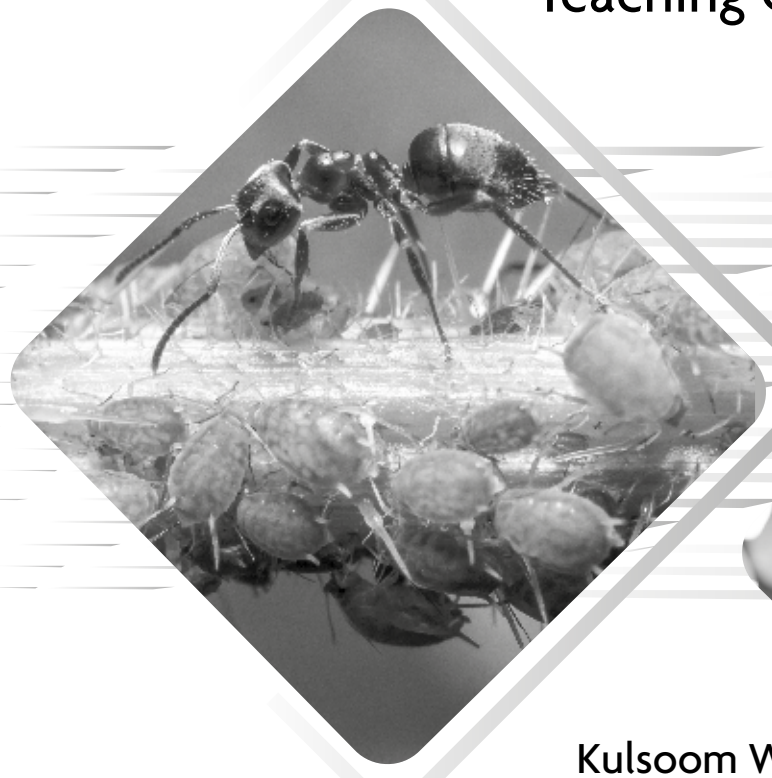
5

New Get Ahead

# SCIENCE

## Teaching Guide



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# Introduction to the Guide

The Teaching Guides for the *New Get Ahead Science* series provide guidelines for help of the teacher in classroom. This Teaching Guide includes:

- An introduction on how to approach *New Get Ahead Science* in class.
- Teaching strategies mentioned in the national curriculum.
- Sample lesson plans.
- Suggested answers to the exercises in the textbook.
- Suggested worksheet for assessments.
- Suggested scheme of work.

## How to Approach *New Get Ahead Science*

To teach *New Get Ahead Science* in a more constructive manner, teachers are advised to make classrooms more Student-centered. Students are to be given a more active role in the classroom, to be encouraged to present their thoughts and ideas confidently, and be instructed to respect differing opinions. In order to achieve this, teachers are to facilitate students so that they can take more responsibility for their learning journeys. The following summarizes the methodology with which all units of *New Get Ahead Science* are to be approached, in order to make classroom more Student-centered:

- Students to be given a chance to work independently, as well as collaboratively i.e. in groups. Real-life examples to be discussed by teachers and students.
- Students to be given tasks where they share opinions with each other and with the teacher. They are to be encouraged to give reasons for their opinions.
- Teacher to role-model the ideals of respect, collaboration, and active learning in the classroom. During group discussions, all students should be encouraged to work together.
- Teacher should facilitate students only when directions are needed; most of the time, students should work on their own while reading, writing, and discussing the lessons in specific units.

## Contents and Sequence of the Teaching Guide

The Teaching Guide for *New Get Ahead Science* contains suggestions for starting a lesson and provide teaching strategies for each unit. The instructional model focuses on exploring background knowledge, where students participate actively.

## Recommended Schedule for an Active and Student-centered Classroom

| | |
|---|---|
| Exploring knowledge through essential questions | 5 minutes |
| Teaching Methodology/Activity | 25 minutes |
| Assessment | 10 minutes |

The first part of each unit contains basic suggestions for taking the lesson forward in a constructive manner. The second part of the lesson contains answers to all questions present in the book. Students should be advised to come up with their own answers and teachers can use the Teachers Guide to assess students' understanding and knowledge.

## Teaching Strategies as per General Science National Curriculum

Examples of effective instructional strategies include, but are not limited to, the following:

- inquiry
- questioning and discussion
- investigation and problem solving
- demonstration and laboratory work
- problem based learning
- utilizing whole class, group, and individual work
- incorporating literacy strategies (reading, writing, speaking and listening)
- using student work to inform instruction

For detailed support on teaching strategies of Science, please visit Chapter 7 pages 55 to 64 in the General Science National Curriculum 2006.

## Assessment Strategies as per General Science National Curriculum

Teachers learn about student progress not only through formal tests, examinations, and projects, but also through moment-by-moment observation of students. To assess students' science knowledge, skills, and attitudes, teachers require a variety of tools and approaches, such as:

- selected response
- constructed/ created response
- performance assessment
- personal communication
- students' self-assessment

For detailed support on assessment strategies of Science, please visit Chapter 8 pages 65 to 73 in the General Science National Curriculum 2006.

## Division of Syllabus into Three Terms:

**1st Term** Unit 1: Classification of animals
Unit 2: Classification of plants
Unit 5: Pollution
Unit 7: Forces and Machines

**2nd Term** Unit 3: Micro-organisms
Unit 6: Matter
Unit 8: light

**3rd Term** Unit 4: Seed Structure and Germination
Unit 9: Electricity and magnetism
Unit 10: Soil

## Scheme of Work

| **Chapter** | **Topic-wise allocation of periods** | **Learning outcomes**<br>The students should be able to: |
|---|---|---|
| Unit 1:<br>Classification of animals | 1 period | • learn about reason for classification of animals.<br>• learn about how we classify animals. |
| | 2 periods | • learn about classification of animals.<br>• know about vertebrates and their classification. |
| | 2 periods | • know about invertebrates and their classification. |
| Unit 2:<br>Classification of plants | 1 period | • learn about reasons for classification of plants.<br>• learn about how we classify plants. |
| | 2 periods | • learn about classification of plants.<br>• differentiate flowering and non-flowering plants.<br>• differentiate monocot and dicot. |
| | 2 periods | • learn parts of a plants and their functions.<br>• differentiate taproot and fibrous root. |

| Chapter | Topic-wise allocation of periods | Learning outcomes<br>The students should be able to: |
|---|---|---|
| Unit 3:<br>Micro-organisms | 2 periods | • know about micro-organisms.<br>• learn about healthy habits.<br>• identify ways by which microorganism can enter the human body. |
| | 2 periods | • know that we should look after our bodies.<br>• know how we should be able to stay healthy.<br>• know what we should eat to stay healthy.<br>• explain how we become ill.<br>• identify bacteria and viruses. |
| | 2 periods | • understand how doctors help us fight diseases and infections.<br>• understand immunity.<br>• discuss how we can protect ourselves from diseases. |
| Unit 4:<br>Seed Structure and Germination | 2 periods | • understand the internal structure of seed.<br>• explain the formation of fruits and seeds.<br>• describe the ways of dispersal of seeds.<br>• describe the structure of a dicot and a monocot seed.<br>• know the functions of cotyledons. |
| | 2 periods | • describe the favourable conditions for germination of a seed.<br>• describe the process of germination of a seed and the conditions required. |
| | 1 period | • differentiate the types of germination. |
| Unit 5:<br>Pollution | 1 period | • know what is meant by pollution.<br>• discuss about types of pollution.<br>• explain the causes and effects of different types of pollution. |
| | 1 period | • describe the problems caused by over- population.<br>• explain the harmful effects of pollution. |
| | 2 periods | • suggest some ways to control pollution.<br>• explain the importance of trees in helping to keep the environment in balance. |

| Chapter | Topic-wise allocation of periods | Learning outcomes<br>The students should be able to: |
|---|---|---|
| Unit 6:<br>Matter | 2 periods | • Learn about matter.<br>• know about the different arrangements of particles in states of matter.<br>• describe the movement of particles in matter.<br>• explain how the movement of particles brings about changes in state. |
| | 2 periods | • explain the different physical methods of separation.<br>• define what is meant by the melting and boiling points of matter.<br>• know about expansion and contraction. |
| | 2 periods | • analyse some practical applications of expansion and contraction in our daily lives.<br>• identify where condensation and evaporation take place in water cycle. |
| Unit 7:<br>Forces and Machines | 2 periods | • know the term and uses of machine.<br>• explain the structure and functions of simple machines.<br>• define mass and weight and explain the difference between them.<br>• explain how a force can make an object start, stop, or change its motion. |
| | 1 period | • explain that forces occur in pairs.<br>• recognize the difference between balanced and unbalanced forces. |
| | 2 periods | • explain friction and its causes.<br>• understand the useful and harmful effects of friction.<br>• know ways of reducing friction. |

| Chapter | Topic-wise allocation of periods | Learning outcomes<br>The students should be able to: |
|---|---|---|
| Unit 8:<br>Light | 3 periods | • explain that light is a form of energy.<br>• know the main sources of light.<br>• explain that we see things when light falls on them. |
| | 2 periods | • understand the properties of light.<br>• explain what are luminous and non-luminous bodies. |
| | 1 periods | • understand about the lunar and solar eclipse. |
| | 2 periods | • differentiate how transparent, translucent, and opaque materials.<br>• analyse how shadows are formed. |
| Unit 9:<br>Electricity and magnetism | 1 period | • describe current and electricity.<br>• know about a simple circuit.<br>• explain need of electricity. |
| | 2 periods | • explain the importance of a switch and a fuse in a circuit.<br>• realize the importance of being safe around electricity. |
| | 2 periods | • know about magnetism.<br>• understand the uses of electromagnetism. |
| Unit 10:<br>soil | 2 periods | • describe the composition of soil.<br>• explain the usefulness of each component<br>• describe how soil is formed. |
| | 2 periods | • explain the composition of different kinds of soil and their importance.<br>• describe the layers of soil. |
| | 2 periods | • explain why soil becomes infertile.<br>• explain the uses of different kinds of fertilizers. |

UNIT 1

# Classification of animals

## Lesson plan 1

### Students learning outcomes

- Learn about reasons for Classification of animals
- Learn about how we classify animals

### Materials

red, blue and green colour cards

### Keywords

classification, variety, groups, vertebrates, invertebrates, kingdom, feature

### Overview

Students will learn about the classification of animals like vertebrates and invertebrates and its importance. Students will know about the animal kingdom and features of different classes.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why do we make sets like cutlery set?
2. Why are we different from birds?

### Method:

- As an introduction to the activity, teacher will discuss classification in general. Ask students what we mean by classification and discuss making group of similar objects. For example tools, food, and flowers.
- Explain the reason to classify things: it makes our study easier.
- Teacher will distribute red, blue and green colours to each student randomly. Ask the students to make three groups. All the students having red cards will make one group and so on.

- Show a classification table to the students to explain how animals are classified as vertebrates and invertebrates with pictures of vertebrates and invertebrates.
- Conduct in classroom:
  - Activity 1, page 1
  - Activity 2, page 5

### Assessment

1. Name the class to which each of the following animals belongs.

| Animal | Class |
|---|---|
| pigeon | |
| snake | |
| elephant | |
| frog | |
| shark | |

2. Complete the table by choosing examples of each class from the given names of the animals.

   **frog, snake, ostrich, rabbit, salmon**

| Mammal | Amphibian | Bird | Reptile | Fish |
|---|---|---|---|---|
| | | | | |

### Reinforcement/homework

Exercise questions 1 and 2

## Lesson plan 2

### Students learning outcomes

- Learn about classification of animals
- Know about vertebrates and their classification

### Materials

pictures of animals

### Keywords

fish, amphibians, reptiles, birds, mammals

### Overview

Students will learn about the different classes of animals. Examples of each class will be described so they can classify animals easily.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why do we classify things?
2. Why are living and non-living things different?

### Method:

- Teacher will show pictures of animals and ask the students to verify their features. E.g. birds have feathers, fish breathe with gills, and reptiles are covered with scales.
- Students will bring a collection of pictures of animals from books or, if they can draw and colour their own pictures of animals. Teacher may encourage students to make their own jungle book. Use these pictures to classify animals.
- Ask students to group the animal cards based on one property. For example, make a group of animals based on the property scales on the body. They might have pictures of animals that have fur and ones that have feathers. This will illustrate the concept of classification.
- Students will be divided into small groups and take with them the animals' cards / jungle book to explain the concept.
- Conduct in classroom:
  - Activity 3, page 6

### Assessment

1. Write two differences between vertebrates and invertebrates.
2. How is a fish different from a lizard?

### Reinforcement/homework

Exercise question 3

## Lesson plan 3

### Students learning outcomes

- Know about invertebrates and their classification.

## Materials

pictures of animals like vertebrates and invertebrates

## Keywords

insects, worms, head, thorax, abdomen

## Overview

Students will learn about the classification of vertebrates and invertebrates. Students will classify vertebrates and invertebrates. Clear concept of classification of vertebrates and invertebrates will be given with the help of examples.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are the properties of fish and amphibians?
2. What are the properties of reptiles?
3. What are the differences between amphibians and birds?

## Method:

- Continuing from previous lesson, evaluate each group's classification on the basis of whether animal are vertebrates or invertebrates.
- Students will be asked to locate their own vertebral column (spinal cord). They will realize that they are vertebrates.
- There are two types of invertebrates: insects and worms. Students will make two groups having charts of insects and worms.
- Teacher will explain about the difference between insects and worms that insects have three parts of the body head, thorax, and abdomen while worms have soft and long bodies.
- Conduct in classroom:
    - Activity 4–5, page 7

## Assessment

1. Name the class to which each of the following animals belongs.

| Animal | Class |
|---|---|
| butterfly | |
| jellyfish | |
| octopus | |
| sponge | |
| starfish | |

## Reinforcement/homework

1. Exercise question 4
2. Make a jungle book using pictures of fifteen different animals and write features of classification.

