

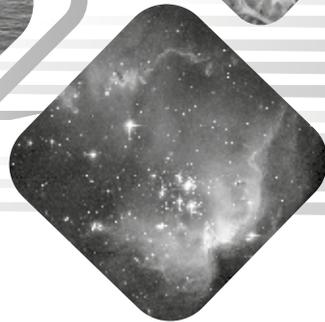
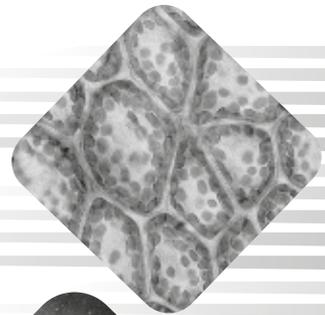
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New Get Ahead

SCIENCE

Teaching Guide



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Based on Revised Pakistan National Curriculum

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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: Cellular Organization of Plants and Animals
	Unit 2: Sense organs
	Unit 5: Elements, mixtures and compounds
	Unit 8: Energy
2nd Term	Unit 3: Photosynthesis and respiration
	Unit 6: Air
	Unit 9: Simple machines
	Unit 10: Properties of light
3rd Term	Unit 4: Environment and interactions
	Unit 7: Solution and suspensions
	Unit 11: Investigating sound
	Unit 12: Space and satellite

Scheme of Work

Chapter	Topic-wise allocation of periods	Learning outcomes The students should be able to:
Unit 1: Cellular Organization of Plants and Animals	2 periods	<ul style="list-style-type: none"> understand that living things are made up of cells differentiate between an animal and a plant cell differentiate between unicellular and multicellular organisms
	2 periods	<ul style="list-style-type: none"> understand the building up of cells into tissues, organs, and organ systems describe the structure and functions of various tissues and systems in living organisms
	2 periods	<ul style="list-style-type: none"> understand the organs and functions of digestive system understand the organs and functions of circulatory system understand the organs and functions of excretory system understand the organs and functions of nervous system
	2 periods	<ul style="list-style-type: none"> describe the main parts of a plants and their functions

Chapter	Topic-wise allocation of periods	Learning outcomes The students should be able to:
Unit 2: Sense organs	2 periods	<ul style="list-style-type: none"> • understand that all living things can sense • describe sensitivity in humans • describe the structure of the ear • explain how the ears enable us to hear
	3 periods	<ul style="list-style-type: none"> • describe the structure and the functions of the eye • describe the structure and the functions of the skin • describe the structure and the functions of the nose • describe the structure and the functions of the tongue
Unit 3: Photosynthesis and respiration	2 periods	<ul style="list-style-type: none"> • state that we get food from green plants • describe the process of photosynthesis
	2 periods	<ul style="list-style-type: none"> • describe the structure of a leaf and its function • explain how the structure of a leaf is adapted for the functions that it performs • explain how food is utilized by the plant
	2 periods	<ul style="list-style-type: none"> • describe the process of respiration in green plants • describe how a leaf is adapted for respiration • differentiate between photosynthesis and respiration
Unit 4: Environment and interactions	2 periods	<ul style="list-style-type: none"> • Know about environment and its factor • Know about ecosystem and its components • Know about ecologist
	2 periods	<ul style="list-style-type: none"> • Analyse the different types of habitat • Know the living things adapt many characters to survive in an environment.
	2 periods	<ul style="list-style-type: none"> • Understand the role of biotic factors • Analyse that organisms depend on each other

Chapter	Topic-wise allocation of periods	Learning outcomes The students should be able to:
Unit 5: Elements, mixtures and compounds	2 periods	<ul style="list-style-type: none"> • describe the structure of an atom • define an element • know about the symbols of different elements
	2 periods	<ul style="list-style-type: none"> • differentiate between metals and nonmetals • explain that a compound is made up of two or more atoms
	2 periods	<ul style="list-style-type: none"> • write the formula of compounds • explain that a solution is a mixture
	2 periods	<ul style="list-style-type: none"> • differentiate between compounds and mixtures • describe the methods by which the components of mixtures can be separated
Unit 6: Air	3 periods	<ul style="list-style-type: none"> • describe the composition of air • know that air is a matter • understand that air exerts pressure called atmospheric pressure • describe the effects of atmospheric pressure • explain how atmospheric pressure can be measured • identify ways in which air pressure can be useful
	2 periods	<ul style="list-style-type: none"> • know about the composition of air • understand about the uses of some gases present in the air
	2 periods	<ul style="list-style-type: none"> • define air pollution • identify the causes of air pollution • describe its harmful effects
Unit 7: Solution and suspensions	2 periods	<ul style="list-style-type: none"> • explain that a mixture is not a pure substance • know about solute and solvent and solutions • explain about solubility
	3 periods	<ul style="list-style-type: none"> • differentiate between solution and suspension • describe the different kinds of solution • explain about effects of temperature on solubility • describe the different kinds of mixture • know about the uses of solutions

Chapter	Topic-wise allocation of periods	Learning outcomes The students should be able to:
Unit 8: Energy	2 periods	<ul style="list-style-type: none"> • explain what is meant by energy • identify the various kinds of energy and their sources • know the uses of different kinds of energy
	3 periods	<ul style="list-style-type: none"> • identify the energy sources of the future • explain how they can be used to generate energy • explain that energy can neither be created nor destroyed • understand that energy can change from one form to another form
Unit 9: Simple machines	2 periods	<ul style="list-style-type: none"> • define a machines • identify simple machines and their uses • understand the meanings and working of effort, work, and power • identify simple machines
	2 periods	<ul style="list-style-type: none"> • explain that simple machines provide a mechanical advantage • explain how these simple machines make our work easier
Unit 10: Properties of light	3 periods	<ul style="list-style-type: none"> • explain the reflection of light • explain the laws of reflection • describe the characteristics of an image formed by a plane mirror • differentiate between regular and irregular reflection of light • know the importance of regular and irregular reflection of light
	2 periods	<ul style="list-style-type: none"> • differentiate in different types of mirror • describe the use of plane mirrors in optical instruments • describe spherical mirrors • describe the characteristics of images formed by spherical mirrors • list some uses of spherical mirrors

Chapter	Topic-wise allocation of periods	Learning outcomes The students should be able to:
Unit 11: Investigating sound	3 periods	<ul style="list-style-type: none"> • explain sound and how sound is produced • describe oscillations and explain how they can be used to make waves • explain how different kinds of waves are produced • describe the speed of sound in different mediums
	2 periods	<ul style="list-style-type: none"> • explain that sound waves travel through solid, liquid and gases • describe the characteristics of sound • list the factors on which the quality of sound depends
	2 periods	<ul style="list-style-type: none"> • explain how an echo is produced • understand the production of echoes • explain the difference between noise and musical sounds • describe the causes and effects of noise pollution
Unit 12: Space and satellite	2 periods	<ul style="list-style-type: none"> • know about space and the heavenly bodies present in the space • describe a space probe and explain its functions
	2 periods	<ul style="list-style-type: none"> • describe various kinds of satellite and explain their orbits • explain how different kinds of satellites are useful

Cellular Organization of Plants and Animals

Lesson plan 1

Students learning outcomes

Learn that cells are the building blocks of all living things.

Materials

play dough of different colours, slides of animal and plant cells, a microscope

Keywords

cell, cell wall, cell membrane, nucleus, cytoplasm, vacuole

Overview

Students will learn that all living things are made up of cells and will differentiate between an animal and a plant cell. They will also be able to differentiate between unicellular and multicellular organisms. They will discover how cells organise to make an organism.

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 living things made of?
2. What is a cell?

Method:

Draw plant and animal cells on the board and call students one by one to label their different parts. Use play dough of different colours to make different parts of animal and plant cells.

- Arrange slides of animal and plant cells in order to observe the different parts under a microscope.

- Select a group of students. Make sure each group has an equal number of members as animal and plant cells have. One group can be a plant cell and other group can be an animal cell. Each member will be assigned a role: for example; student A is the nucleus so he/she will tell his function and structure in the cell. Similarly, activity will be preceded until all the members are done with presenting their roles.
- Discuss about the difference between unicellular and multicellular organisms. Discuss about simple, one-celled organisms such as amoeba or euglena and draw their structures on the board.
- Conduct in classroom:
 - Activity 1, page 1
 - Activity 2, page 2
 - Activity 3-4, page 3

Assessment

1. What are the differences between plant and animal cell?
2. What are three jobs of the cell membrane?
3. Which cell contains cellulose?

Reinforcement/homework

1. Exercise questions 1 and 2
2. Draw a plant and animal cell.

Lesson plan 2

Students learning outcomes

Learn that cells organise to make an organism.

Materials

diagrams/ charts of different types of cell, colour paper, slides of animal and plant tissues, a microscope

Keywords

specialized cells, microscope

Overview

Students will learn the building up of cells into tissues, organs, and organ systems and describe the structure and functions of various tissues, organs and systems in living organisms.

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 organ?
2. What are the organs of digestive system?

Method:

Show the students diagrams/ charts of different types of cell and explain the structure of a typical cell. With the help of diagrams, explain the structures of a typical animal and plant cell. Explain the functions of each part and ask the students to describe the differences between them. Give colour paper to every student and ask them to draw plant and animal cell and mark the difference.

- Arrange slides of animal and plant tissues and show to the students in order to observe the different parts clearly under a microscope.
- Divide students into four groups. Make sure each group has an equal number of members. Each group will present one type of tissue. Students will describe the type and functions of tissues.
- Conduct in classroom:
 - Activity 5, page 4
 - Activity 6, 7 page 5

Assessment

1. What part of the cell is needed to make food?
2. What is a microscope?

Reinforcement/homework

Exercise questions 3 and 4

Lesson plan 3

Students learning outcomes

Learn the functions of different systems.

Materials

pictures/ charts of different organs and organ system, cut-outs of heart, liver and lung
sheep's kidney, Sheep's lungs

Keywords

unicellular, multicellular organisms, organs

Overview

Students will learn about the organs and functions of digestive system, circulatory system, excretory system and nervous system.

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. Name some organs in your body?
2. What is the function of eye?

Method:

Show pictures/ charts of different organs and organ systems, and explain that different tissues combine to form an organ. The stomach is an organ that digests food. It is made up of muscle tissue, nerve tissue, and blood tissue. Explain that organs work together to form organ systems, which carry out much larger functions than a single organ is able to do. The digestive system is made up of various organs such as the stomach, liver, and intestines.

- Make a group of 4 students. Among these 4 students, one will be a tour guide and rest of them will be the heart, liver, and lung respectively. Help students to make cut-outs of heart, liver and lung to wear around their waists to represent the organ. The tour guide can start with “Hello!!! I am a tour guide and today I am taking you inside a human body to meet the major organs.” When the tour guide reaches the heart, the student wearing a heart cut-out will explain its function. Similarly, the tour guide will introduce the liver and lung. After their introduction the students wearing lung and liver cut-outs will tell about their function in the human body. This way students will describe the functions of different systems of our body.
- Explain how waste products are removed from the body? Show the students a sheep's kidney. Explain the structure of the kidney. Explain that its function is to

filter blood to remove waste. With the help of charts and diagrams on the board, explain the process of excretion.

- Conduct in classroom:
 - Activity 8-9, page 8

Assessment

1. Arrange the following in order from the smallest to the largest: Organ, organ system, cell, tissue
2. Draw a labelled diagram of a plant cell and an animal cell.

Reinforcement/homework

1. Exercise questions 5 and 6
2. Draw a labelled diagram of digestive system on a chart paper.

Lesson plan 4

Students learning outcomes

Learn the main parts of plants and their functions.

Materials

picture of a plant with various parts of a plant like stem, leaves, flowers

Keywords

root, flower, branches, vessel, sieve tube, root hair, transpiration, stomata

Overview

Students will learn the organisation of cells to make a plant. They will describe the main parts of plants and their functions. They will learn the coordination of stem, leaves, flowers and their work.

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. From where do green plants get food?
2. How would the world be affected if there were no green plants?

