share advisories for protection of their health.
- Student should be able to plan and schedule their activity as per the air quality levels or air quality index (AQI).

Project Plan and Schedule:

Steps	Location	Duration
Project Introduction	School	30 minutes
Project Allotment and Team Formation	School	30 minutes
Preparation project plan and work distribution	School	30 minutes
Interview questionnaire preparation	School	30 minutes
Announcements and questions for Assembly	School	10 minutes on-going activity during Assembly
Data Collection, Analysis and Report	School	30 minutes - 3 week
Presentation	School	30 minutes

Project Steps in Detail:

Invite a family doctor, a pulmonologist, a public health expert and an environmentalist as guest speakers to talk on the health impacts of air pollution in a panel discussion for all students, teachers and if possible, parents. Request them to explain different kinds of impacts, which organs are affected apart from the respiratory system, who is more vulnerable to air pollution and methods to protect their health? Ask them how air pollution and COVID19 pandemic are linked?

Ask them what students can do for those who are sensitive and vulnerable to poor air quality in order to safeguard their health?

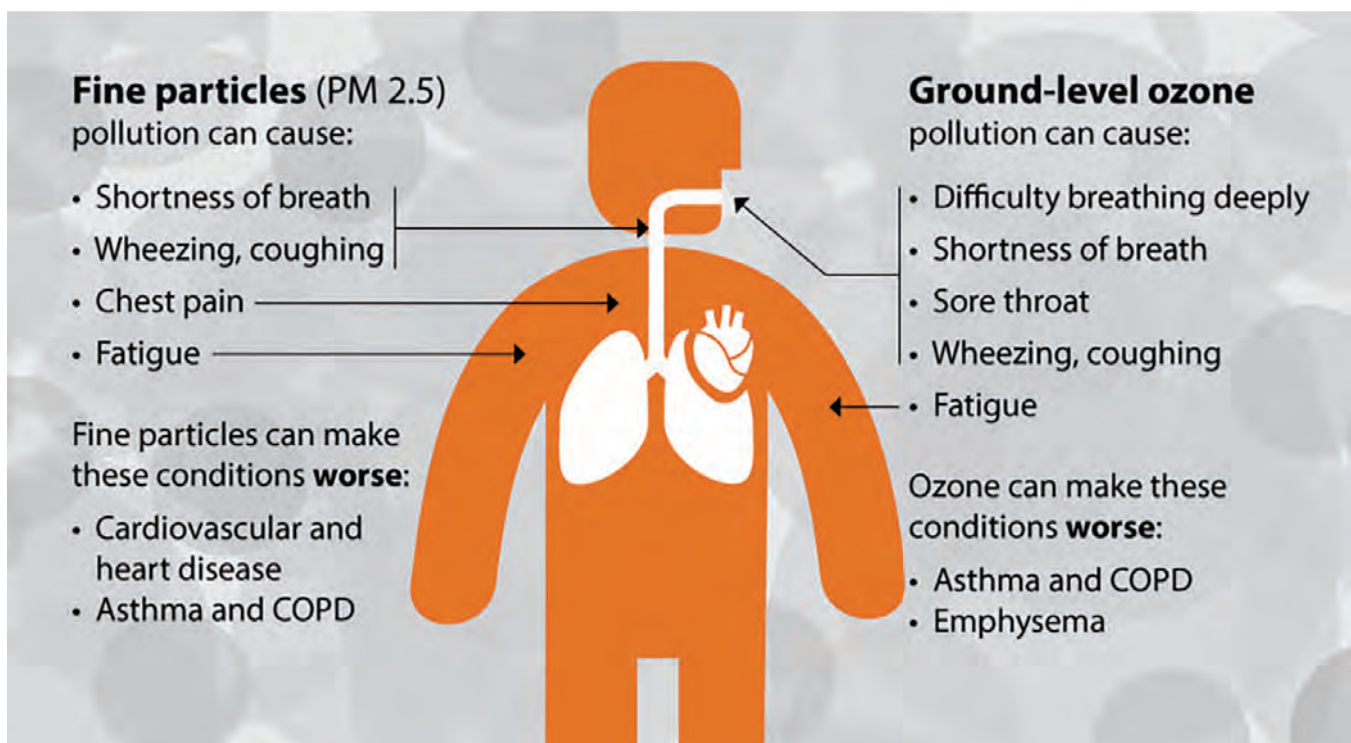
This can also be organized in an online mode. Alternatively, students can take the interviews of doctors and experts and share the information in a session organized for the rest of the class, using video or slideshow.

Make groups of 4-5 students and explain the project objectives to them. Discuss the key aspects from the talk by the expert panel.

Ask the groups to prepare sets of posters on air pollution including – sources and effects of pollution, methods to safeguard our health and measures to mitigate air pollution. They can also convert these posters into slideshows or short videos.

Ask the groups to reach out to students of other classes and adults (staff, teachers and parents). Explain to them about air quality, bad air quality health impacts, protection from air pollution and actions for improving the air quality using posters, slideshows or videos they have made.

They can conduct a quick survey to find out about people who face any kind of health-related problem due to air quality. These could be breathlessness, uneasy breathing, shortening of breath, allergies due to poor air quality. It can also be illnesses like asthma, bronchitis or other respiratory problems. Also find out those who need to take any medication like inhaler or medicine for such disease, either sometimes when required or regularly.



Information of such students and adults can be compiled and kept confidentially with the school counsellor or medical personnel in a manner that can be accessed easily in case required. The details of these students should not be shared publicly.

The group can explain to the class that the health problems associated with breathing can start or aggravate when the air pollution level in the atmosphere rises and air quality becomes poor. Ask them if they would like to have information about poor air quality and measures to safeguard health as health advisory. Inform them from where they can receive this information.

Students can start announcing the air quality level of the city and health advisories in the morning assembly while reading the news.

Groups can also prepare posters on the health advisories for different air quality and put this on display at different places in the school.

In some cities the Air Quality Index (AQI) for the day is announced with health advisories. AQI is simple colour coded information on air

quality for laypersons to understand the quality of air as well as the health-related precautions that can be taken by people. Find out if your city has the AQI available.

The groups can speak with parents, relatives, neighbours and others from their society and community and inform them about air pollution and its health impacts using posters, slideshows and videos. They can find out about people having breathing or similar problems due to air pollution. Ask them what kind of problem they face and how they manage that. Check with them if they would like to receive information about the air quality and health advisories to safeguard themselves. Share with them the method of receiving this information from the website or mobile applications on air quality by Maharashtra Pollution Control Board (MPCB), Government of Maharashtra and Indian Institute of Tropical Meteorology (IITM), Pune.

Discussion

Ask students about the health impacts of poor air quality that affect people. What kind of health problems people are facing in their school and neighbourhood due to poor air quality? Who are more vulnerable and sensitive to poor air quality? Are they aware of the impacts of poor air quality and how to protect themselves? What health advisories need to be provided to them? What health advisories schools and students need to follow to safeguard the health of students?

Ask them what can they do to improve the air quality?



FAQs

Q - Who is more vulnerable to poor air quality and why?

A - Sensitive people are more vulnerable to the ill effects of poor air quality. They are the people with respiratory diseases like asthma, bronchitis, people with allergies, heart disease, diabetes and hypertension, those taking cancer treatment and those who have recovered from COVID19. They are vulnerable due to their responsiveness to air pollutants, weak systems and co-morbid conditions that get aggravated. Apart from them, children, elderly and pregnant women are particularly vulnerable to the poor air quality. Children are vulnerable due to their weak and developing organ system and immunity, sensitivity to air pollutants as well as poor nutrition. Children generally do not eat green vegetables and fruits. Elderly people are vulnerable as their organ system and immunity become weak due to old age and existence of other comorbidities. Pregnant women are again vulnerable due to weak immunity, low nutrition and immunity and they may affect the foetus in their womb. It needs to safeguard their health as a priority in case of forecast of poor air quality.

Q - What is the relation between air quality and COVID19 pandemic?

A - A weakened lung because of poor air quality is much more susceptible to the lung affecting/damaging effects of the COVID19 and less capable to fight from the infection caused in

lungs by the virus and recover fast. The risk of lung damage and development of pneumonia is higher in weak lungs due to poor air quality. Even recovery after the infection gets impaired due to poor air quality and a good air quality can help COVID19 patients recover better and faster. There are some studies that say that the particulate matter present in air may also act as carrier for the viruses.

Q - How to organise a panel discussion?

A - You can invite some experts from the field of medicine like pulmonologists or chest disease experts, public health experts, air quality or environment experts from any government department or NGO for a panel of two to four experts. Talk to them to inform them about the topic, audience and what you want to understand from them. Prepare a list of five to six questions for each panellist you would like to ask and understand from them about the topic. You may share these questions of topics beforehand to them also. Invite the audience, students, teachers and parents also to ask questions in the later part of the panel discussion based on their responses and topics they would like to know. The panel discussion can also be organised on an online video conference platform. Total duration of the discussion session organised can be of 60 minutes. Of which, 30 minutes can be given for the panel to discuss and rest can be given for question and answer with the audience participating in the session. You may record the same to share with others. Students may also share their project ideas and seek their inputs and suggestions on the same.

Learning outcomes:

The health impacts of poor air quality, the vulnerable and sensitive people to air pollution as well as how people in their community are impacted due to air quality. The health advisories and ways to protect from poor air quality.

Green Habits

Check Air Quality Index (AQI) and health advisory and inform sensitive people.

Case Story: Air quality non-attainment cities

The cities that are not complying with the National Ambient Air Quality Standards of India prescribed under the Air (Prevention and Control of Pollution) Act 1981 of India are listed and called as non-attainment cities. In 2019, seventeen cities in Maharashtra were categorized as non-attainment cities, namely Amravati, Chandrapur, Mumbai, Nashik, Navi Mumbai, Pune, Badlapur, Sangli, Solapur, Nagpur, Ulhasnagar, Kolhapur, Latur, Jalgaon, Akola, Aurangabad and Jalna.

The Maharashtra Pollution Control Board (MPCB) has prepared the Air Action Plan for these cities in consultation with the city governments under the National Clean Air Programme (NCAP) of the central government. The Air Action Plan of each city is expected to reduce the air pollution level, especially of particulate matter (PM10 and PM2.5) by 25 to 35 percent of its level in the city in the year 2017, in a timeframe of five years.

Cities are provided funds from the Finance Commission of the central government for preventing and controlling air pollution and improving air quality. To control air pollution, cities have to provide public transport services, avoid waste burning, manage construction, diesel generator sets, industries and power plants, etc.

The actions recommended broadly include shifting people to public transport, walking and cycling by improving conditions for them, source segregation of wastes and improved collection, recycling and disposal of waste, site management for construction, emission reduction from factories and power plants and increasing vegetation and green ground cover.

Refer to the city air action plans at <https://www.mpcb.gov.in/non-attainment-cities>

Level/Class: 7 and 8

Curriculum links: Social Studies, Art and Craft, Languages, Computer

Resources and Preparations needed: Questionnaire, worksheet, pen, pencil, colour pens and pencils, mobile phone with camera

Project Timing:

Project Allotment and Team Formation - start of the academic year.

Preparation of project plan and work distribution - before the semester examination.

Observation and Record - continue activity over the academic year.

Data Collection, Analysis and Report - before the final examination.



Topic:

Climate change, impacts of climate change and need for adaptation

Concept:

Climate change has already started having its impacts on our planet. It affects all, the physical environment (like temperature, rainfall (precipitation), water availability, etc.), the biodiversity (flora and fauna) and the human beings, which are dependent on the previous two. Unfortunately, it affects people differently. Ironically, it affects those most who pollute less and are dependent more on the natural resources for their livelihood like the farmers and the forest dwellers. The changing pattern of rainfall and raising temperature affects those dependent on these for the farm and forest produce. Moreover, they are unaware of such impacts and unprepared to cope with it. Knowing the impacts faced by them will help us understand climate change with a different perspective with evidence. This will also help in thinking of adaptation with a bottom up approach.

Objective:

Learning objectives:

- To understand the impacts of climate change faced by the people at the bottom of the pyramid, those who are vulnerable and exposed to it without the knowledge of how to cope with it.
- To understand the need and importance of adaptation measures focused at the community level.

Action objectives:

- To understand and document the stories of the farmers and forest dwellers of the kind of changes they observe and experience in the climate, locally.
- To understand from their experiences what needs to be done for adaptation to the already happening climate change.

Project Plan and Schedule:

Step	Location	Duration
Project Introduction	School	30 minutes
Project Allotment and Team Formation	School	30 minutes
Preparation of project plan and work distribution	School	30 minutes
Observation and Record	Community	Continue activity over the academic year
Data Collection, Analysis and Report	School	30 minutes - 3 week
Presentation	School	30 minutes

Project Steps in Detail:

Make groups of 4-5 students and explain to them the project objective to understand the story of farmers facing the impacts of climate change and how they are coping with it.

Ask each group to identify two to three farmers in their village or near to their city.

Ask them to do an interview with them to understand the kind of impacts they have experienced and are facing with regard to climate change on their livelihood agriculture.

One or two groups can also identify and interview any forest dwellers whose livelihood is also dependent on the natural environment and resources harvested from the forest.

Some groups can interact with women farmers to get a different perspective on farming. Try to have a variety of farmers like medium, small and marginal farmers and those with limited resources to get a better understanding of the challenges faced by them. Some groups can also interview an elderly from their village or family to mark their observations.

