TEACHING GUIDE

FOR SECONDARY CLASSES

SCIENCE FACT FILE

GRADE 7

THIRD EDITION

David Coppock

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Introduction

As science teachers in the 21st century, we stand on the shoulders of many hundreds, if not thousands, of scientific giants who have gone before us. Never in human history has so much been understood about the scientific world. Yet, there still remains a lot that is unknown.

We should open up to students the many wonderful discoveries that have already been made, and stir in them a desire to continue to investigate and explore those areas of science that are still not fully understood.

When Newton, Faraday, or Pasteur, were looking at the world and seeking explanations, they did not have a book that contained all the answers; they used the knowledge they had to ask questions, to investigate, to try to discover what they did not know. They were active and life-long learners.

Far too often we permit our students to be passive learners by providing them with information and asking them to learn it. Education must be active! We must encourage our students to be inquisitive and searching, particularly in the field of science education, and empower them to be our partners in the process of acquiring knowledge.

Our hope is that this series of books and teaching guides will help in that endeavour.

Organization of the book

The *Science Fact file* series provides a well-balanced and organized course in science, emphasizing the acquisition of knowledge to be used as a guide for intelligent behaviour in daily life. It is not only a collection of facts about the world around us; the content is focused on the acquisition and understanding of general concepts which are developed using problem-solving methods.

About the Teaching Guide

Science Fact file Teaching Guides 1, 2, and 3 have been written to promote and support effective science teaching. Suggestions for teaching procedures are provided for each unit, and answers for questions and solutions for exercises and problems are supplied.

Background information

This section will prove very helpful as it explains the scientific knowledge necessary to teach a particular unit.

Unit introduction

Below are some of the ways in which a unit can be introduced. Most of them can also be used to tackle new problems within the unit.

1. **Ask questions about the students' experiences in relation to the unit.**

   At the start of a new unit, it is vital to find out what knowledge (and misconceptions!) students may already have. This can give rise to questions which will be answered during the unit. Ask questions such as: *Have you ever seen…..? What did it look like? Have you ever made a …? Have you heard about…? Have you ever watched someone …?* The purpose of these questions is to obtain some facts from the students' past experiences.

   While questioning, the teacher should bear in mind that the purpose is not to obtain correct answers; it is to find out what the students know and how they think. Another purpose is to get the students to ask their own questions. As the discussion progresses, the main points of the answers can be recorded on the board. Any questions that cannot be answered should be written on the board under the heading 'Questions we cannot answer'. The students can then read the text to check their responses and also find answers to their questions.

2. **Using pictures**

   Pictures make it possible for the students to learn indirectly from other people's experiences. Students should be encouraged to study the pictures on the opening pages of a unit. To provide help to develop the concept, several thought-provoking questions should be asked about the pictures.

3. **Reading and discussion**

   Reading is a necessary and desirable activity for learning science, but too often it is the only activity. This is probably because reading is the method most familiar to teachers, who feel more at ease when using it.

   Groups can be formed in different ways, but this will affect how an activity is planned. If each group has a strong scientist, this person can take the lead and support the other group members. Alternatively, differentiated assignments and scaffolding can help strong and weaker groups to get the most out of the activity. Both approaches can and should be used, but both require the teacher to assign the groups. If students choose their groups, the teacher will not know in advance what the groups will be like, so he/she will not be able to design the activity accordingly.

4. **Experiments and observations**

   Though science concepts are best developed through first-hand experiences, sometimes, it is impossible to provide experiments that are simple enough for secondary level students, or they require laboratory facilities far beyond the resources of the average school. It is equally impossible to organize actual observations of all living things in their natural habitats. However with careful preparation, it should be possible to provide students with some opportunities to carry out relevant and meaningful practical work.

   These can be the experiments given in the book and/or those provided by the teacher. The purpose is to explore phenomena that require explanation. There are various ways in which the teacher can use the experiments and observations, depending on the time and materials available, and the size of the class. Ideally each student should do his/her own work; but this is not possible in all schools. Satisfactory results may be obtained by having different groups perform the experiments and make observations. However, the teacher should make sure that each student has an opportunity to work within a group. If an activity takes several days to prepare or carry out, the group should be selected in advance by the teacher.

   Before any experiment or observation is performed, ask questions such as: *What is the purpose of this experiment? What are we trying to find out? Why?* This is effective as the teacher can discover from the answers whether the students understand what is going to be done.

   When the results have been observed and recorded, ask what was done in the experiment and what happened. Do the results answer the questions posed at the start of the experiment? How do they explain what happened?

5. Field trips

Another means to provide opportunities for first-hand observation is through field studies. To decide what to observe and what questions to ask, the teacher should first study the unit thoroughly, then find out what first-hand information is available to help solve problems raised in the unit. Make a list of the things that can be seen and the questions that can be asked. Then take the students on the trip and have them make their observations. When they return to class, ask questions that bring out the observation, and call for explanation of those observations.

How to use this Teaching guide

Please do not see this guide as the definitive or only way in which to present the material in the book. You, as a teacher, know your students best, so use this guide to help you plan lessons that they will find interesting and exciting.

Also remember that the text book contains only some of the information on a given topic. Do not be afraid to extend your students' learning experience by supplementing the work with other resources that you might have access to.

Each chapter of the guide corresponds to a chapter in the textbook.

Lesson Plans – For each unit there is a series of suggested lesson plans based on a 45 minute lesson. These can be used as a basis for planning your lessons based on the resources and time allocation in your school; the timings mentioned are purely as a suggestion. Do take the time to make the plans according to your requirements.

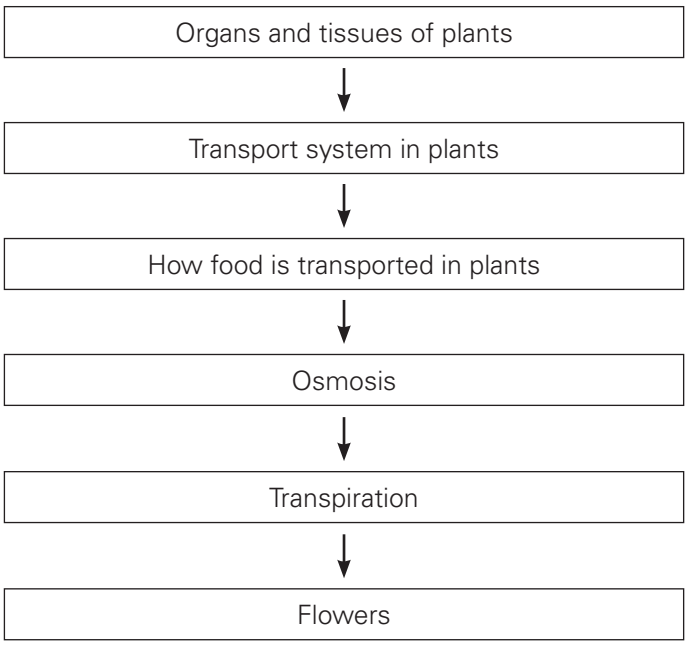
Worksheets – Photocopiable masters are referred to in the lesson plans; use these to supplement and extend the work presented in the textbook. Conduct experiments that can be carried out throughout the unit, there are also suggestions for investigations that can be conducted. The idea of the investigations is not to 'give' the students the experimental procedure but to encourage them to use their existing knowledge and understanding to draw up a plan and then carry out and evaluate their own experimental procedure.

Finally, a word about what we would like to achieve through this course. Our aim is to give students information about themselves and the world they live in, upon which they can base opinions, derive judgments, and determine courses of action in later life. We certainly do not see our suggestions as mandatory. We hope they will supplement and support the teacher's own professional practice. After all, no book can replace a good teacher!

Chapter

1 Plant Systems

UNIT FLOW CHART



INTRODUCTION

The purpose of this chapter is to ensure that students are aware of all the parts of a plant and their functions. They should be able to explain the internal structure of a leaf, the functions of xylem and phloem, and how food is transported by plants through different processes which include osmosis and diffusion.

Lesson 1

Pages 3–5

OBJECTIVE

- To explain the structure and function of a plant, including its constituent organs.

LEARNING OUTCOMES

The students should be able to:

- identify the different parts of a plant and explain their functions.
- explain the root and shoot system in plants and label different parts of leaf, stem and root (external and internal structure).

START (10 min)

Ask students to draw a plant in 30 seconds. Then ask them to label what they drew, as best as they can.

MAIN (25 min)

- Read page 3 to 5 of the Student Book.
- Divide the class into four groups. Give each group a plant and ask them to study its parts and discuss their functions. Please choose plants with appropriate flowers, e.g. hibiscus.
- You can also give each group an appropriate plant (without a flower) and a separate flower from another plant in order to provide the best samples for students.
- Show a plant and explain the root and shoot system.
- Draw a plant on the board and lable different parts like leaf, stem and root.
- Ask 'Test yourself' questions given on page 5 of the student book.

PLENARY (10 min)

Read pages 4 and 5. List the parts of a plant. Ask students to describe the structure of each part.

Ask students to relate structure to function of parts of a plant.

Hand out worksheet 1-1 and support the students in completing this sheet.

HOMEWORK

- Draw and colour a labelled diagram of a plant and write functions of each part.

Lesson 2

Pages 6– 7

OBJECTIVES

- To explain the internal structure and functions of a plant, including its constituent organs.
- To describe the structure of xylem and phloem.

LEARNING OUTCOME

The students should be able to:

- name different plant tissues and explain their internal structures and functions.

START (10 min)

Ask different questions and remind students of the discussion at the end of the last lesson.

Q. What is root system?

Q. What is the function of stem?

MAIN (25 min)

- Read pages 6 and 7 of the Student Book and explain about the term vascular bundles.
- Show them slides of xylem, phloem, and leaf structure under the microscope.
- Cut a cross section of a stem and discuss about vascular tissues there are two kinds of tubes xylem and phloem.
- Xylem and phloem tubes are known as vascular bundles.
- Explain that xylem tubes conduct water and mineral salts from the root to the leaves. They are thick tubes to give support and help with storage. Phloem transports prepared food from leaves to different parts of the plant. They contain holes through which the food is transported.
- Hand out worksheet 2-1 and support the students in completing this sheet.

PLENARY (10 min)

Ask students to look at their original drawing and comment on what they have learnt and/or on possible misconceptions that have been clarified.

HOMEWORK

- Test yourself questions on page 7 of the Student Book.

Lesson 3

Page 8-9

OBJECTIVE

- To describe the function of vascular bundles

LEARNING OUTCOMES

The students should be able to:

- Define osmosis.
- Explain how the process is used by plants.
- Define diffusion and explain its applications in plants.