# Classification of plants

## Lesson plan 1

### Students learning outcomes

- Learn about classification of plants
- Learn about how we classify plants

### Materials

leaves from different plants/trees, a flower

### Keywords

flowering plants, non-flowering plants, algae, mosses, ferns, conifers

### Overview

Students will learn about the classification of plants. Classification of flowering and non-flowering plants will be explained.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why do we classify plants?
2. What is classification?
3. How are plants different?

### Method:

- Teacher will ask the children to bring leaves from different plants/trees and then help them to study the different types of leaves. Ask students if all plants are alike how will be the world. Discuss about the types of plants featured like do all plants look alike? What needs do plants have? How do they get their food?
- Show a flower and discuss the parts of flowering plants and the process of photosynthesis, by which plants make food. Talk about plants that are familiar to the students. What do they look like? Where do they grow? Discuss plant structure and its parts like stem, flower, leaf and roots.

- Choose a familiar flowering plant they would like to learn more about; tell them they will research and write a paragraph about it. Each paragraph should include the plant's common and scientific names; a description of the parts (seed, root, stem, leaves, and flower); its needs; and at least three interesting facts. Also have students draw a picture with each plant part labelled. Students may use books or magazines for research.
- Conduct in classroom:
  - Activity 1, page 13
  - Activity 2, page 15

### Assessment

1. What are the two classes of flowering plants?
2. What are the two main differences between Angiosperm and Gymnosperm?

### Reinforcement/homework

Exercise question 1

## Lesson plan 2

### Students learning outcomes

- Learn about classification of plants
- Differentiate flowering and non-flowering plants
- Differentiate monocot and dicot

### Materials

mango seeds, pictures of plants like dicot and monocot plants

### Keywords

monocotyledon, dicotyledon

### Overview

Students will learn about the monocotyledons and dicotyledons. Different features of monocotyledon and dicotyledon will be explained, e.g. type of seed, type of leaf and type of roots.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are the functions of seeds?
2. Why are roots important?

## Method:

- Students will observe mango seeds. Ask the students questions about how a person could grow a new tree.
- Provide each student with four different pictures of plants. Instruct students to work individually to classify the plants into categories based on how they reproduce (seeds or seedless).
- Students sort (classify) the different plants into categories based on whether they are seedless plants or seed plants. Students record their initial observations about the plants in their science journals.
- Divide the class into groups of three or four so they can share their work. Guide the students to discuss within their groups the differences and similarities of the plants. Ask for volunteers to share what they learned from their research and group discussions.
- Review what students have learned about the needs of plants, the parts of flowering plants, and photosynthesis.
- Show charts to the students how to classify the different plants into two categories (seedless and seed plants) using a new picture not used at the beginning of the lesson.
- Bring dicot and monocot plants with their flowers and seeds in order to compare the physical features of seeds, stems, leaves, roots, and flowers. Explain the difference between them. Divide the class into two groups one representing monocots and other dicots. Ask them to make posters with illustrations and present it in front of the class.
- Conduct in classroom:
    - Activity 3, page 15

## Assessment

1. What are the two major groups of flowering plants and give examples of each group?
2. Define the term monocot and dicot.

## Reinforcement/homework

Exercise question 2

## Lesson plan 3

### Students learning outcomes

- Learn parts of a plant and their functions
- Differentiate taproot and fibrous root

### Materials

a potted plant

### Keywords

leaves, stems, roots, taproot, fibrous roots

### Overview

Students will differentiate between taproot and fibrous root. They will know monocot and dicot plants have different types of roots. Working and composition of taproot and fibrous root is different.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are the different parts of a plant?
2. What are the differences between monocot and dicot seeds?
3. What are the differences between monocot and dicot leaves?

### Method:

- Explain that we could group plants by leaves, stems, or roots. Teacher will discuss about each plant part. Roots are the plant's intake system. They take up water and nutrients from the ground to feed the plant and give it energy. Roots also keep the plants in place in the ground. We eat roots like carrots and reddish.
- Next are the stems. The stem moves food, water, and nutrients through the plant. Stems hold the plant up straight as well. There are woody stems, like on trees and shrubs. There are non-woody stems like on flowers and herbs. We eat stems like sugarcanes.
- Then there are the leaves. The leaves take in sunlight that helps the plant survive. The leaves on plants angle toward wherever the sun is. We eat certain leaves such as spinach.

- Finally, there are seeds. Seeds are everywhere. What do you find when you bite into an apple? Inside a tomato? On the outside of a strawberry. We classify plants by whether or not they have seeds. Most of the plants that you know have seeds. Plants use their seeds to reproduce and make more plants. Sometimes we even eat seeds. Can you name some seeds you have eaten before? We eat seeds like beans
- Conduct in classroom:
  - Activity 4, page 16

## Assessment

1. Explain the term taproot and fibrous root.
2. Fill in the blanks:
   i. The _____ have flowers with three petals or a multiple of three.
   ii. A _____root is a large, central, and dominant root.
   iii. A leaf has a network of _____.
   iv. The seed of a monocot plant has _____ cotyledon/s.
   v. The term _____ means naked seeds.

## Reinforcement/homework

1. Exercise question 3
2. Draw structures of taproot and fibrous root and write down their differences in your notebooks.

UNIT 3

# Microorganisms

## Lesson plan 1

### Students learning outcomes

- Know about microorganisms.
- Learn about healthy habits.
- Identify ways by which microorganisms can enter the human body.

### Materials

dust particles through a beam of window

### Keywords

microorganism, microbes, germ, disease

### Overview

Students will learn about different microorganisms they will learn the healthy habits and will identify ways by which microorganisms can enter the human body.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why we become ill?
2. Why you keep your teeth clean?

### Method:

- Ask the students if they can see rays of light coming through the window. Dust particles and some fibre floating in the air can be seen along with micro-organisms that cannot be seen with our naked eyes.
- Begin your lesson by asking what your students think about the word 'microbe'. Write some of their answers on the board. Students will usually give negative thoughts, so ask them if they have any positive thoughts about microbes as well. Let

them know they may be surprised at how much they actually like what microbes do, apart from not liking the illnesses they cause.

- Tell them that you are going to learn more about microbes and discuss the definition of Microbes.
- Now explain the meaning of microorganisms to the student i.e. "micro" means "small" and "organisms" means "living things". Most microorganisms can be seen by the microscope.
- Explain that each part of the body performs a certain function, just like the different parts of a machine. Explain that, just as a machine needs maintenance and looking after, so does the body. Discuss the importance of keeping our body healthy by taking suggestions from the students.
- Conduct in classroom:
  - Activity 1-3, page 20

### Assessment

1. Explain the ways in which germs can enter the body.
2. Name three microorganisms.

### Reinforcement/homework

Exercise question 1

## Lesson plan 2

### Students learning outcomes

- Know that we should look after our bodies.
- Know how we should be able to stay healthy.
- Know what we should eat to stay healthy.
- Explain how we become ill.
- Identify bacteria and viruses.

### Materials

textbook pictures

### Keywords

infection, toxin, hygiene, bacterium, virus

### Overview

Students will learn about know about microbes and their effects. They should look after their bodies and know how we should stay healthy. They will understand about bacteria and viruses.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are microbes?
2. What are microscopic organisms?
3. Have you ever seen the process of yoghurt making?
4. Do you know the process of yoghurt making?

## Method:

- Ask students why "Dental Hygiene" is important. Why should we keep our teeth clean? Can we see germs with our naked eyes? Which instrument is mostly used to see microorganisms?
- Show pictures / diagrams of viruses, bacteria and fungi from textbook to students. Ask them to observe these pictures carefully and guess which organisms are these. Further explanation can be done by telling the class that there are some diseases that can be caught by micro-organisms present in the air. They can be classified into bacteria, virus, and fungi.
- Ask the class "Are bacteria useful or harmful to us?" to increase the curiosity among the students: Their response may be negative by saying that bacteria are always harmful. The teacher can explain them the benefits of bacteria. Like changing milk into yoghurt.
- Ask the students the use of bacteria and fungi in preparation of yoghurt, cheese and bread. If possible, demonstrate the process of yoghurt making in class. Otherwise explain this process verbally. Ask students to draw diagram to explain this process.
- Explain the advantages of bacteria and fungi in daily life. Use questioning answering and concept maps to teach this part of lesson.
- Explain that many diseases are caused by very tiny single-cell organisms called microorganisms. Bacteria and viruses are microorganisms. Most microorganisms are so small that they can only be seen with the help of a microscope. They are found in the air, water, and on land. Some of them are harmful. They can cause diseases in plants and animals. Viruses are even smaller than bacteria. They can

only be seen with the help of an electron microscope. Make a list of diseases caused by bacteria and viruses.

- Conduct in classroom:
  - Activity 4 and 5, page 22

### Assessment

1. Write down the diseases caused by the following microorganisms:
   a. Virus _____
   b. Bacteria _____
   c. Fungi _____
2. Write down 5 benefits of exercise.
3. What are the two types of bacteria?

### Reinforcement/homework

1. Exercise question 2
2. Draw labelled diagrams of different types of bacteria in your notebook.

## Lesson plan 3

### Students learning outcomes

- understand how doctors help us fight diseases and infections
- understand immunity
- discuss how we can protect ourselves from diseases

### Materials

healthy habits chart

### Keywords

healthy habits, vaccine, immune, disease-carrying germs

### Overview

Students will learn about how doctors work to help us to fight diseases and infections. They will understand the term immunity. They will learn the ways they can protect themselves from diseases and infections.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are good and bad bacteria?
2. Why do we go to the doctor when we are ill?

## Method:

- Divide the students into groups and ask them to make a chart on healthy habits. Display the healthy habit chart, on the soft board.
- Students may also prepare presentation on healthy habits and promote good habits among the young student. For e.g. why do we become ill? How can we fight infection?
- Explain that the doctor gives us medicines called antibiotics to kill the germs. Also discuss ways in which we can protect ourselves from being infected by other people.
- Can the body protect itself? Explain that our white blood cells attack the germs that enter our body. They eat up the germs or they produce chemicals which can kill germs. Explain that a medicine helps your body to fight against disease-carrying germs. Explain about vaccine and its importance. Describe the way in which a vaccine helps to make the body immune to disease-carrying germs.

## Assessment

1. Choose the correct answer:
   i. Many diseases are caused by tiny living things called_____ .
      a. insects b. worms c. germs d. fish
   ii. Vaccinations can make the body immune to many _____.
      a. diseases b. reactions c. bodies d. health
   iii. _____can also help your body to fight against diseased germs.
      a. Teachers b. Engineers c. Doctors d. pilots
   iv. The _____blood cells protect the body from germs.
      a. red b. white c. blue d. yellow
   v. _____are not classified as plants or animals.
      a. Viruses b. bacteria c. fungi d. fish

## Reinforcement/homework

Exercise questions 3 and 4

# Seed Structure and Germination

## Lesson plan 1

### Students learning outcomes

- understand the internal structure of seed
- explain the formation of fruits and seeds
- describe the ways of dispersal of seeds
- describe the structure of a dicot and a monocot seed
- know the functions of cotyledons

### Materials

different seeds (depending on the availability of the seeds), charts of seed and fruit formation

### Keywords

seed coat, cotyledon, endosperm

### Overview

Students will learn about the internal structure of seed, the formation of fruits and seeds. They will understand the ways of dispersal of seeds. Students will describe the structure of a dicot and a monocot seed.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are seeds?
2. Which part of the plant does help in growing a new plant?

### Method:

- Introduce the topic by showing the students different seeds (depending on the availability of the seeds). Ask them to find the differences between the shown seeds: millet seeds, bean seeds, pea seed etc. Students will come up with the

differences that they observed in their colour, shape, and size. This will help them to understand that seeds of different plants differ in their shape, size and colour.

- Explain seed and fruit formation with the help of charts.
- Conduct in classroom:
  - Activity 1, page 27

### Assessment

1. What are the requirements of germination?
2. Complete the following paragraph using the words given below:

   **Green, seed coat, water, downwards, upwards**

   When the seed is planted it absorbs _____from the soil. It begins to swell and the _____sheds off. The root starts to grow _____ into the soil to hold the ground. The shoot of the embryo grows _____to give strength the baby plant above the ground. It comes out of the soil. It then it is able to get air, warmth, and light. It develops a stem and leaves that soon turns_____.

### Reinforcement/homework

1. Exercise question 1
2. Collect five different types of seeds and observe them.

## Lesson plan 2

### Students learning outcomes

- describe the favourable conditions for the germination of a seed
- describe the process of germination of a seed and the conditions required

### Materials

plants grown in a pot/ bottle

### Keywords

favourable, germination, growth, seedling

### Overview

Students will learn about the favourable conditions for germination of plants such as light, water carbon dioxide and the process of germination of a seed.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is required to grow a plant?
2. What will be the effect if you are not watering a plant?