Method:

- Show picture of a plant and discuss the various parts of a plant like stem, leaves, flowers and their work in a coordinated manner in order to keep the plant body in working order.
- Discuss the transport system in plants and, with the help of diagrams and charts, explain how food, water, and air are circulated in the body of a plant.
- Explain the process of photosynthesis with the help of diagrams. Discuss the importance of photosynthesis and its importance for providing food, for maintaining the balance of the amounts of oxygen and carbon dioxide in the atmosphere.
- Conduct in classroom:
 - Activity 10-11, page 9

Assessment

1. Identify the name of the organ:
 - i. _____ are bean-shaped organs situated on either side of the spine.
 - ii. _____ are a pair of spongy, air-filled organs located on either side of the chest.
 - iii. _____ is a muscular organ about the size of a fist.
 - iv. _____ is a large organ that is located on the right side of the stomach.
2. Match the columns:

Name	Functions
artery	returns deoxygenated blood to the heart
root hair	transports food in plants
phloem	absorbs water
vein	absorb oxygen
stomata	carry oxygenated blood

Reinforcement/homework

1. Exercise questions 7, 8, and 9
2. Draw a labelled diagram of parts of a plant.

Sense Organs

Lesson plan 1

Students learning outcomes

Learn the type of senses.

Materials

chart of nervous system, chart of parts of brain, hot and cold water,

Keywords

senses, Sight, taste, sensory cells, touch, sensitivity, eye-spot, stimulus,

Overview

Students will learn about the type of senses. Students will learn that all living things can sense. They will be taught the structure and functions of the ear and other sense organs.

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 sense?
2. Can you name any organs of the body which is used to sense taste?
3. How do you hear sound?

Method:

Ask students to form pairs. Students can hold a competition to find out who amongst them has the most sensitive ears. Ask your students to pair up with a partner. Tell the first student to make a sound and the second student to guess it. Tell them to switch roles after every sound. For example, if the first student makes the sound in the first turn, then the second student should make it in the second turn.

- Keep a record of how often students were able to guess the correct food, when they were not given a chance to see or smell it.

- Ask students to check hot and cold water to explain sense of touch. Show a chart of nervous system and explain that our senses receive stimuli, and our body reacts to these stimuli to bring about responses. Explain that the brain is the main organ which controls all parts of the body, and enables them to work together.
- With the aid of a chart or a diagram on the board, explain the structure of the nervous system. Draw a nerve cell and explain how neurons are linked together to make up the brain, the spinal cord, and nerves. Draw a reflex arc on the board and explain the path of a stimulus to the brain or the spinal cord, and the response produced.
- Conduct in classroom:
 - Activity 1, page 14
 - Activity 2, page 15

Assessment

Complete the following table:

Part	Structure	Functions
	outermost layer consisting of dead skin cells	
		takes messages to and from the brain
	a hollow chamber filled with air; consists of three bones called ossicles.	
		supplies blood to different parts of the eye
	a flexible outer part with a narrow, funnel-shaped tube that leads to the middle ear	

Reinforcement/homework

Exercise questions 1 and 2

Lesson plan 2

Students learning outcomes

Learn the type of senses.

Materials

chart of the structure of tongue, sugar, salt, lemon, bitter guard, models/ chart of structure of ear, nose, eye and skin

Keywords

classification, variety, groups, vertebrates, invertebrates, kingdom, features

Overview

Students will learn the different sense organs and their structures and the functions of the eye, skin, nose and tongue.

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 many senses do we have?
2. Which sense organ can be used to check hot and cold objects?

Method:

Explain the structure of the tongue. Explain how the tongue helps to distinguish between various tastes.

- Bring sugar, salt, lemon, bitter gourd in the class and students will taste and recognize the taste.
- Explain the structure of the ear with the help of models, charts, or diagrams on the board. Label the parts clearly and explain the functions of each part. Explain how the semi-circular canals help to maintain the balance of the body.
- Explain the structure of the eye with the help of models, charts, and diagrams on the board. Label the parts carefully and explain the functions of each part. Explain how the iris controls the amount of light entering the eye.
- Explain the structure of the nose. Explain how the nose distinguishes between different kinds of smells. Discuss the importance of the sense of smell.
- Explain the structure of the skin with the help of models, charts, and diagrams on the board. Label the parts clearly and explain the functions of each part. Explain how the skin helps to maintain a constant body temperature in mammals.
- Conduct in classroom:
 - Activity 3, page 18
 - Activity 4, page 19

Assessment

1. How many senses do we have?
2. Explain the working of ear?

Reinforcement/homework

1. Exercise questions 3 and 4
2. Draw internal structures of ear, nose, eye, skin and tongue.

Photosynthesis and Respiration

Lesson plan 1

Students learning outcomes

Learn the process of photosynthesis.

Materials

picture of a plant/a potted plant

Keywords

Photosynthesis, glucose, chloroplasts

Overview

Students will learn about production of food in green plants that is photosynthesis and that we get food from green plants. Understand the conditions required for photosynthesis. Students will learn that leaves are the kitchen of a plant.

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 living things need to survive?
2. What do they think plants need to survive?
3. From where do green plants get food?

Method:

Show students a picture of a plant or bring a potted plant and ask them to think about what they already know about plants particularly that they are living, and living things need food. Have the class brainstorm ideas explaining how a plant gets its food. Record their ideas on the board.

- Ask students to think about what happens to the process of photosynthesis if sunlight is not available. Ask them to write photosynthesis equation. Have them

write a hypothesis stating what they think will happen to a plant if it can't get the sunlight it needs. Ask the class to write word equation of Photosynthesis and explain that the first product of photosynthesis is glucose.

- Explain the presence of chloroplasts after showing a leaf and discuss their function of absorbing sunlight. Explain the importance of sunlight for the process of photosynthesis.
- Draw a diagram of the structure of a leaf on the board and label it. Explain the functions of each part. Show the students slides of the transverse sections of leaves under a microscope. Explain the structures of the different tissues of a leaf and the functions that they perform. Discuss the importance of plants for all living things.
- Conduct in classroom:
 - Activity 1-2, page 22
 - Activity 3-4, page 24

Assessment

1. Define the following terms:
 - i. Respiration.
 - ii. Photosynthesis.
2. What factors are necessary for photosynthesis?

Reinforcement/homework

Exercise questions 1, 2, and 3

Lesson plan 2

Students learning outcomes

Learn about the structure and function of a leaf.

Materials

a leaf, picture of a plant/ a potted plant

Keywords

stomata, Guard Cells, Chloroplast, sunlight, chlorophyll, carbon dioxide, water, oxygen

Overview

Students will learn about the structure of a leaf that contains chlorophyll which makes food. Students will learn the different functions of a leaf and how food is utilized by the plant.

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 get food?
2. Where do we cook food at home?

Method:

Explain the term by writing the word photosynthesis on the board. Draw a line separating the word into two parts Explain that 'photo' means 'light' and 'synthesis' means 'to make'. Together they mean: 'making in the presence of light'.

- Show a leaf and discuss the process of photosynthesis and how the leaves are adapted for the functions that they perform.
- Explain that plants are autotrophs in that they can make food themselves.
- Explain the importance of the network of veins and the function that they perform.
- Explain the function of stomata to absorb carbon dioxide from air and function of root to absorb water.
- Explain the uses of food in the plant. Discuss the storage of food and how it is utilized later.
- Conduct in classroom:
 - Activity 5, page 25

Assessment

1. Describe the internal structure of leaf.
2. Why is photosynthesis very important?

Reinforcement/homework

1. Exercise questions 4, 5 and 6
2. Draw a labelled diagram of internal structure of a leaf.

Lesson plan 3

Students learning outcomes

Learn the process of respiration.

Materials

a chart of diagram of the oxygen-carbon dioxide cycle

Keywords

Glucose, oxygen, carbon dioxide, internal respiration, cellular respiration

Overview

Students will learn about the process of respiration in the leaves of green plants. They will be able to differentiate between photosynthesis and respiration.

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 do you need to grow?
2. From where do you get this energy?
3. Do you know the name of the process involved in getting energy from food?

Method:

Explain that plants, like all living things, must respire in order to produce energy, and to stay alive. Define respiration and explain where respiration in plants occurs.

- Discuss the structure of a leaf and the position of the stomata.
- Write the equations of photosynthesis and respiration on the board. Explain that photosynthesis and respiration are the opposite of each other.
- Discuss the similarities and differences between the two processes. Show diagram of the oxygen-carbon dioxide cycle on the board.
- Explain how is the composition of air kept fairly constant? Why is it important for the gases in the air to remain in balance? How do plants help to maintain a balance in nature?
- Discuss the importance of the oxygen-carbon dioxide cycle in nature. Ask the class to write word equation of respiration and explain that the first product is carbon dioxide.

Assessment

1. What will be the effect of carbon dioxide and temperature on photosynthesis?
2. Write the functions of the parts of the leaf:
 - a. chloroplasts
 - b. xylem phloem
 - c. air spaces
 - d. Stomata

Reinforcement/homework

Exercise questions 7, 8, and 9

Environment and Interactions

Lesson plan 1

Students learning outcomes

Learn about environment, ecosystem and ecologist.

Materials

pictures of underwater and land environment

Keywords

environment, ecosystem, components, biotic, abiotic, ecology

Overview

Students will discuss living and non-living factors and their interaction in an environment. Students will understand the working of ecologists. They will realise that animals are interdependent on each other.

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. How is an environment of fish different from rabbit?

Method:

In order to explain the difference between biotic and abiotic factors show things present in the class. Differentiate the living and non-living things in the class room. Then introduce the components of environment: biotic and abiotic components.

- Show the pictures of underwater and land environment and discuss the concept of ecology. Discuss the biotic and abiotic factors of every environment. Ask students to analyse the difference between biotic and abiotic components in different environment.

- Explain the term ecosystem that the relationships between living organisms and their environment make up an ecosystem. Explain that an Ecologist is a scientist who studies the ways in which living organisms depend on non-living things like soil, water, sunlight, and air are called ecologists. They also study how living organisms depend on other living organisms in their environment and the ways in which they adapt to it.
- Conduct in classroom:
 - Activity 1, page 26
 - Activity 2, page 27

Assessment

1. What are the factors of ecosystem?
2. What is an environment?

Reinforcement/homework

Exercise questions 1 and 4

Lesson plan 2

Students learning outcomes

Learn the adaptation of living things according to a particular habitat.

Materials

show pictures of a camel, cactus, tall trees

Keywords

adaptation, habitats, survival

Overview

Students will learn about the term habitats and analyse the different types of habitat. They will learn that the living things adapt many characters to survive in a particular environment.

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 ecosystem?
2. Who is an ecologist?

Method:

- Explain the term Adaptation. Discuss that all environments have particular features. In order to survive, living organisms adjust to a particular environment by adapting some distinctive features.
- Show a picture of a camel and discuss that camels usually store fat in their hump in order to survive in deserts. Feet of the camel are broad so can walk easily on a sandy land. Camels have big eyelashes so eyes remain safe from sand.
- Show a picture of a polar bear and discuss that they have thick fur to survive at low temperature. Draw a cactus on the board and explain that cactus plant has the ability to store water. It has long roots that go deep down to suck up water and needle-like leaves in order to avoid loss of water by evaporation. Explain that tall trees and plants with brightly coloured flowers are the result of the heavy rainfall in the rainforests.
- Conduct in classroom:
 - Activity 3, 4 page 30
 - Activity 5 page 32

Assessment

1. Who is an ecologist?
2. Compare the adaptation in animals in rainforest and in desert.
3. Write the name of the animals with their environment:
 - i. _____ has the ability to store water. It has long roots that go deep down to suck up water and needle-like leaves in order to avoid loss of water by evaporation.
 - ii. _____ store fat in their hump in order to survive in deserts.
 - iii. _____ have deep roots to reach underground water.
4. Why polar bears are endangered?

Reinforcement/homework

1. Exercise questions 2 and 3
2. Make a booklet and paste pictures of five animals having different adaptations.

Lesson plan 3

Students learning outcomes

Learn about the interaction of animals with each other.