The students should visit and do the interview and ask them aspects related to the impact of climate change on their livelihood, its productivity, uncertainty and loss in their income. Some of the aspects are suggested here, teachers may change, add or edit as per the local situation. The language of interaction should be local to get the actual insight.

Gather basic information about the farmer like the village or place they live, have their farm and do agriculture.

- For how long s/he has been farming? For how many years or generations?
- How much land do they have? How many crops are they able to grow?
- Get information on the general agro-climate of the region, rainfall, temperature, soil type and pattern, any other, etc.
- What changes have they been experiencing in the rainfall pattern and the temperature?
- Have they experienced water stress or heat stress of temperature in the region?

- Have they observed any extreme weather event in the last few years, like drought, flood, heat wave, hail storm, frost, etc which they had not seen earlier?
- Have they seen any change in the flowering of trees, change in the flowering season or months? What kind of changes are these? Is it happening less or more? Is it shifting to earlier months or getting delayed over the years?
- Ask them what changes they have been observing in the past few years compared to 1 or 2 decades back, with respect to the crop yield. Is it increasing, decreasing or remaining the same?
- Have they shifted their crops or changed the crops they cultivate in terms of crop types or variety? Or changed their time of sowing and harvesting of the crop?
- Have they experienced any crop failure due to unpredicted weather?
- Do they get any support or information for crop management and climate change from the government or local agriculture department or college?
- How do they cope when the crop fails, financially and to sustain their families?
- Do they have any story to share about climate change and its impact on them and their agriculture, which we may have missed to ask?
- Is there any visual evidence or proof we can observe related to climate change and its impacts in the village, agriculture or local climate?
- Ask farmers about the practices and the methods they use for storage and preservation of their crop yields. What are the traditional practices they follow for preservation of grains?



- Discuss with them about the improvements and innovations in grain preservation over the period of time. Ask them if there are any gaps between the traditional and the modern practices and methods. Find out from them what kind of changes they have to do and what support do they need for storage and preservation of their crop yields and grains?
- Do they have any financial support available from any of the government programmes? Do they get adequate support in time?
- Anything else teachers or students think relevant with the local perspective to ask?

The groups should document these as text as well as in videos. They should take photographs of the farmer, their home, the farms or any other visual element of the story.

The groups should discuss this with the teacher or some expert. Experts can be invited to interact with the students and help them understand and put things into perspective and also clarify any doubts they have about their findings from the interviews.

The groups should write the “Farmer’s Story” in simple and easy language to understand. They can write it in vernacular as well as other languages of their interest. They should insert photos they have taken in the story text to give it a visual effect. They should also make video stories of the farmers from the interviews’ recordings.

The students should create posters, photo stories, video stories and share it with the rest of the students and adults in the school. With the help of the Computer Teacher or PTA members they can put these stories on the website, blog page or social media page of the school.

Discussion

Ask students about the impacts of climate change. How real and local are they? Why are farmers and those who are dependent on natural resources and not responsible for causing climate change are more vulnerable and impacted by the effects of climate change? Who is responsible for causing climate change? Which of our actions are linked to causing climate change? How can we mitigate climate change? How can we reduce the impact of climate change on the farmers and forest dwellers? What can the students do at their level for the same?



Learning outcomes:

Climate change and its local relevance, know who are impacted and what kind of local impacts it will have. Also, the inequality in the impacts and need for supporting the adaptation at the local community level for the poor.

Green Habits

Learn more about climate change and inform farmers and others about it.

FAQs

Q - What are climate change mitigation and adaptation?

A - Climate change is one of the biggest looming challenges faced by the present and coming generations. The change in climate will have many irreversible impacts.

Climate change mitigation aims at tackling the causes and minimising the possible impacts of climate change. The efforts and actions for reducing or preventing the emission of greenhouse gases is considered as climate change mitigation. It involves, for example, switching to renewable energy sources, making energy efficiency systems, energy conservation, shifting to green mobility modes, reduction in deforestation and forest degradation, reduction in waste generation, low input green agriculture and other such sustainable practices. It means using new technologies and changing management practices or consumer behaviours, innovating and creating efficient systems. It can be as complex as planning cities, or as simple as improving cook stoves, to cycle paths and footpaths.

Whereas, climate change adaptation looks at how to reduce the negative effects it has and how to take advantage of any opportunities that arise. Sustainable development and building resilience of the communities at global and local levels to cope with the impacts of climate change posed to them will be key to lessen the impacts of climate change and pave the way for survival. These include building capabilities among communities to identify and protect themselves from climate stress and risks, safeguard environmental quality and provide access to knowledge and resources towards this aim. Make this an equitable process taking special care of those poor and exposed to such risks. Sustainable development across sectors are strategies to achieve these goals. These are defined in the seventeen sustainable development goals (SDG) with 169 targets and indicators by the United Nations.

Q - How to conduct an interview?

A - Interview is a structured way of inquiry to explore the knowledge implied in the practitioners from the field. This helps in understanding and documenting the practical knowledge one gains through their experiences. It helps the learner understand the views and information about the topic.

Interviews should be done in a structured way by preparing a questionnaire for the interview, by keeping the person or respondent in mind one wants to interview. It is good to interview a greater number of such respondents in order to gather more sets of information and views. Questionnaire must be prepared to fulfil the objective of the study one wants to collect information for. Sometimes, asking direct questions may not give unbiased required information. While designing the question one needs to be careful about this. One must test the questionnaire with some sample respondents to see its effectiveness, whether it is helping to gather the intended information from these interviews. Final interview can be done after incorporating the inputs from the testing of the questionnaire. The language of the interview should be familiar with the respondents. Interview should be done as a dialogue and the interviewer can explore more on the points of information going beyond the questions in the questionnaire to find out the relevant information, if required. Analysis of the responses received should be done intelligently and carefully to draw and compile the outcome of the interview.

Q - What is the United Nations Framework Convention on Climate Change?

A - The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty to address climate change. It was deliberated and signed by 154 countries at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992. It is informally known as the Earth Summit.



The Kyoto Protocol, signed in 1997 and entered into force in 2005, was the first implementation measure under the UNFCCC, until December 2020. The protocol was superseded by the Paris Agreement, which came into effect in 2016. As of 2020, the UNFCCC has 197 signatory countries. Its supreme decision-making body, the Conference of the Parties (COP), meets annually to assess progress in dealing with climate change.

The UNFCCC seeks to stabilize greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic human-induced interference with earth's climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The treaty established differential responsibilities for three categories of signatory countries. These

categories are developed countries, developed countries with special financial responsibilities and developing countries. The developed countries, also called Annex I countries, consisted of 38 states, 13 of which were Eastern European states in transition to democracy and market economies and the European Union. All belong to the Organisation for Economic Cooperation and Development (OECD). Annex I countries are called upon to adopt national policies and take corresponding measures on the mitigation of climate change by limiting their anthropogenic emissions of greenhouse gases as well as to report on steps adopted with the aim of returning individually or jointly to their 1990 emissions levels. The developed countries with special financial responsibilities are also called Annex II countries. They include all of the Annex I countries with the exception of those in transition to democracy and market economies. Annex II countries are called upon to provide new and additional financial resources to meet the costs incurred by developing countries in complying with their obligation to produce national inventories of their emissions by sources and their removals by sinks for all greenhouse gases not controlled by the Montreal Protocol. The developing countries are then required to submit their inventories to the UNFCCC Secretariat. Because key signatory states are not adhering to their individual commitments, the UNFCCC has been criticized as being unsuccessful in reducing the emission of carbon dioxide since its adoption.





Q - What is the Paris Agreement?

A - The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), on climate change mitigation, adaptation and finance, signed in 2016. The agreement was negotiated by representatives of 196 party countries at the 21st Conference of the Parties of UNFCCC in Paris, France, and adopted by consensus on 12 December 2015. As of March 2021, 191 members of UNFCCC are parties to the agreement.

Goal of the Paris Agreement is to keep the rise in global average temperature well below 2 °C

(3.6 °F) above pre-industrial levels and to pursue efforts to limit the increase to 1.5 °C (2.7 °F), recognizing that this would substantially reduce the risks and impacts of climate change. This should be done by reducing emissions as soon as possible in order to “achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases” in the second half of the 21st century. It also aims to increase the ability of party countries to adapt to the adverse impacts of climate change and make “finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.”

Under Paris Agreement, each country must determine, plan and regularly report the contribution that it undertakes to mitigate global warming. No mechanism forces a country to set a specific emissions target by a specific date but each target should go beyond previously set targets.

Case Story: Season Watch

SeasonWatch is a citizens science initiative which anyone can participate in and share observations about trees around them. Participants identify one or more trees in their locality and observe them throughout the seasons over the years to note the changes. These changes may be related to the time of flowering, shedding of leaves, budding of new leaves or branches in the tree, for instance. We may be able to discern changes in the same tree over consecutive years.

Citizens science involving hundreds or even thousands of people over a large landscape can help discern if there are any patterns in the changes. Observations about the behaviour of the same species of trees, and even across different species, may be correlated with changes observed at the same time in the local climate in terms of temperature, rainfall or extreme climatic events such as heat wave, cold wave, or hailstorm. For example, if many individuals across India observe Bahava trees and the onset of flowering, it may be possible to discern if flowering occurred at the expected time in March-April or if it was earlier or later. Students and teachers can participate in Season Watch by registering on the website <https://www.seasonwatch.in/>

SeasonWatch

Home About Events Explore Publications Updates Login SW App

482153
OBSERVATIONS

15442
REGULAR TREES

79717
CASUAL TREES

1239
INDIVIDUALS

1350
SCHOOLS

Shifting tree cycles
affect animal lives
including ours

Have you noticed how the summers are becoming hotter and the monsoons more unpredictable? Have you wondered how changes in the seasons might affect the world around us? Become a citizen scientist to know more!

Trees are the pulse of changing seasons. Whether it's the summer fruits of Mango or the winter flowers of the Red Silk Cotton or the pre-monsoon blush of new leaves on the Pongam, the passing seasons are recorded in faithful detail by the life cycles of trees. Who better to tell us about the changing climate than, than our friendly neighbourhood trees?

SeasonWatch is an India-wide program that studies the changing seasons by monitoring the annual cycles of flowering, fruiting and leaf-fall of 130+ common trees. Whether you are a school student or an undergraduate, a budding naturalist or a serial botanist, a curious explorer or someone interested in understanding climate change through trees, this is a project for you!

It's very easy! Just REGISTER yourself with SeasonWatch and ADD A TREE from your neighbourhood to OBSERVE every week, and UPLOAD your findings on this website! Continue reading to know how you can PARTICIPATE and REGISTER to join our brigade of nature observers!

Some of the trees we track [View all](#)

Jarul
Capparis indica

Devil's Tree
Antea scholaris

Indian Coral
Erythrina indica

Purple Bauhinia
Bauhinia purpuria

Updates

SeasonWatch: Ferns, June 2021
June 28, 2021

SeasonWatch: Ferns, April 2021
April 6, 2021

SeasonWatch in 2020:
January 26, 2021

4.2.18. No Crackers Campaign

Level/Class: 8

Curriculum links: Science, Social Studies, Art and Craft, Computer

Activity duration: 60 minutes for preparation and other for organising the campaign

Suitable time: Preferably before festivals

Materials needed: Writing materials, material for making posters, chart paper, colours, etc.

Approach: Indoor and outdoor activity with whole class, research and campaign.

Topic:

Air pollution, eco-friendly festival, sustainable lifestyle

Concept:

Crackers are not only responsible for air pollution but also indirectly contributing to child labour issues. After every cracker event there is a high surge in air pollution. Crackers contain harmful heavy metals; after burning when its fumes come in the air, it makes the air toxic for people inhaling it. This aggravates health problems associated with air quality in the sensitive population after the event. Sensitive people include children, elderly and people having ailments like asthma, bronchitis, respiratory or heart diseases.

Aims:

Creating awareness among people about the hazards of crackers and appeal to not to use them.

Key questions to address:

How to design and run an awareness campaign on crackers and air pollution? Can we do away with crackers that create air pollution by adding a lot of load to air pollution in the atmosphere?