START (10 min)

- Ask students if they remember the 'Particle Model'.
- Ask who remembers anything about diffusion.
- Very briefly have a few students, model diffusion in the following way: a few students pretend to be particles of a gas such as air and walk around randomly.
- One or two students pretend to be perfume particles and move around behind a desk or chair.
- When you remove the barrier (take the lid off the perfume bottle), they will move (randomly) into the space of the other students and mix with them.

MAIN (25 min)

Read page 8 to 9 of the Student Book.

- Have students carry out the experiment in Worksheet 2-3.

PLENARY (10 min)

- It is really important to make sure the students have grasped the connections between diffusion and osmosis and understood how osmosis drives transport through the plant.
- Ensure that students have understood the process of osmosis. Take sufficient time to discuss all aspects and ensure all students are involved in the discussion.

HOMEWORK

- Test yourself questions page 9

Lesson 4

Pages 10-11

OBJECTIVE

- To describe the structure of stomata and their role in controlling transpiration.

LEARNING OUTCOME

The students should be able to:

- Define transpiration.
- State the factors which affect the speed of transpiration.
- Explain how water and mineral salts are transported up to the stem and the leaves.

TEACHER'S PREPARATION

Place a transparent bag around the leaf of a plant. Tie it gently around the petiole (i.e. "stem" of the leaf) and leave it for 1-2 days. Make sure the plant has sufficient water and light, but place it in a cooler place an hour or so before the lesson starts. The intention is to show condensation on the bag.

START (15 min)

Show students the plant and point out the condensation on the inside of the bag. Ask where this water has come from. Elicit that it can only come from the leaf. If the leaf loses water, how is it replaced? Ultimately, explain that it must come from the soil.

MAIN (20 min)

Read page 10 of the Student Book.

- Draw structure of stomata on the board and explain the Water vapours passes out of the leaf mainly through the tiny holes called stomata. Stomata are mainly found on the lower side of the leaf.
- Discuss the factors that affect the speed of transpiration.
- Explain the term transpiration stream. And explain the flow of water in the xylem from roots to leaves is called the transpiration stream.
- Ask students to complete Worksheet 2-1.

PLENARY (10 min)

Show pictures of different leaves (with different surfaces, e.g. pine tree, water lily, banana plant,

cactus [the needles are 'leaves']) and relate the shape of the leaf to its natural environment in terms of water loss through transpiration.

HOMEWORK

- Student Book 'Exercise' Question 6, page 22

Lesson 5

Pages 11-12

OBJECTIVES

- To describe the structure of a leaf.
- To describe the structure of stomata and their role in controlling transpiration.

LEARNING OUTCOMES

The students should be able to:

- describe the external and internal structure of a leaf.
- define the process of photosynthesis and derive word equations for it.

START (10 min)

Ask students to draw a leaf. Which parts can they label? Discuss this with their lab partner. Ask students to note down in points what they know about the functions of a leaf. What structures should a leaf have to carry out these functions?

MAIN (25 min)

- Read pages 11 and 12 and discuss the structure of leaf. Relate the structure to functions.
- Ask students to label and colour the diagram on Worksheet 1-3.

PLENARY (10 min)

Make groups of 3-4 students and provide them with one leaf each. Leaves should be different. Ask students to draw and label the leaf. If you want to

extend this activity, ask groups to exchange leaves.

Perform practical given in worksheet 1-3

HOMEWORK

- Ask students to take two glasses and add two different colour solutions to each glass. Place celery in each glass and leave it undisturbed for 6 hours. Record your observations. Write a report about your observations and draw a coloured diagram.

Lesson 6

Pages 12-14

OBJECTIVE

- To describe the process of photosynthesis

LEARNING OUTCOMES

The students should be able to:

- define the process of photosynthesis and derive word equations for it.
- know that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein).
- explain that the structure of leaves is adapted to the process of photosynthesis.

START (10 min)

Ask students how plants get their food as plants cannot move. Discuss it and lead the students to the correct answer which is they prepare their own food.

MAIN (25 min)

Ask students to read page 12- 13

- Explain the process of photosynthesis through this video.

  https://www.youtube.com/watch?v=D1Ymc311XS8
- After explaining he process ask students to think carefully the material necessary for photosynthesis and write those things on board and explain the reason why they think it is necessary.
- Explain the factors necessary for photosynthesis.

PLENARY (10 min)

Discuss and solve worksheet 1-5

HOMEWORK

- Exercise question 5 of the student book.
- Test Yourself page 13-14.

Lesson 7

Pages 15-16

OBJECTIVE

- To understand the importance of minerals for growth of plants.

LEARNING OUTCOME

The students should be able to:

- Know that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein).

START (10 min)

Ask students to read page 14-15.

MAIN (25 min)

- Ask students to explain what they have understood in their own words.
- Explain how glucose is used with the help of book.

PLENARY (10 min)

Ask students to write important points of class on the board.

HOMEWORK

- Students will answer questions of Test Yourself page 15.

Lesson 8

Pages 17-18

OBJECTIVE

- To describe the process of respiration in plants.

LEARNING OUTCOME

The students should be able to:

- describe the process of respiration and write word equations for it.

START (10 min)

Take a leaf or flower in a beaker filled with water. Keep it in sunlight until bubble start to form.

MAIN (25 min)

- Read pages 16 and 17. Discuss the structure of the leaf and relate the structure to the process of respiration.
- Write word equation of respiration on the board and explain.
- Ask students to label and colour the diagram on Worksheet 2-2.

PLENARY (10 min)

Students will discuss questions of Test Yourself page 17 and 18.

HOMEWORK

- Students will answer questions of Test Yourself page 17 and 18 in their notebooks.

Lesson 9

Pages 18 -19

OBJECTIVE

- Compare the processes of photosynthesis and respiration.

LEARNING OUTCOME

The students should be able to:

- Compare and contrast the processes of photosynthesis and respiration.

START (10 min)

Show the following video.

https://www.youtube.com/watch?v=2ZWLFbPK2Ps

MAIN (25 min)

Read pages 18 and 19.

- Ask students to differentiate between photosynthesis and respiration.
- The following website can be used to understand and test the knowledge of students. https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zjqfsk7

PLENARY (10 min)

Students will discuss questions of Test Yourself page 19.

HOMEWORK

- Students will answer questions of Test Yourself page 19.

PLANT TISSUES AND PLANT ORGANS.

All living things are made out of one or more cells. The plants and animals that we study are made up of many cells, and a group of cells with a similar structure and function, which all work together to do a particular job, is called a tissue. An organ is made from a group of different tissues, which all work together to do a particular job. So like animals, plants have tissues and organs.

Read pages 16 and 17 of your Student Book and answer the following questions.

1. Name four different tissues, briefly outline what they look like, and outline their functions.

	Name of the tissue	Structure of the tissue	Function of the tissue
i			
ii			
iii			
iv			

2. These tissues work together in the plant's organs. Name four plant organs and their functions.

	Name of the organ	Structure of the organ	Function of the organ
i			
ii			
iii			
iv			

Task 1

Using your book, complete the definitions of diffusion and osmosis.

1. Diffusion

_____

2. Osmosis

_____

In your definition of osmosis, underline or highlight the keywords which show that osmosis is a special kind of diffusion.

Both processes can be illustrated through a simple demonstration using sweets.

Task 2

In a white plate, put a circle of coloured sweets in the middle. A regular pattern of colours tends to give the best visual result.

Gently and carefully pour some warm water into the middle of the plate. The aim is to have just a thin layer of water, not more than halfway up the height of the sweets (if that much). Be careful to avoid any movement of the plate, the sweets, or the table.

3. Observe and describe what you see happening to the sweets.

_____

4. Use the particle model to explain your observation

_____

Osmosis

Task 1

Get six gummy bears (jelly sweets) in three colours (3 pairs) and measure their length carefully. Record your data below.

- Label three cups with the words 'water', 'slightly salty', and 'very salty'.
- Half-fill each glass with water.
- Add one teaspoon of salt to the cup labelled 'slightly salty' and three teaspoons of salt to the cup labelled 'very salty'. Do not add anything to the cup labelled 'water'.
- Put bear 1 in the cup labelled 'water'.
- Put bear 3 in the cup labelled 'slightly salty'.
- Put bear 5 in the cup labelled 'very salty'.
- Bears 2,4, and 6 will not be put in any cup.
- Leave the experiment for 6 - 24 hours.
- Use a spoon to carefully take the bears out of their cups. Put them on a piece of paper and measure them. Record the result below. Also measure bears 2, 4 and 6 and record the results.

Results

		Before the experiment			**After the experiment**		
		Length cm	Width cm	Height cm	Length cm	Width cm	Height cm
Colour 1 water	Bear 1						
	Bear 2						
Colour 2 slightly salty	Bear 1						
	Bear 2						
Colour 3 very salty	Bear 1						
	Bear 2						

i. Which gummy bear changed the most?

_____

ii. The change was caused by the process of osmosis. Why do you think not all bears changed the same way? If you need some help, use page 22 of your Student book.

_____

iii. What is the role of bears 2, 4, and 6?