### Method:

- Teacher will explain the favourable conditions for germination of plants such as light, water, carbon dioxide.
- Demonstrate through activity the germination of seed in different conditions. Through this activity teacher can explain in detail the factors necessary for germination. Explain that seeds will not grow if we put them in a freezer or boil the seeds. Explain that different seeds need different time to grow.
- Encourage students to observe the daily growth of bean and maize seeds in order to compare and contrast the stages of germination in both the seeds. Show their seedlings and help them to identify cotyledons in order to understand the functions of cotyledons.
- Encourage students to sow a seed and looking after it. Can seeds grow without water? Students will discuss about conditions necessary for seeds to germinate.
- Conduct in classroom:
    - Activity 2-3, page 29

### Assessment

1. What are the parts of a seed?
2. Identify the name of the part for given description:
    i. A baby plant called embryo within the seed of a plant.
    ii. The outer covering of a seed.
    iii. Stores food helps the baby plant to grow.

### Reinforcement/homework

1. Exercise question 2
2. Draw a labelled diagram of internal structure of a monocot and a dicot seed.

## Lesson plan 3

### Students learning outcomes

Learn about hypogeal germination and epigeal germination.

### Materials

millet seed, maize seed, bean seeds, pea seed

## Keywords

hypogeal germination, epigeal germination

## Overview

Students will learn about rent types of germination take place in monocot and dicot plants like hypogeal germination and epigeal germination.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is germination?
2. What factors are necessary for germination?

## Method:

- Explain the two types of germination with the help of charts. Hypogeal germination takes place in monocot seed, whereas Epigeal germination takes place in dicot seed.
- Discuss the differences between two types of germination.
- Ask the students to bring different seeds like millet seed, maize seed, bean seeds, pea seed etc. to germinate and observe the process of hypogeal and epigeal germination. During the process, students also identify cotyledons in dicot and monocot seeds.
- At this phase of the lesson the teacher will explain the differences between the structure and types of germination in these two types of seeds.
- Use magnified pictures of internal structures of bean and maize seeds to understand the differences between them.
- Conduct in classroom:
    - Activity 4, page 31

## Assessment

1. What are the differences between Epigeal and Hypogeal Germination?
2. Why is cotyledon important?

## Reinforcement/homework

Exercise question 3

# Environmental Pollution

## Lesson plan 1

### Students learning outcomes

- know what is meant by pollution
- discuss types of pollution
- explain the causes and effects of different types of pollution

### Materials

charts showing water pollution, land pollution, air pollution

### Keywords

environment, air, soil, water, crop, pollution, rainfall

### Overview

Students will learn about pollution and different types of pollution. They will explain the causes and effects of different types of pollution. They will know the ways by which they can reduce pollution.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is an environment?
2. Why do we keep our house clean?

### Method:

- Introduce lesson by writing the term "environment" on board and ask the students what they understand by it. Write the responses on the board.
- Ask the students to observe their immediate environment and list them down. Teacher will ask the students 'Is your environment clean?' Students will come up with their responses. Students will share several examples that are related to pollution having a negative effect on land over time. The majority of the answers may relate to pollution will be for cars and factories smoke.

- Discuss with the students how many people live in your house? Do more people live in villages or cities? Is there more traffic in a town or a city? Is there a park in your locality? Do you get clean drinking water? Where do you throw your rubbish? Do you have a garden in your house? Do you often get sick?
- Show the students pictures of a busy street and a peaceful village. Explain that the population of the world is increasing and that more people come to cities to find work. More homes, food, clothes, transport, etc. are needed. We need more resources, more industries, and more roads and buildings. All these things are having a bad effect on our planet.
- Explain the meaning of environment and the effects of changes to the environment on living organisms.
- Explain the uses of trees and the harmful effects of cutting down trees.
- Explain the harmful effects on animals, the soil, and the climate.
- Many people believe that the changes humans have made over time to improve life are also causing pollution. Students do agree and begin wanting to add information and share stories.
- After sharing a few responses, ask students what they heard that was the same in every response. Students tell pollution is a negative effect. Teacher will write the definition of "pollution" on board and share it with students. Contamination of air, water or soil by substances that are harmful to living organisms.
- Conduct in classroom:
  - Activity 1, page 36
  - Activity 2, page 37

### Assessment

1. Identify some of the harmful effects of pollution on the following:
   a. the weather
   b. ice caps
   c. river life
   d. sea life

### Reinforcement/homework

Exercise questions 1 and 2

## Lesson plan 2

### Students learning outcomes

- describe the problems caused by over-population
- explain the harmful effects of pollution

## Materials

charts showing water pollution, land pollution, air pollution

## Keywords

reduce, reuse, pollutant, biodegradable, non-biodegradable

## Overview

Students will learn about the problems caused by overpopulation and explain the harmful effects of pollution.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Do you leave electrical appliances on?
2. Do you use trash bins?

## Method:

- Discuss the benefits of a clean environment and again write their responses on the board. At this stage write the term pollution on the board and ask the students to brainstorm about its meaning.
- Introduce the term and write its types by making a web. Introduce the types of pollution like water pollution, land pollution, air pollution by showing the pictures or take them around to different places. Explain the causes and effects of each type of pollution in detail.
- Discuss common things that humans do that add to the pollution of soil, water, and air and ways we create pollution.
    1. Leaving chargers plugged.
    2. Factories have to burn fuel to make electricity.
    3. Washing your car near grass.
    4. Fertilizers and pesticides that are sprayed on the lawn.
    5. Driving a short distance.
- Conduct in classroom:
    - Activity 3, page 39
    - Activity 4, page 42

### Assessment

Complete the following table:

| Type of pollution | Causes | Effects |
|---|---|---|
| Land | | |
| Air | | |
| Water | | |

### Reinforcement/homework

Exercise questions 3 and 4

## Lesson plan 3

### Students learning outcomes

- suggest some ways to control pollution
- explain the importance of trees in helping to keep the environment in balance

### Materials

diagram of the Earth's atmosphere showing ozone layer

### Keywords

harmful, control, effects, garbage

### Overview

Students will learn about some ways to control pollution and explain the importance of trees in helping to keep the environment in balance.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why should we keep our environment clean?
2. How are we damaging our environment?

### Method:

- Show the students a diagram of the Earth's atmosphere. Point out the ozone layer.
- Explain that the ozone layer protects the Earth from the harmful ultraviolet rays of the Sun. Air pollution is causing the ozone layer to become thinner in places. As a result, the Earth is getting warmer.
- Discuss the greenhouse effect and its harmful effects on the Earth.
- Discuss ways in which pollution can be controlled. Also discuss how man is playing a role in destroying plants and animals for fun, for food, for building houses and roads.
- We must realize that we have to coexist with the flora and fauna on Earth and our own existence will be difficult if we do not look after these.
- Introduce the 3Rs: reduce, reuse, and recycle by reusing the plastic containers and recycling different things to make them useful. Also, introduce biodegradable and non-biodegradable things.
- Conduct in classroom:
    - Activity 5, page 44

### Assessment

Write down 5 ways to reduce pollution.

### Reinforcement/homework

1. Exercise questions 5 and 6
2. Make a poster about pollution.

UNIT 6

# Matter

## Lesson plan 1

### Students learning outcomes

- Learn about matter
- Know about the different arrangements of particles in states of matter
- describe the movement of particles in matter
- explain how the movement of particles brings about changes in state

### Materials

marble balls and 3 small boxes

### Keywords

solid, liquid, gas, shape, volume, matter

### Overview

Students will learn about matter and the different arrangements of particles in different states of matter. Students will realise the movement of particles in different states of matter and about changes in states from one form to another form.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is matter?
2. What are different states of matter?

### Method:

- Explain matter and its three states using examples. Discuss the properties of matter. Explain that a gas has no shape and doesn't take space, such as air. Explain that air is made of gases, and they can't be seen. Ask your students to arrange themselves as gases.

- Explain that a solid is something that has a fixed shape and takes up space. Have your students come up with examples, and write them on the board. Offer examples, such as pencil, books, and box. Ask your students to arrange themselves as solids.
- Explain that a liquid is something that doesn't have a fixed shape but takes up the shape of the container, such as water. Ask your students to arrange themselves as liquids.
- Explain that these different phases are of matter. Matter is any substance that has mass and occupies space. Teacher will give a clear concept that gas also has mass and occupy volume.
- Help students to make the particle models of solids, liquids, and gases. For this, ask students to use marble balls and 3 small boxes. In order to show the atomic arrangement in a solid, start arranging marbles side by side in a box. Make sure they are set in the box so that there will be no empty or lose space left. This type of arrangement shows exactly the arrangement of atoms in a solid which gives it shape, size, and volume.
- Similarly, in another box arrange the marbles in a loose setting so that they can bump into each other. This type of arrangement will show the arrangement of atoms in a liquid which allows them to flow and have no specific shape but can take the shape of a container.
- Likewise, arrange the marbles very loosely in a box so that they can roll around the box with a free bump into each other. This arrangement will show the arrangement of atoms in a gas which allow them to float far in the air therefore, they have no specific shape, size and volume. Teachers can use the activity in the lesson to explain the difference between the arrangement of atoms in solids, liquids, and gases.
- Conduct in classroom:
  - Activity 1, page 47
  - Activity 2-3, page 48
  - Activity 4-5, page 49

### Assessment

1. What are the different states of matter?
2. Draw the arrangement of particles in the separate boxes.

### Reinforcement/homework

Exercise questions 1, 2, and 3

## Lesson plan 2

### Students learning outcomes

- explain the different physical methods of separation

- define what is meant by the melting and boiling points of matter
- know about expansion and contraction

### Materials

ice cubes, burner

### Keywords

evaporation, condensation, boiling, freezing arrangement, spaces

### Overview

Students will learn about the different physical methods of separation of different types of mixtures. They will know about melting and boiling and the method to record melting and boiling points. They will know about the effects of heating and cooling on a substance like expansion and contraction.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are the arrangements of particles in solids?
2. Why do solids have fixed shape?
3. Why do gases not have a fixed shape and size?

### Method:

- Show ice cubes and discuss that particles of water gets close to each other on cooling and change into solid. Teachers can conduct a demonstration in the laboratory to explain the processes of evaporation and condensation.
- Explain that a cube of ice can turn into a liquid with heat. Place a cube of ice in warm water, and have your students observe it for 5 minutes. Show your students how the ice is starting to melt. Show boiling of water. Show freezing of water.
- Put some ice cubes in a beaker and leave it on the table for a while. Heat the water till it dries up. Explain the changes of state occur on heating.
- Explain the movement of particles when a substance is heated. The spaces between the particles increase due to the heat, and more and more particles bump into each other, and a change of state occurs from solid, to liquid, to gas. The opposite

happens when a liquid is cooled. The particles lose energy. They move closer together and a change of state occurs from gas, to liquid, to solid.

- Conduct in classroom:
  - Activity 6-7, page 50

### Assessment

1. Write true or false:
   i. Melting is caused when particles lose energy.
   ii. A decrease in size or volume occurs when a substance is heated.
   iii. An increase in the volume occurs when a liquid changes into a gaseous state.
   iv. The change of state from a liquid to a solid is caused by cooling.
   v. Expansion in a substance is caused when particles gain energy.
2. Name the process of the given changes:
   i. Solid to liquid
   ii. Gas to liquid

### Reinforcement/homework

Exercise questions 4 and 5

## Lesson plan 3

### Students learning outcomes

- analyse some practical applications of expansion and contraction in our daily lives
- identify where condensation and evaporation take place in water cycle

### Materials

chart showing water cycle

### Keywords

snow, dew, fog, frost, water cycle

### Overview

Students will learn about some practical applications of expansion and contraction in our daily lives and will identify where condensation and evaporation take place in water cycle.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What happens when we warm an ice cube?
2. What happens when we put water in a freezer?

## Method:

- The concept of evaporation and condensation in the water cycle can be explained by showing them a picture or video easily available on the internet. Show a chart of the water cycle to students and explain different stages. Discuss the importance of water cycle.
- Identify the points in water cycle, where evaporation and condensation take place. Explain that the formation of fog and mist are due to the process of evaporation, and the formation of dew and frost are due to the process of due to condensation.

## Assessment

1. Draw a labelled diagram of water cycle.
2. Write down the different stages of water cycle.

## Reinforcement/homework

Exercise questions 6 and 7

# Forces and Machines

## Lesson plan 1

### Students learning outcomes

- know the term machine and its uses
- explain the structure and functions of simple machines
- explain how a force can make an object start, stop, or change its motion

### Materials

simple machines like scissors, knife, wheel

### Keywords

force, simple machine, work, lever

### Overview

Students will learn about the definition, uses and structure of simple machine. They will define mass and weight and explain the difference between them. They will explain how a force can make an object start, stop, or change its motion.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is a machine?
2. Why do we use machine?

### Method:

- As an introductory lesson, ask students to bring any simple machine from home. Ask them to present it to the class, how to use this particular machine and how it can make our work easier and faster. Students can also use pictures drawn on chart paper.
- Explain to the students the term simple machine and ask the students to name some simple machines they often use in daily life. Make a list of these on the

board. Ask your students, can you imagine a life without machines? Students' responses can be collected on the board during the discussion.

- Explain that we come across big machines like washing machines, sewing machines, etc., but a spoon is also a machine. Explain how a simple machine helps to make our work easier. It helps us to do more work with less effort. Explain that machines give us a mechanical advantage.
- All complex machines are made up of one or more simple machines. Discuss the different types of simple machine and the work they do.
- Conduct in classroom:
  - Activity 1, page 60

### Assessment

1. Draw the structure of fixed pulley.
2. Identify the type of lever and write in the correct column:

   **Racket, tongs, scissors, mousetrap, pliers, wheelbarrow**

| 1st kind | 2nd kind | 3rd kind |
|---|---|---|
| | | |
| | | |

### Reinforcement/homework

Draw pictures of five simple machines on a colour paper.

