

8

PARVEEN ARIF ALI

# Teaching Guide

Revised Edition

# Amazing Science



**OXFORD**  
UNIVERSITY PRESS





# Contents

Introduction .....	iv
<b>Unit 1</b> Introduction to scientific measurement .....	1
Lesson plans .....	4
Worksheets.....	7
<b>Unit 2</b> Sensitivity in living organisms .....	9
Lesson plans .....	13
Worksheets.....	17
<b>Unit 3</b> Cells, heredity, and evolution.....	19
Lesson plans .....	23
Worksheet.....	27
<b>Unit 4</b> Biotechnology.....	28
Lesson plans .....	31
Worksheets.....	34
<b>Unit 5</b> Environmental pollution and conservation .....	36
Lesson plans .....	40
Worksheet.....	44
Test paper 1 .....	45
<b>Unit 6</b> Chemical reactions and chemical equations.....	47
Lesson plans .....	51
Worksheets.....	54
<b>Unit 7</b> Acids, alkalis, and salts .....	56
Lesson plans .....	59
Worksheets.....	62
<b>Unit 8</b> Oxygen and carbon dioxide .....	64
Lesson plans .....	67
Worksheets.....	69
Test paper 2 .....	71
<b>Unit 9</b> Lenses at work .....	73
Lesson plans .....	75
Worksheets.....	79
<b>Unit 10</b> Force and pressure .....	82
Lesson plans .....	85
Worksheets.....	89
<b>Unit 11</b> Expansion of solids and liquids.....	91
Lesson plans .....	94
Worksheets.....	98
<b>Unit 12</b> Electricity and magnetism.....	100
Lesson plans .....	104
Worksheets.....	108
<b>Unit 13</b> Modern technology and space travel .....	110
Lesson plans .....	114
Worksheets.....	118
Test paper 3 .....	120

# 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.

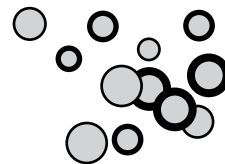
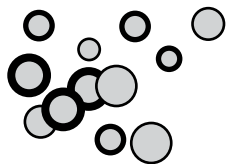
Most of the experimental work should be carried out by the students themselves, as it develops more interest and a sense of responsibility among the students. The basic method or technique should be thoroughly understood by the students before an experiment is performed. The students should be allowed 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.





# Introduction to scientific measurement

---

## Teaching objectives:

- to define physical quantities of length, volume, mass, time
- to define the SI units and explain their importance to scientists
- to interconvert smaller and bigger units
- to know the use of measuring instruments
- to use SI units in daily life

## Teaching strategy:

**Ask:** Why do we measure? Explain that long ago people had only vague ideas about distance and time. For example, half an hour's walk may mean very different distances for different people. When buying and selling things we must agree on the measurement to be used. Scientists make many kinds of measurements in the laboratory. It is only by making careful and accurate measurements that science makes progress. Since 1960, scientists have used SI units for all measurements. SI stands for System International or the International System of Units.

## Measurement in science

Many of the experiments in science involve making measurements of one kind or another. When making measurements, the questions most often asked are: how many? how long? how big? The most common or basic measurements concern: length, mass, time.

## Measurement of length

Long ago length was measured by comparing an object with parts of the body like the arm or the foot. In ancient Egypt one cubit was the length from the elbow to the tip of the middle finger of a person's hand.

The SI unit for length is the metre (m). **Ask:** Do you have any idea how long a metre is?

milli means a thousandth,  $1/1000$

centi means a hundredth,  $1/100$

kilo means a thousand, 1000

Smaller units of the metre are the millimetre and centimetre. The larger unit of the metre is the kilometre. Instruments for measuring length are the measuring tape, metre rule, vernier callipers, and the screw gauge.

## The unit for mass

The SI unit for mass is the kilogram (kg).

$$1\text{kg} = 1000\text{g}$$

The smaller units of mass are the gram and milligram. We often work with these smaller units in the laboratory.

## Measuring mass

An instrument to measure mass is called a balance. There are many types of balances.

## Measuring temperature

**Ask:** What is temperature? How do you find out how hot or cold a body is? One way is to feel with our hands. Temperature is a measure of how hot or cold a body is. In a laboratory, the mercury or alcohol thermometer is used to measure temperature. The unit for measuring temperature is degrees Celsius.

## Measuring volume

The formula for finding the volume of regular solids is:

$$\text{length} \times \text{breadth} \times \text{height}$$

The following instruments are used in the laboratory for measuring the volume of liquids: measuring cylinder, burette, pipette, and measuring flask. For reading the volume of a liquid accurately we have to read the bottom of the meniscus. The eye must be level with the bottom of the meniscus. The cylinder must also be upright when read. This is to ensure that the liquid is level. The volume of an irregular solid can be found by lowering it into a cylinder containing a suitable amount of water. The water level will then rise. The rise in the water level gives the volume of the solid.

## Measuring time

**Ask:** Think of the world with no clocks, watches, or calendars. Would life be easier for you? In the past, sundials were used to tell the time. A sundial is one of the simplest clocks. The Sun casts a shadow on the face of the sundial. The movement of the shadow follows the apparent movement of the Sun. The position of the shadow on the scale gives the time. **Ask:** Have you ever seen a stopwatch? Where was it used? Do you know how to use a stopwatch? Stopwatches and stop clocks measure time. A stopwatch has knobs or buttons to start, stop, and reset the digits. It has a large seconds hand. One full round of this hand measures 60 seconds. Electronic stopwatches can measure time intervals accurate to 0.01 seconds. They have digital display of the time. This makes taking readings easier.

## Answers to Exercises in Unit 1

- (a) screw gauge                      (b) vernier callipers                      (c) callipers
- millimetre, tonne, milligram, centimetre
- (a) 1600g                      (b) 1450 mm
- 1000                      100,000                      10                      100                      1000,000
- 1000 mm                      1500 mm                      1534 m                      1.652 m
- 24 cubic centimetres  
192 cubic centimetres

## Additional Exercise

### MCQs

- The SI unit for length is the \_\_\_\_\_.  
metre                      pound                      mile                      kilogram                      [*metre*]
- \_\_\_\_\_ is the amount of space something takes up.  
Volume                      Weight                      Mass                      Balance                      [*Volume*]
- Mass can be measured by using a \_\_\_\_\_.  
callipers                      balance                      meniscus                      cylinder                      [*balance*]
- The volume of liquids is measured in \_\_\_\_\_.  
tons                      kilograms                      newtons                      litres                      [*litres*]
- The volume of a substance is measured in \_\_\_\_\_.  
newtons                      litres                      cubic metres                      metres                      [*cubic metres*]
- A \_\_\_\_\_ is used for measuring given volumes.  
burette                      pipette                      balance                      vernier calipers                      [*pipette*]
- The curved surface of a liquid is called the \_\_\_\_\_.  
meniscus                      MKS                      gauge                      crescent                      [*meniscus*]
- The mass of a body is the quantity of \_\_\_\_\_ it contains.  
water                      weight                      blood                      matter                      [*matter*]
- Weight is measured in \_\_\_\_\_.  
newtons                      metres                      ounces                      grams                      [*newtons*]
- The two main \_\_\_\_\_ sciences are chemistry and physics.  
earth                      solid                      amazing                      physical                      [*physical*]

Date:

Time: 40 mins

Unit: 1 Topic: Introduction to scientific measurements	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Scientific measurements	<ul style="list-style-type: none"> <li>to demonstrate different ways of measuring length</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>use different instruments to measure length</li> </ul>	Metre rule, measuring tape, callipers, vernier callipers, screw gauge	<p>Reading: p 2, 3, 4 Activity: p 4 CW: Q1 HW: Q5</p>

**Key words:** matter, SI units, MKS system, metre, kilogram, second

**Method:** Begin the lesson by explaining what measuring something means. Explain that long ago people had only inexact ideas about distance and time. For example, half an hour's walk may mean very different distances for different people. When buying and selling things we must agree on the unit of measurement to be used. Scientists make many kinds of measurements in the laboratory. It is only by making careful and accurate measurements that scientific work can be carried out. Since 1960, scientists have used SI units for all measurements. SI stands for System International, or the International System of Units.

**Measurement in science**

Many scientific experiments involve making measurements of one kind or another. When making measurements, the questions most often asked are: How long? How many? How big? How small? etc. The most common or basic measurements concern: length, mass, and time.

**Measurement of length**

Long ago, length was measured by comparing an object with parts of the body, like the arm or the foot. In ancient Egypt, one cubit was the length from the elbow to the tip of the middle finger of a person's hand.

The SI unit for length is the metre (m).

**Ask:** Do you have any idea of how long a metre is? Show the students a metre rule. Ask them to measure it using hand spans to get a rough idea of how long a metre is.

Explain the smaller units: *milli* means a thousandth part or 1/1000; *centi* means a hundredth part or 1/100.

A centimetre and a millimetre are smaller units than a metre. A kilometre is larger unit than a metre and is equal to 1000 metres.

Explain how the measuring tape, metre rule, callipers, vernier callipers, and the screw gauge are used for measuring length.

Date:

Time: 40 mins

Unit: 1 Topic: Introduction to scientific measurements	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/WW
2. Measuring mass, volume, and time	<ul style="list-style-type: none"> <li>• to explain the terms <i>mass, volume, and time</i></li> <li>• to introduce the instruments used for measuring mass, volume, and time</li> </ul>	<ul style="list-style-type: none"> <li>• explain what is meant by <i>mass, volume, and time</i></li> <li>• explain the difference between mass and weight</li> <li>• use correctly the instruments for measuring mass, volume, and time</li> </ul>	A beam balance, measuring cylinder, measuring flask, pipette, burette, clock, a stopwatch, a digital clock	Reading: p 4, 5, 6 CW: Q2, Q3 HW: Q4, Q6
<p><b>Key words:</b> mass, weight, kilogram, gram, milligram, microgram, volume, litre, millilitre, measuring cylinder, measuring flask, pipette, burette, meniscus, time, hour, minute, second, clock</p> <p><b>Method: Ask:</b> What is mass? What is weight? What is the difference between the two? Explain the difference between mass and weight. Weight is a force and is measured in newtons. Mass is the quantity of matter in a body. The mass of a body does not change, no matter where it is, but the weight can vary from place to place.</p> <p>The unit for measuring mass is the kilogram (kg). 1 kg = 1000 g</p> <p>The smaller units of mass are the gram and milligram. We often work with these smaller units in the laboratory. The instrument used to measure mass is called a balance. Discuss the different types of balance.</p> <p><b>Measuring volume</b></p> <p><b>Ask:</b> What is volume? How can we measure the volume of a body? Discuss the formula for finding the volume of regular solids: length x breadth x height.</p> <p>The volume of liquids is measured in litres (l). 1 litre = 1000 millilitres (ml)</p> <p>The instruments used for measuring the volume of liquids are: measuring cylinder, measuring flask, burette, pipette, etc. For reading the volume of a liquid accurately we have to read the bottom level of the meniscus. The eye must be level with it. To ensure that the liquid is level the cylinder must be upright when the reading is taken.</p> <p style="text-align: right;">Contd.</p>				

The volume of an irregular solid such as a stone can be found by lowering it into a cylinder containing a suitable amount of water. The rise in the water level will give the volume of the solid.

### **Measuring time**

Ask the students to think what the world would be without clocks, watches, or calendars.

Explain that in the past, sundials were used to tell the time. A sundial is the simplest clock. The sun casts a shadow on the face of the sundial. The movement of the shadow follows the apparent movement of the Sun. The position of the shadow on the scale gives the time.

**Ask:** What is a stopwatch? What is it used for?

Explain that stopwatches, watches, and clocks are used to measure time. A stopwatch has knobs or buttons to start, stop, and reset the digits. It has a large seconds hand. One full round of the hand measures 60 seconds. Electronic stopwatches can measure time intervals accurate to 0.01 second. They have digital display of time, which makes taking readings easier.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Q. Match the branch of science with its field of study.

**Branch of science**

physics

chemistry

biology

microbiology

biotechnology

genetics

ecology

space technology

**Field of study**

living organisms

matter and energy

microscopic organisms

matter

environment

the universe and heavenly bodies

use of microbes in making useful substances

cells and heredity

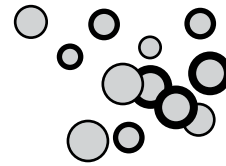
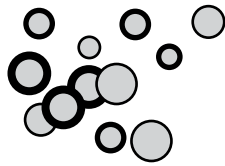
Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Fill in the blanks to complete the statements:

- a. km is the symbol for \_\_\_\_\_.
- b. To measure the volume of a liquid we use the unit \_\_\_\_\_.
- c. What is the volume of 50 cubic centimeters in litres? \_\_\_\_\_
- d. A measuring cylinder is used to measure \_\_\_\_\_.
- e. A metre rule is used to measure \_\_\_\_\_.
- f. A balance is used to measure \_\_\_\_\_.
- g. A pair of callipers is used to measure \_\_\_\_\_.
- h. A screw gauge is used to measure \_\_\_\_\_.





## Sensitivity in living organisms

### Teaching objectives:

- to explain that all living things respond to changes inside and outside their bodies
- to explain how simple organisms respond
- to describe how plants and animals respond
- to explain how coordination takes place in our bodies
- to describe the structure and working of the nervous system
- to explain the position and function of the glands of the endocrine system
- to explain the structure and functions of the brain and the sense organs
- to explain the structure and function of the excretory system in humans
- to discuss some common diseases of the kidney and their treatment

### Teaching strategy:

Introduce the topic of sensitivity by asking the students some questions. **Ask:** Do plants move? Will a plant run away if you hit it? What characteristics of a plant help you to know that it is living? Where does an amoeba live? What is the green layer seen on the surface of stagnant water? Explain that all living organisms are sensitive to changes in their environment. Explain that plants move their parts as in the sunflower plant whose leaves and flowers turn to face the Sun. Roots always grow downwards towards soil and water. Some flowers open and close their petals according to the intensity of light. Explain that chlamydomonas and euglena can detect changes in light intensity by their eyespot. In an amoeba the whole cytoplasm is sensitive. Explain the difference between tactic, nastic, and tropic movements. Perform the experiments described in the book, and explain that tropic movements are caused by a chemical substance called auxin. **Ask:** Which way will the root and shoot grow if the plant is on its side? Explain that auxin collects in the lower half of the stem and root, which slows down the growth of the root cells, and the root curves downwards.

**Ask:** How do animals respond to changes in their surroundings? Explain that simple organisms can sense general stimuli such as light or temperature changes. **Ask:** How do we receive information from our surroundings? Explain that we have special organs called sense organs, which help us to receive stimuli from our environment. **Ask:** What happens when we put food in our mouth? Explain that as the food passes down the alimentary canal, different glands pour their secretions to digest the food. Blood carries the digested food to the cells. Kidneys help in the removal of waste products from the body. Explain that the working together of all the organs and organ systems is called coordination.

**Ask:** What happens when you touch something hot or when you smell food? Explain that our senses help us to receive stimuli, and the body reacts to these stimuli to bring about responses. **Ask:** Who is the coordinator of all stimuli and responses in the body? Explain that the brain is the main organ

which controls all the parts of the body and helps them to work together. **Ask:** What is the nervous system made up of? With the aid of a chart or a diagram made on the board, explain the structure of the nervous system. Draw a neuron or nerve cell and explain how neurons are linked together to make up the brain, spinal cord, and nerves. Draw a reflex arc on the board and explain the path of a stimulus to the brain or spinal cord and the response produced.

**Ask:** Why do you sneeze, cough, or blink your eyes in strong light? Explain that these are reflex actions which are produced spontaneously without the intervention of the will. **Ask:** What kind of actions are reading, speaking, walking, etc? Explain that we read, speak, and walk by our own will. These are called voluntary actions. Show a complete walnut and explain that the human brain is of the same shape. Show the students a model of the human brain. Explain the name and functions of each part.

**Ask:** In which part of your body do you feel happiness or fear? What are your reactions when you feel happy or sad? Explain that emotions affect the whole body. There is no specific organ that reacts. The heart beats faster, the breathing rate increases, you may start blushing or become pale, etc. These reactions are produced due to the release of special chemical substances in the blood. These chemical substances are called hormones. There are several glands in various parts of the body, which produce hormones that control different reactions of the body. This system of glands is called the endocrine system, and the glands are called endocrine glands. Explain the position of the endocrine glands with the aid of a chart or a diagram.

**Ask:** How does the body get rid of the waste products produced inside it? Explain the role of the kidneys in helping to maintain a balanced environment. Show the students a specimen of a fresh kidney of a sheep. Discuss its shape, and colour. Slice it open longitudinally and show them the inner structure. Explain with the help of charts and diagrams how the kidneys help to filter out poisonous waste substances from the body. Perform the experiments and activities at the end of the lesson to provide a better understanding of the topic. Encourage children to make diagrams and models of the various organs and systems described in the lesson. Before attempting the exercise, read out the summary for a quick review of the lesson.

## Answers to Exercises in Unit 2

- In single celled organisms, the whole cytoplasm is sensitive to changes in the environment.
  - The ability of an organism to respond to a stimulus is called sensitivity.
  - The movement of plants towards light and gravity are called tropic movements.
  - Auxin is a chemical substance which is made in the cells at the tips of the roots and shoots. Auxin speeds up the growth in stems, and slows down the growth in roots.
  - Higher animals respond to changes in their environment by taking appropriate action. The nervous system and the endocrine system help to bring about changes in the body.
  - The working together of all the organs and systems of the body is called coordination. Coordination in the body is brought about by two systems—the nervous system and the endocrine system.
- cerebrum—receives impulses from your eyes, ears, nose, and skin
  - medulla—controls heartbeat, breathing, etc.
  - cerebellum—controls muscles and balance of the body
  - thyroid gland—controls the speed of chemical reactions in the body
  - adrenal gland—prepares the body for action
  - pancreas—controls the amount of glucose in the blood

3. sensory neurons                      motor neurons

A nerve cell has a cell body with long branches extending from it. The shorter branches are called dendrites. Dendrites take in messages from other nerve cells. One long branch called the axon, carries messages from the nerve cell. The axon connects with other nerve cells and passes messages to muscles, glands, or organs. Bundles of axons form nerves.

Sensory nerve cells carry messages from the sense organs to the brain and spinal cord.

4. A quick and sudden movement which does not involve the brain is called a reflex action. The spinal cord interprets the message and brings about the response. It takes a very short time for such a message to travel from the spinal cord and back to a muscle. Blinking, sneezing, coughing, and shivering are examples of reflex actions.

(a) We blink our eyes. (b) The iris reduces in size so that less light enters our eyes.

5. **A kidney:** The kidney is an organ of excretion. It removes harmful wastes that are produced by the body.

**B ureter:** The ureter carries the waste products (urine) from the kidneys to the bladder.

**C bladder:** The bladder stores the urine for some time.

**D urethra:** Urine is passed out of the body through the urethra.

6. cortex, nephrons, Bowman’s capsule, gomerulus, water, salts, proteins, water, dissolved, glucose and salts, urea, urine

## Additional Exercise

### MCQs

- (1) The ability of an organism to respond to a stimulus is called \_\_\_\_\_.  
 geotropism                      sound                      energy                      sensitivity                      [*sensitivity*]
- (2) Responses in plants are controlled by \_\_\_\_\_.  
 nerves                      auxins                      light                      water                      [*auxins*]
- (3) The removal of waste products from the body is called \_\_\_\_\_.  
 radiation                      suspension                      excretion                      deletion                      [*excretion*]
- (4) \_\_\_\_\_ collects in the nephron.  
 Blood                      Carbon dioxide                      Urine                      Moisture                      [*Urine*]
- (5) We must drink enough \_\_\_\_\_ for our kidneys to function properly.  
 cola                      tea                      milkshake                      water                      [*water*]
- (6) A quick and sudden movement is called a \_\_\_\_\_ action.  
 fast                      reflex                      jerky                      smooth                      [*reflex*]
- (7) The secretions of the endocrine glands are called \_\_\_\_\_.  
 hormones                      juice                      neurons                      stimuli                      [*hormones*]

- (8) The movement made by a mimosa plant is called \_\_\_\_\_ movement.  
jerky                      tropic                      nastic                      gentle                      [*nastic*]
- (9) The pituitary gland lies just below the \_\_\_\_\_.  
tongue                      brain                      heart                      leaves                      [*brain*]
- (10) The brain and the spinal cord are made up of \_\_\_\_\_.  
neurons                      tissues                      backbone                      glands                      [*neurons*]

Date:

Time: 40 mins

Unit: 2 Topic: Sensitivity in living organisms	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Movements in plants	<ul style="list-style-type: none"> <li>• to define sensitivity</li> <li>• to explain that all living things are sensitive</li> <li>• to explain that plants are sensitive</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• define what is meant by sensitivity</li> <li>• explain that all living things are sensitive</li> <li>• describe the different kinds of movement in plants</li> </ul>	Specimens of growing seedlings, touch-me-not plant, slides and diagrams of euglena, chlamydomonas	Reading: p 10, 11 CW: Q1 (a) (b) HW: Q1 (c) (d)
<p><b>Key words:</b> sensitivity, irritability, stimulus, response, movement, nastic, tactic, tropic, phototropism, geotropism, auxin</p> <p><b>Method:</b> Introduce the term <i>sensitivity</i> by asking the students: Do plants move? Will a plant run away if you hit it? What characteristics of a plant help you to know that it is living? Where does an amoeba live? What is the green layer that you see on the surface of stagnant water?</p> <p>Explain that all living things are sensitive to changes in their environment. Some plants, such as the sunflower, turn to face the Sun. Roots grow downwards towards soil and water. Some flowers open and close their petals according to the intensity of light. Explain that the chlamydomonas and the euglena can detect changes in light intensity by their eye spot. In an amoeba the whole cytoplasm is sensitive. Explain the difference between tactic, nastic, and tropic movements. Explain that tropic movements are caused by a chemical substance called auxin.</p> <p><b>Ask:</b> Which way will the root and the shoot grow if a plant is placed on its side? Explain the effect of auxin on the growth of the root and shoot. When a plant is placed sideways, auxin collects in the cells of the lower half of the root. This slows down the growth of the root cells, and the root curves down.</p>				

Date:

Time: 40 mins

Unit: 2 Topic: Sensitivity in living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW															
2. Sensitivity in animals	<ul style="list-style-type: none"> <li>to discuss sensitivity in animals</li> <li>to explain coordination and how it is brought about</li> <li>to describe the endocrine system</li> </ul>	<ul style="list-style-type: none"> <li>explain how animals are sensitive</li> <li>define coordination and explain how coordination is brought about in higher animals</li> <li>describe the endocrine system and explain the functions of the hormones</li> </ul>	Diagrams of the amoeba, the human endocrine system	<p>Reading: p 11, 12 CW: 1. Draw a diagram of the human endocrine system and mark the position of the endocrine glands. 2. Complete the table:</p> <table border="1" data-bbox="758 207 997 638"> <thead> <tr> <th>Gland</th> <th>Position in the body</th> <th>Function in the body</th> </tr> </thead> <tbody> <tr> <td>pituitary</td> <td></td> <td></td> </tr> <tr> <td>thyroid</td> <td></td> <td></td> </tr> <tr> <td>pancreas</td> <td></td> <td></td> </tr> <tr> <td>adrenal</td> <td></td> <td></td> </tr> </tbody> </table>	Gland	Position in the body	Function in the body	pituitary			thyroid			pancreas			adrenal		
Gland	Position in the body	Function in the body																	
pituitary																			
thyroid																			
pancreas																			
adrenal																			
<p><b>Key words:</b> stimulus, response, endocrine gland, hormone, receptor, coordinator, effector, response, pituitary, hypothalamus, thyroid, pancreas, adrenal gland, oestrogen, testosterone</p> <p><b>Method. Ask:</b> How do animals respond to changes in their surroundings? Explain that all animals and human beings have special organs called sense organs which help them to receive stimuli from their environment.</p> <p><b>Ask:</b> What happens when we put food in our mouth? Explain that as food passes down the alimentary canal, different glands pour out their secretions to digest the food. Blood carries the digested food to the cells. Kidneys help in the removal of waste products from the body. This working together of all the organs and organ systems of the body is called coordination.</p> <p>Show the students a chart of the human endocrine system. Discuss the position and function of the endocrine glands and the hormones that they produce.</p>																			