_____

1. Define transpiration.

_____

2. Under which conditions would a plant's transpiration rate be highest? Refer to page 23 if you need some help.

i. _____

ii. _____

iii. _____

iv. _____

3. Which plant organs are involved in the transpiration stream and what are their roles?

_____

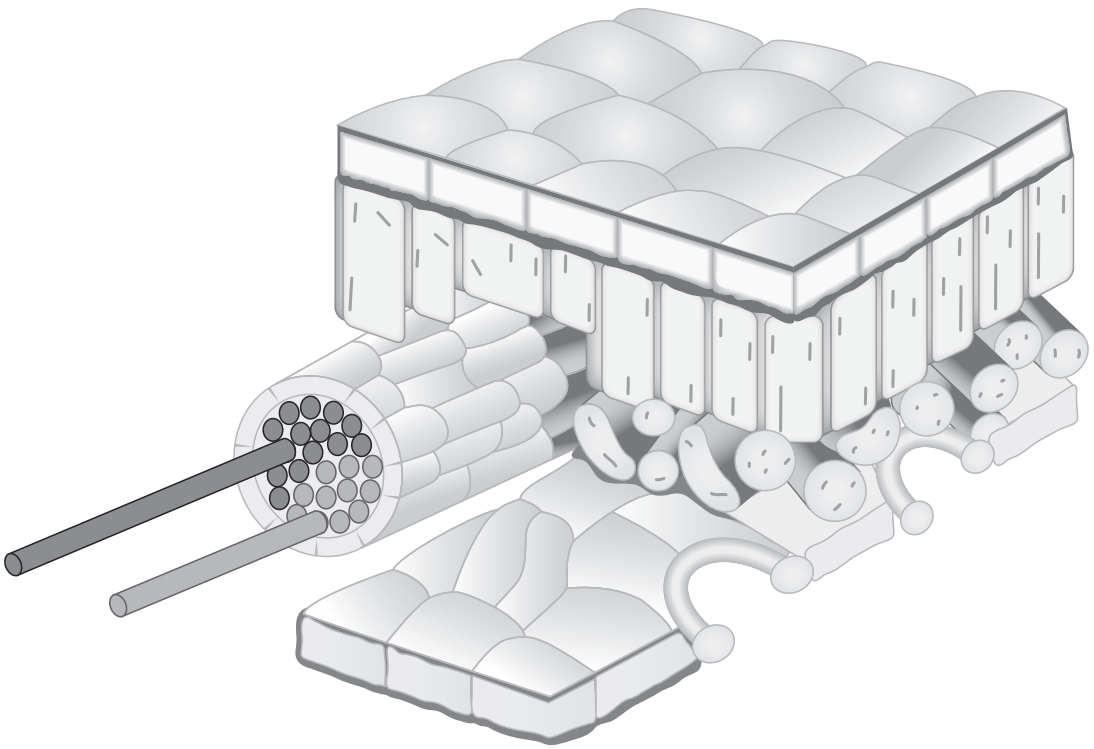
4. Colour the following structure of leaf.

chloroplasts green.

guard cells red.

stomata yellow.

waxy cuticle blue.



1. If you were to take a glass of fizzy water (water with carbon dioxide), put it in the Sun for some time, and then test it for starch, would you expect to find starch present? Explain your answer

_____

2. So what do we need to add to the equation that, so far, we have not included? Write the missing word in the box.

   light carbon dioxide + water ⟶ glucose + oxygen.

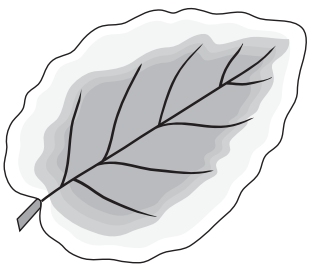
   ☐

3. Which experiment will prove that we not only need a plant, but also chloroplasts, for photosynthesis to occur?

_____

Testing whether chlorophyll is needed for photosynthesis

A plant with variegated leaves is put in a dark cupboard for 2-3 days. During this time, it will not photosynthesize and will use up all the starch from its leaves. One leaf is taken off the plant (keeping it in the dark) and immediately tested it for starch.



Variegated leaf

1. What will the starch test show?

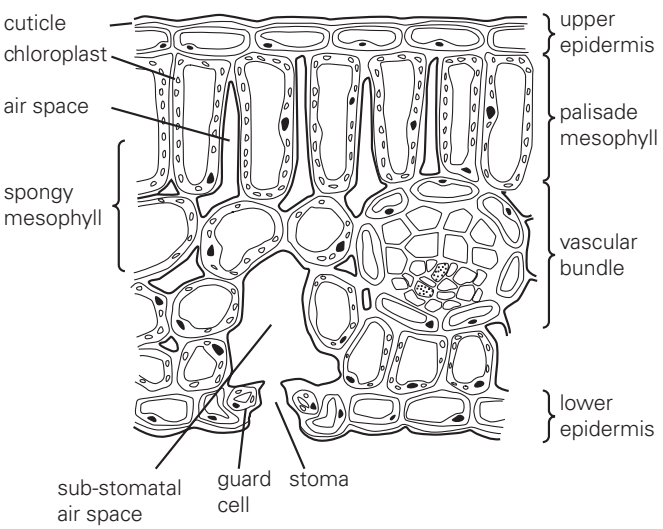
_____

2. The plant is put in the light. After 24 hours, a leaf is tested for starch.

   What will the leaf show? Explain your observations

_____

Look at the diagram of the leaf below.



In the diagram on page 10, colour the chloroplasts (which contain chlorophyll) green.

3. Where do you find these chloroplasts? Give the name of the layer of cells.

_____

4. You also find chloroplasts in the guard cells which open and close the stomata leaf pores. In which layer do you find the stomata?

   (The singular is "stoma" while the plural is "stomata". So, one stoma, two stomata.)

_____

5. The upper skin (or upper epidermis) is transparent. Why is this important?

_____

The structure of the leaf is adapted to best suit its function.

Write the correct structural adaptation of the leaf with the given function needed for photosynthesis in the table.

chlorophyll	large surface area	network of veins	stomata	thin

	allows carbon dioxide to diffuse into the leaf
	absorbs sunlight energy needed for photosynthesis
	The absorbed carbon dioxide only has to travel a short distance to reach the chloroplasts.
	to absorb more light at the same time
	to bring water and minerals to the leaf and to take away the glucose produced

The leaf has a network of veins to bring in water and minerals, but where do these come from? Just as the leaf is specially adapted for photosynthesis, the structure of the roots is very well suited to taking up water and minerals.

Plants have different-looking roots. Some plants have very deep roots, others have many shallow roots, and others have roots that are also used for storing food (like carrots).

However, all roots anchor the plant in the soil and take up water and minerals. Write the correct structural adaptation to the function of the root.

large vacuole	living cells	network of veins	root hairs

	To increase the surface area so more water can be absorbed
	to absorb and hold as much water as possible
	take up oxygen from the air spaces in the soil and can release energy which they use to take up some minerals from the soil
	to take water and minerals to other parts of the plant and to bring food

1. List the four main ways that plants use glucose, and briefly explain the main point of each.

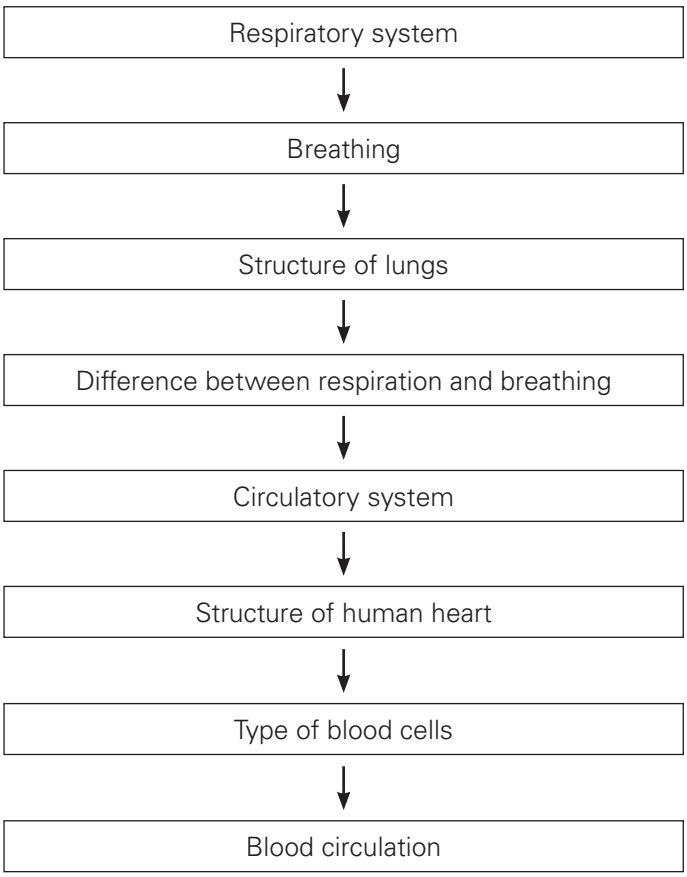
Use of glucose	Main point

2. Animals, including humans, use plants for food. Even when we eat meat, the chicken we are eating was eating grain from plants as it was growing. All food originally comes from plants.

   However, humans make use of plants in many other ways. Can you think of at least 5 other ways?

Chapter 2 Human Respiratory and Circulatory system

UNIT FLOW CHART



INTRODUCTION

All life processes require energy. This energy is found in the food we eat, but it needs to be released in the cell. This happens in the chemical processes of aerobic and anaerobic respiration and takes place in the mitochondria. Students will learn some details of both processes, but it is important that they understand the relationship between cellular respiration and the process of breathing, which allows oxygen to enter the body.

As aerobic respiration requires oxygen, it depends on breathing to bring this into the body. However, breathing requires muscle action and the energy to contract these muscles comes from respiration.

There is a similar situation with regard to glucose. It is needed for cellular respiration and is provided by the process of digestion. However, digestion requires energy which comes from glucose in the process of respiration.

As always, when discussing the structure of the respiratory system, please make sure the students understand the relationship between structure and function. An example is the numerous alveoli which ensure a large surface area, and the process

of gas exchange between the air in the alveoli and the blood. Although this process is fast, it still takes some time and the large surface area is required to supply all the cells in the body with sufficient oxygen.

This chapter describes in detail how human transport system works.

The chapter will be best explained with the help of different practical experiments, videos, and demonstrations. Some examples of these practicals are given in the lesson plans.

It will help the students understand what the transport system is made up of, the structure of the heart and how the blood circulates in the heart. They will learn the difference between arteries, veins, and capillaries, and red blood cells and white blood cells.

Lesson 1

Pages 25-26

OBJECTIVE

- To show how living things release energy.

LEARNING OUTCOMES

The students should be able to:

- define respiration.
- distinguish between respiration and breathing.
- differentiate between the processes of respiration and breathing.
- differentiate between aerobic and anaerobic respiration.

START (10 minutes)

- Ask students to list things they do frequently. Answers are likely to include: getting up, eating, getting dressed, going to school, playing, watching tv/films/videos, etc.
- Ask them what they are doing now. You may gently direct them to consider "breathing".
- Follow up with a discussion on what would happen if we decided to stop breathing. (We would become unconscious and then the automatic part of the brain would take over and we would start to breathe again.) Without breathing, we would die. Why? (All cells need energy. Some can release small amounts of energy without oxygen, but brain cells cannot. Without oxygen, cells in the brain die within minutes.)

MAIN (20 minutes)

Read pages 26.

- Help the students understand that breathing is a simple physical process comprising inhalation and exhalation by the lungs, whereas respiration is a chemical process that take place in the cells when oxygen and glucose are combined together in a chemical reaction and produce carbon dioxide, water, and energy.
- Ask the students: where in the cells does respiration take place?
- Explain that there are rod-like structures called mitochondria in the cytoplasm of the body cells.
- This is where respiration takes place.
- Ask the students: do all the body cells have the same number of mitochondria?
- Explain that mitochondria are found in the cytoplasm of all cells, but the number varies according to the kind of job that the cells do. For example, muscle cells have lots of mitochondria because they need to release large amounts of energy quickly for movement.
- Write word equation of respiration and discuss in detail.
- Explain that the energy released during respiration is needed for many purposes. We need it for movement and to keep our body temperature steady. As a result it is very important that our bodies should be able to store energy, as chemical energy, ready for use.