## Lesson plan 2

### Students learning outcomes

- explain that forces occur in pairs
- recognize the difference between balanced and unbalanced forces

### Materials

apple, knife, wedge

### Keywords

levers, wedge, pulley, load (L), effort (E), fulcrum (F), friction

### Overview

Students will learn that forces occur in pairs and recognize the difference between balanced and unbalanced forces. Students will learn friction and its causes.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is a machine?
2. How do machines make our work easier?

## Method:

- As an introduction cut an apple using a knife and explain them, it is easy to cut with knife. Inform them that knife is also a simple machine called wedge.
- The three types or classes of levers can be explained by showing everyday simple machines like a pair of scissors, knife, and tweezers.
- Once the students begin to know the names of these simple machines, ask them to recognize the positions of effort, load, and fulcrum. They can easily sort them into their type or class of lever.
- Take a ruler and mark load (L), effort (E) and fulcrum (F). Now explain these terms. Explain about first kind, second and third kind of lever and their working. Explain different ways a lever make our work easier?
- Conduct in classroom:
  - Activity 2-3, page 63

## Assessment

Identify and write the name of the type of simple machine:

1. It has a long arm which can lift a heavy load by applying very little effort.
2. It is a sloping surface along which a heavy load can be pulled in order to raise it.
3. It is two inclined planes that increase and change the direction of the force.

## Reinforcement/homework

Exercise questions 2 and 3

## Lesson plan 3

### Students learning outcomes

- explain friction and its causes
- understand the useful and harmful effects of friction
- know ways of reducing friction

### Materials

marble, smooth surface, toy cars

### Keywords

friction, opposing force, smooth and rough surface

### Overview

Students will learn about the useful and harmful effects of friction and discover ways of reducing friction. They will realise the importance of friction.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is a lever?
2. Does the cap of a jar/bottle open easily if your hands are dry?
3. Why do we put oil on creaking hinges of a door?
4. Why does a piece of sandpaper feel hot after rubbing it against a rusty surface to clean it?

### Method:

- Ask the students to rub their hands together. Explain that when you rub your hands together they become hot due to friction.
- Explain that there is a force which opposes the forward motion of anything. This opposing force is called friction. Roll a marble on the table. Will the marble stop after a while? Explain that friction is a force that is produced when two surfaces rub against each other. It tries to stop the surfaces from sliding over one another. For smooth surfaces like glass, ice, etc. the force of friction is less. For rough surfaces like sandpaper, wood, and rubber, the force of friction is much greater.

- Push a marbles/toy car on a rough and a smooth surface. Ask them to observe on which surface can the marbles/toy cars move the farthest? The concept that smooth surfaces offer less friction vs rough surfaces can be easily explained by this simple activity.
- Explain that friction helps all kinds of motion such as walking, writing, climbing, etc. Explain that friction is caused by tiny bumps on the surfaces in contact and also due to the atoms of the materials which tend to stick to each other.
- Explain that friction in liquids and gases is known as resistance. The resistance experienced by swimmers, runners, cyclists, etc. is called drag force. The drag force can be overcome by making the shape of the objects moving in water and air sleek and smooth or streamlined.
- Discuss how a skydiver overcomes air resistance using a parachute, and falls gently to Earth without getting hurt.
- Discuss the harmful effects of friction and the methods by which it can be reduced. Discuss the advantages and disadvantages of friction in detail. Teacher will explain the methods to reduce friction.

## Assessment

Complete the following paragraph using the given words:

**Heat, Lubricants, rubbing, Friction, energy**

_____is a force that is produced when things rub against each other. A lot of _____is needed to overcome the force of friction. It produces _____, which wastes a lot of energy. The moving parts of a machine wear out by _____against each other. Friction helps in all kinds of motion such as walking, writing, climbing, etc. _____such as oil and grease are used in machines to reduce friction.

## Reinforcement/homework

Exercise questions 1 and 4

UNIT 8

# Light

## Lesson plan 1

### Students learning outcomes

- explain that light is a form of energy
- know the main sources of light
- explain that we see things when light falls on them

### Materials

torch, candle, luminous, non-luminous

### Keywords

light, energy, dark, rays, luminous, non-luminous, shadow

### Overview

Students will learn about the light is a form of energy and the main sources of light. They will explain that we see things when light falls on them. They will know about luminous and non-luminous objects.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why you cannot see in the dark?
2. Do you see stars in the sky?
3. What are the sources of light?

### Method:

- The lesson can begin by asking the students about the sources of light. Put up the responses on the blackboard. Explain the importance of light for plants and animals.
- Explain that light is a form of energy that helps us to do many things. It travels in the form of waves. Explain that light travels faster than sound; that is why we see the lightning first. Explain that light can travel through space.

- Discuss the nature of light. Anything which is hot enough gives off light like Sun, burning candle. Make a hollow tube of a newspaper. Light a candle and place it on the desk. Ask a student to look at the flame through the tube. Bend the tube. Ask the student if they can see the flame. Explain that light cannot go round corners. It travels in straight lines. Then ask them the name the major source of light.
- Ask the students to make a list of the sources of light that have their own light. Ask them if they think the Moon is also a source of light or not. At this phase of the lesson introduce the concept of luminous and non-luminous objects.
- Students should take a torchlight and make shadows. Discuss their light and shadow activity. Discuss about the different light sources (the Sun, the candle) Help the students to make shadows using their hands.
- Conduct in classroom:
  - Activity 1, page 66
  - Activity 2, page 67

### Assessment

Circle the names of the luminous objects:
Moon, bulb, stone, stars, fire, pencil

### Reinforcement/homework

1. Exercise question 1
2. Write names of five luminous and five non-luminous objects.

## Lesson plan 2

### Students learning outcomes

- understand the properties of light.
- explain what are luminous and non-luminous bodies.

### Materials

plastic sheet, a wooden block, tissue paper

### Keywords

transparent, opaque, translucent

### Overview

Students will understand the properties of light and explain different types of materials like transparent, opaque, and translucent.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Can you see through tissue paper?
2. Can you see through a glass?
3. Can you see through a wooden block?

## Method:

- Bring a plastic sheet, a wooden block and a tissue paper. And ask the students to try to see through them. Teacher can ask the following questions: Is the view through the plastic sheet clear? Can you see something through the wooden block? Can you see through the muslin cloth clearly?
- Write some of these rules on the board. Whenever possible, try to demonstrate the suggested rules. For example, if someone suggests that light travels in a straight line, you can test this by doing the following demonstration. Darken the room and have one student hold an index card while another student shines a flashlight at the card. Then have a third student hold a pencil so that it casts a shadow on the card.
- Conduct in classroom:
  - Activity 3, page 68
  - Activity 4, page 69

## Assessment

Identify the names for the following descriptions:

a. Materials that allow some light to pass through. _____

b. Materials that allow light to pass through. _____

c. Materials that do not allow light to pass through. _____

d. A very simple camera that works without a glass lens. _____

e. It is formed when an opaque object comes in the way of light. _____

## Reinforcement/homework

Exercise questions 2 and 3

## Lesson plan 3

### Students learning outcomes

understand about the lunar and solar eclipse

### Materials two

balls of different sizes like one tennis ball and one football, torch

### Keywords

solar eclipse, lunar eclipse, orbit, phases of moon

### Overview

Students will differentiate between transparent, translucent, and opaque materials and analyse how shadows are formed. They will understand the solar eclipse and lunar eclipse is due to the formation of shadow.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. How are shadows formed?
2. What are luminous and non-luminous objects?

### Method:

- The concept of eclipse can be explained by making a group of three students. Student A can be Sun, Student B can be Moon and Student C can be the Earth. Place them in the position to show lunar and solar eclipse.
- Explain the formation of shadows with the help of diagrams and charts.
- Explain that the phases of the Moon using **two** balls of different sizes like one tennis ball and one football, torch. Explain that the shadows are formed while the Moon is orbiting the Earth.
- With the help of a torch, a tennis ball and a football explain the formation of eclipses due to the rotation of the Earth and the Moon. Help them to investigate solar and lunar eclipses of the current and the previous year.
- Conduct in classroom:
  - Activity 5-7, page 70

### Assessment

Draw a labelled diagram of a lunar eclipse and solar eclipse.

### Reinforcement/homework

Exercise questions 4, 5 and 6

## Lesson plan 4

### Students learning outcomes

- The working of a pinhole camera
- Discuss uses of laser beams

### Materials

a piece of cardboard, a toy laser light,

### Keywords

pinhole, camera, vertical, image, upside down image

### Overview

Students will learn about light travels in straight line. They will know the working and making of pinhole camera.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is a camera?
2. What is the use of a camera?

### Method:

- Make a pinhole in the centre of a piece of cardboard. Shine a torch through the hole. Explain the difference between a ray and a beam.
- A pinhole camera is a very simple camera that works without a glass lens. It is a dark, lightproof box with a tiny hole at one end. The other end of the box works as a screen. This camera works on the principle of light travels in straight lines.

- The objects reflect the light it gets from the light source. The reflected light enters through the hole of the camera. These reflected rays form an upside down image on the screen.
- Show the students a toy laser light. Explain that a laser beam is a narrow beam of light of one colour only. It is used by doctors to seal cuts on the skin. It is also now being used in telephone lines and in detecting damage in underground pipes, etc.
- Conduct in classroom:
  - Activity 8, page 72
  - Activity 9-10, page 74

### Assessment

Explain the working of pinhole camera with the help of a diagram.

### Reinforcement/homework

Take an empty box and make a model of pinhole camera.

UNIT 9

# Electricity and Magnetism

## Lesson plan 1

### Students learning outcomes

- describe current and electricity
- know about a simple circuit
- explain need of electricity

### Materials

pencil, key, wood, wires, cells, magnets

### Keywords

electricity, energy, conductors, insulators

### Overview

Students will describe current and electricity and know about a simple circuit. They will try to make a simple circuit. They will know about the terms conductors and insulators. They will explain the need of electricity.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is energy?
2. What happens when you leave a light bulb on for a while?

### Method:

- You cannot always see energy, touch it or hold it in your hand, but energy is everywhere.
- Energy is the ability to do work, to make things happen and to cause changes. Energy cannot be made or destroyed; it can only be changed into different forms.

- Can you name a form of energy? (Take students responses Examples: Light, heat, electricity, sound.) From where do you think we get electricity? (Possible answers: Power plant, the outlet in the wall, food.)
- Can you think of an example in which energy is changed from one form to another? How about a light bulb? We turn it on by plugging it into the wall. What happens when you leave a light bulb on for a while? It gets hot! This is an example of electrical energy changing into heat energy in the filament light, as when filament gets hot it radiates light.
- Students can be asked to bring a few small objects from home and sort them into insulators and conductors. Form groups of 4 to 5 students for this activity. The teacher should then move around in class and ask students the reason why they have chosen to sort some of the objects as conductors and some as insulators. Discuss about the uses of conductors and some as insulators.
- Conduct in classroom:
  - Activity 1, page 79

### Assessment

1. Draw an electric circuit that includes the following components: a battery, a switch, a bulb, and copper wire.
2. Complete the following sentences:
   i. _____ Electricity is produced when you rub two things together.
   ii. Materials through which electricity can move easily are called _____.
   iii. Electricity is generated in a _____house.
   iv. A fuse is made of thin wire that has a _____melting point.
   v. Materials which do not allow electricity to pass through them are called _____

### Reinforcement/homework

Exercise question 1

## Lesson plan 2

### Students learning outcomes

- explain the importance of a switch and a fuse in a circuit
- realize the importance of being safe around electricity

### Materials

an electric circuit, metals, plastic

### Keywords

circuit, switch, closed circuit, open circuit

## Overview

Students will learn the importance of a switch and fuse in a circuit and understand the importance of being safe using electricity.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is electricity?
2. What are conductors?
2. What are insulators?

## Method:

- Students can be asked to discuss in pairs "what would happen if there was no electricity?" Pairs can then be asked to share their thoughts with the whole class. The devices used by people to do their work in old days should also be discussed with the class.
- A simple circuit can be made by using the basic components of an electric circuit. A switch can also be added to the circuit and the difference between a closed and an open switch can be explained practically.
- These objects can also be further used during revision activities to verify the definitions of insulators and conductors by connecting different objects one by one to form a simple circuit. The lighting up of the bulb would indicate the material is a conductor or insulator.
- Discuss about the importance of electricity. Students will give their ideas about the importance of electricity.
- Conduct in classroom:
    - Activity 2, page 81

## Assessment

1. Write down the use of the following components:
    a. Fuse
    b. Switch
2. What are electromagnets?

### Reinforcement/homework

Exercise questions 3 and 4

## Lesson plan 3

### Students learning outcomes

- know about magnetism
- understand the uses of electromagnetism

### Materials

different kinds of magnets, coil of wires,

### Keywords

magnet, magnetic, electromagnet

### Overview

This topic is related to the use of magnets. Students will know about magnets and magnetism. They will understand making of electromagnets and understand the uses of electromagnetism.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What is a circuit?
2. What is a switch?

### Method:

- Show the students different kinds of magnets. Explain that a magnet is an object that can attract objects made of, or containing, iron. Explain hard and soft magnetic materials.
- Make an electromagnet with a coil of wire wound around an iron rod. Attach it to a battery cell. Bring it close to some paper clips. Explain what an electromagnet is.
- Show the students a bar magnet. Explain that all the particles inside a magnet have a north pole and a south pole. They are arranged in such a way that all the north poles of the particles face in the same direction and all the south poles face in the opposite direction. When a magnet is cut in half, the smaller magnets retain their magnetic

properties and each half becomes a magnet with a north pole and a south pole. Importance of electromagnets will be discussed.