Date:

Time: 40 mins

Unit: 2 Topic: Sensitivity in living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. The nervous system of a mammal	<ul style="list-style-type: none"> <li>• to describe the nervous system</li> <li>• to explain what the nervous system is made of</li> <li>• to explain how the nervous system works</li> <li>• to explain what a reflex action is</li> </ul>	<ul style="list-style-type: none"> <li>• describe the nervous system and explain how it works</li> <li>• to describe and explain a reflex action</li> </ul>	Diagrams and charts of the human nervous system, nerve cells, reflex action	Reading: p 13, 14, 15 CW: Q2, Q3, Q4 HW: Q1 (e) (f)
<p><b>Key words:</b> nervous system, peripheral nervous system, central nervous system, neuron, motor nerve cell, sensory nerve cell, synapse, brain, cerebellum, cerebrum, medulla oblongata, spinal cord, cranial nerve, spinal nerve, reflex action, receptor, effector, voluntary action, involuntary action</p> <p><b>Method:</b> <b>Ask:</b> What happens when you touch something hot? When you smell food? Explain that our senses help us to receive stimuli and the body reacts to these stimuli to bring about a response.</p> <p><b>Ask:</b> What coordinates all stimuli and responses in the body? Explain the structure of the brain and the functions of each part. The brain is the main organ which controls all the parts of the body and helps them to work together. <b>Ask:</b> What is the nervous system made up of? With the help of charts and diagrams on the board, explain the structure of the nervous system. Draw a neuron and explain how neurons are linked together to make up the nervous system. Draw a reflex arc on the board and explain the path of a stimulus to the brain or spinal cord and the response produced.</p> <p><b>Ask:</b> Why do you cough, or sneeze, or blink your eyes in strong light? Explain that these kinds of reactions are called reflex actions which are produced spontaneously without the intervention of the will. <b>Ask:</b> What kind of actions are reading, speaking, walking, etc? Explain that such actions are called voluntary actions.</p>				

Date:

Time: 40 mins

Unit: 2 Topic: Sensitivity in living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Excretion	<ul style="list-style-type: none"> <li>• to define excretion</li> <li>• to describe the structure of the excretory system</li> <li>• to discuss some diseases of the kidney and their treatment</li> </ul>	<ul style="list-style-type: none"> <li>• define excretion</li> <li>• describe the structure of the excretory system</li> <li>• describe the structure and function of a nephron</li> <li>• name some diseases of the kidneys and discuss their treatment</li> </ul>	Charts and diagrams of the human excretory system, a sheep's kidney, a hand lens	Reading: p 16, 17 CW: Q5 HW: Q6
<p><b>Key words:</b> excretion, kidney, ureter, bladder, urethra, cortex, nephron, Bowman's capsule, glomerulus, urea, renal artery, renal vein, urinary tubule, urine</p> <p><b>Method: Ask:</b> How does the body get rid of waste products? Explain the working of the kidneys. Explain the role of the kidneys in helping to maintain a balance of salt and water in the body. Show the students a fresh specimen of a sheep's kidney. Describe its shape and colour. Make a longitudinal section and show them the inner structure through a hand lens. Explain, with the help of charts and diagrams on the board, how the kidneys help to filter out poisonous waste substances from the body.</p> <p>Discuss kidney diseases and their causes and effects. Explain how kidney disease can be treated. Also discuss dialysis and kidney transplants.</p>				



Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Match the part of the brain to its function(s):

**Part of the brain****Function(s)**

cerebrum

serves as a pathway for the nerve fibres; also controls certain reflexes

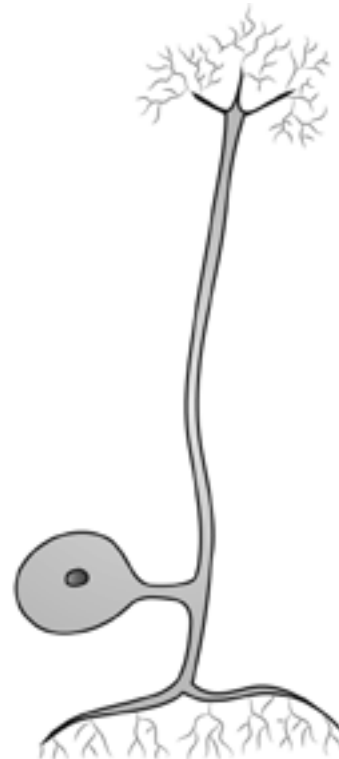
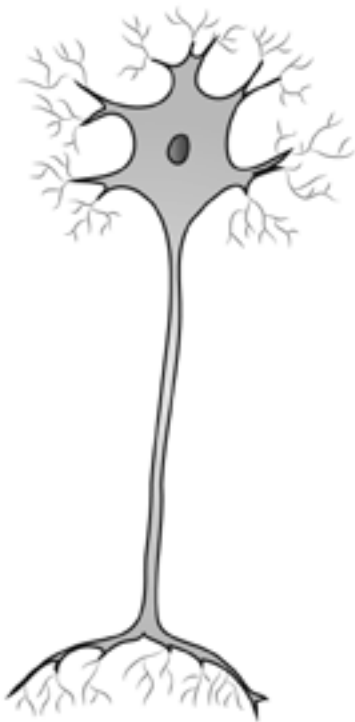
cerebellum

controls many of the involuntary movements of the body, such as respiration, heartbeat, and digestion

medulla oblongata

the largest part of the brain which is concerned with receiving stimuli and the coordination of responses

2. On the diagram below, label the cells and write their names:



Name: \_\_\_\_\_

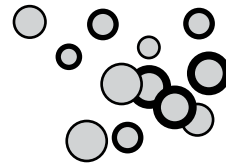
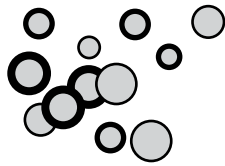
Date: \_\_\_\_\_

1. Fill in the table about the endocrine system:

<b>Name of the gland</b>	<b>Hormone produced</b>	<b>Function of the hormone</b>
pituitary		
thyroid gland		
pancreas		
adrenal gland		

2. Complete the following table about responses in plants:

<b>Part of the plant</b>	<b>Stimulus</b>	<b>Response (positive/negative)</b>
stem	light	
root	light	
stem	gravity	
root	gravity	
root	water	



## Cells, heredity, and evolution

### Teaching objectives:

- to identify some inherited characteristics
- to explain the structure of chromosomes and genes
- to describe the types of cell division and the behaviour of chromosome during cell division
- to show how to draw genetic diagrams
- to explain how genetic information is passed on from parents to offspring
- to explain patterns of inheritance by genetic diagrams
- to explain that mutations occur due to changes in gene or chromosome structure
- to identify some genetic diseases
- to discuss evolution and the theories supporting it

### Teaching strategy:

**Ask:** What do human beings have in common? Explain that human beings belong to the same group of living organisms. They belong to one species of animal called *Homo sapiens*. Show the students pictures of different people. **Ask:** What do all these different people have in common? Explain that all human beings have the same general body shape and their faces have similar features. However, even though they are easily recognizable as humans there are lots of small differences between them. These small differences are called variations. Variations are very important as they have helped *Homo sapiens* to evolve over millions of years into very successful animals. **Ask:** In what way do we resemble each other? In what way do we resemble our parents? Explain that many of our features, for example hair and eye colour, are controlled by a pair of genes. These colours were determined at the time when the egg was fertilized by the sperm. The passing on of characteristics from one generation to the next is called heredity. The study of heredity is called genetics.

**Ask:** Do plants reproduce? How? Dissect a flower longitudinally and show the male and female parts of the flower with a magnifying glass. Discuss the structure and formation of sperm (pollen) and eggs (ovules) in the anthers and the ovary of a flower. Explain that in the same way some of the cells in our bodies, called sex cells or gametes, are produced in our bodies. In the male body they are called sperms. Sperms are produced in the male reproductive organs called testes. In the female body they are called eggs. Eggs are produced in the ovaries. Draw a cell on the board. Discuss its structure and the role of each part.

**Ask:** What is the nucleus of a cell made up of? Explain with the help of diagrams, the structure of chromosomes and genes. Discuss cell division and the behaviour of chromosomes during cell division. Show the students slides of the two kinds of cell division and the role of meiosis in the formation of gametes. Explain with the help of diagrams the formation of sex cells or gametes. Also explain that during gamete formation the number of chromosomes is reduced to half.

**Ask:** What is fertilization? Explain that the union of the male and female gametes is called fertilization. At the time of fertilization the male sex cell joins up with a female sex cell to make a fertilized egg cell called a zygote. The zygote has the same number of chromosomes as those of the body cells of a species.

For example, in humans, the number of chromosomes

in body cells is	in male gamete is	in female gamete is				
46	23	23				
at the time of fertilization	sperm	+	egg	=	fertilized egg	body cells of baby
	23		23		46	46

**Ask:** Whom do you resemble in the family? Do you know why? Explain that we inherit characteristics from our parents through their chromosomes. Draw the structure of a chromosome on the board and explain that a chromosome has small parts called genes all the way along it. Genes are made of a chemical called DNA. Genes control the development of inherited characteristics such as eye colour, hair colour, etc. **Ask:** What do you think happens to genes during fertilization? Explain that a sperm has 23 chromosomes with genes from the father. An egg has 23 chromosomes with genes from the mother. During fertilization the sperm and egg join up. Each chromosome from the sperm pairs up with a matching chromosome from the egg. This brings the two sets of genes together. Discuss the patterns of inheritance from the examples given in the text. Encourage the students to draw crosses of different characteristics of parents and ask the students to try and predict the results. Explain that the genes in a pair may be identical.

**Ask:** How does the characteristic of one parent express itself in the offspring? Explain that the gene that is able to express itself is called a dominant gene. The gene which does not express itself is called recessive. Explain the terms homozygous and heterozygous and dominant and recessive genes with diagrams of examples, on the board. **Ask:** How do you think varieties of different kinds of animals and plants are produced? Discuss Mendel's experiments and draw Punnett squares to explain the inheritance of characters. **Ask:** What do you think would happen if there was a sudden change in gene or chromosome structure? Discuss mutations with examples and pictures. **Ask:** What do you think would happen if one parent had a disease? Would it be passed on to the offspring? How? Why? Discuss inherited diseases and their cause. **Ask:** Where have the millions of different living things come from? What is evolution? Discuss variations and the theories propounded for evolution and the evidence to support them.

Summarize the lesson.

### Answers to Exercises in Unit 3

- Chromosomes and genes are made up of a complex chemical substance called DNA (deoxyribonucleic acid). The DNA molecule is like a twisted ladder called a double helix. DNA controls the development of the characteristics that an organism inherits from its parents. When cells divide, the DNA first duplicates itself. One copy is passed from one generation to the next. This is the reason why we inherit characteristics from our parents.
  - meiosis
    - mitosis
  - At fertilization a male sex cell or sperm joins up with a female sex cell or egg to make a fertilized egg called a zygote.

- (d) swim, roller skate, cycle, drive a car, read, write
- (e) eye colour, hair colour, height, shape of nose, intelligence, shape of chin
- (f) Sometimes, when cells divide, the structure of a chromosome or a gene may change. These changes are called mutations. When gametes are formed in the sex organs there is a chance that changes in the structure or number of chromosomes may take place. This will seriously affect the development of an organism.

Down's syndrome and haemophilia are two diseases that are caused by mutations.

Mutations can occur naturally. They can also be caused by X-rays, other forms of radiation, and by some chemicals.

- (g) Evolution means change and improvement from simple beginnings.

A theory about how evolution took place was first put forward a hundred years ago, by Charles Darwin.

Darwin suggested that:

- there is variation within a population of living things;
  - there is a struggle for survival within populations;
  - some individuals are better adapted to their surroundings. They are more likely to grow and reproduce. Others will die out. This is sometimes referred to as survival of the fittest;
  - so, he concluded that: *'particular organisms have been naturally selected from their population, because they are better adapted than others.'*
2. (a) The nucleus of a cell contains long thread-like structures called chromosomes. These are only visible when a cell is about to divide into two.
- Chromosomes contain a complex chemical called deoxyribonucleic acid or DNA, which controls the development of the characteristics that an organism inherits from its parents. DNA contains the 'instructions' for making the characteristics of an organism, such as skin colour, hair colour, eye colour, etc.
- Chromosomes carry bits of information called genes, which are also made up of DNA. Genes instruct our bodies to make proteins which determine the shape of the body and how it behaves.
- (b) Mitosis is a kind of cell division in which the number of chromosomes in the newly formed (daughter) cells remains the same as that in the original (parent) cell. Cells having the normal set of chromosomes are said to have the diploid number of chromosomes. All the cells in animals and plants, except the sex cells, are diploid.
- Meiosis is a kind of cell division which occurs only within the reproductive organs. Meiosis is concerned with the production of sex cell or gametes. Four daughter cells, with half the number of chromosomes as the parent cell, are produced by meiosis.
- (c) All human beings have similar features, but they are not exactly alike. Differences in hair colour, height, weight, and skin colour are examples of differences that we call variations.

The students in a class can be arranged in a line from the shortest to the tallest. Their height shows continuous variation. It varies from short to tall with many small differences in between.

Characteristics that are distinct, such as blood group, show discontinuous variation. You can belong to only one group: A, B, AB, or O. People can roll their tongues or they cannot. There is no in-between state. Colour blindness is another example of discontinuous variation.

- (d) The characteristics we are born with are called inherited characteristics. Learning how to swim or having a scar on your chin are acquired characteristics.
- (e) The genes in a pair may be identical or they may be different. The child has black hair because the gene for black hair is dominant. It dominates the gene for blonde hair and produces the final hair colour.

Genes which are suppressed or dominated by other genes are called recessive genes.

3. (a) mutation                      (b) nucleus                      (c) genes                      (d) zygote  
 (e) chromosomes                      (f) meiosis                      (g) mitosis

## Additional Exercise

### MCQs

- (1) Chromosomes are made of \_\_\_\_\_.  
 MKS                      DNA                      CBM                      LED                      [**DNA**]
- (2) Differences in characteristics within a species are called \_\_\_\_\_.  
 features                      heredity                      identity                      variations                      [**variations**]
- (3) \_\_\_\_\_ is the study of inherited characteristics.  
 Mutation                      Evolution                      Heredity                      Meiosis                      [**Heredity**]
- (4) Genes are located all along the \_\_\_\_\_.  
 nerve cells                      brain                      chromatids                      chromosomes                      [**chromosomes**]
- (5) Meiosis is concerned with the production of \_\_\_\_\_.  
 gametes                      zygotes                      genes                      chromosomes                      [**gametes**]
- (6) Each chromosome replicates itself to form two \_\_\_\_\_.  
 DNA                      chromatids                      zygotes                      cells                      [**chromatids**]
- (7) Down's syndrome is caused as a result of \_\_\_\_\_.  
 mutations                      fertilization                      variations                      evolution                      [**mutations**]
- (8) Genes which are dominated by other genes are called \_\_\_\_\_ genes.  
 suppressive                      recessive                      oppressive                      dominant                      [**recessive**]
- (9) Each chromosome makes an exact copy of itself by a process called \_\_\_\_\_.  
 replication                      variation                      mitosis                      division                      [**replication**]
- (10) Learning how to swim is an \_\_\_\_\_ characteristic.  
 inherited                      obvious                      acquired                      evolving                      [**acquired**]

Date:

Time: 40 mins

Unit: 3 Topic: Cells, heredity, and evolution	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Cell division	<ul style="list-style-type: none"> <li>• to describe the structures of chromosomes and genes</li> <li>• to explain the kinds of cell division</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• describe the structure of chromosomes and genes</li> <li>• explain the kinds of cell division and the behavior of chromosomes during cell division</li> </ul>	Diagrams and charts of chromosomes, DNA, mitosis, meiosis	Reading: p 21, 22 CW: Q1 (a) (b) HW: Q2 (a) (b)
<p><b>Key words:</b> chromosome, DNA, gene, mitosis, diploid, replication, spindle fibre, chromatid, meiosis, gamete, homologous, haploid number, reduction division</p> <p><b>Method: Ask:</b> What is the nucleus of a cell made up of? Explain with the help of diagrams and charts, the structure of chromosomes and genes. Explain that a chromosome has small parts called genes all the way along it. Genes are made up of a chemical substance called DNA. Genes control the development of inherited characteristics such as eye colour, hair colour, etc.</p> <p>Discuss cell division and the behavior of chromosomes when this takes place. Show the students slides of the two kinds of cell division. Explain the importance of the two kinds of cell division. Mitosis is cell division in which the number of chromosomes remains the same as in the parent cell. It is used for making similar cells for growth of the body.</p> <p>Meiosis is cell division in which the number of chromosomes is reduced to half the number of chromosomes in the parent cell. This kind of reproduction is used for making sex cells, or gametes, in the sex organs.</p>				

Date:

Time: 40 mins

Unit: 3 Topic: Cells, heredity, and evolution	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
2. Heredity and variation	<ul style="list-style-type: none"> <li>• to define heredity</li> <li>• to explain patterns of inheritance</li> <li>• to describe Mendel's experiments</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• define heredity</li> <li>• describe patterns of inheritance</li> <li>• explain how Mendel discovered the inheritance of characteristics from parents to offspring through experiments</li> </ul>	Diagrams and charts of chromosomes and genes, patterns of inheritance, Mendel's experiments	<p>Reading: p 22, 23</p> <p>CW: Q1 (c) (d) (e) Q3</p> <p>HW: Q2 (c) (d) (e)</p>
<p><b>Key words:</b> heredity, variation, gene, continuous variation, discontinuous variation, zygote, dominant, recessive, homozygous, recessive</p> <p><b>Method: Ask:</b> What do human beings have in common? Explain that human beings belong to the same group of living organisms. They belong to one species of animal called Homo sapiens.</p> <p>Show the students pictures of different people. <b>Ask:</b> What do all these people have in common? Explain that all human beings have the same general body shape and their faces have similar features. However, even though they are easily recognizable as humans, there are lots of small differences between them. These small differences are called variations. Variations are important because they have helped Homo sapiens to evolve over millions of years into very advanced animals.</p> <p><b>Ask:</b> In what ways do we resemble each other? In what ways do we resemble our parents?</p> <p>Explain that many of our features such as hair and eye colour are controlled by pairs of genes. These colours were determined at the time when the egg was fertilized by the sperm. The passing on of characteristics from one generation to the next is called heredity. The study of heredity is called genetics.</p> <p>Discuss the formation of pollen and ova in flowers. Explain that in the same way, some of the cells in our bodies, called sex cells or gametes, are produced in our bodies. In males they are called sperm and in females, eggs. The union of the male and female gametes is called fertilization. The fertilized egg is called a zygote.</p> <p style="text-align: right;">Contd.</p>				



**Ask:** Which member of your family do you resemble? Do you know why?

Explain that we inherit characteristics from our parents through their genes.

**Ask:** What do you think happens to genes during fertilization?

Explain that during fertilization the sperm and the egg join up. Each chromosome of the sperm pairs up with a matching chromosome of the egg. This brings the two sets of genes together. Discuss the patterns of inheritance using the examples given in the text. Ask the students to draw crosses of different characteristics of parents and to try and predict the results. Explain that genes in a pair may be exactly alike or they may be different.

**Ask:** How do the parents' genes express themselves in the offspring? Explain that the gene that is able to express itself in the offspring is called a dominant gene. The gene that does not express itself in the offspring is called a recessive gene.

Explain the terms homozygous and heterozygous. With the help of diagrams and charts, explain the patterns of inheritance of characteristics. Discuss Mendel's experiments and his contribution to the study of the inheritance of characteristics.

Date:

Time: 40 mins

Unit: 3 Topic: Cells, heredity, and evolution	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Mutations	<ul style="list-style-type: none"> <li>• to define mutation and to discuss its causes</li> <li>• to describe genetic diseases</li> <li>• to discuss evolution</li> </ul>	<ul style="list-style-type: none"> <li>• define mutation</li> <li>• explain how mutations occur</li> <li>• identify some genetic diseases</li> <li>• discuss evolution and the theories supporting it</li> </ul>	Diagrams and charts of mutations, pictures of fossils	Reading: p 24 Activity: p 25 CW: Q1 (f) HW: Q1 (g)
<p><b>Key words:</b> mutation, evolution, fossil, theory</p> <p><b>Method: Ask:</b> What do you think would happen if there was a sudden change in the structure of a gene or a chromosome?</p> <p>Discuss what mutations are with the help of examples and pictures.</p> <p><b>Ask:</b> What do you think would happen to the offspring if one parent had a disease? Would the disease be inherited by the children? How? Why?</p> <p>Discuss inherited diseases and their causes.</p> <p><b>Ask:</b> Where have the millions of different kinds of living things come from? What is evolution? Discuss variation and the theories propounded for evolution and the evidence to support them.</p>				

Name: \_\_\_\_\_

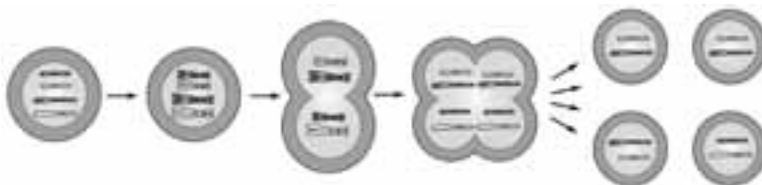
Date: \_\_\_\_\_

1. Name the kind of cell division that is taking place in the following diagrams:

a)



b)



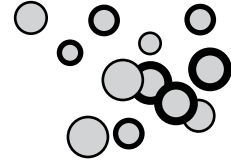
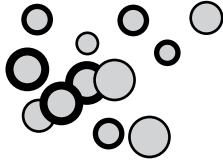
a) \_\_\_\_\_ b) \_\_\_\_\_

2. Arrange the following steps in the correct order to explain the process of meiosis:

- Each chromosome replicates itself to form two chromatids.
- Spindle fibres become attached to the homologous chromosomes and pull them apart.
- Spindle fibres now pull the chromatids of each chromosome away from each other.
- The cell divides into four parts, each containing half the number of chromosomes.
- The chromosomes become shorter and thicker and form pairs called homologous pairs.
- This type of cell division is also called reduction division.
- Homologous pairs of chromosomes arrange themselves around the middle of the cell.
- They move to the opposite ends of the cell.