Materials

charts of desert ecosystem, marine ecosystem

Keywords

ecosystem, mutualism, predation, parasitism

Overview

Students will learn about the living factors called biotic factors. They will understand the role of biotic factors in an ecosystem. They will analyse that living organisms depend on each other for food and shelter.

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 ecosystem?
2. What are biotic factors?

Method:

- Help students to understand the interdependency of several organisms on each other by showing ecology of different environments like desert ecosystem, marine ecosystem etc.
- In order to clear the concept of mutualism, predation, and parasitism, students will be asked to think of some more examples of the relationship between organisms.
- Mutualism is a type of relationship in which the two organism benefits from each other. One example of mutualism is the relationship between a honey bee reproductive process and the nectar-producing plants. Honey bee get nectar from the flowers while helps to pollinate the plant for reproduction.
- Explain in detail that parasitism is the type of relationship when one organism benefits and the other is harmed. The partner which benefits from this relationship

is called a parasite and the one which provides nutrients and shelter to the parasite is called the host.

- Explain predation is a type of interaction in which one organism kills and eats another. The organism that kills another organism for its food is known as the predator and the organism that is killed for this purpose is called the prey. For example, a fox kills a rabbit for food. In this case, the fox is the predator and the rabbit is the prey.

Assessment

1. Define the following terms:
 - a. Mutualism
 - b. Parasitism
 - c. Predation
 - d. Ecosystem
 - e. Write down adaptations in desert's plants:
2. What do you mean by adaptation?

Reinforcement/homework

Exercise questions 5 and 6

Elements, Mixtures, and Compounds

Lesson plan 1

Students learning outcomes

Learn the structure and the subatomic particles of an atom.

Materials

atomic modelling kit/ balls of different colours/or play dough, copper, carbon, sulphur, aluminium

Keywords

Atom, element, molecule

Overview

Students will learn the structure and the subatomic particles of an atom. They will learn that the same types of atoms combine and make an element and about the symbols of different elements. Students will learn about first 20 elements.

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 the basic unit of life?
2. What is a wall made up of?

Method:

- Introduce the term atom with the help of an atomic modelling kit/ balls of different colours/or play dough and discuss details about the discovery of matter. Show the arrangement of elements, symbols, metals, non-metals by displaying the periodic table in class.
- Draw a diagram of an atom on the board. Label it and explain that all matter in the world is made up of atoms. Describe the structure of an atom.

- Explain the charges on the particles of an atom. What is the mass number of an atom? What is the atomic mass of an atom? Explain what atomic mass and mass number mean. Explain the way that atomic mass and atomic number are written next to the symbol or short form name of the atom.
- Draw a sodium atom on the board. Write the number of protons, neutrons, and electrons of the atom. Explain the distribution of electrons in the K, L, M, N shells. Also explain that the outermost shell cannot hold more than eight electrons.
- Explain that an element is a substance that is made up of only one kind of atom. Also, explain about metal and non-metals.
- Show some elements like copper, carbon, sulphur, aluminium etc.
- Conduct in classroom:
 - Activity 1, 2, 3, page 42

Assessment

Complete the table:

Name	Symbol
	Fe
Chlorine	
calcium	
	Mg
Argon	

Reinforcement/homework

Exercise questions 1 and 2

Lesson plan 2

Students learning outcomes

Learn about the elements and compounds.

Materials

atomic modelling kit/ balls of different colours/or play dough, copper wire, iron nail, table salt, medicines packaging, salt, water

Keywords

mixture, compound, pure, impure

Overview

Students will learn to differentiate between metals and non-metals. They will learn that a compound is made up of two or more atoms of different kinds.

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 taste the salt in the water?
2. Can salt and water be separated easily?

Method:

- Bring some materials in the class like, copper wire, iron nail, table salt, medicines packaging, and ask the students to discuss the uses of elements in daily life. Explain a clear concept about the difference between element, compound, and mixture by showing cards of elements like hydrogen and oxygen, water as a compound and tap water as a mixture.
- Stir a teaspoon of salt into a glass of water. Ask the students can you see the salt in the water? Discuss the uses of compounds and mixtures in daily life. Table salt is a compound and mineral water is a mixture. Explain how compounds are named and have formulae.
- Conduct in classroom:
 - Activity 4, page 45
 - Activity 5, page 46

Assessment

1. Sort out the mixtures and compounds:
Milk, Water, Lemonade, Petrol, Table salt, Seawater, Ammonia
2. Complete the table:

Name	Symbol
	I
Chlorine	
Glucose	
	NH ₃
Copper sulphate	

Reinforcement/homework

Exercise questions 3, 4, and 5

Lesson plan 3

Students learning outcomes

Learn the formation of bonds and compounds.

Materials

atomic modelling kit/ balls of different colours/ play dough

Keywords

Formulae, ions, cation, anion, ionic compound, covalent compound

Overview

Students will learn to write the formula of compounds and explain that a solution is a mixture. They will learn the formation of ions and bonds.

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. Are the atoms of a mixture joined to each other?
2. Can they be separated easily?

Method:

Explain to the students what a compound is and how atoms joined are to each other in a compound.

- Explain with charts and diagrams on the board, the formation of chemical compounds. Explain that ionic bonds are formed when electrons are taken or given away by atoms. Positive ions are formed when electrons are given away by an atom. Negative ions are formed when atoms receive electrons.
- Explain the formation of ions of sodium and chlorine atoms to make the compound sodium chloride (common salt). Explain the properties of ionic compounds.

- Draw two hydrogen atoms on the board. Explain that the two atoms come close to each other and begin sharing electrons, thus forming a covalent bond. Explain the properties of covalent compounds.
- Explain that the atoms in a metal are so tightly packed that their electrons overlap each other and cannot be separated easily. Draw overlapping atoms of a metal to explain the properties of metals.

Assessment

1. Write two differences between elements and compounds?
2. Write the given names of substances in the correct column: methane, oxygen, sulphur, water, iodine, carbon dioxide, phosphorus, table salt

Elements				
Compounds				

Reinforcement/homework

Exercise questions 6 and 7

Lesson plan 4

Students learning outcomes

Learn the difference between compounds and mixtures.

Materials

beaker, filter paper, funnels, round bottom flask, condenser, burner

Keywords

filtration, evaporation, distillation, chromatography, sublimation

Overview

Students will learn to differentiate compounds and mixtures and describe the methods by which the components of mixtures can be separated.

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 change do you observe when you put water in a freezer?
2. Why does water change into vapours from the surface of puddles?

Method:

- Demonstrate practically the various methods of separating mixtures.
- Filtration, evaporation, distillation, chromatography and sublimation are used to separate mixtures. Explain that an insoluble substance can easily be separated by passing the mixture through a filter paper. A soluble solute can be separated from the solvent by heating the solution to evaporate the solvent, and then allowing the saturated solution to cool slowly.
- Demonstrate how crystals of the solute will be formed. Explain how can a pure solvent be obtained from a solution?
- Demonstrate the process of distillation. Explain that the solution is heated and the solvent evaporates and condenses and is collected as a pure substance.
- Demonstrate paper chromatography. Show how the coloured substances in black ink separate out in the form of rings when water is added to it drop by drop.

Assessment

1. Define simple distillation.
2. What is sublimation and why is it important?
3. Write the name of the product or the reactants:
 - i. _____ + _____ → sodium chloride
 - ii. Nitrogen + Hydrogen → _____
 - iii. _____ + _____ → water
 - iv. Magnesium + Nitrogen + Oxygen → _____
 - v. _____ + _____ → carbon dioxide
4. How can you separate a mixture having particles of iron, sand, and table salt?

Reinforcement/homework

Exercise questions 8, 9, 10, and 11

Lesson plan 1

Students learning outcomes

Learn the composition of air and its importance.

Materials

a picture of city and village atmosphere

Keywords

atmosphere, matter, pressure, composition

Overview

Students will learn the composition of air, air pressure, and its effects. They will learn about the instruments used to measure the atmospheric pressure. They will discover how atmospheric pressure can be measured and its importance.

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 is air?
2. Can we see air?
3. Can we feel air?

Method:

As a starter activity ask the students to look around and observe the atmosphere and discuss if it is clean or dirty? Show a chart having a picture of city and village atmosphere and discuss if it is clean or dirty?

- Explain that we cannot see air but we can feel it. We can see things moving when the wind blows.
- Explain to the students the birds such as eagles are floating in the sky because of the presence of air.

- Explain that land and sea breezes are caused by the changes in air pressure due to warm and cool air. Air moves from areas of high pressure to areas of low pressure. Warm air has low pressure and is light. Cool air has high pressure and is heavy. Changes in temperature during daytime and nighttime cause land and sea breezes. Explain to the students that air pressure can be measured.
- Conduct in classroom:
 - Activity 1-2, page 51
 - Activity 3-4, page 52
 - Activity 5-6, page 53

Assessment

What is the composition of air?

Reinforcement/homework

Exercise question 1

Lesson plan 2

Students learning outcomes

Learn about the gases present in the air and their uses.

Materials

a pie chart showing composition of air, Posters

Keywords

Nitrogen, oxygen, carbon dioxide, burning, oxidation, rusting, respiration

Overview

Students will learn that air is a mixture of different gases. They will understand about the uses of some gases present in the air.

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. Is air present on moon and other planets?
2. What is atmosphere?

Method:

Teacher will tell that atmosphere is made up of mixture of gases that are nitrogen 78%, oxygen 21% and other gases 1%, by showing a pie chart showing composition of air.

- Air also contains carbon dioxide. Explain to the students that atmosphere contains air and it surrounds our earth. The atmosphere is very important because it contains gases which are important for the life of plants and animals. Discuss the importance of oxygen for breathing and carbon dioxide for photosynthesis. Discuss the uses of these gases one by one.
- Discuss with the students the presence of nitrogen gas in air.
- Conduct in classroom:
 - Activity 7-8, page 54
 - Activity 9, page 55
 - Activity 10-12, page 56

Assessment

1. What are the two uses of carbon dioxide?
2. What are the two uses of oxygen?
3. Write true or false:
 - i. A flame needs oxygen to burn.
 - ii. Nitrogen is a reactive gas and supports burning.
 - iii. Air pressure is measured with an instrument called a thermometer.
 - iv. Carbon dioxide is heavier than air.
 - v. Rust is formed when nitrogen in the air combines with iron.

Reinforcement/homework

1. Exercise question 2
2. Design a poster about a clean environment.

Lesson plan 3

Students learning outcomes

Learn about the air pollution, causes, and preventions.

Materials

posters, a chart of earth's atmosphere, pictures of Dodo and Tasmanian tigers, one picture of city and one of village

Keywords

pollution, smoke, clean, fumes

Overview

Students will learn about air pollution and its harmful effects. Students will realise the causes prevention of air 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 the air like in a village? A hilly area? A busy city?
2. Why is the air cleaner in the countryside?

Method:

Discuss the causes and effects of pollution and how we can reduce it. Ask the students to make posters to make others aware of the hazards of air pollution.

- Teacher will bring a ball to the classroom and cover it with a piece of cloth to demonstrate the concept of ozone. We have to preserve the ozone layer which protects the Earth from harmful radiations.
- Discuss the harmful effects of depletion of ozone by showing a chart of earth's atmosphere. Explain that this is leading to global warming and this may affect different species. Especially the ones which are near the coastal areas. Show pictures of Dodo and Tasmanian tigers which are extinct now.
- Show a picture of a polar bear and explain that they can also lose their habitat if global warming is increased.
- Show pictures of a city and a village and discuss the advantages and disadvantages of living in a city or a village.
- Take the students to different areas of the school and explain why clean air is essential. Student should be motivated to take care of the environment. They can also be guided to start an awareness campaign in the school.
- Posters designed by the students can be displayed in the school premises and classrooms.
- Conduct in classroom:
 - Activity 13-14, page 57
 - Activity 15-16, page 58

Assessment

1. What is oxidation?
2. What are the methods of separation of gases in the air?
3. Explain rusting.

Reinforcement/homework

Exercise questions 3 and 4

Solutions and Suspensions

Lesson plan 1

Students learning outcomes

Learn about soluble and insoluble substances.