- Conduct in classroom:
  - Activity 3, page 82

### Assessment

1. Why do we use electromagnets?
2. Draw a labelled diagram of a simple electromagnet.

### Reinforcement/homework

Exercise question 5

## Lesson plan 1

### Students learning outcomes

- describe the composition of soil
- explain the usefulness of each component
- describe how soil is formed

### Materials

a soil tray, beaker, water

### Keywords

soil, organic, texture, composition, component, humus

### Overview

Students will learn about the composition of soil and explain the usefulness of each component. Students will understand how soil is formed. They will know about the good soil for different types of vegetation.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Where do we sow a seed?
2. What would happen if there was no soil on the planet Earth?

### Method:

- Begin the lesson by showing a soil tray. Show the soil to the students and ask the following question: Where did the soil come from? What would happen if there was no soil on the planet?
- Explain the various components of soil. Soil is the material found on the surface of the earth that is composed of rock's particles and wastes of living organisms. Soil varies due to its texture and composition. Explain that soil is made up organic and inorganic components.

- Put some soil in a beaker add water and stir it. Leave it undisturbed. Show soil profile and discuss the importance of different layers and each component of the soil for plants and animals.
- Conduct in classroom:
  - Activity 1, page 85
  - Activity 2, page 86

### Assessment

1. Label the diagram of soil profile.
2. What is soil made up of?
3. What is the composition of soil?

### Reinforcement/homework

1. Exercise question 1
2. Draw a labelled diagram of soil profile.

## Lesson plan 2

### Students learning outcomes

- explain the composition of different kinds of soil and their importance
- describe the layers of soil

### Materials

diagram of layers of soil, soil samples

### Keywords

sand, silt, clay, weathering, erosion

### Overview

The teacher will explain the composition of different kinds of soil and their importance and describe the layers of soil.

### Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

### Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. Why is soil different?

2. Which soil is the best to grow a plant?

### Method:

- Bring clay in the class and help students to knead it and make objects out of clay soil. Help the students to observe the things around them made of clay for example, clay pots, clay pitchers, and other decorative items.
- Explain the terms manure, fertilizer. What is the importance of manure and fertilizer in the soil?
- Explain the formation of humus and the importance of the decay of plants for the recycling of elements in the soil. Explain the advantages of humus in the soil.
- Explain the importance of water for plants. Discuss which is the best kind of soil for plants?
- Conduct in classroom:
  - Activity 5, page 88
  - Activity 6, page 89

### Assessment

1. Identify and write the name of the layer of the soil?
   i. It is hard and made up of rocky materials. It is the deepest layer of the soil.
   ii. It contains larger particles and contains very small amounts of dead plants and animals matter.
   iii. It contains particles of different sizes. It contains dead plants and animal matter.
   iv. It is made up of dead plants and animals remains or wastes
2. How will you differentiate sand, clay and loam from each other.

### Reinforcement/homework

Exercise questions 3 and 4

## Lesson plan 3

### Students learning outcomes

- explain why soil becomes infertile
- explain the uses of different kinds of fertilizers

### Materials

clay, soil, fertilisers

### Keywords

manure, Decomposers, texture

## Overview

The teacher will explain why soil becomes infertile and explain the uses of different kinds of fertilizers.

## Teaching methodology

| | |
|---|---|
| Exploring knowledge through essential questions | 10 min |
| Method/activity | 25 min |
| Assessment | 10 min |

## Essential questions

Before starting the lesson ask some questions to explore background knowledge of students, e.g.

1. What are the components of soil?
2. What are the textures of soil?

## Method:

- Students will collect garden soil to find out the components of soil. Introduce the layers of soil by showing the diagram given in the unit. Students may make model of the layers using rocks, soil, and clay.
- Explain the process of weathering and erosion of soil by various agents such as snow, ice, water, wind, etc.
- Explain the various types of soil. Discuss the size of the particles in relation to aeration and drainage. Explain that plants cannot grow in clay and sandy soils. Discuss why loam is the best type of soil for the healthy growth of plants.
- There are three basic types of soil: sand, silt and clay. But, most soils are composed of a combination of the different types. How they mix will determine the texture of the soil, or in other words, how the soil looks and feels.
- Discuss weathering and erosion with the help of diagrams and pictures. Explain that plant roots hold the soil particles together. If trees and plants are cut down or burnt, or eaten by animals, the land becomes bare and the soil can easily be blown or washed away by wind or water. The removal of the topsoil is called erosion.
- Discuss the use of fertilizers. Explain that as plants grow, they use up the minerals present in the soil, so we need to add fertilizers to the soil to replace them. Discuss the types of fertilizers that can be used.
- Manure is made from animal waste, dried blood, and bones of animals. Compost is made from decaying plants.
- Conduct in classroom:
    - Activity 3-4, page 86

## Assessment

1. Which layer of soil is the best for growing plants? Give reasons.
2. Why do we add manure to the soil?

## Reinforcement/homework

Exercise question 2

# Answers to the Exercises

## Unit 1

1.

i. Classification is the process of sorting of things and making groups according to similarities.

ii. Classification of items makes their study easier.

iii. Water set, cutlery set, vehicles, magazines, story books

iv. Fish, Reptiles, amphibians, birds, mammals

2. For examples, refer to the chapter in the Students' Book.

i. Vertebrates: animals having backbone

ii. Invertebrates: animals without backbone

3. Fish: lay eggs without shells in water, breathe with gills, have fins but no legs or toes, are cold-blooded

Amphibians: lay eggs, usually in a jelly-like mass in water, breathe with lungs, gills, and/or their skin, have smooth skin without coverings, and are cold-blooded

Reptiles: lay eggs with leathery shells or give birth to fully-formed young, are covered with scales, are cold-blooded

Birds: lay eggs with a hard shell, are covered with feathers, have a beak, are warm-blooded

Mammals: give birth to their young and feed them with milk, have hair on at least part of their body, breathe with lungs, are warm-blooded

4: Worm: leech, earthworm, tapeworm

Insect: mosquito, butterfly, ant

## Unit 2

1. i. Angiosperms: flowering plants are called Angiosperms.

ii. Gymnosperms: non-flowering plants are called gymnosperms.

2. i. Monocot: maize, wheat. Dicot: apple, mango

ii. a. monocot has one seed in the leaf but dicot has two leaves in the seed.

b. The xylem and phloem are very organized in the stems of dicot plant in the form of a ring. The xylem and phloem are scattered throughout the stem of a monocot plant.

iii. The leaves of a monocot plant have parallel veins while the leaves of a dicot plant have web like veins.

iv. The monocots have flowers with three petals or a multiple of three. The dicots have flowers with 4 or 5 petals or multiple of four or five.

v. A taproot is a large, central, and dominant root from which other roots grow later. It is straight and very thick and grows straight downwards. It consists of a dense mass of roots that arise from the stem. The roots grow downward and outward from the stem.

vi. Flowering plants: They produce flowers and foods. Flowering plants are also known as angiosperms. The seeds of flowering plants are enclosed in fruits or flowers. They have roots, stems and leaves. The examples of flowering plants are rose, lotus, and sunflower.

Non-flowering plants: they do not produce flowers. Non-Flowering plants also known as gymnosperms. The seeds of flowering plants are not enclosed in fruits or flowers.

vii. Refer to the Students' Book.

viii. Cone-bearing plants are called conifers. They produce seeds. While algae are simplest plants which do not have stem, leaves and roots.

3.

| | **Monocot plant** | **Dicot plant** |
|---|---|---|
| **seeds** | one baby plant | two baby plants |
| **leaves** | parallel veins | web like veins |
| **flowers** | flowers with three petals or a multiple of three | flowers with 4 or 5 petals or multiple of four or five |
| **stems** | the xylem and phloem are scattered throughout the stem | the xylem and phloem are very organized in the stems |
| **roots** | fibrous roots | taproots |

## Unit 3

1. i. Minute and tiny organisms are called micro-organisms. Micro means very small and organism means living.

ii. Bacteria are very small organisms. They are present all around us.

iii. Bacteria grow very fast in warm, moist, and dark places.

iv. Some bacteria are useful for us.

a. Bacteria in our stomach help us to digest the food.

b. They are also used to make some of the food we eat like yoghurt, cheese, and bread.

c. Some break down dead organisms into simpler ones. This process is called decomposition.

d. They are also used to make vinegar.

Some bacteria are harmful and cause illnesses and spoil foods.

v. Cold, influenza, measles, and smallpox.

vi. We can reduce the risk of spreading or contracting viral infections by adopting healthy habits.

vii. We eat fungi like mushrooms. Yeast is a microscopic fungus.

2. Teacher should guide the students to make a chart.

3. Bacteria in our stomach helps us to digest the food. They are also used to make some of the food we eat like yoghurt, cheese, and bread. Some break down dead organisms into simpler ones. We eat fungi like mushrooms. Yeast is a microscopic fungus.

4. Refer to the Students' Book.

## Unit 4

1. • Cotyledon: A cotyledon is a baby plant called embryo within the seed of a plant.
   • Germination: a process in which a seed grows into a new plant.
   • Endosperm: It is a food store, which helps the baby plant to grow.
   • Seed coat: The outer covering of a seed is called a seed coat. It protects the seed from drying out.
   • Embryo: This stored food helps the baby plant to grow.

2. i. Suitable Temperature, air, water, sunlight

   ii. Photosynthesis takes place in the cotyledons during germination.

   iii. French bean Seed: A bean seed is shaped like a kidney. Each seed is covered with a protective coat called seed coat or testa which is coloured. It has two cotyledons, it is dicot seed. The cotyledons are fleshy and store food for the seed till plant grows large enough to make its own food. Endosperm is mostly absent. The embryo is made up of two parts, the radicle or the first root, and plumule or the first shoot.

   Maize seed: The outermost covering which encloses the seed is made up of a fused fruit wall and testa. It has one cotyledon. It is a monocot seed. The cotyledon is thin, small and lacks food. Endosperm is mostly present and store food. Maize is somewhat oval and flat in shape. The flat surface at the narrow end has a triangular region which is the embryo.

3. i. seed in pot, being watered, placed in sunlight: good growth

   ii. seed placed inside a box: no growth

   iii. seed being watered but without sunlight: no growth

## Unit 5

1. The presence of harmful substances in air, water, or soil is called pollution. There are different kinds of pollution. The major types are:
   - Air pollution
   - Water pollution
   - Land pollution
2. i. Acid rain also pollutes water by making it acidic which can be harmful to fish and other marine animals.
   ii. Sewerage water from residential areas is pumped into the seas. Waste contains chemicals that are harmful for living organisms.
   iii. Chemical fertilizers on farms seep into the water system through the irrigation canals.
   iv. Oil spills from large tankers destroy marine life by poisoning the water.
   v. Untreated waste material from factories is often dumped into rivers or seas. This waste contains chemicals that are harmful for living organisms.
3. Frequent use of pesticides and herbicides should be discouraged. • Make sure that you don't leave any waste on the beach when you go for a picnic. A proper system to treat the sewage should be introduced. No raw sewage should be thrown directly into the lakes, rivers, or seas.
4. i. Ways to reduce land pollution:
   - Avoid using plastic grocery bags, plastic bottles, and cans.
   - Do not waste paper.
   - Reuse paper bags and envelopes.
   - Buy items made of recycled material.
   - Make compost with kitchen waste.
   - Recycle vegetable and fruit peels, tea bags, and use them in your garden.

   ii. Ways to reduce water pollution:
   - Frequent use of pesticides and herbicides should be discouraged.
   - Make sure that you don't leave any waste on the beach when you go for a picnic.
   - A proper system to treat the sewage should be introduced.
   - No raw sewage should be thrown directly into the lakes, rivers, or seas.

   iii. Ways to reduce air pollution:
   - Using public transportation, walking, or cycling or carpooling.
   - Using natural gas instead of coal.

- Avoid burning leaves, trash, and other materials.
- Use solar power and wind power to generate electricity.
- Planting more trees.

5. **Biodegradable**: These materials can be decomposed by bacteria, fungi and other microorganisms. They can change the chemical present in the dead plants and animals into simpler substances. Some of these substances such as nitrogen return to the soil and are used by plants to make proteins and other types of food.

   **Non-Biodegradable**: These materials are difficult to decompose therefore they are major cause of pollution. For example, plastic cans, plastic bottles, plastic bags, and electrical appliances like computers, mobile phones, and televisions cannot be broken down by bacteria, fungi, and other micro-organisms, therefore they enter rivers and kill water plants and animals.
6. Non-Biodegradable materials are difficult to decompose and release toxic chemicals therefore they are the major cause of pollution. We should therefore avoid using non-biodegradable bags and bottles, such as those made of plastic.

## Unit 6

1.

| **Solids** | **Liquids** | **Gases** |
|---|---|---|
| Handkerchief, pen, book | Petrol, cooking oil, honey | bubbles in a soft drink |
| Fixed shape and size | Fixed shape but size is not fix | Shape and size are not fixed |

2. Particles of a solid do not move around and are tightly packed together.
3. Solids: Fixed shape and size

   Liquids: Fixed shape but size is not fixed

   Gas: Shape and size are not fixed
4. Refer to the Students' Book for the answer.
5. Freezing: on cooling water changes into ice.

   Melting: on heating ice changes into water.

   Evaporation: on heating water changes into steam/ vapours.

   Condensation: on cooling vapours change into water.
6. The Sun heats the surface of water. This causes water to evaporate in the form of water vapour which rises up into the air this is evaporation. When water vapour in the air gets cold and condenses into liquid droplets, the process is known as Condensation. This keeps the amount of water in the nature balanced.