3. Write the name of:

- a. the study of inherited characters \_\_\_\_\_
- b. small parts on a chromosome that control the development of characteristics  
\_\_\_\_\_
- c. similar, but not exactly alike, characteristics in human beings \_\_\_\_\_
- d. the joining up of the male and female sex cells to form a zygote \_\_\_\_\_
- e. genes which are suppressed by other genes \_\_\_\_\_
- f. a person having two different genes for a characteristic \_\_\_\_\_
- g. a person having two identical genes for a characteristic \_\_\_\_\_
- h. a sudden change in the structure of a gene or a chromosome \_\_\_\_\_
- i. change and improvement from simple beginnings \_\_\_\_\_
- j. preserved remains of organisms \_\_\_\_\_



## Biotechnology

### Teaching objectives:

- to define the term *biotechnology*
- to explain that biotechnology has been used for centuries
- to explain the process of fermentation and the use of microbes in biotechnology
- to describe the role of genes in genetic engineering
- to describe the role of modern biotechnology in the fields of food, fuel, health, mining, and industry

### Teaching strategy:

Write the word 'BIOTECHNOLOGY' on the board. **Ask:** What two words is the word *biotechnology* made up of? Explain the meaning of biotechnology and describe some examples of how biotechnology has helped people. **Ask:** How can the term itself explain that it uses cells to make useful things. It brings together the knowledge of the biologist and the skills of the technologist to provide food, medicines, and new materials for industry; it can also help to clear up much of the waste that pollutes our environment. **Ask:** By using which technique does a biotechnologist control complex chemical reactions? Explain that a biotechnologist may use whole cells or parts of cells such as DNA to control chemical reactions. Microorganisms can be grown in vast quantities before being 'harvested' for food. They are also a source of important molecules such as antibodies.

**Ask:** Why are microbes used in biotechnology? Explain that microbes grow quickly when given the right temperature and food supply. It is therefore easier to grow microbes in large quantities than to develop ways of growing plant and animal cells on their own. Also, microbe cells are relatively simple. This makes it easier for scientists to genetically engineer new microbes for specific jobs. Describe the process of genetic engineering with the help of diagrams and charts. Discuss the ways that biotechnology has helped man in the fields of food, fuel, and health. Also discuss the use of biotechnology in industry and in mining.

Summarize the lesson.

## Answers to Exercises in Unit 4

1. (a) Microbes are tiny living things that can only be seen with the help of a microscope. Yeast, bacteria, and fungi are microbes. Bacteria were used to make yoghurt from milk and mould fungi were used to make cheese.
- (b) Biotechnology is a method of using microbes to produce useful products. For centuries people have been making cheese, yoghurt, bread, and vinegar, using microbes such as bacteria and yeast.
- (c) Large areas of the Earth are not suitable for growing food crops. This may be due to high temperatures, poor rainfall, or insect pests. If genes can be found to improve the ability of food plants to survive in these conditions, food shortages might come to an end.
- (d) Genetic engineering involves removing genes from one type of cell and transferring them to another, completely different cell.
- (e) Scientists can make microbes and other organisms produce useful things by changing their genes.
- (f) Animal and plant products used in agriculture, medicine, and industry are often in short supply, or are very expensive. The genes controlling the production of these materials in animals and plants can be inserted into microbe cells. These genes then instruct the microbial cells to produce the required materials, which they do in much greater quantities than the original animal or plant cells, because microbes reproduce and grow at a rapid rate.
- (g) Enzymes used in genetic engineering are called chemical scissors because they use chemicals to remove the gene from the chromosome. They do not cut the chromosome physically.
- (h) The microbial cell in which a gene is inserted is called a plasmid. It is a small circle of DNA which can move from one cell to another and make copies of itself.
2. (a) The production of useful medicines such as vaccines and antibiotics is the job of the biotechnologist. A very powerful medicine called penicillin was discovered in 1928. Penicillin is produced by a fungus. It is an antibiotic which means it can kill germs inside the human body.  
Bacteria have been used to produce human growth hormones for children who do not grow properly, human insulin for diabetics, and vaccines and vitamins.
- (b) Some types of bacteria live in the soil heaps around coal and mineral mines. These bacteria feed on the traces of minerals in the rock and oxidize them to produce energy. Sulphuric acid and iron (II) sulphate are produced as by-products. Surrounding rocks are attacked by these chemicals and many kinds of metals are leached out.
- (c) Many of our industries depend on oil, coal, and gas. Only about one-third of the oil in the ground is brought to the surface. The rest is clinging to rock particles deep below the ground. Biotechnology has provided a way to extract this remaining oil.  
Bacteria are pumped down an oil well and are fed with nutrients while they are deep underground. The bacteria grow and increase in numbers. They produce chemicals that wash oil from surrounding rock particles. They also produce a gas which builds up enough pressure to force the oil to the surface.
3. Please refer to page 30 of the Pupil's Book.

## Additional Exercise

### MCQs

- (1) Fermentation takes place with the help of \_\_\_\_\_.  
germs                  bacteria                  amoeba                  yeast                  [**yeast**]
- (2) Microbes are so tiny they can only be seen with the help of a \_\_\_\_\_.  
microscope          magnifying glass          mirror                  rays                  [**microscope**]
- (3) Fungi such as \_\_\_\_\_ have been eaten for centuries.  
mosses                  cactus                  mushroom                  algae                  [**mushroom**]
- (4) Gasohol is an alternative to \_\_\_\_\_.  
LPG                  CNG                  ethanol                  petrol                  [**petrol**]
- (5) Biotechnology means using \_\_\_\_\_ to make useful things.  
living cells          food particles          green leaves          living organisms          [**living cells**]
- (6) It is \_\_\_\_\_ to grow microbes in large quantities.  
important          difficult                  easy                  wonderful                  [**easy**]
- (7) \_\_\_\_\_ growing inside oil wells help to force oil to the surface.  
Fungus                  Mushrooms                  Creatures                  Bacteria                  [**Bacteria**]
- (8) Scientists can make organisms produce useful things by changing their genes by a process called \_\_\_\_\_.  
evolution          genetic                  chemical                  mutation  
   engineering                  engineering                  [**genetic engineering**]
- (9) \_\_\_\_\_ is produced by sewage and farm animal waste.  
Sui gas                  CNG                  Oxygen                  Biogas                  [**Biogas**]
- (10) Vaccines and antibiotics are produced by \_\_\_\_\_.  
engineers          doctors                  biotechnologists          machines                  [**biotechnologists**]

Date:

Time: 40 mins

Unit: 4 Topic: Biotechnology	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Biotechnology	<ul style="list-style-type: none"> <li>• to define biotechnology</li> <li>• to explain how biotechnology is useful for us</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• define the term <i>biotechnology</i></li> <li>• describe some uses of biotechnology in everyday life</li> </ul>	Pictures and diagrams of the uses of biotechnology in everyday life	<p>Reading: p 29, 30            CW: Q1 (b)            HW: Q1 (a) (c)</p>
<p><b>Key words:</b> biotechnology, fermentation, microbe, fermentation</p> <p><b>Method:</b> Write the word BIOTECHNOLOGY on the board. <b>Ask:</b> What two words is the word biotechnology made up of?</p> <p>Explain the meaning of biotechnology and describe ways in which biotechnology has helped mankind.</p> <p>Explain that the term itself means that it uses cells to make useful things. It brings together the knowledge of the biologist and the skills of the technologist to provide food, medicines, and new materials for industry. It can also be used to clear up much of the waste that pollutes our environment.</p> <p><b>Ask:</b> How does a biotechnologist control complex chemical reactions?</p> <p>Explain that a biotechnologist may use whole cells or parts of cells such as their DNA to control chemical reactions. Microorganisms can be grown in vast quantities before being harvested for food. They are also a source of important molecules such as antibodies.</p> <p><b>Ask:</b> Why are microbes used in biotechnology?</p> <p>Explain that microbes grow quickly when given the right temperature and food supply. It is therefore easier to grow microbes in large quantities than to develop ways of growing plant and animal cells on their own. Also, microbe cells are relatively simple. This makes it easier for scientists to genetically engineer new microbes for specific jobs.</p>				

# Lesson plan

Date:

Time: 40 mins

Unit: 4 Topic: Biotechnology	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
2. Genetic engineering	<ul style="list-style-type: none"> <li>• to define genetic engineering</li> <li>• to explain how genetic engineering works</li> </ul>	Students should be able to: <ul style="list-style-type: none"> <li>• define genetic engineering</li> <li>• describe the steps involved in genetic engineering</li> </ul>	Diagrams and charts to explain genetic engineering	Reading: p 30 CW: Q1 (d) (e) Q3 HW: Q1 (f) (g) (h)
<p><b>Key words:</b> genetic engineering, gene, enzyme, chemical scissors, plasmid, DNA</p> <p><b>Method:</b> With the help of charts and diagrams, explain the process of genetic engineering. Explain that enzymes called chemical scissors are used to cut a portion of the DNA, (carrying a useful gene) of a bacterial cell, which is then inserted into the DNA of another bacterial cell. The gene located on the cut portion instructs the microbial cell to produce the required material, which it does in great quantities, because microbes grow and reproduce at a rapid rate.</p>				



Date:

Time: 40 mins

Unit: 4 Topic: Biotechnology	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
3. Modern biotechnology	<ul style="list-style-type: none"> <li>to explain how we benefit from modern biotechnology in our everyday lives</li> </ul>	Students should be able to: <ul style="list-style-type: none"> <li>describe the uses of biotechnology in producing better food, fuel, and medicines, and also in industry and mining</li> </ul>	Pictures and diagrams to show the uses of biotechnology	Reading: p 31, 32 CW: Q2 (a) HW: Q2 (b) (c)
<p><b>Key words:</b> modern biotechnology, food, fuel, health, industry, mining</p> <p><b>Method:</b> Discuss the use of biotechnology in various fields. It has helped farmers through the development of new kinds of plants and healthier and more productive farm animals. Better and more nutritious food is being developed from fast growing algae and fungi. Alternative sources of fuel such as gasohol and biogas are being produced in countries where their production is cheap and raw materials are easily available. Useful medicines such as vaccines and antibiotics are being produced from bacteria and fungi. Bacteria are also being used to pump oil from the ground.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. List five uses of modern biotechnology.

i. \_\_\_\_\_ ii. \_\_\_\_\_ iii. \_\_\_\_\_

iv. \_\_\_\_\_ v. \_\_\_\_\_

2. Arrange these steps involved in genetic engineering in the correct order.

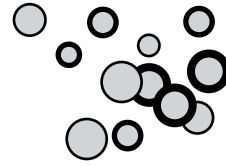
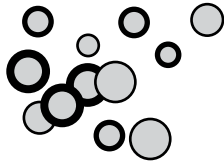
- The required gene is located and collected.
- The gene is inserted into a microbial cell using plasmids.
- The gene is removed from the chromosome by special enzymes called chemical scissors.
- The microbial cell is persuaded to begin making the required product.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## 1. Fill in the blanks to complete the statements:

- a. \_\_\_\_\_ is a hormone which is used for increasing productivity in farm animals.
- b. \_\_\_\_\_ protect animals from disease.
- c. Some algae, fungi, and bacteria are directly used as a \_\_\_\_\_ source.
- d. A fungus called fusarium is used to make artificial \_\_\_\_\_.
- e. Yeast feeds on sugar in the absence of oxygen to produce \_\_\_\_\_.  
When this is mixed with petrol, it makes a fuel called \_\_\_\_\_.
- f. Methane, also called \_\_\_\_\_, is made by bacteria feeding on organic waste in sewage works and farms.
- g. Penicillin, an antibiotic medicine used to kill germs, is produced by a  
\_\_\_\_\_.
- h. \_\_\_\_\_ have been used to produce human growth hormones for children who do not grow properly.



## Environmental pollution and conservation

---

### Teaching objectives:

- to define pollution
- to explain what causes pollution
- to describe how modern technology is affecting wildlife
- to explain the importance of plants for our survival on Earth
- to explain how we can conserve the natural resources and the environment by reducing pollution

### Teaching strategy:

Show the students pictures of polluted areas. Discuss what pollution is and what causes it.

**Explain:** Pollution occurs when something which is unwanted, appears in an environment. For example, litter on the streets or in a park spoils the natural beauty. **Ask:** What kinds of pollution are there? Explain that pollution is of many kinds: air, water, land, noise, etc.

**Ask:** What causes pollution? **Explain:** Air becomes polluted when too much fuel is burned improperly in factories, furnaces, and cars. Discuss the greenhouse effect and the depletion of the ozone layer due to air pollution. The heat which is trapped in the air will cause glaciers to melt, leading to an increase in the overall water level of the Earth. Lakes, rivers, and streams become polluted when chemical wastes from factories and untreated sewage from our homes and farms are emptied into them. Land becomes polluted when it is littered with garbage, or when farmers spray pesticides. Insecticides spoil our air and water. They also contaminate food chains. The levels of noise also pollute a nice quiet place by creating unwanted sounds. Noise pollution disturbs the peace and is a cause of discomfort for the sick and aging.

Show the students pictures of polluted air and water in a city. Discuss the causes of pollution. **Explain:** We all need air to survive. If the air we breathe in is dirty, it can cause illness. All living things need water in order to live and survive. Green plants use water when they make food in their leaves. Most animals can live for a while without food, but they cannot survive without water. Water should be filtered so that insoluble pollutants may be removed from it. **Ask:** What happens if animals drink polluted water?

**Explain:** Animals that drink polluted water and those which live in polluted water become sick and sometimes die. If water is filtered before it is dumped into a lake or river, it helps keep the lake/river cleaner. When accidental pollution occurs due to oil spills into the ocean from an oil tanker, the oil slick settles on the shoreline. It kills birds, fish, and plants that live on or near the shoreline.

Show the students pictures of garbage and litter in the streets. **Ask:** What do we call this? Where does garbage belong? Where do garbage trucks take the garbage? Explain that garbage and trash are solid waste. When solid waste is not disposed of, it looks ugly and becomes smelly. When solid waste is burnt it often pollutes the air. If left in open air it becomes smelly, looks ugly, and attracts insects and rats. If it is buried, dangerous chemicals may drain from it into underground water and contaminate it.

**Ask:** How can we replace valuable materials that are lost by pollution? Explain that materials such as paper, plastic, metals, and glass can be recycled. It eliminates a lot of solid waste by putting trash back into circulation as material that can be used in a new product. **Ask:** What can you do to improve the environment? **Explain:** Walk or ride a bicycle because cars pollute the air. Make your own compost pile from kitchen garbage. Use the compost as a garden fertilizer. Sort out cans, bottles, newspapers that can be recycled from your garbage. Find new uses for things rather than throwing them away.

Summarize the lesson.

## Answers to Exercises in Unit 5

1. (a) The Earth provides us with food, air, and water. It provides materials to build our homes and for our clothes and many other things.
- (b) The things which occur naturally on Earth and are also beneficial for us are called natural resources. Fuels like coal, gas, oil, and minerals are natural resources.
- (c) The expansion of cities is causing the destruction of the natural living places of many plants and animals, due to which many species are in danger of dying out. Animal species which are in danger of dying out are called endangered species.
- (d) Plants are very important for our survival on Earth. They provide food and oxygen. Trees provide a good habitat for animals. They also provide timber. Roots of trees prevent the soil from drying up or being worn away. Trees also prevent the temperature of air from becoming too hot.
- (e) A pollutant is any type of poisonous or harmful chemical or waste material which is carelessly discarded into the environment.
- (f) The addition of fertilizers, poor farming methods, intensive cattle grazing, and spraying of weed killers and pesticides cause land pollution.
- (g) Chemical wastes from factories and warm water from power stations are pumped into rivers. Water from farms and fields also contains harmful chemicals. Sewage is the waste from our houses which decays and uses up the oxygen of the river water. These pollutants affect aquatic life which are either poisoned or die from suffocation.
- (h) Poisonous gases, such as oxides of nitrogen and sulphur, mix with water vapour in the air forming acids such as nitric acid and sulphuric acid. These acids are absorbed in rain clouds and fall to the ground as acid rain. Acid rain causes serious damage. It kills trees and destroys many habitats. When acid rain falls in lakes and rivers, it harms fish, plants, and other freshwater life. It also attacks the stonework of buildings.

2. (a) Earth                                      (b) fossil fuels                                      (c) extinct                                      (d) endangered species  
 (e) habitat                                      (f) roots                                      (g) pollution                                      (h) pesticides  
 (i) oil                                      (j) exhaust

Pollutant	Source	Harmful effects
sulphur dioxide	burning coal and oil	forms acid rain
nitrogen oxide	burning coal and oil	forms acid rain

smoke	burning wood and coal	respiratory diseases
bacteria	sewage and household waste	sickness and skin disease
sewage	homes	causes disease
fertilizers	farms and fields	harm aquatic life
detergents	houses and factories	harm aquatic life
factory waste	chemicals	harms aquatic life
heat	factories	harms aquatic life
oil	oil spills	harms marine life and water animals

4. (a) The Earth's atmosphere traps the heat of the Sun near the Earth's surface. This is called the greenhouse effect. The greenhouse effect is good for us. Without it the Earth's average temperature would be about -45 degrees Centigrade instead of the present +12 degrees Centigrade. However in the last 160 years the amount of carbon dioxide in our atmosphere has risen by over 10%. This is mainly because we have been burning fossil fuels such as coal and oil in our homes and factories. The large increase in carbon dioxide is thought to explain why the temperature of the northern hemisphere appears to be rising. This increase in temperature of the Earth is called global warming.

If the Earth's atmosphere becomes much warmer, the ice at the North and South Poles will begin to melt. This will raise the level of the seas all over the world. If the seas become warmer, sea animals and plants will be badly affected.

- (b) Water from fields and farms contains fertilizers which flow into rivers and lakes. There they cause algae to grow rapidly, which ultimately cover the surface of the water. Algae use up the oxygen needed by all aquatic life living underneath the surface of the water, thereby choking them.
- (c) Roots of trees prevent the soil from drying up or being worn away. If trees are cut the soil will not be held by their roots and will be blown away causing more dust in the air.
- (d) Plants are very important for our survival on Earth. They provide food. They take in carbon dioxide from the air to make their own food, and they give out oxygen which all living things use for breathing. If trees are cut then there will be more carbon dioxide in the air as the trees will not be using it for photosynthesis.

### Additional Exercise

#### MCQs

- (1) The Earth provides us with all our \_\_\_\_\_ resources.  
 artificial      natural      national      global      [*natural*]
- (2) \_\_\_\_\_ is any change or disturbance in the environment brought about by human activity.  
 Pollution      Segregation      Evolution      Variation      [*Pollution*]
- (3) Smoke and fumes cause \_\_\_\_\_ pollution.  
 dirt      noise      air      heat      [*air*]

- (4) \_\_\_\_\_ pollution is caused by spraying pesticides.  
 Plant                  Crop                  Land                  Earth                  [**Land**]
- (5) \_\_\_\_\_ pollution is caused by untreated sewerage and oil spills.  
 Atmosphere          Water                  Liquid                  Land                  [**Water**]
- (6) Nuclear \_\_\_\_\_ destroys the cells of plants and animals.  
 heat                  wind                  reduction                  radiation                  [**radiation**]
- (7) \_\_\_\_\_ rain is formed when the oxides of nitrogen and sulphur mix with the  
 water vapour in the air.  
 Heavy                  Acid                  Harmful                  Chemical                  [**Acid**]
- (8) Animals that do not exist any more have become \_\_\_\_\_.  
 extinct                  ancient                  lost                  distinct                  [**extinct**]
- (9) Animal species in danger of dying out are called \_\_\_\_\_ species.  
 weak                  survivor                  dangerous                  endangered                  [**endangered**]
- (10) Over \_\_\_\_\_ people live on Earth.  
 six million                  seven billion                  sixty billion                  sixty million                  [**seven billion**]

Date:

Time: 40 mins

Unit: 5 Topic: Environmental pollution and conservation	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Environmental pollution	<ul style="list-style-type: none"> <li>• to describe how human activities are damaging the environment</li> <li>• to describe the negative aspects of modern technology</li> <li>• to explain the importance of plants for our survival on Earth</li> </ul>	<ul style="list-style-type: none"> <li>• describe how human activities are damaging natural resources and the environment</li> <li>• explain how animal life is being threatened</li> <li>• explain the importance of plants for the environment</li> </ul>	Pictures showing different kinds of environment, pictures showing the damaging effects of pollution, pictures of endangered animals	Reading: p 35, 36 CW: Q1 (a) (b) HW: Q1 (c) (d)
<p><b>Key words:</b> planet Earth, natural resource, endangered species, extinct</p> <p><b>Method:</b> Show the students pictures of the planet Earth. Describe the different types of environment where plants and animals live. Discuss the needs of human beings, plants, and animals living on Earth. Explain how modern technology is affecting the environment, and the destruction of the habitats of plants and animals. Non-renewable resources such as oil, coal, and gas are being used up at a rapid rate. The increase in population and expansion of cities is causing serious damage to the Earth.</p> <p>Discuss the usefulness of plants in providing food, oxygen, living places for animals, and for providing timber. Also explain how the roots of plants help to hold the oil particles and prevent the fertile top soil layer from being washed away by wind and water.</p>				



Date:

Time: 40 mins

Unit: 5 Topic: Environmental pollution and conservation	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Kinds of pollution	<ul style="list-style-type: none"> <li>• to define pollution</li> <li>• to explain the different kinds of pollution</li> <li>• to raise awareness of the harmful effects of land and water pollution</li> </ul>	<ul style="list-style-type: none"> <li>• define pollution</li> <li>• explain how land and water pollution is harmful for us</li> </ul>	Pictures of land and water pollution	Reading: p 36, 37, 38 CW: Q2, Q3 HW: Q1 (e) (f) (g)
<p><b>Key words:</b> pollution, pollutant, intensive farming, nutrient, fertilizer, fertile, chemical waste, sewage, oil spill</p> <p><b>Method:</b> Show the students pictures of polluted areas. Discuss pollution and its causes. Explain that pollution occurs when something which is unwanted appears in an environment. For example, litter on the streets or in a park spoils the natural beauty.</p> <p><b>Ask:</b> How many kinds of pollution are there? Explain the kinds of pollution, i.e. air, water, land, noise pollution, etc. Land becomes polluted when it is covered with litter or when farmers spray pesticides. Insecticides spoil our air and water. They also contaminate food chains.</p> <p>Show the students pictures of rubbish and litter in the streets. <b>Ask:</b> What do we call this? Where does rubbish belong? Where do rubbish trucks take the rubbish?</p> <p>Explain that rubbish is solid waste. If solid waste is not disposed of, it looks ugly and becomes smelly. If it is burnt, it often pollutes the air. If left in the open air, it attracts insects and rats. If it is buried, dangerous chemicals may drain from it and contaminate underground water</p> <p>Discuss water pollution. Explain that all living things need water to live and survive. Green plants need water when they make food in their leaves. Most animals can live without food for a while, but they cannot survive without water for more than a couple of days.</p> <p><b>Ask:</b> What happens if animals drink polluted water? Explain that they become sick and some times die. If water is filtered before it is dumped into a lake or a river, the water stays cleaner. When accidental pollution occurs due to oil spills in oceans, the oil slick settles on the shoreline. It kills birds, fish, and plants that live on or near the shoreline.</p>				

Date:

Time: 40 mins

Unit: 5 Topic: Environmental pollution and conservation	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Air pollution Nuclear explosions	<ul style="list-style-type: none"> <li>• to define air pollution</li> <li>• to explain nuclear explosions</li> <li>• to discuss the harmful effects of air pollution</li> </ul>	<ul style="list-style-type: none"> <li>• explain how air may be polluted</li> <li>• describe nuclear explosions</li> <li>• explain the harmful effects of air pollution</li> </ul>	Pictures showing air pollution	Reading: p 38, 39 CW: Q4 HW: Q1 (h)
<p><b>Key words:</b> oxygen, oxide, nitric acid, sulphuric acid, acid rain, ozone, global warming, CFC, greenhouse effect, nuclear explosion</p> <p><b>Method:</b> Discuss the importance of air for all living things. We all need air to survive. If the air we breathe in is polluted, it can cause illness.</p> <p><b>Ask:</b> What causes air pollution? Explain that air becomes polluted when too much fuel is burnt improperly in factories, furnaces, and car engines. Discuss the greenhouse effect and the depletion of the ozone layer due to air pollution.</p> <p>The amount of carbon dioxide in our atmosphere has risen by over 10%. This large increase is thought to explain why the temperature of the northern hemisphere appears to be rising. This phenomenon is called global warming. Discuss the harmful effects of global warming.</p> <p>Discuss the harmful effects of nuclear radiation.</p>				

Date:

Time: 40 mins

Unit: 5 Topic: Environmental pollution and conservation	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Conservation	<ul style="list-style-type: none"> <li>to explain what <i>conservation</i> means</li> <li>to discuss ways to conserve natural resources</li> </ul>	<ul style="list-style-type: none"> <li>define conservation</li> <li>explain the importance of conservation</li> <li>suggest ways to conserve our natural resources and preserve life on Earth</li> </ul>	Pictures and posters for saving wildlife and conserving our natural resources	Reading: p 39 Project: p 41 CW: Q. a. What does conservation mean? b. Why is conservation important? c. List five ways in which we can help conserve wildlife.
<p><b>Key words:</b> conservation, natural resource, wildlife, extinct, endangered species, law, game reserve, chemical fertilizer, lead-free petrol, recycle, reuse, reduce</p> <p><b>Method: Ask:</b> How can we replace valuable materials that are lost by pollution? Explain that materials such as paper, plastic, metals, and glass can be recycled. This eliminates a lot of solid waste by putting it back into circulation as a new, useful product.</p> <p><b>Ask:</b> What can you do to improve the environment? Explain that we can walk or ride a bicycle as exhaust fumes from cars pollute the air.</p> <p><b>Activity:</b> Make your own compost pile from kitchen garbage. Use the compost as a garden fertilizer. Sort out from your household refuse cans, bottles, and newspapers that can be recycled. Find new uses for things rather than throwing them away.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Label the diagram to explain how acid rain occurs.