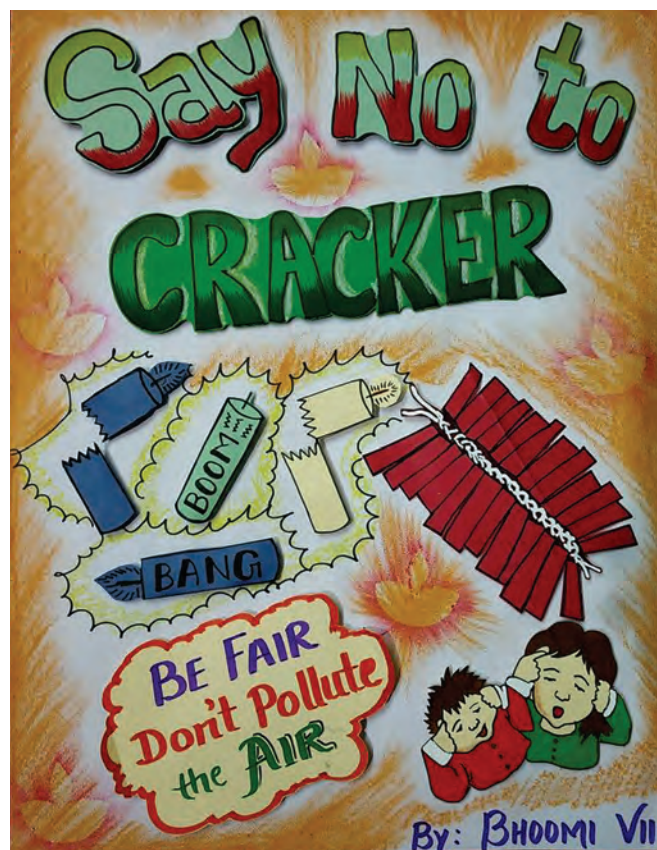


Method/Guide:

1. Discuss with the students issues related to crackers with regards to ambient (outdoor) air pollution. Explain to them that the air is already polluted due to many other activities and sources. The National Air Quality Standards are not being met in many cities in Maharashtra and the levels of pollution are higher than the safe limits.
2. Also, share information about the harmful effects of crackers with respect to air pollution. Crackers have the gun powder and heavy metals present to make the effects and colours. As the cracker is burnt, it produces a lot of very toxic smoke mixed with the poisonous fumes of the heavy metals burnt at high temperature. This smoke of many harmful substances and fumes are very dangerous for people.
3. Touch upon the advantages of banning crackers as well as the problems in banning the use of crackers. Banning the crackers will certainly stop its use and pollution caused by both smoke and noise. It will also stop child labour illegally happening in its manufacturing. But there are many people engaged in the manufacturing and sale of crackers. It is also associated with cultural aspects like festivals and celebrations. There will be opposition to the ban. Also, its illegal business might emerge which will be difficult to regulate.



4. Help students plan a “No Crackers” campaign to reach out to the whole of school, students and their parents.
5. Students can be guided to work in groups choosing from the following ideas:
 - Announcement in the assembly and make class to class appeals and organizing discussions.
 - Write and perform a skit to educate others about the negative effects of crackers (air pollution, noise pollution, accidents, injury and support of child labour)
 - Recruiting volunteers from each class to make posters for their own class. This is likely to evoke greater participation and therefore greater commitment from more students.



- Prepare an “Oath Letter” for not using crackers at any celebrations or festivals and circulate copies to schools. Invite all students to take a pledge just before the festival.
 - Make and distribute badges of “Say No to Crackers” or “Shun Crackers.” Explain to students that only if they are really committed should they wear the badge. At the same time, students should be able to explain why it is important to reduce the use of crackers.
 - Form a network of “No Crackers Schools.” This network can promote the idea of No Crackers Campaign in the village or city. Social media pages can also be created and managed with the help of some adult (teacher or parent of PTA) to promote the idea.
6. Students should be asked to do web-based research and find out about the harmful effects of burning crackers. They should then make posters on the harmful effects of burning crackers and share with people in their society and other schools.
7. No Cracker Slogans
- Divide the students into small groups of 4-5 and have them come up with slogans for a No Cracker campaign. Give them 20-30 minutes to come up with a catchy slogan (such as “Cracker Free Community”)
 - Groups can then present their best slogan and the class can vote on which one/ones they like the best. This slogan can then be incorporated into a class No Cracker campaign.

Extension/Variation:

Research and Poster Making

1. Students should conduct research on the Crackers and Cracker industry in order to become better advocates for No Cracker programs. Students can be given different topics to research and present. Sample topic include:
 - Where are crackers made? In what parts of the state or country.
 - Who is involved in cracker production and sale? Include information on laborers (children) and different levels of the supply chain from the raw materials (the chemical suppliers) to the final point of sale (your local shop).
 - What are the laws and regulations in India regarding cracker production, sale and use?
 - What laws do other countries have regarding cracker production, use and sale, and materials or chemicals used in manufacturing? Have students choose different countries so a good comparison can be made (for example, USA, China, France, Norway, Russia, Egypt, Peru, Brazil and Nigeria, etc.).
2. Ask students to make posters out of the information gathered and share it online and in school before the festival season.

Learning outcomes:

The harmful effects of crackers, explore different facets of issues looking at it from an environmental, social and economic perspective. Learn eco-friendly ways of celebrating festivals and promoting a sustainable lifestyle.

Green Habits

Green Habits Say No to Fire-crackers.

FAQs

Q - What is noise? What are its effects and control measures?

A - Sudden and loud sound is noise. Sounds that are unpleasant and cause trouble to people are considered as noise. Noise has health related impacts on people which are associated with physical, mental and psychological effects. Noise like continuous and sudden loud sound can cause loss of sleep, concentration and even hearing, anxiety, panic, irritation, restlessness, anger, etc.

The Air (Control and Prevention of Pollution) Act, 1981 considers noise as a pollution. It prescribes noise level standards for areas categorised under four zones namely, silent, residential, commercial and industrial. It also prescribes standards for different machines, instruments and crackers. Noise is measured by Sound Level Meter and its measuring unit is decibel (dB). Silent zones are the areas of

100-meter radius around hospitals, schools, colleges and courts. Permissible noise level standards in the silent zone are 50 dB for daytime and 40 dB for night time. There should not be more than 40 dB noise level around your school.

Loudspeakers are major sources of noise during the festivals. Loud noise, more than 45 dB, is prohibited after 10 pm in the residential zone. One can make a police complaint, and request them to stop such noise.

Q - What is a green cracker?

A- Green crackers are the crackers which contain a lesser amount of certain chemicals and heavy metals that release toxic gases in the atmosphere. However, these are not completely pollution free. These produce smoke, air pollution and noise. When used at neighbourhood level by many it causes air quality to deteriorate to the level harmful to health.

Case Story : No cracker campaign

Students of Seth Jyotiprasad Vidyalaya, Daund, Pune District

Fire crackers used during festivals and celebrations cause air pollution. There is a sudden rise in the level of air pollution observed due to crackers. The worst impact is on the health of people who are sensitive to poor air quality. These are children, the elderly, pregnant women and people with respiratory and heart diseases such as asthma, bronchitis, hormonal problems, blood pressure or heart-related problems. Hence, crackers need to be discouraged or stopped.

The students of Seth Jyotiprasad Vidyalaya, Daund, Pune District, carried out a 'No Cracker' campaign in their school and community. The campaign aimed at making students, adults at school and parents aware of the impacts of crackers. They organized a talk on the ill-effects

of using crackers, such as air pollution and the related health and environmental damage. They conducted a competition for students of other classes at school on the topic. They prepared posters, placards and performed a street rally with street plays to spread the message in their community.

Students collected money they usually get to buy crackers. They buy sweets and new clothes for the children in the orphanage. The campaign has become an annual feature of the school.

The students were inspired and guided by their teacher Shri Pramod Kakade. Shri Kakade has been awarded the Srushti Mitra appreciation certificate by the Environment Department of Government of Maharashtra.

4.2.19. Fuel Saving Drive

Level/Class: 8

Curriculum links: Science, Social Studies

Activity duration: 30 + 30 minute, additional for survey activity at home

Materials needed: Survey sheet, questionnaires, writing material

Approach: Indoor activity for whole class, student can do at home or neighbourhood

Topic:

Energy, air pollution, climate change, energy conservation

Concept:

Maintenance of vehicles and correct driving habits can save fuel and emission of air pollution and gasses responsible for greenhouse effect. The gases responsible for greenhouse effect and global warming are called radiatively important gases. These are popularly known as the greenhouse gases (GHG) also. Reducing the use of fossil fuels like petroleum products will reduce the emission of air pollution coming out of vehicles as well as emission of carbon dioxide. Carbon dioxide is an important GHG associated with the use of energy derived from fossil fuels (petrol, diesel and CNG) and responsible for global climate change.

Aims:

- Understand how small and low-cost vehicle maintenance practices can increase a vehicle's fuel economy.
- Identify driving habits which increase fuel consumption in order to rectify.

Key questions to address:

What are the vehicle maintenance aspects and driving habits that can save fuel? How to reduce emission of air pollution and greenhouse gases by conserving energy?

Method/Guide:

- Discuss with the students some wrong driving and maintenance habits and how these could be rectified to help us save many litres of fuel and reduce emissions and pollution of the environment.
- Read out the "Auto Quiz Questions". Discuss these and the preferred answers in the "Auto Quiz Recommendations". Ask the students to copy both these in their notebooks (if possible, photocopies could be distributed).
- Tell the students that the "Auto Quiz" is a "quiz" for any vehicle owner or driver, to draw their attention to proper ways to use and maintain their vehicles.

- Tell each student that they must give the quiz to 3 to 5 persons.
- Teachers should ask the students that before conducting the “Auto Quiz” they (students) should inform the driver that they are going to conduct a quiz with them. Drivers can answer to the questions of the quiz in a “Yes” or a “No”. Then the students should start to pose the “Auto Quiz Questions” to the drivers.
- Ask the students to inform the drivers that the quiz scores would help them understand how many of their practices are energy saving or wasting.
- After asking the quiz questions, tell the students to give the ratings and recommendations for each energy saving/wasting habit.

Extension/ Variation:

Ask the students to ponder this: An unwanted tool box weighing 25 kg could lower a car’s fuel efficiency up to 0.72 km/l. If someone currently gets 15 km/l and they drive 15,000 kilometres a year, they could save 46 litres of fuel! At Rs. 95/- per litre that would save Rs. 4,370/- per year, or it would be like driving almost 723 kilometres “free!”

Auto quiz questions

A. *Is there any excess weight in the vehicle (for example, decorative items, unwanted luggage, etc.)?*



B. *Is there any unrequited luggage carrier or other items, decorative items, etc. that just hang loose or break the contour and the streamlining of the body, and thus the aerodynamism of the vehicle?*

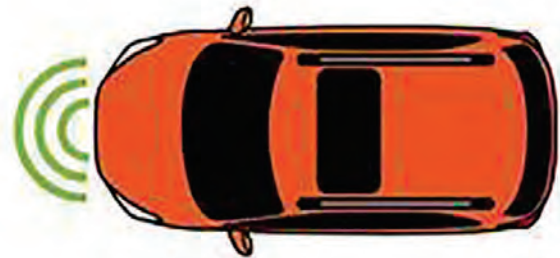
C. *Are you usually the first to get away from the signal light?*

D. *Do you anticipate traffic slow-downs, stop signs and signal lights and slow down gradually?*

E. *When possible, do you plan your trips at times other than peak traffic hours (9-11 am or 5-8 pm)?*

F. *Do you start the engine and proceed immediately?*

G. *Do you “run” the accelerator prior to turning off the engine?*



H. *Do you maintain a steady driving speed?*

I. *Do you use the features in the vehicle to your advantage whenever needed? For example, when attempting a right turn, do you use right turn indicator signal lights to clear your way and gradually slow down to turn, rather than braking suddenly to let the speeding vehicle have its way?*



- J. Do you keep the engine running idle for over 60 seconds when waiting at the traffic signals or when waiting for a passing train at the level crossing?
- K. Have you checked or changed your air filter in the last six months or after driving 6,000 kilometres?
- L. Have you changed your engine oil in the last six months or after driving 5,000 kilometres?

- M. Do you check your engine oil at least once every five times you stop for refuelling?
- N. On a smooth road, does your vehicle vibrate or bounce, (indicating low tyre inflation)?
- O. Do you use the manufacturer's recommended viscosity oil?
- P. Have you had a service and tune up in less than one year after driving 10,000 kilometres?
- Q. Do you check your tyre pressure every time you refill fuel?
- R. Have you got your vehicle Pollution Under Control (PUC) certified?



Rating and recommendations

The person you interviewed should have answered the questions as follows:

No : a, b, c, g, j, and n.

Yes : d, e, f, h, i, k, l, m, o, p, q and r.

For each correct answer, give 5 points. If they score:

75 or more	<i>Congratulate the person as he/she is an energy saving driver!</i>
60 to 75	<i>Inform the person that he/she has passed the test, but there is still room for improvement.</i>
50 to 60	<i>Advise the person that he/she can save some energy and money too! Point out where he/she often makes mistakes.</i>
50 and less	<i>The person needs to seriously look at his/her driving and energy attitudes. He/she needs to seriously evaluate and do something about wasteful driving habits.</i>

Auto quiz recommendations

- A.** The preferred answer is “No”. Removing the unwanted luggage will reduce the vehicle’s weight by 5 or more kilograms and may considerably improve the mileage.
- B.** The preferred answer is “No”. Removing the unused luggage rack and other contour-breaking features could restore the vehicle’s aerodynamics and improve the vehicle’s fuel efficiency.
- C.** The preferred answer is “No”. Rapid acceleration may reduce the mileage considerably.
- D.** The preferred answer is “Yes”. Rapid acceleration and delay in applying the brake for the upcoming stop sign or red signal light may reduce the mileage considerably.
- E.** The preferred answer is “Yes”. By avoiding unnecessary trips during peak traffic hours and driving above or below the optimum speed limit of the vehicle, many drivers could increase their vehicle’s fuel efficiency.
- F.** The preferred answer is “Yes”. Warming up the engine before shutting off consumes unnecessary fuel, lowering the km/l. The manufacturers of fuel-efficient vehicles no longer recommend the 10-15 second engine warm-up. They do recommend no hard acceleration, heavy pulling or steep hill climbing for the first kilometre or so.
- G.** The preferred answer is “No”. Running the engine before shutting off consumes unnecessary fuel, lowering the efficiency.
- H.** The preferred answer is “Yes”. Driving above the optimum speed limit not only uses more fuel, but the driver is more likely to brake more frequently. The more rapid the stop, the more quickly energy is being wasted. Gradual acceleration, driving at a moderate speed and smooth stopping

can help a vehicle deliver its optimum fuel economy.