Materials

sugar, a cup of tea, salt, a glass of water, powdered chalk, cooking oil

Keywords

solute, solution, solvent, solution, soluble, insoluble, suspensions

Overview

Students will learn that a mixture is not a pure substance. They will learn about solute, solvent, solutions, and solubility.

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. Does seawater contain salt?
2. Can we use the salt present in the seawater?
3. Can salt and water be separated easily?

Method:

- Teacher will mix sugar in a cup of tea to explain the terms solute, solvent and solution. Explain about the formation of solution by the particle model.
- Stir a teaspoon of salt into a glass of water. Explain the properties of a mixture and describe the types of mixture with examples. Explain that the mixture of salt and water is called a solution. The salt is the solute, the solvent is water. We can say that salt is soluble in water.
- Explain the difference between soluble and insoluble. Describe the characteristics of an aqueous (liquid) solution.

- Discuss some everyday examples of solutions.
- Explain that the mixtures known as suspensions. Explain what the solubility of a salt means. Explain that temperature can affect the solubility of a salt.
- Stir some powdered chalk into a beaker of water. Show students some other examples of suspension e.g. muddy water, milk of magnesia.
- Conduct in classroom:
 - Activity 1, page 62
 - Activity 2-5, page 63
 - Activity 6, page 64
 - Activity 7, page 65

Assessment

1. Sort out the insoluble and soluble from the given substances:

Sand, table salt, chalk, sugar,

Write the solute and solvent of the given solution/mixtures:

Solution/mixtures	Solute	Solvent
Salt and water		
Sand and water		
Sugar and water		
Chalk and water		

Reinforcement/homework

Exercise question 1

Lesson plan 2

Students learning outcomes

Learn the effect of temperature on solubility.

Materials

salt, a glass of water, milk

Keywords

dilute, concentrated, homogeneous, heterogeneous, suspensions

Overview

Students will learn about different kinds of solutions. They will learn about effects of temperature on solubility and the different kinds of mixture. They will discover the uses of solutions.

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. Is blood a solution?
2. Does sugar dissolve quickly in cold water or hot?

Method:

- Demonstrate how dilute and concentrated solutions are made by dissolving 1 table spoon of salt in a glass of water and then 5 tablespoons of salt in a glass of water; also explain the terms.
- Teacher will give a clear concept of homogeneous and heterogeneous mixture by showing that a salt solution is transparent and the milk is opaque. Teacher will explain how to identify uses of solutions and suspensions in daily life.
- Teacher will dissolve copper sulphate/ salt bit by bit in a beaker containing 100 ml of cold water until dissolving stops and then warming water and dissolving some more copper sulphate to demonstrate about the effects of temperature on solubility. Explain what will happen to the solution if we add more salt to it? Explain the difference between a dilute and a concentrated solution. Explain that the solution will become saturated. No more salt will be able to dissolve in it.
- Conduct in classroom:
 - Activity 8-10, page 66
 - Activity 11-12, page 67

Assessment

1. Define the following terms:
 - i. saturated solution
 - ii. unsaturated solution
 - iii. Solubility
2. What is the effect of temperature on solubility?

3. Complete the following paragraph using the given words:

solvents, solute, temperature, increase, concentrated

A solute can be in solid, liquid, or gas form. Not all solutes dissolve in all _____ . The amount of solute dissolved depends on the _____ of the solvent. All solvents dissolve a fixed amount of _____ at a certain temperature. If you _____ the temperature, the amount of solute that can be dissolved also increases. If a solution has more solute particles than it is called _____ solution.

Reinforcement/homework

Exercise question 2

Energy

Lesson plan 1

Students learning outcomes

Learn about different types of energy.

Materials

wind-up toy, a ball, a pile of sand

Keywords

energy, potential, kinetic, mechanical, solar, chemical

Overview

Students will learn about energy, its kinds and sources. They will also learn about the renewable and non-renewable fuel.

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. Where do we get energy to work and play?
3. How does energy get into food?
4. What does a car, a steam engine, an aeroplane need to move?

Method:

- Bring a wind-up toy in the class to show the transformation of energy. Explain to them when they wind up the key, the potential energy stored in the spring of the toy converts into kinetic energy.
- Explain that energy is the ability to work. All things need energy to work. Explain that we get energy from the food we eat. Revise how green plants use the energy from the Sun (solar energy) to make their food by photosynthesis.

- Explain that all fuels come from solar energy which was trapped in coal and mineral oil millions of years ago. Explain the formation of fossil fuels.
- Explain that atoms are always moving so they have kinetic energy. When an ice cube is heated, its molecules begin to move faster and faster, and finally they break away from each other and the ice melts to form water.
- Hold a ball in your hand and explain to the students that ball has potential energy. Let the ball fall from your hand onto a pile of sand and show that falling ball has kinetic energy. Explain with more examples the difference between kinetic and potential energy.
- Conduct in classroom:
 - Activity 1, page 69
 - Activity 2, page 70
 - Activity 3-6, page 71

Assessment

1. What is the main source of energy?
2. Complete table to show the energy input and output of some useful energy converters:

Converter	Energy input	Energy output
Bulb		
Iron		
television		
electric drill		
calculator		

3. Write the names of two Non-renewable Sources of Energy.

Reinforcement/homework

Exercise questions 1 and 2

Lesson plan 2

Students learning outcomes

Learn the interconversion of energy.

Materials

a light bulb, a fan, and electric cattle

Keywords

hydroelectric energy, Wind Energy

Overview

Students will learn how to generate energy and understand that energy is the ability to perform work. Students will understand that energy can neither be created nor be destroyed but it can change 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 energy?
2. Where does all the energy in the world come from?
3. How do green plants use energy from the Sun?

Method:

Perform different activities to explain the different kinds of energy. For example, turn on a light bulb, a fan, and electric kettle and explain the change of energy.

- Explain that we are using energy all the time. Explain the meaning of energy and how it can be used to do useful work.
- What are firecrackers made of? Why does a firecracker make a crackling sound when it is lit? Explain the energy changes that take place. Discuss the various kinds of energy that we use and their sources.
- Explain that nuclear energy is generated by fusion and fission of atoms. Nuclear energy can be used to make an atom bomb, but it can also be used to generate electricity.
- Explain the energy changes that take place in different works.
- Conduct in classroom:
 - Activity 7, page 74

Assessment

1. Write the names of two renewable sources of energy.
2. Give examples of the following:
3. The changing of chemical energy into kinetic energy.
 - i. The changing of potential energy into kinetic energy

Reinforcement/homework

Exercise questions 3, 4, and 5

Simple Machines

Lesson plan 1

Students learning outcomes

Learn that machines make work easier.

Materials

a chart having pictures of machines

Keywords

machine, pulley, wheel, axle, fixed pulley, movable pulley

Overview

Students will learn about machines and their uses. They will get a concept of simple machines. They will understand the meanings and working of simple machines with the help of effort, work, and power.

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. Can you name some machines that we use every day?
3. Is a clock a machine?

Method:

Show a chart having pictures of machines and explain that a machine is a device that helps us with our work, therefore even a teaspoon or a knife is a machine.

- Explain that machines need some kind of energy to function. A car needs petrol, a fan needs electricity. The energy can be electrical, mechanical, or chemical. Discuss the different kinds of energy that are needed by machines.
- Explain that force is needed to make something move. Describe the things that force can do. Explain that a machine transfers force from one part to another, and keeps

changing direction. Explain that the amount of work that a machine does depends on the amount of effort applied.

- Explain that effort is the force that is applied. For example, if one person pushes a car, it will move slowly and will travel a short distance. If two people push the car, the force will be doubled and the car will move further and faster. Explain that the amount of work done by a machine during a certain period of time is called the power of that machine.
- Continue with the explanation of basic purpose of machine, what is it and why is it used. Explain to them that machine can be anything which makes the work easier, even a ruler is a machine. Explain that big machines are the combination of simple machines.
- Divide the students in groups and ask them to write the names of machine that they can identify in school.
- Conduct in classroom:
 - Activity 1, page 79
 - Activity 2, page 80

Assessment

1. What is a machine?
2. What are the types of pulleys?
3. Why do we use machines?

Reinforcement/homework

Exercise question 1 and 2

Lesson plan 2

Students learning outcomes

Learn the working of simple machines in a complex machine.

Materials

a bottle opener, a bottle of a soft drink, an axe or a knife, a bicycle

Keywords

elevator, fishing rod, brakes, gears

Overview

Students will learn that simple machines provide us with an advantage. Complex or big machines are the combination of many simple machines.

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 name some machines that are present in your classroom?
2. Why is using a machine better than trying to do the same work with your bare hands?

Method:

Show the students a bottle opener. Explain that it is a machine. Use it to open a bottle of a soft drink. Explain that a machine helps us to do useful work with less effort. A pair of scissors is also a machine.

- Explain the types of simple machine and the useful work that they do. Explain the meaning of mechanical advantage. Show the students various types of lever and their use in everyday life.
- Explain how the positions of load, fulcrum, and the effort applied help a machine to make work easier. Ask: How can we push a heavy load uphill? Explain the use of an inclined plane.
- Show the students an axe or a knife. Explain that an axe is made up of two inclined planes. Explain that when we strike the axe downwards, it creates a strong sideways force that splits the wood. A sharp axe will have a greater splitting force than a blunt one. Discuss that all the complex machines are combination of these simple machine. Briefly discuss about the simple machine they have studied before.
- Show a bicycle to the students and explain that it is a complex machine which is made up of several simple machines.
- Ask the students to identify the simple machines in a bicycle like pulley, wheel and axle.

Assessment

1. Write true or false:
 - i. A wheel itself is a machine.
 - ii. A pulley consists of a grooved wheel with a rope wrapped around it.
 - iii. Brakes are used to stop the bicycle by friction.

- iv. Axle are toothed wheels which transmit power from one part to another.
 - v. Doorknob works on the principle of the wheel and axle.
 - vi. Define gears and explain their function in the working of a bicycle.
2. Identify the wheel and axle, gear system and pulleys in the following machines and write in the correct column:

industrial crane, water well, fishing rod, egg beater, pendulum clocks, elevators

wheel and axle	gear system	pulleys

Reinforcement/homework

Exercise questions 3, 4, and 5

Properties of Light

Lesson plan 1

Students learning outcomes

Learn that light is a form of energy. Learn about the functions of light.

Materials

a mirror, a rough surface, a glass, a piece of wood, torch

Keywords

reflection, transmission, absorption, regular, irregular

Overview

Students will understand that light is a form of energy. They will explain the reflection of light and the laws of reflection. They will describe the characteristics of an image formed by a plane mirror and will differentiate between regular and irregular reflection of light and its importance.

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 light?
2. What happens when light falls on a shiny surface?

Method:

Explain that the bouncing off of light from a shiny surface like a mirror is known as reflection.

- Study the laws of reflection and draw the ray diagram of the experiment on the board. Explain that the incident ray is reflected at the same angle.
- Help the students to set up their own experiment, and draw a diagram of the reflection of rays by a plane mirror. Explain the laws of reflection.

- Explain the size of the image formed in a mirror. Explain the students to see the distance from the mirror at which the image is formed. Explain the characteristic of an image formed by a plane mirror. Draw diagrams on the board to explain the reflection of light from smooth and rough surfaces.
- Take a mirror, a glass, and a piece of wood in the class and with the help of a torch show what is reflection, absorption, and transmission. Explain to the students that when light strikes the surface of an opaque material, the light energy is converted into heat energy, which is how it gets absorbed into the material.
- Conduct in classroom:
 - Activity 1, page 86
 - Activity 2, page 87
 - Activity 3-4, page 88

Assessment

1. What are the laws of reflection? Draw a labelled ray diagram.
2. How many types of reflection are there?
3. Draw ray diagram to show the reflection of light on:
 - a. A smooth surface
 - b. A rough surface

Reinforcement/homework

Exercise question 1

Lesson plan 2

Students learning outcomes

Learn the uses of plane and curved mirrors.