PLENARY (15 minutes)

PAIR AND SHARE ACTIVITY

- Discuss why muscle cells contain many mitochondria.
- Draw a table to show the composition of air.
- Discuss and solve Worksheet 1-2.

HOMEWORK

- Answer the 'Test yourself' page 26 of student book

Lesson 2

Page 27 -28

OBJECTIVE

- To explain that cells need a supply of food and oxygen for respiration.

LEARNING OUTCOMES

- describe aerobic respiration as a chemical reaction with oxygen.
- explain the difference between aerobic and anaerobic respiration.

START (10 minutes)

Approximately 1-2 hours before the lesson, prepare a dough from flour (500 g), water (300 ml), and either fresh or dried yeast. As this will not be eaten, use enough yeast and add 50 g of sugar (to "feed" the yeast) for the best results. Mix the ingredients, knead the dough into a ball, and wrap it in cling foil.

- Have a brief discussion about bread. What bread do they like and why do they like it? What do they know about baking bread?
- Divide the students into pairs. Give each pair a small ball of dough and put it in a beaker or (disposable) cup. Ask students to write their names on the cup.
- Ask them to weigh the dough and to measure the height and/or diameter. Record the results of each group in a table on the board. They will weigh and measure the dough again near the end of the lesson.
- Cover the cups with cling foil and keep them at around 30°C. (Out of sight is best.)
- Discuss:

  Why do you get tired after strenuous exercises?

  Why do some people tire more quickly than others?

MAIN (20 minutes)

- Aerobic respiration is respiration with oxygen. It produces carbon dioxide, water, and more energy. When you start to do exercise, aerobic respiration, with oxygen, takes place. When you get tired after doing hard exercise, anaerobic respiration (without oxygen) takes place. Lactic acid is produced and less energy is given out.
- When yeast is mixed with glucose with no oxygen, the process is called fermentation. This is an example of anaerobic respiration and is used in baking.

PLENARY (15 minutes)

Draw two flow charts, one of aerobic and the other of anaerobic respiration.

Ask students to differentiate between the two.

Ask students to measure and weigh their balls of dough again. Record the results on the board. (The balls of dough should have become bigger but not really heavier.)

Discuss and solve Worksheet 2-2

Lesson 3

Pages 29

OBJECTIVES

- To show how living things release energy.
- To explain that cells need a supply of food and oxygen for respiration.

LEARNING OUTCOMES

The students should be able to:

- define respiration.
- explain the respiratory system of humans.
- describe the role and function of major organs in the Human Respiratory System including trachea, lungs and alveoli (air sacs).

START (10 minutes)

Review questions from previous lesson on respiration.

MAIN (15 minutes)

- Show the students a chart of the human respiratory system.
- Explain the parts of the respiratory system. Discuss the structure of the respiratory system and explain that during breathing, air is taken into the lungs from where oxygen is removed and carried in the blood to body cells. Carbon dioxide and water, produced in the cells during respiration, leave the body by the reverse process. Oxygen moves into the blood system by diffusion. The lungs are two elastic pouches lying inside the ribs. They are connected to the air outside the body by

the windpipe or trachea. This opens into the back of the mouth and nose. The trachea divides into two smaller tubes called bronchi. One of these goes into each lung before dividing further into smaller tubes called bronchioles. After yet more branching the tubes end in tiny, thin walled air sacs called alveoli. Lining all the air passages are two types of cells. One type is covered with tiny hair called cilia. The other produces a sticky liquid called mucus. Small dust particles and bacteria stick to the mucus. The cilia 'beat' to carry the mucus to the back of the mouth where it is swallowed.

DEMONSTRATION (10 minutes)

Cow/ goat lungs

PLENARY (10 minutes)

Show a model of a bell jar with tube and balloon and rubber representing the diaphragm. Ask students to show the mechanism of respiration with this model.

Discuss the function of the alveoli in the lungs.

Worksheet 4-2

HOMEWORK

- Draw and colour labelled diagram of respiratory system.
- Exercise question 3 and 5 of student book.

Extension activity

It is quite easy to make a model of how air gets into and out of the lungs. If you do a video search on the internet, using search terms like "how to make fake lung" or "model of a lung", you get several videos explaining how to do this.

Each student could make their model, using a small plastic bottle, two balloons, a straw, an elastic band, and some play dough. They can use the model to demonstrate to their parents what is explained on page 28 of their Student Book.

Lesson 4

Pages 32 -33

OBJECTIVE

- to explain the human circulatory system, including the heart and blood vessels.

LEARNING OUTCOMES

The students should be able to:

- sketch and label the Human Circulatory System.
- hypothesize how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate. Test their hypothesis, calculate their pulse rate and record their findings.

START (20 minutes)

Help the students find a place on their neck or wrist to feel their pulse. See Worksheet 4-2

When all students have found their pulse, insist on complete silence and tell students to start counting from the moment you say, 'Start'. Tell them to stop after 20 seconds and record the number on their worksheet and calculate the frequency.

Discuss what they actually felt (their heartbeat).

What is the function of the heart?

If they find this difficult, ask them what happens when a person's heart stops. They are likely to answer that the person will die, so follow up and ask why s/ he would die, i.e., What is it that the heart does that keeps us alive?

(The main reason is that the brain will not receive oxygen and will not function anymore.)

MAIN (15 minutes)

- Ask all students to participate in some brief exercise. For example, they could step up onto their chair and down 5 times, or they could jog up and down one flight of stairs. Ensure classroom discipline—this is not a race and there is no need to show off. Should you have one or more students who are rather unfit and/or very overweight, you may choose to give them a supervisory role, such as start students off when they jog up the stairs and you can be at the top of the stairs to avoid a stampede.

PLENARY (10 minutes)

Go back to the start of the lesson and consider the function of the heart in the light of what they have found out. You may wish to ask students to clench and unclench their hand for 20 seconds, aiming for the same frequency as the contractions of their heart. After 20 seconds, they are likely to feel the beginning of fatigue in their hand. Imagine having to

do this for even 2 minutes? How is it that the heart does not get tired? (Because it is made of a unique type of muscle that does not tire easily.)

HOMEWORK

- Do Test Yourself page 33 of student book.

Lesson 5

Pages 34

OBJECTIVE

- to explain the human circulatory system, including the heart and blood vessels.

LEARNING OUTCOMES

The students should be able to:

- explain that living organisms have a complex transport system for transfer of various solids, liquids, and gases across the body.
- describe the structure and function of the human heart.

Preparation:

It is great to get a cow's heart from the butcher and show students this. However, some students may not be able to handle this much (bloody) reality and feel sick or faint. You can show an online 3D model instead.

START (10 minutes)

Discuss what was taught in the last lesson: our heart pumps blood around our body. The blood takes oxygen and food to the cells, including those in the brain. Without oxygen, (brain) cells would die very quickly and we would not survive. From here, you can ask students what they already know about how the heart pumps blood around the body. You can outline the concept of double circulation, i.e. that blood goes from the body to the heart, to the lungs, and back to (the other side of) the heart to go to the cells of the body again. Pumping blood through these very small capillaries is not easy.

Blood is pumped through the capillaries of the lungs where it picks up oxygen. It then goes to the left side of the heart to be pumped to the capillaries in the body where the blood gives up its oxygen. It then returns to the right side of the heart to be pumped to the lungs.

MAIN (20 minutes)

- Ensure that students understand the way the diagrams are drawn, i.e. as if they are part of a person facing you. So 'right' and 'left' in the diagram are the right and left of this imaginary person.
- Worksheet 5-2

DEMONSTRATION (15 minutes)

Cow/goat heart demonstration.

HOMEWORK

- Explore ideas for investigation page 44, 45 of student book

Lesson 6

Pages 35-36

OBJECTIVE

- To explain the role of the blood in the transport of materials.

LEARNING OUTCOMES

The students should be able to:

- describe how the blood transports materials around the body.
- describe the composition of blood and the functions of red cells, white cells, platelets and plasma

START (10 minutes)

Show the blood that has separated into plasma and cells. Draw students' attention to the facts that the (red) cells are responsible for the colour of the blood (the plasma is yellowish) and that the cells make up about half the volume of the blood.

Show a slide of blood under a microscope. If possible, have students study the slides under their own microscopes. Ask them to draw the cells. Depending on the slide, they may only see red cells or, if the slide is stained to show cell nuclei, they may see a few white cells. Explain that the reason they see some cells and not others is related to the relative number of the cells and their colour. If the slide is stained, they do not see the nuclei of the red cells. Why not? (They do not have nuclei.)

A model of the composition of blood should be shown. Diagrams of blood cells should be drawn on the board.

MAIN (15 minutes)

- Divide the students into four groups. Give each group one blood component to study from red blood cells, white blood cells, platelets, and plasma.
- Ask students to complete Worksheet 6-2.

PLENARY (20 minutes)

The group leader from each group will explain their component of the blood.

Each group will make models of red blood cells, white blood cells, platelets, and plasma on a piece of thermopole, and will paint the cells.

HOMEWORK

- Draw and colour a labelled diagram of type of cells of blood in the notebook

Lesson 7

Pages 37-39

OBJECTIVE

- To explain the blood circulation.

LEARNING OUTCOMES

- explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gases, nutrients, wastes and heat.
- compare and contrast arteries, veins and capillaries.

Preparation

One or two days before the lesson, get some blood from the butcher and put it in the fridge so that the blood cells sink to the bottom.

START (10 minutes)

- Show a chart about blood circulation in a human body and explain the whole path of blood circulation.

MAIN (15 minutes)

- Discuss the key points about blood circulation.
- explain the term double circulation in human body
- ask student to show arrow on the chart using colours:

  Blue colour: blood entering in the heart

  Red colour: blood leaving the heart
- ask a student to draw a flow chart showing arrows to show blood circulation
- Divide the students into four groups. Give each group one chamber of heart to study, ask them to play a skit and explain the circulation of blood
- Ask students to complete Worksheet 7-2.

PLENARY (20 minutes)

The group leader from each group will explain their component of the blood.

Each group will make models of red blood cells, white blood cells, platelets, and plasma on a piece of thermopole, and will paint the cells.

HOMEWORK

- Draw and colour a labelled diagram of blood circulation in notebook.