- I. The preferred answer is “Yes”. The features in the vehicle could help the driver get his/her way cleared and help him/her to brake less frequently. Driving at a moderate speed and smooth stopping help a vehicle deliver its optimum fuel economy.
- J. The preferred answer is “No”. When a vehicle is not moving and the engine is running, the vehicle gets ZERO km/l. Those “ZERO’s” negatively impact efficiency.
- K. The preferred answer is “Yes”. Dirty air cleaners restrict the engine’s air flow intake and result in an excessively fuel rich mixture.
- L. The preferred answer is “Yes”. Old spent oil loses important engine-protecting, friction-reducing, fuel-saving additives and causes the engine to waste energy.
- M. The preferred answer is “Yes”. Old thick oil causes the engine to waste energy.
- N. The preferred answer is “No”. Tyre balance and wheel alignment are important for optimising fuel economy.
- O. The preferred answer is “Yes”. Owner’s manuals list appropriate viscosity (weight), and grades of oil that provide protection against engine wear and deterioration. Typically, manufacturers provide a chart illustrating the recommended viscosity as a function of vehicle load and ambient temperature. Too high a viscosity or too low a viscosity will result in excessive engine wear. If the viscosity is too high for the ambient temperature, the oil pump will have to work more to deliver the oil and result in lower mileage. Conversely, if the

oil viscosity is too low, then the engine will have an excessive amount of internal friction. Lower mileage will result.

- P. The preferred answer is “Yes”. Ignition tune ups include checking, adjusting and replacing critical components such as spark plugs, spark plug wires, distributor cap and rotor, vacuum lines, ignition timing and critical emissions control devices. These components must deliver the ignition spark at the precise instant to burn the fuel effectively and efficiently. Ignition timing that is off by as little as 3 or 4 milliseconds (that’s 3 or 4 millionths of a second!) can significantly reduce fuel economy. Each component must operate optimally for a vehicle to retain its designed fuel economy.
- Q. The preferred answer is “Yes”. Low tyre inflation is the most cited tyre related fuel eater. Tyres as little as two kilograms under inflated can reduce fuel economy by 2, 5 or even 10 per cent. Under inflation promotes rapid tyre wear and could be unsafe.
- R. The preferred answer is “Yes”. PUC certificates indirectly serve as a guide to the performance of the vehicle and the maintenance needed. If below standard, the vehicles need to be serviced and brought up to proper operating level.

Learning outcomes:

The vehicle maintenance, fuel saving practices, promotion and adaptation of good driving habits and sustainable transportation practices.

Green Habits

Ask elder people to maintain their vehicles and check tyre pressure to use fuel more efficiently.

FAQs

Q - What is CNG? What are CNG vehicles and electric vehicles?

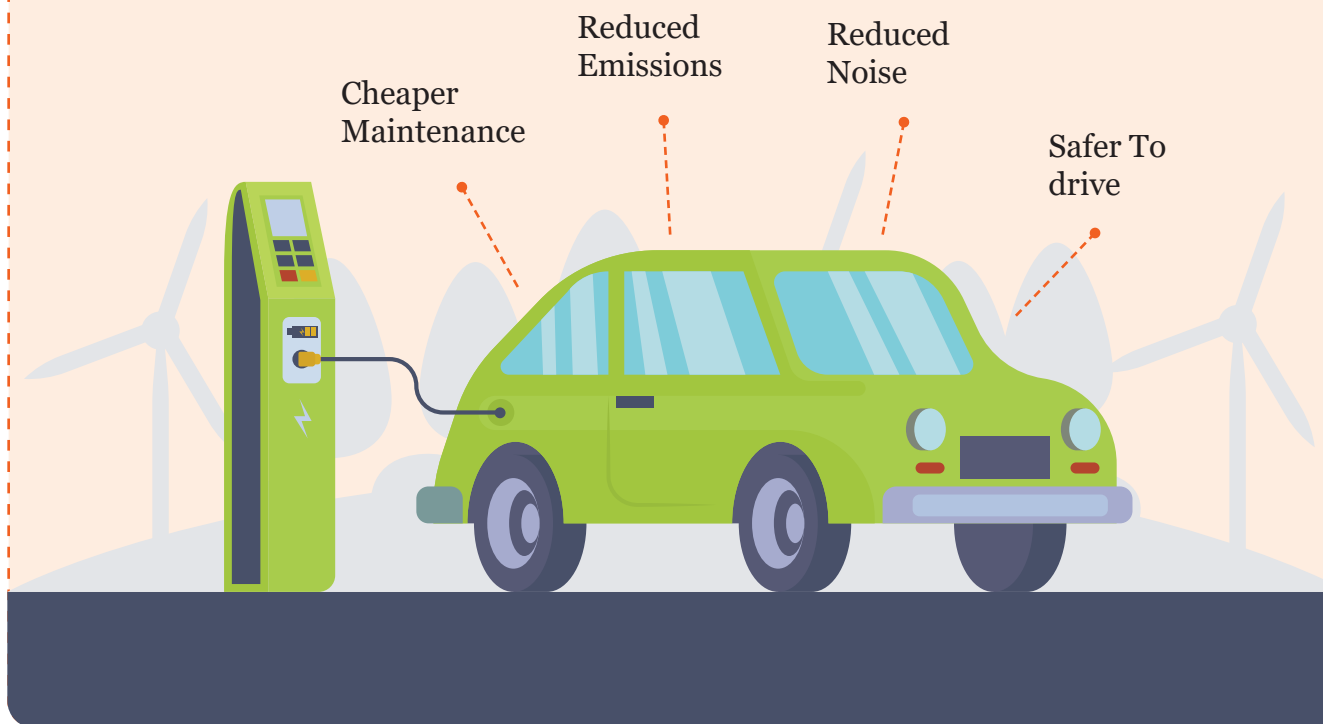
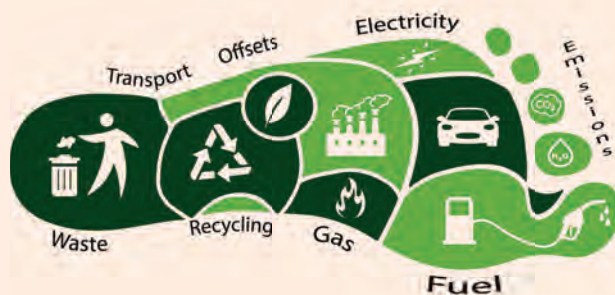
A - CNG or compressed natural gas is a fossil fuel extracted from earth. It is a less polluting fuel compared to petrol or diesel. It also gives a higher mileage and fuel economy. There are vehicles that run on CNG, these vehicles produce a lesser amount of air pollution compared to their petrol or diesel models. Electric vehicles run on electricity which is stored in the battery of the vehicle. Electric vehicles produce no air pollution at the local level. But electricity is used to charge the battery of the vehicle. If the energy is sourced from a renewable source like solar or wind energy it does not cause air pollution. But if the electricity is sourced from the conventional, non-renewable source like coal it causes pollution at the place of generation. In India, most electrical energy is sourced from coal burnt in thermal power plants.

Electric vehicles need batteries throughout their life. Making batteries and its disposal or recycling is also a very polluting process.

Q - What is the carbon footprint?

A - Carbon footprint is the total amount of carbon dioxide (or greenhouse gases expressed as carbon dioxide equivalent) released into the atmosphere as a result of the activities of a particular individual, organisation or community. It is calculated in terms of energy or resources used and greenhouse gases (GHG) emissions caused by such activities. Activities like transportation, use of electricity and production of material, etc consume energy derived from the sources which release carbon dioxide or GHG.

Carbon dioxide is one of the GHG. GHG in the atmosphere is responsible for climate change and our actions are responsible for the release of GHG.



4.2.20. Wise Traveller

Level/Class: 8

Curriculum links: Science, Mathematics, Social Studies

Activity duration: 30-60 minutes, activity at home, preferably in day time

Materials needed: Survey sheet, questionnaires, writing material

Approach: Indoor activity for whole class, can be done at home or neighbourhood

Topic:

Energy, air pollution, climate change, sustainable mobility

Concept:

Transport plays an important role in the overall development of the national economy. The transport sector in India is a major energy consuming sector, particularly oil. Almost half of the total petroleum products of the country are consumed by the transport sector in the form of diesel and petrol.

Commercial energy consumption in the transport sector has increased at the rate of 3.1 percent a year between 1970-71 and 1980-81. It grew at a much faster rate of 4.9 percent a year between 1980-81 and 1990-91, and at 5.6 percent a year during 1990-91 to 1997-98. The higher rates of growth of energy consumption can be attributed to the shift that has occurred from a rail dominant economy of the 1950s, to a road dominant economy in the 1980s. Also, there has been a sharp increase in the use of personalized modes of transport, partly due to inadequacy of public transport systems.

With the increase in diesel and petrol consumption and the limited resources available to us, there is a need to look at alternative modes of transportation. Small changes in our habits like cycling or walking short distances instead of taking a vehicle can help to save a lot of fuel.

Aims:

- Become aware of various types of transportation and how much fuel is consumed by each.
- Calculate and compare the energy efficiency of a variety of automobile models in the market.

Key question to address:

What are the sustainable modes of transport or mobility? Which mode consumes less energy, causes reduced emission of air pollution and greenhouse gases per person per km travelled?

Method/Guide:

Ask students to find out from their local bus station or any bus driver following aspects:

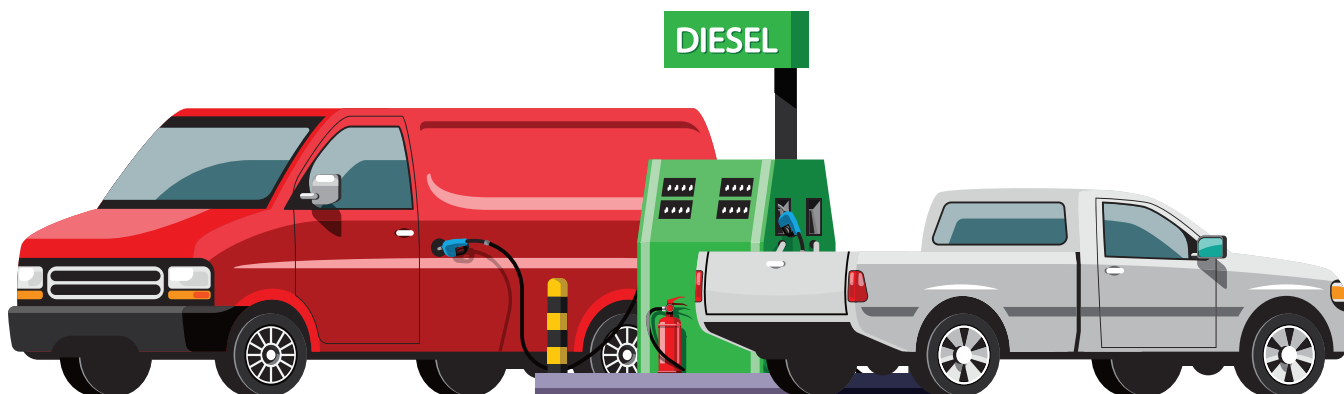
- a. What is the fuel used?
- b. What is the cost of the fuel per litre?
- c. What is the average distance (in kilometres) the vehicle travels per litre of fuel?
- d. How many people can ride on the vehicle?

- e. How many people usually (at least on 50 percent of the occasions) ride in their vehicle?

Ask the students to interview a couple of drivers of cars, auto rickshaws, motorcycles, scooters and other vehicles to get the above details for their vehicles. Record all the data in the “Transportation Chart” given below.

Ask the students to calculate the fuel consumed per person if he/she goes the same distance by bus, car, motorcycle, cycle rickshaw, bicycle and other modes of transport.

<i>Transportation Chart</i>					
<i>Vehicle</i>	<i>Fuel Used</i>	<i>Average No. of Passengers</i>	<i>Fuel Efficiency km/l</i>	<i>Litres per Kilometre per Person</i>	<i>Cost per Person per Kilometre</i>
<i>Scooter/ Scooty</i>					
<i>Motorcycle</i>					
<i>Auto Rickshaw</i>					
<i>Car</i>					
<i>Jeep</i>					
<i>Van</i>					
<i>Mini Bus</i>					
<i>Bus</i>					



Extension/Variation:

- Ask students the following questions:
 - a. Which mode of transportation do you choose most often, and why?
 - b. What other factors are considered in choosing a mode of transportation?
 - c. Which form of transportation is most energy efficient?
- Ask the students to collect brochures of different models of any one type of vehicle (say a car, scooter, motorcycle, other).
 - a. Let them mark the salient features of each model that are used for promoting its sales.
 - b. Let them find out efficiency in km per litre of fuel consumed.
- Ask the students to also compare walking and bicycling with these options.
- Ask the student to put together a “Transportation Guide of the Year” that advertises a current model of the type of automobile that is most fuel efficient and energy conserving. Throughout the year, more drawings, pictures and information about transportation can be added.
- Ask them, if given an option (assuming that they know to ride or drive all the vehicles), which model and brand would each student select for his/her personal use and why? What criteria did they consider in making their selection?
- Ask them to plan and organize a “Wise Traveller Campaign” for the school, aimed at cutting down use of personal vehicles, encouraging use of bicycles, public transport and pooling.