2. Match the activities to their effects on the environment.

**Activities**

- a. intensive farming
- b. poor farming methods and intensive cattle grazing
- c. use of pesticides
- d. use of weedkillers
- e. chemical wastes from factories and power stations pumped into rivers
- f. sewage from our houses and farms poured into rivers
- g. oil spills in oceans
- h. poisonous exhaust gases
- i. acid rain
- j. CFCs from aerosol sprays and refrigerators
- k. burning fossil fuels
- l. nuclear explosions

**Effects on the environment**

- harms fish and plants and also attacks the stone work of buildings
- cause respiratory diseases and brain damage
- damage the ozone layer
- nuclear radiation damages cells of organisms
- global warming
- hazardous to marine life
- uses up the oxygen in river water causing aquatic life to suffocate
- soil becomes deficient in minerals
- erosion of soil by wind and water
- upset food chains
- absorbed by plants and reach our food indirectly
- harmful for water animals and plants

# Test paper 1

**Time: 3 hours**

**Max marks: 100**

1. Attempt any five questions (All questions carry equal marks.) [50]
- What are tropic movements? How do auxins control tropic responses in plants?
  - How do higher animals respond to changes in their environment? Describe the endocrine system.
  - What is the DNA? What is the function of the DNA?  
Describe the kind of cell division which halves the chromosome number.
  - Write down six characteristics that you have acquired.  
Write down six characteristics that you have inherited.
  - Differentiate between the following:
    - genes and chromosomes
    - mitosis and meiosis
    - continuous and discontinuous variations
    - inherited and acquired characteristics
    - dominant and recessive genes
  - What is meant by evolution? What theory did Darwin suggest about the evolution of a new species?
  - What is genetic engineering? What are the steps involved in genetic engineering?
  - What useful role do microbes play in the following industries?
    - health
    - mining
    - petroleum

2. Fill in the blanks to describe the process of filtration of blood by the kidneys. [10]

The outer part of the kidney called the \_\_\_\_\_, contains millions of tiny tubes called \_\_\_\_\_. Each nephron starts in a cup-shaped structure called \_\_\_\_\_, which contains a bunch of capillaries called \_\_\_\_\_. As blood flows through the capillaries, substances such as \_\_\_\_\_ and dissolved \_\_\_\_\_ are filtered as they pass into the Bowman's capsule. Large molecules such as \_\_\_\_\_ cannot pass through the wall of the capillary and so are left in the blood.

The liquid which passes into the Bowman's capsule contains mainly \_\_\_\_\_ and \_\_\_\_\_ materials. Useful substances such as \_\_\_\_\_ are reabsorbed by blood vessels. The rest of the liquid passes down the long looped part of the nephron which now contains waste materials such as \_\_\_\_\_. The solution is called \_\_\_\_\_.

3. Fill in the table.

[20]

<b>Pollutant</b>	<b>Source</b>	<b>Harmful effects</b>
sulphur dioxide		
nitrogen oxides		
smoke		
bacteria		
sewage		
fertilizers		
detergents		
factory waste		
heat		
oil		

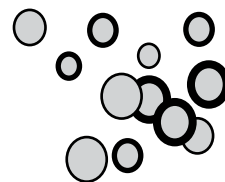
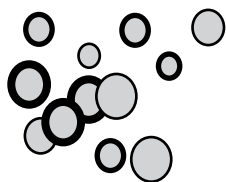
4. Draw any two of the following diagrams and label them:

[20]

Technique of genetic engineering

Mitosis

Reflex action



## Chemical reactions and chemical equations

---

### Teaching objectives:

- to explain the structure of an atom
- to explain mass number and the atomic mass
- to define a molecule and describe how molecules are formed
- to explain what an element is and know that there are more than 117 known elements
- to explain that elements can be divided into metals and non-metals and to know the properties of metals and non-metals
- to define a mixture and describe the various types of mixtures
- to define a solution and describe the various types of solutions
- to explain the methods by which the components of a mixture can be separated
- to define a compound
- to explain physical and chemical changes
- to explain the physical and chemical properties of a substance

### Teaching strategy:

**Ask:** What would happen if a piece of silver or coal is pounded with a hammer for a long time? Explain that it will be crushed into almost invisible particles but they will still be the same. (This will help develop the concept of an element being a pure substance.)

Show the students a piece of charcoal and a piece of iron and ask the difference between the two. Explain the differences between metals and non-metals. Mix sugar and salt in a clean dish and ask the students to taste it. Mix salt and crushed charcoal and ask the students if they can see the two kinds of particles. Mix powdered charcoal and iron filings and ask the students if they can see the two types of particles. Bring a bar magnet near the mixture and ask the students what they see. Explain the properties of a mixture. With the help of experiments given in the textbook, explain types of mixtures.

**Ask:** Can you think of a way to separate a mixture of salt and sand? Perform an experiment in the laboratory to separate salt and sand and let the students participate in it. Explain what has happened. Mix iron filings and sulphur powder in a china dish and show the mixture to the students. Stir a bar magnet in the mixture, the iron filings will stick to it. Put the filings back in the dish and heat it. Explain the changes saying why they take place. Explain the formation of compounds and the differences between mixtures and compounds.

**Ask:** What happens when ice melts? What happens when a piece of paper is burnt? Explain the meaning of physical and chemical changes with the help of examples. Show students some substances such as sugar, sulphur powder, iron filings, common salt, etc. and ask the students to describe them. Explain that they have just described the physical properties of these substances. Explain further the

physical properties of a substance saying that the physical properties are the physical appearance of a substance.

**Ask:** What are the chemical properties of a chemical substance? Refer to the previous experiment of heating iron filings and sulphur powder and explain the chemical nature and properties of substances. When a piece of solid magnesium is placed in some dilute hydrochloric acid, a chemical reaction takes place. During this reaction a gas is given off. This gas is called hydrogen. The solution remaining contains magnesium chloride. **Ask:** Can we show the above reaction by writing it? Discuss the steps involved in writing a chemical reaction in the form of an equation. Discuss the ways in which chemical reactions can be controlled. In chemical reactions we use the following formula to tell us how fast the reaction is taking place:

rate of chemical reaction = change in the amount of substance / time

Discuss the ways in which the rate of a reaction can be speeded up by performing experiments given in the Pupil's Book.

Summarize the lesson.

## Answers to Exercises in Unit 6

- 1 (a) A reaction which gives out heat is called an exothermic reaction, e.g. fireworks are an example of an exothermic reaction.

A reaction which absorbs or takes in heat is called an endothermic reaction. For example frying an egg is an endothermic reaction.

- (b) The reactants are on the left of the arrow. These are the chemicals that are added together at the beginning of the reaction. The products are on the right of the arrow. The products are the chemicals that are made during the reaction. The arrow indicates the direction in which the reaction takes place.

reactants  $\rightarrow$  products

If the reactants are to be heated to make the reaction take place, then the word 'heat' can be written above the arrow.

Sometimes equations tell you whether a chemical is a solid, a liquid, a gas, or a solution (dissolved in water). This can be done by placing state symbols after the formula. The state symbols are:

(s) solid      (l) liquid      (g) gas      (aq) aqueous solution

- (c) Steps to follow when writing a chemical equation:

- (i) Write down the word equation.
- (ii) Write down the correct formula for each of the chemicals.
- (iii) Add up the atoms of each element on the left-hand side of the arrow.
- (iv) Add up the atoms of each element on the right-hand side of the arrow.

If there are the same numbers of atoms of each element on the left-hand side of the arrow as there are on the right-hand side of the arrow, then the equation is balanced. If not, then balance the equation by putting numbers in front of the formulae.





- (5) Though \_\_\_\_\_ may change its form, it can neither be created nor destroyed.  
 ice                      matter                      liquid                      gas                      [*matter*]
- (6) In a chemical equation, the \_\_\_\_\_ are on the left of the arrow.  
 reaction                      chemical                      reactants                      products                      [*reactants*]
- (7) The equation is said to be \_\_\_\_\_ when the numbers of the different atoms are the same on both sides of the equation.  
 irreversible                      balanced                      equal                      good                      [*balanced*]
- (8) The \_\_\_\_\_ indicates the direction in which the reaction takes place.  
 arrow                      number                      formula                      sign                      [*arrow*]
- (9) \_\_\_\_\_ symbols tell whether a chemical in the equation is a solid, liquid, or gas.  
 Country                      Chemical                      State                      Direct                      [*State*]
- (10) In a chemical equation, the mass of the reactants must be equal to the mass of the \_\_\_\_\_.  
 products                      sum                      reaction                      outcome                      [*products*]

Date:

Time: 40 mins

Unit: 6 Topic: Chemical reactions and chemical equations	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Types of chemical reactions	<ul style="list-style-type: none"> <li>to describe a physical and chemical change and to compare the two</li> <li>to discuss the different types of chemical reaction</li> </ul>	<ul style="list-style-type: none"> <li>define physical and chemical changes</li> <li>differentiate between the types of change</li> <li>describe the different kinds of chemical reaction</li> </ul>	A table showing different types of chemical reaction	Reading: p 43, 44 CW: Q2 HW: Q1 (a)
<p><b>Key words:</b> physical change, chemical change, chemical reaction, synthesis, decomposition, precipitation, combustion, exothermic reaction, endothermic reaction</p> <p><b>Method: Ask:</b> What happens when an ice cube melts? Can the water be changed into ice again? What happens when salt dissolves in water? Can you retrieve the salt?</p> <p>Explain that melting and dissolving are examples of physical changes. In a physical change only the behaviour of the particles changes. The actual particles are the same throughout. Because of this, the total mass of the substance remains the same.</p> <p><b>Ask:</b> What happens when iron rusts, or when toast burns? Explain that new chemical compounds are made and it may be impossible to reverse the process. These are chemical changes, also known as chemical reactions. Discuss what happens when a chemical change takes place. Discuss the different types of chemical reaction with examples. Write the reactions on the board and explain how the substances have reacted to form new compounds.</p> <p>Explain exothermic and endothermic reactions with examples.</p> <p>When iron and sulphur are mixed and heated together, a new substance, iron oxide, is formed. Although you have to heat the iron and sulphur to start this reaction, it gives out heat once it gets going. A reaction which gives out heat is called exothermic. Fireworks are an example of exothermic reactions. Chemical substances are mixed in just the right amounts to produce light and sound energy as well as heat energy. Some reactions take in heat while they are taking place. These are called endothermic reactions. The reactions that take place when you fry an egg are endothermic.</p>				

Date:

Time: 40 mins

Unit: 6 Topic: Chemical reactions and chemical equations	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Chemical equations	<ul style="list-style-type: none"> <li>• to explain what a chemical equation is</li> <li>• to explain how to write a chemical equation</li> </ul>	<ul style="list-style-type: none"> <li>• explain what a chemical equation is</li> <li>• explain the method for writing a chemical equation</li> </ul>	Charts with chemical equations written on them	Reading: p 44, 45 CW: Q3, Q4 HW: Q1 (c)
<p><b>Key words:</b> chemical equation, chemical reaction, reactant, product, arrow, state symbol, balancing</p> <p><b>Method: Ask:</b> How can we write a chemical reaction? Write a word equation for the reaction between iron and sulphur on the board: iron + sulphur → iron sulphide</p> <p>The same reaction can be written in symbols in a chemical equation: <math>\text{Fe} + \text{S} \rightarrow \text{FeS}</math></p> <p>The substances at the start of the reaction are called reactants. The substances left at the end of the reaction are called products.</p> <p>The arrow indicates the direction in which the reaction takes place. If the reactants are to be heated to make the reaction take place, the word 'heat' can be written above the arrow.</p> <p>We can add more information to equations by writing the state symbols for the reactants and products. The state symbols are: (s) for solid, (l) for liquid, (g) for gas, (aq) for aqueous solution (solution in water). Write equations with state symbols, on the board.</p> <p>Explain the steps for writing chemical equations with examples.</p>				

Date:

Time: 40 mins

Unit: 6 Topic: Chemical reactions and chemical equations	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Law of conservation of mass	<ul style="list-style-type: none"> <li>• to state the law of conservation of mass</li> <li>• to explain how to balance equations</li> </ul>	<ul style="list-style-type: none"> <li>• state the law of conservation of mass</li> <li>• balance chemical equations</li> </ul>	Charts showing balanced equations	Reading: p 45, 46 CW: Q1 (b) Q5 HW: Q6
<p><b>Key words:</b> Law of conservation of matter, balanced equation</p> <p><b>Method:</b> Write on the board the chemical equation <math>\text{Fe} + \text{S} \rightarrow \text{FeS}</math></p> <p>Ask the students to count the number of atoms of the reactants and products on both sides of the arrow.</p> <p><b>Ask:</b> Are they equal?</p> <p>Now write the equation: <math>\text{C} + \text{O} \rightarrow \text{CO}_2</math></p> <p>Ask the students to count the number of the atoms of the products and reactants.</p> <p><b>Ask:</b> Are they equal on both sides? Explain the importance of balancing equations and the law of conservation of matter, with more examples.</p> <p>Help the students to practise balancing equations.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Match the description to the kind of chemical reaction, and write an example of each:

<b>Type of chemical reaction</b>	<b>Name of the reaction</b>
a. when two or more substances combine to form a single chemical substance	decomposition
Example: _____ _____	
b. when a single chemical substance is broken down into two or more different substances	combustion
Example : _____ _____	
c. when two solutions are mixed and an insoluble product is formed	synthesis
Example : _____ _____	
d. when a chemical substance reacts with oxygen in the air giving out heat and light	precipitation
Example : _____ _____	
e. a reaction which gives out heat	endothermic
Example : _____ _____	
f. a reaction which absorbs heat	exothermic
Example : _____ _____	

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Arrange the following steps of how to write a chemical equation in the correct order.

- Write down the word equation.
- Add up the number of atoms of each element on the left-hand side of the equation.
- Add state symbols.
- Balance the equation by putting numbers in front of the formulae.
- Write the correct formula for each of the chemicals.
- If the number of atoms of each element on the left hand side is equal to those on the right-hand side of the arrow, the equation is balanced.
- Add up the number of atoms of each element on the right-hand side of the equation.

2. Complete the following equations and balance them:

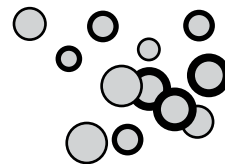
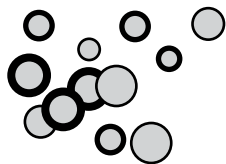
four hydrogen atoms + two oxygen atoms  $\rightarrow$  two water molecules

two hydrogen atoms + two chlorine atoms  $\rightarrow$  two hydrogen chloride molecules

two nitrogen atoms + six hydrogen atoms  $\rightarrow$  two ammonia molecules

two iodine atoms + two chlorine atoms  $\rightarrow$  two iodine chloride molecules

two phosphorus atoms + six chlorine atoms  $\rightarrow$  two phosphorus chloride molecules



## Acids, alkalis, and salts

---

### Teaching objectives:

- to explain what an acid is
- to explain that acids can be weak or strong
- to explain the physical and chemical properties of acids
- to explain how acids are useful
- to define an alkali
- to explain the properties of alkalis and discuss how alkalis are useful
- to explain that acids are neutralized by alkalis
- to describe the use of neutralization in daily life
- to explain the uses of alkalis
- to explain what salts are and describe the properties of salts
- to explain the methods by which salts can be prepared and discuss their uses

### Teaching strategy:

**Ask:** What is the taste of lemon juice and vinegar? Explain that acids are sour. Acids that we use in our food are weak acids. Take some sulphuric acid in a beaker. Put a piece of paper in it. **Ask:** What happened to the paper? Why? Explain that some acids like sulphuric acid are strong. They are corrosive. Dip a litmus paper in dilute acid. **Ask:** What colour change do you see? Explain that acids turn litmus paper red. Dip a pH paper in an acid. **Ask:** What colour change do you see? Explain that acids have a low pH value. Set up an electrolytic cell with dilute hydrochloric acid solution. Show that a current is flowing through the cell. **Ask:** What does this show? Explain that acids are good conductors of electricity. Do the activity exercises to test the chemical properties of acids. **Ask:** What are acids used for? Explain the uses of acids.

**Ask:** What is the taste of soap? What is the taste of saliva? Explain that alkalis have a bitter taste. Saliva is a weak alkali so it is tasteless. Take some sodium hydroxide in a test tube and put a blob of fat in it. Shake the tube. **Ask:** What happened to the fat? Explain that strong alkalis attack grease. Dip a litmus paper in an alkali. **Ask:** What colour change do you see? Explain that alkalis turn litmus paper blue. Dip a pH paper in an alkali. **Ask:** What colour change do you see? Explain that alkalis have a high pH value. Set up an electrolytic cell with dilute sodium hydroxide solution. Show the students that a current is flowing through the cell. **Ask:** What does this show? Explain that alkalis are good conductors of electricity. Make a soap solution and make the students feel it. Explain that alkalis feel slippery. Dip pH paper in an alkali. **Ask:** What colour change do you see? Explain that alkalis have a high pH value. Add a solution of calcium hydroxide to some ammonium chloride in a test tube. **Ask:** What can you smell? Explain that alkalis produce ammonia on reaction with ammonium compounds.



Perform the neutralization experiment in the activity at the end of the lesson. Explain that alkalis neutralize acids to form salt and water. Explain the uses of alkalis.

**Ask:** What do you take when you have acidity or indigestion? Explain that indigestion tablets are alkaline. They neutralize the acids produced by the stomach. **Ask:** What is the taste of toothpaste? Why do we use toothpaste to clean our teeth? Explain that toothpaste is alkaline. It neutralizes the acids produced by the decay of food particles in the mouth. **Ask:** Why do you rub an onion on a bee sting? Explain that a bee sting is acidic and ammonia in the onion is alkaline. It neutralizes the acid in a bee or ant sting. Explain that a wasp sting is alkaline. It can be neutralized by rubbing with vinegar which is a weak acid. **Ask:** What is common salt? In what form do we see salts? Explain that most salts are solids. Salts are found in the form of crystals. Salts have high melting and boiling points. Put some sodium chloride crystals in a china dish and heat it. **Ask:** Does the salt melt? Explain that salts have high melting and boiling points.

Set up an electrolytic cell with a solution of sodium chloride. **Ask:** Is it conducting electricity? Explain that salt solutions are good conductors. Salts can occur naturally, but some salts are prepared in laboratories and factories. Explain the various reactions by which salts can be prepared. Add dilute sulphuric acid to pieces of zinc in a test tube. Hydrogen gas will evolve which can be tested with a burning splint. The gas will begin to burn with a 'pop' sound and will give a blue flame. Perform the precipitation reaction by mixing solutions of barium chloride and magnesium sulphate. A white precipitate of barium sulphate will be formed. Explain how salts are useful.

Do the activities at the end of the lesson. Summarize the lesson.