Task 1

1. Write down the definition of breathing.

_____

2. In breathing, one gas enters our bodies and another gas is excreted. What are the names of these gases?

_____

3. What is the definition of cellular respiration?

_____

4. What is needed for cellular respiration? Where do these chemicals come from?

_____

5. What is produced during cellular respiration?

_____

6. What is the relationship between breathing and cellular respiration? Think about the gas needed for cellular respiration and the gas produced.

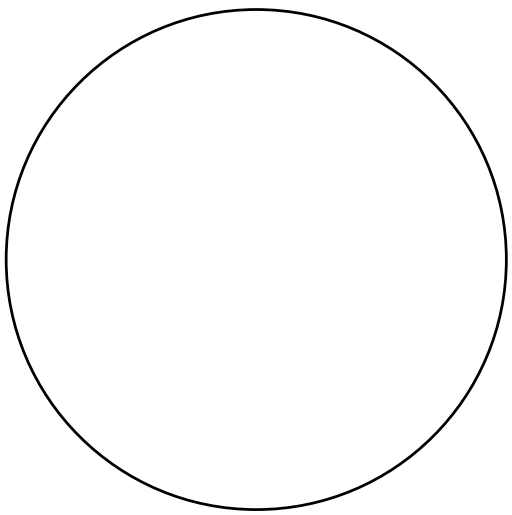
_____

7. Which cell organelle is responsible for cellular respiration?

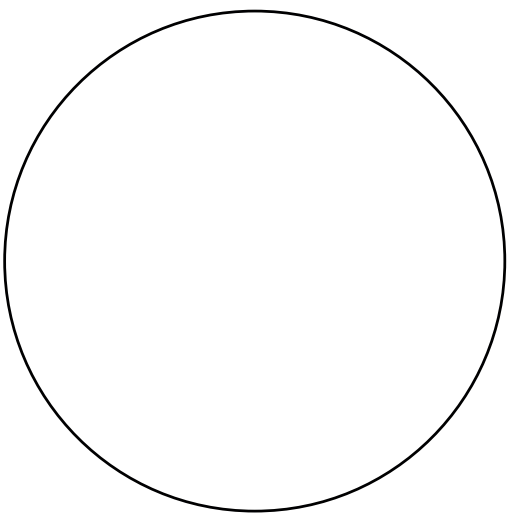
_____

Task 2

Draw pie charts for the composition of inhaled and exhaled air.



Inhaled air



Exhaled air

Task 1

Three students measured their pulse rates before and after doing exercise for three minutes. By looking at the table, answer the following questions:

	Pulse rate (beats per minute)		
	Student A	Student B	Student C
Pulse rate (beats per minute)	72	68	76
1 minute after exercise	172	147	180
2 minutes after exercise	144	118	134

i. Which student had the highest pulse rate after exercise?

_____

ii. Which of the three students was fittest? Explain your answer.

_____

Task 2

i. Walking is an aerobic exercise, while running fast is an anaerobic exercise. Why?

_____

ii. What is the word equation for aerobic respiration?

_____

iii. What is the word equation for anaerobic respiration?

_____

Task 3

In your experiment with bread dough, you weighed and measured the dough, left it for some time, and weighed and measured your ball of dough again.

i. Did the weight of your ball of dough change?

_____

ii. Did the size change?

_____

iii. What process was taking place in your ball of dough?

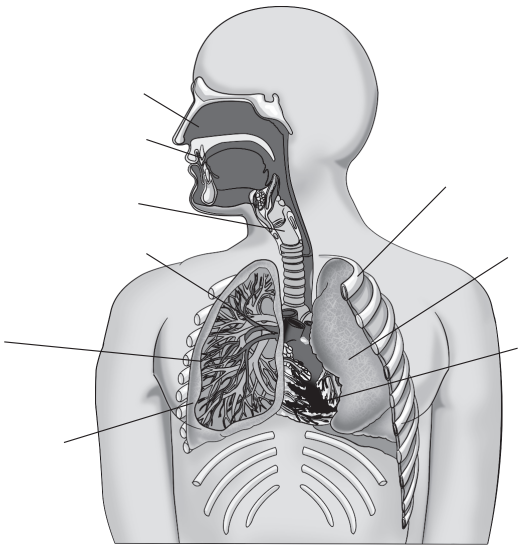
_____

iv. What was the cause of the changes that you observed?

_____

Task 1

1. Label the marked parts on the diagram of the respiratory system.



2. What is respiration?

_____

3. Draw (in the space given below) a flow chart to show air entering the lungs from the mouth.

4. What is the function of the cilia in the respiratory system?

_____

5. Write down two differences between the following:

Breathing	Respiration

Aerobic respiration	Anaerobic respiration

Inhaled air	Exhaled air

Task 1 – Finding your pulse

There are two places where it is usually fairly easy to feel your pulse. One is on the inside of your wrist, the other in your neck. Please use the pictures for guidance. Use your fingers to find your pulse, not your thumb, because you may also feel the artery in your thumb and get an incorrect result.

i. In 20 seconds, I counted _____beats.

ii. This means the frequency is _____x 3 = _____per minute

In this exercise, you counted the number of heart beats in 20 seconds and calculated your cardiac frequency per minute. How many times would your heart beat in 70 years?

iii. cardiac frequency per minute x 60 = number of beats per hour _____x 60 = _____beats per hour

iv. number of beats per hour x 24 = number of beats per day. _____x 24 = _____beats per day

v. number of beats per day x 365 = number of beats per year x 365 = _____x365=_____ beats per year

vi. By the time you are 70 years old, your heart will have contracted number of beats per year x 70 = number of beats in 70 years.

_____x 70 = _____beats in 70 years.

vii. The results of i. and ii. were "at rest". Your teacher will give you an exercise to do and afterwards you will again count your heart rate. Do you expect it to be different?

_____

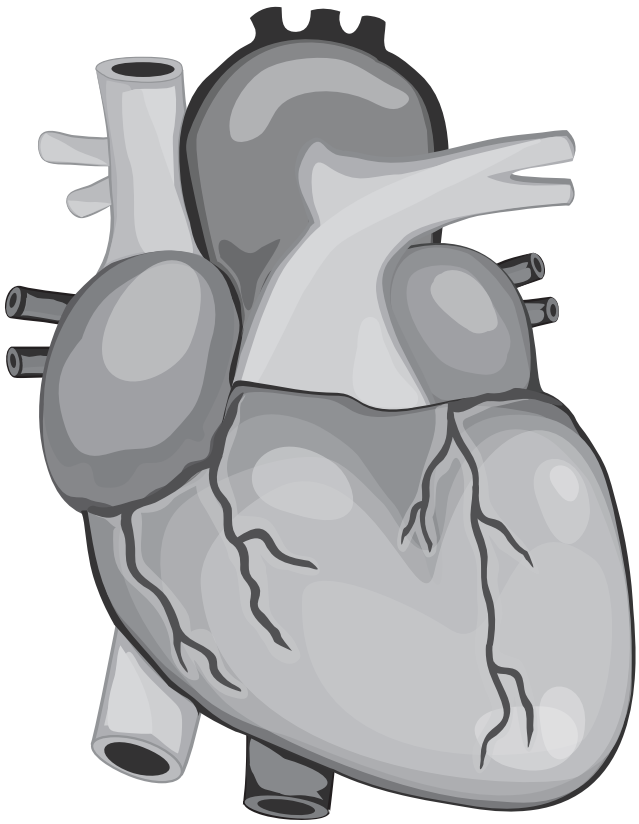
viii. In 20 seconds, I counted _____beats.

ix. This means the frequency is _____x 3 =_____per minute

x. What happened to your cardiac frequency after exercise?

_____

Below is a diagram of the internal structure of the heart. Use page 137 of your Student book to help you answer the questions. Remember that this is the heart as you look at it, as if it were still in a person. This is the reason that what is called the right side of the heart seems to be at the left side of the drawing.



i. Several veins carry the blood from the body to the heart. They are called the vena cava. Colour them light blue.

ii. Draw blue arrows to show how the blood from the body enters the heart.

iii. Blood arriving from the body enters the heart in a certain chamber. What is the name of this chamber? Colour it light blue.

_____

iv. From the chamber in iii, the blood flows into a chamber with a thick wall. What is the name of this chamber? Colour it light blue.

_____

v. Draw red arrows to show how the blood from the heart goes to the body.

vi. The blood leaves the right hand side of the heart to go to the lungs via a large artery. What is the name of this artery? Colour it light blue.

_____

vii. Draw a blue arrow to show how the blood leaves the right side of the heart.

viii. In the diagram above, you can see that the artery taking the blood to the lungs soon separates into two. The diagram shows that each of these two divides again into two, so there are four arteries taking blood to the lungs. It is therefore not surprising that there are also four veins bringing blood from the lungs back to the heart: two of them from either side. These veins are called the pulmonary veins.

ix. Label them and colour them pale red. Draw a red arrow to show how the blood enters the left side of the heart via these four pulmonary veins.

x. Blood arriving from the lungs enters the heart in a certain chamber. What is the name of this chamber? Colour it pale red.

_____

xi. Draw 4 red arrows showing how oxygenated blood from the lungs enters the heart.

xii. The blood leaves the left hand side of the heart to go to the body via a very large artery. What is the name of this artery? Colour it pale red.

_____

xiii. Draw red arrows showing how the oxygenated blood leaves the heart to go to the body.

Task 1

i. What is the function of the left and right atria?

_____

ii. What is the function of the left and right ventricles?

_____

iii. Complete the table

Blood vessel	Blood pressure: high or low	Oxygenated or deoxygenated blood
vena cava		
pulmonary artery		
pulmonary vein		
aorta		

iv. How is the blood in the pulmonary artery different from the blood in all the other arteries?

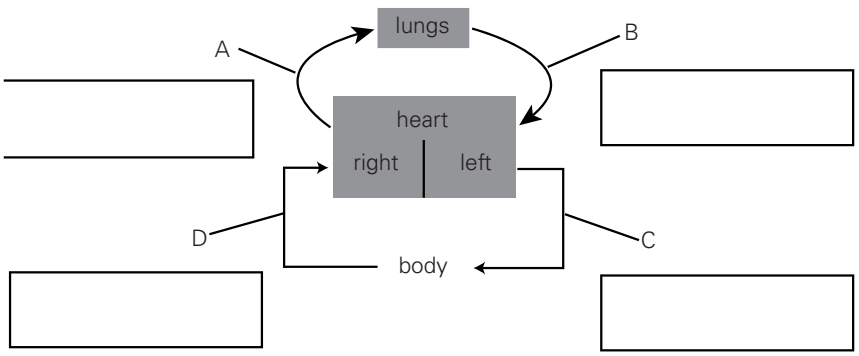
_____

v. How is the blood in the pulmonary vein different from the blood in all the other veins?