Learning outcomes:

The energy consumption aspect of different modes of transportation and look forward to adopting sustainable transportation practices.

Green habit:

Promote and use sustainable modes for travel i.e., walk, cycle and public transport.

FAQs

Q - What is sustainable transportation? How can this be developed?

A - Sustainable transportation are the modes or systems that are energy efficient, non-polluting, consume less space on road and provide mobility to all in the community. It should promote active and healthy lifestyle, be safer in terms of road safety and can be used by children, women, elderly, persons with disabilities, poor and rich alike and accessible

for all. It must be economically affordable for both the users and the providers/operators and cause least impact on the environment in its development. Such sustainable transport systems should provide choices to its users and integrate them for the convenience of its users.

Walk, bicycle and public transport are the modes of sustainable transport systems and fit in above criteria and expectations. Walk and bicycle are pollution free with no energy need and consume minimal space on road. These are affordable, active and healthy modes that can be used for short trips of 2 to 5 km easily.

Public transport systems based on buses are most efficient in energy use per person per km travelled, similarly least polluting. It provides mobility to a higher number of people comparatively consuming less space on road. It can be used by all types of commuters in the society with the ease of access. Public transport can be seen as a strategy to improve road safety. It can be designed so people with disabilities can also use it with ease. Bus based public transport is affordable for its users and providers, has flexibility to extend and cover all areas, and has the least impact on environment while development and operations. It can also be integrated with other transport modes and systems in a planned manner.

It needs to provide safer and convenient infrastructure for walking and bicycles like footpaths, cycle tracks, pedestrian and bicycle crossings, cycle stands, pedestrian and cycle signals, etc. It needs to provide separate lanes for buses, high quality buses, high frequency and punctual service, secure stops, passenger information system and integration with other modes for an efficient bus based public transport system.

Q - What is metro?

A - Metro is a rail based public transport system operated on very high capacity routes. It is operated on separate constructed elevated or underground corridors. It is a very costly infrastructure both for its construction and operations. It is also energy intensive but pollution free. It can not be taken to all parts of the city and all in the society cannot afford it to use. It can be integrated with other modes if planned and implemented carefully. It is a high capacity system suitable for large and densely populated metropolitan areas.

Q - What is BRTS?

A - Bus Rapid Transit System (BRTS) is a bus based high capacity, mass, rapid transit system. In BRT, segregated lane is provided for rapid movement of buses without traffic congestion with many other modern commuter friendly features like signal priority for buses, level boarding, safe pedestrian crossing, wheelchair accessible, passenger information, high quality buses, safe bus stops, high frequency and other commuter friendly services like any modern high capacity public mass transit system. BRT is extremely affordable and economical compared to any rail-based transit system, it is very energy efficient, and low in pollution emission due to high ridership. It is easy and quick to implement and can be extended to full city scale due to its flexibility and based on local technology of buses. It can easily be integrated with other modes and systems. BRT is appropriate for the small, mid and large size cities. BRT is accessible and convenient for all different kinds of commuters as it is a bus based mass transit system. BRT is operating in many cities in India and giving the desired outcomes.



Level/Class: 8

Curriculum links: Science, Mathematics, Social Studies

Activity duration: 30-60 minutes, activity at home, preferably in day time

Materials needed: Survey sheet, questionnaires, writing material

Approach: Indoor activity for whole class, can be done at home or neighbourhood

Topic:

Energy, climate change, energy conservation

Concept:

With the invention of electricity, life has become comfortable and we are becoming more and more dependent on gadgets of all sorts, for daily chores as well as entertainment. Students hardly realize that the increasing use of electricity has a price, not only in terms of paying the bills, but also the impact this has on the environment.

An energy audit refers to examination and verification of energy consumption in the form of electricity, gas and other forms of fuel energy, used in households, schools, industries, institutions or other public entities. Energy audit undertaken periodically would reflect increase or decrease in energy used over a period of time.

Aims:

A school energy audit looks at energy consumption in a school. Through this activity students find out about the use of electricity for various purposes. They get to know how to conserve electricity and the importance of inculcating simple conservation habits, in making a marked difference.

Key questions to address:

What is the amount of energy used and for what purposes? Is there any wastage? How to find out any wastage and conserve that?

Method/Guide:

The students can be introduced to the topic through:

A talk by a resource person, (for example an official from the electricity board), on production, uses and conservation of electricity. The problem of limited fossil fuels and also the problems caused by dams and nuclear fuels are discussed.

A field trip could be arranged to a nearby power substation where the office, engineer or in charge could provide students the details about how they receive electricity in their school and locality (i.e. generation in thermal, hydro or nuclear power station, the transmission to main station to substation to school) and the environmental consequences of electricity generation.



Students should also be familiarized with an electricity bill. They should study what kind of information is found on the bill and discuss what each head means. What is the rate of electricity, telescopic rate calculation, uses patterns over the months, etc.

Taking Action:

Once students have been introduced to the system of recording and billing electricity use, they could conduct a survey to find out where and for which appliances electricity is used in the school. They may use the given survey sheet and add to it other items that are specific to their situation, e.g. use of a pump for pump-water up to the overhead tank.

Electricity Survey for the School								
Complete the table								
Appliance	Class				School			
	No.	Working hrs/month*	Number you think actually required	Should work hrs/month*	No.	Working hrs/month*	Number you think actually required	Should work hrs/month*
1. Incandescent Bulb 40 W 60 W 100 W								
2. Fluorescent Tube Light 20 W 40 W								
3. Fans								
4. Projector								
5. TV								
6. Video player								
7. Public Address System								
8. Water Pump								
9. Cooler								
10. Computer								
11. Printer								
12. Other								

B. Answer the following questions
 How many times in a week did you find lights and fans 'on' in your class when nobody was present in the room?
 Does your school campus use energy efficient LED bulbs? Yes/No:
 The total electricity bill for the past year of the school was:
 The total electricity bill for the past month of the school was:
 *Approximate

The survey should be done twice, once before the start and once after the campaign, so that the two may be compared.

Taking Action:

Using the data collected during the survey students could calculate the units and cost of a fan and light which are not switched off for an hour and for a day.

The Calculation:

Suppose a 1000 Watts electrical appliance consumes one unit of power every hour and per unit of electricity costs Rs. 2.30.

If a fan of 60 watts runs for 24 hours, the cost to run it would be as follows:

- One unit is consumed in 16 hours and 40 minutes for a fan of 60 watts i.e. 1000 minutes.
- Therefore in 24 hours or 1,440 minutes electricity consumed is = 1 unit \times 1440 min
- So, in 1000 min = 1.44 units would be consumed
- If the cost of one unit is Rs. 2.30 then 1.44 units costs = Rs. 3.31 (1.44 \times 2.30)

After the calculation, students should take up an action campaign. Some tips for acting are listed below:

If the appliances are not switched off after use, they should put a note asking the person(s) using it to switch it off after use and also to switch off other lights and fans when leaving the room.

Form groups to patrol the campus at intervals (during recess, lunch, leave, etc.) to determine if there are any appliances left on in unoccupied rooms and then bring it to the notice of the person concerned. Or if they have the permission, students may enter the room and switch these off. (Prior permission is always required, as in the case of laboratories, where experiments may be going on, even during the recess.)

Talk to the school administration to get them to maintain the electrical appliances in proper condition (not letting dust accumulate on the lights and fans, keeping them clean, following the instructions for using the electrical appliances properly, etc.)

A graph of monthly unit consumption and amount of bill can be prepared and analysed for knowing the consumption as well as compared with monthly consumption of previous years. Monthly consumption will vary according to the need in that season.

Keep a record of the electricity bill every month to determine whether the bill has reduced after the awareness campaign. This is a great achievement for the school and this news could be displayed on the notice board and announced in the assembly.

Extension/Variation:

Students can be asked to undertake the Energy Audit for their home and share the findings with the class.

Learning outcomes:

The energy consumption patterns, types of energy uses, identifying leakages or wastage in energy uses, thinking of ways for energy conservation and recognizing the saving habits.

Green habit:

- Use natural light whenever possible instead of electric lights.
- Conserve electricity and become energy efficient.

FAQs

Q - What is CFL and LED?

A - CFL is a compact fluorescent lamp or light. It is an energy saving light and alternative to incandescent filament light bulbs. It consumes 80% less energy compared to a filament light bulb and gives a similar amount of light. It is costly but has longer durability and saves cost on electricity uses. It contains mercury which is harmful for the environment after it is discarded.

LED or light emitting diode is a semiconductor light source that emits light when current flows through it. It has many advantages over incandescent lights, it consumes only 5 to 10% energy compared to incandescent light, has longer life and colour options for different applications. It is costly but lifetime cost is lower due to longer durability and high electricity savings. The Government promotes using LED lights and makes it available for people at a discounted price.

Q - What are the indirect wastages of electricity?

A - Water is being pumped to overhead tanks by using electric motors. From the overhead tank it is supplied to tap through gravity. This use of electricity is not readily visible at our schools, homes or public buildings. In pipe water supply system, a large amount of electricity is used to pump the water to reach our home, school or other public places. Water is pumped from the dam or river to water treatment plants, while treatment also consumes electricity to run pumps and treatment appliances, then it is pumped through a network of pipes to reach our home, school and other places. Therefore, wastage of water is also the wastage of energy consumed in pumping the water. Hence, saving water has twofold benefits of additionally saving energy. Let's think and find out what are other such ways and possibilities for saving energy.



CFL

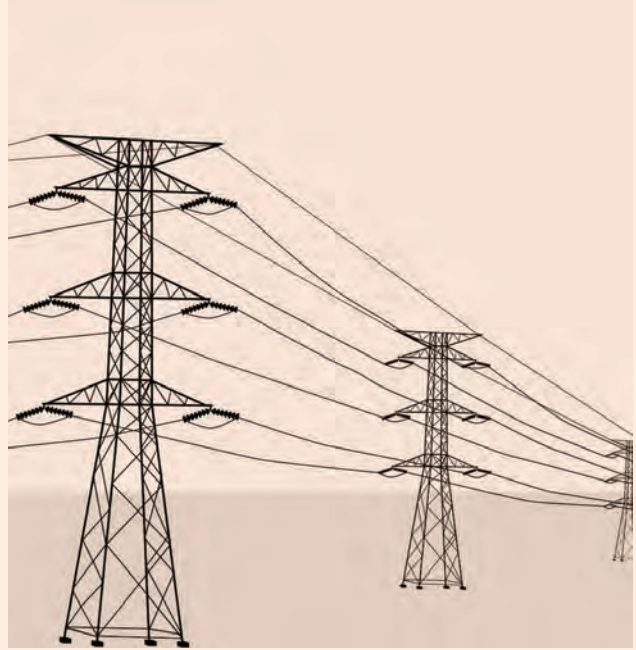


LED

Case Story: Leading in renewables

Maharashtra is one of the leading states in renewable energy generation. The state has adopted a renewable energy policy called the 'Unconventional Energy Generation Policy' to promote renewable energy such as solar power, wind power, biomass based and hydro power. The policy also promotes the use of appliances like agriculture solar pumps, rooftop solar system, solar water supply stations, solar electrification of rural homes, solar water heating, solar cooking systems and solar cold storage projects, which are independent of grid connection. It ranks fourth in solar rooftop installations in India. The state also leads in wind power with some of the mega wind farm projects in the state located near the coasts.

Maharashtra has renewable energy potential of 75 Giga Watt (GW), which is 8.3 percent of the country's total potential. The state has a renewable energy target of 22 GW to be achieved by 2022. As of 2020, it had installed capacity of 9.7 GW renewable energy.



4.2.22. Weather Clues

Level/Class: 8

Curriculum links: Social Studies

Activity duration: 35 minutes

Materials needed: Graph paper, map of India, colour pencils and ruler, data set copies (given in appendix 4.2.25)

Approach: Indoor activity for entire class in groups

Topic:

Climate change, climate and weather

Concept:

Climate of a place is the average of its weather parameters over many years. The climate of a place depends on its geographical location. While the weather of a place can change in just a few hours, climate takes hundreds of or sometimes thousands and even millions of years to change. The climate of a place is defined in terms of the maximum and minimum temperature, precipitation or rainfall, duration of the day and night and sunshine, etc. over a period of recorded history of 50 to 100 years.

The change in the average mean temperature and precipitation or rainfall from the average of many years can be perceived as climate change. It is a change in the usual weather found in a place. This could be a change in how much rain a place usually gets in a year. Or it could be a change in a place's usual temperature of a month or season. Climate change is also a change in the Earth's climate or change in Earth's usual temperature.

Aims:

To help students correlate the climatic and weather parameters to the geographical location of a place.

Key questions to address:

What is the climate of a place? How is it associated with the geographical location of the place?

Method/Guide:

Divide the class into five groups. Make one copy of each of the five data sets.

