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# Teaching Guide

Revised Edition

# Amazing Science

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# Contents





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# Introduction

Science and technology have assumed great importance in the world today. Not only has science changed our life, it has also influenced our thinking. We have used scientific knowledge to raise our standard of living and develop a better relationship with nature.

The study of science develops a spirit of enquiry that enables the scientist to understand the interrelationships that exist in nature. A student of science develops the habit of observing carefully, and collecting data accurately so that scientific phenomena can be seen in their true perspective. This habit not only develops a scientific attitude but also inculcates critical thinking that helps in drawing conclusive results from observations. Thus it enables a student of science to better understand and appreciate the environment as a whole.

The subject of science has always been considered a learning subject at the school level and the student has to go through a rigorous exercise of learning it by heart in order to pass examinations. In reality, science is not a subject to be memorized; it has to be given serious thought and this makes it a difficult subject. But if science is taught in such a manner that students understand its true meaning and develop a scientific approach towards understanding scientific phenomena, its study becomes meaningful as well as interesting.

A teacher can play a very important role in arousing the interest of students by allowing them to discuss facts and ideas and helping them to draw conclusions from them as to why and how things happen.

The teacher can stimulate the thinking process of students by asking questions and also by encouraging them to ask questions. Experimental work enables students to test for themselves the facts that have been learnt by them, thereby making it easier for them to understand the implications of the background to their activities.

This course has been developed to provide information about the world around on which students can base their opinion, verify information, come to conclusions, and use the knowledge thus gained in their everyday life. It will help in maintaining the curiosity and enthusiasm of students who have just started studying science. Concepts developed at this stage will be of use in their studies at an advanced level later. It will help them to develop a better outlook of life. In order to control the learning process the teacher not only encourages and advises but also critically evaluates the work of the students.

## About the Pupil's Book:

This science series has been written especially for children both at the primary and secondary levels. It provides information at a child's level of understanding and has a direct appeal for children who need interesting and easy to read material.

Keeping in view the interests, abilities, curiosities, and needs of children, it provides stimulating learning experience and offers enjoyable educational motivation, thus serving as a building block for further learning.

The keyword in science is curiosity. The material in the series is designed to awaken in a child the same urge that motivates a scientist; the desire to know the answer to a question. There is a wide range of topics that will interest and motivate the child.

Teachers will recognize that it deals with those broad areas about which most children frequently express curiosity; that it provides answers to many questions they ask, offering new and exciting information on many fields. It aims to create an awareness, as well as stimulate an interest in science.

The language is simple and easy to read and within the grasp of the students' abilities of each grade. Together, the text and illustrations motivate children to discuss, question, and explore.

The contents have been selected and are presented in such a way as to capture and hold the interest of the students. The objective is to simplify complex ideas and present them in an interesting way. Every effort has been made to keep the language simple.

When it is necessary to use a specialized word, it has been gently introduced into the text. When it is not self-explanatory within the context, it is defined. Clear and well-labelled illustrations have been included, which help to identify and clarify the topics dealt within.

Good pictures and diagrams arouse and develop interest. These make lasting impressions. They help to make the text clear. They also appeal to the child's imagination, while satisfying his/her curiosity and often provoke a favourable reaction.

Simple practicals—interesting and stimulating presentation of factual materials—offer every chance of successful learning experiences. Knowledge of problem-solving techniques so acquired can be applied in everyday life.

It is intended, through this series, to introduce children to many of the interesting and enjoyable things they can learn about and do for themselves. Also to develop in them the quest for knowledge and understanding of how science is shaping the world in which they live.

## Syllabus break-up:

The textbook has been divided into four parts, namely biology, chemistry, physics, and the Earth and universe. Each chapter of the Teaching Guide pertains to the topics discussed in the textbook. This makes the work of the teacher easier.

In most schools the school year is roughly divided into three terms, i.e. Spring, Summer, and Winter. It is up to the teacher to select the topics to be taught in each term, but this selection should be well-balanced as sometimes a teacher would prefer to teach the topics that are easier or are better liked by him or her than others. For instance, a biology teacher would prefer to teach biology first and neglect the other parts.

To overcome these problems, each part of the textbook has been written in such a way that each topic is self-explanatory and the answers to the questions at the end of each chapter can be readily found in the text. Definitions and all aspects of each topic have been highlighted for quick reference, and simple experiments have been given wherever possible to make the concepts clear as well as make learning interesting and easy.

## The role of the teacher:

It is up to the teacher to devise means and ways of reaching out to the students, so that they have a thorough knowledge of the subject without getting bored.

The teacher must use his/her own discretion in teaching a topic in a way that he/she finds appropriate, depending on the intelligence level as well as the academic standard of the class.

## To the teacher:

With your assurance and guidance the child can sharpen his skills.

Encourage the child to share his experiences. Try to relate to real things. Do not rush the reading. Allow time to respond to questions and to discuss pictures or particular passages. It will enhance learning opportunities and will enable the child to interpret and explain things in his/her own way.

## Preparation by the teacher:

Be well-prepared before coming to class.

i) Read the lesson.
ii) Prepare a chart if necessary.
iii) Practise diagrams which have to be drawn on the board.
iv) Collect all material relevant to the topic.
v) Prepare short questions.
vi) Prepare homework, tests, and assignments.
vii) Prepare a practical demonstration.

The following may also be arranged from time to time.

i) Field trips
ii) Visits to the laboratory
iii) A show of slides or films
iv) Plan projects

## Method of teaching:

The following method can be employed in order to make the lesson interesting as well as informative.

The basic steps in teaching any science subject are:

i) locating the problem
ii) finding a solution by observation and experimentation
iii) evaluating the results
iv) making a hypothesis and trying to explain it

The usual strategy which is easy as well as effective can be adopted:

i) Before starting a lesson, make a quick survey of the previous knowledge of the students by asking them questions pertaining to the topic, from everyday observation of their surroundings, or from things they have seen or read about in books, magazines, or newspapers.
ii) Explain the lesson.
iii) Write difficult words and scientific terms on the board.
iv) Ask students to repeat them.
v) Help students to read text.
vi) Show materials, models, or charts.
vii) Make diagrams on the board.

viii) Perform an experiment if necessary.
ix) Ask students to draw diagrams in their science manuals.
x) Students should tackle objective questions independently.
xi) Ask questions from the exercises.
xii) Answers to questions to be written for homework.
xiii) The lesson should be concluded with a review of the ideas and concepts that have been developed or with the work that has been accomplished or discussed.

## Starting the lesson:

Before starting a lesson, the teacher should make a quick survey of the previous knowledge of the students by asking some questions pertaining to the topic from their everyday observation.

It is not necessary that the class should begin with the reading of the textbook. The lesson should begin with the teacher telling an interesting incident or information that will keep the students interested and make them want to know more about the topic which has been introduced. Each topic of the lesson should be explained thoroughly and to check whether students are following, short questions should be asked in between the lecture.

Making a sketch or diagram on the board is a very important aspect of the study of science but too much time should not be spent on it or the students lose interest. An alternative to drawing on the board is a ready-made chart, or one made by the teacher, which can be hung in the classroom. The use of visual material is very effective as it keeps the students interested as well as helps them to build mental pictures which are learnt quickly and can be recalled whenever needed. Students, too, take interest in drawing diagrams and they should be helped by the teacher when diagrams are being made in class. If a diagram is not in the textbook then the students should either copy it from the board or a chart, or the teacher should photocopy it and distribute among the students.

## Practicals and experimental work:

The science laboratory of any school should be well-equipped for meeting the requirements of the practical work done at the school level. The science teacher may make suggestions and request for material and equipment to perform simple experiments.

Science students should be taken to the laboratory to see the laboratory in charge at work. They can also see the specimens of various plants and animals on display and be introduced to some scientific equipment, chemicals, and solutions.

Practical work arouses interest in the subject. Some experiments can be easily performed in class. Class activities can be organized in such a way that the whole class can participate in and benefit from them. Students can be asked to work in groups or in pairs, depending on the type of work that is to be done, or the amount of material that is available. Demonstrations by the teacher are unnecessary. A clear sequence of instructions related to the activity should be given and the students should be allowed to work independently, but the teacher, should be in direct and immediate control of everything. Teachers should also determine the pace of work.

If there is any difficulty or danger encountered at the start of an experiment, or during it, the teacher should be prepared to improvise, and provide an alternative method, or a different experiment giving the same results.

Most of the experimental work should be carried out by the students themselves, as it develops more interest and a sense of responsibility among the students. The basic method or technique should be thoroughly understood by the students before an experiment is performed. The students should be allowed to work independently under strict supervision. A record of the observations should be carefully made, preferably in tabular form. The conclusions or results should be thoroughly discussed in class before writing them down. Written work should be checked carefully and regular tests should be conducted. (Simple experiments have been given in each topic which will enable the teacher to plan and prepare them quickly and with ease.)

If the steps involved in the experiment and the precautions to be taken are explained clearly and thoroughly, the experiment can be successful and the students will develop a sense of achievement and confidence.

When the discussion of a topic has been completed, it should be summarized by the teacher along with the participation of the students by writing down all the important ideas and concepts that have developed from the text and the experimental work.

These guidelines for teachers will enable them to teach science effectively and develop in their students an interest in the subject which can be maintained throughout the academic year and possibly in their lives as a whole. These suggestions are not mandatory. They can only supplement and support the professional judgement of the teacher and in no way can they serve as a substitute for it.


# Structure of living organisms

## Teaching objectives:

- to explain the structure and functions of the vegetative parts of a plant
- to explain the structure and function of the reproductive parts of a plant
- to study the basic structure of the body of an animal
- to explain the importance, structure, and function of the skeleton
- to describe the structure and function of different types of skeletons
- to explain the importance, structure, and function of joints

## Teaching strategy:

## Structure of plants

Place a complete flowering plant, a grass plant, and an onion bulb on the table. Show the students the onion. Ask if it is a plant. Hold up the flowering plant and the grass plant and show them the various parts. **Ask**: What is the difference between the onion and the flowering plant?

Peel the onion, remove the fleshy leaves and show them the stem and the roots. Pluck the leaves off the stem of the flowering plant and show them the nodes and internodes and the axillary buds. Explain that the leaves, branches, and flowers grow at the nodes. Show the stem tip and explain that it is the growing point of the stem. Explain the structure of the stem and ask them to compare it to the grass stem. **Ask**: What are the functions of the stem? Explain the stem as the part of the plant that bears all other parts of the plant and is a means of transporting food and water. Thick fleshy stems can also store food.

Show the roots of three plants. **Ask**: What is the difference between them? Explain the different kinds of root systems. Draw the microscopic structure of a root on the board and explain the function of each part. Explain the functions of roots.

Show students different kinds of leaves. Give them a leaf each and ask them to examine it carefully. Teach them to make a leaf print by placing a tracing paper on the leaf and rubbing it. Draw a leaf on the board and label its parts. Ask students to label their leaf prints. **Ask**: What are the functions of leaves? Explain the importance of leaves for plants. Explain why some leaves are thick, hairy, or spiny. Ask students to bring flowers to the class. Encourage them to examine the flowers carefully. Draw a flower on the board and label it. Explain the structure and function of each part. Explain the importance of the flower as the reproductive part of the plant. Explain the difference in structure of various flowers.

Ask students to touch the centre of the flower. Explain what the yellow powder is. Draw a longitudinal section of a flower on the board. Label each part. Cut a longitudinal section of a flower and show the parts to the students with a hand lens. Ask students to dissect the flower with a forceps and stick each part with a pin in its correct place on a sheet of paper, and write the name of each part. Cut the cross section of the ovary of a flower and show the attachment of the ovules inside it.

## Structure of animals

Show a model of a butterfly or a cockroach and a vertebrate animal to the students. Ask them to point out the differences between them. Explain the division of the body into parts.

**Ask**: Why are most of the sense organs located in the head region? Explain the importance of the brain and the central nervous system in controlling the whole body. **Ask**: What is the function of the trunk? Explain the attachment of the limbs which help to bring about movement and also how all the organs and body systems are located in the trunk region.

Explain the skeleton as an outer covering for insects and as a bony structure in vertebrates. **Ask**: Does an earthworm have a skeleton? Explain the types of skeletons and their functions. Show the model of a human skeleton or a preserved specimen of a rabbit or frog to the students. Explain the general plan of the skeleton in all vertebrates. Show the various types of bones and joints. Explain how the skeleton can perform its various functions. Explain the formation of joints and the types of movements that they can carry out.

Summarize the lesson.

## Answers to Exercises in Unit 1

1. (a) The vegetative parts of a plant are stem, roots, and leaves. The reproductive parts of a plant are flowers.

   (b) The stem is the part of a plant which grows above the ground. It is usually erect and upright but some stems grow horizontally along the ground. Some stems are long, thin, and weak or they are thick and fleshy. Some stems grow underground and store food. Stems bear leaves, buds, flowers, and fruits. They also transport water from the roots to the leaves and prepared food from leaves to all parts of the plant.

   (c) The different kinds of roots are: tap roots, fibrous roots, adventitious roots.

   Some roots have one thick main root from which branch roots grow. Such roots, like carrots and radishes, are called tap roots.

   In some plants, like grass, many branched roots of the same size grow out at the same time. Such roots are called fibrous roots.

   Some roots, like the onion bulb, grow directly from the stem. These are called adventitious roots.

   (d) The leaf manufactures food for the plant. Stomata in the leaves help in gaseous exchange. Some thick and fleshy leaves store food.

   (e) The male reproductive part of the flower is called an androecium. It forms the third whorl. It is composed of stamens. Each stamen has a filament which is a thin stalk and an anther which is attached to the filament and contains four pollen sacs. The male sex cells are pollen grains which are produced inside the pollen sacs.

The female reproductive part of the flower is called the gynoecium. It is composed of carpels. Each carpel is composed of an ovary, style, and stigma. Ovary which is the swollen basal part contains the female sex cells called ovules. The style is a thin stalk and the stigma which is the flat tip of the carpel, is sticky and receives the pollen grains during pollination.

(f) The hard material which supports and gives shape to the body of an animal is called skeleton. The types of skeleton are: hydrostatic skeleton, exoskeleton, and endoskeleton.

Some soft-bodied animals like earthworms and caterpillars do not have hard skeletons. Their bodies are supported by a liquid which is present in the cells and in the spaces between them. This type of a skeleton is called a hydrostatic skeleton.

An exoskeleton is found in most invertebrates. The bodies of insects are covered by a hard, tough skin or cuticle which is made of a strong, waterproof material called chitin. The cuticle is composed of plates and hollow tubes which not only protect and support the body, but also give it a specific shape.

Movement is brought about by muscles which are attached to the inside of the exoskeleton.

All vertebrates are supported by a hard internal skeleton called the endoskeleton. The endoskeleton is made up of bones of different shapes and sizes. It grows with the body of the animal. It supports the body and gives it shape. It protects the internal organs and helps in the movement of the body. The long bones produce red and white blood cells.

2. A root fixes the plant firmly in the soil. It absorbs and mineral salts from the soil. It may store food.

The stem bears leaves, buds, flowers, and the fruit of a plant. It spaces out the leaves so that each leaf can get air and sunlight. It transports water from the roots to the leaves. The stem also transports prepared food from the leaves to all parts of the plant.

A leaf manufactures food for the plant by photosynthesis. Stomata in the leaf help in gaseous exchange. Some thick and fleshy leaves store food.

A flower helps to make fruits and seeds.

Sensory organs help the animal to detect changes in its surroundings and to react to them accordingly.

A skeleton helps to support and protect the internal organs of the body. It also helps to bring about movement.

3, 4, 5 Refer to Pupil's Book.

| **Parts of body** | **Description** |
|---|---|
| head | contains the mouth and the sensory organs |
| trunk | contains the important organs and systems |
| exoskeleton | is composed of plates and hollow tubes which protect and support the body |

| | |
|---|---|
| cuticle | gives shape and support s the body of animals |
| hydrostatic skeleton | supports soft-bodied animals by a liquid present between the cells |
| endoskeleton | made up of bones of different sizes and grows inside the body |
| moulting | is the process when the cuticle is shed and a new one grows in its place |
| bones | are hard and made up living cells and mineral substances |

## Additional Exercise

MCQs

(a) The stem, root, and leaves are the _____ parts of a plant.
vegetative reproductive characteristic [***vegetative***]

(b) The part of the plant that bears the leaves, buds, flowers, and fruits of the plant is _____.
Roots leaves stem [***stem***]

(c) The flat green part of the leaf is called _____.
petiole midrib lamina [***lamina***]

(d) Flowers arranged in a group or cluster is called _____.
spike inflorescence florets [***inflorescence***]

(e) Flowers of the wheat plant are arranged in an inflorescence called _____.
floret spike florets [***spike***]

(f) The part of the animal body that contains the sensory organs is called _____.
head trunk limbs [***head***]

(g) Which one of the following animals does not have a hard skeleton?
rabbit squirrel jellyfish [***jelly fish***]

(h) A hydrostatic skeleton is made up of a _____.
solid liquid gas [***liquid***]

(i) The body of an insect is covered by a hard, water-proof skin called _____.
chitin cuticle wax [***cuticle***]

(j) The skeleton which forms the main axis of the body of a mammal is called _____.
appendicular skeleton axial skeleton exoskeleton [***axial skeleton***]

# Lesson plan

Date: Time: 40 mins

| Unit: 1<br>**Topic: Structure of living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Structure of a flowering plant vegetative parts | • to describe the structure of the stem, the root, and a leaf of a flowering plant<br>• to explain the functions of the stem, root, and leaf of a flowering plant | • describe the stem, the root, and the leaf of a flowering plant<br>• explain the function of each | A flowering pot plant, an onion bulb, some potted grass, specimens of roots, stems and leaves, slides of stem tip, root tip<br>TS of leaf | Reading: p 2, 3, 4<br>Activity: 3<br>CW: Q1 (a) (b)<br>Q3<br>HW: Q1 (c) (d) |

**Key words**: vegetative part, reproductive part, stem, node, internode, stomata, terminal bud, axillary bud, root tip, root cap, root hair, taproot, fibrous root, adventitious root, petiole, lamina, midrib, vein, photosynthesis

**Method**: Place a complete flowering plant, an onion bulb, and a grass plant on the table. Show the students the onion bulb.

**Ask**: Is this a plant? Hold up the flowering plant and the grass plant. Describe the structure of a plant and explain the functions of each part. Explain that the roots, stem, and the leaves are called the vegetative parts of a plant.

**Ask**: What is the difference between the onion bulb and the flowering plant? Peel the onion and cut it longitudinally. Show the students the stem, the growing tip, and the fleshy leaves. With a hand lens show them the position of the buds at the base of the leaves. Also show the roots growing from the base of the bulb.

Pluck off the leaves of the flowering plant and show the students the nodes, internodes, and the axillary buds. Explain that the leaves, branches, and flowers grow from the axillary buds at the nodes. Point out the stem tip and explain that it is the growing point of the stem. Explain the structure of the stem. Ask the students to compare the flowering plant to a grass plant and to the onion bulb.

**Ask**: What is the function of the stem? Explain that the stem is the part of the plant that bears all the other parts and is also a means of transporting food and water. Thick, fleshy stems can also store food.

Show the students the roots of the three plants. **Ask**: What is the difference between them? Describe the different kinds of root system. With the help of diagrams, explain the microscopic structure of the root and explain the function of each part. Explain the functions of roots.

Show the students different kinds of leaves. Give each one a leaf and ask them to examine it carefully. Draw a leaf on the board and label its parts. Demonstrate how to make leaf prints on tracing paper by rubbing over the leaf with a pencil. Ask the students to label the parts of their leaf prints. **Ask**: What is the function of a leaf? Explain the importance of leaves for plants. Describe different kinds of leaves and explain why some leaves are thick, or have hair or spines.

# Lesson plan

Date: Time: 40 mins

| **Unit: 1**<br>**Topic: Structure of living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Reproductive parts | • to describe the structure of a flower<br>• to discuss variations in flower structure | • describe the structure of a flower<br>• explain the variations in the structure of flowers | Different kinds of flowers, hand lens, forceps, sheets of paper, straight pins | Reading: p 4, 5<br>Activity: 1<br>CW: Q4<br>HW: Q1 (e) |

**Key words**: reproductive part, inflorescence, whorl, receptacle, pedicel, calyx, sepal, corolla, petal, pollination, androecium, stamen, filament, pollen grain, pollen sac, gynoeciun, carpel, ovary style, stigma, nectar, nectarine, ray floret, disc floret, spike

**Method**: Ask the students to bring some flowers to the class. Ask them to examine the flowers carefully. Draw a flower on the board and label its parts. Explain the structure and function of each part. **Ask**: Why does a plant produce flowers? Explain that the flower is the reproductive part of the plant. It helps to make seeds which grow into new plants.

Ask the students to touch the centre of the flower. Explain that the yellow powder on their fingers is pollen. Draw the longitudinal section of a flower on the board and label it. Cut a longitudinal section of a flower and show the students its parts with a hand lens.

Ask the students to draw the outline of a flower on a sheet of paper. Take the parts of the flower apart with a pair of forceps and pin each part in its correct place on the sheet of paper and write the name of the part. Cut a cross section of the ovary of a flower and point out the attachment of the ovules inside it.

Show the students different kinds of flowers such as a rose, a sunflower, a hibiscus, sweet pea, and a wheat spike. Explain the differences in their structures.

# Lesson plan

Date: Time: 40 mins

| Unit: 1<br>**Topic: Structure of living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Structure of animals | • to describe the basic structure of the body of animals<br>• to describe types of skeleton<br>• to explain the general plan of the skeleton | • describe the basic structure of the body of animals<br>• describe different types of skeleton<br>• explain the general plan of the skeleton | Specimens of an ant, a cockroach, an earthworm, a rabbit skeleton, a model of a human skeleton and a rabbit skeleton | Reading: p 6, 7<br>Activity: 2<br>CW: Q6<br>HW: Q1 (f)<br>Q2 |

**Key words**: head, anterior, mouth, sensory organ, trunk, skeleton, hydrostatic skeleton, exoskeleton, endoskeleton, bone, axial skeleton, appendicular skeleton

**Method**: Show the students an ant, a cockroach, an earthworm, and the model of a rabbit. Ask them to point out the differences. Explain the division of the body into parts. **Ask**: Why are most of the sense organs located in the head region? Explain the position and importance of the brain and the nervous system in controlling the whole body.

**Ask**: What is the function of the trunk? Explain that the limbs are attached to the trunk: they help to bring about movement. All the organs and body systems are located in the trunk region of the body. Explain the importance of the skeleton for all animals. Discuss the kinds of skeleton in insects and other invertebrates, and in vertebrates.

**Ask**: Does the earthworm have a skeleton? Explain the different types of skeleton and their functions. Show the students a rabbit skeleton and the model of the human skeleton. Explain the general plan of the skeleton in all vertebrates, and explain that the axial skeleton forms the main axis while the appendicular skeleton is attached to the axial skeleton.

# Lesson plan

Date: Time: 40 mins

| **Unit: 1**<br>**Topic: Structure of living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Joints | • to describe a joint<br>• to describe the types of joint | • explain the importance of joints<br>• describe the structures of joints<br>• identify different kinds of joint | A model of the human skeleton, diagrams of different kinds of joints | Reading: p 8<br>CW: Q5<br>HW: Name the type of joint:<br>a. hip joint _____<br>b. knee joint _____<br>c. ankle joint _____<br>d. skull bones _____<br>e. between skull and backbone _____ |
| **Key words**: joint, ligament, cartilage, synovial fluid, capsule, tendon<br>**Method**: Show the students models of various types of joint and explain the type of movement each joint can make. Explain how muscles help bones to move. Describe a typical joint with the help of models and charts. Explain the functions of each part of a joint. Explain the various kinds of joint and where they are found in the skeleton. | | | | |

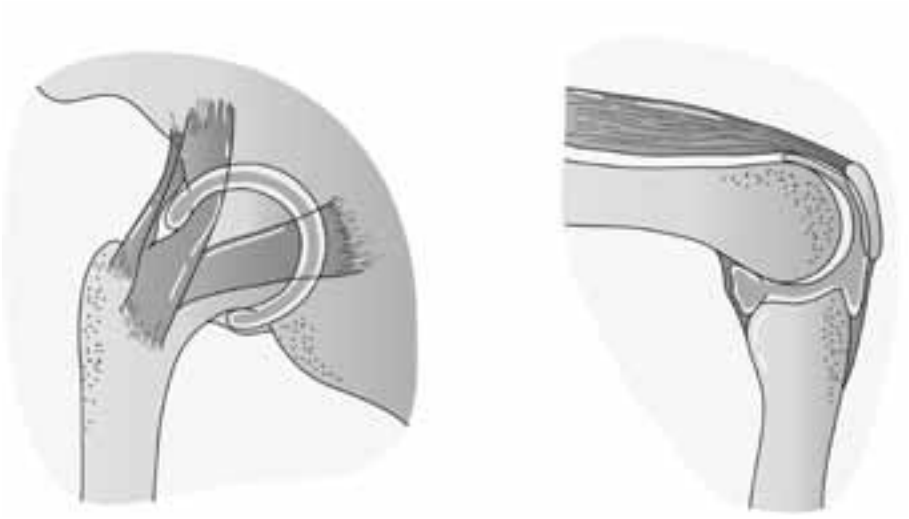
Name: _____ Date: _____

1. Write the name of the part that matches the description.

| Description | Name |
|---|---|
| a. the main body of the plant that is made up of roots, stem, and leaves | _____ |
| b. the reproductive part of the plant which makes seeds and fruits | _____ |
| c. swollen areas on the stem from where leaves and buds grow | _____ |
| d. tiny holes on the stems and leaves for the exchange of gases | _____ |
| e. a bud at the tip of the stem | _____ |
| f. the part of the root from where it increases in length | _____ |
| g. fine hair on the root which absorb water and salts from the soil | _____ |
| h. the flat green part of a leaf | _____ |
| i. the parts of a leaf which transport food and water | _____ |
| j. a group or a cluster of flowers | _____ |

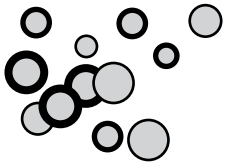
Name: _____ Date: _____

1. On the diagram, label the parts of the joint and name the type of joint.

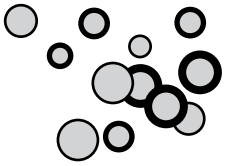


2. Where in the human skeleton would you find the following types of joint?

| **Type of joint** | **Example** |
|---|---|
| a. ball and socket joint | _____, _____ |
| b. hinge joint | _____, _____ |
| c. sliding joint | _____, _____ |
| d. fixed joint | _____ |
| e. pivot joint | _____ |



# UNIT 2



# Organ systems in human beings

## Teaching objectives:

- to explain the functions of the digestive system
- to describe the various parts of the digestive system and explain its working
- to discuss the common disorders of the digestive system and the measures that can be taken to prevent them
- to explain what respiration is and describe the various parts of the respiratory system
- to explain the mechanism of breathing
- to explain the difference between respiration and breathing
- to describe the common respiratory diseases, their causes, and preventive measures

## Teaching strategy:

**Ask**: What happens to the food that we eat? How does the meat that we eat make our flesh? Explain the process of digestion and the role of enzymes. Show the students a chart of the digestive system and explain the role of each part in the digestion of food. **Ask**: Why should we include fruits and vegetables in our diet? Discuss the different vitamins and minerals that we get from fruits and vegetables and the importance of dietary fibre. Discuss the disorders associated with eating unhealthy food.