## Answers to Exercises in Unit 7

- Weak acids: citric acid, lactic acid, acetic acid. Strong acids: hydrochloric acid, nitric acid, sulphuric acid
  - Acids have a sour taste. Acids turn blue litmus paper red. Acids turn pH paper red.
  - Alkalis have a bitter taste. Alkalis turn red litmus paper blue. Alkalis are soapy to touch.
  - Alkalis are used to make soap. They are used to clean greasy ovens. Ammonia is an alkali which is used as household bleach.
- |               |          |
|---------------|----------|
| lemon juice   | acidic   |
| soap powder   | alkaline |
| aspirin       | acidic   |
| baking powder | alkaline |
| vinegar       | acidic   |
- |                              |   |
|------------------------------|---|
| (a) zinc chloride + hydrogen | (b) calcium chloride + water + carbon dioxide |
| (c) zinc chloride + water    | (d) calcium chloride + water + ammonia        |
| (e) sodium nitrate + water   | (f) zinc sulphate + hydrogen                  |
| (g) copper sulphate + water  | (h) sodium chloride + water                   |
- |           |             |          |             |           |
|-----------|-------------|----------|-------------|-----------|
| (a) acids | (b) alkalis | (c) both | (d) alkalis | (e) both  |
| (f) both  | (g) acids   | (h) both | (i) both    | (j) acids |

**Additional Exercise**

## MCQs

- (1) Acids have a \_\_\_\_\_ taste.  
sour                  bitter                  saltish                  sweet                  [*sour*]
- (2) Acids turn blue litmus paper \_\_\_\_\_.  
orange                  red                  white                  pink                  [*red*]
- (3) \_\_\_\_\_ is used to preserve food.  
Chilly                  Acid                  Alkali                  Salt                  [*Salt*]
- (4) The acid found in our stomach is \_\_\_\_\_ acid.  
nitric                  sulphuric                  hydrochloric                  citric                  [*hydrochloric*]
- (5) Fizzy drinks contain \_\_\_\_\_ acid.  
nitric                  citric                  ascorbic                  carbonic                  [*carbonic*]
- (6) Alkalis have a \_\_\_\_\_ taste.  
sour                  bitter                  saltish                  sweet                  [*bitter*]
- (7) Tea, baking soda, and toothpaste are \_\_\_\_\_.  
alkalis                  acids                  chemicals                  salts                  [*chemicals*]
- (8) Many \_\_\_\_\_ are made from plant extracts.  
acids                  alkalis                  salts                  indicators                  [*indicators*]
- (9) \_\_\_\_\_ are found in the form of crystals.  
Alkalis                  Acids                  Salts                  [*Salts*]
- (10) Alkalis are useful in everyday life because they neutralize \_\_\_\_\_.  
salts                  chemicals                  acids                  alkalis                  [*alkalis*]

Date:

Time: 40 mins

Unit: 7 Topic: Acids, alkalis, and salts	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Acids	<ul style="list-style-type: none"> <li>• to define an acid and to state its properties</li> <li>• to discuss the uses of acids</li> </ul>	<ul style="list-style-type: none"> <li>• define an acid and describe its properties</li> <li>• list some uses of acids</li> </ul>	Samples of some weak and strong acids, litmus paper, pH paper, sodium hydroxide	Reading: p 50, 51 Experiment: 2, 3 CW: Q3 HW: Q1 (a) (b)
<p><b>Key words:</b> strong acid, weak acid, litmus, corrosive, sour, hydrogen ion, pH paper</p> <p><b>Method: Ask:</b> What does lemon juice taste like? Or vinegar? Explain that acids are sour. The acids that we use in our food are weak acids. Discuss the physical properties of acids.</p> <p>Put a piece of paper in a beaker containing some sulphuric acid. <b>Ask:</b> What has happened to the paper? Why? Explain that acids like sulphuric acid are very strong. They are corrosive. Dip a litmus paper in some dilute hydrochloric acid. <b>Ask:</b> Has the colour changed. Explain that acids turn litmus paper red. Dip pH paper in an acid. <b>Ask:</b> What colour change do you see? Explain that acids have a low pH value.</p> <p>Set up an electrolytic cell with dilute hydrochloric acid solution. Explain that a current is flowing through the cell. This shows that acids are good conductors of electricity.</p> <p>Demonstrate the chemical properties of acids by performing the tests. Discuss the uses of acids.</p>				

Date:

Time: 40 mins

Unit: 7 Topic: Acids, alkalis, and salts	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Alkalis	<ul style="list-style-type: none"> <li>to define alkalis and to state their properties</li> <li>to discuss the uses of alkalis</li> </ul>	<ul style="list-style-type: none"> <li>define an alkali and explain its properties</li> <li>list some uses of alkalis</li> </ul>	Samples of weak and strong alkalis, litmus paper, pH paper, dilute hydrochloric acid	Reading: p 51, 52 Experiment 1, 4 CW: Q2, Q4 HW: Q1 (c) (d)
<p><b>Key words:</b> weak alkali, strong alkali, hydroxyl ion, corrosive, pH paper, neutralize</p> <p><b>Method: Ask:</b> What does soap taste like? Or saliva? Explain that alkalis have a bitter taste. Saliva is a weak alkali therefore it has no taste. Pour some sodium hydroxide into a test tube and put a blob of fat in it. Hold your thumb over the top and shake the test tube vigorously. <b>Ask:</b> What has happened to the fat? Explain that strong alkalis can dissolve fats. Dip a litmus paper and a pH paper in an alkali. <b>Ask:</b> What colour change do you notice? Explain that alkalis turn litmus paper red and pH paper purple. Alkalis have a high pH value.</p> <p>Set up an electrolytic cell with dilute sodium hydroxide solution. Show the students the flow of the current through the alkali. Explain that alkalis are good conductors of electricity.</p> <p>Discuss the neutralization reaction between an acid and an alkali. Explain how indigestion, tooth decay, and insect bites can be treated by neutralization reactions.</p>				

Date:

Time: 40 mins

Unit: 7 Topic: Acids, alkalis, and salts	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Salts	<ul style="list-style-type: none"> <li>• to define a salt and to state its properties</li> <li>• to describe how salts can be prepared</li> <li>• to discuss the uses of salts</li> <li>• to describe different indicators</li> </ul>	<ul style="list-style-type: none"> <li>• define salts and explain the properties of salts</li> <li>• list some uses of salts</li> <li>• describe the ways in which salts can be prepared</li> <li>• describe different indicators</li> </ul>	Samples of some salts, acids, and alkalis, litmus paper, Universal Indicator, pH paper	Reading: p 53, 54 Activity: p 54, 56
<p><b>Key words:</b> salt, crystal, fertilizer, indicator, litmus, Universal Indicator, pH paper</p> <p><b>Method:</b> Ask: What is a salt? In what form do we see salts? Explain that salts are solids that we see in the form of crystals. Discuss the properties of salts. Set up an electrolytic cell with a solution of sodium chloride (common salt). Explain that salt solutions are good conductors of electricity.</p> <p>Most salts occur naturally, but some salts are prepared in the laboratory, or in factories. Explain the reactions by which salts can be prepared. Explain the uses of salts.</p> <p><b>Ask:</b> What is an indicator? Discuss the various indicators that are used to find out whether a solution is acidic, alkaline, or neutral.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Complete the table below to differentiate between acids and alkalis.

<b>Properties</b>	<b>Acid</b>	<b>Alkalis</b>
taste		
effect on litmus paper		
effect on pH paper		
solubility		
ability to conduct electricity		
ions produced in water		
reaction with metals		
reaction with carbonates		
reaction with acids		
reaction with alkalis		

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Complete the following reactions and write the names(s) of the salt(s) produced:

- zinc + dilute sulphuric acid →
- copper oxide + dilute sulphuric acid →
- sodium hydroxide + dilute hydrochloric acid →
- barium chloride + magnesium sulphate →

2. Match the indicator to its description:

**Description****Name of indicator**

- |   |                     |
|---|---------------------|
| a. a dye made from lichen                 | Universal Indicator |
| b. a mixture of several indicators        | pH paper            |
| c. paper coated with a chemical substance | litmus              |

3. Give the colour of the indicators listed below when placed in acids and alkalis.

<b>Indicator</b>	<b>Colour in acid</b>	<b>Colour in alkali</b>
litmus		
phenolphthalein		
methyl orange		
bromothymol blue		
pH paper		



## Oxygen and carbon dioxide

---

### Teaching objectives:

- to stress the importance of oxygen for living things
- to explain where oxygen is found
- to describe the properties and uses of oxygen
- to explain where carbon dioxide is found in nature
- to explain the importance of carbon dioxide and describe how carbon dioxide can be made
- to describe the properties and uses of carbon dioxide

### Teaching strategy:

**Ask:** What is oxygen? Where is oxygen found? Explain the presence of oxygen in the atmosphere. Introduce Scheele and the fact that he identified oxygen. Explain the preparation of oxygen in the laboratory. Prepare a few jars of oxygen in the laboratory and check whether the gas collected is oxygen or not, by testing it with a glowing splint. Demonstrate the physical and chemical properties of oxygen. Explain that plants produce oxygen during the daytime, in the presence of sunlight. Conduct an experiment to show that plants produce oxygen by the method explained in the book. Explain that oxygen production by plants is important because it is used up by all living organisms for respiration.

**Ask:** Do you know what oxygen is used for? Explain the uses of oxygen.

**Ask:** What is carbon dioxide? Where is it found? Explain the presence of carbon dioxide in the atmosphere. Discuss the importance of carbon dioxide. **Ask:** What do plants use to make their food? Explain the process of photosynthesis. Explain how carbon dioxide can be prepared in the laboratory. Test the gas with lime water. Demonstrate and explain the physical and chemical properties of carbon dioxide. Show the students a fire extinguisher and ask them how it works. Explain the principle involved in the construction of a fire extinguisher. Explain the uses of carbon dioxide. Do the activities at the end of the lesson.

Summarize the lesson.



## Answers to Exercises in Unit 8

1. (a) One-fifth of the air contains oxygen. Living things use the oxygen in air to breathe. It is also used in burning, but its amount in air remains fairly constant because green plants produce oxygen during the process of photosynthesis.
  - (b) Preparation of oxygen in the laboratory: Oxygen is prepared in the laboratory by heating potassium chlorate. A small amount of manganese dioxide is added to it so that oxygen is given off more quickly.
  - (c) Experiment to prove that one-fifth of the atmosphere is oxygen: Mark five equal divisions on a gas jar. Place a lighted candle on a wooden block in a trough of water. Invert the marked gas jar over the candle. When the candle goes out, the water level in the jar rises to the first mark i.e. one-fifth of the air in the jar has been used up.
  - (d) Test for oxygen: A glowing splint bursts into flames when brought near a jar containing oxygen.
  - (e) Properties of oxygen:
    - (i) It has no colour, taste, or smell.
    - (ii) It is slightly soluble in water.
    - (iii) It is heavier than air.
    - (iv) It is very reactive chemically.
    - (v) It helps in breathing, burning, and rusting of iron.
  - (f) Carbon dioxide is found in very small quantities (about 0.04%) in the atmosphere. Plants use carbon dioxide to make their food. It is replaced by the process of respiration of all living organisms, so its amount in the atmosphere remains fairly constant.
  - (g) Preparation of carbon dioxide in the kitchen: Take half a teaspoon of baking powder in a glass bottle and add some vinegar to it. Bubbles of carbon dioxide will come out of the mixture.
  - (h) Preparation of carbon dioxide in the laboratory: Put some marble pieces in a glass flask and pour some dilute hydrochloric acid. Bubbles of gas will be seen coming out of the mixture. The gas can be collected in a gas jar.
  - (i) Test for carbon dioxide:
    - (i) Bring a burning match near the mouth of the jar. It will go out.
    - (ii) Put some lime water in the jar and shake it. The lime water will turn milky.
  - (j) Experiment to prove that carbon dioxide is produced by breathing: Blow air into a beaker containing some lime water with a drinking straw. The lime water turns milky.  
Experiment to prove that carbon dioxide is produced by burning: Light a small candle and lower it in a jar containing lime water. Cover the jar with a glass plate. When the candle goes out, shake the gas jar. The lime water turns milky.
2. (a) photosynthesis      (b) O<sub>2</sub>      (c) catalyst      (d) acids
  - (e) alkalis      (f) oxyacetylene      (g) liquid      (h) breathing
  - (i) sugar      (j) respiration      (k) CO<sub>2</sub>      (l) lime water
  - (m) burning

**Additional Exercise**

## MCQs

- (1) Carbon dioxide tastes \_\_\_\_\_.  
sour                  bitter                  sweet                  salty                  [*sour*]
- (2) \_\_\_\_\_ helps in burning.  
Carbon dioxide    Sulphur dioxide    Oxygen                  Nitrogen                  [*Oxygen*]
- (3) One-fifth of the atmosphere consists of \_\_\_\_\_.  
nitrogen                  carbon dioxide                  oxygen                  ozone                  [*Oxygen*]
- (4) \_\_\_\_\_ has no taste, colour, or smell.  
Oxygen                  An acid                  Carbon dioxide                  Nitrogen                  [*Oxygen*]
- (5) \_\_\_\_\_ turns lime water milky.  
Oxygen                  Carbon dioxide                  Nitrogen                  Smoke                  [*Carbon dioxide*]
- (6) \_\_\_\_\_ is used in fizzy drinks and fire extinguishers.  
Oxygen                  Nitrogen                  Nitric acid                  Carbon dioxide                  [*Carbon dioxide*]
- (7) \_\_\_\_\_ does not assist in burning.  
Carbon dioxide    Citric acid                  Oxygen                  Ozone                  [*Carbon dioxide*]
- (8) Carbon dioxide can be prepared at home by mixing \_\_\_\_\_ and baking soda.  
vinegar                  sugar                  oil                  flour                  [*vinegar*]
- (9) \_\_\_\_\_ combines with metals to give alkaline oxides.  
Carbon dioxide    Sulphur dioxide                  Oxygen                  Nitrogen                  [*Oxygen*]
- (10) Plants produce oxygen during \_\_\_\_\_.  
growth                  photosynthesis                  transpiration                  [*photosynthesis*]

Date:

Time: 40 mins

Unit: 8 Topic: Oxygen and carbon dioxide	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW:
1. Oxygen gas	<ul style="list-style-type: none"> <li>• to discuss the occurrence of oxygen gas in the air</li> <li>• to demonstrate the preparation, properties, and uses of oxygen gas</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• explain the occurrence of oxygen gas in the air</li> <li>• describe the methods of preparation and the physical and chemical properties of oxygen gas</li> <li>• list some uses of oxygen gas</li> </ul>	<p>A pie chart showing the amounts of different gases in the atmosphere, potassium chlorate, manganese dioxide, gas jar, a match box, candle, glass tumbler, pictures of gas cylinders, an oxygen tent, welding torch, space rocket</p>	<p>Reading: p 60, 61 Experiments: 1, 2 p 61 CW: Q1 (a) (b) HW: Q1 (c) (d) (e)</p>
<p><b>Key words:</b> oxygen, catalyst, oxide, oxyacetylene, liquid oxygen</p> <p><b>Method: Ask:</b> What is oxygen? Where is it found? Discuss the presence and the importance of oxygen gas in the air. Explain that a Swedish chemist, Scheele, identified oxygen in 1772.</p> <p>Demonstrate the method of preparing oxygen in the laboratory. Fill a few gas jars with oxygen. Use a glowing splint to test whether it is oxygen or not. Demonstrate the physical and chemical properties of oxygen. Explain its uses. Give students additional information about oxygen by drawing the oxygen cycle on the board and explaining it.</p>				

Date:

Time: 40 mins

Unit: 8 Topic: Oxygen and carbon dioxide	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Carbon dioxide	<ul style="list-style-type: none"> <li>• to discuss the occurrence of carbon dioxide gas in the air</li> <li>• to demonstrate the preparation, properties, and uses of carbon dioxide</li> </ul>	<ul style="list-style-type: none"> <li>• explain the occurrence of carbon dioxide gas in the air</li> <li>• describe the methods of preparation and the physical and chemical properties of carbon dioxide gas</li> <li>• list some uses of carbon dioxide gas</li> </ul>	Baking powder, vinegar, matchbox, round bottom flask, thistle funnel, delivery tube, gas jars, lime water, test tube, glass tube, fire extinguisher	Reading: p 61, 62, 63 Experiments: 1, 2 p 62 Experiments: 1, 2 p 63 CW: Q2 HW: Q1 (f) (g) (h)
<p><b>Key words:</b> carbon dioxide, marble chips, dilute hydrochloric acid, lime water, fizzy drink, fire extinguisher, dry ice</p> <p><b>Method:</b> Ask: What is carbon dioxide? Where is it found? Explain the occurrence and importance of carbon dioxide in the atmosphere. Ask: What do plants use to make their food? Revise photosynthesis. Draw the carbon cycle on the board and explain it.</p> <p>Demonstrate the methods of preparing carbon dioxide. Test the gas with lime water. Demonstrate and explain the physical and chemical properties of carbon dioxide. Show the students a fire extinguisher and explain its construction and working with the help of diagrams. Discuss the uses of carbon dioxide.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

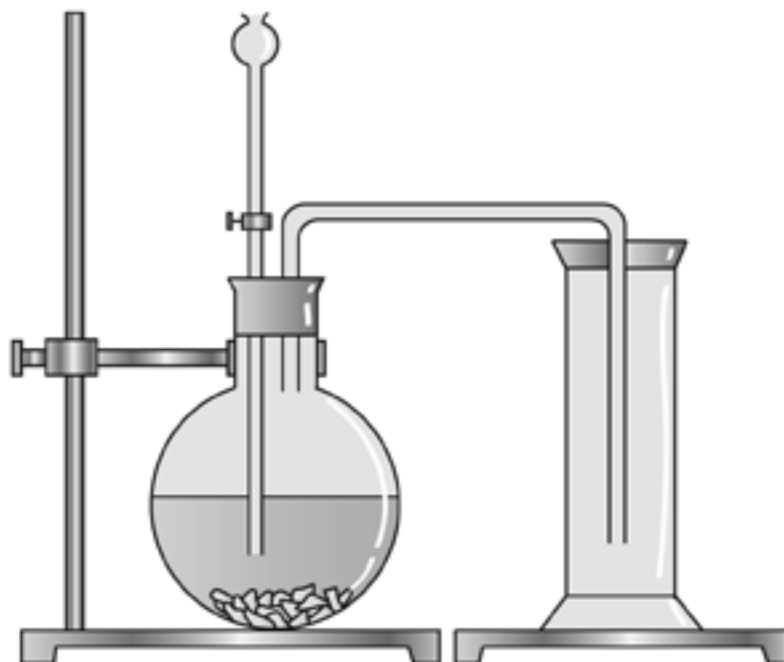
1. Complete the table to show a comparison of the properties of oxygen and carbon dioxide.

<b>Property</b>	<b>Oxygen</b>	<b>Carbon dioxide</b>
taste		
colour		
smell		
heavier than air		
solubility		
reaction with metals		
reaction with non-metals		
supports combustion		

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Label the diagram of the apparatus that is used for the preparation of carbon dioxide gas.



2. Write the chemical equation \_\_\_\_\_

3. How would you test that the gas is carbon dioxide?

- i. \_\_\_\_\_

- ii. \_\_\_\_\_

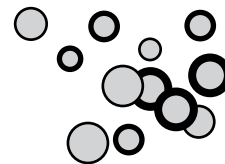
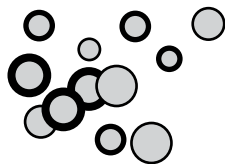
# Test paper 2

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

1. Attempt any 5 questions. (All questions carry equal marks.) [50]
- (a) What information does a balanced chemical equation give us? What are the rules for writing chemical equations?
  - (b) What are the ways in which the rate of a chemical reaction can be changed?
  - (c) Write the method of preparation, properties, and uses of oxygen.
  - (d) Write the method of preparation, properties, and uses of carbon dioxide.
  - (e) Write the methods for the preparation of salts.
  - (f) Write the physical and chemical properties of acids.
  - (g) Write the properties and uses of alkalis.
  - (h) Distinguish between:
    - (i) catalyst and enzyme
    - (ii) acid and alkali
    - (iii) chemical equation and chemical reaction
2. Identify the type of chemical reaction: [10]
- (a) iron + sulphur  $\rightarrow$  iron sulphide
  - (b) carbon + oxygen  $\rightarrow$  carbon dioxide
  - (c) methane + oxygen  $\rightarrow$  carbon dioxide + water
  - (d) calcium carbonate  $\rightarrow$  calcium oxide + carbon dioxide
  - (e) lead nitrate  $\rightarrow$  lead oxide + nitrogen oxide + oxygen
  - (f) silver nitrate + sodium chloride  $\rightarrow$  silver chloride (solid) + sodium nitrate (soluble in water)
  - (g) barium chloride + sodium sulphate (solid)  $\rightarrow$  barium sulphate + sodium chloride (soluble)
3. Complete the reactions. [10]
- (a) zinc + hydrochloric acid  $\rightarrow$
  - (b) calcium carbonate + hydrochloric acid  $\rightarrow$
  - (c) zinc oxide + hydrochloric acid  $\rightarrow$
  - (d) calcium hydroxide + ammonium chloride  $\rightarrow$
  - (e) sodium hydroxide + nitric acid  $\rightarrow$
  - (f) zinc + sulphuric acid  $\rightarrow$
  - (g) copper oxide + sulphuric acid  $\rightarrow$
  - (h) sodium hydroxide + hydrochloric acid  $\rightarrow$

4. Fill in the blanks. [10]
- (a) Oxygen is produced by plants during the process of \_\_\_\_\_.
  - (b) The chemical formula of oxygen is \_\_\_\_\_.
  - (c) A \_\_\_\_\_ is a chemical substance which changes the speed of a chemical reaction without being changed itself.
  - (d) The oxides of non-metals such as carbon and sulphur produce \_\_\_\_\_ when dissolved in water.
  - (e) The oxides of metals such as sodium and potassium produce \_\_\_\_\_ when dissolved in water.
  - (f) Oxygen is used in an \_\_\_\_\_ torch for cutting and welding metal.
  - (g) \_\_\_\_\_ oxygen is used as fuel in spaceships.
5. (a) How will you prove by an experiment that dilute acids react with metal carbonates to give off carbon dioxide? [10]
- (b) How will you prove that an acid and an alkali neutralize each other? [10]





## Lenses at work

### Teaching objectives:

- to explain what a lens is and describe the different kinds of lenses
- to explain the focal length of a lens
- to explain that a lens can magnify the image of an object
- to explain how to calculate the magnification of the image
- to describe the uses of lenses and explain the arrangement of lenses in various optical instruments

### Teaching strategy:

Show the students a magnifying glass. Tell them to read the words on the page of their books.

**Ask:** Why do the words look big? Explain the structure of a lens and the types of lenses. Explain how light refracts when it passes through a lens. Hold the magnifying glass near a window. Focus a sharp image of the Sun on a sheet of paper. Explain that the clear image of an object is formed at a point where all the rays coming from it come to a point (converge). This point is called the principal focus, and the distance between the image and the lens is called the focal length. Show the students how the focal length of a lens can be calculated with the help of an optical bench.

Explain the path of rays when they pass through a lens. With the aid of diagrams on the board explain the formation of images of an object placed at various distances from the lens. Explain the types of images that will be formed. Explain that images that can be made on a screen are called real images. Images that cannot be made on a screen are called virtual images. Show the students a microscope and explain its parts. Put a slide under the objective lens. Tell them to see the image. Explain that the combination of lenses in optical instruments helps us to see clear images of objects. Draw a section of the telescope and explain how images of distant objects can be seen by it. **Ask:** What kind of an image is formed by a telescope? Explain that the image is upside down but it doesn't matter when we are observing heavenly bodies.

Draw the longitudinal section of the human eye and a camera. Explain the similarities and differences between the eye and the camera. Identify some students in the class who wear glasses. **Ask:** Can you see distant objects without your glasses? Does any one of your parents or grandparents wear glasses? Discuss the use of spectacles and the defects of vision. Explain how lenses can be used to correct vision with the help of diagrams on the board. **Ask:** Can you see in the dark? Discuss the role of the iris and the pupil of the eye in adjusting to light and dark. Also explain the role of the rods and cones in helping the eyes to get used to seeing in the dark. Discuss night vision.

Summarize the lesson.

## Answers to Exercises in Unit 9

- (a) Please see Pupil's Book.

(b) A real image can be made on a screen. An image that cannot be formed on a screen is called a virtual image, e.g. an image formed by a convex lens is real. An image formed by a concave lens is virtual.

(c) Individual work      (d) Individual work

(e) A person suffers from long-sightedness when in his eyes the distance between the lens and the retina is shorter than normal. Distant objects can be focused properly, but the point of focus for an object close to the eye is behind the retina. [Pupils to draw the diagram]

(f) Individual work
- (a) principal focus      (b) principal focus      (c)  $2f$

(d) converge      (e) refracted      (f) convex

## Additional Exercise

### MCQs

- (1) A lens can \_\_\_\_\_ light.

refract                      reflect                      break                      distort                      [*refract*]
- (2) \_\_\_\_\_ lenses curve outwards.