1. Assign one data set to each group; ensure that they do not know which place that data pertains to. Ask them how they could most effectively depict the data given to them. Bar graph for rainfall data and line graph in two different colours for maximum and minimum temperatures may be appropriate. Based on the discussion, ask each group to represent their data graphically.

2. Let each group study the data represented graphically and note:

- The highest and the lowest temperatures recorded.
- The months that record highest/lowest temperatures.
- The highest rainfall recorded and
- The months which record high rainfall and their number.

3. Now, ask each group to guess the region their meteorological data is likely to represent. Let them bear in mind that the climate of a place

is determined by its latitude, altitude and its distance from the coast (inland or coastal), etc. 'More clues' given with data sets will be helpful. Make the table given here on the board and ask each group to fill it with the information pertaining to their data set.

4. Now, disclose the station to which the data belongs. Ask each team to present the findings to the class describing how they tried to correlate the given weather data to arrive at the conclusion. Ask them to point out the station on the Indian map and provide interesting facts related to the climate and weather of that region

	Group 1	Group 2	Group 3	Group 4	Group 5
Month recording highest temperature					
Month recording lowest temperature					
Month recording highest rainfall					
Our guess about the location of the data station					
And the station is...					

Discussion

Everything about a place is influenced by its weather. Weather is the condition of the atmosphere at any given time with respect to such factors as temperature, humidity, barometric pressure, wind speed and direction, precipitation and cloudiness. Averaging the weather pattern for a particular region or location over long periods of time (approximately 30 to 50 years), gives us the climate of the place. Climate of a place influences the biodiversity (plants, animals and microbes), agriculture, architecture, local customs and traditions, festivals, the kind of clothes people wear and the food they eat.



Partly Cloudy



Sunny



Cloudy



Stormy



Rainy



Snowy

Learning outcomes:

The climate and weather and the correlation of weather parameters with the geographical location of a place.

Green habit:

Learn about local and traditional practices followed by people to live and survive in different climatic areas.

FAQs

Q - What constitutes the climate of a place? What is the difference between climate and weather?

A - Climate of a place is determined by its meteorological parameters. Meteorological parameters are sunshine, temperature, relative humidity, precipitation (rainfall and snowfall, etc), wind speed and wind direction, etc. These parameters interplay and affect each other. The short-term variations in these parameters is experienced as the weather of that place.

Climate is the long-term pattern of weather in a particular area. Weather can change from hour to hour, day to day, month to month or even year to year. Climate of a place is the average of its weather or meteorological parameters over a period of 30 years or more. A region's weather patterns, usually tracked for at least 30 years, are considered its climate. It is the mean and variability of meteorological variables over a time spanning from months to decades.

In a broader sense, climate is the state of the components of the climate system which includes the ocean and ice on Earth. Climate of a place or region is affected by its latitude, terrain and altitude, as well as nearby water bodies and their currents.

Q - What is climate change? What are its consequences?

A - Climate change is the change in the usual weather found in a place. It is a long-term change in the average weather patterns that defines the climate of the earth, region and place. Climate change will result in many serious consequential impacts at local, regional and global levels affecting all life forms. This change in climate is induced by the increase in the global atmospheric concentration of radiatively important gases (RIG) commonly called greenhouse gases (GHG). These gases are responsible to maintain the earth's temperature by absorbing and retaining the heat reflected back by earth. Because of building concentration of these gases this phenomenon is increasing and causing rise in the mean temperature of the earth, commonly known as global warming. Global warming will induce many changes in the earth's climate system, some of them unpredictable at the local level. As these changes are happening at a rate faster than ever experienced any time in history it might be beyond the capacity of many organisms and ecosystems to adapt and they may go extinct. Please see the section in biodiversity to understand the impact of climate change on biodiversity. The human induced change in the climate system is a long term and irreversible process.

Case Story: Climate Action Plan

The Environment and Climate Change Department of Government of Maharashtra has prepared the Maharashtra State Action Plan on Climate Change (SAPCC). The action plan assesses vulnerability of the state to the changing climate and outlines broad strategies for building climate resilience.

The adaptation plan estimates the changes in temperature and rainfall that may take place across the state in the future, in the years 2030, 2050 and 2070 by taking the average climate of 1970-2000 as the baseline.

A vulnerability index has been created with 19 indicators. The plan identifies the most vulnerable districts using this index. Nandurbar, Dhule and Buldhana are considered more vulnerable. On the other hand, Satara, Ratnagiri and Sindhudurg are considered as less vulnerable to climate change.

The Maharashtra SAPCC project changes in rainfall, temperature and future sea level rise.

Amravati (Vidarbha) and Aurangabad (Marathwada) divisions are projected to experience greater rise in annual mean

temperatures in the range of 1.44 to 1.64 degree Centigrade in 2030, of 2.2 to 2.35 degree Centigrade in 2050 and 3.06-3.46 degree Centigrade in 2070, respectively. Whereas, minimum temperature is projected to increase in Konkan, Pune and Nashik divisions which could adversely impact crops.

The findings of the plan are important and clearly describe the adverse impacts of climate change on all the regions of the state. The Plan broadly projects impacts on agriculture, water resources, health, forests and biodiversity, livelihood, and energy and infrastructure. It indicates risks such as heat stress, increase in malaria transmitting mosquitoes, decrease in yield of certain crops such as rice, sorghum and cotton, increase in intense rainfall event, and more dry days in south central Maharashtra causing droughts.

The different government departments, and all sectors such as industries, farmers, and the public have to work together face these challenges. The Environment and Climate Change Department is the nodal department in Government of Maharashtra for implementing the SAPCC.

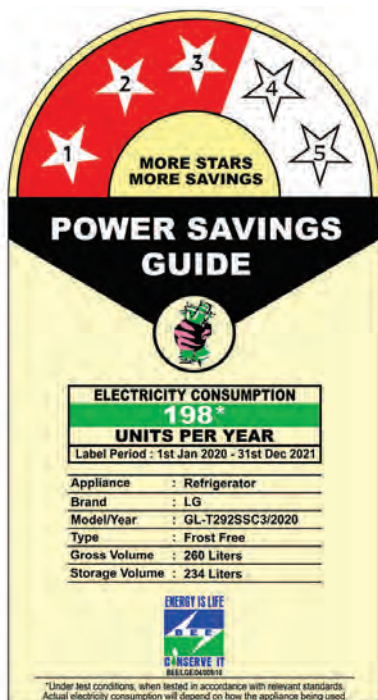
Level/Class: 8

Curriculum links: Science, Mathematics, Social Studies

Resources and Preparations needed: Worksheet, pen, pencil, colour pens and pencils

Project Timing:

- # Project Allotment and Team Formation - start of the academic year
- # Preparation of project plan and work distribution - before the semester examination
- # Observation and Record - continue activity over the academic year
- # Data Collection, Analysis and Report - before the final examination
- # Presentation - before the end of year



Topic:

Energy, climate change, energy conservation, energy efficiency

Concept:

Our life has become dependent on various gadgets, devices and appliances that run on electricity. We purchase them looking at its appearance, our comfort and other features we like. But we seldom look at its energy consumption while purchasing. In their full lifecycle they consume a lot of energy and even a small percentage of saving makes a big difference over the life of the product. Household appliances are one of the major consumers of electricity.

In India, the Bureau of Energy Efficiency (BEE) promotes manufacturers to make products that are energy efficient. They initiated a “Star Rating System for the Energy Efficient Appliances” where they test the appliances and provide Star Ratings on the scale of “5 Stars” based on its increasing energy saving potential. They keep on enhancing the criteria for the same with improving technology. The 5-Star Rating system is there for many of the appliances like fan, air conditioner, refrigerator, etc. However, it is not there for all kinds of appliances due to technological challenges.

Energy efficiency means using less energy for the same output or work, hence saving energy. Energy efficiency leads to reducing greenhouse gas (GHG) emissions, reducing demand for energy imports, and lowering costs on a household and economy level. Students need to be made aware that using less energy means conserving natural resources, educating them on their energy consumption in their homes and classrooms and how they can reduce their impact in easy and healthy ways that will benefit themselves and their surroundings.

Objective:

Learning objectives:

- To prioritize and make choices regarding environment friendly technologies and systems in living spaces.
- To learn about the options available for different appliances, do a comparative analysis with regards to energy efficiency for making the choice.

Action objectives:

- Students conduct research on energy efficiency of the products available in the market and develop information to help purchase energy efficient products and appliances
- Draft and suggest a product purchase policy for the school



Project Plan and Schedule:

Step	Location	Duration
Project Introduction	School	30 minutes
Project Allotment and Team Formation	School	30 minutes
Preparation of project plan and work distribution	School	30 minutes
Observation and Record	Community	Continue activity over the academic year
Data Collection, Analysis and Report	School	30 minutes - 3 week
Presentation	School	30 minutes

Project Steps in Detail:

Make groups of 4-5 students and explain the project objective. Assign each group two to four

categories of the product or appliances that are used in the school or at their home. Students can take from the following product categories:

1. Bulbs
2. Water heaters (geysers)
3. Water Purifiers
4. Tube lights
5. Refrigerators
6. Vacuum Cleaners
7. Fans
8. Washing machines
9. Computers
10. Coolers
11. Microwave Ovens
12. Printers
13. Air Conditioners
14. Grinder, Mixer and Food Processor
15. Press/Irons
16. Televisions
17. Water Pumps
18. Room Heaters/Blowers
19. Others

Ask students to do a web based research and find out about the BEE Star Rating system.

- What is the Star Rating system for appliances' energy efficiency?

- Which are the categories of appliances covered under this?

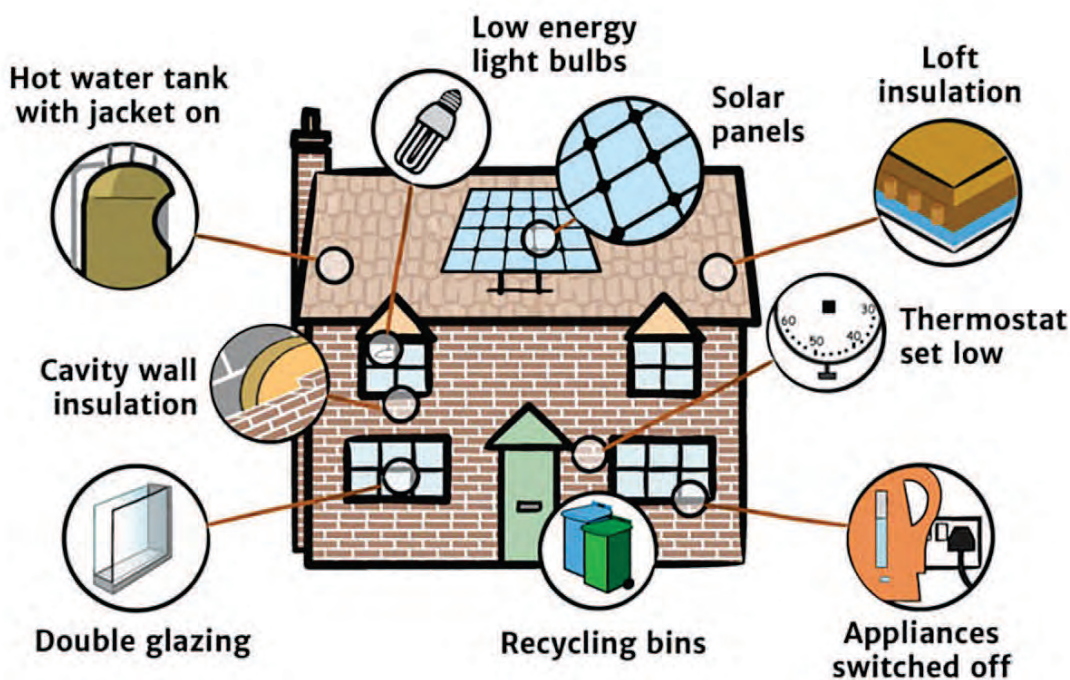
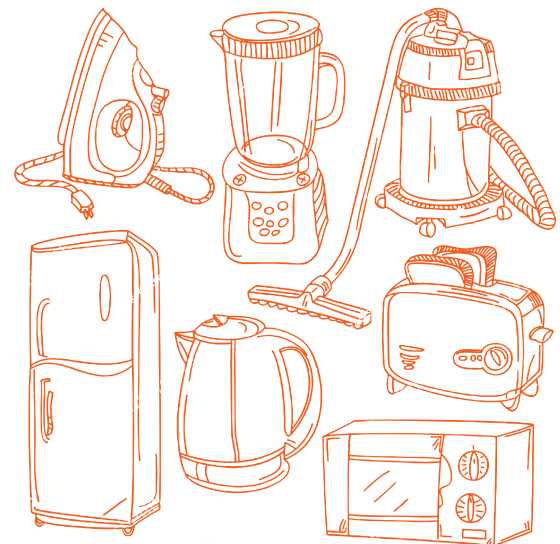
Students can visit any shop or mall and prepare a list of different products available under that category. Identify 10 to 15 products man-

ufactured by same or different makers or companies in each of the categories. Students can collect brochures of these products and take pictures or note down the information given on the labels put on the product or their boxes. Students can also be watchful of advertisements on television and note the companies that make these products. They can visit websites of these companies to find out about the products manufactured by them.