Tell the students to take a deep breath with their hands on their ribs. Tell them to breathe out. **Ask**: What did you feel with your hands? Explain the breathing movements. **Ask**: Why do you breathe? Explain the process of respiration and gaseous exchange in the air sacs. **Ask**: Which gas do we breathe in? Which gas do we breathe out? How can you test the gas that we breathe out? Tell a student to breathe out into a beaker containing freshly prepared lime water with a drinking straw. **Ask**: What happens? Explain that the air we breathe out contains a lot of carbon dioxide which turns the lime water milky. Describe the respiratory system and the structure of an air sac with the help of charts and diagrams on the board. Explain the importance of respiration for all living things. **Ask**: What are the bad effects of smoking? How does smoking affect our health? Discuss the causes and effects of respiratory diseases.

Help the students perform the various activities.

Summarize the lesson.

## Answers to Activities

2. (a) The balloons

   (b) Oxygen is taken in and carbon dioxide is given out

   (c) In the air sacs (alveoli)

   (d) Food is oxidized in the cells and energy and carbon dioxide are released.

   (e) Differences between respiration and burning:

   Respiration releases energy more slowly than burning.

   The rate of respiration can be controlled.

   Respiration produces heat only.

   Burning produces light as well as heat.

## Answers to Exercises in Unit 2

1. Name the correct part of the digestive system:

   | | | |
   |---|---|---|
   | (a) teeth | (b) mouth | (c) stomach |
   | (d) pancreas | (e) liver | (f) glands in the intestines |
   | (g) large intestine | (h) anus | (i) villi |

2. (a) Respiration is the process by which food is broken down, or oxidized in the body to release energy
   (b) oxygen (c) carbon dioxide (d) alveoli (e) rib cage
   (f) breathing takes place in living organisms. It releases energy slowly. The rate of respiration can be controlled. It produces only heat.

3. Arranging the activities in the correct sequence:

   The diaphragm contracts.

   The intercostal muscles contract.

   The chest gets larger.

   Air is forced into the lungs.

   The diaphragm relaxes.

   The intercostal muscles relax.

   The chest gets smaller.

   Air is forced out of the lungs.

4. Label the parts of the respiratory system.

   Refer to Pupil's Book.

## Additional Exercise

MCQs

(a) The breaking down of food into liquid form is called _____.
digestion respiration excretion [***digestion***]

(b) The digestion of food in humans takes place inside a long tube called _____.
excretory canal alimentary canal respiratory canal [***alimentary canal***]

(c) Enzymes in the gastric juice in the stomach help to digest _____.
proteins fats carbohydrates [***proteins***]

(d) Bile is produced in the _____.
stomach intestines liver [***liver***]

(e) Digested food is absorbed into the blood by finger like projections called _____.
tubes villi capillaries [***villi***]

(f) Water from the undigested food is absorbed in the _____.
colon small intestine kidney [***colon***]

(g) The process by which food is oxidized to release energy is called _____.
digestion excretion respiration [***respiration***]

(h) Exchange of gases in the body takes place in the _____.
lungs kidneys stomach [***lungs***]

(i) Excess animal fat in the diet leads to the formation of _____.
cholesterol proteins vitamins [***cholesterol***]

(j) Many respiratory diseases like emphysema are caused by _____.
sleeping eating smoking [***smoking***]

# Lesson plan

Date: Time: 40 mins

| Unit: 2<br>**Topic: Organ systems in human beings** | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. The digestive system | • to describe the parts if the digestive system<br>• to explain the functions of each part | • describe the digestive system<br>• explain the functions of each part | Diagrams of the digestive system, stomach, villus | Reading: p 13, 14<br>CW: Q1<br>HW: Q4 |

**Key words**: digestion, alimentary canal, enzyme, tooth, saliva, salivary gland, tongue, gullet, stomach, gastric juice, acid, small intestine, pancreas, pancreatic juice, bile, liver, intestinal juice, villi

**Method**: Start the lesson by asking: What different kinds of food do we eat? What happens to the food that we eat? What is digestion? Where does the digestion of food start? Where does it end? What happens to the digested food? What happens to the undigested food?

Show the students a chart of the digestive system and describe each part. Explain the function of each part. **Ask**: What is the role of the digestive juices? Write the digestive process in the form of a table:

| Part of the digestive system | The digestive juice | Type of food it acts upon | End product |
|---|---|---|---|

Ask the students to fill in the table after studying the digestive system.

# Lesson plan

Date: Time: 40 mins

| Unit: 2<br>**Topic: Organ systems in human beings** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Food and health | • to discuss the importance of food for health<br>• to define dietary fibre and explain its importance<br>• to discuss some disorders of the digestive system | • explain how eating too little or too much affects our health<br>• explain the importance of dietary fibre in our diet<br>• describe some digestive disorders | A chart of healthy and unhealthy foods, pictures of people with diet problems | Reading: p 14<br>CW: 1. What is the importance of dietary fibre in our diet?<br>2. What are the bad effects of eating the wrong kinds of food?<br>3. What are the causes of<br>a. indigestion?<br>b. ulcers? |

**Key words**: obesity, cholesterol, tooth decay, high blood pressure, roughage, fibre, indigestion, diarrhoea, constipation, laxative, ulcer

**Method**: Discuss the harmful effects of eating too much, eating the wrong kinds of food, and the diseases associated with this.
**Ask**: What is dietary fibre? Explain the importance of including roughage in our food. Ask the students to list the important reasons for eating dietary fibre.

**Ask**: When do we feel nausea or indigestion? Explain the causes of indigestion and how acidity in the stomach can be controlled.
**Ask**: Why is roughage important? Explain the importance of including fruit and vegetables in our diet.

**Ask**: What is an ulcer? How is an ulcer caused? Discuss the bad effects of eating very spicy foods. Explain the treatment that can be taken to prevent or cure stomach disorders.

# Lesson plan

Date: Time: 40 mins

| **Unit: 2**<br>**Topic: Organ systems in human beings** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. The respiratory system | • to describe the parts of the respiratory system and discuss the functions of each<br>• to explain how exchange of gases takes place in the lungs<br>• to explain the similarities and differences between respiration and breathing<br>• to decribe some respiratory diseases and discuss their prevention and treatment | • describe the parts of the respiratory system<br>• explain the function of each part<br>• explain how gaseous exchange takes place in the lungs<br>• differentiate between respiration and burning<br>• describe the causes, effects, and treatment of respiratory diseases | Charts and diagrams of the human respiratory system | Reading: p 15<br>Activities: 1, 2<br>CW: Q3<br>HW: Q2 (a) to (f)<br>Project: p 17 |

**Key words**: respiration, thoracic cavity, larynx, trachea, cartilage, rib, intercostal muscle, bronchii, bronchiole, alveoli, diaphragm, cancer, emphysema, bronchitis

**Method**: Ask the students to take a deep breath with their hands on their ribs. Ask them to breathe out. **Ask**: What did you feel? Explain breathing movements. Describe the respiratory system with the help of charts and diagrams on the board. **Ask**: Why do we breathe? Explain the process of respiration and gaseous exchange in the lungs. **Ask**: Which gas do we breathe in? Which gas do we breathe out? How can you test the gas that we breathe out? Ask a student to breathe out through a drinking straw into a beaker containing freshly prepared lime water. **Ask**: What happens? Explain that the air we breathe out contains a lot of carbon dioxide gas which turns the lime water milky. Discuss the chart of *How air changes in the lungs* on page 15.

**Ask**: How does respiration help the body? Explain that respiration is the process by which food is burned to release energy. **Ask**: How is respiration like burning? Discuss the similarities and differences between burning and respiration. **Ask**: Is smoking harmful? What are the bad effects of smoking? Discuss the causes and effects of respiratory diseases and how they can be prevented and treated.

Name: _____ Date: _____

1. Complete the table of information about the digestive system.

| Part of the digestive system | Gland | Juice produced | Food it acts upon |
|---|---|---|---|
| mouth | | | |
| stomach | | | |
| pancreas | | | |
| liver | | | |
| small intestine | | | |

2. Complete the sentences on the importance of dietary fibre.

   i. It helps avoid _____

   _____.

   ii. It absorbs _____

   _____.

   iii. It allows gut muscles to _____

   _____.

   iv. It helps the body to avoid diseases such as _____

   _____.

Name: _____ Date: _____

1. Write the functions of the parts of the respiratory system.

   a. larynx: _____

   _____

   b. ribcage: _____

   _____

   c. intercostal muscles: _____

   _____

   d. alveoli: _____

   _____

   e. diaphragm: _____

   _____

2. Match the symptoms to the diseases of the respiratory system.

| Disease | Symptoms |
|---|---|
| cancer | inflammation of the air passages in the lungs; reduces the ability of the lungs to absorb oxygen |
| bronchitis | cells start dividing rapidly until they get out of control |
| emphysema | walls of the alveoli become thin and weak and eventually break down, leaving large empty spaces in the lungs |


# Transport systems in plants and animals

## Teaching objectives:

- to explain the system of transport in humans
- to describe the structure of the heart and explain how it works
- to explain how the circulatory system works
- to discuss some transport disorders affected by diet
- to explain the absorption and transport of materials in plants
- to explain how the structure of roots, stems, and leaves assists in the transport of materials in plants

## Teaching strategy:

Show the students a sheep's heart. **Ask**: What is the function of the heart? Dissect the heart longitudinally and show the students the atria and ventricles. Draw the section of the heart on the board and explain the circulation of blood in it.

**Ask**: What are the thick blue lines which you can see on the back of your hand? Tell the students to feel their pulse. **Ask**: Can you see very fine red lines in your eyes? Explain the structure of an artery, a vein, and a capillary, and the difference in functions between them. Help the students perform the various activities.

**Ask**: Do plants have tissues, organs, and systems? Discuss the vascular system in plants. **Ask**: Which part of the plant absorbs water? Where does the water go? Explain the transpiration stream and the circulation of water, salts, and food in plants. Explain the structure of xylem and phloem and their functions. With the help of charts and diagrams explain how roots absorb water.

Draw the transverse section of a leaf and explain the position and function of the mesophyll tissue, and how the arrangement of tissues helps a leaf to make food by photosynthesis, and how the arrangement of tissues helps in gaseous exchange. **Ask**: How is water lost from a plant? Discuss transpiration and its importance for the plant. Set up an experiment to demonstrate that water is lost from the lower surface of a leaf. Discuss the factors which affect the rate of transpiration. Set up a potometer and explain how it is used to measure the uptake of water by the root. **Ask**: Does a plant need food? How does a plant get its food? Where is food manufactured in a plant? Discuss photosynthesis and the conditions necessary for it to take place.

**Ask**: How does food manufactured in the leaves reach all the cells and tissues? Discuss the role of the phloem tissue in the transport of food in plants. **Ask**: Do plants breathe? Explain the process of respiration in plants with the help of diagrams and charts. Show the students prepared slides of the transverse section of a leaf and ask them to observe the stomata and the intercellular spaces between the mesophyll cells.

Summarize the lesson.

## Answers to Activities

2. To compare the transpiration rates of the two surfaces of a leaf.

   Place two equal pieces of cobalt chloride paper, and fix them firmly by cello tape, one on the upper surface and the other on the lower surface of a leaf attached to a plant.

   After a few minutes, the cobalt chloride paper shows a change In colour from blue to pink. (Dry cobalt chloride paper changes colour from blue to pink when water touches it). The time taken for the cobalt chloride paper on the upper surface of the leaf to turn pink is much longer than that for the lower surface. So we can say that the rate of transpiration from the lower surface of a leaf is faster than from the upper surface. This is because most leaves have more stomata on the lower surface than on the upper surface.

3. Slow, fast, fast, slow, slow, fast, fast, slow

   (a) On a bright, sunny, and windy day

   (b) Stomata are open during the daytime.

Wind blows away the water vapour as it passes out, and water evaporates faster when it is hot.

## Answers to Exercises in Unit 3

1. Individual work
2. (a) The heart is made of a special kind of muscle called 'cardiac muscle'.

   (b) Valves present between the atria and the ventricles stop the blood from flowing backwards through the heart.

   (c) The heart pumps blood by contracting and relaxing. One complete contraction and relaxation is called a heart beat.

   (d) The heart normally beats about 70 times in a minute.

   (e) Arteries divide into small thin-walled blood vessels called capillaries. They penetrate into all the tissues of the body. Exchange of food, gases, and materials takes place by diffusion through the thin capillary walls.

3. (a) The body needs more energy when it is working harder, so the breathing rate increases.

   (b) The heart beats normally when the body is at rest, but it has to work more when the body is working harder.

   (c) The pulse rate would be over 100 times per minute. The breathing rate would be over 25 times per minute.

4 (a) water (b) blood

5. Valves inside the heart help the blood to circulate in one direction only. They stop the backward flow of blood.
6. The transfer of food, gases, and excretory materials between the blood and the cells takes place by diffusion through the thin capillary walls.

7. Plants lose water vapour into the atmosphere by evaporation. The water passes through tiny holes called stomata which are found mainly on the lower side of leaves. This process is called transpiration.

8. It is important because it helps in the transportation of water in the plants and it also helps a plant to keep cool in summer.

9. (a) An artery is a blood vessel that takes blood away from the heart. It has thick muscular walls to withstand the high pressure of the blood. It usually lies deeply embedded inside the body. It divides into small thin-walled vessels called capillaries.

   Capillaries join up to form veins. A vein returns blood to the heart. It is wider than an artery and has thinner walls. It has valves to make sure that the blood flows in one direction only. The blood pressure in an artery is usually low.

   (b) In flowering plants materials are circulated in a system of tubes called the vascular system. The vascular system of plants is composed of specialized tissues called xylem and phloem. Xylem is made up of long, dead cells called vessels. Vessels have thick walls. They carry water from the roots, through the stem to the veins in the leaves. Phloem is made up of long thin walled tubes called sieve tubes. Sieve tubes are made of living cells whose horizontal walls have tiny holes. Food flows from the leaves to other parts of the plant through the sieve tubes.

   (c) Photosynthesis is a process by which green plants make their own food in the presence of sunlight. It takes place in the green parts of a plant. Oxygen gas is released during photosynthesis.

   Respiration is a process by which food is oxidized to release energy. It takes place in all the cells of the body. Carbon dioxide gas is released during respiration, along with heat energy.

   (d) Water flows in a continuous stream through a plant. It enters through the roots and flows up the xylem vessels of the root and stem to the leaves and diffuses out of the stomata in the leaves. This evaporation of water from the leaves is called transpiration. Transpiration is the main force which moves water through a plant.

   Circulation of blood takes place in the blood vascular system which is composed of the heart, arteries, and veins. It helps to circulate food, oxygen, and food materials inside the body. It also helps to remove waste products such as carbon dioxide and urea from the body.

   (e) The absorption of soil water by plants is done by the root hairs which occur in a small zone a short distance behind the root tip. Each root hair is only a part of a cell; however, the vast number of root hairs helps to bring about a very large increase in the absorbing area of the root.

   A capillary is a thin walled blood vessel which forms a connection between an artery and a vein. Capillaries penetrate into all the tissues of the body. The transfer of food, gases, and excretory materials takes place by diffusion through the thin capillary walls.

## Additional Exercise

MCQs

(a) _____ are blood vessels that carry blood away from the heart.

Arteries Veins Capillaries [***Arteries***]

(b) Arteries divide into small thin-walled vessels called _____.

veins villi capillaries [***capillaries***]

(c) Blood vessels that carry blood back to the heart are called _____.

arteries veins capillaries [***arteries***]

(d) The heart is made up of a special type of muscle called _____.

muscle fibre cardiac muscle intercostal muscle [***cardiac muscle***]

(e) Normally the human heart beats about _____ times in a minute.

40 70 100 [***70***]

(f) Xylem is the type of vascular tissue through which _____ are transported.

water and mineral salts food and salts water and food

[***water and mineral salts***]

(g) The evaporation of water from the leaves is called _____.

respiration translocation transpiration [***transpiration***]

(h) The transport of food from the leaves to all parts of the plant is called _____.

respiration translocation transpiration [***translocation***]

(i) When is the rate of transpiration fastest?

On a bright sunny day At night On a rainy day

[***On a bright, sunny day***]

(j) Translocation is the movement of _____ in the phloem.

water food oxygen [***food***]

# Lesson plan

Date: Time: 40 mins

| **Unit: 3**<br>**Topic: Transport systems in plants and animals** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. The circulatory system | • to describe the transport system in animals<br>• to describe the structure of the heart and how it works | • explain the system of transport of materials in human beings<br>• describe the structure of the heart and explain its working | A sheep's heart, charts, diagrams and models of the human heart | Reading: p 20<br>CW: Q1, Q2<br>HW: Q5, Q6 |

**Key words**: blood vessel, artery, vein, capillary, cardiac muscle, chamber, atrium, ventricle, heartbeat

**Method**: Show the students a sheep's heart. **Ask**: What is the function of the heart? Dissect the heart longitudinally and show the atria and the ventricles. Draw a section of the heart on the board and label it. Explain the circulation of blood inside it.

**Ask**: What are the thick blue lines that you can see on the back of your hand? Can you see very fine red lines in your eyes? Describe the structures of an artery, a vein, and a capillary and the functions that they perform. Explain the differences between them.

Ask the students to feel their pulse? Explain that this is a way of feeling the heart beat. Ask them to count the number of times their heart beats in 15 seconds. Discuss what a heartbeat is.

# Lesson plan

Date: Time: 40 mins

| **Unit: 3**<br>**Topic: Transport systems in plants and animals** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Heart disease | • to explain the causes of heart disease<br>• to describe how heart diseases can be treated and avoided | • identify the causes of heart disease<br>• describe the ways in which heart disease can be treated<br>• explain how heart disease can be avoided | Diagrams and pictures of heart disease and heart surgery<br>A chart of how heart disease can be avoided | Reading: p 20, 21<br>Activity: 1<br>CW: Q3<br>HW: Define the following:<br>a. cholesterol<br>b. thrombosis<br>c. heart attack<br>d. graft<br>e. pacemaker<br>f. transplant |

**Key words**: coronary artery, cholesterol, thrombosis, angina, heart attack, graft, pacemaker, transplant

**Method**: **Ask**: What does the heart need to keep working properly? How are food and oxygen supplied to the heart? What is cholesterol? What is a heart attack? Describe how food and oxygen are supplied to the heart and how a poor diet can lead to a heart attack. Explain that the clotting of blood in the arteries is called thrombosis; this can lead to pain in the heart called angina, or to a heart attack.

With the help of pictures and if possible a video/dvd/youtube clip, explain how heart surgery is performed. Explain what a graft, a pacemaker, and a heart transplant are. Discuss the ways in which heart disease can be avoided.

# Lesson plan

Date: Time: 40 mins

| Unit: 3<br>**Topic: Transport systems in plants and animals** | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 3. Transport system in plants | • to describe the transport system in plants<br>• to explain how roots absorb water | • describe the transport system in plants<br>• explain how roots absorb water | Diagrams and charts of the vascular system in plants, slides of a root hair, xylem and phloem | Reading: p 22<br>CW: Q4<br>HW: Describe the vascular system in plants. |
| **Key words**: vascular tissue, xylem vessel, phloem, sieve tube, root hair<br>**Method**: **Ask**: Do plants have tissues, organs, and systems? Explain the vascular system in plants.<br>**Ask**: Which part of the plant absorbs water? Where does the water go? Describe the positions and structures of xylem and phloem. Show the students slides of the sections of plant tissues. Discuss the functions of xylem and phloem. With the help of diagrams and charts explain how roots absorb water. | | | | |

# Lesson plan

Date: Time: 40 mins

| **Unit: 3**<br>**Topic: Transport systems in plants and animals** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Flow of water through plants<br>Transport of food in plants<br>Gaseous exchange in plants | • to define transpiration and explain how it takes place<br>• to identify factors which affect the rate of transpiration<br>• to explain the transport of food in plants<br>• to explain how gaseous exchange takes place in plants | • explain how water and food are transported in plants<br>• explain how the exchange of gases takes place in plants | Diagrams and charts of transport of materials in plants<br>A simple photometer, a leafy shoot | Reading: p 22, 23, 24<br>Activity: 3<br>CW: Q7, Q8<br>HW: Q9 |

**Key words**: transpiration, translocation

**Method**: **Ask**: How does a plant absorb water? Where does that water go? How does water circulate in a plant? Discuss the absorption of water by the roots and its flow from the stems to the leaves. Explain what transpiration is and the factors which affect the rate of transpiration.

**Ask**: Does a plant need food? How does a plant get its food? Where in a plant is food manufactured? Discuss photosynthesis and the conditions necessary for it to take place. **Ask**: How does the food manufactured in the leaves reach all the cells and tissues? Discuss the role of phloem in the transport of food in plants.

**Ask**: Do plants breathe? Explain with the help of diagrams and charts the process of respiration in plants. Show the students prepared slides of the transverse section of a leaf and ask them to observe the stomata and the intercellular spaces . Discuss the importance of the transpiration stream in transporting water and materials; for keeping the cells turgid; for keeping the plant cool in hot weather.

Name: _____ Date: _____

1. On the diagram below, label the parts of the heart. Draw arrows to show the circulation of the blood inside the heart.

2. On the diagram below, draw arrows to show how water circulates inside a plant.

Name: _____ Date: _____

1. Fill in the blanks to complete the description of heart diseases.

The heart needs _____ and _____ to keep working properly. The arteries which supply blood to the heart are called _____ arteries. _____ is a fatty substance which can stick to the walls of an artery and make it narrow. Bits of _____ break off into the blood stream and block narrow blood vessels. This blockage is called a _____. Severe pain in the chest caused by the coronary arteries becoming partly blocked is called _____. This kind of blockage can cause a _____.

If a coronary artery becomes blocked, a heart surgeon can by-pass the blockage using a piece of a vein taken from the patient's leg; this is called a graft. Heart valves can be replaced with _____ valves, which help to control the heartbeat. Receiving a healthy heart from another person is called a _____.


# Growth and reproduction in living organisms

## Teaching objectives:

- to explain what is meant by growth
- to describe how animals and plants grow
- to explain reproduction
- to describe the kinds of reproduction
- to explain the process of pollination, fertilization, and seed and fruit formation
- to explain the structure of seeds and fruits
- to describe the methods of seed and fruit dispersal and their importance
- to explain how a seed germinates

## Teaching strategy:

**Ask**: What is growth? How do animals grow? How do plants grow? Can an animal's tail or ears grow back if they are cut off? Can a plant grow new leaves and branches if its twigs are cut off? Explain that growth is an increase in size which takes place by using food to build more cell material. Growth in animals is limited. Growth in plants is unlimited and takes place at the tips.

**Ask**: How do living things increase in number? Explain the process of reproduction and its importance in maintaining the continuity of generations.

**Ask**: How do new plants grow? Can new plants grow from leaves? Explain that some plants are capable of producing new plants if some part is placed in water. Such as the bryophyllum which can grow new plants from its leaves, the money plant can grow new plants from its stem. Show the students an onion bulb and a potato tuber. Slice the bulb. Explain that bulbs are the leaves which store food, and in their centre is a flower bud. Tubers are swollen stems. The eyes are where the buds grow. If a potato is cut up and planted in the ground, each eye can produce a new potato plant. Sow some potato eyes and some onion bulbs in a flower pot. Show them the sprouting leaves and stems. Grow a root garden by burying a carrot, a radish, and a turnip in some sand in a bowl. Keep the water level high enough for the roots to reach the water. After several days green stems and leaves will sprout from the vegetable tops.

Explain that some simple animals can also grow in this way. This method of reproduction is called asexual reproduction and the new plants or animals are exact copies of their parents. Explain the various methods of asexual reproduction with examples. Ask a gardener to show the students cuttings of plants, and explain to them how grafting of scion and stock is done. Explain that there is another method of reproduction in which there is a union of male and female sex cells. This process is called fertilization. The fertilized egg develops into a new individual by cell division. It has characteristics of both parents. Explain the stages of development of a frog, a butterfly and a cockroach from the egg to the adult stage.

**Ask**: Why are flowers brightly coloured? Why do they have a scent and nectar? Explain the importance of pollination and fertilization for the development of fruits and seeds. **Ask**: Why do seeds need to be dispersed? Explain the importance of dispersal and how seeds and fruits are adapted for dispersal. Show the students some soaked bean seeds. Draw a seed on the board and label it. Tell the students to identify its various parts. Sow some wheat and bean seeds in moist sawdust. Show the students the various stages of germination in both.

Summarize the lesson.

## Answers to Exercises in Unit 4

1. (a) Growth is an increase in the size of an organism. The body of an animal grows all over till it reaches adult size, after which growth stops. Only some cells retain the power to divide and bring about the repair of worn out or damaged tissues, whereas, plants grow throughout their lives, if they get sufficient warmth, air, light, water, and minerals. Growth in plants is restricted to the tips of the roots and shoots, where cell division occurs. The new cells that are produced grow to a maximum size and then become specialized to form different tissues.

   (b) The process by which living organisms produce new living organisms of their own kind is called reproduction. In asexual reproduction the offspring is an exact copy of the parent.