_____

Task 2

Below is a diagram of part of the circulation.



i. Label the lettered part of the diagrams.

_____

ii. Which blood vessels carry oxygenated blood to the body?

_____

iii. What are the names of chambers of the heart called?

_____

iv. Why is the circulation in the heart called double circulation?

_____

v. Name the blood vessel which carries deoxygenated blood to the lungs.

_____

2. The table below contains statements about arteries, veins, and capillaries. Tick the correct boxes.

	Arteries	Veins	Capillaries
thick walled and muscular			
have valves			
are in close contact with cells			
blood flows under high pressure			
pick up oxygen from the lungs			

3. State whether the following statements are true or false.

i. The pulmonary artery carries oxygenated blood to the lungs.

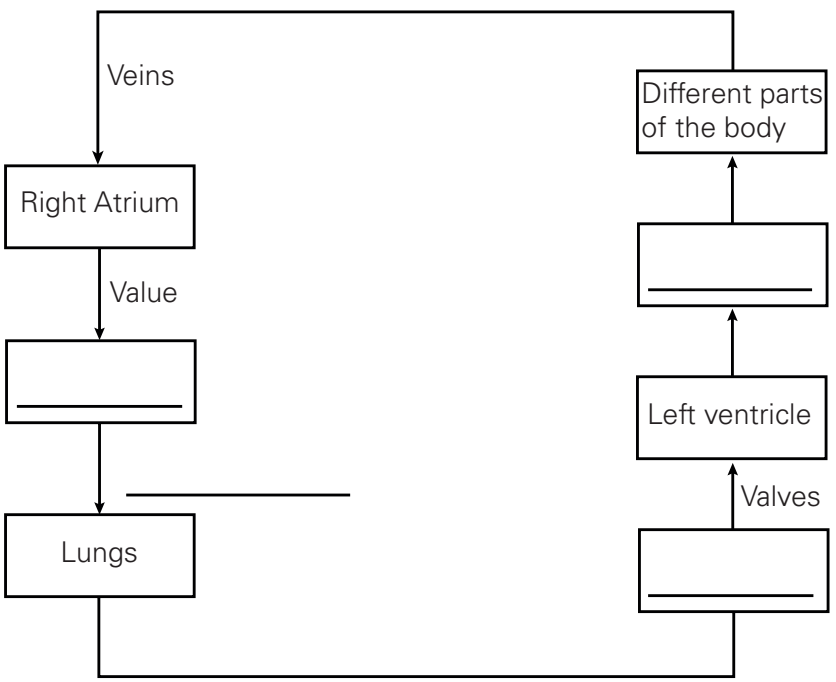
ii. The exchange of gases takes place through the thin walls of the capillaries.

iii. The blood circulatory system is made up of the lungs, blood, and blood vessels.

iv. The human heart has five chambers.

v. The left side of the heart receives oxygenated blood from the lungs.

4. Complete the following flow chart of the circulation of blood in the heart.



Task 1

Below is a list of some structures in the blood circulatory system.

Artery, heart, ventricle, red blood cells, valves, vein ,

plasma, platelets ,white blood cells, capillary

Which structure

i. supply oxygen with haemoglobin?

_____

ii. helps in clotting blood?

_____

iii. carries blood away from the heart?

_____

iv. defend the body against germs and bacteria?

_____

v. brings blood back to the heart?

_____

vi. is very thin-walled and the exchange of gases takes place through it?

_____

vii. allows the blood to flow in one direction and prevent the backward flow of blood?

_____

viii. is a mixture of liquid with cells floating in it?

_____

ix. pumps blood to all parts of the body?

_____

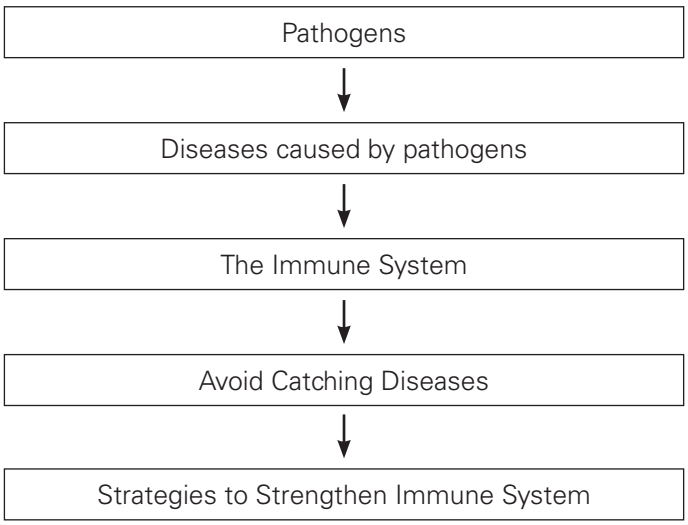
x. is a chamber of the heart?

_____

Chapter

3 Immunity and Disease

UNIT FLOW CHART



INTRODUCTION

Although there is insufficient conclusive evidence, many people who study the history of disease and medicine believe that pre-historic civilisations most likely related (some) diseases to the actions or influence of spirits. It is also likely that they had some knowledge of herbal medicine.

The Egyptian civilization developed writing so they could pass on knowledge beyond what was remembered. Doctors carefully observed the results of treatments and (religious) value was placed on cleanliness.

Chinese medicine initially thought disease was caused by evil spirits, but around 1000 BCE there is evidence that they used specific drugs to treat diseases. The earliest evidence for the use of acupuncture is from 100-200 BCE.

The Greeks continued the process started by the Egyptians. They still believed in many gods, but the influence they were believed to exert on people's lives diminished as the Greeks gained more scientific knowledge. Roman medicine was influenced by the needs of the army and this resulted in a focus on prevention rather than cure.

Of course, we now believe we know a lot more and are beyond superstitions – but most of us will warn others to dress warmly in winter 'or you will catch a cold'. A 'cold', like a number of other diseases, is caused by infection by a virus, not by a drop in temperature. As it gets colder outside, we spend more time indoors, rebreathing the same air and in closer contact with others. If one of these has a 'cold', the opportunities for transmission are greater than they are when it is warmer.

In this chapter, we will learn about microbes – organisms we did not even know existed until the middle of the 17th century. Some microbes are certainly capable of causing a lot of harm (such as the bacteria which caused the plague and killed as many as 25 million people in the Middle Ages) but others are beneficial, and quite a few are essential to our lives.

Lesson 1

Pages 46-47

OBJECTIVES

- To introduce microorganisms as living things and to explain that they can be both useful and harmful.
- To explain how knowledge of microbes can help control the spread of infectious diseases.

LEARNING OUTCOMES

Students should be able to:

- identify the various types of pathogens that cause infectious diseases.
- explain the various defenses that the body has against pathogens, before the innate immune system is activated.
- explain that bacteria, viruses, and fungi are classified as microorganisms (microbes).
- explain that microbes can be useful and harmful.

START (10 min)

Ask if any of your students has been sick recently. Ask them if they would like to say what was wrong with them and what caused it. Answers may include injury, genetic diseases, and things like colds and measles. Discuss the difference between injury and disease, and between infectious and non-infectious diseases (those which have, e.g. genetic causes, allergies, etc.). It is worth spending some time on this since not all students may be clear on the causes of infectious diseases.

MAIN (25 min)

Read Pages 46-47

- Draw students' attention to the fact that one bacterium, one virus, or one fungus is unlikely to have any effect, good or bad. So the reproduction of these organisms is what we want, or want to avoid. Ask students to complete Task 1 of Worksheet 1-3.
- In Task 2, students are asked to calculate bacterial growth. Either have them do this with a calculator or co-teach with your IT colleague (and do it in Excel). The aim is to develop the understanding that bacterial growth initially is small, but once a sizable population exists, numbers increase very rapidly. You will refer to this when talking about disease.
- Stress that microbes are useful too. It is important that students realize this because it is a common perception that an absence of microbes would be ideal; but this is not the case.

PLENARY (10 min)

Not only is cheese made with bacteria, some cheeses, get their structure and taste from the (edible) fungus that grows on their crust. Other foods which require the action of microbes are coffee, chocolate, olives, vinegar, etc. Ask students to investigate one of these or another type of food which involves microbes.

'Test yourself' questions on pages 48 of the student book.

HOMEWORK

- Write a report about the spread of the diseases in your area.

Lesson 2

Pages 48-50

OBJECTIVE

- To introduce the spread of infectious diseases.

LEARNING OUTCOMES

Students should be able to:

- explain how infectious diseases such as Hepatitis, COVID-19, Typhoid, Whooping Cough, Measles and Dengue are caused/contracted, how they are tested and diagnosed, and how they can be prevented.

START (10 min)

In Germany, it is fairly common for all students to shake hands with the teacher at the beginning and end of the lesson. While this may be considered polite, is it a good idea from the perspective of health? Suppose the first student carries some disease-causing microbes on his/her hands.

Who would these microbes have spread to by the end of the lesson?

Discuss the following with students:

- Would they be willing to shake hands with a classmate?

- What if they saw this person sneeze while covering his/her nose and mouth with his/her hand. Would they still shake hands?
- What if this person used this hand to open the door?
- Would the student be willing to touch the door handle?
- What would be their reasons for being reluctant in any of the above scenarios?

MAIN (25 min)

Read Pages 48-50

- Discuss the diseases mentioned on page 48-50 and show pictures to the students.
- Discuss about hygiene in general, or focus on one disease.
- Discuss about the prevention and vaccination about the diseases.
- Explain that the hepatitis virus causes inflammation of the liver.
- Test yourself page 51 of the student book.

PLENARY(10 min)

Discuss methods of transmission and what students can do to prevent it.

a. Are hand sanitizers available, maybe at certain times of the year?

b. Does the school encourage hand washing at regular times?

c. What is hygiene?

Ask students to complete Worksheet 2-3.

HOMEWORK

- Assignment: organize an awareness campaign for students and parents. Select one of the following methods.

a. Write a play

b. make posters

c. give presentations

Lesson 3

Pages 51 to 55

OBJECTIVE

- To understand about the immune system.

LEARNING OUTCOMES

Students should be able to:

- describe the parts of the immunity system and how they function to produce an immune response.
- describe the three types of immunity in humans – innate, adaptive, and passive.
- how adaptive immunity develops over time.
- visualize the ways to add additional layers of defense (such as wearing masks, using sanitizers, etc.)