Materials

pictures of a telescope, a periscope, a projector, a microscope, and a kaleidoscope

Keywords

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

Overview

Students will differentiate between different types of mirror and describe the uses of plane mirrors in optical instruments. They will learn characteristics of the image formed by spherical mirrors and its uses.

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 the difference between glass and mirror?
2. How can you see small organisms under a microscope?

Method:

- Show the students pictures of a telescope, a periscope, a projector, a microscope, and a kaleidoscope.
- Use charts and diagrams to explain how reflecting surfaces are used in various optical instruments. Discuss the uses of different optical instruments. Explain that a telescope is used for observing heavenly bodies in space. A periscope is used in submarines for observing things on the surface of the sea. A projector is used for showing pictures on a cinema screen. A microscope is used for observing very tiny cells and organisms. A kaleidoscope is used for observing colourful formations of beads or other coloured objects.
- Explain the meanings of real and virtual image. Virtual means “not physically existing but made to appear to do so”. Virtual images are not formed when light rays physically meet with one another after reflection but they are the projection of reflected rays beyond the mirror. On the other hand, a real image is formed when light rays physically meet one another.
- Conduct in classroom:
 - Activity 5-6, page 89
 - Activity 7, page 90
 - Activity 8, page 91

Assessment

1. Draw a periscope and explain its working:
2. Complete the following table:

Mirror	Kind of image formed	Size of image formed
Concave		
Convex		

3. What is a Kaleidoscope?
4. What are the differences between Telescope and Microscope?

Reinforcement/homework

Exercise questions 2, 3 and 4

Investigating Sound

Lesson plan 1

Students learning outcomes

Learn that sound is a form of energy.

Materials

a bob, a piece of string, a soft spring, a plastic tray

Keywords

pendulum, amplitude, oscillations, waves

Overview

Students will learn about sound and the ways sound is produced. They will be taught the term oscillations and different kinds of waves. They will describe the speed of sound in different mediums.

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 sounds can you hear in a busy street?
2. Which sounds do you like?

Method:

- Tie a rope to a fixed point on a wall. Move the free end from side to side. Explain that a transverse wave is being formed.
- Fix one end of a soft spring to a wall and pull it towards you. Let the spring go. Waves will travel along the spring. Some sections of the spring will be compressed while others will be loose. Explain that the tight portion of the spring is called a compression, while the loose part is called a rarefaction. Such waves are called longitudinal waves.

- Explain that a wave is used to transport energy from one point to another. A wave is produced by vibrations. The molecules of the material help sound wave to travel through it. Pour water in a plastic tray and produce waves in water to show to the students.
- Conduct in classroom:
 - Activity 1, page 97
 - Activity 2-3, page 99
 - Activity 4-5, page 100

Assessment

1. How does sound travel?
2. Can sound travel through a vacuum? give reason
3. Why is sound a form of energy?

Reinforcement/homework

Exercise questions 1 and 2

Lesson plan 2

Students learning outcomes

Learn the comparison of speed of sound waves in different mediums.

Materials

two balloons, clock, bell jar, a whistle, a buzzer

Keywords

space, sound, echo, vacuum,

Overview

Students will learn that sound waves travel through solid, liquid and gases; they will describe the characteristics of sound. They will explain the factors on which the quality of sound depends.

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 is sound waves produced?
2. What kind of waves are sound waves?

Method:

Explain that sound waves are longitudinal waves that are produced by vibrating bodies. Compressions and rarefactions made by vibrating bodies produce sound waves. Explain the difference of speed of sound or light. Explain that during a thunderstorm, the flash of lightning can be seen before the clap of thunder is heard. Explain that sound waves need a medium to travel in. Sound can travel in solids, liquids, and gases. The denser the medium, the faster the waves travel, and the louder the sound.

- Inflate two balloons. Heat one balloon till it bursts and simultaneously prick the other balloon with a pin. Explain that sound waves travel faster in warm air than in cold. Discuss the experiment: Sound waves in a vacuum. Explain that the ticking sound of the clock will gradually decrease as the air is evacuated from the bell jar, because sound waves cannot be produced without a medium.
- Explain that sound waves spread in all directions, and the sound becomes fainter as the distance from the vibrating body increases.
- Ask students the difference between the sounds of a whistle and a buzzer? Explain that the sound of the whistle is shrill because it has a high pitch. The pitch of the sound depends on the frequency of the sound waves produced by the vibrating body. A fast vibrating body has a high frequency: it produces a shrill sound.
- Explain that voices and the sounds of musical instruments is a combination of sound waves of different frequencies which collectively make up a particular sound.
- Conduct in classroom:
 - Activity 6, page 101
 - Activity 7-8, page 102

Assessment

1. Why does sound travel with different speeds in different mediums?
2. Match the items in lists A and B to complete the sentences.

The loudness of sound depends on high	frequency
Sound waves cannot travel through	hot air
Sound waves travel faster through	air pressure
The speed of sound is not affected by	vacuum

Sound waves are caused by	330 m/s
Sound waves travel at a speed of	vibrations
Shrill sounds have a on the amplitude of the	vibrating body
A fast vibrating body has a	high pitch

Reinforcement/homework

Exercise questions 3 and 4

Lesson plan 3

Students learning outcomes

Learn the internal structure of an ear. Learn how the ear hears sounds. Learn about the loud noises causing noise pollution.

Materials

a picture of an internal structure of ear, poster

Keywords

sound, noise, pollution

Overview

Students will learn about echo and the production of echoes. They will differentiate between noise and musical sounds. They will describe the causes and effects of noise pollution. They will understand the internal structure of an ear and its functions.

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 know the speed of sound?
2. What is the speed of light?

Method:

- Show a picture of an internal structure of ear and discuss each part one by one. Explain the working of each part. Discuss how we can hear sounds.

- Explain that they should not put any sharp object into ears. Students will be asked to identify sound without looking at the origin. Send two students out of the classroom. Ask them to say hello from behind the closed door. Ask the name of the student who said hello first?
- Discuss loud and low sounds. Explain in detail about noise pollution. Students will discuss the ways by which noise pollution can be reduced.
- Students will be asked to make posters to stop noise pollution.

Assessment

1. How does the human ear receive Sound?
2. How can we reduce noise pollution?
3. What is an echo?

Reinforcement/homework

Exercise question 5

Space and Satellites

Lesson plan 1

Students learning outcomes

Learn about space and astronauts.

Materials

rocks of different sizes, spacecraft's picture, a picture of an artificial satellite

Keywords

space, orbit, comets, asteroids, meteoroids

Overview

Students will learn about space and the heavenly bodies present in the space. They will describe a space probe and explain its functions. They will learn about planets and other heavenly bodies in space.

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 do you see in the sky at night?
2. How does the Moon move?
3. What does the Earth orbit around?
4. Does the Sun orbit around anything?

Method:

- Begin the chapter with the explanation of the structure of a comet, asteroids, and meteors. Show the difference with the help of rocks of different sizes. Discuss what shooting star is and why it glows.
- How have scientists learned about the planets and other heavenly bodies in space? Give concept of how far is the Moon from the Earth? Has anyone been to the Moon? Explain that astronauts have travelled to the Moon, but robot spacecraft have

travelled much further into space. These robot spacecraft are called space probes. Space probes carry cameras and different instruments to study the planets they visit.

- Explain that a satellite is any object that circles or orbits around another object. Explain that the Moon and the Earth are called natural satellites, and so are asteroids, comets, etc. With the help of pictures explain about space travel and spacecraft.
- Show a picture of an artificial satellite and discuss what artificial satellites are and how they are used to collect information about space and the planets.
- With diagrams and pictures explain the orbit of the Earth around the Sun and the orbit of the Moon around the Earth. Explain the orbits of artificial satellites and what they are used for.

Assessment

1. Define the following:
 - a. Meteors
 - b. Asteroids
 - c. Comets
2. What is a satellite?

Reinforcement/homework

Exercise questions 1 and 2

Lesson plan 2

Students learning outcomes

Learn about the different types of satellite.

Materials

a picture of an artificial satellite, picture of astronaut

Keywords

satellites, Low Earth Orbit (LEO), Medium Earth Orbit (MEO), geostationary

Overview

Students will describe various kinds of satellite and explain their orbits they will explain how different kinds of satellites are useful.

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 does our phone work?
2. What is a natural satellite?
3. What is a satellite?
4. What is an orbit?

Method:

- With the help of pictures, explain the uses of different kinds of satellite that are used for gathering information about the Earth.
- Explain how and where do scientists stay in space? Explain that scientists can stay in a large spacecraft that stays in orbit all the time.
- Discuss how mobile phones work. How can you talk to people in far off countries using a mobile phone? Explain that GPS is a space-based global navigation system that provides reliable location and time information in all kinds of weather, and at all times, anywhere on or near the Earth.
- GPS stands for Global Positioning System. It is widely used for commerce, banking, science and mobile phone operation.
- Ask the students to Prepare a poster to show the distances of Low earth orbit (LEO), Medium earth orbit (MEO) and Geostationary orbit (GEO) from the Earth surface.

Assessment

1. Give names of any two types of satellites?
2. Write down the uses of the following:
 - a. Communication Satellite
 - b. Navigation Satellite
 - c. Weather Satellite

3. Write down the full form of the following:
 - a. GEO
 - b. MEO
 - c. LEO
 - d. What are artificial satellites?
4. Describe some uses of artificial satellites.

Reinforcement/homework

Exercise questions 3, 4, and 5

Answers to the Exercises

Unit 1

1.
 - i. All living things are made up of cells. A cell is the basic unit of living things.
 - ii. Unicellular organisms are composed of a single cell which means they carry out all of their life processes as one single cell. They take in food, excrete waste, move, grow, and reproduce. Example: Bacteria, Euglena, Amoeba.
 - iii. Organisms that consist of more than one cell are known as multicellular organisms. Example: rose, cat, tree.
 - iv. A tissue is made up of cells of one type. These cells have a similar structure and perform a specific function. Examples: There are four basic types of tissues in an animal body: • epithelial tissue • connective tissue • muscular tissue • nervous tissue.
 - v. Organs are made up of tissue. Different tissues are grouped together to form organs, which are responsible for carrying out one or more than one function. Example: stomach, heart.
 - vi. Epithelial Tissue: This is just like a sheet of cells that covers the outer surfaces of the body cavities and passage ways. Skin is made up of epithelial tissue.
 - vii. Connective Tissue: Connective tissue, binds the cells and organs of the body together to protect, support, and connect all parts of the body. Most of the body organs are made up of connective tissue. For example, muscles, joints, veins, etc.
Muscular Tissue: The muscular tissues move and contract the structures within the body. Our heart and body muscles are made up of muscular tissue.
Nervous Tissue: The nervous tissue enables responses to stimuli and coordinates bodily functions. These tissues help to send signals in the form of nerve impulses that communicate between the different parts of the body. Our brain is made up of nerve tissue.
2. Refer to the Students' Book.
3. Refer to the Students' Book.
- 4.

Animal Cells	Plant Cells
There is no cell wall	The outer layer is called the cell wall
The cell membrane is the outermost layer of the cell	The cell membrane is inside the cell wall

The nucleus is in the centre	The nucleus is usually on one side
The vacuoles are small	The vacuoles are small

5. **Tissue:** The bodies of animals and plants are made up of millions of cells. Each part of the body is made up of a group of cells that perform the same function. Such groups of specialized cells are called tissues. A tissue is made up of cells of one type. These cells have a similar structure and perform a specific function.

Organ: Organs are made up of tissue. Different tissues are grouped together to form organs, which are responsible for carrying out one or more than one function. For example, the heart is an organ which is made up of strong muscular tissue. Similarly, the kidneys are made up of several nephrons which is a type of tissue. The stomach is the organ responsible for digestion. It is made up of muscle, nervous, and blood tissues.