   (c) In sexual reproduction there are two parents male and female. In animals the female produces eggs in the ovaries and the male produces sperms in the testes. In plants the ovules are produced in the ovaries of the flowers and the pollen grains are produced in the anthers of the stamens. For sexual reproduction to take place one cell from the male and one cell from the female join together to form new off-spring.

   (d) In plants, the pollen is carried from the anther to the stigma of flowers by insects, or by wind. This process is called pollination. After pollination, a pollen tube grows out from the pollen grain and enters the ovule. The male gamete is released and joins with the female gamete. This process is called fertilization.

   (e) After fertilization all the parts of the flower dry up and fall off except the ovary which grows rapidly to form the fruit. The ovules form the seeds.

   (f) Fruits and seeds are dispersed in different ways. Some seeds and fruits have feathery hairs or wings by which they are carried by wind to far away places. Some seeds and fruits have small hooks by which they get attached to the fur of animals. Some juicy fruits are eaten by birds. Their seeds remain undigested and they are passed out of their gut away from the parent plant. Some flowers produce pods which dry up in the Sun. The pod splits and the two halves curl up and flick out the seeds.

2. (a) A fruit is the part of the plant that contains seeds.

   (b) Seeds need to be dispersed or scattered away from the parent plant so that each seed has a chance to grow into a new plant.

   (c) A seed has the baby plant or embryo, which is made up of a baby shoot or plumule, and a baby root or radicle, and one or two seed leaves or cotyledons, which contain stored food.

   (d) Seeds need a store of food for the growth of the embryo till the shoot develops its own green leaves.

3. (a) anthers

   (b) stigma

   (c) petals are brightly coloured

   (d) the petals shrivel and fall off; the ovary either swells up or dries up to form the fruit; the ovules develop into seeds

   (e) pollen and nectar

4. (a) growth (b) adult (c) mitosis
   (d) clones (e) binary fission (f) buds

5. (a) binary fission (b) by spores (c) forms buds
   (d) swollen underground (e) part of a stem (f) a stock and scion
   (g) in ovaries (h) has cones (i) is the resting period of a seed

6.

| **Insect-pollinated flowers** | **Wind-pollinated flowers** |
|---|---|
| large, brightly coloured | small, green |
| present | absent |
| present | absent |
| large, sticky | powdery, numerous |
| large, inside the flower | have long filaments, hang outside the flower |
| large, sticky | feathery, hang outside flower. |

7. tube, pollen, ovule, gamete, seed, fruit

## Additional Exercise

MCQs

(a) The increase in the size of an organism is called _____.

growth reproduction elongation [***growth***]

(b) Growth in plants takes place at the _____ of the root and shoot.

sides tips base [***tips***]

(c) The type of reproduction in which there is only one adult of the species is called _____.

sexual reproduction asexual reproduction fission [***asexual reproduction***]

(d) Yeast is a simple non-green plant that reproduces by _____.

cuttings tubers budding [***budding***]

(e) The process by which pollen from the anther is carried to the stigma of a flower is called _____.

fertilization germination pollination [***pollination***]

(f) The process of the joining of male and female cells is called _____.

fertilization germination pollination [***fertilization***]

(g) Pine trees produce male and female reproductive organs called _____.

fruits seeds cones [***cones***]

(h) The process by which the embryo of a seed grows into a new plant is called _____.

germination pollination fertilization [***germination***]

(i) The scattering of seeds away from the parent plant is called _____.

dispersal pollination fertilization [***dispersal***]

(j) When a seed is planted in the soil it absorbs water through the _____.

testa micropyle cotyledon [***micropyle***]

# Lesson plan

Date: Time: 40 mins

| **Unit: 4**<br>**Topic: Growth and reproduction in living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Growth | • to define growth<br>• to explain that there are two kinds of reproduction<br>• to describe asexual reproduction | • explain what is meant by *growth*<br>• explain what reproduction is<br>• describe asexual reproduction in animals and plants | Diagrams and charts of asexual reproduction in animals, specimens of asexual reproduction in plants (potatoes with 'eyes', carrot, radish, turnip)<br>Pots of compost for planting these vegetables,<br>an onion bulb | Reading: p 29, 30, 31<br>Activity: 1, 2<br>CW: Q4<br>HW: Q1 (a) (b) |

**Key words**: growth, reproduction, asexual, clone, mitosis, binary fission, bud, sporangia, budding, spore, eye, runner, cutting, grafted, stock, scion

**Method**: **Ask**: What is growth? How do animals grow? How do plants grow? Can a plant grow new leaves and branches if twigs are cut off? Can an animal's tail or ears grow back if they are cut off? Explain that growth is an increase in size which takes place by using food to build more cell material. Growth in animals is limited. Growth in plants is unlimited and takes place at the tips.

**Ask**: How do living things increase in number? Explain the process of reproduction and its importance in maintaining the continuity of species. **Ask**: Can animals reproduce asexually? Explain the method of asexual reproduction in simple animals like the amoeba and hydra. Explain that individuals that are produced by asexual reproduction are exact copies of their parents.

**Ask**: How do new plants grow? Can new plants grow from leaves? Explain that some plants are capable of producing new plants if some part is placed in water. A bryophyllum plant can grow new plants from its leaves. The money plant can grow new plants from its stem. Show the students an onion bulb and a potato tuber. Slice the bulb. Explain that bulbs are made up of fleshy leaves which store food, and in their centre is a flower bud. Tubers are swollen stems. The eyes of a potato are where the buds grow. If a potato is cut up and planted in the soil, each eye can produce a new potato plant.

In a flower pot, sow some potato pieces with eyes and an onion bulb. After a few days, show the students the sprouting leaves and stems. Grow a root garden by burying a carrot, a radish, and a turnip in sand in a bowl. Keep the water level high enough for the roots to reach the water. After a few days, green stems and leaves will sprout from the vegetable tops.

Ask a gardener to show the students cuttings of plants and explain how grafting of scion and stock is done.

# Lesson plan

Date: Time: 40 mins

| **Unit: 4**<br>**Topic: Growth and reproduction in living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Sexual reproduction | • to define sexual reproduction<br>• to describe sexual reproduction in flowering plants | • define sexual reproduction<br>• explain how it takes place in flowering plants | Charts and diagrams of pollination and fertilization | Reading: p 32, 33<br>Activity: 3<br>CW: Q6, Q7<br>HW: Q1 (c) (d)<br>Q3 |

**Key words**: sexual reproduction, ovule, ovary, pollen grain, anther, stamen, pollination, self pollination, wind pollination, fertilization, egg, sperm, pollen tube, fruit, cone, pollen sac, axis, scale

**Method**: Define sexual reproduction. Explain that the male and female sex cells join together to form a fertilized egg which develops into a new individual by cell division. It has characteristics of both parents.

**Ask**: Why are flowers brightly coloured? Why do they have a scent and nectar? Explain the importance of pollination and fertilization for the development of seeds which grow into new plants of the same kind. Define pollination and explain the methods of self-pollination and cross-pollination. Describe the characteristics of insect-pollinated and wind-pollinated flowers.

**Ask**: What happens after a pollen grain lands on the stigma of a flower of the same kind? Discuss the growth of the pollen tube and how a pollen grain cell combines with an egg cell to produce a fertilized egg cell. Discuss fruit and seed formation. Discuss the process of pollination and fertilization in plants that do not produce flowers. Give the example of a pine tree. Explain that it has male and female cones which produce ovules and pollen sacs on their scales. Wind pollination takes place and the production of seeds takes three years.

# Lesson plan

Date: Time: 40 mins

| **Unit: 4**<br>**Topic: Growth and reproduction in living organisms** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Seeds and fruits | • to explain how seeds and fruits are formed<br>• to discuss the dispersal of seeds and fruits | • describe the process of seed and fruit formation<br>• explain the formation of different kinds of fruits<br>• explain the ways in which seeds and fruits are dispersed | Specimens of soft and fleshy fruits, dry fruits diagrams and charts of different kinds of fruit | Reading: p 33, 34<br>CW: Q5<br>HW: Q2 |
| **Key words**: seed, dormancy, fruit, pod, capsule, disperse, hair, wing<br>**Method**: **Ask**: What is a seed? What is a fruit? How are seeds and fruits formed? Discuss the process of seed and fruit formation. Explain that a seed may be soft and fleshy like a tomato, or it may be dry and hard like a pea pod. Explain the different kinds of fruit and the methods of their dispersal.<br>**Ask**: Why are fruits formed? Why must seeds be dispersed? Explain that the seeds need to be scattered away from the parent plant so that each seed has a chance to grow. | | | | |

Name: _____ Date: _____

1. Fill in the table to show how fruit and seed dispersal take place.

| Seed/fruit | Adaptation | Method of dispersal |
|---|---|---|
| dandelion | | |
| sycamore | | |
| burdock | | |
| guava | | |
| blackberry | | |
| pea pod | | |
| coconut | | |

2. Match the organism to its method of asexual reproduction:

| Name of organism | Method of reproduction |
|---|---|
| amoeba | budding |
| paramecium | binary fission |
| hydra | spores |
| yeast | eyes |
| fungi | budding |
| potato | runner |
| strawberry | budding |
| rose | grafting |
| mango | cutting |

Name: _____ Date: _____

Q. Fill in the blanks to complete the description of how seeds and fruits are formed.

In plants, during pollination the _____ or the male cells are carried from the _____ to the stigma of flowers by insects or by the wind. The _____ cells and the _____ cells unite to produce seeds which grow into new plants. After pollination, a pollen _____ grows from the pollen grain. It enters the _____ and the male gamete is released. It joins with the female gamete and the ovule becomes a _____. The wall of the ovary grows to form the _____.

Pine trees produce male and female reproductive organs called _____ which are made up of woody _____ arranged around an _____. Each scale of a female cone has _____ ovules. Male cones are small. They have pollen _____ on their scales. _____ carries the pollen grains to the ovules of the female cones. _____ and production of seeds takes three years.

# Test paper 1

**Time: 3 hours** **Total marks: 100**

1. Attempt any 5 questions. [All questions carry equal marks.] [40]

   (a) Describe the stem of a plant.
   (b) What is a skeleton? What are the different types of skeletons found in animals?
   (c) How is water lost from a plant? What is the importance of transpiration for a plant?
   (d) Differentiate between:
      (i) an artery and a vein
      (ii) xylem and phloem
      (iii) photosynthesis and respiration
      (iv) transpiration and circulation
      (v) a root hair and a capillary
   (e) What is pollination? What happens after pollination? How is a fruit formed?
   (f) What are the important features of a natural environment?
   (g) What is a food chain? What are herbivores, carnivores, omnivores, and decomposers, and how are they linked in a food chain?
   (h) Define reproduction. What are the various methods of asexual reproduction in plants?

2. Draw labelled diagrams of:

   (a) The longitudinal section of a root [5]

   (b) The structure of a seed [5]

   (c) The nitrogen cycle [10]

3. Name the correct part of the digestive system. [10]

   (a) Food is broken into small pieces by the _____.

   (b) Digestion starts in the _____.

   (c) Gastric juice is produced in the _____.

   (d) Pancreatic juice comes from the _____.

   (e) Bile is made in the _____.

   (f) Intestinal juice is made in the _____.

   (g) Water is absorbed from undigested food in the _____.

   (h) Faeces are passed out of the body through the _____.

   (i) Absorption of digested food takes place through the _____.

4. Arrange the following activities in the correct sequence to show what happens when we breathe: [10]

   (a) The intercostal muscles relax.
   (b) The intercostal muscles contract.
   (c) The diaphragm relaxes.
   (d) The diaphragm contracts.

(e) The chest gets smaller.
(f) The chest gets larger.
(g) Air is sucked into the lungs.
(h) Air is forced out of the lungs.

5. Match the items of lists A and B. [10]

| | **A** | **B** |
|---|---|---|
| (a) | An amoeba reproduces by | forming buds |
| (b) | Fungi reproduce | swollen underground stem |
| (c) | A sea anemone | binary fission |
| (d) | A potato tuber is a | by spores |
| (e) | A cutting is | a stock and scion |
| (f) | Grafting needs | in ovaries |
| (g) | Ovules are produced | part of a stem |
| (h) | Sperm are produced | has cones |
| (i) | A pine tree | the resting period of a seed |
| (j) | Dormancy is | in testes |

6. Match the plant/animal to its adaptation. [10]

| | **Plant/Animal** | **Adaptation** |
|---|---|---|
| (a) | water plants | spines and hair on stem |
| (b) | swamp plants | grow on tree trunks |
| (c) | evergreens | special breathing roots |
| (d) | desert plants | air spaces in leaves and stems |
| (e) | epiphytes | waxy, needle-like leaves |
| (f) | whale | thick, scaly skin |
| (g) | lizard | layer of fat called blubber |
| (h) | mountain goat | thick fur coat |
| (i) | snow leopard | webbed feet |
| (j) | water birds | strong hoofs |


# Living organisms and their environment

## Teaching objectives:

- to explain that the study of interrelationships of organisms and their environment is called ecology, and the people who study ecology are called ecologists
- to explain that the living place of animals and plants is called habitat, and that there are many kinds of habitats
- to explain that the surroundings of plant or an animal is called environment
- to explain that different types of environment have distinct characteristics that animals and plants have to adapt to in order to survive
- to explain that animals depend on green plants for food and that green plants depend on the Sun's energy
- to explain that all living things are the food of other living things, and are eaten by decomposers when they die
- to explain that the elements in an ecosystem are recycled to maintain a balance in their proportions

## Teaching strategy:

Write the word ecology on the board. **Ask**: Do you know what it means? Explain that 'eco' means home and 'logos' means study. Ecology is the study of living organisms in their natural homes. An ecosystem includes the plants and animals and their immediate surroundings. So ecology is the study of interdependence of organisms and their environment. **Ask**: What does environment mean? Explain that environment means the surroundings of a living thing. Show the students pictures of bees, ants, or wasps living in a colony, animals living in a herd, a flock of birds, etc. Explain that when a group of plants and animals live together in the same area, they are called a community. A community is made up of many populations. A population is a particular kind of plant or animal that lives in a community. A farm community may have a population of horses, cows, etc.

Explain that the grasshopper eats grass. It is a primary consumer. A primary consumer is the first animal in a food chain that eats a plant. **Ask**: Can you think of other primary consumers? Explain that all herbivores are primary consumers. Animals that eat primary consumers are called secondary consumers in a food chain. If a frog eats a grasshopper and is then eaten by a snake, the snake would be the third consumer in the food chain. A hawk could eat the snake. The hawk would then be the fourth consumer in the food chain. When the hawk dies, other animals eat it, or bacteria and fungi turn the remains of the hawk into soil. The soil then becomes rich in minerals and nutrients to grow new plants. Draw a picture of the food chain marking it with arrows from the first to the fourth consumer. Tell the children to make food chains with pictures cut from magazines. Explain that all food chains start with the Sun, and the first living thing in a food chain is a green plant. A food chain

traces the chain of energy that transfers from plants, (that produce food) to animals, (that consume food) and then to other animals that consume these.

Draw a spider's web on the board. **Ask**: What happens when you shake the web? Explain that it bounces around but stays together. **Ask**: What happens to the shape of the web if one small strand breaks? Explain that the shape of the web changes slightly. **Ask**: What happens if a big strand breaks? Explain that a food web is like a spider web. Food web is a complex system in which animals can be in more than one food chain. For example, rabbits, squirrels and mice all eat plants. Rabbits are eaten by foxes and hawks. Squirrels are also eaten by foxes and hawks.

**Ask**: Can you name any other kinds of population? Show some pictures of busy, crowded streets. **Ask**: How do you feel being held up in traffic, or standing in a long line at the ticket office of a park or zoo? Explain that when a population of a community becomes too large, people begin to compete with each other for space and position. Only the strongest or fastest survive. **Ask**: What would happen if you plant twenty seeds in one pot? Explain that as the seeds sprout they will begin to compete for space, water, and sunlight. Some seeds will produce long stems with many leaves. Others will probably shrivel up and die. The strongest plants will grow best in the overpopulated pot. Show the students pictures of animals with protective parts like claws, teeth, beaks, hooves, etc. and plants with spines and thorns. Discuss the functions of each part. Explain that all living things grow and change to suit their environment. These changes are called adaptations. Adaptation means that a plant or animal changes to fit its environment so that it can survive. Species of animals or plants that cannot adapt will die or they might become extinct.

**Ask**: What did you eat for breakfast? Where did the bread come from? Where did the wheat for the bread come from? Explain that green plants are producers. They are able to make their own food from the Sun's energy. These plants provide food for animal. Animals are the consumers of food. Some animals eat other animals. Plant eaters are called herbivores and meat eaters are called carnivores. Show the students pictures of assorted animals. **Ask**: Can you guess what kind of food each animal eats? Animals that eat both plants and animals are called omnivores. Show the students a picture of a grasshopper, a frog, a snake and a hawk. Explain that the food chains are interlocked and interwoven like a spider web. Many food chains make up a food web. If one small chain in the food web breaks, not much damage is done. But if a major part of a chain is broken, a lot of damage can occur. The whole food web could collapse. Draw a food chain on the board.

**Ask**: Which organisms are the largest in numbers? Which organisms are biggest in size? Explain the pyramid of numbers. As the energy flows through a food chain, it is lost at every level. The position of an organism in a food chain is called its trophic level. The number of consumers at every trophic level decreases, whereas their size increases as they consume more of the organisms from the level below them. The transfer of energy is reduced at every level, and the amount of energy passed on to the fourth level is reduced to such an extent that it cannot support another population of consumers. **Ask**: How much oxygen, nitrogen, carbon dioxide, and water vapour is there in the atmosphere? What do living things use oxygen for? What do living things use carbon dioxide for? What do living things use nitrogen for? How do we use water? How does the level of all these elements remain constant in the atmosphere? How are they replaced? Explain the natural cycles of carbon, nitrogen, and water with diagrams and charts.

Summarize the lesson.

## Answers to Exercises in Unit 5

1. (a) The branch of biology which deals with the relationships between the living organisms themselves and with their surroundings is known as ecology. Scientists who study these interrelationships are called ecologists.

   (b) The two main types of environment are:

   (i) Natural environment: Animals live in such natural conditions for which they are best suited. Since their bodies are well adapted to these conditions they are found in one particular habitat. For example, squirrels are found in woodlands.

   (ii) Artificial environment: An environment which is created by man is called an artificial environment. Factors such as temperature, light, water and minerals are controlled to produce ideal conditions for the organisms to live. For example, zoos, aquariums, and greenhouses are artificial environment.

   (c) The important features of a natural environment are climate, soil, landscape, and other living organisms.

   (d) The place where animals and plants live is called habitat. All the things which affect the way of life of an organism are called its environment. A group of living things sharing a habitat is called a community. The number of creatures of the same kind living in a habitat are called population.

   (e) The characteristic features of an organism, which enable it to obtain everything that it needs from its habitat are called adaptation. The roots of desert plants spread out just below the surface of the ground. Their stems are thick and fleshy. There are spines and hair on the stems and leaves. Some trees have deep roots. Small animals hide under rocks and stones or in sand. They come out at night. Camels store food in their humps, and water in special pouches in their stomachs. Lizards have thick scaly skins.

   (f) A food chain comprises of a series of organisms, each dependent on the next as a source of food and energy. Herbivores are animals that eat plants like cow. Carnivores are animals that eat meat like lion. Omnivores are animals that eat both plants and animals like crow. Decomposers are bacteria and fungi which break down the bodies of dead plants and animals.

   (g) The position of an organism in a food chain is called its trophic level. Green plants usually occupy the first trophic level, herbivores the second and carnivores the third and fourth trophic levels. Most food chains do not have more than four trophic levels because some energy is lost at each level and a limit is reached by the fourth trophic level. The amount of energy available is reduced to such an extent that it cannot support another population of consumers.

2. (a) environment (b) squirrel (c) air spaces in leaves (d) feathers (e) omnivores

3. (a) air spaces in leaves and stems
   (b) special breathing roots
   (c) waxy, needle-like leaves
   (d) spines and hair on stem
   (e) grow on tree trunks
   (f) layer of fat called blubber
   (g) hibernates
   (h) stores food in its hump
   (i) thick scaly skin
   (j) strong hoofs
   (k) thick fur coat
   (l) scales and gills
   (m) webbed feet

4. Refer to Pupil's Book.

5. b, a, c

## Additional Exercise

MCQs

(a) Things which affect the way of life of an organism are called _____.

habitat environment community [***environment***]

(b) Which one of the following animals is warm-blooded?

Fish Frog Squirrel [***Squirrel***]

(c) Which one of the following is not an adaptation of desert plants?

Thick stem Deep roots Air spaces in the leaves

[***Air spaces in the leaves***]

(d) An adult frog breathes through its _____.

lungs gills fins [***lungs***]

(e) The body of a bird is covered with _____.

hair scales feathers [***feathers***]

(f) Animals that eat both plants and animals are called _____.

herbivores carnivores omnivores [***omnivores***]

(g) Many food chains are inter-connected to form a _____.

food cycle food chain food web [***food web***]

(h) The position of an organism in a food chain is called its _____.

water level trophic level tropic level [***trophic level***]

(i) At the base of every food chain, green plants are the _____.

producers consumers decomposers [***producers***]

(j) Bacteria and fungi which break down the bodies of dead plants and animals in the soil are called _____.

scavengers decomposers carnivores [***decomposers***]

# Lesson plan

Date: Time: 40 mins

| **Unit: 5**<br>**Topic: Living organisms and their environment** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Habitat and environment | • to define ecology and describe the work of an ecologist<br>• to define habitat, community, and population<br>• to define an ecosystem | • define ecology and explain what ecologists do<br>• explain the relationship between habitat, community, and population<br>• describe an ecosystem and what constitutes it | Pictures of different kinds of environment and habitat, and the kinds of organisms living there | Reading: p 39, 40<br>Activity: 1, 2<br>CW: Q1 (a)<br>HW: Q1 (d) |

**Key words**: habitat, environment, ecology, ecologist, community, population

**Method**: Write the word ECOLOGY on the board. **Ask**: Do you know what it means? Explain that 'eco' means home and 'logos' means study. Ecology means the study of living organisms in their natural homes. An ecosystem includes the plants and animals and their immediate surroundings. So ecology is the study of the interdependence of organisms and their environment. **Ask**: What does environment mean? Explain that environment means the surroundings of a living thing. It includes the physical conditions such as climate, soil, water, etc. It also includes the organisms living there.

**Ask**: What is a habitat? Explain that the physical conditions such as light, temperature, water, and soil which affect the lives of the animals and plants living in a particular place are called their habitat. Show the students pictures of bees or ants living in a colony, animals living in a herd, a flock of birds, etc. Explain that when a group of plants and animals live together in the same habitat, they are called a community. A community is made up of many different populations. A population is a particular kind of plant or animal that lives in a community. For example a farm community may have a population of horses, cows, etc. There are many different kinds of habitat such as woodland, grassland, river, coast, etc.

**Ask**: What is environment? Explain that all things that affect the way of life of a plant or animal are called its environment. Environment includes the physical conditions such as climate, soil, water, etc. and all the other organisms living in the same place.

**Ask**: What is an ecosystem? Explain that an ecosystem is a community of organisms together with the habitat in which they live. An ecosystem is made up of all the producers and consumers in a community, as well as the physical environment.

# Lesson plan

Date: Time: 40 mins

| **Unit: 5**<br>**Topic: Living organisms and their environment** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Types of environment | • to describe different types of environment<br>• to identify the important features of a natural environment | • describe various kinds of environment<br>• describe the important features of a natural environment | Pictures of different kinds of artificial and natural environment | Reading: p 40, 41<br>CW: Q1 (b)<br>HW: Q1 (c) |
| **Key words**: artificial environment, natural environment, climate, soil, landscape<br>**Method**: Show the students pictures of an aquarium and a zoo. Discuss why animals are kept there. Explain what an artificial environment is. **Ask**: What is a natural environment for frogs? For fish? For squirrels? Discuss the natural environment of different kinds of plant and animal. Discuss the important features of a natural environment. Explain that animals and plants live in the natural conditions for which they are best suited. | | | | |

# Lesson plan

Date: Time: 40 mins

| Unit: 5<br>Topic: Living organisms and their environment | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 3. Adaptations | • to explain how plants and animals are adapted to live in a particular environment | • explain how animals and plants are adapted to live in a particular environment | | Reading: p 42, 43, 44<br>CW: Q3<br>HW: Q1 (e) |

**Key words**: adaptation, desert, water, swamp, mountain, epiphyte, warm-blooded, cold-blooded, hibernate, forest, sea

**Method**: Show the students pictures of animals with protective parts such as claws, teeth, beaks, hooves, etc. and plants with spines and thorns. Explain how animals and plants use different parts of their bodies to protect themselves from their enemies and also to catch prey. Explain that all living things grow and change to suit their environment. These changes are called adaptations. Adaptation means that a plant or animal changes to fit its environment so that it can survive. Species of animals or plants that cannot adapt will die and may eventually become extinct. With the help of pictures in the book, discuss the kinds of adaptation in plants and animals living in different kinds of environment.

**Ask**: What is the meaning of warm-blooded? Cold-blooded? Explain that animals that have a constant body temperature are called warm-blooded. Human beings, all mammals, and birds are warm-blooded. Animals whose body temperature changes with the surroundings are called cold-blooded. Amphibians, reptiles, and fish are cold-blooded. Cold-blooded animals survive low environmental temperatures by hibernating. They hide in a warm place until the temperature becomes warm.

# Lesson plan

Date: Time: 40 mins

| Unit: 5<br>Topic: Living organisms and their environment | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 4. Food chains | • to describe a food chain<br>• to explain the trophic levels of a food chain<br>• to explain how energy flows through a food chain<br>• to define a food web | • describe a food chain<br>• explain the trophic levels of a food chain<br>• explain the flow of energy through a food chain<br>• explain how food chains are interconnected by food webs | Diagrams and charts of food chains, and food webs<br>Animal pictures | Reading: p 44, 45, 46<br>CW: Q5<br>HW: Q1 (f) (g) |

**Key words**: food chain, consumer, producer, herbivore, carnivore, omnivore, primary consumer, secondary consumer, decomposer, trophic level, pyramid of numbers, food web

**Method**: **Ask**: What did you eat for breakfast? What is bread made from? Where does the wheat for making bread come from? Explain that green plants are producers. They are able to make their own food using the Sun's energy. These plants also provide food for animals. Animals are called consumers of food. Some animals eat the flesh of other animals. They are called carnivores. Animals that eat plants are called herbivores. Animals that eat plants and animals are called omnivores. Show the students pictures of assorted animals.