Students should find out the information with regards to the energy consumption or saving by these products. They should find out if there are “Star Rated” products available in this category in the market. They should then compare the products for their energy consumption for different Star Ratings available like (1 Star to 5 Star) and non-Star Rated products. They should look at following factors:

- Are Star Rated products available in this category

- What are the Star Ratings available from 1 to 5 Star?
- Wattage or Energy consumption in units (KWH)
- Energy saving potentials for a period (month or year)
- Capacity or output of the product if applies (like light output in lumens for bulb, RPM or air put through for fan, ton of an AC, Litre (L) for refrigerator or washing machine, etc)
- Cost of these products



Compile this information in an easy to understand manner where it can be compared

easily. You can use the observation table similar to the one given below:

Observation Table of Energy Efficient Equipment and Appliances Available in the Market

<i>Product Information</i>	<i>Product 1</i>	<i>Product 2</i>	<i>Product 3</i>	<i>Product 4</i>
<i>Category of the product</i>				
<i>Name and model of the product</i>				
<i>Manufactures or company</i>				
<i>Is product Star Rated, if yes Star Rating</i>				
<i>Capacity if the product (if applicable)</i>				
<i>Energy consumption or Wattage in KWH</i>				
<i>Saving on energy, given or calculated</i>				
<i>Period of energy saving (month or year)</i>				
<i>Cost of energy saving in a year (calculate)</i>				
<i>Cost of the product</i>				
<i>Savings in terms of money in a year (calculate)</i>				
<i>Time money is recovered (in year)</i>				

Analyse the information to find out which product consumes less energy for similar outputs.

Find out the savings in terms of energy that will happen in one year by using the energy efficient product compared to other products consuming more energy.

Convert the savings in terms of the money saved on the energy bill over a year.

Calculate the time it will take to recover the money which is spent extra for purchasing the energy efficient products.

The cost of the energy efficient products is higher compared to the normal products. This is due to

the technology, superior parts fitted and cost of testing and certification. It is also due to lower sales of Star Rated or energy efficient products due to its higher cost. However, energy efficient products can save in terms of electricity bills and save money in the complete lifecycle of the product.

Draft a purchase policy for the school which says that the school will henceforth only purchase the energy efficient or Star Rated products for the school. Support this policy recommendation with the information and findings of the project and make recommendations for the products to be purchased. Discuss this with the school management committee (SMC) and request to adopt the same by the procurement or purchase committee of the school. Make a

presentation of your findings in the SMC and parents teacher association (PTA) meeting.

Develop posters on the key findings of the project highlighting the need and benefits of the energy efficient products and appliances. Also put information for awareness on the Star Rated and energy efficient products available and benefits of buying these products.

Learning outcomes:

Energy efficient products and appliances, the Star Rating system by BEE and options available in the market. The benefits of using these products, the barriers in wider proliferation of energy efficient products in the market and have ideas to provide solutions.

Discussion:

Ask students which are the products that they recommend for purchasing under each category or types of the products. Do they think that the higher cost paid for the products is justified? What are the benefits they see in purchasing and using these products - economic, social and environmental? What do they find as hurdles or barriers in wider acceptance and use of these products? What can students do to overcome these hurdles or barriers for consumers?

Green habit:

Always purchase and promote use of 5 Star Rated energy efficient equipment and appliances.

FAQs

Q - What is the Life Cycle Analysis (LCA) of a product?

A - Products consume energy and resources at different stages of their lifecycle. These include sourcing of resource materials for production, production process, utility or uses part of its life and lastly discarding and disposal after it is out of use.

It consumes energy and causes pollution in sourcing the raw materials for making the products. Production processes also consume natural resources and energy and give by-products like waste and pollution. When a product is put in use it consumes energy to run it. At last, when it is discarded it creates waste that needs to be disposed of. Sometimes the production process may be clean and produce less waste but in its full lifecycle product might generate lots of pollution and waste. It needs to be careful while selecting or purchasing a product for its use, especially for those with long life. As the

product may be produced in the most efficient way but the product itself might cause lots of pollution throughout its life and may be after it is discarded. This analysis of the environmental impact of the product over its full life is called life cycle analysis (LCA). LCA gives an actual picture of the impact of the product and helps us in comparing it with other alternatives to select a more environment friendly product.



Q - What is the long-term impact of a technology choice?

A - Climate change is the change in the usual weather found in a place. It is a long-term change in the average weather patterns that defines the climate of the earth, region and place. Climate change will result in many serious consequential impacts at local, regional and global levels affecting all life forms. This change in climate is induced by the increase in the global atmospheric concentration of radiatively important gases (RIG) commonly called greenhouse gases (GHG). These gases are responsible to maintain the earth's temperature by absorbing and retaining the heat reflected back by earth. Because of building concentration of these gases this phenomenon is increasing and causing rise in the mean temperature of the earth, commonly known as global warming. Global warming will induce many changes in the earth's climate system, some of them unpredictable at the local level. As these changes are happening at a rate faster than ever experienced any time in history it might be beyond the capacity of many organisms and ecosystems to adapt and they may go extinct. Please see the section in biodiversity to understand the impact of climate change on biodiversity. The human induced change in the climate system is a long term and irreversible process.

Q - What is a green purchase policy?

A - Institutions like schools, colleges, offices, factories, industries, developers, municipalities, panchayat, etc purchase equipment and appliances in bulk quantities and imply them for long term uses. The purchase processes usually look for the requirements and technologies and the decisions are mostly taken based on the cost and purchase of the least quoted products. Energy efficiency is rarely taken into considerations in such purchase processes. The policy preference here is to save on the upfront cost of purchase.

Therefore, it needs to make amendments in the policy to consider the environmental impacts and the energy efficiency of the product to be purchased with the objective of reducing the impact due to the energy consumption by such products throughout their life. The policy should recommend to look for the alternatives available in the market, their energy efficiency potential and recommend purchasing energy efficient products and services giving preference to energy efficiency over the cost of the product. Many times they have vendors, suppliers and contractors to provide such products and services. The policy should also recommend to ask the vendors for supply and use of the energy efficient products and services and include things as a clause in the contract and cover the cost for the same.

Q - What are the sustainable development goals?

A - The Sustainable Development Goals (SDGs) are a collection of 17 interlinked global goals designed to "achieve a better and more sustainable future for all". SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by the year 2030. They are included in a UN Resolution called 2030 Agenda. The Agenda contains 17 goals and 169 targets covering a broad range of sustainable development issues. The 17 SDGs and targets demonstrate the scale and ambition of this universal Agenda. SDGs were developed as a future global development framework to succeed and build upon the Millennium Development Goals (MDGs) which ended in 2015 and complete what those did not achieve.

The 17 SDGs are: (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (9) Industry, Innovation and Infrastructure, (10) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13)

Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the Goals.

The 17 SDGs are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental. The UN resolution identifies specific targets for each goal along with

indicators that are being used to measure progress toward each target. The SDGs pay attention to multiple cross-cutting issues like gender equity, education and culture cut across all of the SDGs. Education acts as a key driver for change and plays a key role in the attainment of the SDGs.



4.2.24. Additional Resources

Sl No	Resources	Link
1.	Ambient Air Quality Network in Maharashtra	mpcb.gov.in/air-quality
2.	System of Air Quality and Weather Forecasting and Research (SAFAR)	safar.tropmet.res.in
3.	SAFAR Mobile App	play.google.com/store/apps/details?id=com.cloud.mobile.android.airqualityindex&hl=en
4.	Srushti Mitra Awards (SMA) of Environment Dept, Govt of Maharashtra	smawards.in
5.	Pune Bicycle Plan	www.pmc.gov.in/en/bicycle-plan-0 punecycleplan.wordpress.com/
6.	Rainbow Bus Rapid Transit System (BRT) Pune	www.pmc.gov.in/en/bus-rapid-transit-route-brt rainbowbrtpune.wordpress.com/
7.	Sustainable Development Goals	sdgs.un.org/goals en.wikipedia.org/wiki/Sustainable_Development_Goals
8.	United Nations Framework Convention on Climate Change (UNFCCC)	en.wikipedia.org/wiki/United_Nations_Framework_Convention_on_Climate_Change
9.	Paris Agreement	en.wikipedia.org/wiki/Paris_Agreement
10.	Easy Solar Cooker Making	www.instructables.com/Easy-Solar-Cooker/
11.	City Air Action Plans at MPCB website	www.mpcb.gov.in/non-attainment-cities
12.	Season Watch by registering on the website	www.seasonwatch.in
13.	Maharashtra State Climate Action Plan (MSCAP)	http://mahenvis.nic.in/skmcc.aspx http://thewire.in/environment/maharashtras-climate-action-plan-comes-up-short http://krishi.maharashtra.gov.in/Site/Upload/Pdf/MSAAPC.pdf https://cdkn.org/2018/11/feature-maharashtras-story-of-developing-its-state-climate-change-policy/?loclang=en_gb https://www.opml.co.uk/blog/maharashtra-s-story-of-developing-its-state-climate-change-policy

<i>Sl No</i>	<i>Resources</i>	<i>Link</i>
14.	<i>Maharashtra Energy Development Agency (MEDA), Government of Maharashtra</i>	<i>https://www.mahaurja.com/meda/</i>
15.	<i>Department of Environment and Climate Change, Government of Maharashtra</i>	<i>https://envd.maharashtra.gov.in/</i>
16.	<i>Environment Information System, Maharashtra</i>	<i>http://mahenvis.nic.in/</i>
17.	<i>Maharashtra Pollution Control Board (MPCB), Government of Maharashtra</i>	<i>https://www.mpcb.gov.in/</i>

4.2.25. Green Habits

Standard	Green Habits
5	Use dark colour clothes in winter and light colour clothes in summer to reduce need for heating and cooling
5	Never smoke tobacco
5	Do not burn any garbage or waste
5	Use public transport buses
5	Wear a pollution mask in poor air quality
5	Promote and use green modes like walking and cycling when you can
6	Promote and use clean fuel and smokeless Chulha for cooking
6	Soak pulses (Dal) and rice before cooking to reduce fuel usage
6	Conserve energy at all places and use renewable energy
6	Conserve and plant more indigenous trees
6	Adopt and promote green and eco-friendly lifestyle
6	Never burn leaves, garbage or waste and use bicycle or buses
7	Do not destroy any biotic and abiotic element in environment
7	Use a bicycle to travel for a distance of up to 5 km
7	Use solar energy devices like solar cooker, water heater, charger, etc.
7	Do experimenting with and learn about solar energy
7	Harvest rainwater and recharge groundwater
7	Check Air Quality Index (AQI) and health advisory and inform sensitive people
8	Say No to Fire-crackers
8	Ask elder people to maintain their vehicles and check tire pressure to use fuel more efficiently
8	Promote and use sustainable modes for travel i.e., walk, cycle and public transport
8	Use natural light whenever possible instead of electric lights
8	Conserve electricity and become energy efficient
8	Learn more about climate change and inform farmers and others about it
8	Always purchase and promote use of 5 Star Rated energy efficient equipment and appliances

4.2.26. Appendix

Weather Clues Data Sets:

Data Set I:

Month	Mean Temperature °C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
Jan	20.6	28.4	16.2	-
Feb	21.2	29.9	3.7	-
Mar	23.1	31.9	3.0	-
Apr	25.9	33.6	13.6	-
May	27.6	36.4	48.9	-
Jun	27.2	36.6	53.7	4
Jul	25.9	34.7	97.8	7
Aug	25.3	33.9	149.7	9
Sep	25.3	33.5	109.1	7
Oct	24.3	31.4	282.7	10
Nov	22.8	29.2	350.3	10
Dec	21.6	28.1	138.2	6

More Clues:

1. Bharatanatyam is the classical dance form of this region.
2. Pongal is a harvest festival celebrated in the state to mark the withdrawal of the Southeast monsoon and when the sun passes from one Zodiac sign to another. Pongal is a sweet dish made out of rice, pulses and jaggery during the festival.

Data Set 2:

Month	Mean Temperature °C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
Jan	16.4	30.6	0.6	-
Feb	17.3	31.3	1.5	-
Mar	20.6	32.7	0.1	-
Apr	23.7	33.1	0.6	-
May	26.1	33.3	13.2	-
Jun	25.8	31.9	574.1	15
Jul	24.8	29.8	868.3	24
Aug	24.5	29.3	553.0	22
Sep	24.0	30.1	306.4	14
Oct	23.1	32.9	62.9	3
Nov	20.5	33.4	14.9	-
Dec	18.2	32.0	5.6	-

More Clues:

1. This place has three railway lines - Western, Central and Harbour, all of which get paralysed due to water logging during monsoons, bringing life in the megapolis to a virtual halt.
2. People relish a favourite delicacy, 'til gul' during the festival Makar Sankranti. (Makar Sankranti is celebrated in the month of Magha when the sun passes through the winter solstice from the Tropic of Cancer southwards. It takes 6 months for the sun to move from the Tropic of Cancer to the Tropic of Capricorn.)
3. The River Godavari rises in the hills in this state.

Data Set 3:

Month	Mean Temperature °C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
Jan	7.8	22.5	7.9	-
Feb	10.7	25.7	11.7	-
Mar	15.8	31.5	6.1	-
Apr	21.4	37.0	4.1	-
May	25.4	40.3	16.2	-
Jun	27.2	39.3	66.0	4
Jul	25.5	33.9	216.3	11
Aug	24.3	32.0	231.2	12
Sep	22.9	33.2	80.3	5
Oct	18.6	33.4	22.6	-
Nov	13.1	29.0	3.2	-
Dec	9.1	24.4	3.3	-

More Clues

1. This region has the oldest mountain range in our country.
2. This region has a relatively dry climate with precipitation insufficient for many trees or shrubs to grow. The absence of greenery and lack of colours in their surroundings is compensated by the people who wear colourful clothes.