6. **Heart:** The heart pumps blood to all parts of the body.
- **Lungs:** We breathe in oxygen and breathe out carbon dioxide through the lungs
 - **Liver:** The liver plays an important part in all metabolic process in the body.
 - **Leaves:** leaves have chlorophyll which is important for photosynthesis
 - **Flower:** it attracts insects and change into fruit.
7. **Root System:** The functions of the root system include fixing the plant firmly in the soil. The roots also absorb water and minerals from the soil and send them to other parts of the plant. In some plants roots also work as the storage organ of a plant because they store food in the form of carbohydrates for use when required. This type of special root appears like a bulb, for example, beetroot and turnip.
- Shoot System:** The shoot system grows upwards above the ground in the direction of the sunlight. It consists of stems and leaves and also the buds, flowers, fruits, and seeds. The vascular system in plants transports water and minerals to all parts of the plant and is also responsible for taking the prepared food from the leaves to all the parts of the plant.
8. i. Nervous
 ii. Kidneys
 iii. System
 iv. muscle tissue
 v. animal cell
9. The cells attach to each other to form a multicellular organism. In multicellular organisms different functions are performed by different types of cells. Most multicellular organisms are visible to the naked eye.

Unit 2

1. Refer to the Students' Book.
2. Eyes are important because if we cannot see it would be difficult to perform tasks.
- 3.

Part	Structure	Function
taste buds	sensory cells on the surface of the tongue	recognizes and delivers the tastes to the nerves
layer of fat	innermost layer; formed of the cells which deposit fats	stores food and keeps the body warm
iris	flat, coloured membrane behind the cornea, with capillaries	imparts colour to the eye: supplies blood to different parts of the eye
Retina	Rods are more responsive to low intensity light, cones are sensitive to coloured light.	rods are more responsive to low intensity light, cones are sensitive to coloured light.
middle ear	a hollow chamber filled with air; consists of three bones called ossicles. It links with the eardrum on one hand and to the buccal cavity through the eustachian tube on the other	keeps the air pressure equal on both sides of the eardrum to keep it stretched
epidermis	outermost layer consisting of dead skin cells	prevents the body from losing water; protects the body against infections
pupil	dark, circular opening in the centre of the iris	controls the entrance of light to the retina by contracting and expanding

4. Teacher supervision required.

Unit 3

1. Photo means light and synthesis means to make. Plant leaves are well suited to their work of photosynthesis due to their specialized internal structure. Their broad, flat shape provides a large surface area where sunlight can be absorbed for photosynthesis. The special cells are arranged in such a way that helps the leaves to make their food.

- i. **Light:** Light plays an important role. The more light plants receive, the faster the rate of photosynthesis. Plants grow faster in summer than any other season because the leaves get maximum sunlight, which help the plants to make more food for their growth.

Water: Water is another essential factor for faster photosynthesis. Too little water slows down the process of photosynthesis. A plant wilts if it does not receive a required amount of water. Too much water also results in wilting of a plant. Therefore, an appropriate amount of water is necessary for the proper growth of plants.

Temperature: An increased amount of heat slows down the process of photosynthesis. Similarly, lower temperature also slows down photosynthesis in plants. Therefore, temperature ranges between 30 degree centigrade and 40 degree centigrade are considered the best for the growth of plants. Sometimes plants continue the process of photosynthesis up to 40 degrees centigrade.

Carbon dioxide: Plant cells use carbon dioxide and energy from the Sun to make sugar. An increased amount of carbon dioxide, increases the rate of photosynthesis and growth in the plants.

2. Plants need food to live, grow, and stay healthy. They produce the food in their leaves. The process by which plants make the food in the presence of sunlight, carbon dioxide, and water is called photosynthesis. Photo means light and synthesis means to make. Plant leaves are well suited to their work of photosynthesis due to their specialized internal structure.
3. carbon dioxide + water + sunlight \longrightarrow glucose + oxygen
4. Glucose is made as a final product in photosynthesis which is used by plants for various purposes. The following are the major reasons for its production:
- It is used to provide energy for growth and other purposes.
 - Excess glucose is stored in different parts of a plant for later use.
 - It is used to repair the body of the plant if it is damaged.
5. In respiration, glucose breaks down into carbon dioxide and water in the presence of oxygen and releases energy. Plants also respire like animals. Plants respire all the time because their cells need energy to stay alive. Unlike animals, plants have no specialized organs for gas exchange. Each part of the plant, such as the leaves, stems, and roots, perform their own respiration.
6. glucose + oxygen \longrightarrow water + carbon dioxide + energy
7. The tube-like structures in the leaves are called vascular bundles. The tubes in the bundle that carry water and minerals from the roots to the leaves to make food are called xylem.

8. There are tiny holes on leaves, called stomata. The stomata in the lower surface of the leaves enable a speedy absorption of carbon dioxide for photosynthesis.
9. Teacher supervision required.

Unit 4

1.
 - i. The non-living parts of an environment are known as the abiotic components.
 - ii. The living parts of an environment are known as the biotic components.
 - iii. The relationships between living organisms and their environment make up an ecosystem.
 - iv. Scientists who study the ways in which living organisms depend on non-living things like soil, water, sunlight, and air are called ecologists.

2.

Rainforest	Desert
A rainforest receives a large amount of rainfall.	A desert receives very little rainfall.
The temperature ranges from hot to moderate.	Daytime is usually hotter than the night time.
Due to large tall trees, less sunlight reaches the ground.	A desert is a dry hot place because it receives maximum sunlight.
There is a lot of surface water.	There is no surface water.
The air in a rainforest is very humid due to the heavy rainfall.	The air in a desert is dry.

3. **Mutualism:** In this type of relationship the two organism benefits from each other. One example of mutualism is the relationship between a honey bee reproduction and the nectar-producing plants.

Parasitism: In this type of relationship one organism benefits and the other is harmed. The partner which benefits from this relationship is called a parasite and the one which provides nutrients and shelter to the parasite is called the host. Some parasitic plants like mushrooms get food from plants. Some plants, like the Pitcher plant and Venus fly-trap, even catch flying insects and ants for food.

Predation: it is a type of interaction in which one organism kills and eats another. The organism that kills another organism for its food is known as the predator and the organism that is killed for this purpose is called the prey. For example, a lion kills a fox for food. In this case the lion is the predator and the fox is the prey.

4. The abiotic factors are very important because they tell us which types of plants and animals can be found in a particular ecosystem. It is important to understand the

role these factors play in an ecosystem. Some of the abiotic factors are water, air, soil, and temperature.

5. A cactus plant has the ability to store water. It has long roots that go deep down to suck up water and needle-like leaves in order to avoid loss of water by evaporation.
6. All animals depend directly or indirectly on plants for their food. Herbivores such as goats, sheep, rabbits, cows, and elephants are called primary consumers because they eat only plants. Plants also depend on animals for dispersal of seeds etc.

Unit 5

1.
 - i. An element is a substance that cannot be split into simpler substances. A matter that is made up of only one type of atom is called an element. Elements can be divided into two groups, metals and non-metals. Copper iron, silver, magnesium and zinc are metals. The non-metals include hydrogen, helium, carbon, nitrogen, sulphur and chlorine.
 - ii. Atom is the smallest particle of an element.
 - iii. Calcium is the main constituent of the bones and teeth of animals.
 - iv. Iron is a major constituent of haemoglobin in the red blood cells of animals. Potassium and Magnesium are necessary for muscle contraction in animals. Iodine is important for proper functioning of the thyroid gland. Nitrogen, Sulphur, and Phosphorus are important constituents of proteins. Carbon, Hydrogen, and Oxygen are important constituents of fats and carbohydrates.
 - v. For the sake of simplicity, the names of elements are written in a special way so that it is easy to record and identify them. These are called symbols.
2. Carbon is an element, it is solid and combustible, while carbon dioxide is a compound, made up of carbon and oxygen and helps put out fires.
3.
 - i.

Metals	Non-metals
hard and strong	soft and brittle
bright and shiny, metal reflects light	dull in appearance
good conductors of heat and electricity	poor conductors of heat and electricity

ii.

Compound	Mixture
chemical combination of two or more elements	physical blend of two or more elements
constituents lose their own properties	constituents retain their specific properties
constituents are in a fixed ratio	constituents are in a fixed ratio

iii.

Elements	Compound
made up of same type of atoms	chemical combination of two or more elements
symbols are used to represent	formulae are used to represent
cannot be further change into simpler substance.	can be changed into element

4. Element

i. Compound

ii. Hydrogen and oxygen

iii. Sulphur, oxygen

iv. Ne

5. False

i. True

ii. False

iii. True

iv. False

6. Molecule of a compound D

i. Molecule of an element A

ii. Atoms of an element B

iii. Mixture of elements C

7. i. I iodine

ii. Fe iron

iii. Co cobolt

iv. Na sodium

8. nitrogen N
 - i. sulphur S
 - ii. magnesium Mg
 - iii. aluminium Al
9.
 - i. sodium chloride sodium and chlorine
 - ii. water hydrogen and oxygen
 - iii. carbon dioxide carbon and oxygen
10.
 - i. Breakfast cereal and milk is a mixture.
 - ii. Vinegar is a mixture of water and acetic acid.
 - iii. Pizza and cake mix are mixtures.
 - iv. Wood is a very complicated mixture of many kinds of compounds.
 - v. Concrete is a mixture of sand, cement, gravel or crushed rock, and water. These are compounds or mixtures of compounds
11. Filter the mixture through a filter paper. Water will pass through the filter paper while the sand will not pass.

Unit 6

1.
 - i. There is a layer of air around the Earth called the atmosphere. This layer of air filters the rays of the Sun, protecting the Earth from intense heat and harmful rays. Air is also essential for living things.
 - ii. nitrogen 78%, oxygen 21% carbon dioxide, rare gases, and water vapour 1%
 - iii. We cannot see air but we can feel it. Moving air is called wind. Wind is pressing on our body from all directions and applying a force called air pressure. A machine that is used to measure air pressure is called a barometer. Our bodies also exert a force that is equal to atmospheric pressure. That is why we do not feel atmospheric pressure on our bodies.
 - iv. A flame needs oxygen to burn. Wood, coal, and paper all contain an element called carbon. When any carbon-containing substance is burnt, oxygen in the air combines with carbon to produce carbon dioxide gas, heat, and light.
 - v. methane + oxygen carbon dioxide + water + energy (heat)
 - vi. Air contains oxygen which helps in burning.

2.

Gas	Uses
nitrogen	liquid nitrogen is so cold that it freezes food immediately.
oxygen	does not burn, but helps other substances to burn.
carbon dioxide	does not burn, and puts out things which are burning
argon	does not burn or allow other things to burn in it.

3. false

- i. false
- ii. true
- iii. false
- iv. true
- v. true
- vi. true
- vii. true

- 4.
- i. barometer
 - ii. atmospheric pressure
 - iii. oxygen
 - iv. oxygen
 - v. oxygen, carbon dioxide

Unit 7

1.
 - i. A solution is a homogenous mixture. This means that that the colour, physical and chemical properties are same throughout the solution.
 - ii. Add salt to water, stir it well. The salt is the solute and it dissolves in water. Water is the solvent and together they form salt solution.
 - iii. The amount of solute dissolved depends on the temperature of the solvent. All solvents dissolve a fixed amount of solute at a certain temperature. If you increase the temperature, the amount of solute that can be dissolved also increases.
 - iv. The quantity of solute in a saturated solution is considered the solubility of that solute. In scientific terms, the quantity of a solute (in grams) dissolved in 100 grams of a solvent at 25°C is the solubility of that solute.
2. A substance is said to be soluble if it dissolves completely in a solvent. A substance is said to be insoluble if it does not dissolve in a solvent

- i. A solution is a homogenous mixture. This means that the colour, physical and chemical properties are same throughout the solution. A suspension is a heterogeneous mixture with large particles. This means that the colour and physical and chemical properties are not the same throughout the suspension.
- ii. A solution that cannot dissolve more of the solute at a particular temperature is said to be a saturated solution at that temperature. An unsaturated solution is a solution which contains less of solute than is required to saturate it at that temperature.
- iii. A solution with less solute is called dilute, while a solution with more solute is known as a concentrated solution.