**Ask**: Can you guess what kind of food each animal eats? Ask the students to make a food chain from the pictures shown. Explain that food chains are interlocked and interwoven like a spider's web. Many food chains make up a food web. If one small chain in the food web breaks, not much damage is done, but if a major part of the chain is broken, a lot of damage can occur. The whole food web could collapse.

Draw a food chain on the board. **Ask**: Which organisms are the largest in numbers? Which organisms are biggest in size? Explain the pyramid of numbers. The position of an organism in a food chain is called its trophic level. As energy flows through a food chain, some of it is lost at every level. The number of consumers at every trophic level decreases, whereas the size of the animals increases as they consume more of the organisms from the level below them. The transfer of energy is reduced at every level, and the amount of energy passed on to the fourth level is reduced to such an extent that it cannot support another population of consumers.

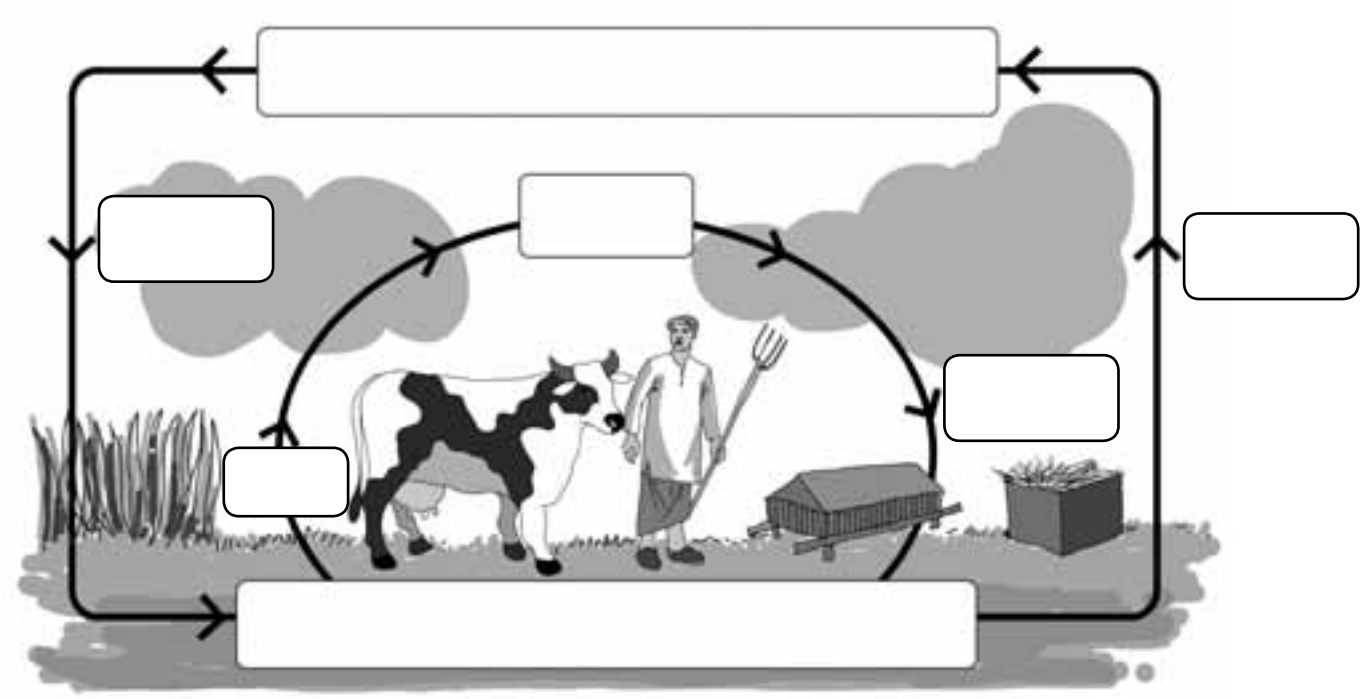
# Lesson plan

Date: Time: 40 mins

| **Unit: 5**<br>**Topic: Living organisms and their environment** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 5. Natural cycles of elements | • to explain the natural cycles of elements | • describe the natural cycles of elements<br>• explain their role in the environment | Diagrams and charts of the carbon cycle, water cycle, nitrogen cycle | Reading: p 46, 47, 48<br>Activity: Draw diagrams of the water cycle and the nitrogen cycle.<br>CW: Q4 |
| **Key words**: natural cycle, water cycle, nitrogen cycle, nitrogen-fixing bacteria, nitrate, plant protein, animal protein, denitrifying bacteria, carbon cycle, carbon dioxide<br><br>**Method**: **Ask**: How much oxygen, nitrogen, carbon dioxide and water vapour are there in the atmosphere? What do living things use oxygen for? What do living things use carbon dioxide for? What do living things use nitrogen for? How do we use water? How does the level of all these substances remain constant in the atmosphere? How are they replaced?<br><br>Explain the natural cycles of carbon, nitrogen, and water with the help of diagrams and charts. | | | | |

Name: _____ Date: _____

1. Fill in the spaces on the diagram to describe the nitrogen cycle:



2. Use the following food chains to make a food web:

   grass ⟶ grasshopper ⟶ praying mantis ⟶ eagle

   grass ⟶ beetle ⟶ frog ⟶ snake ⟶ eagle

   grass ⟶ beetle ⟶ sparrow ⟶ eagle

   From your food web, write the names of:

   a producer _____

   primary consumers _____, _____, _____

   secondary consumers _____, _____, _____

   a tertiary consumer _____

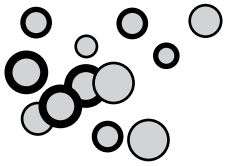
Name: _____ Date: _____

Q. Fill in the blanks to complete the description of the flow of energy through food chains.

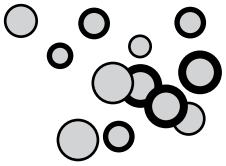
The position of an organism in a food chain is called its _____. Green plants usually occupy the _____ trophic level. The second trophic level is occupied by _____. The third trophic level is occupied by _____.

Most food chains do not have more than _____ trophic levels, because _____ is lost at each level and cannot be passed on to the next level. Some of this is lost as _____ and some of the food that is eaten remains undigested. The amount of energy at the fourth trophic level is reduced to such an extent that it cannot support another population of _____.

In a food chain, organisms at the base are _____ in size, but _____ in number, while the successive groups of consumers show a progressive _____ in size and a _____ in number. This relationship can be represented by a chart known as the _____ of numbers.



# UNIT 6



# Water

## Teaching objectives:

- to explain the occurrence of water in nature
- to explain the chemical nature of water
- to explain the water cycle
- to explain the states in which water exists and describe how water changes its states
- to explain the test for the purity of water
- to describe the types of water and discuss why hard water is harmful
- to describe the properties of pure water
- to describe the impurities found in water and explain how drinking water is purified
- to explain how water is distilled in the laboratory
- to explain how water becomes polluted and the harmful effects of water pollution

## Teaching strategy:

**Ask**: What is water? How do we use water? From where do we get water? How does water reach a well? Explain the occurrence of natural water. Write the chemical formula of water on the board. Explain that it is made up of two gases, hydrogen and oxygen. **Ask**: What impurities are found in river water? How do these impurities reach river water? Explain how harmful substances flow in the river water and reach the sea. **Ask**: How do fish breathe? From where do aquatic animals get oxygen? Explain that oxygen dissolves in water, and is used by fish and aquatic animals.

Wipe the board with a wet sponge. **Ask**: How long will the board stay wet? Will the board dry by itself? Does it have to be wiped dry? Where will the water on the board go? Can you see the water as it leaves the board? Explain that when the water goes into the air it is called water vapour. Water vapour is invisible. The process of water going into the air is called evaporation. **Ask**: Where does the water from puddles go after a rain? How do wet clothes become dry? Place some ice cubes into a glass or an empty tin can. Add some water, so that the glass or can is 3/4 full. Let it stand for about ten minutes. **Ask**: What can you see on the outside of the glass or can? Where did the water come from? Explain that the water droplets came from the air. Air contains a lot of vapours that we cannot see. It is called water vapour. When water vapour condenses into droplets we can see it. This process is called condensation.

Tell the children you're going to make rain. Pour a cup of very hot water into a large empty pyrex jar to make a lot of steam. Place a tin can filled with ice cubes on top of the jar. **Ask**: What can you see inside the jar? Explain that the heat inside the jar warms the air. The warm moist air in the jar begins to look like steam. The steam condenses and turns into water vapour. As the droplets of water become larger and heavier they form a cloud. Large droplets form on the cold bottom of the tin can. They will begin to roll down the sides of the jar or just drop as rain.

Show the students the water cycle chart. Explain the water cycle. **Ask**: What happens to the water in the oceans? Where does the water in the oceans come from? What happens to the water when it evaporates? Does new water fall from the sky or is it the same water that fell before? Put some ice cubes in a beaker. Take the temperature of the ice cubes. Write it on the board. Heat the water. Take the temperature of the liquid water, when it begins to boil. Write it on the board. **Ask**: What can you see in the beaker? Explain the change of state due to heat, and the freezing and boiling points. Hold a cold saucer over the steam coming from the boiling water. **Ask**: What is happening? Explain the process of condensation and evaporation.

**Ask**: What do you think will happen to the boiling point of water if we add some salt to the water? Explain that impurities lower the boiling point. Take some copper sulphate crystals in a china dish. Show the students the blue colour of the crystals. Heat the dish. The copper sulphate crystals will crumble to a white powder. Show it to the students. Now add a drop of distilled water to the white powder. The blue colour will reappear. Explain that this is a test for water. **Ask**: Have you been to a hill station? What happens when you rub soap on your hands to wash? Explain that water which does not form lather with soap is called hard water. Hardness of water is due to some chemicals dissolved in the water. As rainwater passes through rocks, some chemicals get dissolved in it, which make the water hard. Explain that one way to make hard water soft is by boiling it.

**Ask**: How can we clean dirty water? Demonstrate and explain filtration of muddy water. Also explain the purification of drinking in a filtration plant by a chart. Explain the process of distillation with the help of a chart. **Ask**: Will distilled water have impurities in it? Why? How do we use water? In what other ways is water used? Explain the uses of water. Discuss water pollution in the class. Explain that when water is polluted, the animals that drink the polluted water become sick, and sometimes die. If water is filtered and then dumped into rivers and lakes, it helps keep the water cleaner. Oil spills in the ocean kills birds, fish, and plants. Discuss ways in which we can improve the environment and reduce pollution.

Summarize the lesson.

## Answers to Exercises in Unit 6

1. (a) Water is a compound of oxygen and hydrogen. Its chemical formula is $H_2O$.

   (b) Fish and other water animals can breathe in water because it contains dissolved air.

   (c) Pure water boils at 100°C and freezes at 0°C at normal atmospheric pressure. Pure water turns white copper sulphate powder blue.

   (d) Hard water does not form lather with soap easily.

   (e) Hardness of water is due to some chemicals that get dissolved in rainwater when it falls on rocks.

   (f) Properties of pure water:

      (i) It has no colour, taste, or smell.

      (ii) It freezes at 0°C.

      (iii) It boils at 100°C.

(iv) It is a bad conductor of electricity.

(v) It is a very good solvent.

(vi) It reacts with many metals and non-metals.

(g) The common impurities in water are: bacteria, mud, sand, mineral salts, and the remains of dead plants and animals.

(h) Water can be purified in the laboratory by distillation in an apparatus called a Liebig condenser.

(i) Water becomes polluted by:

(i) dirty water from our houses and farms

(ii) liquid wastes from factories

(iii) oil spills from oil tankers in the seas

2. (a) 3/4 (b) $H_2O$ (c) taste, smell (d) filtration
   (e) Chlorine (f) Soft (g) chemicals (h) boiling

3. Unwanted and harmful substances in the water cause water pollution. Dirty water from our houses and farms contains germs that can cause diseases in humans and animals. If this water drains into a river, the river water becomes polluted. Waste liquid from factories is dumped into rivers. It contains dangerous chemical substances which may not kill fish but are stored in their bodies. They can poison humans if they eat them.

   Oil pollution is caused by oil spills from oil tankers at sea. It kills seabirds by poisoning them and by clogging up their wings, so that they cannot fly to find food. Oil also kills all forms of life on rocks, in the mud, and on beaches.

4. Refer to Pupil's Book.

## Additional Exercise

MCQs

(a) The boiling point of pure water in degrees Centigrade is _____.

0 50 100 [***100***]

(b) Green plants need water for _____.

digestion respiration photosynthesis [***photosynthesis***]

(c) Water becomes hard due to the presence of dissolved _____.

sand rock chemicals [***chemicals***]

(d) Chlorine is added to water in a water purification plant to _____.

kill germs remove hardness filter it [***kill germs***]

(e) What percentage of water covers the Earth? _____.

50% 75 % 100 % [***75%***]

(f) The purest form of water is _____.

drain water sea water rain water [***rain water***]

(g) Unwanted and harmful substances in the water cause _____.

air pollution water pollution land pollution [***water pollution***]

(h) Which kind of pollution is harmful for marine life in the sea? _____.

Oil pollution Air pollution Land pollution [***Oil pollution***]

(i) The movement of water between the sea, the land, and the atmosphere is called _____.

hydrogen cycle oxygen cycle water cycle [***water cycle***]

(j) Water can be purified in the laboratory by a process called _____.

filtration distillation evaporation [***distillation***]

# Lesson plan

Date: Time: 40 mins

| Unit: 6<br>Topic: Water | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. Water | • to explain what constitutes water<br>• to explain the water cycle<br>• to explain the properties of pure water | • explain the occurrence of water<br>• state the chemical formula of water<br>• explain the water cycle<br>• list the properties of pure water<br>• test the purity of water | Charts of the water cycle, diagram of the water molecule, beaker, burner, stand, thermometer | Reading: p 53, 54<br>Activity: 1<br>Experiment: Test for pure water [p 53]<br>CW: Q1 (a) (b)<br>HW: Q1 (f) |

**Key words**: water, hydrogen, oxygen, water cycle, property, copper sulphate

**Method**: **Ask**: What is water? How do we use water? From where do we get water? How does water reach a well? Explain the occurrence of natural water. Write the chemical formula of water on the board. Explain its composition. **Ask**: What impurities are found in river water? How do these impurities reach the rivers? Explain how harmful substances from our homes, farms, and factories flow into the river and then reach the sea.

**Ask**: How do fish breathe? From where do aquatic animals get oxygen? Explain that oxygen is slightly soluble in water and is used by fish and other water animals.

Show the students a diagram of the water cycle. Explain how water is recycled in nature. Put some ice cubes in a beaker. Record the temperature of the ice cubes. Heat the ice until it turns into water and starts boiling. Record the temperature of the boiling water. **Ask**: What do you think will happen to the boiling point of water if we add some salt to it? Explain that impurities in water lower the boiling point. Describe the properties of pure water.

Describe the tests for pure water and perform the experiments on pages 53 and 58.

# Lesson plan

Date: Time: 40 mins

| Unit: 6<br>Topic: Water | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Types of water | • to describe types of water<br>• to explain the causes of hardness of water | • identify different types of water<br>• explain the causes of hard water | Diagrams and charts of hard and soft water | Reading: p 54, 55<br>CW: Q2<br>HW: Q1 (d) (e) |
| **Key words**: soft water, hard water, temporary hardness, permanent hardness, calcium hydrogen carbonate, limestone, chalk, calcium carbonate<br><br>**Method**: **Ask**: Have you been to a hill station? What happens when you rub soap on your hands to wash them? Explain that water which does not form lather with soap is called hard water. The hardness of water is caused by some chemicals dissolved in it. As rainwater passes through rocks some chemicals dissolve in it which makes the water hard. Explain the different types of hard water. Explain that one way to make hard water soft is by boiling it. Permanent hardness can be removed by adding chemicals to hard water to make it soft. | | | | |

# Lesson plan

Date: Time: 40 mins

| **Unit: 6**<br>**Topic: Water** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Impurities in water | • to describe the impurities in water<br>• to explain the ways by which water can be purified | • describe the impurities in water<br>• describe the methods by which water can be purified | Charts and diagrams of a water filtration plant, a Leibig condenser, a round bottom flask, a thermometer, a conical flask | Reading: p 55, 56<br>Activity: 2, 3<br>CW: Q4<br>HW: Q1 (g) (h) |

**Key words**: bacterium, mineral salt, distillation, Leibig condenser, sedimentation tank, chlorine, pump, storage tank, filtration plant

**Method**: **Ask**: How can dirty water be purified? Demonstrate the filtration of muddy water in the laboratory. Set up the apparatus used for distillation in the laboratory and describe the process. Explain that distilled water is the purest form of water. It is produced by the process of evaporation and condensation, rather like the water cycle. Rainwater is also the purest natural form of water, but it becomes impure as it passes through the atmosphere where gases, smoke, dust particles, and bacteria get mixed with it.

Show the students a diagram of a filtration plant. Explain that the water that reaches our homes is filtered and cleaned in a filtration plant.

# Lesson plan

Date: Time: 40 mins

| **Unit: 6**<br>**Topic: Water** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Uses of water<br>Ways to reduce wastage of water<br>Water pollution | • to identify the uses of water<br>• to discuss ways to save water<br>• to explain water pollution | • identify the ways we use water<br>• explain why we must save water and suggest ways of doing so<br>• explain how water pollution is caused and assess its impact | Charts and diagrams of the uses of water, water pollution | Reading: p 56, 57<br>CW: Q1 (i)<br>HW: Q1<br>Q3 |

**Key words**: use, wastage, water pollution

**Method**: **Ask:** Will distilled water contain impurities ? Why? How do we use water? In what other ways is water used?

Discuss the domestic and commercial uses of water. Discuss water pollution. Explain that when water becomes polluted it can make animals and human beings sick. If water is filtered and then dumped into rivers and lakes, it helps to keep the water cleaner. Oil spills in the ocean kill birds, fish, and plants. Discuss the ways in which water pollution can be reduced and the ways in which we can reduce pollution and improve the environment.

Name: _____ Date: _____

Q. Underline the correct word(s) in the sentences below.

a. Water is a chemical / physical substance which is found in abundance on the Earth.

b. Two-thirds / three-quarters of the Earth's surface is covered with water.

c. Water is a combination of hydrogen and oxygen / hydrogen and nitrogen.

d. Rainwater is the dirtiest / purest form of natural water.

e. When water falls through the atmosphere many gases / solids are dissolved in it.

f. As rainwater sinks into the ground, it dissolves many minerals / gases.

g. Sea water / River water contains a lot of suspended and dissolved impurities and is therefore unfit for drinking.

h. Fresh water contains dissolved air / dust particles, which are used by water plants and animals for breathing.

Name: _____ Date: _____

1. Explain how water is used:

   a. by animals and plants _____

   _____

   b. by human beings _____

   _____

   c. in industry _____

   _____

   d. in agriculture _____

   _____

   e. for generating electricity _____

   _____

   f. for travel and transport _____

2. List five ways in which water becomes polluted.

_____

_____

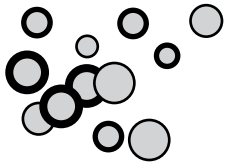
_____

_____

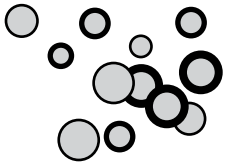
_____

_____

_____



# UNIT 7



# Composition of matter

## Teaching objectives:

- to explain the structure of an atom
- to explain the difference between atomic number and mass number
- to describe the atomic configuration of the first 18 elements in the periodic table
- to define valency
- to explain the formation of ions
- to describe isotopes and explain their uses
- to explain the formation of ionic and covalent bonds
- to explain the types and number of elements in simple molecules and compounds
- to explain the chemical formulae of some compounds
- to explain the law of constant composition and verify it, using examples

## Teaching strategy:

Draw an atom on the board. Ask the students what they know about an atom? What is everything around us made of? Explain the composition of matter and describe the structure of an atom. Every atom is thought to be made up of a nucleus containing protons and neutrons. The nucleus is surrounded by a cloud of electrons. Protons carry a positive charge; electrons carry a negative charge while neutrons do not have any charge. Explain the distribution of electrons in the various shells of an atom.

**Ask**: How can you write your name in shorthand? Explain that a symbol is a way of writing the names of symbols in shorthand. Discuss the various ways in which symbols can be written. Also discuss the Latin and Greek names of elements and their symbols.

**Ask**: What happens when lots of atoms of the same kind join up? Explain the structure of elements as being made up of the same kind of atom. Show the students samples of different elements. Ask them to name some elements. Draw the atomic model on the board and explain the different particles and the charges on them. Explain the distribution of electrons in the shells and how ions are formed when electrons are given or taken by atoms. Ask the students to draw diagrams showing the structures of some atoms. Explain what atomic number and mass number mean. Discuss the formation of ionic and covalent bonds.

**Ask**: What will happen to a piece of coal if we keep on pounding it? Explain that the smallest particle that you get will still be coal or to be more exact carbon. Discuss what an element is and display a chart of the first twenty elements of the periodic table and ask the students to write the number of proton, electrons, neutrons, and the mass number of each element. Discuss isotopes as being heavier atoms of certain elements. Discuss how isotopes are useful in experiments and

diagnosis of diseases. **Ask**: What is a compound? Discuss the formation of compounds on the basis of joining up of atoms. Explain valency as the combining capacity of atoms to make compounds. Discuss the types of bonds that help to make compounds. Explain the methods of writing formulae of compounds.

Summarize the lesson.

## Answers to Activities

1.

| Compound | Atoms in it | Formula | Ratio of the atoms |
|---|---|---|---|
| carbon dioxide | carbon, oxygen | $CO_2$ | 1:2 |
| ammonia | nitrogen, hydrogen | $NH_3$ | 1:3 |
| sodium chloride | sodium, chlorine | NaCl | 1:1 |
| calcium oxide | calcium, oxygen | CaO | 1:1 |
| methane | carbon, hydrogen | $CH_4$ | 1:4 |

2.

| Element | Number of electrons in each shell | | | |
|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th |
| hydrogen | 1 | - | - | - |
| carbon | 2 | 4 | | |
| nitrogen | 2 | 5 | - | - |
| oxygen | 2 | 6 | - | - |
| sodium | 2 | 8 | 1 | - |
| magnesium | 2 | 8 | 2 | - |
| aluminium | 2 | 8 | 3 | - |
| chlorine | 2 | 8 | 7 | - |
| potassium | 2 | 8 | 8 | 1 |
| calcium | 2 | 8 | 8 | 2 |

4. (a) A B E (b) D (c) C (d) B E

(e) A magnesium
B Isotope of magnesium
C magnesium positive Ion
D oxygen negative ion
E isotope of flourine

5. (a) The gas is ammonia.
(b) Its formula is $NH_3$.
(c) Covalent bond
(d) Water

## Answers to Exercises in Unit 7

1. (a) An atom is made up of tiny particles called electrons, protons, and neutrons. Electrons are negatively charged particles that revolve around the nucleus in a specific path called an orbit. Protons are positively charged particles found in the nucleus of an atom. Neutrons are neutral particles which are also present in the nucleus. The mass of a neutron is equal to the mass of a proton.

   (b) (i) An element is a substance that is made up of the same kinds of atoms. For example, the element carbon is made up of carbon atoms only.

   (ii) C, N, H, O, S, P, Ca, Cl

   (iii) Scientists sometimes call the valency the 'combining power' of an element. Depending on the arrangement of electrons around a nucleus, atoms of different elements may tend to 'lose' or 'gain' electrons. If this tendency is strong, then the element is reactive or unstable. If it is weak, the element is unreactive or stable.

   The valency of an element depends on the number of electrons the element has in its outermost shell. If an element has four or fewer electrons in its outer shell, then the number of electrons is the same as the valency. If the element has more than four electrons, its valency is eight minus the number of electrons.

   (c) When two or more atoms combine chemically, they form a compound. For example, hydrogen and oxygen combine chemically to form water.

2. (a) Ionic bond

   (b) Covalent bond

3. (a) atoms (b) Protons (c) electron (d) atomic number
   (e) mass number (f) 2 (g) 8 (h) chemical bond
   (i) positive

4. (a) The proton is a positively charged particle which is present in the nucleus of an atom.

   An electron is a negatively charged particle which revolves around the nucleus of an atom in a specific path called an orbit.

   (b) The chemical names of elements written in abbreviated form are called symbols; usually the first letter or the first two letters of the name of the element are used. Sometimes the first or the first two letters of the Latin or Greek names of elements are used.

   The molecule of a substance written in symbols is called a chemical formula.

   (c) The number of protons in an atom is called is atomic number. The oxygen atom has 8 protons so its atomic number is 8.

   The sum of the number of protons and neutrons in an atom is called its mass number or atomic mass. A carbon atom has 6 neutrons and 6 protons, so its mass number is 12.

   (d) An atom is a tiny indivisible particle of which all matter is composed. It is made up protons, neutrons, and electrons.

   A molecule is made up of two or more than two atoms which are held together by chemical bonds. The atoms in a molecule may be of the same or of different elements joined together.

(e) An element is a substance that is made of only one kind of atom. Sodium is made of sodium atoms only so it is an element. Carbon, mercury, iron, copper, etc. are all elements. Altogether 117 different elements are known. Of these, 90 have been obtained from the Earth's crust and atmosphere, and 23 have been artificially made by scientists.Every element has a name and a symbol.

A compound is formed when two or more atoms join together in a chemical reaction. The atoms from the elements are held together by forces which scientists call chemical bonds.Water is a compound. It is made up of water molecules. In the same way sodium chloride (common salt) is formed by the joining up of sodium and chloride ions.

(f) In an ionic bond, the electrons are either given to or received from atoms. The atoms become charged particles called ions. When an atom gives away electrons it becomes a positive ion. When an atom receives electrons it becomes a negative ion. Ions are held together by electrostatic forces

When two atoms react together and both of them need to gain electrons in order to reach the number of electrons to complete their outer shells, they do so by sharing electrons between them.

Because the atoms share electrons, there is a strong force of attraction between them. This force is called a covalent bond. The bonded atoms form a molecule.