Concave                      Flat                      Plastic                      Convex                      [*Convex*]
- (3) Concave lenses curve \_\_\_\_\_.

backwards                      outwards                      inwards                      sideways                      [*inwards*]
- (4) The central point of a lens is called the \_\_\_\_\_ focus.

teacher                      tutor                      principal                      main                      [*principal*]
- (5) The image formed by a \_\_\_\_\_ lens is real.

convex                      flat                      concave                      plastic                      [*convex*]
- (6) Shortsight is corrected by wearing \_\_\_\_\_ lenses.

plastic                      diverging                      converging                      flat                      [*diverging*]
- (7) The \_\_\_\_\_ regulates the amount of light entering the eye.

iris                      cornea                      lens                      retina                      [*iris*]
- (8) A film camera uses a \_\_\_\_\_ lens.

concave                      convex                      prism                      magnifying                      [*convex*]
- (9) A projector uses \_\_\_\_\_ convex lenses.

one                      two                      three                      no                      [*two*]
- (10) In \_\_\_\_\_ people, the point of clear focus is somewhere behind the retina.

long-sighted                      short-sighted                      [*long-sighted*]

Date:

Time: 40 mins

Unit: 9 Topic: Lenses at work	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Lenses	<ul style="list-style-type: none"> <li>• to describe a lens</li> <li>• to discuss the different types of lens</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• identify a lens</li> <li>• describe the different types of lens</li> </ul>	Different kinds of lenses, optical bench, magnifying glass	Reading: p 67 Experiment: p 67
<p><b>Key words:</b> lens, convex lens, concave lens, converging lens, diverging lens, principal focus, focal length, image, inverted, real image</p> <p><b>Method:</b> Show the students a magnifying glass. Ask them to use it to read. <b>Ask:</b> Why do the words appear bigger?</p> <p>Describe a lens. With the help of real lenses and diagrams on the board, explain the types of lenses, and how light refracts when it passes through lenses. Hold a magnifying glass near a window. Focus a sharp image of the Sun on a sheet of paper. Explain that a clear image of an object is formed at a point where all the rays coming from the object come to a point (converge). This point is called the principal focus, and the distance between the image and the lens is called the focal length of the lens. Show the students how to calculate the focal length of a lens using an optical bench.</p>				

Lesson plan

Date:

Time: 40 mins

Unit: 9 Topic: Lenses at work	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Refraction of rays by a lens	<ul style="list-style-type: none"> <li>• to explain that rays are refracted by a lens</li> <li>• describe how images are formed by lenses</li> </ul>	<ul style="list-style-type: none"> <li>• state the rules of refraction of rays by a lens</li> <li>• describe the formation of images by a convex and a concave lens</li> </ul>	Convex lens, concave lens	Reading: p 67, 68, 69 Activity: p 69 CW: Q2 HW: Q1 (a) (b) (c) (d)
<p><b>Key words:</b> refraction, inverted, upright, real, virtual</p> <p><b>Method:</b> With the help of diagrams explain the paths of rays when they pass through a lens. Explain the formation of images of an object placed at various distances from the lens. Describe the kinds of images that will be formed. Explain the difference between real and virtual images. Help the students practise drawing refraction of rays through lenses.</p>				

Date:

Time: 40 mins

Unit: 9 Topic: Lenses at work	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Uses of lenses	<ul style="list-style-type: none"> <li>to describe how lenses are used</li> </ul>	<ul style="list-style-type: none"> <li>describe how lenses are used in optical instruments such as a projector, a camera, a compound microscope, a telescope</li> </ul>	Diagrams of a projector, a camera, a compound microscope, a telescope	Reading: p 69, 70, 71 Activity: Draw a diagram to show how a projector is used to show slides on a screen. CW: Q. Describe a microscope. Q1 (f)
<p><b>Key words:</b> optical instrument, projector, microscope, camera, magnifying glass, telescope</p> <p><b>Method:</b> Show the students a microscope and explain its construction. Put a microscope slide under the objective lens and ask the students to observe the image. Explain that the combination of lenses in optical instruments helps us to see clear images of objects. Draw a section of the telescope and explain how images of distant objects can be seen through it.</p> <p><b>Ask:</b> What kind of an image is formed by a telescope? Explain that the image is upside down or inverted, but it does not matter when we are observing heavenly bodies.</p>				

Date:

Time: 40 mins

Unit: 9 Topic: Lenses at work	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. The human eye	<ul style="list-style-type: none"> <li>• to describe the structure of the human eye</li> <li>• to compare a camera to the human eye</li> <li>• to discuss the uses of spectacles</li> <li>• to describe some common eye defects and their correction</li> <li>• to explain how we can see in the dark</li> </ul>	<ul style="list-style-type: none"> <li>• describe the structure of the human eye</li> <li>• compare the eye to a camera</li> <li>• list some defects of vision</li> <li>• explain how poor eye-sight can be corrected</li> <li>• explain night vision</li> </ul>	Diagrams of the eye, long-sight, short-sight	Reading: p 71, 72, 73 Activity: p 71, p 73 HW: Q1 (e)

**Key words:** eye, lens, iris, retina, optic nerve, light-sensitive cell, upright image

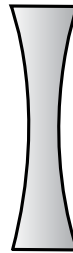
**Method:** Draw the longitudinal section of the human eye, and describe its parts. Draw a section of a camera and explain the similarities and differences between the eye and the camera.  
Identify some students in the class who wear glasses. **Ask:** Can you see distant objects without your glasses? Does anyone in your family wear glasses? Discuss the use of spectacles and the defects of vision. Explain, with diagrams on the board, how corrective lenses can be used to help improve poor vision.

**Ask:** Can you see in the dark? Discuss the role of the iris and the pupil of the eye in adjusting to light and dark. Also explain the role of rods and cones in helping the eyes to get used to seeing in the dark. Discuss night vision.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Write the names of the lenses shown below.



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Draw diagrams to show how rays are refracted by a lens.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## 1. Match the optical instrument to its name:

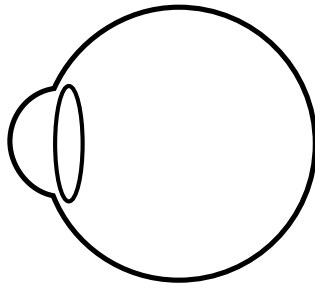
Description of the optical instrument	Name
a. used for showing slides on a screen; it consists of two convex lenses	the human eye
b. used for taking photographs of objects; it has a convex lens which focuses the image on the film, coated with light-sensitive chemicals	a film projector
c. takes still and video photographs by recording images using an electronic imaging sensor	a microscope
d. a simple convex lens which has a short focal length; it produces an erect, magnified, and virtual image of the object	a film camera
e. used for studying very tiny objects; has two convex lenses; a magnified, clear image of the object is seen by it	a telescope
f. used for studying heavenly bodies; consists of two convex lenses; rays coming from a heavenly body form a real, inverted, and small image of the object	a magnifying glass
g. It is like a camera in the human body. It has a convex lens which forms an inverted image of any object on a screen made up of light-sensitive cells, which send messages to the brain through the optic nerve. The brain produces an upright image of the object.	a digital camera



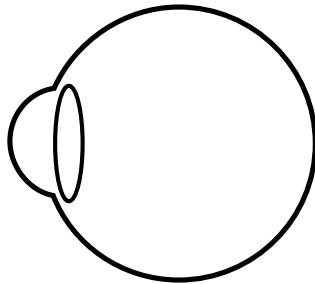
Name: \_\_\_\_\_

Date: \_\_\_\_\_

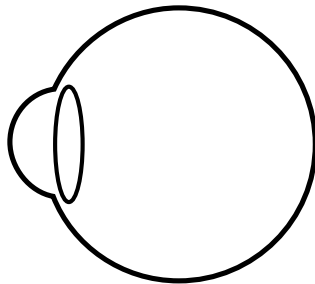
1. (a) Draw rays to show the kind of defect in short-sightedness:



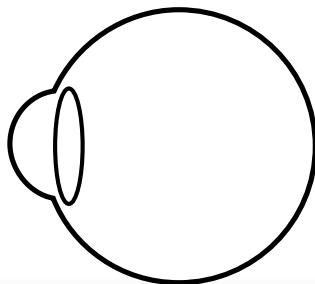
(b) Draw rays on the diagram to show how a lens can be used for its correction:

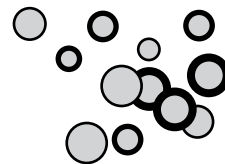
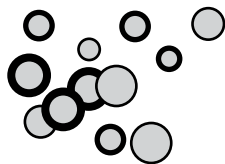


2. (a) Draw rays to show the kind of defect in long-sightedness:



(b) Draw rays on the diagram to show how a lens can be used for its correction.





## Force and pressure

### Teaching objectives:

- to define pressure
- to explain the relationship between force, area, and pressure
- to describe how to calculate pressure on a given object
- to define the units used to measure pressure
- to describe the hydraulic system
- to explain how gases behave under pressure

### Teaching strategy:

**Ask:** What causes more damage to a wooden floor, shoes with flat soles or stiletto heels? Explain that stiletto heels can ruin carpets and punch holes in wooden floors. This is not just because of the strong downward force, but because this force is concentrated on such a small area that it produces strong pressure. **Ask:** Can you define pressure? Explain that pressure is the word used by scientists to describe how concentrated a force is. **Ask:** Why does a swimmer feel pressure in his ears? If he goes deeper into the water, how will this affect the pressure? Why does blood have pressure? Explain that walking on sand hurts less than walking on pebbles because pressure is related to area. The greater the area the lesser the pressure. **Ask:** How can we find out the pressure on the surface of a body? Explain that pressure tells us how concentrated a force is. It can be calculated using the equation:

$$\text{pressure} = \text{force} / \text{area}$$

Pressure is measured in units called pascal (Pa)

When a force of 1 newton acts on an area of 1 square metre we say that there is a pressure of 1 pascal.

**Ask:** Does air exert pressure? Explain that the Earth's atmosphere contains billions of tonnes of air. At sea level, the atmospheric pressure is equivalent to a force of about 100,000 newtons pushing on every square metre.

**Ask:** Does a gas exert pressure? Explain that in a gas the molecules are continuously moving, so at any time many of them are colliding with the sides of the container. They bounce off without losing any energy. And in doing so each one exerts a small outward force on the wall. Because billions of molecules are doing this each second, the force appears as constant pressure.

**Ask:** Do liquids exert pressure? Explain that liquids have two special features: they cannot be squashed and if liquid in a container is put under pressure, the pressure is transmitted to all parts of the liquid. Discuss hydraulic machines which use liquid pressure to transmit forces from one place to another. Most hydraulic machines are force magnifiers. They give out more force than is put in. This happens because the output piston is larger than the input piston.

You can calculate the pressure in liquids if you know the density and the depth of the liquid.

Summarize the lesson.

## Answers to Exercises in Unit 10

1. (a) Scientists use the word pressure to describe how concentrated a force is.  
 Pressure can be defined as the force exerted per unit area.  
 If force is measured in newtons (N) and area in square metres, then pressure is measured in newtons per square metre (N/m<sup>2</sup>).  
 A pressure of 1 N/m<sup>2</sup> is also called 1 pascal (Pa).  
 If force is measured in newtons (N) and area in square metres, then pressure is measured in newtons per square metre (N/m<sup>2</sup>).  
 A pressure of 1 N/m<sup>2</sup> is also called 1 pascal (Pa).
  - (b) If a force is concentrated on a small area it creates a high pressure. If the same force is spread over a larger area, its effect is less concentrated. The pressure is less.  
 For example, a box has the same weight (200 N) no matter which way it is resting on the floor. However the pressure on the floor will change, depending on which side of the box is in contact with it.
  - (c) density of water is 1000 kg/m<sup>3</sup>  
 pressure = density x depth x g = 1000 x 4 x 10 = 40,000 Pa
  - (d) The size of the force (measured in newtons)  
 The area of the surface it is pressing on (measured in square metres).
  - (e) pressure = force / area  
 If force is measured in newtons (N) and area in square metres, then pressure is measured in newtons per square metre (N/m<sup>2</sup>)
  - (f) A gas behaves like a liquid in some ways. Its pressure acts in all directions. Its pressure decreases as you rise up through it. However, unlike a liquid, gases can be compressed.
  - (g) Gases can be compressed. This means that it is easier to stop a gas expanding than a liquid or a solid. But if a gas is enclosed in a sealed container, and is not allowed to expand, its pressure rises. This is because the molecules in a gas are always moving. They travel very fast, hitting each other and the sides of the container. If the temperature rises, the molecules move faster, and the pressure rises.
  - (h) The siphon is a bent tube made of glass, rubber, or plastic, with its short arm dipping in the tank and its longer arm outside. To start the siphon it must first be filled with liquid. After this, the liquid will continue to run out as long as the end of the longer arm of the tube is below the level of the water in the tank. A siphon is used to remove water from a fish tank or other vessels, which cannot otherwise be easily emptied. It is generally thought that a siphon works by atmospheric pressure.
2. The pressure of a liquid increases with depth and the density of the liquid petrol is less dense than water, so a container of petrol will exert less pressure than the same container full of water.
  3. Experiment to prove that air exerts pressure:  
 Moisten a rubber sucker and press it on a smooth flat surface. Air is squeezed out from beneath it. The sucker is held tightly to the surface due to atmospheric pressure.

4. The transmission of pressure in fluids can be demonstrated by a simple apparatus which consists of a bulb with small holes on all sides and a tightly fitted plunger. Fill the bulb with water and push the plunger. Water squirts equally from all the holes.
5. force; newtons per metre or pascal; force/area,  $6 \text{ N/m}^2$ ; more
6. (a) 100,000 Pa      (b) 200,000 Pa      (c) 300,000 Pa

[hint: pressure = density x depth x g ]

The width or the shape of the container does not affect the pressure.

## Additional Exercise

### MCQs

- (1) Pressure describes how concentrated the \_\_\_\_\_ is.  
 weight                  force                  volume                  mass                  [**force**]
- (2) \_\_\_\_\_ the load reduces pressure.  
 Spreading                  Mixing                  Diluting                  Rubbing                  [**Spreading**]
- (3) Pressure is affected by the \_\_\_\_\_ of the liquid.  
 opacity                  density                  weight                  colour                  [**density**]
- (4) \_\_\_\_\_ under pressure pushes on every surface it touches.  
 Solid                  Gas                  Liquid                  [**Liquid**]
- (5) A siphon works by \_\_\_\_\_ pressure.  
 container                  water                  solid                  atmospheric                  [**atmospheric**]
- (6) In a siphon, the liquid will continue to run out as long as the end of the longer arm of the tube is \_\_\_\_\_ the level of the water in the tank.  
 alongside                  above                  below                  [**below**]
- (7) Unlike a liquid, \_\_\_\_\_ can be compressed.  
 solid                  air                  water                  [**air**]
- (8) If force is concentrated on a small area, it creates a \_\_\_\_\_ pressure.  
 low                  normal                  high                  [**high**]
- (9) \_\_\_\_\_ is equal to pressure multiplied by area.  
 Force                  Weight                  Mass                  [**Force**]
- (10) An aerosol demonstrates how gases and liquids behave under \_\_\_\_\_.  
 burden                  weight                  pressure                  [**pressure**]

Date:

Time: 40 mins

Unit: 10 Topic: Force and pressure	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Force and pressure	<ul style="list-style-type: none"> <li>• to define pressure</li> <li>• to explain how to calculate pressure</li> <li>• to explain the relationship between pressure and force</li> <li>• to discuss the applications of pressure</li> </ul>	<ul style="list-style-type: none"> <li>• define pressure</li> <li>• know the formula for calculating pressure</li> <li>• explain the relation between force and pressure</li> <li>• list examples of where we experience pressure in our everyday life</li> </ul>	Diagrams showing the pressure exerted by different objects	Reading: p 76, 77 Activity: p 76, 77 CW: Q5 HW: Q1 (a) (b) (c)
<p><b>Key words:</b> pressure, force, area, newton, square metre, pascal</p> <p><b>Method:</b> Ask: What causes more damage to a wooden floor, shoes with flat soles or high heels? Explain that high heels can ruin carpets and punch holes in wooden floors. This is not just because of the strong downward force, but because this force is concentrated on such a small area that it produces strong pressure.</p> <p><b>Ask:</b> Can anyone define pressure? Explain that scientists use the word pressure to describe how concentrated a force is. Explain the method of calculating pressure and the unit that pressure is measured in. Ask: Can we calculate the force on an area if we know the pressure? Explain how force can be calculated by rearranging the pressure equation. Discuss the pressure of objects on different surfaces, and explain the applications of pressure.</p>				

# Lesson plan

Date:

Time: 40 mins

Unit: 10 Topic: Force and pressure	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
2. Pressure in liquids	<ul style="list-style-type: none"> <li>• to explain how liquids exert pressure</li> <li>• to calculate pressure in liquids</li> </ul>	Students should be able to: <ul style="list-style-type: none"> <li>• explain how liquids exert pressure</li> <li>• calculate pressure in liquids</li> </ul>	Diagrams of a tank of water placed in different positions	Reading: p 78, 79 CW: Q1 (c) (d) HW: Q6
<p><b>Key words:</b> pressure, force, area, density, depth, weight</p> <p><b>Method:</b> Ask: Why does a swimmer feel pressure in his ears? If he goes deeper into the water, how will it affect the pressure? What is blood pressure?</p> <p>Explain that gravity is a force that pulls any liquid in a container downwards. A liquid under pressure pushes on every surface it touches. The pressure of a liquid increases with depth. The width or the shape of the container does not affect the pressure.</p> <p><b>Ask:</b> Which will exert greater pressure, petrol or water? Explain that pressure is affected by the density of the liquid. Explain the formula for calculating the pressure of liquids.</p>				

Date:

Time: 40 mins

Unit: 10 Topic: Force and pressure	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Transmitting pressure in liquids	<ul style="list-style-type: none"> <li>• to explain that a fluid exerts pressure equally in all directions</li> <li>• to describe hydraulic machines</li> <li>• to explain how a siphon works</li> </ul>	<ul style="list-style-type: none"> <li>• explain that a fluid exerts pressure equally in all directions</li> <li>• explain how hydraulic machines work</li> <li>• explain how a siphon works</li> </ul>	Pictures and diagrams showing transmission of pressure in fluids, hydraulic press, a siphon	Reading: p 79, 80 Activity: p 80 CW: Q1 (h) HW: Q2, Q3, Q4
<p><b>Key words:</b> transmit, hydraulic machine, siphon</p> <p><b>Method: Ask:</b> Do liquids exert pressure? Explain that liquids have two special features: they cannot be squashed, and if a liquid in a container is put under pressure, the pressure is transmitted equally to all parts of the liquid. Discuss hydraulic machines which use liquid pressure to transmit forces from one place to another. Most hydraulic machines are force magnifiers: they give out more force than is put in. This happens because the output piston is larger than the input piston.</p> <p>Make a siphon and demonstrate how it is used. Explain how a siphon works.</p>				

# Lesson plan

Date:

Time: 40 mins

Unit: 10 Topic: Force and pressure	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Pressure in gases and atmospheric pressure	<ul style="list-style-type: none"> <li>• to explain how the atmosphere behaves like a liquid</li> <li>• to explain that gases can be compressed</li> <li>• to discuss the applications of atmospheric pressure</li> </ul>	<ul style="list-style-type: none"> <li>• explain how the atmosphere can be called a liquid</li> <li>• explain that gases can be compressed</li> <li>• explain how we make use of atmospheric pressure</li> </ul>	Diagrams of molecules of a gas, a rubber sucker, aerosols	Reading: p 80, 81 CW: Q1 (f) (g) HW: Q4
<p><b>Key words:</b> atmosphere, atmospheric pressure, compressed, fluid pressure, aerosol</p> <p><b>Method: Ask:</b> Does air exert pressure? Explain that the Earth's atmosphere contains billions of tons of air. At sea level, the atmospheric pressure is equivalent to a force of about 100,000 newtons pushing on every square metre.</p> <p><b>Ask:</b> Does a gas exert pressure?</p> <p>Explain that in a gas the molecules are continuously moving, so at any given time many of them are colliding with the sides of the container. They bounce off without losing any energy, and in doing so, each one exerts a small outward force on the wall. Because billions of molecules are doing this each second, the force appears as constant pressure. Discuss the applications of atmospheric pressure and liquid pressure. Explain the construction and working of an aerosol.</p>				



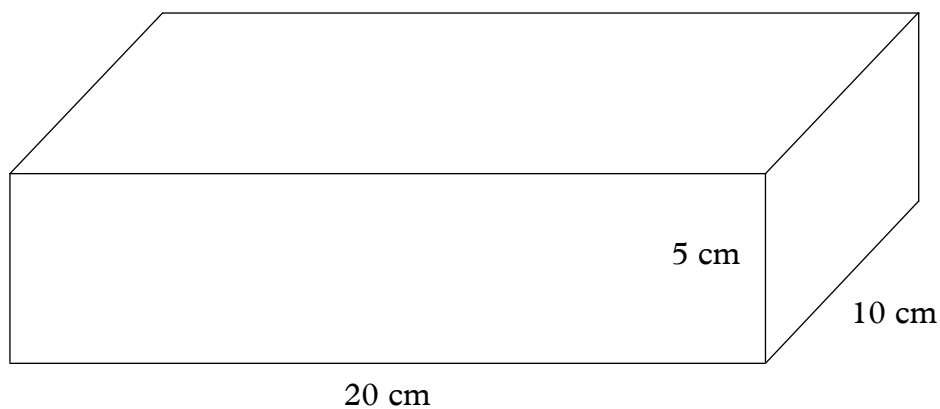
Name: \_\_\_\_\_

Date: \_\_\_\_\_

## 1. Fill in the blanks to describe pressure:

- Scientists use the word pressure to describe how \_\_\_\_\_ a force is.
- Pressure can be defined as the \_\_\_\_\_ exerted per unit area.
- If a force is concentrated on a small area, it creates a \_\_\_\_\_ pressure.
- If the same force is spread over a larger area, its pressure is \_\_\_\_\_.
- To calculate the size of pressure we can use the formula:  
pressure = \_\_\_\_\_ / \_\_\_\_\_
- A pressure of 1 pascal is equal to \_\_\_\_\_.
- A concrete floor can withstand a pressure of \_\_\_\_\_.
- Soft sand can only support a pressure of \_\_\_\_\_.

## 2. Calculate the pressure of the box when it is lying on its:

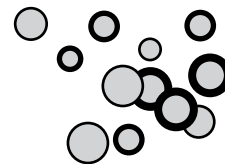
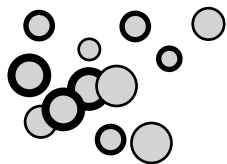


- base \_\_\_\_\_
- side \_\_\_\_\_
- back \_\_\_\_\_
- In which position does the box exert the greatest pressure? \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Underline the correct word(s) to describe atmospheric pressure:
- The Earth's atmosphere contains billion of tons of water vapour / air.
  - At sea level, atmospheric pressure is equivalent to a force of about 100,000 newtons pushing on every square centimeter / square metre.
  - The atmosphere behaves like a solid / liquid in some ways.
  - Air pressure acts in all ways / directions.
  - Air pressure decreases / increases as you rise up through it.
  - Unlike a liquid, air can be depressed / compressed.
  - The molecules of a gas are always moving / slowing down.
  - If a gas is enclosed in a sealed container and is not allowed to expand / contract, its pressure rises.
  - The pressure in a gas is caused by the fast moving / slow moving molecules colliding with the sides of the container.
  - If a gas is compressed into a smaller space, the molecules become more diluted / concentrated.



## Expansion of solids and liquids

### Teaching objectives:

- to explain the thermal expansion of solids, liquids, and gases
- to explain the effects and applications of the expansion and contraction of solids
- to describe the uses of expansion and contraction of liquids
- to explain the peculiar behaviour of water during contraction and expansion
- to explain the latent heat of vaporization and fusion
- to explain that evaporation causes cooling
- to explain that the volume of a liquid changes on solidifying
- to describe the effect of pressure on the melting point of solids
- to discuss the expansion of gases and its application in daily life

### Teaching strategy:

Discuss the three states of matter and the behaviour of particles on heating. Explain that solids, liquids, and gases are made up of tiny particles which can attract each other. The particles are constantly moving. In a solid the particles attract each other strongly. Therefore the particles stay close together. They move by vibrating. In a liquid, the particles attract each other less strongly. The particles can move about as they vibrate. Liquids can flow. In a gas the particles attract each other very little. The particles move about very fast and quickly fill the container. As solids, liquids, and gases get hotter, the particles move faster. When the particles of a solid are heated, they begin to break the attraction they have between them. The solid may become a liquid. When a liquid is heated, the particles may break all the attractions between them. The liquid will then become a gas. A hot substance has more energy than a cold substance. Heat transfer is the flow of energy from a hot place to colder one.

**Ask:** How is heat transferred in solids, liquids, and gases? How are particles in a solid packed? How is heat transferred in a solid? Explain that when a solid is heated the particles vibrate faster and make particles close to them vibrate faster as well. These vibrations pass heat energy from particle to particle from the hot part of the solid to the cold part. Explain that metals are good conductors of heat.

**Ask:** Are air and water good conductors of heat energy? Explain that heat is transferred in water by both conduction and convection, but mainly by convection. **Ask:** How does heat travel in gases? Explain that heat transfer in air is by both conduction and convection but it is mainly by convection.