7. **Snow**: Snowflakes form in clouds where the temperature is below freezing. The ice crystals form around tiny bits of dirt that have been carried up into the atmosphere by the wind. As the snow crystals grow, they become heavier and fall to the ground.

   **Fog**: Fog is a cloud that occurs at ground level instead of the sky. Fog is made up of tiny droplets of water that are suspended in the air.

   **Frost**: The dew point is the point where the air gets so cold, the water vapour in the atmosphere turns into liquid. This liquid freezes. If it gets cold enough, little bits of ice, or frost form. The ice is arranged in the form of ice crystals.

   **Rain**: When water becomes warm enough, it evaporates as vapour into the air. When a mass of air quickly cools to its saturation point, the water vapour condenses into clusters of tiny water droplets and frozen water crystals.

   **Dew**: Dew forms in the night air through a process called condensation. Air contains water in the form of a gas called water vapour. In the evenings, when warm, moist air passes over the cool surfaces, the air cools down.

## Unit 7

1. i. Machine
   ii. Axle
   iii. Friction
   iv. Friction
   v. Lubricating
   vi. Rough
2. i. A knife is a simple machine. It makes cutting easier.
   ii. Anything that makes a job easier to do is called a machine.
   iii. An inclined plane helps move wheeled objects up to a different level.
   iv. There are three kinds or classes of levers, according to where the load and effort are located with respect to the fulcrum.

   1st kind: this lever has the fulcrum placed between the effort and load. The movement of the load is in the opposite direction of the movement of the effort. This is the most common type of lever.

   Examples of this kind of lever are: • see-saw • claw hammer

   2nd kind: this lever has the load between the effort and the fulcrum. In this type of lever, the movement of the load is in the same direction as that of the effort.

   Examples of this kind of lever are: • tongs • wheelbarrow

   3rd kind: this lever has the effort between the load and the fulcrum. Both the effort and load are in the same direction. The, load in Class 3 lever moves in the same direction as the effort.

Examples of this kind of lever are: • weighing balance • tweezers

v. The Advantages of Friction; 1. If there was no friction, moving objects would never stop moving. 2. The speed of a moving vehicle can be decreased by applying the force of friction. Brakes in a vehicle create friction, thereby bringing the vehicle to rest. 3. We can walk, run, climb, and ride a bicycle on the surface of the Earth because of friction.

The Disadvantages of Friction: 1. Machine parts wear out quickly because of the force of friction. 2. More force is needed in order to make an object move or to increase its speed. 3. More energy is consumed to overcome the force of friction while operating machines.

vi. Friction can be reduced in many ways such as by: 1. polishing surfaces to make them smooth and plain. 2. Lubricating surfaces and parts of machines with oil and grease. 3. Using ball bearings in equipment and machines. 4. Streamlining the shape of vehicles.

vii. Pulley.

viii. Refer to the Students' Book for the answers.

3.

| **Object** | **Simple machine** | **Object** | **Simple machine** |
|---|---|---|---|
| flagpole | pulley | see-saw | 1st kind of lever |
| nail | Inclined plane | scissors | 1st kind of lever |
| shaving razor | 1st kind of lever | screwdriver | wheel and axle |
| axe | wedge | knife | wedge |

4. Refer to the Students' Book for the answers.

## Unit 8

1. i. a. Objects that produce their own light are called luminous objects. The Sun, stars and fire are examples of luminous objects. Objects that do not produce their own light are called non-luminous objects. Like book, pencil, ball

b. The materials which allow light to pass through them completely are called transparent materials. The materials that do not allow light to pass through them are called opaque materials.

ii. The Moon is like a ball. It does not actually change its shape. It just appears to change shapes as we look at it from the Earth. Because it orbits around the Earth, different parts of the Moon receive light from the Sun. We can only see the lit up portion of the Moon. Therefore, sometimes we see the full Moon and sometimes we see a portion of the Moon.

iii. This camera works on the principle that light travels in straight lines and is stopped due to opaque objects in its path.

iv. Refer to and adapt Activity 6 in the unit.

v. Shadows are formed when an opaque object comes in the way of light.

vi. The Earth and the Moon get light from the Sun. The Earth revolves around the Sun, and also rotates on its own axis. The Moon revolves around the Earth. During these movements, sometimes the Earth or the Moon obstruct the sunlight and cast shadows. These shadows are called eclipses.

2.

| Transparent Objects | Translucent Objects | Opaque Objects |
|---|---|---|
| clear glass, a clear plastic sheet | paper, coloured plastic sheet, a frosted glass, muslin cloth, a thin sheet of drawing paper | wood, a rock |

3. i. luminous

ii. translucent

iii. straight

iv. orbit

v. opposite

4. A solar eclipse occurs when the Moon comes between the Sun and the Earth, obstructing the Sun's rays.

5. A lunar eclipse occurs when the Earth comes between the Sun and the Moon obstructing the sunlight.

6. Refer to the Students' Book for the answer.

## Unit 9

1. i. electricity

ii. insulators

iii. conductors

iv. open

v. electricity

2. Test must be conducted under the supervision of the teacher.

3. A fuse is a thin wire which melts and breaks the circuit in case a large current tries to flow through it. The fuse is placed between the source of electricity supply and an electrical appliance. It helps to keep our appliances safe from damage.

4. It makes our work easy and our lives comfortable. We use electricity for many purposes. We use it to light tube lights, bulbs, fans, refrigerators, and televisions.
5. i. Do not leave an electrical appliance turned on and connected to the electricity outlet, when not in use.
   ii. Turn off light and fans when no one is in the room.
   iii. Use daylight whenever possible.
   iv. Use electricity carefully so that we do not waste it.
   v. Do not leave computer on standby.

## Unit 10

1. i. The topmost layer of the Earth surface is called soil. Soil is a mixture of dead plant and animal matter, fine rock particles, air and water. Most of the living organisms depend on the soil, as it provides food and shelter to many animals. Plants grow in soil. It supports the root and also provides food for them. Many living organisms like fungi and bacteria live in the soil. Insects like ants and snails also live in it.
   ii. There are three layers: Topsoil, subsoil, bedrock.
   iii. Top soil because it contains dead plants and animal matter called humus. It is the best soil for growing plants. It gets nutrients from dead plants and animal matter and other minerals which are present in the topsoil.
   iv. **Topsoil:** The uppermost layer of the soil is called topsoil. It contains particles of different sizes. Topsoil is dark. This is because it contains dead plants and animal matter called humus. It is the best soil for growing plants. It gets nutrients from dead plants and animal matter and other minerals which are present in the topsoil.

   **Subsoil:** Just under the layer of topsoil is the subsoil. It contains larger particles than the topsoil. Subsoil is lighter in colour than topsoil. This is because it contains very small amounts of dead plants and animals matter. For this reason it cannot support plant life. The roots of some plants may reach this layer in search of water.

   **BedRock:** The third layer of the soil is called bedrock. It is hard and made up of rocky materials. It is the deepest layer of the soil.
   v. Many living organisms like fungi and bacteria live in the soil. They attack dead organisms and mix nutrients in the soil to increase the fertility of the soil.

2. Refer to the Students' Book.
3. i. True
   ii. False
   iii. False
   iv. True
   v. True
   vi. True
4. The water drains quickly through the sand particles, because there is space between the grains of sand. Whereas water cannot pass through clay, because there is no space between the particles of clay. Loam is a fertile soil of clay and sand containing humus.

## Notes

## Notes

ایک برقی سرکٹ کے مختلف اجزا طلبا کو دکھایئے اور ان کے استعمالات پر بحث کیجیے، مثال کے طور پر فیوز، فیوز وائر، سوئچ، پلگ، تانبے کی حاجز تار (insulated copper wire) ، سیل، بیٹری پیک (battery pack)۔طلبا کو دو قسم کے فیوز یعنی کارٹرِج فیوز اور سیرامک فیوز بھی دکھائے جاسکتے ہیں۔ کارٹرِج فیوز میں واضح طور پر نظر آنے والی فیوز وائر طلبا کو یہ سمجھنے میں مدد دے گی کہ کیسے یہ ایک بند سرکٹ کا حصہ بن جاتی ہے اور کیسے کرنٹ کی بڑی مقدار گزرنے پر پگھل کر بند سرکٹ کو کُھلا (open) سرکٹ بنا دیتی ہے۔

طلبا سے کہا جاسکتا ہے کہ جوڑیاں (paris) بنا کر اس سوال پر تبادلۂ خیال کریں،''اگر بجلی نہ ہوتی تو کیا ہوتا؟'' پھر جوڑیوں سے کہا جاسکتا ہے کہ اپنے خیالات سے کلاس کو آگاہ کریں۔ پرانے وقتوں میں لوگ کام کرنے کے لیے جو آلات اور طریقے استعمال کرتے تھے، ان پر بھی طلبا کے ساتھ تبادلۂ خیال کیا جائے۔

تانبے کی حاجز تار کو لوہے کی ایک لمبی کیل کے گرد لپیٹ کر اور سروں کو سرکٹ سے منسلک کرکے ایک سادہ برقی مقناطیس (electromagnet) بنایا جائے۔ کچھ دیر تک کرنٹ گزرنے کے بعد طلبا سے کہا جائے کہ کیل کو عام استعمال کی پنوں (common pins) کے ڈھیر میں پھیریں اور دیکھیں کہ کتنی پنیں کیل سے چپک جاتی ہیں۔ اب کرنٹ کی فراہمی منقطع (switch off) کردیں اور کیل کو دوبارہ پنوں کے ڈھیر میں پھیریں۔

طلبا سے پوچھیے کہ انھوں نے کیا فرق دیکھے اور کیا ہوا تھا؟

طلبا کو لاؤڈ اسپیکر، اسکریپ آئرن کرین، ڈور کیچر وغیرہ جیسے آلات دکھاتے ہوئے باری باری برقی مقناطیس اور ان کے استعمالات زیرِ بحث لائے جاسکتے ہیں۔

## باب 10

زرخیز مٹّی سے بھری ٹرے (soil tray) دکھا کر سبق شروع کیجیے۔طلبا کو مٹّی دکھایئے اور مندرجہ ذیل سوالات پوچھیے:

☆ یہ مٹّی کہاں سے آئی ہے؟

☆ اگر ہمارے سیارے زمین (Earth) پر مٹّی نہ ہوتی کیا ہوتا؟

☆ زمین کس سے بنی ہوئی ہے؟

☆ مٹّی کو متعارف کرانے کے لیے زمین (Earth) کی تخلیق کو بیان کیجیے۔

سرگرمی 1 کی انجام دہی کے لیے طلبا کو باغیچے میں لے جایئے۔

اس کے بعد طلبا باغیچے کی مٹّی اکٹھی کریں گے اور اس کے اجزا جاننے کے لیے سرگرمی 2 انجام دیں گے۔

باب میں دیا گیا تصویری خاکہ دکھاتے ہوئے مٹّی کی تہوں کے بارے میں بیان کیجیے ۔طلبا پتھروں، مٹّی اور چکنی مٹّی کا استعمال کرتے ہوئے تہوں کا ماڈل بنا سکتے ہیں۔

کلاس میں چکنی مٹّی لے کر آیئے ، پھر اسے گوندھ کر مختلف چیزیں بنانے میں طلبا کی مدد کیجیے۔طلبا کے اردگرد موجود مٹی/چکنی مٹّی سے بنی ہوئی اشیا جیسے مٹّی کے برتن، مٹّی کے ڈونگے، اور دوسری آرائشی چیزوں کا مشاہدہ کرنے میں ان کی مدد کیجیے۔

☆ مٹّی کی جانچ کے لیے سرگرمی 4انجام دینے میں طلبا کی معاونت کیجیے۔

## باب 8

سبق کا آغاز طلبا سے روشنی کے مآخذ یا ذرائع (sources) کے بارے میں پوچھتے ہوئے کیا جاسکتا ہے۔ جوابات بلیک بورڈ پر درج کردیجیے۔ پھر ان سے کہیے کہ روشنی کے بڑے مآخذ کے نام بیان کریں۔

طلبا سے کہیے کہ روشنی کے ان مآخذ کی فہرست بنائیں جن کی اپنی روشنی ہوتی ہے۔ استفسار کیجیے کہ کیا ان کے خیال میں چاند روشنی کا ماخذ ہے یا نہیں۔ سبق کے اس مرحلے میں روشن (luminous) اور غیرروشن (non-luminous) اجسام کا تصوّر متعارف کروایئے۔

ایک پلاسٹک شیٹ، لکڑی کا بلاک اور ململ (muslin) کا کپڑا لے کر آیئے اور طلبا سے کہیے ان کے آر پار دیکھیں۔ پھر طلبا سے مندرجہ ذیل سوالات پوچھے جاسکتے ہیں:

☆ کیا پلاسٹک شیٹ کے دوسری طرف کا منظر واضح ہے؟

☆ کیا آپ لکڑی کے بلاک کے پار کسی چیز کو دیکھ سکتے ہیں؟

☆ کیا آپ ململ کے کپڑے کے دوسری جانب کا منظر واضح طور پر دیکھ سکتے ہیں؟

اس سرگرمی کے ذریعے شفاف (transparent)، نیم شفاف (translucent) اور غیرشفاف (obaque) اجسام کا تصوّر متعارف کروایئے۔

ہاتھوں کا استعمال کرتے ہوئے سائے بنانے میں طلبا کی مدد کیجیے۔ علاوہ ازیں دن کے مختلف اوقات میں سائے کی جسامت (سائز) کی پیمائش کرنے میں بھی ان کی معاونت کیجیے۔