(g) Refer to (b)

(h) An element is a substance that is made of only one kind of atom. Sodium is made of sodium atoms only so it is an element. Carbon, mercury, iron, copper, etc. are all elements. Altogether 117 different elements are known. Of these, 90 have been obtained from the Earth's crust and atmosphere, and 23 have been artificially made by scientists.

Atoms of one element all have the same number of protons and electrons but they do not necessarily have the same number of neutrons. Atoms of the same element, with the same number of protons but different numbers of neutrons are called 'isotopes' of that element. They behave in an unusual way that has nothing to do with their electrons. Most elements have more than one isotope, chlorine has two, carbon has three isotopes.

5. Individual work

6. Plants absorb some carbon-14 atoms from the carbon dioxide in the air during the process of photosynthesis. When a plant or animal dies it takes in no more carbon atoms. The carbon-14 atoms in it slowly decay. By measuring the radiation from them, the age of the dead remains can be worked out.

7, 8, 9 Individual work

10.

| **Latin names** | **Symbols** |
|---|---|
| Cuprum | Cu |
| Argentum | Ag |
| Aurum | Au |
| Hydrargyrum | Hg |
| Ferrum | Fe |
| Kalium | K |
| Natrium | Na |
| Plumbum | Pb |
| Stannum | Sn |

## Additional Exercise

MCQs

(a) The nucleus of an atom contains _____.

electrons and neutrons | protons and electrons | protons and neutrons

[***protons and neutrons***]

(b) Electrons in an atom have _____.

a positive charge | negative charge | no charge [***negative charge***]

(c) The number of protons in an atom is called _____.

atomic number | mass number | electronic number [***atomic number***]

(d) The number of electrons in an atom is _____ the number of protons.

greater than | equal to | less than [***equal to***]

(e) A molecule is composed of two or more _____.

electrons | protons | atoms [***atoms***]

(f) A compound is formed when two or more atoms are combined _____.

physically | chemically | electronically [***chemically***]

(g) Isotopes are _____ atoms of the same element.

heavier | lighter | equal [***heavier***]

(h) _____ is the combining power of an atom.

Tendency | Valency | Accuracy [***Valency***]

(i) The name of a chemical compound written in symbols is called _____.

chemical equation | chemical reaction | chemical formula

[***chemical formula***]

(j) We can find out the _____ of a compound by the number of atoms and their ratios.

formula | name | valency [***formula***]

# Lesson plan

Date: Time: 40 mins

| Unit: 7<br>**Topic: Composition of matter** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Structure of an atom | • to describe the structure of an atom<br>• to explain the distribution of electrons in an atom<br>• to explain atomic number and mass number | • describe the structure of an atom<br>• explain the distribution of electrons in an atom<br>• define mass number and atomic number | Diagrams and charts of atoms | Reading: p 61, 62, 63<br>Activity: 2<br>CW: Q5<br>HW: Q1 (a) (b)<br>Q9 |

**Key words**: atom, electron, proton, neutron, nucleus, atomic mass unit

**Method**: Draw a diagram of an atom on the board. Ask the students what they know about an atom.

Describe the structure of an atom. Every atom is thought to be made up of a nucleus containing protons and neutrons. The nucleus is surrounded by a cloud of electrons. Protons carry a positive charge, electrons carry a negative charge, while the neutrons do not have any charge on them. Explain the arrangement of electrons in the various shells of an atom, using the formula $2\mathbf{n}^2$ , where '**n**' is the number of the shell. eg. First shell : $2 \times \mathbf{1}^2 = 2$ electrons

Second shell : $2 \times \mathbf{2}^2 = 8$ electrons

Third shell : $2 \times \mathbf{3}^2 = 18$ electrons, and so on.

The last shell can hold only up to eight electrons. Help the students to practice drawing the electronic configuration of different atoms. Explain that the distribution of electrons in the various shells of an atom is called its electronic configuration.

Draw a sodium atom on the board. Explain that the number of protons in an atom is called its atomic number, whereas the sum of the protons and neutrons in the atom is called its atomic mass. Explain the ways of writing the atomic number and the atomic mass of an atom.

# Lesson plan

Date: Time: 40 mins

| Unit: 7<br>Topic: Composition of matter | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Elements | • to define an element<br>• to explain the symbols, and the number of particles in atoms<br>• to define isotopes<br>• to explain the uses of radiation | • define an element<br>• write the symbols, atomic number, and mass number of atoms and be able to draw diagrams of them<br>• explain what isotopes are and list the uses of radiation | A chart of the first twenty elements of the periodic table | Reading: p 63, 64<br>Activity: 3<br>CW: Q1 (b) (i) (ii)<br>HW: Q6, Q10 |

**Key words**: element, decay, isotope, radiation

**Method**: **Ask**: Can you write your name in shorthand? Explain that a symbol is a shorthand way of writing the name of an element. Discuss the various ways in which symbols can be written. Also discuss the Latin and Greek names of elements and their symbols.

**Ask**: What happens when lots of atoms of the same kind join up? Explain that elements are made up of the same kind of atom. Show the students the chart of the first twenty elements of the periodic table and discuss their atomic structures.

**Ask**: What is an isotope? Explain that atoms are not always identical. Atoms having the same number of protons and electrons, but different numbers of neutrons are called isotopes of that element. They behave differently from the normal atoms of the same element. Discuss the behaviours of isotopes and the process of decay in the carbon-14 isotope. Carbon-14 is said to be radioactive. When it decays it gives out radiation from its nucleus.

Discuss the uses of radiation.

# Lesson plan

Date: Time: 40 mins

| **Unit: 7**<br>**Topic: Composition of matter** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Valency<br>Formation of ions | • to explain valency<br>• to explain how ions are formed | • explain valency<br>• describe the formation of ions | Diagrams of the structure of atoms, table of valencies of atoms | Reading: p 65, 66<br>Activity: 4<br>CW: Q3<br>HW: Q1 (b) (iii), Q7 |

**Key words**: valency, ion, cation, anion, ionic bond

**Method**: **Ask**: How do atoms join up with each other? Explain that the combining power of an element is called its valency. The valency of an element depends on the number of electrons in the outermost shell of an atom. With examples of elements in the periodic table, explain the valency of elements. If an atom has one electron in its outermost shell its valency is 1+. If an atom has 7 electrons its valency is 1- because it is one electron short of the 8 electrons that an atom can hold in its outermost shell. Discuss how valency can be used to work out the chemical formulae of compounds.

**Ask**: What is an ion? Explain that when atoms lose or gain electrons, ions are formed. With diagrams on the board explain how negative and positive ions are formed. Negative ions are called anions and positive ions are called cations. Discuss the formation of ionic bonds with examples.

# Lesson plan

Date: Time: 40 mins

| **Unit: 7**<br>**Topic: Composition of matter** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Molecules and compounds | • to explain how molecules and compounds are formed<br>• to explain what a covalent bond is<br>• to explain the law of constant composition<br>• to explain how the formulae for compounds are worked out | • explain how molecules and compounds are formed<br>• explain the formation of a covalent bond<br>• state the law of constant composition<br>• describe the method for working out the formulae of compounds | Charts and diagrams of atoms and molecules, the formation of covalent bonds, examples of the law of constant composition, formulae of compounds | Reading: p 66, 67<br>Activity: 1, 5<br>CW: Q2, Q8<br>HW: Q1 (c), Q4 |
| **Key words**: molecule, compound, covalent bond, law of constant composition, formula<br><br>**Method**: **Ask**: What is a compound? Discuss the formation of ionic and covalent compounds, with diagrams on the board. Explain the role of valency in the joining of atoms in different ways. Discuss the types of bond that form compounds. Explain the methods of working out and writing the formulae of compounds. | | | | |

Name: _____ Date: _____

1. Write the valency of each of the following elements.

| **Element** | **Valency** |
|---|---|
| hydrogen | |
| calcium | |
| aluminium | |
| carbon | |
| sodium | |
| oxygen | |
| nitrogen | |
| chlorine | |
| magnesium | |

2. Use the valencies to write the chemical formulae of the following compounds:

| **Compound** | **Valencies of elements in the compound** | **Formula** |
|---|---|---|
| sodium chloride | | |
| carbon dioxide | | |
| aluminium chloride | | |
| nitrogen oxide | | |
| carbon monoxide | | |
| magnesium chloride | | |

Name: _____ Date: _____

Write the names of the elements represented by the following symbols:

Cu _____

Pt _____

K _____

Ag _____

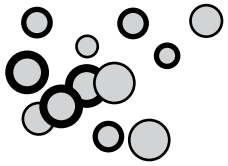
Hg _____

Na _____

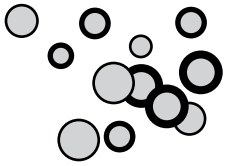
Au _____

Fe _____

Pb _____



# UNIT 8



# Changes in matter

## Teaching objectives:

- to explain the difference between physical and chemical changes
- to explain physical and chemical changes taking place in the environment
- to describe the characteristics of a chemical change
- to explain the difference between exothermic and endothermic reactions
- to explain the different types of chemical reactions
- to explain how raw materials can be changed into useful products

## Teaching strategy:

**Ask**: Have you ever changed a material so that it had different characteristics? What did you do to it? How was it different? Explain that changes in materials are going on around us all the time. Most of the changes in materials are of two main kinds. In one kind of change the volume of the state of the material is changed. We call this a physical change. In the other kind, one material is changed into another material. We call this a chemical change. Explain that when a physical change takes place, a material is changed in size or form without actually becoming another material. If we stretch or squeeze a piece of soft rubber, we change its size, but it is still rubber. It springs back when we let it go. When sugar dissolves in water it changes form from a solid to a liquid, but it is still sugar. **Ask**: Can you describe some other physical changes? Discuss other physical changes such as the melting of ice. The freezing of water, drying of wet things, etc.

**Ask**: What happens when we burn a piece of paper? Can we get back the paper in its original form? Explain that when a chemical change takes place, a material is changed into one or more different materials. When we hold a piece of paper close to a lighted match the paper catches fire and burns. A flame is seen, some smoke and then nothing but ashes. **Ask**: Where has the paper disappeared to? Can we get the paper back? Explain that such a reaction cannot be reversed. We cannot get back the paper we have burnt. Similarly, other chemical changes occur when wood rots, iron rusts, milk sours, and cloth fades.

Ensure that the students understand the difference between a physical and chemical change. Discuss physical and chemical changes in everyday life. Explain that frying an egg is a one-way reaction. Once it has been fried it is impossible to change back into a raw egg. The burning of fuel is another one-way reaction. Many chemical reactions are of this type. Reactions which are one-way are called 'irreversible reactions'. **Ask**: Are all reactions irreversible? Explain that there are some changes which can be reversed. A simple example is the physical change when ice is heated to form water. The water can be changed back into ice. Write the equation on the board. Explain that this change can be written as an equation. This is called a reversible reaction. The symbol for this is à ß.

**Ask**: How can chemical reaction help to produce useful products? Discuss the various chemical reactions used in industry to make fertilizers, plastics, margarine, soaps, and detergents, etc. Help the students to make soap in the laboratory.

**Ask**: What are fossil fuels? How are fossil fuels extracted from the ground? Discuss the formation of fossil fuels and the extraction of coal, oil, and natural gas. If possible take the students to an oil refinery and show them how crude oil is refined. Draw a fractionating column on the board and explain how the different fractions are separated.

Summarize the lesson.

## Answers to Exercises in Unit 8

1. (a) When no new chemical substance is formed, a change is called a physical change. Physical changes are easy to reverse.

When iron rusts, or a candle burns, new chemical compounds are made. It may be impossible to reverse the process. These types of changes are called chemical changes or chemical reactions.

(b) In a chemical reaction the following things happen:

- A new substance is made
- Energy is either given out or taken in
- The change is almost impossible to reverse

Although the atoms of each element combine in different ways, the same atoms that were present at the start are there at the end of the reaction. Because of this, the total mass of the substances remains the same.

(c) There are some reactions which can be reversed. A simple example is the physical change when ice is heated to form water. The water can be changed back into ice. Another reversible change is the heating of blue copper sulphate. It decomposes to give white copper sulphate powder and water vapour.

(d) A fertilizer is a combination of elements that a plant needs in order to grow strong and healthy. A good fertilizer contains the elements needed to promote healthy growth in plants. It must also be cheap to produce and soluble in water.

(e) In industry, ammonium nitrate is made by reacting ammonia with nitric acid.

(f) A plastic is a synthetic material which can easily be shaped. Plastics are usually tough and versatile. They are very good electrical insulators. They can be spun into fibres to make clothes and carpets, or moulded to make objects such as cups or chairs.

Plastics are polymers. Polymers contain very large molecules that are made by adding together many small molecules called monomers. Some familiar polymers are polyethene, polystyrene, and poly vinyl chloride (PVC). Nylon, Perspex, and Terylene are the common names of some other important plastics.

| | |
|---|---|
| polyethene | plastic bags |
| polystyrene | ball-point pens |
| PVC | hose pipes |
| Nylon | rope, clothing |

| | |
|---|---|
| Terylene | clothing |
| (polyester) | phenolic resins saucepan handles |
| Perspex | rulers |
| Bakelite | electrical fittings |

(g) Crude oil is called a fossil fuel because it was made from fossils of animals that lived in the sea millions of years ago. Hundreds of millions of years ago, while ancient forests were starting to form coal on the land, other fossil fuels were being made under the sea. We use them now as oil and natural gas.

(h) petrol, kerosene

(i)

| | |
|---|---|
| solid fuels | wood, coal |
| liquid fuels | petrol, kerosene |
| gaseous fuels | methane, butane |

(j) Some of the fats and plant oils can be turned into valuable food such as margarine. The oil for making margarine comes from the seeds of plants such as sunflowers. The sunflower seeds are crushed and squeezed to extract oil. The oil is refined by heating with sodium hydroxide. The impurities in the oil react to form a sort of soap. The purified oil is separated and then washed. Hydrogenation of the unsaturated acids in the oil takes place when the oil is heated with hydrogen under pressure over a nickel catalyst (the catalyst speeds up the reaction which would otherwise be slow). The fat is then heated and steam is blown over it to take away the unpleasant smell. Colouring, flavouring, and salt may be added. Vitamins are also added to make it healthier to eat.

(k) Detergents are chemicals which, when dissolved in water, can remove dirt and grease from cloth, metal, ceramics, and of course, human skin. Soap is a detergent made from animal fats or plant oils.

(l) Crude oil was made from the microscopic plants and animals which lived in the sea. As they died, their bodies collected at the bottom of the ocean. Here they were covered by mud and sand. Over thousands of years the layers of mud and sand became very thick. High temperature and pressure changed them into thick black liquid called crude oil.

(m) gas, petrol, kerosene, diesel oil, lubricating oil, fuel oil, paraffin waxes, bitumen

2. chemical, physical, physical, chemical, chemical, physical, physical, physical, chemical, chemical

## Additional Exercise

MCQs

(a) A change in which no new chemical substance is formed is called _____.

physical change  chemical change  ion exchange  [***physical change***]

(b) A _____ change can be easily reversed.

chemical  physical  ionic  [***physical***]

(c) A _____ change is a permanent change.

physical  chemical  reversible  [**chemical**]

(d) A _____ reaction can easily be changed back.

reversible irreversible chemical [***reversible***]

(e) Chemicals which are needed by plants for their proper growth are called _____.

nutrients food fertilizers [***fertilizers***]

(f) A synthetic material made from polymers is called. _____.

rubber wood plastic [***plastic***]

(g) Crude oil and natural gas are called _____.

fossil fuels natural fuels synthetic fuels [***fossil fuels***]

(h) Fossil fuels have been made from the _____ that were on the Earth millions of years ago.

bodies of plants and animals rocks and soil water and mud

[***bodies of plants and animals***]

(i) _____ are organic compounds made up of carbon, hydrogen, and oxygen.

Fats Plastics Glass [***Fats***]

(j) Electrical fittings are made of a plastic called _____.

melamine nylon bakelite [***bakelite***]

# Lesson plan

Date: Time: 40 mins

| Unit: 8<br>Topic: Changes in matter | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. Physical and chemical change | • to define physical change<br>• to define chemical change<br>• to explain a reversible reaction | • define physical and chemical changes and differentiate between the two<br>• explain how reversible reactions take place | Ice cubes, candle wax, salt, water, iron filings, sulphur powder, bar magnet, rusty nail, match box, copper sulphate, burner, china dish | Reading: p 73, 74<br>CW: Q2<br>HW: Q1 (a) (b) (c) |

**Key words**: physical change, melting, dissolving, chemical change, chemical reaction, reversible reaction
**Method**: **Ask**: What happens when you boil an egg? What did you do to it? How has it changed? Explain that changes in materials are taking place around us all the time. Most of the changes in materials are of two main kinds. In one kind of change the state and the volume of a material is changed. We call this kind of change a physical change. There is another kind of change in which a material is changed into a completely different material. This kind of change is called a chemical change.
Explain that when a physical change takes place, a material is changed in size or form without actually becoming another material. If we stretch or squeeze a piece of soft rubber, we change its size, but it is still rubber. It springs back when we let it go. When sugar dissolves in water it changes form from a solid to a liquid, but it is still sugar.
Ask the students to describe other physical changes from their everyday observation, such as the melting of ice, freezing of water, drying of wet clothes, etc. **Ask**: What happens when we burn a piece of paper? Can we get the paper back in its original form? Explain that when a chemical change takes place, a material is changed into one or more different materials. For example, when we hold a piece of paper close to a lighted match the paper catches fire and burns. A flame is seen, some smoke, and then nothing but ashes. **Ask**: Where has the paper disappeared to? Can we get the paper back? Explain that such a reaction cannot be reversed. We cannot get back the paper we have burnt. Similarly, other chemical changes occur when wood rots, iron rusts, milk turns sour, and the colour of cloth fades. Ensure that the students understand the difference between physical and chemical changes. Discuss physical and chemical changes in everyday life.
**Ask**: What type of a reaction is the frying of an egg? Explain that it is a one-way reaction. Once it has been fried it is impossible to change it back into a raw egg. The burning of fuel is another one-way reaction. Almost all chemical reactions are of this type. Reactions which are of this type are called irreversible reactions.
**Ask**: Are all reactions irreversible? Explain that there are some changes that can be reversed. A simple example is that of the ice changing to water. The water can be changed back into ice.
Write the change on the board: ice $\longrightarrow$ water, water $\longrightarrow$ ice.
Explain that this change can also be written with arrows in the opposite direction. ice $\longleftarrow$ water.
This type of reaction is called a reversible reaction.

# Lesson plan

Date: Time: 40 mins

| Unit: 8<br>Topic: Changes in matter | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Changing raw materials into useful products<br>Fertilizers | • to explain how raw materials can be changed into useful products<br>• to describe fertilizers<br>• to discuss the uses of fertilizers | • explain how raw materials can be changed into useful products<br>• explain how fertilizers work<br>• describe the harmful effects of the improper use of fertilizers | Pictures of a fertilizer factory, bags of different types of fertilizers | Reading: p 74, 75<br>Activity: 3<br>CW: Q1 (d)<br>HW: Q1 (e) |

**Key words**: fertilizer, nitrogen, phosphorus, potassium, ammonium nitrate

**Method**: **Ask**: What do plants need to grow strong and healthy? Discuss plant needs. **Ask**: From where do plants get mineral salts? Why do plants need minerals? Discuss the importance of minerals for plants. Discuss the nitrogen cycle and how plants use the nitrates in the soil. Explain the uses of organic and chemical fertilizers for plants, especially crops. **Ask**: How are chemical fertilizers made? Explain the manufacture of fertilizers in factories with pictures and charts.

Write the names of the different chemicals that are used to produce fertilizers. Discuss the importance of fertilizers. Also discuss the harmful effects of using too much fertilizer.

# Lesson plan

Date: Time: 40 mins

| **Unit: 8**<br>**Topic: Changes in matter** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Plastics | • to define plastics<br>• to explain how plastics are manufactured<br>• to discuss the uses of plastics | • define plastics<br>• explain how plastics are made<br>• describe how we use plastics | Plastic items or pictures of things made of plastic | Reading: p 75, 76<br>Activity: 4<br>Project: 1<br>CW: Q1 (f) |
| **Key words**: plastic, synthetic, polymer, polyethene, monomer<br>**Method**: Show the students objects made of plastic. **Ask**: What is plastic? Discuss the properties of plastic.<br>Explain that plastics are made up of many small molecules called monomers. Lots of monomers join together to make the polymers of which plastics are made. Write the names of some familiar polymers such as polyethene, polystyrene, and PVC. Discuss the uses of different kinds of plastic to make everyday items. | | | | |

# Lesson plan

Date: Time: 40 mins

| Unit: 8<br>Topic: Changes in matter | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 4. Fossil fuels<br>Refining crude oil | • to describe fossil fuels<br>• to explain how crude oil is refined to make useful products | • explain how fossil fuels were made<br>• explain the refining process of crude oil to make useful products | Pictures of fossils, coal, petroleum, natural gas plant, fractionating column | Reading: p 76, 77<br>Project: 2<br>CW: Q1 (g) (h)<br>HW: Q1 (i) (l) (m) |

**Key words**: fossil fuel, crude oil, fractional distillation, refining crude oil, hydrocarbon, fractional distillation, fractionating tower, fraction

**Method**: Show the students pictures of fossils. **Ask**: What are fossils? How are fossils made? What information do we get from fossils?

Discuss the formation of fossil fuels in the sea and on land. Explain that millions of years ago coal was formed from plants, and oil was made from the bodies of microscopic plants and animals that lived in the sea.

Show the students charts and diagrams of the fractional distillation of crude oil and explain the use of the different groups of compounds called fractions.

# Lesson plan

Date: Time: 40 mins

| Unit: 8<br>Topic: Changes in matter | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 5. Fats<br>Making margarine and soap from fats | • to define fats<br>• to explain the importance of fats for all living things | • explain the composition of fats<br>• identify the uses of fats<br>• explain how fats can be used to make useful products | Pictures and charts of the uses of fats, making margarine, detergents, and soaps | Reading: p 77, 78, 79<br>Activity: 1, 2<br>CW: Q1 (j)<br>HW: Q1 (k) |

**Key words**: fat, lipid, fatty acid, margarine, hydrogenation detergent, soap

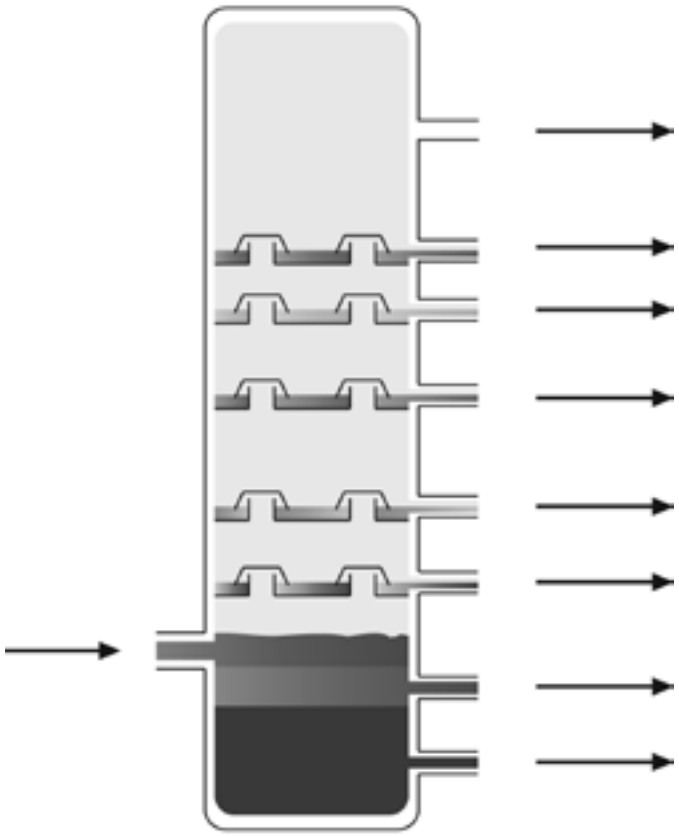
**Method**: **Ask**: What are fats? What are fats made of? Explain that fats are made from fatty acids. Oils are liquid and fats are solid.

**Ask**: How are fats used in the body? Discuss the importance of fats. Discuss the process by which margarine is made, with the help of charts and diagrams.

**Ask**: What is soap? What is the difference between a soap and a detergent? Explain the difference between soap and detergent. Explain the process by which soap is made industrially.

Name: _____ Date: _____

1. Label the diagram of the fractional distillation of crude oil:



2. Complete the table below.

| **Name of the fraction** | **Use** |
|---|---|
| bitumen | |
| paraffin wax | |
| fuel oil | |
| lubricating oil | |
| diesel oil | |
| kerosene | |
| petrol | |
| gas | |

Name: _____ Date: _____

1. Write the stages in the production of margarine in the correct order:

   a. Vitamins are added to make it healthier to eat.

   b. Sunflower seeds are crushed and squeezed to extract oil.

   c. The impurities in oil react to form a sort of soap.

   d. The purified oil is separated and then washed.

   e. The oil is refined by heating with sodium hydroxide.

   f. Colour, flavouring, and salt may be added.

   g. The fat is heated and steam blown over it to take away the unpleasant smell.

   h. Oil is heated under pressure over a nickel catalyst, with hydrogen, for the hydrogenation of the unsaturated acids in the oil, to make fats.

2. Explain the difference between a soap and a detergent.

_____

_____

_____

_____

3. What are the harmful effects of using too much chemical fertilizer?

_____

_____

_____

_____

# Test paper 2

**Time: 3 hours** **Total marks: 100**

1. Attempt any five questions. (All questions carry equal marks.] [50]

   (a) What is hard water? What causes the hardness of water?
   How can hard water be made soft?

   (b) Describe the structure of an atom.
   What is the atomic number and mass number of an atom?

   (c) (i) What is an element?
   (ii) Write the symbols of the following elements:
   carbon, nitrogen, hydrogen, oxygen, sulphur, iodine, phosphorus, calcium, chlorine, zinc.

   (d) What is a compound?
   Write the formulae for the following compounds:

   sodium chloride, sodium hydroxide, potassium hydroxide, carbon dioxide, water, sugar, glucose, copper oxide, copper sulphate, ammonia.

   (e) Explain the difference between the following:

   (i) proton and electron
   (ii) symbol and formula
   (iii) atom and molecule
   (iv) ionic bond and covalent bond
   (v) element and compound

   (f) Explain the difference between a physical and a chemical change.