**Ask:** How can you remove the top off a bottle? **Suggest:** Try putting it in hot water. The top expands before the heat reaches the bottle. This makes it a looser fit. **Ask:** How can you regulate the temperature of an electric iron? What controls the heat? Explain that the bimetallic strip is made by bonding together two thin strips of metal such as brass and invar. When the strip is heated, the brass

expands more than the invar. This makes the strip bend. The brass is on the outside of the bend, because the distance round the outside of the curve is greater than round the inside. If the strip were cooled instead of being heated, it would bend the opposite way. **Ask:** Can anyone name some of the household gadgets and appliances that use bimetallic strips? Why is some space left at the top of a cola bottle? Explain that the space is to allow for expansion. Most liquids expand when heated. **Ask:** Does water also behave like other liquids when it is heated? Discuss the anomalous expansion of water and its benefit to fish that can survive the severe winter by staying in deeper warmer water.

**Ask:** What do you feel if you hold a piece of ice in your hand? Why does the ice feel hot? Explain that ice is a marvellous substance for keeping things cool, not just because it is cold but because it absorbs so much heat when it melts. If you heat ice it melts, but it doesn't get any hotter. The temperature stays at 0 degrees Celsius until all the ice has melted. The heat absorbed when a solid melts is called latent heat of fusion. Fusion means melting and latent means hidden. The effect of heat seems to be hidden because the temperature does not rise. In fact, the heat absorbed is used to pull molecules of the solid apart, so that they are free to move around as a liquid. Every time you put the kettle on, heat energy is absorbed by the water. The temperature rises to 100 degrees Celsius, but no further. If you leave the kettle on the stove, the extra energy just turns more and more of the water into steam, but the temperature remains 100 degrees Celsius. The heat energy absorbed when a liquid changes into gas is called the latent of vaporization. The energy is needed to pull the molecules apart so that they can move around freely as a gas. Perform the experiment of relegation and discuss the effects of pressure on the melting point of a solid, such as ice.

Summarize the lesson.

## Answers to Exercises in Unit 11

1. Substances expand when heated. When we heat a solid its molecules vibrate more rapidly. The vibrations take up more space. The molecules push each other further apart.
2. When rods of the same length but of different substances are heated through the same range of temperature, their expansions are not equal. Brass, for example, expands about one and a half times as much as steel. Aluminium expands twice as much as steel. An alloy of steel and nickel known as invar expands very little when its temperature rises.
3. The bimetallic strip has many useful applications, one of which is the electric thermostat, which is a device for maintaining a steady temperature.

The principle of a thermostat is used for controlling the temperature of a room warmed by an electric heater. Thermostats are also used to control the temperature of laundry irons, hot-water storage tanks, and fish aquaria.

4. Most liquids expand when heated, and they expand much more than solids.
5. Water behaves in a very unusual way when heated from 0 degrees Celsius. As its temperature rises from 0 to 4 degrees Celsius it actually contracts. However, from 4 degrees upwards it expands like any other liquid. This means that water takes up least space at 4 degrees Celsius. It has its greatest density at this temperature, and will sink through warmer or colder water around it.
6. The heat energy absorbed when a liquid changes into a gas is called latent heat of vaporization. The energy is needed to pull the molecules apart so that they can move around freely as gas. The heat absorbed when a solid melts is called latent heat of fusion.

Just as latent heat is taken in when water changes to vapour at the same temperature, heat is taken in when ice melts to form water as well. But in this case the latent heat is not so high.

7. To change from liquid to vapour, the liquid requires latent heat which it takes from a warm surface. The warm surface loses heat and cools down.
8. (a) Its melting point is lowered.  
(b) Its melting point is raised.

## Additional Exercise

### MCQs

- (1) Water \_\_\_\_\_ when its temperature rises from 0 to 4°C.  
expands                  contracts                  boils                  evaporates                  [*contracts*]
- (2) As a gas expands, the distance between the molecules grows and its volume \_\_\_\_\_.  
increases                  decreases                  freezes                  [*increases*]
- (3) Overhead electric wires are kept loose because they can break in very cold weather due to \_\_\_\_\_.  
expansion                  current                  contraction                  weight                  [*contraction*]
- (4) When spirit evaporates from hand a cooling sensation is felt. This happens because \_\_\_\_\_ heat is taken from the hand which loses heat and cools down.  
thermal                  useful                  latent                  [*latent*]
- (5) When paraffin wax solidifies, it \_\_\_\_\_.  
breaks                  expands                  contracts                  melts                  [*contracts*]
- (6) When water freezes, it \_\_\_\_\_.  
expands                  evaporates                  solidifies                  contracts                  [*expands*]
- (7) A thermostat is a device used for maintaining a steady \_\_\_\_\_.  
volume                  quantity                  temperature                  flow                  [*temperature*]
- (8) Relegation is a factor in the making of \_\_\_\_\_.  
snowballs                  ice                  vapours                  dust                  [*snowballs*]

Date:

Time: 40 mins

Unit: 11 Topic: Expansion of solids and liquids	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Expanding solids	<ul style="list-style-type: none"> <li>to explain that solids expand on heating</li> </ul>	<ul style="list-style-type: none"> <li>explain the effect of heat on solids</li> </ul>	A bimetallic strip, a thermostat	Reading: p 85 CW: Q1 HW: Q2, Q3
<p><b>Key words:</b> solid, molecule, expand, vibrate, invar, thermostat, bimetallic strip</p> <p><b>Method. Ask:</b> How can you remove a tightly fitting metal cap from a glass bottle? Explain that we can remove it by dipping the cap in hot water. The cap expands before heat reaches the bottle. This makes a looser fit and the cap can be removed easily.</p> <p><b>Ask:</b> How do we regulate the temperature of an electric iron? What controls the temperature? Explain that a bimetallic strip is made by bonding together strips of brass and invar. When the strip is heated, the brass expands more than the invar. This makes the strip bend. Explain some other uses of the bimetallic strip.</p>				

Date:

Time: 40 mins

Unit: 11 Topic: Expansion of solids and liquids	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Expanding liquids Expansion in gases	<ul style="list-style-type: none"> <li>to explain that gases and liquids expand on heating</li> </ul>	<ul style="list-style-type: none"> <li>explain the effect of heat on liquids</li> <li>explain the effect of heat on gases</li> </ul>	Thermometer, round bottom flasks, trough of hot water Water, ether, benzene, alcohol	Reading: p 85, 86, 87 Activity: 1, 2 p 86 CW: Q4 HW: Q5
<p><b>Key words:</b> liquid, expand, temperature, thermometer</p> <p><b>Method:</b> Ask: Why is a little space left at the top of a cola bottle? Explain that the space is to allow for expansion. Most liquids expand when heated. Ask: Does water behave like other liquids when it is heated? Discuss the expansion of water and its benefits to fish that can survive the severe winter by staying in deeper, warmer water.</p> <p><b>Ask:</b> Do gases expand and contract? Explain that expansion and contraction in a gas occurs in the same way as in solids and liquids. The difference in the expansion of gases is that the amount of expansion is much larger than that in a solid or a liquid. Discuss the ways in which the expansion of gases is useful.</p>				

Lesson plan

Date:

Time: 40 mins

Unit: 11 Topic: Expansion of solids and liquids	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Problems of expansion and contraction in our surroundings	<ul style="list-style-type: none"> <li>to discuss problems of expansion and contraction in our surroundings</li> </ul>	<ul style="list-style-type: none"> <li>describe the effects of expansion and contraction in everyday life</li> <li>identify useful applications of expansion</li> </ul>	Pictures of a steel bridge, railway tracks	Reading: p 87, 88 CW: Q. Give five examples of the effects of expansion and contraction in everyday life.
<p><b>Key words:</b> expansion, contraction</p> <p><b>Method:</b> Discuss the problems of expansion and contraction in our surroundings, with examples. Explain the effects of expansion and contraction in everyday life. Describe the useful applications of expansion.</p>				



Date:

Time: 40 mins

Unit: 11 Topic: Expansion of solids and liquids	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Latent heat Evaporation Change of volume Effect of pressure on melting point	<ul style="list-style-type: none"> <li>• to explain latent heat of vaporization and fusion</li> <li>• to explain that evaporation causes cooling</li> <li>• to explain that the volume of a substance changes on solidification</li> <li>• to describe the effect of pressure on the melting point of a solid</li> </ul>	<ul style="list-style-type: none"> <li>• explain what is meant by latent heat</li> <li>• explain why evaporation causes cooling</li> <li>• describe how the volume of a liquid changes when it solidifies</li> <li>• explain the effect of pressure on the melting point of a solid</li> </ul>	Diagrams showing latent heat of vaporization, latent heat of fusion, evaporation causing cooling Beaker, ether, rubber tube, bellows, molten paraffin wax, test tube, ice block, copper wire, weights	Reading: p 89, 90 Activity: p 90 Experiment: p 90 CW: Q8 HW: Q6, Q7
<p><b>Key words:</b> latent heat of vaporization, latent heat of fusion, evaporation, ether, solidification, relegation, pressure, melting point</p> <p><b>Method: Ask:</b> What do you feel when you hold a piece of ice in your hand? Why does the ice feel hot? Explain that ice is a marvellous substance for keeping things cool, not just because it is cold, but because it absorbs so much heat when it melts.</p> <p>If you heat ice, it melts, but it does not become hotter. The temperature stays at 0 degrees Celsius until all the ice has melted. The heat absorbed when a solid melts is called the latent heat of fusion: <i>fusion</i> means to melt, and <i>latent</i> means hidden. The effect of heat seems to be hidden because the temperature does not rise. In fact, the heat absorbed by the solid is used to pull the molecules apart, so that they are free to move around as a liquid.</p> <p>Every time that you put the kettle on to boil, heat energy is absorbed by the water. The temperature rises to 100 degrees Celsius, but no further. If you leave the kettle on the stove, the extra energy just turns more and more of the water into steam, but the temperature remains the same.</p> <p>The heat energy absorbed when a liquid changes into gas is called the latent heat of vaporization. The energy is needed to pull the molecules apart so that they can move around freely as a gas.</p> <p>Perform the experiment of relegation and discuss the effects of pressure on the melting point of a solid, such as ice.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Write short answers to the following questions:

i. What is expansion?

---

---

---

ii. Why do substances expand on heating?

---

---

---

iii. What is invar?

---

---

---

iv. Which expands more, brass or steel?

---

---

---

v. What is a thermostat?

---

---

---

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Fill in the blanks to explain how the expansion of water is different from other liquids.

Water behaves in a very \_\_\_\_\_ way when it is heated from  $0^{\circ}\text{C}$ .

As its temperature rises from  $0$  to  $4^{\circ}\text{C}$ , it actually \_\_\_\_\_.

However, from  $4^{\circ}\text{C}$  upwards, it \_\_\_\_\_ like any other liquid. This means that water takes up least \_\_\_\_\_ at  $4^{\circ}\text{C}$ . It has the greatest \_\_\_\_\_ at this temperature, and will \_\_\_\_\_ through warmer or colder water around it.

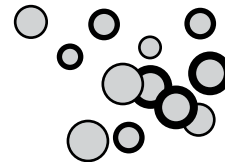
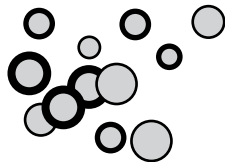
As soon as the water on the surface of a lake cools to  $0^{\circ}\text{C}$ , it \_\_\_\_\_ to the bottom.

Even if the lake freezes over, water at the bottom can still be at \_\_\_\_\_.

Fish can \_\_\_\_\_ a severe winter by staying in this deeper, warmer water.

2. Write the name of the term:

Description	Term
i. the heat energy that is absorbed when a liquid changes into a gas	_____
ii. the heat that is absorbed when a solid melts	_____
iii. the change from a liquid to a vapour	_____
iv. the effect of pressure on the melting point of ice and its refreezing	_____



## Electricity and magnetism

---

### Teaching objectives:

- to explain the relationship between electricity and magnetism
- to describe a solenoid
- to investigate the factors that help to increase the strength of the magnetic field of a solenoid
- to describe the motor effect
- to explain the dynamo effect
- to describe the practical applications of a.c. and d.c. motors
- to explain how electricity is generated in a power station
- to explain the functions of the National Grid

### Teaching strategy:

**Ask:** Where does electricity in our homes come from? What do we use in a torch to light the bulb? How does an electric clock work? Explain the various types of cells and batteries that are used to produce electricity. **Ask:** What things should we keep in mind when using electricity? Make a list of all the suggestions on the board. Wind a loop of wire on a nail. Remove the nail and attach the ends of the coil to a battery. Bring a magnetic needle close to it. The needle will be deflected showing that there is a magnetic field around the coil. Explain that this type of coil is called an electromagnet or solenoid. If the number of turns of the coil is increased or if the current is increased, the electromagnet can be made stronger. 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.

**Ask:** If you had to build a big, strong electromagnet, what would you do? What material would you use to make the core? How many turns of wire would you wind round it? What size of current would you use? Explain that all these things matter. When a current flows through a single wire, the magnetic field around it is very weak. If the wire is made into a coil, the field is stronger. Putting a piece of iron inside the coil makes the field even stronger. A coil of wire behaves like a bar magnet when a current flows through it. One end of the coil behaves like a magnet's north pole and the other like the south pole. Changing the direction of the current changes the direction of current round the poles. Switching off the current destroys the magnetism.

You have just found out that electricity can be used to make magnets; the opposite is also true. Magnets can be used to produce or generate electricity. It is quite easy to generate electricity in the laboratory. All you need is a U-shaped magnet and a loop of wire. To generate electricity, you have to supply moving energy. Move the wire up and down between the magnet's poles. To show that a current is flowing you have to connect in a meter. It will give a tiny reading, but only while the wire is

moving. This experiment shows that current flows while a conducting wire is moved through a magnetic field. To generate useful electricity you will need a long wire wound into a coil. Mount the coil on an axle. Place the coil between the poles of a magnet. Spin the coil steadily. This is the arrangement in a model generator. It uses the moving energy from a steam engine or a water turbine to spin the coil. When it is working, this generator can supply a steady current big enough to light a torch bulb. A power generator is much more complicated and much more powerful. It can generate enough electricity to supply a whole town.

Spinning a coil between the poles of a fixed magnet is not the only way to generate electricity. Spinning a magnet inside a fixed coil generates electricity just as well. The bicycle dynamo uses a spinning magnet. You have to supply the energy to spin it. With a bicycle dynamo and a lamp you can change chemical energy in your food into light energy. The power station alternator generates electricity in the same way as the bicycle dynamo, but it is much bigger, it generates a far larger current, it has a cooling system, and it uses a spinning electromagnet instead of a permanent magnet.

**Ask:** How does electricity generated at a power station reach us? Explain that after electrical energy has been generated it has to be transmitted round the country using thick aluminium or copper cables which are hung from pylons or buried underground. **Ask:** Why are cables made of aluminium or copper? Explain that these metals are good conductors; the cables are thick to give low resistance.

**Ask:** What is the role of transformers in transmitting electricity? Explain that very high voltages are used when electrical energy has to be transmitted over long distances. Also, different users require electricity at different voltages. **Ask:** What is the National Grid? Explain that it is the network which carries electrical energy round the country. It uses step-up and step-down transformers to increase or decrease the voltage.

## Answers to Exercises in Unit 12

1. (a) In 1820, Oersted, a scientist from Denmark, showed that if a compass was placed below a wire carrying an electric current, the compass needle moved. This showed that a wire carrying an electric current has a magnetic field around it. This is called electromagnetism.
- (b) The magnetic field is strongest close to the wire.
- (c) When a current flows in a long coil of wire with many loops, the magnetic field looks just like that of a bar magnet. A coil like this is called a solenoid. The direction of the field of a solenoid can be found by using the fingers of your right hand to show the direction of the current in the loops of wire. Your right hand thumb shows the north pole of the solenoid.
- (d) A current is produced when a wire is moved through a magnetic field. This is called the dynamo effect. It is just the opposite of the motor effect.

The bicycle dynamo is an electrical generator. The energy which generates electricity in a bicycle dynamo comes from the cyclist. The food that the cyclist eats supplies the energy to turn the wheel which turns the magnet inside the coil of wire!

When the magnet is lined up with the iron core there is a strong magnetic field in the coil of wire. As the magnet turns, the field gets weaker. It then gets stronger again but in the opposite direction. It is this changing magnetic field inside the coil which provides a voltage at the dynamo's terminals.

The size of the voltage produced by the dynamo depends on the speed of the spinning magnet. As it spins faster the voltage increases so the light of the bicycle gets brighter. When the bicycle stops, the dynamo does not generate any electricity and the lights go out.

(e) In power stations fuel such as coal, gas, oil, or energy from a nuclear reactor is used to heat water and turn it into steam. The steam then turns turbines connected to a.c. generators. These are called alternators. They work on the same principle as the bicycle dynamo. The voltage is produced by a magnet spinning inside fixed coils of wire. The power station uses a spinning electromagnet. By changing the current in the electromagnet the output from the alternator can be accurately controlled without slowing the turbines. The current for the electromagnet comes from a small d.c. generator which is also driven by the turbines.

(f) Output components and their uses:

Calculators: these devices use electronic circuits to solve mathematical problems quickly and accurately.

Digital clocks: these devices use electronic timing circuits. These timers can be used in other devices.

Central heating control units: these devices use programmable electronic circuits to allow easy control and are more reliable than mechanical switches.

Computers: these devices are used for solving mathematical problems, business purposes and games.

Electronic organs: these devices use electronic circuits to produce musical notes and rhythms.

Satellite communications: these devices are used for international communications, military purposes, and satellite television.

2. magnetic; magnet; solenoid; solenoid; motor; turbines

3. A magnet moving near a coil of wire induces a voltage. This can make a current flow in a circuit. The current generated in this way is not like a current flowing from a battery. Instead it is pulled and pushed backwards and forwards round the circuit 50 times every second. This current is known as alternating current, or a.c. Most generators give out alternating current. a.c. generators are called alternators. A dry cell or battery gives a steady current called a direct current (d.c.). When electrons are pushed out of a battery, they carry energy with them. In a circuit, the electrons spend all their energy passing through the bulb. The energy is changed into heat and light. When the electrons reach the battery again, all their energy has been used up.

When an electric current flows in a wire in a magnetic field, a force is produced. The force can make the wire move. This is sometimes called the motor effect. The motor effect has been used by engineers to build electrical motors which are so commonly used in small motors which move the tape in cassette players, to the powerful motors used to move heavy machines and trains, etc.

A current can be produced when a wire is moved through a magnetic field. This is called the dynamo effect. It is just the opposite of the motor effect.

A current can also be generated or induced by moving a magnet towards or away from a coil of wire. The current is only induced when the magnet is moving.

The size of the current can be increased by:

- (a) moving the magnet faster
- (b) using a stronger magnet
- (c) using more turns of wire in the coil

## Additional Exercise

### MCQs

- (1) A solenoid is a long coil of wire with many \_\_\_\_\_.  
 threads            magnets            loops            colours            [*loops*]
- (2) The motor effect has been used by engineers to build electrical \_\_\_\_\_.  
 motors            engines            cars            machines            [*motors*]
- (3) A magnet moving near a coil of wire induces a \_\_\_\_\_.  
 solenoid            dynamo            voltage            [*voltage*]
- (4) The bicycle \_\_\_\_\_ is an electrical generator.  
 handle            light            dynamo            gear            [*dynamo*]
- (5) Homes take their power at \_\_\_\_\_ volts.  
 240            440            303            420            [*240*]
- (6) Alternating voltage currents can be increased or decreased easily using \_\_\_\_\_.  
 pylons            solenoids            transformers            generators            [*transformers*]
- (7) At a power station water is heated to make \_\_\_\_\_ which turns turbines.  
 current            generator            transformer            steam            [*steam*]
- (8) The \_\_\_\_\_ effect is the force which makes a wire move when an electric current flows in it.  
 motor            engine            strong            current            [*motor*]
- (9) The \_\_\_\_\_ effect is the force which is produced when a wire is moved in a magnetic field.  
 motor            dynamo            solenoid            generator            [*dynamo*]
- (10) The electricity generated by power stations is distributed through a large network of cables called the \_\_\_\_\_.  
 direct current    optic fibre            National Grid            power turbines            [*National Grid*]

Date:

Time: 40 mins

Unit: 12 Topic: Electricity and magnetism	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Electricity and magnetism	<ul style="list-style-type: none"> <li>• to define electromagnetism</li> <li>• to explain what a solenoid is</li> </ul>	<ul style="list-style-type: none"> <li>• explain what electromagnetism is</li> <li>• describe a solenoid</li> <li>• explain how electricity and magnetism are related</li> </ul>	A solenoid, card, iron filings, a battery	Reading: p 93 CW: Q1 (a) HW: Q1 (b) (c)
<p><b>Key words:</b> Oersted, compass, magnetic field, electromagnetism, solenoid</p> <p><b>Method:</b> Wind a loop of wire round a nail to make a coil. Remove the nail and attach the ends of the coil to a battery. Bring a magnetic needle close to the coil; the needle will be deflected showing that there is a magnetic field around the coil.</p> <p>Explain that this type of coil is called an electromagnet or a solenoid. If the number of turns of the coil is increased, or if the current is increased, the electromagnet will be stronger. Putting a piece of iron inside the coil makes the field even stronger. One end of the coil behaves like the north pole and the other, the south pole of a magnet. Switching off the current destroys the magnetism.</p> <p><b>Ask:</b> If you had to build a stronger electromagnet, what would you do? How many turns of wire would you wind round it? What size of current would you use? Explain that all these things need to be considered when making an electromagnet.</p>				



Date:

Time: 40 mins

Unit: 12 Topic: Electricity and magnetism	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Electric motors	<ul style="list-style-type: none"> <li>• to define motor effect</li> <li>• to explain how the motor effect is used</li> </ul>	<ul style="list-style-type: none"> <li>• describe the motor effect</li> <li>• explain how the motor effect is used to make electric motors</li> </ul>	Motor from an electric toy, diagrams of the motor effect	Reading: p 93, 94 Activity: p 94 CW: Q2
<p><b>Key words:</b> electric motor, motor effect, field magnet, rotating coil, commutator, brush</p> <p><b>Method:</b> Set up the circuit of the motor effect as shown on p 94. 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. Engineers and scientists use the motor effect to build electric motors.</p>				

Date:

Time: 40 mins

Unit: 12 Topic: Electricity and magnetism	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Generating electricity	<ul style="list-style-type: none"> <li>• to describe an alternating current</li> <li>• to explain how a dynamo works</li> <li>• to define direct current</li> <li>• to explain how an alternating current can be changed to a direct current</li> <li>• to discuss some output components and their uses</li> </ul>	<ul style="list-style-type: none"> <li>• define alternating current</li> <li>• describe the dynamo effect</li> <li>• explain how an alternating current and a direct current can be produced</li> <li>• identify electrical appliances which use alternating current or direct current</li> </ul>	A cycle dynamo, diagrams of a.c. current, d.c. current, pictures of a calculator, digital clock, computer, electric organ, satellites, etc.	Reading: p 95, 96 CW: Q3 HW: Q1 (d) (f)
<p><b>Key words:</b> alternating current, generator, alternator, dynamo, dynamo effect, direct current, output component</p> <p><b>Method:</b> Tell the students that they have just found out that electricity can be used to make magnets; the opposite is also true; magnets can be used to produce or generate electricity.</p> <p>It is quite easy to generate electricity in the laboratory. All you need is a U-shaped magnet and a loop of wire. Move the wire up and down between the poles of the magnet. To show that a current is flowing you have to connect a meter to the wire. It will give a tiny reading, but only while the wire is moving.</p> <p>To generate useful electricity you will need a long wire wound into a coil. Mount the coil on an axle. Place the coil between the poles of a magnet. Spin the coil steadily. This is the arrangement in a model generator. It uses the moving energy from a steam engine or a water turbine to spin the coil. When it is working, this generator can supply a steady current big enough to light a torch bulb. A power generator is much more complicated and much more powerful. It can generate enough electricity to supply a whole town.</p> <p>Spinning a coil between the poles of a fixed magnet is not the only way to generate electricity. Spinning a magnet inside a fixed coil generates electricity as well. The bicycle dynamo uses a spinning magnet. You have to supply energy to spin it. With a bicycle dynamo and a lamp you can change chemical energy in your food into light energy!</p> <p>Discuss some output components and their uses.</p>				