START (15 min)

Discuss about the defences against enemies of a country.

MAIN (25 min)

Read pages 51 to 55

- Discuss about the defences against diseases.
- Explain the immune system page 53 of the student book.
- Discuss about the different types of the immune system.
- Explain that the skin is a very efficient protective barrier. However, if it is damaged, the blood forms a clot which quickly plugs the hole and keeps microorganisms out.
- Ask students to draw a flow chart about the immune system

PLENARY (10 min)

Exercise questions 3 and 4 page 59 of the student book.

Home work

- Test yourself page 51-55 of the student book.

Lesson 4

Pages 56-57

OBJECTIVE

- To explain how knowledge of microbes can help control the spread of infectious diseases.

LEARNING OUTCOMES

Students should be able to:

- propose some common strategies for strengthening student's immune system.
- suggest ways in which communities of people can safeguard against the spread of infectious diseases.

START (10 min)

Ask and discuss the following questions:

- When people go swimming in a river or canal, there will be microbes in the water. Why do they not get sick?
- If you were to leave a piece of cheese out, it would be covered in mould after a day or two. How come we are not covered in mould?

MAIN (25 min)

Read pages 56-57

- Discuss the concepts of keeping microbes out and the problems with an injury.
- Do task Worksheet 3-2.
- Discuss how vaccination can prevent disease, even if a microbe or two enters the body.
- Discuss the strategies for strengthening the immune system.
- Explain how to avoid catching a disease.

PLENARY (10 min)

Exercise questions 5 and 6 page 59 of the student book.

Discuss vaccination with your students.

a Have they been vaccinated?

b Did they mind being vaccinated?

c What was worse: the actual injection, or the fear?

d Do they understand the benefits of one vaccination versus getting seriously ill?

HOMEWORK

- Ideas of investigation 1 and 2 page 60 of the student book.

Task 1

In the table below, name the three groups of microbes and explain how they reproduce.

Type of microbe	Method of reproduction

Task 2

Bacteria reproduce by dividing into two and that they may be able to do this every 20 minutes. So in the table below, you will calculate the growth of a population from one bacterium over time.

Time from start	Number of bacteria
0 minutes	
20 min	
40 min	
1 h	
1 h 20 min	

Use the numbers you calculated above to answer the following questions.

i. If you had only one bacterium on your hand and you did not wash your hands for 7 hours, how many bacteria might be living on your hand at the end of that time?

ii. What was the increase in the number of bacteria from 40 minutes to 1 hour?

iii. What was the increase in the number of bacteria from 6 h 40 minutes to 7 hours?

iv. How long does it take to grow 1,000 bacteria from 1? And how long to get from 1,000 to 2,000?

v. Suppose you had washed your hands after 2 hours and cleaned them of all bacteria except one. How many bacteria would be on your hands after 2 hours and 20 minutes?

vi. Suppose you wash your hands every 2 hours. What is the greatest number of bacteria that will ever be on your hands?

Task 3

i. List the things which microbes do that we find useful.

_____

ii. Decomposition involves both bacteria and fungi. Which microbes are used in making cheese, yoghurt, and baking?

_____

iii. What happens to most plastics which are non-biodegradable?

_____

Task 1

Harmful microbes are sometimes called 'germs'. Below is an incomplete table of some diseases, their causes, symptoms, and whether a vaccine exists.

i. Find out which type of microbe causes the disease and complete the second column of the table.

ii. Some of the diseases already have descriptions of their symptoms. For the others, copy the correct description from the word bank below.

muscle weakness, inability to move, may cause permanent paralysis	rash, fever, sore throat	red patches on skin
nausea, vomiting, diarrhoea, abdominal pain	raw skin, peeling, blisters	runny nose, coughing, sneezing, mild fever

Name of the disease	**Causes**	**description of symptoms and consequences**	**is there a vaccine?**
athlete's foot		raw skin, peeling, blisters	No
cold			Yes
Malaria	Mosquito		
flu			Yes
pneumonia		fever, cough, difficulty breathing	
whooping cough			
Dengue fever	Mosquito		
Covid 19			Yes

Task 1

i. What is one of the main functions of your skin?

_____

ii. Suppose you have a slight cut. What is the first thing that happens? How does it help keep microbes out?

_____

iii. After a few minutes, what is the next process that occurs which helps prevent infection?

_____

iv. What are some good ideas when treating an injury?

Cross out the bad ideas and put a tick next to any good ideas.

All injuries should be treated by a doctor, even better at a hospital.

Mild injuries can be treated at home.

Mild injuries do not need treatment at all.

Mild injuries should be rinsed with just water or water with a little salt.

Mild injuries need to be treated with strong antiseptics.

Dirt should be rinsed out or removed gently with sterile forceps.

Any dirt in a wound is already there so should be left.

Small scabs should be scratched off as often as possible.

Small scabs should be left until they fall off by themselves.

Scratching off scabs will leave fewer scars.

Serious wounds should be left to bleed.

Very serious bleeding should be stopped by applying direct pressure, if possible with a clean cloth, but if necessary with dirty hands to prevent extensive blood loss. Wounds where blood comes out in squirts always need urgent medical attention.

Use common sense but when in doubt, see a doctor.

Task 2

i. Two kinds of white cells in the blood play an important role in a person's defence system. What does each of them do?

_____

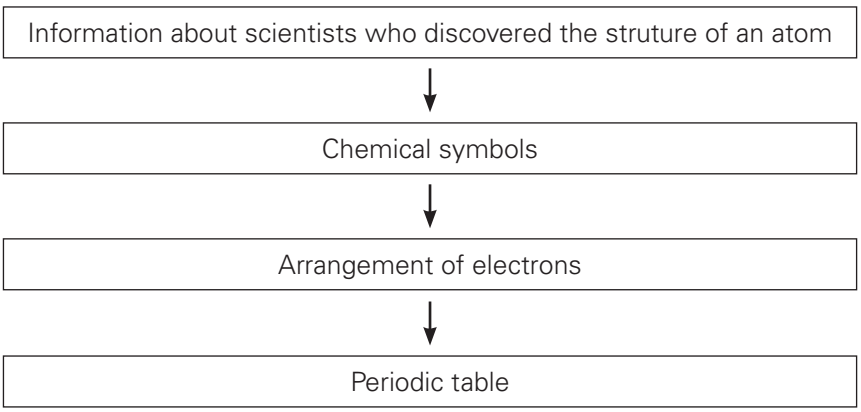
ii. Which of these two responses is triggered by vaccination or immunization? How does it help to prevent you from catching the disease?

_____

Chapter

4 Structure of an atom

UNIT FLOW CHART



INTRODUCTION

The purpose of this chapter is to give the students a basic knowledge of an atomic structure, the periodic table, and how atoms combine together in different ways to form compounds. Students should have a basic knowledge of atoms, molecules, and formulae which are the fundamentals of chemistry.

An atom is far too small to be seen by the naked eye. Only by using powerful microscopes it is possible to obtain a picture of an atom. It is difficult to imagine anything so small. Despite these difficulties scientists have been able to find out a great deal about atoms.

The periodic table is one way of arranging elements into groups that share similar properties. It was developed gradually over many years. In the early nineteenth century, a scientist called Döbereiner noticed that elements could be grouped into threes; each member of the group had similar properties to the other two. This idea was developed further by a British scientist, John Newlands. He arranged all the known elements in order of increasing atomic mass.

In 1869, the Russian chemist Mendeleev arranged the elements in order of relative atomic mass. However, he left gaps for elements that had not yet been discovered, and predicted the properties of those elements. These predictions proved correct when the elements were eventually discovered.

Each of the elements in the periodic table is shown by a symbol, a number above it and a number below it. The lower one is the atomic number. The upper one is the relative atomic mass.

Lesson 1

Pages 61-62

OBJECTIVE

- To introduce some of the scientists who made important discoveries about the atom.

LEARNING OUTCOMES

The students should be able to:

- identify some of the scientists who made important discoveries about the atom.
- describe and draw the structure of an atom in terms of electrons, protons and neutrons.
- describe how an atom is electrically neutral.

START (10 min)

- Elicit prior information of atoms from students.

MAIN (20 min)

Read pages 61-62 of Student Book.

- Divide the students into four groups. Give each group a model of the atom as described by each scientist in the Student Book.
- Ask them to list the advantages and disadvantages of each model.
- Groups will discuss their responses for five minutes.
- Each group leader will explain his/her model of atomic structure to the whole class with an illustration.
- Ask students to draw a labelled diagram of the structure of atom
- Help students to solve worksheet 1-4

PLENARY (15 min)

GROUP ACTIVITY In groups, students will construct a model of the atomic structure using play dough and match sticks. .

HOMEWORK

- Ask the students to research on internet how the atomic structure model has been developed over the years.
- test yourself page 63 of the student book.

Lesson 2

Pages 63-64

OBJECTIVE

- To introduce the concept of chemical symbols for the elements and their ions.

LEARNING OUTCOMES

The students should be able to:

- differentiate between atomic number and mass number.
- determine the atomic number and mass number of elements on the basis of the number of protons, electrons and neutrons.
- show the arrangement of electrons in K, L and M shells of elements.
- draw the atomic structure of the first eighteen elements of the Periodic Table.

START (10 min)

- Ask students if they know about shorthand and if they use it in their daily lives. Give example of emojis/emoticons used in mobiles/tablets or computers to express emotions.
- Ask students about their nicknames. Chemical symbols are used in much the same way. A chemical symbol is a shorthand method of representing an element. Instead of writing out the name of an element, we represent an element name with one or two letters. Each element is represented by a chemical symbol consisting of letters.

MAIN (20 min)

Read pages 63-64 of Student Book.

- Ask students to work in pairs and learn the symbols given on page 64.
- Introduce the concept of atomic number and mass number and arrangement of electrons in shells.
- Divide the students into four groups. Give them two elements with their atomic number and mass number and ask how they will distribute electrons into different shells and orbits; for example, Na.
- Each group leader will explain atomic structure to the whole class.
- Next explain them how ions are formed.

PLENARY (15 min)

- In groups, students will construct a model of the atoms showing the electronic arrangement of atoms and their ions using play dough and wires.
- Worksheet 2-4

HOMEWORK

- Ask the students to draw electronic arrangement of any 5 elements.

Lesson 3

Pages 65-67

OBJECTIVE

- To introduce the periodic table as a way of classifying elements.

LEARNING OUTCOMES

The student should be able to:

- describe the periodic table and name some groups.
- explain that the Periodic Table, is a way to organise elements in a systematic order.
- recognise periods and groups in the Periodic Table.