   How do we know that a chemical change has taken place?

   (g) What is a fertilizer? What are some of the harmful effects of the improper use of fertilizer?

   (h) What are plastics? Write the names of the plastic that is used for making:

   plastic bags, ballpoint pens, hose pipes, rope, clothing, saucepan handles, rulers, electrical fittings.

2. Draw a diagram to show what happens when a sodium atom reacts with a chlorine atom. [5]

3. Draw diagrams to show the bonding in a molecule of water, ammonia, methane. [5]

4. How can soap be made in the laboratory? [10]

5. Draw a fractionating column and write the names of the different fractions being separated in it. [10]

6. Fill in the blanks to describe how margarine is made.

   Some of the fats and plant oils can be turned into valuable food such as _____.
   The oil for making margarine comes from the _____ of plants such as sunflowers.



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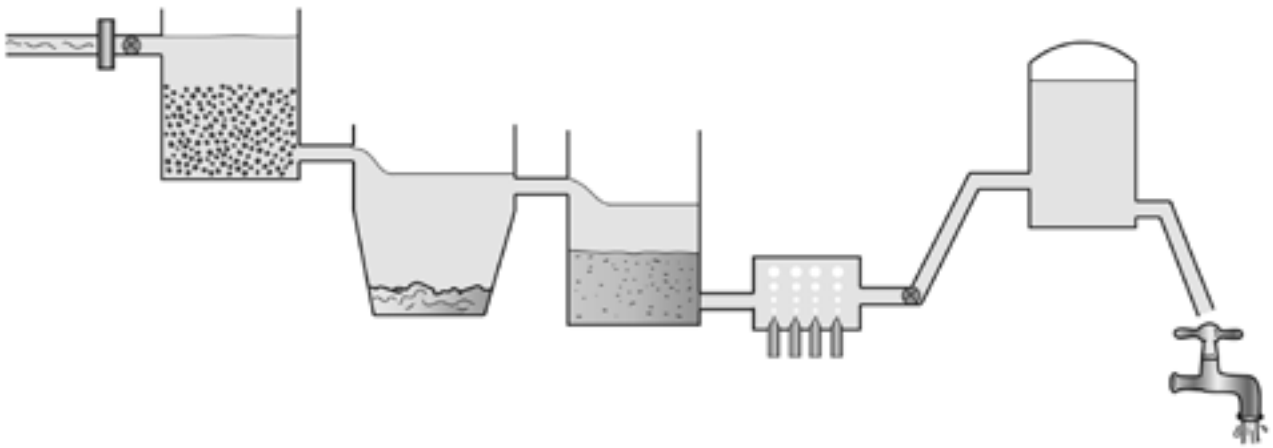
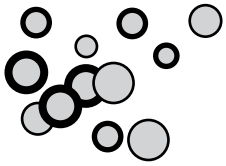
The sunflower seeds are _____ and squeezed to extract oil. The oil is refined by heating with _____. The _____ in the oil react to form a sort of soap. The purified oil is separated and then _____. _____ of the unsaturated acids in the oil takes place when the oil is heated with hydrogen under pressure over a nickel catalyst (the catalyst speeds up the reaction which would otherwise be slow). The fat is then heated and _____ is blown over it to take away the unpleasant smell. Colouring, _____, and salt may be added. _____ are also added to make it healthier to eat.

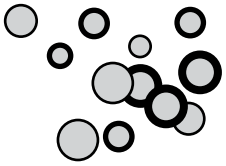
[10]

7. Label this diagram of a filtration plant. [10]





# UNIT 9



# Heat and energy

## Teaching objectives:

- to explain heat energy transfers from one body to another
- to explain the methods of heat transfer by conduction, convection, and radiation
- to explain by giving everyday examples of convection currents in nature
- to describe the use of conductors in everyday life
- to explain what a vacuum flask is and describe how it helps to maintain the temperature

## Teaching strategy:

Place some ice cubes in a glass dish and press them with your finger. **Ask**: Why does the ice melt? Explain the movement of molecules as they gain energy from the hand. **Ask**: Why does water in a pan begin to boil when placed on a stove? Explain the gain of energy by the molecules from the fire. Dip a teaspoon in a cup of hot tea. **Ask**: Why does the metallic handle get hot? Why do we feel warm when we sit in front of a room heater? Explain heat as a form of energy that travels from one place to another in waves and radiations. Perform simple experiments shown in the textbook to explain the methods of heat transfer.

**Ask**: Why do we cover a teapot with a tea cosy? How does a blanket keep us warm? Explain the use of insulators in daily life. **Ask**: Why do you feel hot after exercise? Why do you feel cool under a fan? Explain heat loss by convection. **Ask**: What is the normal temperature of the human body? How is the normal body temperature maintained at a constant level? Explain the process of sweating and cooling. **Ask**: How do we measure the temperature of our bodies? Explain the use of thermometers. Show a clinical and a laboratory thermometer to the students and explain their working. Draw the temperature scales on the board and show them the lower and upper marks. Explain the difference between the scales and explain the absolute zero and its use in scientific experiments. Explain the uses of the various thermometers. Explain the interconversion of the temperature scales with the help of formulae.

Summarize the lesson.

## Answers to Activities

7. (a) Heat will flow from a hotter body to a cooler one.

   (b) The particles will begin to vibrate faster on gaining heat energy.

   (c) Heat flow will be greatest between A and D, because there is a great temperature difference.

   (d) Heat flow will be the least between A and B , because the particles of cold objects have least energy.

8. Alcohol thermometer

   Electrical thermometer

   Electrical thermometer

   Alcohol thermometer

   Mercury thermometer

## Answers to Exercises in Unit 9

1. (a) Heat is a type of energy found in an object that has a higher temperature than its surroundings.

   (b) When an object is heated, its molecules gain energy and start moving faster. As they vibrate, they bump into each other at a faster rate and push the particles in front of them. As this movement continues, heat travels from one end of the object to the other.

   (c) Materials, like rubber, wood, and plastic that do not allow heat to travel through them are called bad conductors of heat. Materials, like wool, fur, and feathers that do not conduct heat or electricity easily are called insulators.

   Insulators are substances that are poor conductors of heat and electricity. The handles of pots and pans are made of wood or plastic, so that heat is not conducted from the pan to the handle and we do not burn our hands. Firefighters wear clothes made of an insulating material called fiberglass. Air is a good insulator. We wear woollen clothes in winter to keep warm because wool traps air between its fibres.

   (d) Heat can travel through solids by conduction. If one end of a metal spoon is dipped in hot water, the other end heats up after a short while. This happens because the molecules at the dipped end gain energy from the hot water, start vibrating, and push the molecules in front of them. On gaining energy, these molecules also start vibrating, and in this way a chain reaction is set up by which the other end of the spoon heats up.

   Convection occurs when heat is transferred from one part of a fluid to another by the movement of the fluid itself. The ventilation of a room and heating water in a pan are examples of convection.

   Radiation is a particular way in which energy travels. This energy need not be carried by a medium such as a solid, liquid, or gas. It can travel in space because it is not carried by moving particles which need a medium to travel in. Earth is heated by the heat radiation of the Sun. This heat travels through space and reaches the Earth.

   (e) Conductivity is the ability of a material to conduct heat. To compare the conductivity of different materials take some rods which are of the same length and thickness but are made of different materials, such as wood, iron, copper, aluminium, etc. Dip them in wax and allow them to cool, then pass them through a specially made metallic box which has holes in its sides. Pour hot water in the box. After a few minutes, remove the rods. You will observe that the wax melts to a different distance on each rod.

   (f) To prove that water is a bad conductor of heat wrap a cube of ice in a piece of gauze and drop it into a test tube full of water. Hold the top of the tube close to a Bunsen flame. You will observe that although the water at the top boils, the ice at the bottom of the tube does not melt.

   (g) To demonstrate convection in liquids fill a conical flask with tap water and drop a large crystal of potassium permanganate into it. Heat the flask. An upward current of coloured water will

rise and spread outwards. It will then move down the sides of the flask, showing that a convection current has been set up.

(h) During the daytime, the land heats up quickly by the heat of the Sun. As a result, the air above it becomes hot. As this air expands and rises, the cooler air above the sea blows in to take its place. This is called a sea breeze.

At night, the sea water, which has absorbed heat during the day, remains hot for a longer time than the land, and so the air above the sea warms up. It expands and rises and in this way the convection current is reversed. The breeze now blows from the cooler land to the sea and is called a land breeze.

(i) Radiation is a particular way in which energy travels. This energy need not be carried by a medium such as a solid, liquid, or gas. It can travel in space because it is not carried by moving particles which need a medium to travel in. The Earth is heated by the heat radiation of the Sun. This heat travels through space and reaches the Earth.

(j) A thermos flask consists of a double-walled glass bottle which has a vacuum between the two walls. The inner sides of the walls are shiny. The mouth of the bottle is closed with a cork or plastic stopper. The glass bottle is fitted into a metallic or plastic container. Heat cannot enter or leave the flask due to the vacuum which checks conduction and convection. The shiny surface reflects the heat waves. Anything inside the flask will remain hot or cold for a long time.

(k) The degree of hotness or coldness of a body is called its temperature. Temperature depends on the internal kinetic energy of the molecules of a substance. When a body is cold, its molecules move slowly. When it is heated, its molecules begin to move faster. As these molecules move, they begin to vibrate and bump into each other. In doing so, they push each other apart and that is how the change of state in a substance occurs (from solid to liquid and liquid to gas). This also explains the expansion of solids, liquids, and gases on heating.

(l) We cannot rely on our sense of touch to measure the temperature of a body. If you keep your hands in cold water and then dip them in warm water, the water will feel very hot. If you keep your hands in hot water, and then dip them in warm water, the water will feel cold. In order to find out the exact temperature of a body an instrument called a thermometer is used.

(m) A mercury thermometer contains mercury, which expands and contracts with the rise and fall of temperature. The clinical thermometer is a mercury thermometer, and is used to measure the temperature of the human body. It cannot be used to measure temperatures below –39°C because mercury solidifies at temperatures below this.

An alcohol thermometer contains alcohol. It is cheap and easy to use. It can measure very low temperatures because alcohol does not solidify even at –115°C. It is used in the laboratory, in refrigerators, and in deep-freezes.

A maximum and minimum thermometer is used to record the maximum and minimum temperatures of a place every 24 hours. It consists of two bulbs, A and B. Bulb A is partly filled with alcohol and has a vacuum at the top, while bulb B is completely filled with mercury. A U- shaped tube filled with mercury is attached to the bulbs. Indices x and y are attached with springs to the top of the mercury column. Temperature scales are marked on both arms of the U- shaped tube. The expansion and contraction of the alcohol due to the rise and fall in temperature indicate the maximum temperature on the scale towards the A-bulb side and the minimum temperature on the scale on the B-bulb side.

Digital thermometers are electronic thermometers. They are compact and inexpensive and are used for measuring and displaying temperature in numeric values with great precision.

The temperature deep inside a furnace or a kiln needs constant checking. Mercury or alcohol thermometers are not suitable because they ca not measure very high temperatures. Besides you cannot get close enough to the scale to read it. Electrical thermometers are easy to read because they have a digital display. The scale is placed well away from the temperature detector. Temperature readings can be read by a computer, and the temperature range is from -200 to 1600 degrees centigrade or more.

2. (a) When an object is heated its molecules gain energy.
   (b) Rubber and wood are bad conductors of electricity.
   (c) The ability to conduct heat is called conductivity.
   (d) Water is a bad conductor of heat.
   (e) The flow of heat through a liquid is called convection.
   (f) Monsoon winds are convection current winds.
   (g) During the daytime, land gets heated up more quickly than water.
   (h) Radiation does not need a medium to travel in.
   (i) When a substance is hot its molecules move more quickly.
   (j) Absolute zero is equal to 273 K.
3. a) 0+273 b) 100 +273 c) 180 + 273 d) -173 + 273 e) -100 + 273
4. a) 0 - 273 b) 73 -273 c) 150 - 273 d) 473 - 273 e) 561 - 273

## Additional Exercise

MCQs

(a) The transfer of heat energy by the vibration of particles is called _____.

conduction convection radiation [***conduction***]

(b) The particles in the hotter region move to the colder region when heat energy travels by _____.

conduction convection radiation [***convection***]

(c) _____ are better conductors than fluids.

Solids Liquids Gases [***Solids***]

(d) Which one of the following is the best conductor of heat?

Copper Glass Air [***Copper***]

(e) Heat travels from one end of an iron rod to the other end by _____.

conduction convection radiation [***conduction***]

(f) Water is a _____ conductor of heat.

good conductor bad conductor bad insulator [***bad conductor***]

(g) Liquids and gases are _____ of heat.

good conductors poor conductors bad insulators [***poor conductors***]

(h) Hot air moves _____.

downwards upwards forwards [***upwards***]

(i) Which one of the following statements is wrong?

Convection can take place in a liquid. Convection can take place in a vacuum.

A convection current can be present in gas. [***Convection can take place in a vacuum.***]

(j) The sun heats up the Earth by _____.

conduction convection radiation [***radiation***]

# Lesson plan

Date: Time: 40 mins

| Unit: 9<br>Topic: Heat and energy | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. Conductors and insulators | • to define heat<br>• to compare conductors and insulators | • describe heat as a form of energy<br>• differentiate between conductor and insulators | Samples of insulators and conductors | Reading: p 84<br>CW: Q1 (a)<br>HW: Q1 (b) (c) |

**Key words**: vibrate, temperature, internal energy, good conductor, bad conductor, insulator

**Method**: Discuss the composition of matter. Explain that particles of matter are always moving. When an object is heated, it absorbs heat energy. Its particles gain energy and they start moving faster. When this happens the temperature rises. The particles have more internal energy. Explain that heat is a degree of temperature. Scientifically speaking, heat is a kind of energy found in an object that has a higher temperature than its surroundings.

**Ask**: How does heat travel from one end of an object to the other? Explain that when an object is heated its particles gain energy and they begin to move faster. As they vibrate they bump into each other at a faster rate and they push the particles in front of them. As this movement continues, heat travels from one end of the object to the other. Define conductors as materials that allow heat to travel through them, and insulators as materials that do not.

# Lesson plan

Date: Time: 40 mins

| Unit: 9<br>Topic: Heat and energy | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Methods of heat transfer: conduction | • to describe heat transfer in materials<br>• to explain conduction of heat | • explain that heat is transferred in materials<br>• explain how the conduction of heat takes place in solids | Copper wire, beaker, hot water, metal spoon, rods of wood, iron, copper, aluminium, metallic box with holes, molten wax, test tube, burner, ice, gauze | Reading: p 84, 85<br>Activity: 4, 7<br>CW: Q1 (d)<br>HW: Q1 (e) (f) |

**Key words**: conduction, conductivity

**Method**: **Ask**: What happens to a metal teaspoon if it is placed in a cup of hot water? Discuss conduction of heat through solids. Explain that the molecules at the dipped end gain energy from the hot water, start vibrating, and push the molecules in front of them. In this way a chain reaction is set up and the other end of the spoon becomes hot.

Perform the experiments on pages 84 and 85 to demonstrate the conduction of heat.

# Lesson plan

Date: Time: 40 mins

| Unit: 9<br>Topic: Heat and energy | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 3. Methods of heat transfer: convection | • to explain how heat is transferred by convection<br>• to describe convection currents in nature | • explain how heat is transferred in fluids<br>• describe the role of convection currents in nature | Diagrams of land and sea breezes, conical flask, crystal of potassium permanganate, stand, burner, cardboard box, candle, paper | Reading: p 85, 86<br>Activity: 1, 2, 3<br>CW: Q1 (g)<br>HW: Q1 (h) |

**Key words**: convection, wind, thermal, land breeze, sea breeze

**Method**: **Ask**: How does cool air from outside enter a room? How does water in a pan on the stove become heated? Explain that convection occurs in fluids when heat is transferred from one part of a fluid to another with the movement of the fluid itself. With charts and diagrams explain the convection currents in air, and in liquids.

**Ask**: Have you been to the sea coast? What kind of breeze blows there during the day? At night? Explain land and sea breezes with the help of charts and diagrams on the board.

# Lesson plan

Date: Time: 40 mins

| **Unit: 9**<br>**Topic: Heat and energy** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Radiation | • to explain how heat is transferred by radiation<br>• to describe practical applications of heat transfer | • explain how heat is transferred by radiation<br>• identify the practical applications of radiation | Pictures of shiny, dull, black, white surfaces, diagram of a thermos flask, diagram of a greenhouse | Reading: p 86, 87<br>Activity: 5, 6<br>CW: Q1 (i)<br>HW: Q1 (j) |

**Key words**: radiation, absorb, reflect, emit, greenhouse, thermos flask, vacuum

**Method**: **Ask**: What is radiation? Does radiation need a medium to travel in? Explain that radiation does not need a medium to travel in. That is why the heat of the Sun can travel through space to reach the Earth.

Show the students different types of surface. Explain that a white surface reflects more heat, a black surface absorbs more heat. Some surfaces are better at absorbing radiation than others. Some surfaces are better at emitting radiation.

Ask the students to make a list of the surfaces that are: good absorbers, good emitters, good reflectors, bad absorbers, bad emitters, bad reflectors.

Do the activities described on page 87.

Describe a thermos flask with the help of a diagram and explain how it helps to keep things cold or hot.

# Lesson plan

Date: Time: 40 mins

| Unit: 9<br>Topic: Heat and energy | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 5. Temperature | • to define temperature<br>• to explain how to measure temperature<br>• to explain temperature scales<br>• to describe different types of thermometers<br>• to explain how to convert temperature scales | • explain what temperature is<br>• describe a thermometer and the temperature scales marked on it<br>• describe different types of thermometer and their uses<br>• convert temperature scales | Pictures of different kinds of thermometer, a clinical and a laboratory thermometer, a table of temperature scales | Reading: p 88, 89<br>Activity: 8<br>CW: Q2, Q3, Q4<br>HW: Q1 (k) (l) (m) |

**Key words**: temperature, thermometer, capillary tube, Celsius scale, Fahrenheit scale, Kelvin scale, absolute zero, alcohol thermometer, maximum and minimum thermometer, digital thermometer, electrical thermometer

**Method**: **Ask**: What is temperature? What is the normal temperature of the human body? How is the normal body temperature maintained at a constant level? Explain that temperature is the degree of hotness of a body. It can be measured using a thermometer. **Ask**: How do we measure the temperature of our bodies? Explain the uses of thermometers. Show the students a clinical and a laboratory thermometer, and demonstrate how they work. Write the temperature scales on the board, and mark the upper and lower limits. Explain the differences between the scales and explain absolute zero, and its use in scientific experiments.

Show the students pictures of the various kinds of thermometer and explain their use. With the help of formulae explain how temperature scales can be converted.

Name: _____ Date: _____

1. Fill in the blanks to complete the text below.

Heat is a degree of _____. In scientific terms, heat is a type of energy found in a body that has a _____ temperature than its surroundings. When an object is heated, its molecules _____ energy and they start moving _____. As they _____, they bump into each other at a _____ rate, and push the _____ in front of them. As this movement continues, _____ travels from one end of the object to the other.

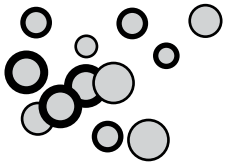
2. Complete the table below by writing the correct temperatures.

| **Temperature scales** | **Fahrenheit** | **Celsius** | **Kelvin** |
|---|---|---|---|
| Melting point of ice | | | |
| Boiling point of water | | | |
| Human body temperature | | | |

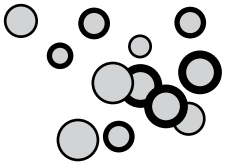
Name: _____ Date: _____

Q. Underline the correct word(s) in the sentences below.

1. Radiation is a particular way in which energy / electricity travels.
2. Radiation needs / does not need a medium to be carried.
3. Radiation can travel through solids / space.
4. The Earth is heated by the radiation from the Sun / Moon.
5. Clouds / Stars cut down some of the heat radiation reaching the Earth.
6. A white surface absorbs / reflects more heat.
7. A black surface absorbs / reflects more heat.
8. Good absorbers of heat radiation are good / bad emitters.
9. Dull black surfaces are the best emitters / absorbers of radiation.
10. Shiny silvery surfaces are the best / worst absorbers of radiation.
11. Dull black surfaces are the best / worst emitters of radiation.
12. Shiny, silvery surfaces are the best / worst emitters of radiation.



# UNIT 10



# Dispersion of light

## Teaching objectives:

- to define refraction and explain how refraction is caused
- to explain the effects of refraction with examples
- to explain the laws of refraction with the help of an experiment
- to describe what refractive index means
- to explain what critical angle of refraction is
- to show how to find the critical angle of glass and water by means of an experiment
- to explain how total internal reflection is caused
- to explain dispersion of light and describe it using a prism
- to discuss primary colours and secondary colours
- to show by an experiment that white light is made up of seven colours
- to explain why objects appear coloured

## Teaching strategy:

Place a beaker of water on the desk. Dip one end of a pencil in it. **Ask**: Does the pencil seem straight? Can you tell why this happens? Explain that if we fill a tub with water, it appears shallower than it actually is. This is because when light travels from one transparent medium into another, it bends. This bending of light is called refraction. The bending of light occurs because when light rays pass into a denser medium, the speed of light slows down. When light passes into a thinner or rarer medium, its speed increases. Demonstrate the glass slab experiment, and help the students to perform the experiment with pins and a glass slab. Ask them to measure the angles of incidence and refraction. **Ask**: What do you see in the drawing? Explain that the rays of light go out of the block and bends at the surface. Your eyes see the rays after they have been bent. A ray of light is always refracted in a definite direction. As light passes from a dense material into a less dense material (e.g. from glass to air) it is bent away from the normal (the line drawn at right angles to the surface). As light goes into a more dense material (e.g. from air to glass) it bends towards the normal. Explain the laws of refraction.

**Ask**: What do you think would happen if you pass a beam of light through a rectangular block? Explain that the ray of light is refracted as it enters and leaves the block. The emerging ray is parallel to the incoming ray. **Ask**: When you look through the front of a fish tank, why does a fish look closer than it really is? Explain refraction using a diagram. **Ask**: Can you explain why refraction of light occurs? Explain that light waves travel at a speed of about 300,000 km/s in air, but they slow down when they enter any other material such as water or glass. If a ray of light meets the new material at an angle it bends. This is refraction. Discuss refractive index as the ratio of the speed of light in vacuum to the speed of light in a medium. The greater the speed of light the greater the change of

direction. **Ask**: Why does a pool appear shallower than it actually is? Explain that one of the effects of refraction is that our brains can be tricked into thinking that pools are shallower or glass blocks are thinner than they actually are. The apparent depth is given by the real depth divided by the refractive index. The refractive index of water is about 4/3 so a 2 m pool only looks 1.5 m deep.

**Ask**: What is 'critical angle'? Perform an experiment with a glass slab and pins to demonstrate the critical angle. You can see what happens when the angle of incidence inside a glass block increases from 35 to 50 degrees. At 35 degrees most of the light gets out of the glass with just a small part being reflected. At about 42 degrees the refracted ray just gets out of the block but much more of the light is being reflected. This is the 'critical angle'. At angles greater than 42 degrees all the light is reflected. This is called total internal reflection. Explain that 'critical angle' is defined as the angle of incidence that provides an angle of refraction that is of 90 degrees, above which all the light is reflected and total internal reflection occurs. Discuss the uses of total internal reflection in optical instruments and optical fibres. Explain that optical fibres can also carry coded signals as pulses of light from a laser. These can be changed into electrical signals at the receiving end. For example many of our telephone calls are now transmitted down light which can carry several thousand conversations at once! Glass fibres are more efficient at transmitting messages than copper wires and so fewer booster stations are needed. this keeps costs low.

**Ask**: What is coloured light? How do we see colours? Discuss coloured light and primary and secondary colours. Explain how we can see coloured objects. Discuss the mixing of pigments and the use of filters to see coloured objects. Help the students to mix coloured lights and paints to see for themselves how we can see coloured objects. Make a colour viewing box.

Summarize the lesson.

## Answers to Exercises in Unit 10

1. (a) 300,000 km

   (b) Light waves travel at a speed of about 300,000 km/s in air, but they slow down when they enter another transparent material such as water or glass. If a ray of light meets the new material at an angle, it bends. This bending of light is called 'refraction'.

   (c) The ratio of the speed of light in a vacuum to the speed of light in the material is called the refractive index of the material.

   $$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in material}}$$

   (d) refractive index = speed of light in vacuum / speed of light in medium

   1.33 = 300,000 / ?

   ? = 300,000 / 1.33

   speed of light in medium = 225,000 km/s (the medium is water)

   (e) This happens because light bends as it passes from one transparent material to another.

   A ray of light is always refracted in a definite direction. As light passes from water to air it bends away from the normal. As light goes into a denser material it bends towards the normal.

   (f) Glass prisms can act like perfect mirrors if light rays strike an inside face at an angle greater than its critical angle.

(g) Critical angle is defined as the angle of incidence that provides an angle of refraction that is of 90 degrees, above which all the light is reflected and total internal reflection occurs.

When the angle of incidence inside a glass block increases from 35 to 50 degrees. At 35 degrees most of the light gets out of the glass with just a small part being reflected. At about 42 degrees the refracted ray just gets out of the block but much more of the light is being reflected. This is the 'critical angle'. At angles greater than 42 degrees all the light is reflected. This is called total internal reflection.

2. Refer to Pupil's Book.

3. Optical fibres are thin fibres of glass through which light can pass. They are bundled together and used as a 'light pipe'. Light hits the sides of the fibres at an angle greater than the critical angle. All the light is reflected and it emerges from the other end of the fibres almost as bright as when it went in.

   Optical fibres can be used for inspection inside machines and even inside the human body. Optical fibres can carry coded signals as pulses of light from a laser. They can be changed into electrical signals at the receiving end. They are used to transmit telephone signals.

4. Refer to Pupil's Book.

5. (a) red (b) blue

6. Objects appear coloured because the materials that they are made of absorb some of the colours of the spectrum and reflect the rest. As a result we only see the colours of the reflected light. The petals reflect yellow light and the leaves reflect green light.