Data Set 4:

Month	Mean Temperature °C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
Jan	-2.3	4.7	56.5	5
Feb	-0.6	7.8	64.9	5
Mar	3.8	13.6	98.5	8
Apr	7.7	19.4	87.5	7
May	10.7	23.8	71.9	6
Jun	14.7	29.2	37.2	3
Jul	18.2	30.0	48.7	4
Aug	17.5	29.7	69.7	5
Sep	12.9	27.8	33.3	3
Oct	6.1	21.9	36.4	2
Nov	0.9	14.7	27.0	2
Dec	-1.6	8.2	43.3	3

More Clues:

1. This state has two capitals, a summer and a winter capital.
2. The weather here is conducive for growing the most expensive spice in the world, saffron.

Data Set 5:

Month	Mean Temperature °C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
Jan	15.7	7.2	11.0	-
Feb	17.3	8.9	46.0	3
Mar	20.5	12.5	240.0	9
Apr	21.7	14.5	938.0	19
May	22.4	16.1	1214.0	22
Jun	22.7	17.9	2294.0	25
Jul	22.0	18.1	3272.0	29
Aug	22.9	18.2	1760.0	26
Sep	22.7	17.5	1352.0	21
Oct	22.7	15.8	549.0	10
Nov	20.4	12.3	72.0	3
Dec	17.0	8.3	29.0	-

More Clues:

1. Two places separated by no more than 10 km in this region have been vying to clinch a world record in one of the weather parameters.
2. Despite heavy rainfall, there is a dearth of drinking water in this beautiful place.

Comments:

- Climatological information is based on monthly normal for the 30 years period 1951-1980 for Jaipur, Srinagar, Mumbai and Chennai.
- Climatological information is based on monthly normal for the 20 years period 1971-1990 for Cherrapunji.
- Mean number of rainy days = Mean number of days with at least 2.5 mm of rain
“-” indicates less than 2 days of rainfall.

The Answers

- Set 1 = Chennai
- Set 2 = Mumbai
- Set 3 = Jaipur
- Set 4 = Srinagar
- Set 5 = Cherrapunji

4.2.27. Annexure

Textbook Analysis for Energy, Air Pollution and Climate Change for Grade 5 to Grade 8

Theme	Sub-theme	Class	Subject	Lesson Name	
Air	Earth	5	EVS-1	The Earth and Living World	
Climate Change	Adaptation	5	EVS-1	Our Home and Environment	
Energy	Nutrition	5	EVS-1	Substances, Objects and Energy	
Traffic	Sustainable transport	5	EVS-1	Transport	
Climate Change	Settlement	5	EVS- II	From Shelter to Village Settlements	
Air	Air quality	5	Hindi Sugam Bharati	Hava	
Air	Empathy	5	Marathi Sugam Bharati	Varyala Chuk Kalali	
Energy	Conservation	5	Marathi Sulabh Bharati	Endhan Bachat	
Energy	Types of Fuel	6	Geography	Energy Resources	
Energy	Sources of energy	6	Geography	Energy Resources	
Energy	Types of energy	6	Geography	Energy Resources	
Energy	Types of energy	6	Geography	Energy Resources	
Energy	Types of energy	6	Geography	Energy Resources	
Energy	Types of energy	6	Geography	Glossary	
Energy	Types of energy	6	Science	Work and Energy	
Energy and Pollution	Types of air pollution	6	Science	Natural Resources-Air, Water and Land	
Energy and Pollution	Air	6	Science	Natural Resources-Air, Water and Land	

	<i>Lesson No</i>	<i>Page No</i>	<i>Content form</i>	<i>Content sub topic</i>
	3	14	Lesson/Note	The earth's atmosphere
	11	51	Lesson/Note	Regions and type of homes. As time passed, humans went on making suitable changes in their shelter. Environmental pollution affects us. Eco friendly houses.
	24	130	Lesson/Note	Energy, other form of energy
	14	68	Lesson/Note	Advantages of using a bicycle
	7	30	Lesson/Note	They moved their camps to different places according to seasonal changes.
	Unit One - 2	3	Poem/Song	nature and properties of air
	9	14	Play/Skit	About air behaviour
	11	16	Lesson/Note	About energy saving behaviour
	9	53	Activity	Images of different cooking fuels provided, students have to classify these and say whether alternative sources may be used for cooking
	9	55	Lesson/Note	Map of India showing major coal and mineral oil fields
	9	56	Images and words	Concept of biogas, atomic energy, energy from waste, hydel and atomic power is explained using words and images
	9	57	Images and words	Concept of wind energy, solar energy, tidal energy is explained along with respective pictures
	9	58	Activity	Geothermal energy, activity on classification of energy resources and comparing environment friendliness.
		66	Glossary entry	Atomic energy, energy sources short descriptions
	11	76	Lesson/Note	Energy sources, energy from actions
	1	3	Images and words	Air pollution, images of air pollution, board displaying pollution status
	1	3	Lesson/Note	Description of Ozone layer and its importance

<i>Theme</i>	<i>Sub-theme</i>	<i>Class</i>	<i>Subject</i>	<i>Lesson Name</i>	
<i>Energy and Pollution</i>	<i>Climate change</i>	<i>6</i>	<i>Geography</i>	<i>Air</i>	
<i>Energy and Pollution</i>	<i>Air</i>	<i>6</i>	<i>Geography</i>	<i>Air</i>	
<i>Energy and Pollution</i>	<i>Climate change</i>	<i>6</i>	<i>Geography</i>	<i>Glossary</i>	
<i>Energy and Pollution</i>	<i>Sources of energy</i>	<i>6</i>	<i>Geography</i>	<i>Energy Resources</i>	
<i>Energy and Pollution</i>	<i>Energy sources</i>	<i>6</i>	<i>Geography</i>	<i>Energy Resources</i>	
<i>Energy and Pollution</i>	<i>Sources of pollution</i>	<i>6</i>	<i>Geography</i>	<i>Glossary</i>	
<i>Air</i>	<i>Air</i>	<i>7</i>	<i>General Science</i>	<i>Properties of natural resources</i>	
<i>Energy</i>	<i>Fuels</i>	<i>7</i>	<i>General Science</i>	<i>Natural Resources</i>	
<i>Energy</i>	<i>Fuels</i>	<i>7</i>	<i>General Science</i>	<i>Natural Resources</i>	
<i>Air Pollution</i>	<i>Preventive measures</i>	<i>7</i>	<i>History and Civics</i>	<i>Directive Principles of State Policy and Fundamental Duties</i>	
<i>Energy</i>	<i>Solar energy</i>	<i>7</i>	<i>Hindi</i>	<i>Jivan Nahin Mar Sakta Hai (Poem)</i>	
<i>Energy</i>	<i>Electricity</i>	<i>7</i>	<i>Geography</i>	<i>Tides</i>	
<i>Air</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Air quality</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Air quality</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Air quality</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Air</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	

	<i>Lesson No</i>	<i>Page No</i>	<i>Content form</i>	<i>Content sub topic</i>
	5	26	Words	Effect of greenhouse gases (box), climate change
	8	45	Words	Air is a resource. We need air for different purposes. Air quality can change (one sentence)
		67	Glossary entry	Greenhouse gases brief explanation
	9	51	Activity	Energy resources, pictures of lantern, solar panel, fuel station, auto rickshaw, winnowing and pinwheel are provided, students are asked to identify the energy source
	9	52	Words	Difference between substance based and process based energy resources given, generation of energy leads to pollution with substance-based energy resources, while process-based energy resources are pollution-free
		67	Glossary entry	Industrialization, brief description including 'industrialization has led to issues like pollution and environmental degradation'
	3	16	Lesson/Note	Air composition, air pressure, temperature
	16	106	Activity	What is meant by fuels? Which natural resources do we use as fuels? Various substances are used in day-to-day life for generating energy
	16	109	Activity	Discussion: Why is natural gas an eco-friendly fuel?
	6 (Civics)	86	Lesson/Note	Let us celebrate festivals by avoiding pollution of the environment
	8	23	Writing assignment	make a note on solar energy its importance and uses
	3	15	Activity	Collect information from the internet about how electricity is generated from weaves find places where such electricity is being generated
	8	55	Exercise	Do vehicles with two stroke engines cause more pollution than four stroke engines?
	8	55	Exercise	Plot a graph showing the proportion of various gases in earth's atmosphere
	8	56	Exercise	Collect information about effect of air pollution on human health from large cities and villages from Maharashtra
	8	57	Lesson/Note	Greenhouse effect and global warming
	8	58	Lesson/Note	Air Quality Index
	8	60	Lesson/Note	Mention of existence of law on air pollution and prevention
	8	61	Exercise	How does the pollution occur due to vehicles? Give the names of vehicles causing least pollution. Suggest four preventive measures for air pollution. Explain the relation between greenhouse effect and global warming. Construct two slogans on air pollution

<i>Theme</i>	<i>Sub-theme</i>	<i>Class</i>	<i>Subject</i>	<i>Lesson Name</i>	
<i>Air Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Hindi Sugam-bharti</i>	<i>hrudya ka ujala</i>	
<i>Energy and Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Geography</i>	<i>Humidity and Clouds</i>	
<i>Energy and Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Geography</i>	<i>Industries</i>	
<i>Energy and Pollution</i>	<i>Energy</i>	<i>8</i>	<i>Science</i>	<i>Inside the Atom</i>	
<i>Energy and Pollution</i>	<i>Energy</i>	<i>8</i>	<i>Science</i>	<i>Inside the Atom</i>	
<i>Energy and Pollution</i>	<i>Energy</i>	<i>8</i>	<i>Science</i>	<i>Cell and Cell Organelles</i>	
<i>Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Man Made Objects</i>	
<i>Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Pollution</i>	
<i>Pollution</i>	<i>Pollution</i>	<i>8</i>	<i>Science</i>	<i>Sound</i>	

	<i>Lesson No</i>	<i>Page No</i>	<i>Content form</i>	<i>Content sub topic</i>
	1	1	Poem/Song	Message, do not shine sparklers, neither burst crackers
	3	20	Lesson/Note	Smog
	8	57	Lesson/Note	Industries and environment note, with a box on pollution
	5	37	Lesson/Note	Nuclear energy, reactors
	5	38	Exercise	Collect detailed working information of atomic reactor from www.youtube.com and show video in the class
	10	72	Activity	Which type of energy is required to run the fans, computers and electric bulbs? Where is this energy produced?
	8	54	Lesson/Note	Air, water and soil pollution
	17	116	Lesson/Note	Plastic and Environment
	8	61	Activity	Visit the square having heavy traffic in your area and report the pollution at different times of day and find out the duration of maximum pollution
	15	108	Exercise	Measure the sound level of a sound from a loudspeaker at some public place using an app. Measure the sound level at different distances from the loudspeaker. Do you observe some relation between the distance from the loudspeaker and the sound level?

Credits

Biodiversity

Activities adapted from

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning I

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning II

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning III

Centre for Environment Education, Paryavaran Mitra Teacher's Handbook

Centre for Environment Education, IEC for Maharashtra Gene Bank Project, Shivarferi Handbook

Centre for Environment Education, IEC for Maharashtra Gene Bank Project, Habitat Linked Projects Based Learning (H-PBL) modules.

Solid Waste Management and Personal Health

Activities adapted from

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning I

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning II

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning III

Centre for Environment Education, Garbage to Gardens

Centre for Environment Education, Building Blocks

Centre for Environment Education, Towards Cleaner Air

Centre for Environment Education, Paryavaran Mitra Teacher's Handbook

Centre for Environment Education, Handprint for Waste Management Module for Teachers

Centre for Environment Education, Swachhagraha Children's Activity Book

Centre for Environment Education, Joy of Washing Teachers' Manual

Unicef and CACR, Hand Washing With Soap Module for class 1-4

Unicef and CACR, Hand Washing With Soap Module for class 5-8

Unicef and CACR, Training Module for Menstrual Hygiene Management for Adolescent Girls

Centre for Environment Education, Teachers' module on Air Quality

Centre for Environment Education, Joy of Washing

Bal Bharati, English Textbook for Class 5th

Bal Bharati, Science Textbook for Class 6th

Conceptualization and writing of new activities/projects: Sanskruti Marathe, Programme Officer and Kunal Jaiswal, Project Officer, Centre for Environment Education, Pune

Water Management

Energy, Air Pollution and Climate Change

Activities adapted from

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning I

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning II

Centre for Environment Education, NCERT and VIKSAT (1986), Joy of Learning III

Centre for Environment Education, Paryavaran Mitra Teacher's Handbook

Centre for Environment Education, Energy Matters

Centre for Environment Education, Towards Cleaner Air

Centre for Environment Education, Towards Green Future

Centre for Environment Education, Building Blocks

Centre for Environment Education, Schools for Clean Air Student Activity Book on Air Quality

Conceptualisation and writing of new activities/project: Amarnath Karan, Scientist SD, Centre for Environment Education, Pune