Unit 8

1. Potential energy
2. Water will change into vapours because particles will get energised by heat of the Sun.
3.
 - i. False
 - ii. True
 - iii. False
 - iv. True
 - v. False
4. Refer to the Students' Book.
5. Refer to the Students' Book.
6. The Sun or Solar Energy, Running Water or Hydroelectric Energy, Wind Energy. Refer to the Students' Book.

Unit 9

1. Refer to the Students' Book.
2. Movable pulley
3. Fixed pulley is used in wells and flag poles, in a well the bucketful of water is raised when the rope is pulled downwards
4. There are two types of pulley:
Fixed Pulley: In this type of pulley, the grooved wheel is fixed to a rigid surface like a ceiling or wall. In this system, a fixed pulley is used. The load of 100 N is attached to the rope. The pulley is used to redirect the force. Therefore the same amount of effort is required to lift the load.
Moveable Pulley: In this type of pulley, the grooved wheel is moved along with the rope. One end of the rope is fixed and the other end is free or connected to the other

equipment. This type of pulley is very common in industries and is used for loading and unloading ships, etc. The moveable pulley moves itself while lifting loads.

5. Gears are toothed wheels which transmit power from one part to another. Each gear fits with another to pass on the motion of the machine. They are useful for changing the direction and speed of movement.
6. Refer to the Students' Book.

Unit 10

1. Reflection: Light bounces back when it falls on a shiny material.

Transmission: Light passes through transparent material.

- i. The laws of reflection:

There are two laws of reflection

1. The angle of incidence is equal to the angle of reflection. $\angle i = \angle r$
 2. The incident ray, reflected ray, and the normal all lie in the same plane
- ii. a. A concave mirror: In this mirror the reflecting surface is the inner part of the curve; the outer part is polished.
 - b. A convex mirror: In this mirror the reflecting surface is the outer part of the curve, the inner part is polished

- iii. Uses of curved mirrors:

Uses of concave mirror: These are used in the microscope and telescope. It is used to focus light rays. Concave mirrors are used as shaving mirrors or makeup mirrors. When the mirror held close to the face, a magnified image can be seen.

Uses of convex mirror: They are used in cars as side view and rear view mirrors. They are used in driveways, roads, and alleys to provide safety to the drivers at curves and turn where there is a lack of visibility. They are also used in medical instruments, for example, dentists' mirrors.

2. Refer to the Students' Book.
3. Refer to the Students' Book.
4. Refer to the Students' Book.

Unit 11

1. Teacher supervision required.
2. Refer to the Students' Book.
3. Sound is kinetic energy which is energy of motion.
 - i. If you drop a metal spoon and a wooden spoon from the same height of 1m, each will produce a different sound. Both materials are solids but they sound

different. Why is this so? Sound travels in metals at a high speed because the molecules of metal are more tightly packed than in wood. Metals are denser than wood, therefore the sound they produce is different from the sound produced by wood.

- ii. Metal, wood, plastic,
 - iii. The pinna collects the sound wave and passes it through the ear canal. The sound wave reaches the eardrum and makes it vibrate. The louder the sound, the faster the eardrum will vibrate. These vibrations are passed on to the middle ear. The middle ear has three tiny bones called ossicles.
4. Echo sound you hear when the sound wave reflects off a distant object. The sound wave travels through matter in a straight line. When the wave hits a different material, some of it is reflected, absorbed and transmitted through the material. When sound waves travelling in the air hit a hard surface, it is reflected back after a short while.
 5. Beyond that layer of air, there is a vacuum. The Sun and stars are in this vacuum. Sound always needs a medium—solid, liquid, or gas—in order to travel. This is why we cannot hear explosions that take place in space. Even astronauts who go into space cannot hear each other. They have to use radio signals in order to communicate.

Unit 12

1. The Moon is a natural satellite of the Earth. The Earth and other planets are natural satellites of the Sun.

The man-made satellites are known as artificial satellites.

2. False
 - i. False
 - ii. True
 - iii. True
 - iv. False
3. Refer to the Students' Book.
4. Weather Satellite: These satellites are used to monitor weather conditions. Some satellites can even detect volcanic eruptions and hurricanes.

Navigation Satellite: This satellite is used to locate the position of an object on the Earth. The GPS (Global Positioning System) is an example of a navigation satellite.

Communication Satellite: This satellite is used for sending and receiving messages from the Earth. Radio, television, telecommunications, and internet services use them for communication. Today video conferences are possible because of the communication satellites.

5. In 1705 the English astronomer Edmond Halley suggested that the same comet kept returning to the Earth approximately every 75 years. He predicted that the comet would be seen in 1758. He was not alive to see it but his prediction was correct. Halley's Comet is a big chunk of rock and ice. The orbit of this comet is elliptical.
6. This satellite is used to locate the position of an object on the Earth. The GPS (Global Positioning System) is an example of a navigation satellite. It helps you to figure out the exact location.

انعکاس شدہ شعاعوں کو آئینے کی سطح کے پیچھے تصوراتی طور پر بڑھانے (projection) کا عمل ہے۔ دوسری طرف حقیقی شبیہ اس وقت بنتی ہے جب روشنی کی شعاعیں طبعی طور پر ایک دوسرے سے ملتی ہیں۔

باب 11

☆ بیان کیجیے کہ ایک نقطے سے دوسرے نقطے تک توانائی کی منتقلی کے لیے موج یا لہر (wave) سے کام لیا جاتا ہے۔ موج یا لہر ارتعاشات (vibrations) کے نتیجے میں وجود میں آتی ہے۔ مادے (میٹیریل) کے مالیکول لہر کی اس (مادے) میں سے گزرنے یا سفر کرنے میں معاونت کرتے ہیں۔

☆ ٹھوس، مائع اور گیس کے تین میٹیریل لے لیجیے۔ ارتعاش پیدا کرنے کے لیے انہیں ضرب لگائیے اور عملی مظاہرے کے ذریعے ان مادوں سے خارج ہونے والی آوازوں کے درمیان فرق بیان کیجیے۔

باب 12

سبق کا آغاز دُم دار ستارے (comet)، سیارچے (asteroid) اور شہاب ثاقب (meteor) کی ساخت بیان کرتے ہوئے کیجیے۔ مختلف جسامت (سائز) کے پتھروں کی مدد سے فرق واضح کیجیے۔

بحث کیجیے کہ ٹوٹا ہوا تارا (شہاب ثاقب) کیا ہوتا ہے اور یہ چمکتا کیوں ہے۔

سطح ارض سے زمین کے زیریں مدار (Low earth orbit) (LEO)، زمین کے وسطی مدار (Medium earth orbit) (MEO) اور جیوا سٹیشنری مدار (Geostationary orbit) (GEO) کا فاصلہ ظاہر کرنے کے لیے ایک پوسٹری تیار کیجیے۔

(heterogeneous) آمیزے کا تصور بیان کیجیے۔

روزمرہ زندگی میں محلول اور تعلیق (suspension) کے استعمالات بیان کیجیے۔

لون نگاری (chromatography)، قلماء (crystallisation)، اور عمل کشید کی تکنیک کا عملی مظاہرہ کیجیے۔

چمکی چمکی کا پرسلفیٹ رنمک 100 ملی لیٹر پانی سے بھرے ہوئے کنٹینر میں ڈالیے یہاں تک کہ حل پذیری (dissolving) کا عمل رُک جائے۔ پھر درجہ حرارت کے حل پذیری پر اثرات کا عملی مظاہرہ کرنے کے لیے پانی کو گرم کیجیے اور اس میں کچھ مزید کا پر سلفیٹ حل کیجیے۔

باب 8

توانائی کی تبدیلی (transformation) ظاہر کرنے کے لیے کلاس میں چابی سے چلنے والا کھلونا لے کر آئیے۔ طلباء پر واضح کیجیے جب وہ چابی بھرتے ہیں تو کھلونے کے اسپرنگ میں محفوظ مخفی توانائی (potential energy)، حرکی توانائی (kinetic energy) میں بدل جاتی ہے۔

توانائی کی مختلف اقسام کو بیان کرنے کے لیے سبق میں دی گئی سرگرمیاں انجام دیجیے۔

باب 9

مشین کے بنیادی مقاصد بیان کرتے ہوئے شروع کیجیے کہ یہ کیا ہے اور اس کا استعمال کیوں کیا جاتا ہے۔ طلباء کو بتائیے کہ مشین کوئی بھی شے ہو سکتی ہے جو کام کو آسان بنائے، حتیٰ کہ فُٹا (ruler) بھی ایک مشین ہے۔

طلباء کو گروپوں میں تقسیم کر دیجیے اور ان سے کہیے کہ اسکول میں وہ جن مشینوں کو پہچان سکتے ہیں ان کے نام لکھیں۔ بیان کیجیے کہ تمام پیچیدہ مشینیں ان سادہ مشینوں سے مل کر بنتی ہیں۔ ان مشین کا مختصر تذکرہ کیجیے جس کے بارے میں وہ پہلے پڑھ چکے ہیں۔

بائیکل ایک پیچیدہ مشین ہے جو متعدد سادہ مشینوں سے مل کر بنتی ہے۔

طلباء سے کہیے کہ بائیکل میں سادہ مشینوں کی شناخت کریں۔

بائیکل کے مختلف حصوں پر گفتگو کے بعد بائیکل کی کارکردگی میں گیرز (gears) کی اہمیت بیان کیجیے۔

باب 10

آئینہ، شیشہ اور لکڑی کا ایک ٹکڑا کلاس میں لے کر آئیے اور ٹارچ کی مدد سے دکھائیے کہ انعکاس (reflection)، انجذاب (absorption) اور ترسیل (transmission) کیا ہوتا ہے۔ طلباء کو بتائیے کہ جب روشنی کسی غیر شفاف مادے یا میٹریل کی سطح سے ٹکراتی ہے تو روشنی کی توانائی حرارتی توانائی میں تبدیل ہو جاتی ہے، کیوں کہ یہ توانائی مادے یا میٹریل میں جذب ہو جاتی ہے۔

ورچوئل (Virtual) کے معنی ہیں ”طبعی یا مادی لحاظ سے موجود نہ ہونا مگر موجود ہوتے ہوئے نظر آنا“ ہے۔ ورچوئل یا فرضی شبیہیں (images) اس وقت تشکیل نہیں پاتیں جب شعاعیں منعکس ہونے کے بعد ایک دوسرے سے مادی طور پر ٹکراتی ہیں بلکہ یہ

(mineral water) ایک آمیزہ ہے۔
بیان کیجیے کہ مرکبات کے نام کیسے رکھے جاتے ہیں اور ان کے فارمولے ہوتے ہیں۔

باب 6

افتتاحی یا شروعاتی سرگرمی کے طور پر طلباء سے کہیے کہ اپنے اردگرد پر توجہ دیتے ہوئے فضا (atmosphere) کا بہ غور مشاہدہ کریں اور بحث کریں کہ فضا صاف ہے یا آلودہ؟
طلباء کو بتائیے کہ فضا (کرہ ہوائی) گیسوں کے آمیزے سے بنتی ہے۔ فضا یا کرہ ہوائی ہوا پر مشتمل ہے اور اس نے ہماری زمین کو چاروں طرف سے گھیر رکھا ہے۔

فضا یا کرہ ہوائی بے حد اہم ہے کیوں کہ یہ گیسوں پر مشتمل ہے جو پودوں اور جانوروں کی بقا کے لیے انتہائی اہم ہیں۔ آکسیجن سانس لینے اور کاربن ڈائی آکسائیڈ ضیائی تالیف (photosynthesis) کے لیے ناگزیر ہے۔
طلباء کو اسکول کے مختلف حصوں میں لے کر جائیے اور واضح کیجیے کہ صاف ہوا کیوں ضروری ہے۔
طلباء کو تحریک (motivate) دی جائے کہ وہ ماحول کا خیال رکھیں۔ اسکول میں آگاہی مہم (awareness campaign) شروع کرنے کے سلسلے میں بھی ان کی رہنمائی کی جاسکتی ہے۔ طلباء کے بنائے گئے پوسٹر اسکول کے احاطے اور کلاس رومز میں لگائے جاسکتے ہیں۔