7. Primary colours: white, yellow, magenta, cyan
   Primary pigments: green, purple, orange

## Additional Exercise

MCQs

(a) The bending of light waves when passing from a one transparent medium to another is called _____.

reflection refraction dispersion [***refraction***]

(b) When a ray of light passes from a rarer to a denser medium it bends _____ from the normal.

away towards like a wave [***towards***]

(c) The angle which the incident ray makes with the medium is called the angle of _____.

incidence refraction reflection [***incidence***]

(d) The ratio of the speed of light in air to the speed of light in a medium is called _____ index.

reflective refractive objective [***refractive***]

(e) The size of the angle of incidence at which the refracted ray runs parallel to the surface of the medium is called _____.

angle of incidence | angle of refraction | critical angle | [***critical angle***]

(f) Very thin fibres of glass through which light can pass are called _____.

fibre glass | fibres | optical fibres | [***optical fibres***]

(g) The splitting of light when it passes through a prism is called _____.

refraction | reflection | dispersion | [***dispersion***]

(h) Red, blue, and green are called _____ colours.

primary | secondary | plastic | [***primary***]

(i) Cyan, magenta, and _____ are secondary colours.

blue | green | yellow | [**yellow**]

(j) Objects appear coloured because they reflect or _____ some of the colours of the spectrum.

absorb | disperse | refract | [***absorb***]

# Lesson plan

Date: Time: 40 mins

| Unit: 10<br>Topic: Dispersion of light | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. Refraction of light | • to define refraction<br>• to explain refractive index<br>• to describe real and apparent depth | • explain how refraction occurs<br>• describe refractive index<br>• distinguish between real and apparent depth | Glass slab, pins, trough of water, a stone, beaker, pencil | Reading: p 94, 95<br>Activity: 1<br>CW: Q1 (a) (b)<br>HW: Q1 (c) (d) (e) |

**Key words**: refraction, refractive index, real depth, apparent depth

**Method**: Place one end of a pencil in a beaker of water.

**Ask**: Does the pencil appear straight? Can you explain why this happens? Explain that when light passes from one medium into another it bends. This bending of light is called refraction. The bending of light rays occurs because when light rays pass into a denser medium, the speed of light slows down. When light passes from a denser to a rarer or thinner medium, its speed increases.

Demonstrate the glass slab activity described on page 94 and help the students to set up the experiment themselves and measure the angle of incidence.

**Ask**: What do you see in the drawing? Explain that the rays of light go out of the block and bend at the surface. Your eyes see the rays after they have bent. As light passes from a dense material into a less dense material (from glass to air) it bends away from the normal ray which is perpendicular to the surface. As light goes into a more dense material (from air to glass) it bends towards the normal. Explain the laws of refraction.

**Ask**: What is the speed of light? Discuss refractive index as a ratio of the speed of light to the speed of light in a medium. The greater the speed of light, the greater the change of direction.

**Ask**: Why does a pool appear shallower than it actually is? Explain that one of the effects of refraction is that our brains can be tricked into thinking that pools are shallower or glass blocks are thinner than they actually are. The real depth can be calculated by multiplying the apparent depth by the refractive index of the medium. The refractive index of water is about 4/3, so a pool 2 metres deep appears to be only 1.5 metres deep.

# Lesson plan

Date: Time: 40 mins

| Unit: 10<br>Topic: Dispersion of light | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Critical angle<br>Total internal reflection | • to define critical angle<br>• to describe total internal reflection | • define critical angle<br>• describe total internal reflection<br>• explain how total internal reflection is useful | Glass block, lamp, prism, pictures of optical fibre and periscope | Reading: p 95, 96<br>Activity: 2<br>CW: Q2, Q3<br>HW: Q1 (f) ((g) |

**Key words**: critical angle, total internal reflection, optical fibre, periscope

**Method**: **Ask**: What is critical angle? Perform an experiment with a glass slab and pins to demonstrate the critical angle of glass. Explain that you can see what happens when the angle of incidence inside a glass block increases from 35 to 50 degrees. At 35 degrees most of the light gets out of the glass with just a small part being reflected. At about 42 degrees the refracted ray just gets out of the block, but much more of the light is reflected. This is the critical angle. At angles greater than 42 degrees all the light is reflected. This is called total internal reflection.

Define critical angle as the angle of incidence that provides an angle of refraction of 90 degrees, beyond which all the light is reflected and total internal reflection occurs. Discuss how critical angles of glass are used in optical instruments and how optical fibres are used for inspection inside machines and even inside the human body. Optical fibres can also carry coded signals as pulses of light from a laser. These can be changed into electrical signals at the receiving end. Many of our telephone calls are now transmitted through optical fibres which can carry several thousand conversations at once. Glass fibres are more efficient at transmitting messages than copper wires and so fewer booster stations are needed and this keeps the costs low.

# Lesson plan

Date: Time: 40 mins

| **Unit: 10**<br>**Topic: Dispersion of light** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Colours | • to discuss colours<br>• to identify primary and secondary colours<br>• to explain why objects appear coloured<br>• to explain pigments and filters | • explain that white light is composed of seven colours<br>• explain coloured light<br>• explain pigments and filters | Prism, torch, coloured lights, paints, coloured filters | Reading: p 96, 97, 98<br>Activity: 3, 4<br>CW: Q4, Q5<br>HW: Q6, Q7 |

**Key words**: colour, dispersion, spectrum, primary and secondary colour, sensors, pigment, filter

**Method**: **Ask**: What is coloured light? How do we see colours?

Explain coloured light and primary and secondary colours with the help of charts and practical demonstrations. Explain how we see the colours of objects. Objects appear coloured because the materials they are made of absorb some colours of the spectrum and reflect the rest.

**Ask**: What are paints, ink, and crayons made of? Why do they appear coloured? Explain that pigments are chemical substances which reflect some colours only. Our skin, leaves and petals of plants, all contain pigments. Explain by practical demonstrations the mixing of pigments to produce a wide range of colours.

Show the students filters of different colours. Ask them to look through the filters and say what colours they can see. Explain that filters allow some colours to pass through, and filter out all the others. For example a green leaf looks black if we observe it through a red filter. This is because the filter has absorbed the green colour and there is no green light to reflect.

Name: _____ Date: _____

1. Using the formula: refractive index = speed of light in vacuum/speed of light in a material, calculate the speed of light in the given materials.

| Material | Refractive index | Speed of light in vacuum ( 300,000 km/ s) |
|---|---|---|
| Air | 1.00 | |
| Water | 1.33 | |
| Glass | 1.51 | |

2. What colour will you see when:

   a. red light falls on a red surface? _____

   b. blue light falls on a red surface? _____

   c. magenta light falls on a red surface? _____

   d. red light falls on a cyan surface? _____

   e. magenta light falls on a cyan surface? _____

   f. yellow light falls on a cyan surface? _____

Name: _____ Date: _____

1. Fill in the blanks to complete the text about pigments.

Pigments are _____ which reflect only certain colours. _____ is an example of a pigment. Petals, leaves, and animal skins also contain _____. There are _____ primary pigment colours, _____, _____, _____. We can produce a wide range of colours by _____ pigments, this is because they do not reflect only _____ colour, but a small part of the _____.

2. Complete the table below.

| Colours of pigments | Colour produced |
|---|---|
| red + blue | |
| yellow + red | |
| blue + yellow | |
| red + blue | |
| red + blue + yellow | |

3. Fill in the blanks to complete the text.

A filter is a piece of _____ glass or plastic which allows some colours to pass through, but _____ out all the others. A leaf looks green because it reflects _____ light. If we look at it in red light it will look _____. This is because there is no _____ light to reflect.

4. What will be the colour of white light when it is passed through the filters listed below?

| Colour of the filter | Colour of light |
|---|---|
| red | |
| green | |
| blue | |

# UNIT 11

# Oscillations and waves

## Teaching objectives:

- to define the terms wavelength, frequency, and amplitude
- to describe the factors which are essential for producing sound
- to discuss the audible frequency range of humans and other animals
- to explain how to design a musical instrument
- to discuss the application of different sounds in daily life

## Teaching strategy:

**Ask**: What kinds of sounds can you hear in a busy street? Which kind of sound do you like? Make a pendulum by tying a bob to a piece of string. Pull it to one side to make it swing. Explain that the to and fro movement that takes to complete one oscillation is called a period. Count the number of oscillations that the pendulum makes in one minute. Calculate the number of oscillations in one second. Explain that the number of oscillations completed in one second is called the frequency of the oscillation. Draw a pendulum on the board. Explain the mean and extreme position of the bob. The distance that the bob travels from the centre to the extreme position is called its amplitude.

Tie a rope to a fixed point. Move the free end from side to side. Explain that a transverse wave is being made. Fix a soft spring at one end and pull it backwards and forwards, waves will travel along the spring. Sections of the spring will be compressed and others will be loose. Explain that the tight coil of the spring is called a compression and the loose coil is called a rarefaction. Such waves are called longitudinal waves. Sound waves are also made in this way. Sound waves are longitudinal waves, which are produced by a vibrating body. Compressions and rarefaction produced by vibrating bodies produce sound waves that travel in air.

**Ask**: Do you know the speed of sound? What is the speed of light? Which travels faster, sound or light? How do you know? Explain that during a thunderstorm the flash of lightning can be seen before the clap of thunder. Take two balloons and inflate them. Heat one of the balloons till it bursts. Prick the cold balloon with a pin at the same time. **Ask**: Which balloon made a louder sound? Explain that sound waves travel faster in hot air. **Ask**: Can you hear sound through a door? 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 will travel. Explain the experiment of an electric bell in a jar. The sound of the ringing bell will gradually decrease as the air is evacuated from the jar, this happens because sound waves cannot be produced without a medium.

**Ask**: Which will produce a louder sound, a small drum struck lightly or a big drum struck strongly? Explain that the amplitude of the vibrations produced by the bigger drum will be large and so a louder

sound will be produced. Also the bigger drum has a larger surface area; therefore it will produce a louder sound than the smaller drum. Explain the activity at the end of the lesson in which the cone is being used to carry sound waves. **Ask**: Can you hear a louder sound if you stand near a vibrating body or if you are away from it? Explain that sound waves spread in all directions, and the sound becomes weaker as the distance from the vibrating body increases.

**Ask**: What is the difference between the sound of a whistle and that of a buzzer? Explain that the sound of a whistle is shrill because it has a high pitch. The pitch of the sound depends on the frequency of the sound waves produced by a vibrating body. A fast vibrating body has a high frequency. It produces a shrill sound.

Send two children out of the class. Tell them to say 'hello' from behind the door. **Ask**: Can you tell who said 'hello' first? Explain that voices and sounds of musical instruments can be recognized by their timbre. Timbre is the combination of sound waves of different frequencies which collectively make up a particular sound.

**Ask**: What can you hear when you clap or shout in an empty hall? Why does your voice resound? Explain that when sound waves strike a hard surface, they are reflected back. This reflection of sound is called an echo. Explain how echoes are used in echo sounders in ships to calculate the depth of the sea. Explain how bats use echoes to detect obstructions in the dark. **Ask**: How do you feel in a crowded room where everyone is talking? Why do little children begin to cry in a noisy room? What is noise? Explain that noise is an abrupt change in the frequency and amplitude of sound waves. Noise is a kind of pollution that can produce harmful effects in the body. It can cause headache and even deafness.

Summarize the lesson.

## Answers to Activities

1. Yes
2. The pieces of paper bob up and down.
   The waves move towards the edge of the basin.

## Answers to Exercises in Unit 11

1. (a) A to and fro movement is called an oscillation.
   (b) The time taken for one complete oscillation is called a period.
   (c) The number of oscillations that are completed in one second is the frequency of the oscillation. It can also be described as the number of waves passing every second. A frequency of 100 Hz means that 100 waves are passing every second.

   For example if the period of a pendulum is ½ a second, it will make two complete swings in 1 second.

2. frequency = 1 / period
   a period = to time taken for 1 oscillation
   frequency = number of oscillations in one second
   5min = 5 x 60 = 300 s
   period of oscillation = 300 / 100 = 3 s

3. The period of oscillation in seconds is = 28days x 24 hrs x 60 min x 60 s = 2419200 s

4. Its period is too long. The pendulum should be made shorter.

5. Waves can be transverse or longitudinal. Transverse waves are produced when the oscillation is from side to side at right angles to the direction in which the wave travels.

   If one end of a spring is fixed to a wall and the other end is pulled backwards and forwards, a wave will be seen travelling along the spring. Each wave is a compressed section followed by a stretched-out section. Waves produced by these backward and forward movements are called longitudinal waves. The wave on the spring and sound waves are longitudinal waves. The oscillations producing them are in the same direction as the motion of the wave. The squashes are called compressions and the stretches are called rarefactions.

6. A, A, D, C

7. Using the formula: speed = frequency x wavelength

| wave | speed | frequency | wavelength |
|---|---|---|---|
| 1 | 32 m/s | 8 Hz | 4 m |
| 2 | 32 m/s | 16 Hz | 2 m |
| 3 | 32 m/s | 32 Hz | 1m |

8. (i) B (ii) A (iii) C

9. The loudness of sound depends on the amplitude of the vibrating body. If the amplitude is large, a loud sound will be heard. The loudness of sound also depends on the surface area of the vibrating body. A small drum will produce a softer sound than a big one.

10. Electric doorbell

    When the switch of the doorbell is pressed the circuit is closed and the current begins to flow through a solenoid. The hammer begins to vibrate striking the gong and the bell continues to ring as long as the push button is pressed.

    Smoke detector

    All smoke detectors consist of two basic parts–a 'sensor' to sense the smoke and a very loud electric horn to wake up people in case of fire.

    Radio

    At the radio station the sound waves of a program go into a microphone that has an electric current running through it. These sound waves create vibrations in the current as they travel through wires to the control room. In the control room technicians control their volume and send them out through a transmitter. An antenna on the transmitter sends these electrical waves out through the air as radio waves.

    The radio in your home has an antenna that picks up these waves from many stations at the same time. By turning the tuning dial you can select the station you want to listen to.

    Television

    A television station broadcasts a program by converting a sound and video program into a radio frequency. A television set receives these signals and turns them into sound and video by converting the radio frequency into an image.

    Safety alarm

    Safety alarms are electric alarms which are used to indicate the opening of a door or window or detect motion using infrared waves. These types of sensors are designed for indoor use.

## Additional Exercise

MCQs

(a) The regular to and fro movements of a swinging body are called _____.

waves oscillations movements [***oscillations***]

(b) The time taken for one complete oscillation is called _____.

period wave requency [***period***]

(c) The number of oscillations completed in one second is called _____.

frequency period wave [***frequency***]

(d) Frequency is measured in _____.

seconds hertz ohms [***hertz***]

(e) The loudness of sound produced by a vibrating body depends on its _____.

amplitude oscillations frequency [***amplitude***]

(f) Waves that travel perpendicular to the direction of the oscillations are called _____.

longitudinal waves transverse waves vibrations [***transverse waves***]

(g) Sound waves are _____ waves.

transverse longitudinal horizontal [***longitudinal***]

(h) A small drum will produce a _____ sound than a big one.

louder softer shriller [***softer***]

(i) Humans can hear sound of frequencies between _____.

50 to 20,000 Hz 500 to 50,000 Hz 500 to 66,000 Hz [***50 to 20,000 Hz***]

(j) Wavelength is the distance between two _____.

waves wavefront oscillations [***wavefronts***]

# Lesson plan

Date: Time: 40 mins

| **Unit: 11**<br>**Topic: Oscillations and waves** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Oscillation, period, and frequency | • to explain oscillation, period, and frequency | • define the terms oscillation, period, and frequency | A pendulum, a metre rule, a stopwatch | Reading: p 103<br>Activity: 1<br>CW: Q2, Q3, Q4<br>HW: Q1 (a) (b) (c) |

**Key words**: oscillation, period, frequency, hertz, amplitude

**Method**: **Ask**: What kinds of sound can you hear in a busy street? Which sounds do you like? Make a pendulum by tying a bob to a piece of string. Pull it to one side to make it swing. Explain that the to and fro movement that it takes to complete one oscillation is called a period. Calculate the number of oscillations in one second. Explain that the number of oscillations completed in one second is called the frequency of the oscillation.

Draw a pendulum on the board. Explain the mean and extreme positions of the bob. The distance that the bob travels from the centre to the extreme position is called its amplitude.

# Lesson plan

Date: Time: 40 mins

| Unit: 11<br>Topic: Oscillations and waves | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Waves | • to defince waves<br>• to describe the different kinds of wave | • describe waves<br>• identify different kinds of wave | Rope, spring | Reading: p 104<br>Activity: 2<br>CW: Q6, Q8<br>HW: Q5, Q7 |

**Key words**: wave, transverse wave, longitudinal wave, compression, rarefaction, wavefront, wave length, peak, trough

**Method**: Tie a rope to a fixed point. Move the free end from side to side. Explain that a transverse wave is being made.

Fix a soft spring at one end and pull it backwards and forwards. You will see that waves will travel along the spring. Sections of the spring will be compressed and others will be loose. Explain that the tight coil of the spring is called a compression and the loose coil is called a rarefaction. Such waves are called longitudinal waves.

Sound waves are also made in this way. Sound waves are longitudinal waves which are produced by a vibrating body. Compressions and rarefactions produced by vibrating bodies produce sound waves that travel in air.

Draw a diagram of a wave on the board. Mark the crest and the trough. Explain that wave length is the distance between two peaks or two troughs (wavefronts). The speed of a wave tells us how far each wave front moves in one second. The speed can be calculated by the distance travelled by a wave divided by the time taken.

# Lesson plan

Date: Time: 40 mins

| **Unit: 11**<br>**Topic: Oscillations and waves** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Frequency and pitch<br>Characteristics of sound | • to define frequency and pitch of sound<br>• to describe characteristics of sound<br>• to describe frequency ranges of different animals | • explain how frequency and pitch of a sound are related<br>• describe the characteristics of sound<br>• describe the frequency ranges of some animals | A table of frequency and pitch<br>A table of the frequency range of sounds produced by different animals | Reading: p 105<br>Activity: 3<br>HW: Q9 |

**Key words**: frequency, pitch, amplitude, vibration, loud soft, frequency range, hertz

**Method**: **Ask**: What is the difference between the sound of a whistle and that of a buzzer? Explain that the sound of a whistle is shrill because it has a high pitch. The pitch of a sound depends on the frequency of the sound waves produced by a vibrating body. A fast vibrating body produces a shrill sound.

**Ask**: Which will produce a louder sound, a small drum struck lightly or a big drum struck strongly? Explain that the amplitude of the vibrations produced by the bigger drum will be large and so a louder sound will be produced. Also the bigger drum has a larger surface area, therefore it will produce a louder sound than the smaller drum.

Show the students the table of the frequency ranges of animal sounds and discuss them.

# Lesson plan

Date: Time: 40 mins

| Unit: 11<br>Topic: Oscillations and waves | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Assignments/HW |
|---|---|---|---|---|
| 4. Applications of sound in daily life | • to discuss the applications of sound in daily life | • explain how we make the use of sound in our daily lives | Pictures of an electric doorbell, electric siren, telephone, radio and stereo player, television, smoke detector, safety alarm | Reading: p 106<br>Project: p 107<br>HW: Q10 |
| **Key words**: electrical appliance<br>**Method**: Show the students pictures of appliances that produce sound. Describe the applications of electrical appliances such as electric doorbells, sirens, telephones, television, etc. that we use.<br>Discuss noise pollution and its harmful effects, and also the ways in which we can try to reduce noise pollution. | | | | |

Name: _____ Date: _____

Q. Fill in the blanks to complete the sentences below.

a. The to and fro movement of a pendulum is called _____.

b. The time taken for one complete oscillation is a _____.

c. The number of oscillations completed in one second is called _____.

d. The number of waves passing every second is called _____.

e. Frequency is measured in _____.

f. A Hertz is equal to _____.

g. The size of the oscillation is called _____.

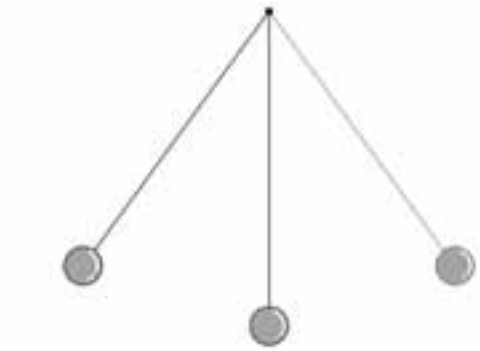
h. Oscillations can be used to make _____.

i. Side to side oscillations at right angles to the direction in which the wave travels are called _____.

j. Oscillations that are in the same direction as the motion of the wave are called _____.

Name: _____ Date: _____

1. Mark the amplitude of the pendulum shown in the diagram.



2. Draw a line to the frequency range in Hz of the following:

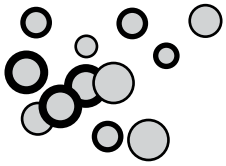
| **Animal** | **Frequency range (Hz) of the sound produced** |
|---|---|
| human | 500 to 4000 |
| dog | 500 to 5000 |
| cat | 4000 to 100,000 |
| porpoise | 500 to 2500 |
| grasshopper | 12000 to 120,000 |
| rat | 800 to 120,000 |

a. Which animal can produce the loudest sound? _____

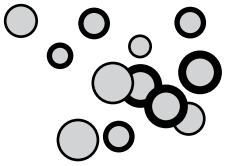
b. What is its frequency range? _____

c. Which animal produces the softest sound? _____

d. What is its frequency range? _____



# UNIT 12



# Current electricity

## Teaching objectives:

- to explain what an electric current is
- to describe an electric circuit
- to show how to connect a circuit in parallel and in series
- to explain the disadvantages of a circuit connected in series
- to explain the safety measures to be taken when using electricity
- to identify the units for measuring current
- to describe the different devices used for measuring current
- to discuss the domestic uses of electricity in the home

## Teaching strategy:

**Ask**: What is lightning? Have you seen tiny sparks coming from a nylon shirt when you take it off in the dark? Why do nylon or silk clothes stick to our legs when we walk? Explain how static electricity is produced. Rub a plastic comb with a woollen cloth and bring it near tiny bits of paper. **Ask**: What happens? Why? Explain that opposite charges are produced due to the rubbing off of electrons from one material on to another. That is how clouds become charged. Explain that when the amount of opposite charges in two bodies becomes large, electrons jump from one to the other and sparks are produced. A streak of lightning is a huge spark of electricity.

**Ask**: What is electricity? What is an electric current? Explain that an electric current is a flow of electrons, and that electric currents are produced by fish such as eels and electric rays. Our body also produces electric currents to make our heart and brain work. Explain the uses of electricity in our daily lives. **Ask**: Why are electric wires coated with plastic or rubber? Why are electric plugs made of plastic? Explain the difference between conductors and insulators.

Set up a simple circuit. Show the students that the bulb lights up. Detach a wire from the battery. **Ask**: Why did the bulb go off? Explain the formation of complete and incomplete circuits and the use of a switch in a circuit. Show the students a battery cell. Break it open and show them the inside. Draw a battery cell on the board. Explain the parts. **Ask**: Have you seen a liquid paste coming out of cells that have been lying around? Explain that a chemical substance called an electrolyte is used in batteries. An electrolyte dissociates into positive and negative ions. The movement of ions towards oppositely charged electrodes produces an electric current. Join two batteries to the circuit you have just made. **Ask**: Does the bulb glow brighter? Why? Explain the meaning of voltage as a push given to the electrons moving in a wire. By adding two batteries the push becomes stronger and the bulb glows brighter. Explain that the electric supply to our houses is of a much higher voltage.

**Ask**: Why mustn't we touch live wires? Explain that high voltage can give an electric shock which can be fatal. Show the students an electric bulb. What is inside the bulb? Is the bulb empty from inside? Explain the structure of a bulb. **Ask**: Why does a bulb become hot when it glows? Explain that a thin wire resists the flow of the current. It becomes hot and gives off heat and light.

Summarize the lesson.

## Answer to Activities

4. No

   No

   The current increases.

   Yes, bubbles of gas are seen collecting on the plates.

   Water is a covalent compound and it does not ionize under the influence of an electric current.

## Answers to Exercises in Unit 12

1. (a) Electrons that can move from one place to another are called free electrons. When free electrons are forced to move in one particular direction, an electric current is produced.

   (b) Materials through which electrons can flow easily are called conductors. They can carry an electric current. The electrons are not tightly held, so they can pass from atom to atom causing the flow of current. Materials through which electrons cannot flow easily are called insulators. The electrons are held tightly so they cannot flow through them. Insulators can be charged by rubbing because the electrons gained or lost remain on the material. They cannot pass back through it. Plastic, rubber, and wood, etc. are examples of insulators.

   (c) The flow of charge in a circuit is called a current. A current is measured in amperes. The instrument that is used to measure current is called an ammeter.

   (d) A switch is a small device which is used to open or close a circuit.

   (e) A fuse protects electric gadgets from damage by a large current. It is made of a thin fuse wire which has a low melting point. If a large current flows through it, the fuse wire melts and breaks the circuit.

   (f) A voltaic cell is a chemical cell. It consists of zinc and copper plates called electrodes, which are dipped in an electrolyte such as dilute sulphuric acid. When the electrodes are connected by a copper wire, an electric current begins to flow in the circuit.

   (g) Refer to page 116 of the Pupil's Book.