تین طلبا کا گروپ بنا کر چاند اور سورج گرہن کا تصوّر بیان کیا جاسکتا ہے۔ طالب علم A کو سورج، طالب علم B کو چاند اور طالب علم C کو زمین بنایا جاسکتا ہے۔ چاند اور سورج گرہن دکھانے کے لیے انھیں اسی پوزیشن یا حالت میں کھڑا کیجیے۔

موجودہ اور گزشتہ سال کے سورج اور چاند گرہنوں کے بارے میں تحقیق کرنے کے سلسلے میں طلبا کی مدد کیجیے۔

## باب 9

طلبا سے کہا جاسکتا ہے کہ وہ گھر سے کچھ چھوٹی چھوٹی چیزیں لے کر آئیں اور انھیں حاجز یا غیرموصل (insulators) اور موصل (Conductors) کے طور پر الگ الگ کریں۔ اس سرگرمی کے لیے 4 سے 5 طلبا پر مشتمل گروپ بنادیجیے۔ اس کے بعد طلبا سے پوچھیے کہ انھوں نے کچھ چیزوں کو موصل اور کچھ کو غیر موصل کے طور پر منتخب کیوں کیا ہے۔

سرگرمی 3 کے لیے ایک برقی سرکٹ کے بنیادی اجزا کا استعمال کرتے ہوئے ایک سادہ سرکٹ تشکیل دیا جاسکتا ہے۔ سرکٹ میں سوئچ کا بھی اضافہ کیا جاسکتا ہے، اور کھلے اور بند سوئچ کا درمیانی فرق عملی طور پر بیان کیا جاسکتا ہے۔

ان اشیا کا مزید استعمال اعادہ کی سرگرمیوں (revision activities) کے دوران موصل اور غیرموصل کی تعریف (definitions) کی تصدیق کی غرض سے ایک سادہ سرکٹ بنانے کے لیے مختلف اشیا کو باری باری منسلک کرکے کیا جاسکتا ہے۔ بلب کا روشن ہونا اس بات کا اشارہ ہوگا کہ کوئی جسم / شے موصل ہے۔

ایک دوسرے سے ٹکرا سکیں۔ یہ ترتیب مائع میں ایٹموں کی ترتیب کو ظاہر کرے گی جو مائع کو بہنے کے قابل بناتی ہے اور اس کی کوئی مخصوص شکل نہیں ہوتی البتہ یہ سمانے (container) کی شکل اختیار کرسکتی ہے۔ اسی طرح سے ایک باکس میں ماربل کی گیندوں کو دور دور رکھیں کہ یہ باکس میں ادھر سے ادھر لڑھکتے ہوئے ایک دوسرے سے ٹکرائیں۔ یہ ترتیب گیس میں ایٹموں کی ترتیب کو ظاہر کرے گی جس کی وجہ سے یہ ہوا میں دور دور تک پھیل سکتی ہیں، اسی وجہ سے ان کی کوئی متعین شکل، جسامت یا حجم نہیں ہوتا۔

☆ سبق میں دی گئی سرگرمی کی مدد سے ٹھوس، مائعات اور گیسوں میں ایٹموں کی ترتیب کے مابین فرق کی وضاحت کی جاسکتی ہے۔

☆ عمل تبخیر (evaporation) اور عمل تکثیف (condensation) کی وضاحت کے لیے لیبارٹری میں آلات کی مدد سے تجربے کا اہتمام کیا جاسکتا ہے۔

☆ آبی چکر میں عمل تبخیر (evaporation) اور عمل تکثیف (condensation) کے تصوّر کی وضاحت طلبا کو تصویر یا انٹرنیٹ پر بآسانی دستیاب ویڈیو دکھا کر کی جاسکتی ہے۔

## باب 7

تعارفی سبق کے طور پر، طلبا سے کہیے کہ گھر سے کوئی سادہ مشین لے کر آئیں۔ ان سے کہیے کہ اسے کلاس کے سامنے پیش کریں اور بتائیں کہ اس مخصوص مشین کو کیسے استعمال کیا جائے اور یہ کیسے ہمارا کام آسان اور تیز تر کرسکتی ہے۔ طلبا چارٹ پیپر پر بنائی گئی اشکال کا استعمال بھی کرسکتے ہیں۔

☆ کیا آپ ایسی زندگی کا تصوّر کرسکتے ہیں جس میں مشینوں کا وجود نہ ہو؟ بات چیت کے دوران طلبا سے جوابات حاصل کیے جاسکتے ہیں۔

روزمرّہ زندگی میں استعمال ہونے والی سادہ مشینیں جیسے قینچی، چاقو، چمٹی، وغیرہ دکھا کر لیور کی تین اقسام یا درجے بیان کیے جاسکتے ہیں۔ طلبا جب کوشش یا قوت (effort) ، وزن (load) ، اور فلکرم (fulcrum) کی پوزیشن کو سمجھنے لگیں گے تو پھر وہ انھیں بآسانی لیور کی اقسام یا درجوں میں تقسیم کرسکتے ہیں۔

سبق کے آغاز پر رگڑ کی قوت (frictional force) کو سمجھانے کے لیے روزمرّہ زندگی سے سادہ مثالیں زیر بحث لائیے۔ طلبا سے کہا جاسکتا ہے کہ ان سادہ سوالوں کے جواب دیں:

1۔ اگر آپ کے ہاتھ خشک ہوں تو کیا جار/ بوتل کا ڈھکن آسانی سے کُھل جاتا ہے؟

2۔ ہم دروازے کے چرچراتے ہوئے قبضوں یا چولوں (hinges) میں تیل کیوں ڈالتے ہیں؟

3۔ زنگ آلود سطح کو صاف کرنے کے لیے اس پر ریگ مال (sandpaper) رگڑنے کے بعد یہ (ریگ مال) گرم کیوں محسوس ہوتا ہے؟

طلبا فرش پر بچھائے گئے ایک لمبے قالین یا ہموار فرش (ٹائل شدہ یا سیمنٹ سے بنے ہوئے) پر سنگ مرمر کی گولیاں یا کنچے (glass marbles) پھینک سکتے یا چھوٹی کھلونا گاڑیوں کو دھکیل سکتے ہیں، ناہموار سطحیں بھی بیان کی جاسکتی ہیں۔ طلبا سے کہیے کہ وہ مشاہدہ کریں کس سطح پر کنچے/کھلونا گاڑیاں سب سے زیادہ دور تک حرکت کرسکتی ہیں؟ اس سادہ سرگرمی کے ذریعے اس تصوّر کی آسانی کے ساتھ وضاحت کی جاسکتی ہے کہ ہموار سطح میں رگڑ، غیر ہموار سطح کے مقابلے میں کم ہوتی ہے۔

کے لیے اس کی شناخت کرنے میں طلبا کی مدد کیجیے۔
لوبیا اور مکئی کے بیجوں کا باہمی فرق سمجھانے کے لیے ان کی اندرونی ساخت کی بڑی تصویروں سے کام لیجیے۔

## باب 5

بورڈ پر environment ( ماحول ) کی اصطلاح لکھ کر سبق کا تعارف کروائیے اور طلبا سے پوچھیے کہ وہ اس سے کیا سمجھتے ہیں۔ جوابات بورڈ پر تحریر کر دیجیے۔ طلبا سے کہیے کہ وہ اپنے اطراف کے ماحول کا بہ غور جائزہ لیں اور اپنے مشاہدات تحریر کر لیں۔ طلبا سے پوچھیے'' کیا آپ کا ماحول صاف ستھرا ہے؟'' طلبا جواب دیں گے۔
کوڑا کرکٹ کے ڈھیر اور اس کے اطراف کے علاقے کی تصویر دکھائیے اور طلبا سے پوچھیے،'' کیا کوڑا کرکٹ کے ڈرموں کے اردگرد کا ماحول صاف ستھرا ہے؟''
صاف ستھرے ماحول کے فوائد کو زیر بحث لائیے اور ایک بار پھر جوابات بورڈ پر درج کر دیجیے۔ اس مرحلے پر بورڈ پر pollution ( آلودگی ) کی اصطلاح لکھ دیجیے اور طلبا سے کہیے کہ وہ مل جُل کر اس کے معنی پر غور کریں۔ طلبا کی حوصلہ افزائی کیجیے کہ لغت میں اس کے معنی تلاش کریں۔ اصطلاح متعارف کروائیے اور پھر جال (web) بنا کر اس کی اقسام درج کر دیجیے۔ تصویریں دکھا کر آلودگی کی اقسام متعارف کروائیے یا پھر طلبا کو مختلف جگہوں پر لے جائیے۔
طلبا کو قریبی پارک میں لے جائیے تا کہ وہ زمینی آلودگی کا مشاہدہ کر سکیں۔ اسی طرح طلبا آبی آلودگی (water pollution) کا مشاہدہ کرنے کے لیے ساحل سمندر یا کسی بھی جگہ کا دورہ کر سکتے ہیں جہاں پانی ہو۔ علاوہ ازیں، طلبا فضائی آلودگی (air pollution) کا مشاہدہ کرنے کے لیے رکشے یا بس سے نکلتا سیاہ دھواں دیکھ سکتے ہیں۔
آلودگی کی ہر قسم کی وجوہ اور اثرات تفصیل سے بیان کیجیے۔
پلاسٹک کے کنٹینر کو دوبارہ استعمال کرتے اور مختلف اشیا کو ازسرنو کارآمد بناتے ہوئے 3Rs متعارف کروائیے: reduce (محدود، کم کرنا)، reuse (ازسرنو استعمال کرنا)، اور recycle (ازسرنو کارآمد بنانا)۔ اس کے ساتھ ساتھ حیاتیاتی طور پر (قابل تحلیل) (biodegradable) اور حیاتیاتی طور پر ناقابل تحلیل (non-biodegradable) اشیا کو متعارف کروائیے۔
طلبا دونوں اقسام کے کوڑا کرکٹ کی شناخت کے بعد یہ بحث کر سکتے ہیں کہ انھیں ٹھکانے (dispose) کیسے لگایا جائے۔ وہ حیاتیاتی طور پر ناقابل تحلیل (non-biodegradable) چیزوں کے لیے 3Rs کا استعمال کر سکتے ہیں۔

## باب 6

☆ ٹھوس، مائعات اور گیس کے ذرات کے ماڈلز بنانے میں طلبا کی مدد کیجیے۔ طلبا سے کہیے کہ ماڈلز بنانے کے لیے سنگ مرمر کی گیندیں (marble balls) اور 3 چھوٹے ڈبے یا باکس لے کر آئیں۔ ٹھوس میں ایٹموں کی ترتیب ظاہر کرنے کے لیے سنگ مرمر کی گیندیں باکس میں ساتھ ساتھ رکھ دیجیے۔ اس بات کو یقینی بنائیے کہ گیندیں باکس میں اس طرح ترتیب سے رکھی جائیں کہ ان کے درمیان کوئی جگہ خالی نہ رہے۔ اس قسم کی ترتیب ٹھوس میں ایٹموں کی بالکل صحیح ترتیب کو ظاہر کرتی ہے جو ٹھوس کو اس کی شکل، سائز اور حجم عطا کرتی ہے۔ اسی طرح، ایک اور باکس میں سنگی گیندوں کے درمیان خالی جگہ رکھتے ہوئے اس طرح ترتیب دیں کہ یہ

## باب 3

خردبینی نامیے یا خردبینی جان دار (micro-organism) کی اصطلاح کو دو الفاظ micro (مطلب بہت ہی چھوٹا) اور organism (مطلب پودے یا جانور) میں توڑ کر متعارف کروایئے۔

طلبا سے کہیے کہ وہ کھڑکی میں سے آتی ہوئی روشنی کی شعاع (ray) کو دیکھیں۔ گرد کے ذرات اور کچھ ریشے (fibre) ہوا میں اڑتے ہوئے دیکھے جاسکتے ہیں، ان کے ساتھ خردبینی جان دار بھی ہیں جنھیں ہم اپنی ننگی آنکھ (naked eyes) سے نہیں دیکھ سکتے۔

مزید وضاحت یہ بیان کرتے ہوئے کی جاسکتی ہے کہ ہوا میں موجود خردبینی جان دار کچھ امراض کا سبب بن سکتے ہیں۔ انھیں بیکٹیریا، وائرس اور فنجائی میں درجہ بند کیا جاسکتا ہے۔

طلبا کے درمیان تجسس بڑھانے کے لیے یہ سوال پوچھیے ''بیکٹیریا ہمارے لیے مفید ہیں یا نقصان دہ؟''۔ ان کے جوابات میں نفی میں ہوسکتے ہیں، وہ کہہ سکتے ہیں کہ بیکٹیریا ہمیشہ ضرر رساں ہوتے ہیں۔ اس کے بعد بیکٹیریا کے فوائد متعارف کروایئے۔

طلبا کے گروپ بنادیجیے اور ان سے کہیے کہ صحت بخش عادات کا چارٹ بنائیں۔ سوفٹ بورڈ پر صحت بخش عادات کا چارٹ لگادیجیے۔

طلبا صحت بخش عادات پر پریزنٹیشن تیار کرسکتے ہیں اور چھوٹے طالب علموں میں اچھی عادات کو فروغ دے سکتے ہیں۔

## باب 4

طلبا کو مختلف اقسام کے بیج (جو بآسانی دستیاب ہوں) دکھا کر سبق سے متعارف کروایئے۔ ان سے کہیے کہ باجرہ، لوبیا، مٹر وغیرہ کے جو بیج دکھائے گئے ہیں ان کے درمیان فرق تلاش کریں۔