اوزون کے تصور کا عملی مظاہرہ کرنے کے لیے کلاس میں روم میں ایک گیند لے کر آئیے اور اسے کپڑے کے ٹکڑے سے ڈھک دیجیے۔ ہمارے لیے اوزون کی تہہ (ozone layer) کا تحفظ کرنا ضروری ہے جو زمین کو نقصان دہ تاب کاری (radiations) سے بچاتی ہے۔

اوزون کی تہہ کے گھٹ جانے یا سکڑ جانے کے خطرناک اثرات پر بحث کیجیے۔ بیان کیجیے کہ یہ اوزون کی تہہ کا گھٹ جانا عالمی حدت (global warming) کا باعث بن رہا ہے اور اس کے مختلف جان دار انواع پر اثرات مرتب ہو سکتے ہیں۔ خاص طور پر ساحلی علاقوں کے قریب پائی جانے والی انواع متاثر ہو سکتی ہیں۔ ڈوڈو (Dodo) اور تسمانیہ کے شیر (Tasmanian Tiger) کی تصویریں دکھائیے جو صفحہ ہستی سے معدوم (extinct) ہو چکے ہیں۔ قطبی ریچھ کی تصویر دکھائیے اور بیان کیجیے کہ اگر گلوبل وارمنگ بڑھی تو یہ بھی اپنے مسکن (habitat) سے محروم ہو سکتے ہیں۔

باب 7

افتتاحی یا ابتدائی سرگرمی کے طور پر ایک کپ چائے میں چینی ملائیے اور پھر منحل (solute)، محل (solvent) اور محلول (solution) کی اصطلاح متعارف کروائیے۔
پریکٹیکل ماڈل کے ذریعے محلول کی تشکیل بیان کیجیے۔

پانی سے بھرے گلاس میں پہلے 1 چمچ نمک اور پھر 5 چمچ نمک ملائیے اور پتلے اور گاڑھے محلول کے درمیان فرق کیجیے۔
طلباء کو دکھائیے کہ نمک کا محلول شفاف اور دودھ غیر شفاف ہے، پھر ہم جنس (homogeneous) اور غیر ہم جنس

باب 3

طلبا سے کہیے وہ بتائیں کہ جان دار اجسام کو زندہ رہنے کے لیے کس کی ضرورت ہوتی ہے۔ پھر خاص طور سے پوچھیے کہ ان کے خیال میں پودوں کو زندہ رہنے کے لیے کس کی ضرورت ہوتی ہے؟

طلبا سے کہیے کہ ضیائی تالیف (Photosynthesis) کی word equation تحریر کریں اور بیان کیجیے کہ ضیائی تالیف کی پہلی پیداوار یا پروڈکٹ گلوکوز ہوتی ہے۔

طلبا کو سبز پتے لے کر آنے کی ہدایت کر دیجیے اور سرگرمی 3 اور 4 کروائیے۔ طلبا سے کہا جا سکتا ہے کہ ضیائی تالیف (Photosynthesis) اور عمل (Respiration) کے باہمی فرق پر پریزنٹیشن تیار کریں۔

باب 4

حیاتی (biotic) اور غیر حیاتی (abiotic) عوامل کے درمیان فرق بیان کرنے کے لیے سبق سرگرمی 1 اور 2 سے شروع کیجیے۔ پھر ماحول کے اجزا: حیاتی (biotic) اور غیر حیاتی (abiotic) اجزا متعارف کروائیے۔

زیر آب اور خشکی کے ماحول کی تصاویر دکھائیے اور ماحولیات (ecology) کے تصور پر بحث کیجیے۔

مختلف قسم کے ماحول کی ماحولیات (ecology) دکھا کر متعدد نامیوں یا جاندار اجسام (organisms) کے ایک دوسرے پر انحصار کو سمجھنے میں طلبا کی مدد کیجیے۔

صحرا اور بارانی جنگل (rain forest) کی طبعی خصوصیات پر تحقیق کرنے کے لیے طلبا کو لائبریری میں موجود کچھ کتابیں تجویز کر دیجیے۔ تحقیق میں بالترتیب صحرا اور بارانی جنگلات کے جانور اور پودے بھی شامل ہونے چاہئیں۔

باہمت یا باہمی تعاون (mutualism)، شکار خوری (predation)، اور طفیلیت (parasitism) کا تصور واضح کرنے کے لیے طلبا سے کہا جائے گا کہ نامیاتی یا جان دار اجسام (organisms) کے درمیان تعلق کی مزید مثالوں پر غور کریں۔

باب 5

مختلف رنگوں یا play dough کی ایٹمی ماڈلنگ کٹ / بالز کی مدد سے ایٹم کی اصطلاح متعارف کروائیے اور مادے کی دریافت کی تفصیلات بیان کیجیے۔

کلاس میں دوری جدول (periodic table) دکھا کر عناصر (elements)، علامات (symbols)، دھاتوں (metals) اور غیر دھاتوں (non-metals) کی ترتیب ظاہر کیجیے۔

کلاس میں کچھ مادے یا میٹریل جیسے تانبے کی تار، لوہے کی کیل، کھانے کا نمک، دواؤں کے ڈبے لے کر آئیے اور طلبا سے کہیے کہ روزمرہ زندگی میں عناصر کے استعمال پر اظہار خیال کریں۔

ہائیڈروجن اور آکسیجن جیسے عناصر کے کارڈ دکھا کر عنصر، مرکب (compound) اور آمیزے (mixture) کے درمیان فرق کا واضح تصور بیان کیجیے، پانی ایک مرکب اور نلکے کا پانی ایک آمیزہ ہے۔

روزمرہ زندگی میں مرکبات اور آمیزوں کے استعمال پر بحث کیجیے۔ کھانے کا نمک ایک مرکب اور معدنیات سے بھرپور پانی

باب 1

بورڈ پر حیوانی اور نباتاتی خلیوں (plant and animal cells) کی اشکال بنائیے اور طلبا کو باری باری بلا کر ان کے مختلف حصوں کے نام لکھوائیے۔

مختلف رنگوں کے play dough سے حیوانی اور نباتاتی خلیوں کے مختلف حصے بنائیے۔

ایک خردبین (microscope) کے ذریعے جانور اور پودے کے مختلف حصوں کا مشاہدہ کرنے کے لیے ان کی سلائیڈز کا انتظام کیجیے۔

طلبا کا ایک گروپ منتخب کر لیجیے۔ اس بات کو یقینی بنائیے کہ ہر گروپ کے اراکین کی تعداد مساوی ہو جیسا کہ نباتاتی اور حیوانی خلیوں میں ہوتی ہے۔

ایک گروپ حیوانی خلیہ اور دوسرا گروپ نباتاتی خلیہ ہو سکتا ہے۔ ہر رکن کو ایک کردار تفویض کیا جائے گا: طالب علم A مرکزہ (nucleus) ہے لہذا وہ خلیے میں اپنا نفع یا کام اور ساخت بیان کرے گا رکن کے لیے۔ اسی طرح یہ سرگرمی جاری رہے گی جب تک کہ ہر رکن اپنا کردار بیان نہ کر دے۔

مختلف اقسام کی بافتوں (tissues) کو بیان کرنے کے لیے بھی یہی سرگرمی اپنائی جاسکتی ہے۔

چار طلبا کا گروپ بنا دیجیے۔ ان چار طلبا میں سے ایک ٹور گائیڈ (tour guide) اور باقی بالترتیب دل، جگر، اور پھیپھڑے بنیں گے۔ طلبا کی مدد کیجیے کہ وہ دل، جگر اور پھیپھڑے کے cut-outs بنائیں اور انھیں کمر کے گرد پہن کر اس عضو کی نمائندگی کریں۔

ٹور گائیڈ اس طرح آغاز کر سکتا ہے: ”ہیلو!!! میں آپ کا ٹور گائیڈ ہوں اور آج میں بڑے اعضا سے ملاقات کرانے کے لیے آپ کو انسانی جسم کے اندر لے جا رہا ہوں۔“

جب ٹور گائیڈ دل کے پاس پہنچے تو جس طالب علم نے دل کا کٹ آؤٹ پہنا ہوا ہے وہ اپنا نفع یا کام بیان کرے گا۔

اسی طرح ٹور گائیڈ جگر اور پھیپھڑے کا تعارف کرائے گا۔ تعارف کے بعد جن طلبا نے پھیپھڑے اور جگر کا کٹ آؤٹ پہنا ہوا ہے وہ انسانی جسم میں اپنے نفع کے بارے میں بیان کریں گے۔

باب 2

سرگرمی 1 گروپ کی سرگرمی کے طور پر انجام دی جاسکتی ہے۔ طلبا سے کہیے کہ جوڑیاں (pairs) بنالیں۔ طلبا یہ جاننے کے لیے ایک مقابلے کا انعقاد کر سکتے ہیں کہ ان میں سے کس کے کان سب سے زیادہ حساس (sensitive) ہیں۔

سرگرمی 4 میں یہ ریکارڈ رکھیے کہ طلبا کتنی بار خوراک کا درست نام بتانے میں کامیاب رہے، جب کہ انھیں خوراک کو دیکھنے یا سونگھنے کا موقع نہیں دیا گیا تھا۔

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 رد عمل

☆ تعمیر/تخلیقی رد عمل

☆ کارکردگی کی جانچ

☆ ذاتی ابلاغ (personal communication)

☆ طلبا کی خود تشخیصی (self-assessment)

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

رہنمائے اساتذہ کے مشتملات اور ترتیب

رہنمائے اساتذہ برائے نیوگیٹ ایڈ 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 و محور سابقہ یا پہلے سے موجود معلومات کو کھگانا ہے جس میں طلبا کی سرگرم شرکت کی حوصلہ افزائی کی جاتی ہے۔

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

5 منٹ	سابقہ / پہلے سے موجود معلومات کو کھگانا بذریعہ بنیادی سوالات
25 منٹ	آموزش (learning) بذریعہ بحث / سرگرمی
10 منٹ	نتیجہ / حاصل بذریعہ جانچ

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

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

- تحقیق و تفتیش (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 مفصل ہدایات کے لیے قومی نصاب برائے جنرل سائنس 2006 کا باب 7، صفحہ 55 تا 64 ملاحظہ کیجیے۔

نیوگیٹ اہیڈ سائنس سیریز کے لیے تیار کردہ رہنمائے اساتذہ کمرہ جماعت میں استاد کی معاونت کے لیے ہدایات فراہم کرتی ہیں۔
اس رہنمائے اساتذہ میں شامل ہے:

- کمرہ جماعت میں نیوگیٹ 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

نیوگیٹ اہیڈ سائنس کی تدریس کیسے کی جائے

نیوگیٹ اہیڈ سائنس کی مزید تعمیری انداز میں تدریس کے لیے اساتذہ کو مشورہ دیا جاتا ہے کہ طالب علم کو کمرہ جماعت کا محور بنائے۔ طلبا کو کمرہ 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 انہیں 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 انہیں آسانیاں فراہم کیجئے تاکہ وہ زیادہ ذمے داری کے ساتھ اپنا سفرِ آموزش (learning journeys) طے کر سکیں۔ مندرجہ ذیل سطور میں ان تدریسی طریقوں کا خلاصہ کیا گیا ہے جن سے کام لیتے ہوئے کمرہ جماعت کو زیادہ سے زیادہ طالب علم محور بنانے کے لیے نیوگیٹ 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 ر ذمے داریاں تفویض کی جائیں جنہیں انجام دیتے ہوئے وہ آپس میں، اور استاد کے ساتھ تبادلہ خیال کر سکیں۔ 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 کمرہ 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 انہیں رہنمائی کی ضرورت ہو؛ پڑھتے، لکھتے اور مخصوص ابواب میں اسباق پر بحث کرتے ہوئے بیشتر وقت طلبا اپنے طور پر کام کریں گے۔