   (h) When an electric current flows through a wire in a magnetic field, a force is produced. This force makes the wire move, and is called the motor effect. The motor effect is used to build electric motors. When a loop of wire carrying a current is placed between the two poles of a magnet, upward and downward forces acting on the wire make the loop turn. This twisting effect is used in electric

2. (b)
3. (a) parallel circuit (b) series circuit
4. (b)
5. (c)
6 Refer to Pupil's Book.
7. (a) free electrons (b) coal
   (c) conductors (d) switch
   (e) low melting point (f) insulators
   (g) battery (h) electrons cannot flow through them
   (i) electric current (j) silicon
8. 3A, 3A, 3A

## Additional Exercise

MCQs

(a) Electrons that can move from one place to another are called _____.
positive electrons negative electrons free electrons [***free electrons***]

(b) A non-metal which can conduct electricity is _____.
copper gold coal [***coal***]

(c) Materials which allow electricity to pass through them are called _____.
insulators conductors semiconductors [***conductors***]

(d) A device to open and close a circuit is called a _____.
switch fuse circuit [***switch***]

(e) A fuse wire has a _____.
low melting point high melting point [***low melting point***]

(f) Materials which allow electricity to pass through them when hot are called _____.
conductors semiconductors insulators [***semi-conductors***]

(g) A simple circuit needs a source of electricity such as a _____.
fuse bulb battery [***battery***]

(h) Insulators can be charged by rubbing because _____.
electrons can flow through them electrons cannot flow through them
[***electrons cannot flow through them***]

(i) When electrons are forced to move in a particular direction, they produce _____.
a conductor an insulator an electric current [***an electric current***]

(j) Which one of the following materials is a semiconductor?
carbon silicon plastic [***silicon***]

# Lesson plan

Date: Time: 40 mins

| **Unit: 12**<br>**Topic: Current electricity** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 1. Current electricity | • to define electricity<br>• to define electric current<br>• to explain conductors, semiconductors, and insulators | • explain what electricity is<br>• define electric current<br>• explain what conductors, semiconductors, and insulators are | Diagrams of electric symbols, copper wires, a bulb, a dry cell, samples of conductors, semiconductors and insulators | Reading: p 111, 112<br>Activity: 1<br>CW: Q7<br>HW: Q1 (a) (b) |

**Key words**: electrical energy, electric current, conductor, semiconductor, insulator

**Method**: **Ask**: What is electricity? Explain that electrical energy is commonly known as electricity. It is a flow of electrically charged particles along a conductor. It can be stored in batteries and energy cells.

**Ask**: What is an electric current? Explain that an electric current is a flow of free electrons. Free electrons are electrons that can move from one place to another. When free electrons are forced to move in one particular direction an electric current is produced.

**Ask**: What are conductors? How do conductors allow electrons to flow through them? Explain that conductors are materials through which electrons can flow easily, so they can carry an electric current easily. Conductors have electrons which are not tightly held so they can pass from atom to atom and cause a flow of current. Conductors themselves do not get charged because the electrons do not remain on them. They flow through them.

**Ask**: What are semiconductors? Explain that semiconductors are materials that only allow electricity to pass through them under certain conditions. For example the element silicon allows electrons to flow through only when it is heated.

**Ask**: What are insulators? Explain that insulators are materials that do not allow an electric current to pass through. The electrons in insulators are so tightly attached to the atom that they cannot pass from one atom to another, therefore the electrons do not flow through them. Insulators can be charged by rubbing them because when electrons are gained or lost by rubbing they remain on the material. Examples of insulators are plastic, rubber, wood.

# Lesson plan

Date: Time: 40 mins

| Unit: 12<br>Topic: Current electricity | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 2. Circuits | • to describe a circuit<br>• to explain how circuits are connected<br>• to describe a switch and a fuse<br>• to explain how current is measured | • define a circuit<br>• describe how series and parallel circuits are connected<br>• explain the functions of a switch and a fuse<br>• explain how a current is measured | Diagrams of a simple circuit, a series circuit, a parallel circuit, pictures of a switch and a fuse, an ammeter | Reading: p 112, 113<br>CW: Q1 (c) (d) (e), Q7<br>HW: Q2, Q3, Q8 |

**Key words**: circuit, series, parallel, ampere, ammeter, switch, fuse

**Method**: Make a simple circuit and explain how it works. Explain that a current is measured in amperes. Attach an ammeter to the circuit and show the reading in amperes when the current is flowing through the circuit. Draw a circuit in series and a circuit in parallel on the board.

**Ask**: In which circuit does the bulb glow more brightly? Explain the arrangement of bulbs in both circuits and discuss the distribution of the current in both cases.

**Ask**: What is a switch used for? Explain the use of a switch in a circuit. **Ask**: What happens when a bulb suddenly goes off when we switch it on? Explain that we say that it has fused. It means that too much current flowed into the bulb and its filament wire melted.

**Ask**: Have you seen the fuse box in your house? Explain that a fuse is a thin piece of wire placed in an electric circuit. It melts when a large current flows through the circuit. In this way it breaks the circuit and the current stops flowing. A fuse helps to save our household appliances from damage.

**Ask**: How can we judge the size of a current flowing though a circuit? Explain that we can judge the size of the current by looking at the brightness of the bulb. In science, we use a measuring instrument called an ammeter which measures the size of the current in amperes (A). Explain that an ampere means about 6 million, million, million electrons are flowing round the circuit in one second. The size of the current shows how much charge flows through the circuit in one second. A charge is measured in units called coulombs (C).

# Lesson plan

Date: Time: 40 mins

| **Unit: 12**<br>**Topic: Current electricity** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 3. Voltage | • to define voltage<br>• to describe how voltage is measured | • define voltage and to explain how it is measured<br>• identify the units for measuring voltage | Diagrams of voltages around a circuit, connecting a voltmeter, a battery cell | Reading: p 114<br>CW: Answer the following questions:<br>a. What is voltage?<br>b. How can voltage be measured?<br>c. Where in a circuit is a voltmeter attached?<br>d. Draw a diagram to show that the voltage across the bulbs adds up to the voltage of the battery. |

**Key words**: voltage, voltmeter, battery

**Method**: Show the students a battery cell. Ask them to read the voltage on it. **Ask**: What does volts mean?

Explain that all electrical circuits need a source of energy. Draw an electric circuit with a bulb. Explain that when the electrons are pushed out of the battery, they carry energy with them. This energy is changed into heat and light. When the electrons reach the battery again, all their energy is used up. The electrical push which is needed to push a current to flow in a circuit is called voltage. Voltage can be measured by a voltmeter. Show the students a voltmeter. Attach the voltmeter to a simple electric circuit with a bulb, and show the students the reading on the voltmeter. Explain that a voltmeter is attached in a circuit in parallel to the component whose voltage needs to be measured.

Discuss the use of voltage to make current flow. Larger voltages cause larger currents.

# Lesson plan

Date: Time: 40 mins

| **Unit: 12**<br>**Topic: Current electricity** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 4. Resistance | • to explain resistance<br>• to identify the factors on which resistance depends<br>• to describe how resistance is measured | • define resistance<br>• identify the factors on which resistance depends<br>• explain how resistance is measured | Diagrams of circuits containing resistance wires | Reading: p 115<br>Activity: 2<br>CW: What are the factors on which the resistance of a wire depends?<br>Ex: p 115 |

**Key words**: resistance, nichrome wire, copper wire, ohm, omega

**Method**: **Ask**: What is resistance? Through which materials can an electric current pass easily? Explain that copper wire allows a current to pass more easily than a nichrome wire. We say that the nichrome wire has more resistance. When an electric current passes through a nichrome wire, it becomes hot. The reason for this is that more energy is needed to force the electrons to pass through it and the wire becomes hot. Explain that the resistance of any wire depends on three things: the length, the diameter, and the material of the wire. Explain the factors on which the resistance of a wire depends.

Set up a circuit with a resistance wire and an ammeter. Explain that the resistance of a circuit tells us how many volts are needed to make a current of 1 ampere flow. If a circuit has a larger resistance we have to apply a high voltage to get the current of 1A to flow through it. A low resistance needs a smaller voltage.

**Ask**: How is resistance measured? Explain that resistance is measured in units called ohms. To calculate the resistance of a wire we can use the formula: *voltage divided by the current is equal to resistance.*

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|---|---|---|---|---|
| 5. Sources of an electric charge: cells and batteries<br>Electricity for our homes<br>Safety rules for using electricity | • describe the different types of cells and batteries<br>• to explain where electricity for our homes and offices comes from<br>• to explain the safety rules when using electricity | • explain how cells and batteries are sources of electric charge<br>• explain how electricity comes from a power station to our homes and offices<br>• explain the safety rules when using electricity | Voltaic cell, dry cell, battery, mercury button cell, rechargeable cell<br>Picture of a power station<br>A chart of safety rules when using electricity | Reading: p 115, 116, 117<br>Activity: 4<br>CW: Q1 (g)<br>HW: Q1 (f) |

**Key words**: voltaic cell, dry cell, battery, mercury button cell, rechargeable cell, lithium cell, power station

**Method**: With the help of real cells, diagrams, and charts, discuss the structure and use of various types of cells and batteries.

**Ask**: How do we use electricity? Where does electricity for our homes and offices come from? Discuss how electricity is generated in a power station and brought to our homes. Explain how the wiring is fitted with fuses in the main switch board to protect our appliances.

Explain the safety rules for using electricity.

# Lesson plan

Date: Time: 40 mins

| Unit: 12<br>Topic: Current electricity | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 6. Electric currents and magnetism | • to define electromagnetism<br>• to discuss the uses of electromagnets | • explain electromagnetism<br>• describe an electromagnet<br>• explain how an electric motor works<br>• explain how electromagnets are used | A solenoid, electric motor, electric bell, diagrams of electromagnets, electric motor, electric bell | Reading: p 118, 119<br>Activity: 3<br>CW: Q4, Q5<br>HW: Q1 (h), Q6 |

**Key words**: electric current, electromagnetism, solenoid, electric motor, motor effect, electric bell

**Method**: Wind a loop of wire round a nail. Remove the nail and attach the ends of the coil to a battery cell. Bring a magnetic needle close to the coil. The needle will be deflected showing that there is a magnetic field around the coil. Explain that this type of a coil is called an electromagnet or solenoid. If the number of turns of the coil is increased, the electromagnet can be made stronger.

**Ask**: What is an electric motor? How does an electric motor work? Explain that when an electric current flows in a wire in a magnetic field, a force is produced which makes the wire move. This force is called the motor effect. The motor effect is used by scientists and engineers to build electric motors.

Show the students a model of an electric bell. Explain its parts. Attach the wires to a battery. Switch on the current. Explain the working of the bell and the role of the electromagnet inside it.

Name: _____ Date: _____

1. Draw the symbols for the following electrical components:

   a. connecting wire _____

   b. cell _____

   c. battery _____

   d. voltmeter _____

   e. ammeter _____

   f. two wires joined _____

   g. light bulb _____

   h. switch _____

2. Draw the following:

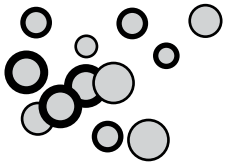
   a series circuit

   a parallel circuit

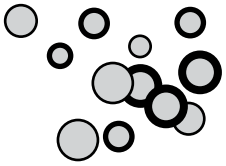
Name: _____ Date: _____

Q. Write the type of cell next to its description.

| Description | Type of cell |
|---|---|
| 1. A chemical cell with zinc and copper plates dipped in an electrolyte such as dilute sulphuric acid | _____ |
| 2. An electrical cell having a metal zinc case and a carbon rod in the middle; the electrolyte is a paste of zinc chloride and ammonium chloride | _____ |
| 3. An electrical cell made up of a number of cells joined together; the electrodes are lead plates dipped in an electrolyte such as dilute sulphuric acid | _____ |
| 4. A very small cell which produces a large current for a short time or a small current for a long time; it is very expensive | _____ |
| 5. A cell made up of nickel and cadmium; it is completely sealed and can produce a large current; it is very expensive. | _____ |
| 6. A very small and light cell made of lithium; it lasts a long time and is very expensive. | _____ |



# UNIT 13



# Investigating space

## Teaching objectives:

- to explain the scientific theories regarding the origin of the universe
- to discuss the characteristics of a star
- to describe the different heavenly bodies
- to describe galaxies
- to explain the major constellations visible in the night sky
- to explain the scientific theories about the birth and death of our Sun
- to describe a 'black hole'

## Teaching strategy:

Historical background

The study of stars and planets has always been important to human beings. In the Stone Age, before calendars were developed, the movement of stars was used to plan the sowing time for crops. Five thousand years ago, priests in the Middle East were making astronomical measurements. They could predict eclipses, and used their information for ceremonies and for astrology. In the 1700s, astronomers collected accurate information on the position of stars and planets so that ocean navigation could become much safer. Nowadays, astronomers continue to try and learn about the nature of the universe. Attempts to explore space has given us new knowledge, and have led to the development of new materials. As you travel in a space ship from the Solar System to the outer edge of the Milky Way Galaxy the planets become invisible, but you can still see the Sun. The Sun is one of many stars grouped together in one of the spiral arms of our galaxy. On a dark night you may already have seen the stars in this spiral arm as a misty area across the sky, known as the Milky Way. You will have to travel much further before you can see what the whole galaxy looks like. Our galaxy contains about 100,000 million stars. It is spiral in shape. It has a central core of older stars, and the spiral arms contain newer stars. Take the students to a planetarium.

**Ask**: How do you think the universe came into being? Discuss the theories about how the universe was formed. **Ask**: What is the Sun? Why is the Sun hot? Are stars hot? Explain what stars are and how they are formed. Discuss the life of a star. Discuss other heavenly bodies in space. Show the students pictures of a telescope. Draw a diagram on the board to explain the structure and working of a telescope. Discuss the safety measures that need to be taken to view the sun and other objects in space.

Summarize the lesson.

## Answers to Exercises in Unit 13

1. (a) Space is emptiness. It is black because it has no light of its own. It is neither hot nor cold and there is no air or water in space. But there are billions and billions of stars, huge clouds of dust and gas, and meteorites and rocks hurtling through space. Waves of light from stars travel through it and tiny invisible particles move about in it.

   (b) Space is full of waves. These are waves of radiation. Radiation is streams of tiny, tiny bits of atoms travelling at tremendous speed. Radiation is given off by most things in space–stars, quasars, planets, and nebulae.

   (c) Radiation comes to the Earth in the form of heat, light, radio waves, X-rays, cosmic rays, and gamma rays. The Earth's atmosphere shuts out some of these things; otherwise they could be very harmful for all living things on Earth.

   (d) The big bang theory suggests that the universe began about 10, 000 million years ago with an enormous explosion. Scientists believe that all the matter now in the universe was contained in one primitive atom which they called a primordial atom. This atom blew up and its contents flew off in all directions. As the primordial material spread out, it cooled, joined together and made the galaxies.

   This theory, however, does not suggest where the primordial atom came from in the first place.

   (e) The pulsating universe theory suggests that the universe is continually contracting and expanding. When the universe has expanded to a certain size it will begin to shrink. The galaxies will be pushed closer and closer together. Eventually they will explode causing the universe to expand again.

   The expanding universe theory suggests that the universe will never collapse. It will keep on expanding. This theory implies that there has only ever been one 'big bang'.

   [Ask the students opinion about what they think how the universe was formed]

   (f) A huge mass of stars is called a galaxy. There are at least ten billion other galaxies, and possibly many more than this! And each of them contains many billions of stars!

   Galaxies shaped like the Milky Way galaxy are called spiral galaxies. Some galaxies are round or oval. They are called elliptical galaxies. Others have no regular shape.

   Most galaxies are so far away that we cannot see them without a telescope, but we can see a few. People north of the Equator can see the Andromeda Galaxy, which is the farthest object that we can see with our eyes alone. People south of the Equator can see two galaxies as white patches in the sky. They are the Small and Large Magellanic Clouds.

   (g) On a clear summer night we can sometimes see a bright haze in a part of the sky. This haze is called the Milky Way. It looks like a gigantic cloud of stars, close together. The Milky Way is part of an even bigger cloud of stars. This star cloud is shaped like a disc with a bulge in the centre. This huge mass of stars is called a galaxy - the Milky Way Galaxy. Our Sun is one of the stars in this galaxy. The Sun is so far from the centre that it takes the Sun 200 million years to go all the way round it.

2. All stars are balls of hot, glowing gas, like our Sun. But stars can be very different from one another. A star such as our Sun is a medium-sized star. Stars called giant stars may be a hundred times bigger than our Sun. Stars called super giants may be a thousand times bigger. The smallest stars are called dwarf stars. Some of them are smaller than our Earth. The colour of a star shows

how hot it is. The hottest stars shine with brilliant blue light. White stars are less hot. Yellow stars, such as our Sun, are cooler, and the red stars are the coolest of all.

Great clouds of gas and dust called nebulae are found throughout the universe. Stars may form in nebulae. The process begins when gravity pulls the gas and dust particles together. As the mass of particles becomes tightly packed, or compressed, it heats up. In time, the temperature inside rises to over one million degrees Celsius. At such high temperatures atoms of hydrogen gas begin to fuse together to form helium gas. As they do so, they release enormous amounts of energy as heat and light. The mass of gas and dust begins to shine as a star.

3. (a) Great clouds of gas and dust called nebulae, are found throughout the universe. Stars may form in nebulae. The process begins when gravity pulls the gas and dust particles together. As the mass of particles becomes tightly packed, or compressed, it heats up. In time, the temperature inside rises to over one million degrees Celsius. At such high temperatures atoms of hydrogen gas begin to fuse together to form helium gas. As they do so, they release enormous amounts of energy as heat and light. The mass of gas and dust begins to shine as a star.

   (b) Pulsars were once giant stars, but now they have shrunk until they are much smaller than the Earth. There is as much material in a pulsar as there is in our Sun, but the material is tightly squeezed together. Pulsars give off energy as ordinary stars do, but they do not give it in a steady stream. They give off even bursts of energy, like a beating heart.

   Quasars seem to be like huge, dim stars, far out in space. They are not really dim. They are the brightest things in space. They give off as much light as millions and millions of stars all rolled into one. Perhaps they seem dim because they are so far away.

   (c) Red giant stars and white dwarf stars are stars that have grown old. When a yellow star, such as our Sun, gets old and ready to die, it swells up and becomes a red giant star. Then it shrinks and becomes a white dwarf. A white dwarf is a very heavy star. It swells into a super giant. It uses up the last of its energy and blasts itself apart in a supernova explosion. After a supernova, a tiny neutron star (smaller than our planet) may be left.

4. Astronomers think that a black hole could be an enormous star that has shrunk until it is squeezed together so tightly that nothing is left of it but gravity. The pull of gravity would be so strong that nothing could get away from it, not even light. That is why they are called black holes.

5. Moons, planets, comets, and asteroids do not emit light. They reflect light.

   Black holes absorb everything, including light.

6. Stars are the only heavenly bodies that emit light. They use nuclear fusion which produces enormous amounts of energy in the form of heat and light.

   The Sun is the only object in the Solar System that generates and emits visible light.

7. Refer to page 129 in the Pupil's Book.

## Additional Exercise

MCQs

(a) Space and all the things in it make up the _____.

world solar system universe [***universe***]

(b) The big bang theory suggests that the universe was contained in a primitive atom called _____.

nuclear atom primordial atom electronic atom [***primordial atom***]

(c) _____ are balls of hot glowing gases.

Stars Comets Meteors [***Stars***]

(d) Bright stars which join up to make patterns in the sky are called _____.

galaxies constellations nebulae [***constellations***]

(e) A huge mass of stars which may be spiral or elliptical is called _____.

great bear pole star galaxy [***galaxy***]

(f) Giant stars which have shrunk, but give off bursts of energy are called _____.

constellations pulsars quasars [***pulsars***]

(g) _____ are great clouds of gases and dust in space.

Nebulae Comets Pulsars [***Nebulae***]

(h) Stars may have formed in _____.

nebulae solar system clouds [***nebulae***]

(i) Stars that have grown old are called _____.

white dwarfs black holes quasars [***white dwarfs***]

(j) Our _____ is a star that is part of the Milky Way Galaxy.

Moon Sun Earth [***Sun***]

# Lesson plan

Date: Time: 40 mins

| Unit: 13<br>Topic: Investigating space | Teaching objectives | Learning outcomes<br>Students should be able to: | Resources/Materials | Activities/CW/HW |
|---|---|---|---|---|
| 1. What is space?<br>How the universe was formed<br>Stars, constellations, galaxies | • to define space<br>• to explain the scientific theories put forward to explain the origin of the universe<br>• to define stars, constellations, and galaxies | • define space<br>• discuss theories that try to explain the origin of the universe<br>• explain what stars, constellations, and galaxies are | Diagrams and charts explaining space and the theories of how the universe was formed, pictures of stars, constellations, and galaxies | Reading: p 125, 126, 127<br>CW: Q1 (a) (b) (c)<br>HW: Q1 (d) (e) (f) (g) |

**Key words**: space, wave, universe, radiation, primordial atom, big bang theory, pulsating universe theory, expanding universe theory

**Method**: Explain the historical background of how the universe came into being.

The study of stars and planets has always been important to human beings. In the Stone Age, before calendars were developed, the movement of stars was used to determine the sowing time for crops. Five thousand years ago, priests in the Middle East were making astronomical measurements. They could predict eclipses, and used their information for religious ceremonies and for astrology.

In the 1700s, astronomers collected accurate information about the position of stars and planets so that ocean navigation became much safer. Nowadays, astronomers continue to discover more about the nature of the universe. Attempts to explore space have given us new knowledge, and have led to the development of new materials.

If you could travel in a spaceship from the Solar System to the outer edge of the Milky Way Galaxy, the planets would become invisible, but you could still see the Sun. The Sun is one of many stars grouped together in one of the spiral arms of our galaxy. On a dark night, you may have seen the stars in this spiral arm as a misty area across the sky, known as the Milky Way. You would have to travel much further before you could see what the whole galaxy looks like. Our galaxy contains about 100,000 million stars. It is spiral in shape and has a central core of older stars. The spiral arms contain newer stars.

If possible, take the students to a planetarium to observe the universe and stars.

**Ask**: How do you think the universe came into being? Discuss the theories about how the universe was formed.

**Ask**: What is the Sun? Why is the Sun hot? Explain what stars are and how they are formed. Discuss constellations and galaxies.

# Lesson plan

Date: Time: 40 mins

| **Unit: 13**<br>**Topic: Investigating space** | **Teaching objectives** | **Learning outcomes**<br>Students should be able to: | **Resources/Materials** | **Activities/CW/HW** |
|---|---|---|---|---|
| 2. Strange things in space<br>The telescope | • to describe some strange things in space<br>• to describe the life of a star<br>• to explain how a telescope works<br>• to explain the safety precautions to be taken when looking at the Sun | • describe pulsars, quasars, and black holes<br>• explain how long a star lasts<br>• explain the working and use of a telescope<br>• describe the harmful effects of looking directly at the Sun and to list the precautions that must be taken | Pictures of pulsars, quasars, stars | Reading: p 127, 128<br>CW: Q2, Q3, Q4<br>HW: Q5, Q6, Q7<br>Project: p 131 |

**Key words**: pulsar, quasar, black hole, nebula, helium gas, red giant, white dwarf

**Method**: Show the students pictures of pulsars and quasars.

Explain what pulsars and quasars are and how they are formed. Explain what a black hole is. Describe the life of a star. Explain that white dwarfs and red giants are stars that have grown old. Describe the process by which a star becomes a red giant and then how a white dwarf swells to form a super giant and blasts itself apart in a supernova explosion, and finally a tiny neutron star may be left. Discuss the emission and reflection of light by heavenly bodies. Explain that black holes absorb everything including light.

Show the students a model of a telescope. Explain its structure and its use. Draw a diagram on the board to explain how an upside down image of a heavenly body is formed.

Explain the safety precautions to be taken when viewing the Sun.

Name: _____ Date: _____

1. Fill in the blanks in the text to explain how the universe was formed.

   Scientists suggest various _____ to explain how the universe was formed:

   (i) The Big Bang theory suggests that the universe began about _____ years ago, with an enormous _____. Scientists believe that all the matter that is now contained in the universe was contained in one primitive atom called the _____.

   This atom blew up and its contents flew off in all _____. As the material spread out, it cooled, joined together, and formed the _____.

   (ii) The _____ theory suggests that the universe is continually contracting and expanding. When the universe has _____ to a certain size it will begin to _____. The _____ will be pushed closer and closer together. Eventually they will _____, causing the universe to _____ again.

   (iii) The _____ theory suggests that the universe will never collapse. It will continue to _____. This theory implies that there has only ever been one _____.

Name: _____ Date: _____

Q. Write the name of the heavenly bodies described below.

| Description | Name |
|---|---|
| 1. A ball of hot, glowing gases | _____ |
| 2. A star a hundred times bigger than our Sun | _____ |
| 3. A star a thousand times bigger than our Sun | _____ |
| 4. The smallest star | _____ |
| 5. Patterns of stars in the sky | _____ |
| 6. A cloud of stars | _____ |
| 7. Shrunken stars that give out bursts of energy | _____ |
| 8. The brightest stars in space | _____ |
| 9. An enormous star that has shrunk until it is squeezed so tightly that nothing is left of it except gravity | _____ |
| 10. A yellow star that swells up and becomes red when it gets old and is ready to die | _____ |

# Test paper 3

**Time**: **3 hours** **Total marks**: **100**

1. Attempt any six questions. [All questions carry equal marks.] [60]

   (a) What is heat? Explain the methods of heat transfer?

   (b) How do convection currents move in a liquid? Explain what causes land and sea breezes.

   (c) Explain how heat is radiated. How does the temperature of a liquid in a thermos flask remain the same for a long time?

   (d) What is temperature? What does the temperature of a body depend on?

   How is temperature measured? Name the various types of thermometers.

   (e) (i) What is refraction of light? What is meant by the refractive index of a material?

   (ii) Calculate the speed of light in water when the refractive index of water is 1.33.

   (f) (i) Define an oscillation, a period, frequency of an oscillation?

   (ii) A child on a swing goes backwards and forwards 100 times in five minutes. Calculate the period of the oscillation and the frequency in hertz.

   (g) What is the motor effect? How is the motor effect used in electric motors?

   (h) (i) Briefly explain the Big-bang theory.

   (ii) Compare the expanding universe theory with the pulsating universe theory for the origin of the universe. Which theory do you think could be most accurate? Why?

   (i) What is a star? What do scientists think about how stars are formed?

2. Draw and label the following diagrams: [15]

   (a) A dry cell

   (b) An electric bell and its circuit

   (c) A telescope

3. Correct the following statements. [10]

   (a) When an object is heated, its molecules lose energy.

   (b) Rubber and wood are good conductors of electricity.

   (c) The ability to conduct heat is called radioactivity.

   (d) Water is a good conductor of heat.

   (e) The flow of heat through a liquid is called radiation.

   (f) Monsoon winds are conduction current winds.

   (g) During the daytime, water heats up more quickly than land.

   (h) Radiation needs a medium to travel through.



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(i) When a substance is cold, its molecules move quickly.

(j) Absolute zero is equal to –273°F.

4. Write short notes on the following: [15]

(a) nebulae

(b) pulsars

(c) quasars

(d) red giants and white dwarfs?

(e) black holes