طلبا رنگ، شکل وصورت اور جسامت یا سائز کے اعتبار سے مشاہدے میں آنے والے فرق بیان کریں گے۔ اس سے انھیں یہ سمجھنے میں مدد ملے گی کہ مختلف پودوں کے بیج رنگ، شکل وصورت اور جسامت کے لحاظ سے ایک دوسرے سے مختلف ہوتے ہیں۔

طلبا سے کہیے کہ باجرے، مکئی، لوبیا، مٹر وغیرہ کے بیج اُگانے کے لیے لے کر آئیں اور زمین دوز (hypogeal) اور بالائے زمین یا زمین گیر (epigeal) اگاؤ (germination) کا مشاہدہ کریں۔ اس عمل کے دوران طلبا دو دالہ (dicot) اور یک دالہ (monocot) بیجوں میں برگ تخم یا بیج پتّا (cotyledon) کی شناخت کریں۔ سبق کے اس حصے میں اساتذہ ان دونوں اقسام کے بیجوں کی ساخت اور ان کے درمیان اُگاؤ کے عمل میں فرق بیان کریں گے۔

طلبا یک دالہ (monocot) اور دو دالہ (dicot) پودوں کی جڑوں، پتوں اور پھولوں کے خواص کے درمیان فرق کرسکتے ہیں۔ اس کے لیے طلبا کو یک دالہ (monocot) اور دو دالہ (dicot) پودے لانے کی ہدایت کردیجیے۔

مختلف حالات (conditons) میں بیج پھوٹنے کے عمل کے مشاہدے کے لیے متن میں دی گئی سرگرمی کا عملی مظاہرہ کیجیے۔ اس سرگرمی کے ذریعے اُگاؤ کے عمل کے لیے ضروری عوامل (factors) کو تفصیل سے بیان کی جاسکتی ہے۔

طلبا کی حوصلہ افزائی کیجیے کہ وہ روزانہ لوبیے اور مکئی کے بیجوں کی نمو کا مشاہدہ کریں اور دونوں بیجوں میں اُگاؤ کے مراحل کا موازنہ اور تقابل کریں۔ دونوں بیجوں میں سے پھوٹنے والے ننھے پودے دکھایئے اور برگ تخم یا بیج پتا (cotyledon) کے افعال کو سمجھنے

# نوٹس برائے اساتذہ

## باب 1

سبق کا آغاز کرنے سے قبل ہر طالب علم کو تین رنگین پنسلیں (سرخ، نیلی، سبز) دیجیے۔ اُن سے کہیے کہ کوئی بھی ایک پنسل منتخب کریں۔ اب کلاس سے کہیے کہ جن طالب علموں نے سرخ رنگ منتخب کیا ہے وہ ہاتھ اٹھائیں، پھر ان کا گروپ بنا دیجیے۔ باقی دو رنگوں کے لیے بھی یہی عمل دہرائیے۔ اس سرگرمی سے طلبا کو درجہ بندی (classification) کا تصوّر سمجھنے میں مدد ملے گی۔

طلبا سے کہیے کہ اپنے اردگرد موجود اشیا پر غور کریں اور پھر انھیں جان دار (living) اور بے جان (non-living) اشیا کے کالموں میں درج کریں۔ پھر طلبا سے پوچھیے کہ انھوں نے کچھ چیزوں کی جان دار اور کچھ کی بے جان کے کالم میں درجہ بندی کیسے کی تھی۔

طلبا نے دو بڑی اقسام کے درمیان چیزوں کی جو درجہ بندی کی تھی اس سے انھیں اس کی وجوہ بیان کرنے میں مدد ملے گی۔

طلبا کو یہ سمجھانے کے لیے کہ سائنس دانوں نے جانوروں کے ہر گروہ یا گروپ کی درجہ بندی کیسے کی ہے انھیں باب میں دیا گیا درجہ بندی کا جدول (classification table) دکھائیے۔

☆ سبق کے اس حصے میں طلبا سے کہیے وہ غور کریں کہ جانوروں کو 5 بڑے گروہوں میں درجہ بندی کرنے کی ضرورت کیوں پیش آئی۔

☆ طلبا کو ہر گروپ کے جانوروں کی تصاویر دکھائیے اور کہیے کہ ان کی خصوصیات کو پہچانیں۔

☆ کچھ دیر تک مل جُل کر غور و فکر (brainstorming) کرنے کے بعد ہر قسم کو فقاریے (vertebrates) اور غیرفقاریے (invertebrates) کے تصوّر کے ساتھ بیان کیجیے۔ فقاریے (vertebrates) اور غیرفقاریے (invertebrates) کے تصوّر کی وضاحت کرتے ہوئے طلبا کو بتائیے کہ بنی نوع انسان (human beings) بھی فقاریہ ہیں کیوں کہ ان میں ریڑھ کی ہڈی (back bone) ہوتی ہے، پھر طلبا کی ریڑھ کی ہڈی تلاش کرنے میں ان کی مدد کیجیے۔

☆ کلاس کو 7 گروپوں میں تقسیم کر دیجیے، اور ہر گروپ کو جانوروں کا ایک گروپ تفویض (assign) کر دیجیے کہ وہ اس پر پریزنٹیشن تیار کرے۔ مثال کے طور پر گروپ A: ممالیہ (Mammals) پر پریزنٹیشن تیار کرے گا۔

## باب 2

طلبا سے کہیے کہ مختلف پودوں / درختوں کے پتے لے کر آئیں، پھر پھول دار اور غیر پھول دار پودوں کے درمیان فرق سمجھنے میں ان کی مدد کیجیے۔

بیج، تنا، پتّے، جڑوں اور پھولوں کی طبعی خصوصیات کا موازنہ کرنے کے لیے یک دالہ (monocot) اور دو دالہ (dicot) اور پودے پھولوں سمیت لے کر آیئے۔ ان کے درمیان فرق بیان کیجیے۔

کلاس کو دو گروپوں میں بانٹ دیجیے، ایک گروپ یک دالہ اور دوسرا گروپ دو دالہ پودوں کی نمائندگی کرے گا۔ ان سے کہیے کہ تصویری خاکوں کے ساتھ پوسٹر بنائیں اور کلاس میں پیش کریں۔

## قومی نصاب برائے جنرل سائنس کے مطابق جانچ (Assessment) کی حکمت عملیاں

استاد طالب علم کی تعلیمی کارکردگی سے نہ صرف روایتی ٹیسٹ، امتحانات اور عملی کام (پروجیکٹ) کے ذریعے واقف ہوتے ہیں بلکہ طلبا کا لمحہ بہ لمحہ مشاہدہ بھی اس میں معاون ہوتا ہے۔ سائنس کے بارے میں طلبا کی معلومات، سائنسی مہارتوں، اور رویوں کو جانچنے کے لیے اساتذہ کو مختلف النوع اوزار (tools) اور طریقہ ہائے کار کی ضرورت ہوتی ہے۔ مثلاً:

- ☆ مخصوص ردعمل
- ☆ تعمیری/تخلیقی ردعمل
- ☆ کارکردگی کی جانچ
- ☆ ذاتی ابلاغ (personal communication)
- ☆ طلبا کی خود تشخیصی (self-assessment)

سائنس کی تشخیصی حکمت عملیوں پر مفصّل ہدایات کے لیے قومی نصاب برائے جنرل سائنس 2006 کا باب 8، صفحہ 65 تا 73 ملاحظہ کیجیے۔

## رہنمائے اساتذہ کے مشتملات اور ترتیب

رہنمائے اساتذہ برائے نیو گیٹ اہیڈ سائنس میں سبق کا آغاز کرنے کے لیے تجاویز شامل ہیں نیز ہر باب کے لیے تدریسی حکمت عملیاں بھی فراہم کی گئی ہیں۔ ہدایاتی ماڈل کا مرکز ومحور سابقہ یا پہلے سے موجود معلومات کو کھنگالنا ہے جس میں طلبا کی سرگرم شرکت کی حوصلہ افزائی کی جاتی ہے۔

## ایک فعال اور طالب علم محور کمرۂ جماعت کے لیے سفارش کردہ ترتیب کار (شیڈول)

| | |
|---|---|
| سابقہ/ پہلے سے موجود معلومات کو کھنگالنا بذریعہ بنیادی سوالات | 5منٹ |
| آموزش (learning) بذریعہ بحث/ سرگرمی | 25 منٹ |
| نتیجہ/ ماحصل بذریعہ جانچ | 10 منٹ |

ہر باب کا ابتدائی حصہ تعمیری انداز میں سبق کو آگے بڑھانے کے لیے بنیادی تجاویز پر مشتمل ہے۔ دوسرے حصے میں کتاب میں موجود تمام سوالات کے جوابات دیے گئے ہیں۔ طلبا کی حوصلہ افزائی کی جائے کہ وہ اپنے ذہن سے کام لیتے ہوئے جوابات دیں اور پھر استاد ان جوابات کی بنیاد پر طلبا کی تفہیم اور معلومات کی جانچ کر سکتے ہیں۔

## قومی نصاب برائے جنرل سائنس کے مطابق تدریسی حکمت عملیاں

مؤثر ہدایاتی تدریسی حکمت عملیوں میں مندرجہ ذیل شامل ہیں (تاہم حکمت عملیاں انھی تک محدود نہیں ہیں):

- تحقیق وتفتیش (انکوائری)
- سوالات اور گفتگو
- تحقیق اور مسئلے کا حل
- عملی مظاہرہ اور تجربہ گاہی کام (لیبارٹری ورک)
- مسائل پر مبنی آموزش (problem based learning)
- پوری جماعت، گروپ، اور انفرادی کام سے استفادہ
- خواندگی کی حکمت عملیوں (پڑھنا، لکھنا، بولنا اور سننا) کی شمولیت
- طالب علم کے کام کی بنیاد پر ہدایات کی فراہمی

سائنس کی تدریسی حکمت عملیوں پر مفصّل ہدایات کے لیے قومی نصاب برائے جنرل سائنس 2006 کا باب 7، صفحہ 55 تا 64 ملاحظہ کیجیے۔

# تعارف

نیو گیٹ اہیڈ سائنس سیریز کے لیے تیار کردہ رہنمائے اساتذہ کمرۂ جماعت میں استاد کی معاونت کے لیے ہدایات فراہم کرتی ہیں۔ اِس رہنمائے اساتذہ میں شامل ہے:

- کمرۂ جماعت میں نیو گیٹ اہیڈ سائنس کی مؤثر تدریس کا طریقہ
- قومی نصاب میں مذکور تدریسی حکمت عملیاں
- سبق کی تدریس کی منصوبہ بندی کے نمونے
- نصابی کتاب میں دی گئی مشقوں کے مجوزہ جوابات
- جانچ (assessments) کے لیے مجوزہ ورک شیٹ
- کام کی مجوزہ اسکیم

## نیو گیٹ اہیڈ سائنس کی تدریس کیسے کی جائے

نیو گیٹ اہیڈ سائنس کی مزید تعمیری انداز میں تدریس کے لیے اساتذہ کو مشورہ دیا جاتا ہے کہ طالب علم کو کمرۂ جماعت کا محور بنائیے۔ طلبا کو کمرۂ جماعت میں زیادہ فعال کردار دیا جائے، اُن کی حوصلہ افزائی کی جائے تاکہ وہ اپنے خیالات اور تصورات کو اعتماد کے ساتھ پیش کریں، نیز انھیں مختلف آرا کا احترام کرنا بھی سکھایا جائے۔ یہ تمام مقاصد حاصل کرنے کی غرض سے اساتذہ کے لیے ضروری ہے کہ طلبا کی معاونت کرتے ہوئے انھیں آسانیاں فراہم کیجیے تاکہ وہ زیادہ ذمے داری کے ساتھ اپنا سفرِ آموزش (learning journeys) طے کرسکیں۔ مندرجہ ذیل سطور میں ان تدریسی طریقوں کا خلاصہ کیا گیا ہے جن سے کام لیتے ہوئے کمرۂ جماعت کو زیادہ سے زیادہ طالب علم محور بنانے کے لیے نیو گیٹ اہیڈ سائنس کے تمام ابواب پڑھائے جائیں گے:

- طلبا کو انفرادی اور اجتماعی، یعنی گروپ میں، کام کرنے کا موقع فراہم کیا جائے۔ اساتذہ اور طلبا حقیقی زندگی سے مثالیں زیر بحث لائیں۔
- طلبا کو ایسے کام / ذمے داریاں تفویض کی جائیں جنھیں انجام دیتے ہوئے وہ آپس میں، اور استاد کے ساتھ تبادلۂ خیال کرسکیں۔ طلبا کی حوصلہ افزائی کی جائے کہ وہ اپنی رائے یا خیالات کے پس پردہ وجوہ بیان کریں۔
- استاد کے لیے ضروری ہے کہ وہ کمرۂ جماعت میں خود کو عزت و احترام، شرکت اور فعال آموزش (active learning) کے آئیڈیل کے طور پر پیش کریں۔ گروپ کے مباحثوں کے دوران مل جل کر کام کرنے کے لیے طلبا کی حوصلہ افزائی کی جائے۔
- استاد کو طلبا کی معاونت اس وقت کرنی چاہیے جب انھیں رہنمائی کی ضرورت ہو؛ پڑھتے، لکھتے اور مخصوص ابواب میں اسباق پر بحث کرتے ہوئے بیشتر وقت طلبا اپنے طور پر کام کریں گے۔