Date:

Time: 40 mins

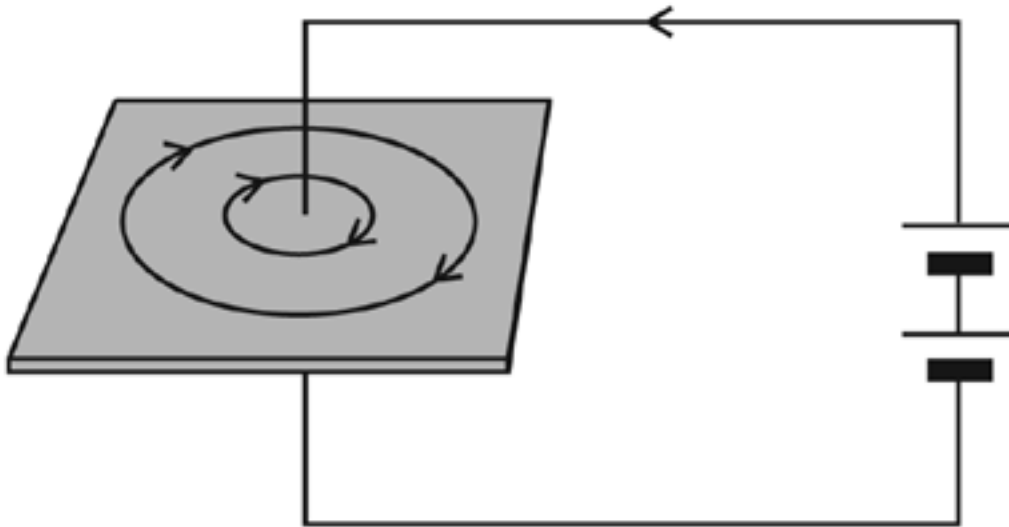
Unit: 12 Topic: Electricity and magnetism	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
4. Power generators, transformers, the National Grid	<ul style="list-style-type: none"> <li>• to explain how electricity is generated in power stations</li> <li>• to raise awareness of the problems of electricity generation</li> <li>• to define transformers</li> <li>• to explain the National Grid</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• describe the process of electricity generation at a power station</li> <li>• explain the problems of electricity generation, and the points to be considered when choosing a site for a power station</li> <li>• explain how electricity is distributed</li> </ul>	<p>Pictures of power station, turbine, dam, windmill, solar panel, National Grid</p>	<p>Reading: p 97 CW: Q1 (e) Project 1, 2</p>
<p><b>Key words:</b> power station, energy source, wind turbine, hydroelectric power plant, solar energy, solar panel, transformer, National Grid</p> <p><b>Method: Ask:</b> How is electricity generated at a power station? How does it reach us?</p> <p>Explain the method of electricity generation at a power station. When electricity is generated it has to be transmitted round the country using thick copper or aluminium cables which are hung on pylons or buried underground. <b>Ask:</b> Why are the cables made of aluminium or copper? Explain that these metals are very good conductors of electricity. The cables are thick to give low resistance.</p> <p><b>Ask:</b> What are transformers? What is their role in transmitting electricity? Explain that very high voltages are used when electrical energy has to be transmitted over long distances. Also, different uses require different voltages.</p> <p><b>Ask:</b> What is the National Grid? Explain that it is the network which carries electrical energy round the country. It uses step-up and step-down transformers to increase or decrease the voltage.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Fill in the blanks to explain the results of Oersted's experiments:

- a. The magnetic lines of force are in \_\_\_\_\_ around the wire.
- b. The direction of the magnetic field is \_\_\_\_\_ if we look at the direction of the flow of the current from + to -.
- c. If the direction of the current is reversed, the \_\_\_\_\_ also reverses.
- d. The magnetic field becomes \_\_\_\_\_ as the size of the current increases.
- e. The magnetic field is \_\_\_\_\_ close to the wire.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

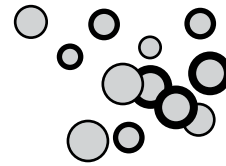
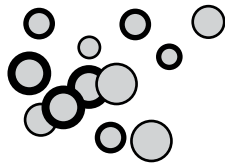
Write the terms for these descriptions:

Description	Term
a. the force produced when an electric current flows in a wire in a magnetic field	_____
b. the current generated by a magnet moving near a coil of wire	_____
c. the current produced when a wire is moved through a magnetic field	_____
d. a device which uses electronic circuits to solve mathematical problems quickly and accurately	_____
e. a device that uses electronic timing circuits	_____
f. a device that uses electronic circuits to produce musical notes	_____
g. a device used for international communication in space	_____
h. the kind of plant used to generate electricity using the power of water	_____

2. Match the problems of electricity generation with the sources:

**Sources of power generation****Problems**

a. using fossil fuels	do not need reservoirs to store water, and do not create pollution, but their construction costs are high
b. hydroelectric power plants	are relatively expensive and do not work at night or in bad weather
c. wind turbines	They are not renewable. They took millions of years to make, and at some point in time will run out. They can cause serious environmental problems.
d. solar panels	use a reservoir to store water, due to which lots of land is submerged; dams which are built to store water, displace people and destroy wild life; dam bursts can be disastrous



## Modern technology and space travel

---

### Teaching objectives:

- to define telecommunication
- to describe the various means of telecommunication
- to explain what a computer is
- to explain how nuclear energy is produced in a nuclear reactor
- to explain what artificial satellites are
- to discuss about space travel

### Teaching strategy:

**Ask:** What is communication? How did communication take place in olden times? How is communication brought about nowadays? Explain that the invention of the telegraph marks the beginning of modern telecommunication. Explain how the key and sounder are used to send and receive messages. Explain that messages are sent by telegraph in the Morse Code which is a code of dots and dashes. Show the students a telephone set. Open the mouthpiece and earpiece of the receiver and show the diaphragm. Explain how sound waves are transmitted from the speaker's voice in the mouthpiece to the earpiece of the receiver by the vibration of the diaphragm.

**Ask:** What is a radio? Where are songs and programmes transmitted from? Explain how radio waves can travel through space from the radio station to the radio set. Explain that the carrier wave is the main part of the radio signal. Sound waves become weak as they travel away from the transmitter. They are made stronger by an amplifier. **Ask:** How do programmes relayed from a television station reach our television sets? Explain the transmission of sound and light waves in the form of electric signals to our TV sets, and that they are converted back into sound and light waves. Tell the children to see the screen of a TV set with a magnifying glass. Explain that the coloured dots they see are due to the coating of phosphor at the back of the screen. Phosphor glows when electrons are shot at it.

**Ask:** What is a laser light? Explain that laser light is a concentrated beam of light which can travel long distances. It can also travel in glass tubes. These glass tubes are called optical fibres. Optical fibres are being used instead of telephone cables. **Ask:** What is a computer? Show the students a computer and its parts. Explain how a computer works.

**Ask:** What is an atom bomb? What kind of energy does an atom bomb have? Explain nuclear fission with diagrams on the board. Explain how nuclear fission can be controlled in a nuclear reactor. Nuclear energy can be very dangerous as it produces tremendous amounts of heat as well as harmful radiations which kill cells of living organisms. It can also be used for producing electricity in power stations. **Ask:** What is a satellite? What is the natural satellite of the Earth? How do we receive radio and television programmes from other countries? How do we receive telephone calls from far off

countries? Explain that satellites are sent in space. They orbit the Earth. They carry aerials and machines which are used to send and receive signals. **Ask:** From where do satellites get their supply of energy? Explain that satellites have solar panel cells that capture the Sun's energy. The Sun's energy is changed into electrical energy.

**Ask:** Can an aeroplane travel to space? Why? What is a rocket? How does it travel in space? Who is an astronaut? Explain that only rockets can go into space because they carry their own supply of liquid fuel. They travel at a very fast speed. They overcome the Earth's gravity and orbit the Earth at the same velocity. Show pictures of spacecraft and astronauts. A spacecraft has its own life-support system, which provides food, air, and water to the astronauts. **Ask:** How do astronauts survive in space? Explain that the spacesuit that an astronaut wears keeps the pressure and temperature constant. Do the activities at the end of the lesson. Summarize the lesson.

### Answers to Exercises in Unit 13

1. (a) Sending and receiving messages over long distances is called telecommunication. The various modes of telecommunication used nowadays are: radio, television, satellite, wireless, telegraph, telephone, fax, and electronic mail.
- (b) The invention of the telegraph in the 1850s marked the beginning of modern telecommunication.
- (c) When you speak in the mouthpiece of a telephone, the sound waves of your voice make the diaphragm vibrate very fast. As the diaphragm moves inwards it pushes the carbon granules behind the plate close together. This allows an electric current to flow through the carbon granules easily. As the diaphragm moves outwards, the electric current becomes weaker. These changes in the electric current make the current flow to the earpiece of another telephone along a wire, where the above procedure is reversed and the sound waves can be heard.
- (d) Radio waves are electric signals that can travel over long distances through empty space. They travel at the speed of light (300,000 kilometres per second). At the radio station there is a transmitter, which is connected to an aerial. The transmitter makes a radio signal which the aerial sends out. The main part of the radio signal is called the carrier wave. As radio waves travel away from the transmitter, they grow weaker. They are made stronger by the amplifier in the receiver's radio set.
- (e) A television camera turns light and sound waves into electric signals. It scans the pictures which appear on our television screen. The television aerial receives radio waves from the transmitter, which are turned into electric signals. A tuner selects a signal, which is then split into sound and picture signals.
- (f) A laser light is a concentrated beam of light which can travel long distances. It can also travel down glass tubes, carrying messages from one place to another.
- (g) The thin glass tubes which carry laser light are called optical fibres. They can carry more messages than a wire.
- (h) A computer is a machine that can be used to do many different types of work. A computer is part of a computer system which needs an input device such as a keyboard or mouse, with which we can feed in data and programmes, and an output device or monitor which gives us the results on a screen.

- (i) Nuclear energy is produced by nuclear fission. The nucleus of an atom of a metal called uranium can be split into two. Some of its neutrons escape and crash into other uranium atoms, causing them to split. This splitting process releases huge amounts of energy.

A nuclear reactor: controlled nuclear fission is done in a special container called a nuclear reactor. Uranium is packed in stainless steel tubes. Inside the reactor there are a large number of fast moving neutrons which are absorbed by the uranium atoms and their nuclei are split to release energy. The heat given out during fission is carried away by a cooling fluid called coolant. The coolant becomes hot and is used to produce steam in a boiler. The steam is used to generate electricity in a generator.

2. (a) communication (b) electricity  
 (c) 1850s (d) Alexander Graham Bell; 1876  
 (e) diaphragm (f) Guglielmo Marconi; 1895  
 (g) carrier wave (h) television  
 (i) phosphor (j) nuclear reactor
3. Nowadays, space rockets use liquid oxygen as fuel. Most of the space inside the rocket is taken up by two storage tanks: one for the fuel and the other for the oxidizer. The fuel and the oxidizer are pumped into a combustion chamber, where they are set alight. The hot gases produced shoot backwards out of the tail nozzle and the rocket shoots forwards.

Astronauts wear special clothes called spacesuits which are made of several layers of materials to protect them when they space walk. The outer layers protect them from flying particles. Oxygen for breathing is fed into the inner layer. The white surface reflects sunlight. Water flows through pipes in the suit to keep the astronaut cool. The backpack holds the oxygen supply as well as a radio with batteries.

The spacecraft has a life support system which provides the astronauts with air, food, and water.

The main communication centre for human flights in space is called the mission control, by which astronauts keep in contact with scientists on Earth.

The return of the spacecraft back to Earth is called re-entry. It is the most dangerous time for the astronauts. There is friction between the air and the spacecraft as it re-enters the atmosphere. The spacecraft is protected by a thick heat shield which prevents it from burning up.

## Additional Exercise

### MCQs

- (1) Radio waves travel at the speed of \_\_\_\_\_.  
 light                      water                      sound                      rockets                      [*light*]
- (2) The earpiece of a telephone contains \_\_\_\_\_.  
 sound waves                      an electromagnet                      an amplifier                      a transmitter  
[*an electromagnet*]



- (3) Sending and receiving messages by electricity is called \_\_\_\_\_.  
 communication      telecommunication      signal      email      [*telecommunication*]
- (4) A laser light is a \_\_\_\_\_ beam of light which can travel long distances.  
 strong      colourful      concentrated      weak      [*concentrated*]
- (5) Optical fibres are glass tubes that carry laser \_\_\_\_\_.  
 light      current      wires      messages      [*light*]
- (6) A \_\_\_\_\_ is a body which orbits the Earth.  
 sun      rocket      satellite      comet      [*satellite*]
- (7) A television camera turns light and sound waves into \_\_\_\_\_ signals.  
 electrical      physical      picture      clear      [*electrical*]
- (8) A key and a sounder are used for sending \_\_\_\_\_ message.  
 an email      a written      a telegraphic      an important      [*a telegraphic*]
- (9) Marconi sent radio signals in \_\_\_\_\_.  
 1985      1895      1785      1885      [*1895*]
- (10) The telephone was invented in \_\_\_\_\_.  
 1876      1976      1776      1875      [*1876*]

Date:

Time: 40 mins

Unit: 13 Topic: Modern technology and space travel	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
1. Telecommunication	<ul style="list-style-type: none"> <li>• to define telecommunication</li> <li>• to discuss the various means of telecommunication</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• define telecommunication</li> <li>• describe how the various means of telecommunication are used</li> </ul>	Pictures of telegraph, radio, telephone, mobile phone	<p>Reading: p 101, 102            CW: Q1 (a) (b)            HW: Q1 (c) (d)</p>
<p><b>Key words:</b> telecommunication, telegraph, key, sounder, radio, signal, vibrate, frequency, transmitter, carrier wave, amplifier, telephone, sound wave, diaphragm, microphone, mobile phone, wireless, circuit board, antenna, computer chip</p> <p><b>Method: Ask:</b> What is communication? How did people communicate in the past? How do people communicate nowadays? Explain that the invention of the telegraph marks the beginning of modern telecommunication. Discuss how the key and sounder are used to send and receive messages. Explain that messages are sent by telegraph using Morse Code, which is a code of dots and dashes.</p> <p>Show the students a telephone set. Open the mouthpiece and the earpiece of the receiver and look at the diaphragm. Explain how sound waves are transmitted from the speaker's voice in the mouthpiece to the earpiece of the receiver by the vibration of the diaphragm.</p> <p><b>Ask:</b> What is a radio? Where are songs and programmes transmitted from? Explain that radio waves can travel through space from the radio station to the radio set. Explain that the carrier wave is the main part of the radio signal. Sound waves become weak as they travel away from the transmitter. They are made stronger by an amplifier.</p> <p>Discuss what a mobile phone is. Explain the technology used in it. Explain that it is a combination of the telephone and wireless communication systems. Discuss its uses in the world today.</p>				

Date:

Time: 40 mins

Unit: 13 Topic: Modern technology and space travel	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Television, laser light, computer, nuclear technology	<ul style="list-style-type: none"> <li>• to explain what a television, a laser light, a computer, and a nuclear reactor are</li> <li>• to explain the use of a television, a laser light, a computer, a nuclear reactor</li> </ul>	<ul style="list-style-type: none"> <li>• explain the kind of technology used in a television, a laser light, a computer, and a nuclear reactor</li> <li>• describe the uses of a television, a laser light, a computer, nuclear reactor</li> </ul>	Pictures of a television, a laser light, a computer, a nuclear reactor, diagrams of nuclear fission	Reading: p 102, 103 CW: Q1 (e) (f) Q2 HW: Q1 (g) (h) (i)
<p><b>Key words:</b> television, scanning, tuner, phosphor, laser, computer, programme, mouse, monitor, nuclear reactor, nuclear fission</p> <p><b>Method: Ask:</b> How do programmes relayed from a television station reach our television sets? Explain the transmission of sound and light waves in the form of electric signals to our TV sets, and how they are converted back into sound and light waves. Ask the students to observe the screen of a TV set with a magnifying glass. Explain that the coloured dots that they see on the screen are due to the coating of phosphor at the back of the screen. Phosphor glows when electrons are shot at it.</p> <p><b>Ask:</b> What is laser light? Explain that laser light is a concentrated beam of light which can travel long distances. It can also travel in glass tubes called optical fibres. Optical fibres are being used instead of telephone cables.</p> <p><b>Ask:</b> What is a computer? Show the students the parts of a computer. Explain how a computer works.</p> <p><b>Ask:</b> What is an atomic bomb? What kind of energy does it have? Explain nuclear fission with diagrams on the board. Explain how nuclear fission can be controlled in a nuclear reactor. Discuss the hazards of nuclear radiation. Discuss the useful aspects of nuclear energy.</p>				

Date:

Time: 40 mins

Unit: 13 Topic: Modern technology and space travel	Teaching objectives	Learning outcomes	Resources/Materials	Activities/CW/HW
3. Artificial satellites	<ul style="list-style-type: none"> <li>• to describe artificial satellites</li> <li>• to explain how we use artificial satellites</li> </ul>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• describe artificial satellites</li> <li>• list the functions of artificial satellites</li> </ul>	<p>Pictures of artificial satellites, radio telescope, space station, space shuttle, space probe</p>	<p>Reading: p 104, 105            CW: Q. a. What is an artificial satellite?            b. What are artificial satellites used for?            HW: Write notes on:            i. radio telescope            ii. space station            iii. space shuttle            iv. space probe</p>
<p><b>Key words:</b> artificial satellite, aerial, radio telescope, space station, space shuttle, space probe</p> <p><b>Method: Ask:</b> What is a satellite? What is the natural satellite of the Earth? How do we receive radio and television programmes from other countries? How do we receive telephone calls from far off countries? Explain that artificial satellites are sent in space. They orbit the Earth. They carry aerials and machines which are used to send and receive signals.</p> <p><b>Ask:</b> From where do artificial satellites get their supply of energy? Explain that satellites have solar panels that capture Sun energy, which is converted into electrical energy. Discuss the various types of spacecraft and machines that are being used to explore space.</p>				

Date:

Time: 40 mins

Unit: 13 Topic : Modern technology and space travel	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Space travel	<ul style="list-style-type: none"> <li>• to discuss space travel</li> <li>• to examine the benefits generated by space technology</li> <li>• to identify the problems that have resulted from space exploration</li> </ul>	<ul style="list-style-type: none"> <li>• describe a rocket</li> <li>• explain how a rocket is launched into space</li> <li>• describe an astronaut and the clothes he wears</li> <li>• explain how astronauts survive in space</li> <li>• describe re-entry of space craft into the Earth's atmosphere</li> <li>• discuss the benefits and problems of space exploration</li> </ul>	Pictures of rockets, astronauts, spacesuits	Reading: p 105, 106 Activity: p 106 HW: Q3 Project: Collect pictures of space technology and travel and paste them in your science journal. Make a list of the benefits generated by space technology, and the problems that have resulted from space exploration.
<p><b>Key words:</b> space travel, rockets fuel, oxidizer, combustion chamber, multi-stage rocket, astronaut, cosmonaut, space walking, spacesuit, backpack, life support system, mission control, re-entry</p> <p><b>Method: Ask:</b> Can an aeroplane travel into space? Why? What is a rocket? How does a rocket travel in space? What is an astronaut?</p> <p>Explain that only rockets can go into space because they carry their own supply of liquid fuel. They travel at a very fast speed to overcome the Earth's gravity, and they orbit the Earth at the same velocity. Show the students pictures of spacecraft and astronauts. Explain that a spacecraft has its own life-support system, which provides food, air, and water to the astronauts.</p> <p><b>Ask:</b> How do astronauts survive in space? Explain that the spacesuit that an astronaut wears keeps their pressure and temperature constant. Discuss the benefits generated by space technology, and the problems that have resulted from space exploration.</p>				

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Identify the means of communication:

1. This invention marks the beginning of the telecommunication age. It needs a key and a sounder at the sending and receiving end so that two-way communication can take place.

\_\_\_\_\_

2. It is composed of a transmitter, a carrier wave, an amplifier, and a receiver.

\_\_\_\_\_

3. It is composed of a diaphragm, a microphone, a receiver, and an earpiece.

\_\_\_\_\_

4. It is a combination of wireless and telephone communication systems. It contains a circuit board, an antenna, an LCD, a speaker, a battery, and several computer chips.

\_\_\_\_\_

5. It has a camera which turns light and sound waves into electric signals. It has an aerial which receives from a transmitter radio waves which are turned into electric signals. A tuner selects a signal and then splits it into sound and picture signals at the receiving end.

\_\_\_\_\_

6. It is a concentrated beam of light which can travel long distances. It can also travel through glass tubes, carrying messages from one place to another. \_\_\_\_\_

7. It is a complicated device that uses a series of simple instructions called a programme. It cannot work on its own. It needs a keyboard, a mouse, and a monitor. The results appear on the screen of the monitor in the form of numbers, word, or pictures.

\_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. List the benefits generated by space technology in the following areas:

- a. commercial products \_\_\_\_\_
- b. telecommunication: \_\_\_\_\_
- c. medicine: \_\_\_\_\_
- d. environmental protection: \_\_\_\_\_

2. List the problems resulting from space technology in the following areas:

- a. economic: \_\_\_\_\_
- b. medical: \_\_\_\_\_
- c. safety: \_\_\_\_\_

# Test paper 3

**Time: 3 hours**

**Total marks: 100**

1. Attempt any five questions. (All questions carry equal marks.) [65]

- (a) Differentiate between latent heat of fusion and latent heat of vaporization. How does evaporation cause cooling?
- (b) Describe a siphon and explain how it works.
- (c) How is electricity generated at a power station?
- (d) Write short notes on the following.
  - (i) Rocket fuel
  - (ii) Spacesuits
  - (iii) Life support system
  - (iv) Mission control
  - (v) Re-entry
- (e) What are artificial satellites? What are they used for?
- (f) Describe a thermostat. What is a thermostat used for?
- (g) Is there an increase in pressure when a gas is compressed?

2. Fill in the blanks. [10]

- (a) Sending and receiving messages is called \_\_\_\_\_.
- (b) Nowadays we use \_\_\_\_\_ for communication.
- (c) The telegraph was invented in the \_\_\_\_\_.
- (d) \_\_\_\_\_ invented the telephone in \_\_\_\_\_.
- (e) The earpiece of the telephone contains a thin iron plate called a \_\_\_\_\_.
- (f) \_\_\_\_\_ was the first scientist to send radio signals in \_\_\_\_\_.
- (g) The main part of the radio signal made by a transmitter is called the \_\_\_\_\_.
- (h) A \_\_\_\_\_ camera turns light and sound waves into electric signals.
- (i) The back of a television screen is coated with dots of a chemical called \_\_\_\_\_.
- (j) Controlled nuclear fission is done in a special container called a \_\_\_\_\_.

3. Differentiate between:

- (a) short sight and long sight [20]
- (b) solenoid and magnet
- (c) a.c. and d.c. current
- (d) image formed by a convex lens and a concave lens

4. Draw a diagram to explain the construction of a telescope. [5]