START (10 min)

- Ask the students the following questions:
  1. Have you been to the school library?
  2. What happens if all the books are mixed together?
  3. Why are they classified into different sections?

Relating this example to periodic table explain that elements are classified into different groups in the periodic table so that they can be studied according to their properties.

MAIN (25 min)

Read pages 65-67

- Show the students a chart of the periodic table.
- Ask the students to classify the elements into groups and periods horizontally and vertically by observing their properties and their atomic number.
- Help students to identify columns and groups in the periodic table.
- Relating this example to periodic table, explain that elements are classified into different groups in the periodic table so that they can be studied according to their properties.
- Ask the students to classify the elements into groups and periods horizontally and vertically by observing their properties and their atomic number.

Pair activity:

- Give each pair a group from the periodic table to study. Ask them to write down the properties of each group and mention why the elements are in the same group. Pairs will form a group of 4 and discuss their findings with each other.
- After the activity, students attempt exercise question 3, page 69 of the student book.

PLENARY (10 min)

Each group leader will present the properties of one group.

Students should be assessed on the basis of their observation and communication skills.

Test yourself page 67 of the student book.

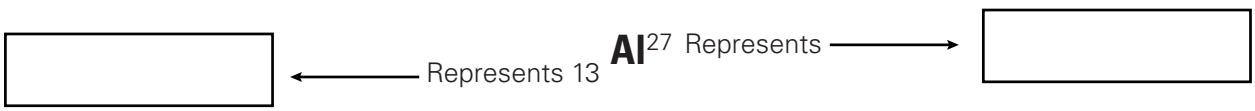
HOMEWORK

- Test yourself 69 of the student book.

1. Write symbols of following elements along with their atomic number and mass number.

Element	Mass number	Atomic number
Hydrogen		
Oxygen		
Nitrogen		
Iron		
Magnesium		
Calcium		
Carbon		

2. Aluminum is represented by



i. What do 13 and 27 represent?

_____

ii. The number of particles in aluminum are:

number of protons _____

number of electrons _____

number of neutrons _____

iii. How are the electrons distributed in the different shells?

_____

iv. Draw a diagram to show the structure of aluminium atom.

		1 H						2 He
3 Li	4 Be		5	6	7 N	8 O	9 F	10 Ne
11 Na	12 Mg		13 Al	14	15	16 S	17 Cl	18 Ar
19 K	20 Ca							

1. Answer the questions below from the given periodic table chart:

   a. Name any two elements of group I.

   _____

   b. Name any two elements of group VI.

   _____

   c. Which group represents alkali metals?

   _____

   d. Which group contains only one electron in the outer-most shell?

   _____

   e. Which group contains seven electrons in the outer-most shell?

   _____

   f. Name two halogens from the table.

   _____

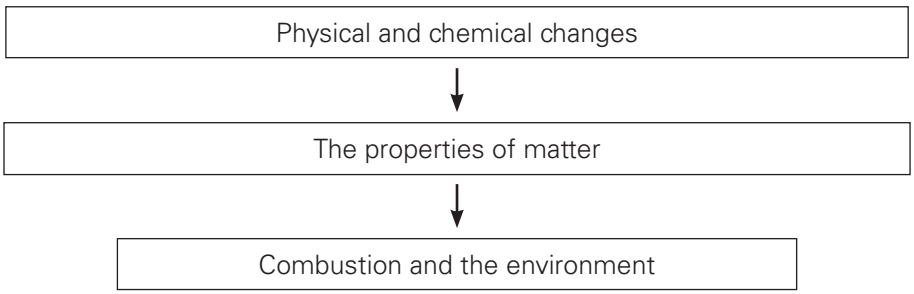
   g. Name two noble gases and write their uses.

   _____

Chapter 5

Physical and Chemical Changes

UNIT FLOW CHART



INTRODUCTION

There are only 118 elements in the periodic table but there are thousands of materials which are made by different combinations of these elements. When two or more elements are mixed a change is observed and a Material is formed.

The main difference between physical and chemical change is that physical changes are reversible while chemical change is usually not. To understand physical and chemical changes in detail consider the following changes.

Mixing flour, butter, milk, and eggs to make batter is a physical change (although one which would, in reality, be hard to undo), but baking the batter to make a cake is a chemical change. For those of you who love French and Italian dishes, tomatoes, onions, garlic, and paprika (bell peppers or capsicum) can be chopped and mixed into a salad (physical change) or cooked and pureed (blended) into a sauce for pasta (chemical change).

Lesson 1

Page 71-72

OBJECTIVE

- To show that a huge range of materials can be made from a relatively small number of elements.

LEARNING OUTCOMES

The students should be able to:

- Differentiate between physical and chemical changes while considering daily life examples.
- Distinguish between physical and chemical properties of matter.

START (10 min)

Discuss about elements, compounds and mixtures.

MAIN (20 min)

Read Page 71-72

- Discuss about type of physical changes and chemical changes. It is important to understand the differences between physical and chemical changes.
- List down differences between physical and chemical changes.
- Worksheet 3-5 and support students working through the questions. This may be suitable for group work.
- Explain that once an egg has been cooked, it cannot be changed back again.
- Discuss that water can change into steam. When steam condenses, it turns back into water again.

PLENARY (15 min)

- It is important that we, as teachers, make it obvious to our students that what they learn at school is linked to their lives at home. Even when we think we have shown how the work in class links to everyday life, not all students may have really understood this. Showing that science is part of 'real life' and not just some abstract information to be memorized for a test, will make students more interested and will make it easier for them to remember the information. They will also talk about it at home, which will make the parents more supportive of the school, which also has a positive influence on the students' academic success.
- One of the ways of linking students' science learning to real life can be by using models. Cooking is an area which relates closely to science, as we saw when discussing the denaturation of proteins, and most students have some awareness of what is involved in preparing food. So this link with reality should be made explicit whenever possible.
- Ask students to consider their usual meals and favourite dishes to identify what the 'elements' would be, and if other dishes or meals can be made with them. Where are the physical or chemical changes involved?

HOMEWORK

- List down physical and chemical changes in daily life.

Lesson 2

Pages 73-75

OBJECTIVE

- To understand that oxygen is needed for combustion, rusting and tarnishing.

LEARNING OUTCOMES

The students should be able to:

- Recognise that oxygen is needed for combustion, rusting and tarnishing.
- Explore methods of preventing rusting.

START (15 min)

Draw a combustion triangle on the board to show the things that are essential for a fire to burn. Explain different components essential for combustion.

MAIN (15 min)

Read Pages 73-75

- When a fuel burns, it reacts with oxygen in the air and produces heat and light energy. The fuel becomes oxidized, forming an oxide.
- Explain the process during burning, hydrogen and carbon combine with oxygen to form carbon dioxide and water.
- Write equation of burning on the board.
- Discuss a metal corrodes whenever a chemical such as water, air (oxygen), or acid attacks its surface. Show rusted iron objects

- Write equation of rusting on the board.
- Explain the process of tarnishing is a layer of decolouration caused by oxidation of metal
- Write equation of tarnishing on the board.
- Worksheet 1-5

PLENARY (15 min)

- Ask students to write equations on the board and do practice.
- Test yourself page 74 of the student book.

HOMEWORK

- Draw and colour fire triangle in the notebook.

Lesson 5–3

Pages 76-77

OBJECTIVE

- relate uses of materials to their chemical properties and physical properties.

LEARNING OUTCOMES

The students should be able to:

- Relate uses of materials to their chemical properties (e.g. tendency to rust, flammability).
- Relate uses of materials to their physical properties (e.g. melting point, boiling point).

START (15 min)

Ask students about matters and different states of matter. Discuss that matter has mass and occupies volume. Ask students to list down names of solid, liquid and gases.

MAIN (15 min)

- Read Pages 76-77 and show pictures to the students.
- Explain that all physical structures are made up of metals.
- Discuss that metals can be prevented from corroding by being given a coating which protects them against water and chemicals in the air.
- Explain that taps are coated with a layer of chromium which is very resistant to corrosion.
- Discuss that Chromium does not oxidise in the presence of water.
- Explain the process of oiling or greasing. Oil or grease not only helps lubricate this bicycle chain but also prevents it from rusting.
- Explain that paint is used to prevent iron objects from rusting.
- Show pictures of fertilisers calcium carbonate is added to acidic soil to increase its pH and make it more alkaline.

PLENARY (15 min)

- Discuss that matter takes on different forms depending upon how atoms and molecules are arranged. These are called 'states of matter' – solids, liquids and gases.
- Test yourself page 76 and 77 of the student book.

HOMEWORK

- Write differences between physical and chemical changes.
- Exercise questions 4 and 5 page 80 and 81 of the student book.

Lesson 5–4

Page 78

OBJECTIVE

- To understand the impact of combustion reaction on environment.

LEARNING OUTCOME

The students should be able to:

- Evaluate impact of combustion reaction on environment.

START (15 min)

Show poster of carbon cycle and oxygen cycle and discuss carbon dioxide acts like the glass in a greenhouse, trapping the Sun's heat and causing the temperature of the Earth to rise.

MAIN (15 min)

Read Page 78

- Explain that the Burning petrol, diesel and coal produce carbon, sulphur and nitrogen oxides which are harmful gases.
- Discuss that these harmful gases go into the air and dissolve in rain to produce acid rain.

- Show different pictures and discuss acid rain harms plants.
- Explain that the acid rain affects aquatic animals and also damages stonework.

PLENARY (15 min)

Exercise questions 6 page 81 of the student book.

HOMEWORK

- Ideas for investigation page 82 of the student book.

Task 1

1. Find the definitions of a physical and a chemical change. Write them below.

   a. In a physical change _____

   _____

   b. In a chemical change _____

   _____

2. Which of the processes listed below are physical changes and which are chemical changes?

Process	physical change	chemical change
boiling water		
boiling an egg		
mixing iron powder and sulphur powder		
heating a mix of iron and sulphur powder		
setting off fireworks		
burning paper		
mixing salt and sand		
dissolving salt in water		
filtering a mixture of salt, sand, and water		
peeling, cutting , and mixing different fruits into a fruit salad		
mixing hydrogen gas and oxygen gas		
igniting a mixture of hydrogen gas and oxygen gas.		

Task 1

1. Read the following sentences and write in the correct column.

   a. One or more new substances are formed.

   b. The change is usually very easy to reverse.

   c. Water changes into steam.

   d. No new substances are formed.

   e. Metals such as silver tarnish easily.

   f. Energy is given out or taken in.

   g. A metal corrodes whenever acid attacks its surface.

   h. Energy is not always given out or taken in.

   i. The change is usually difficult to reverse.

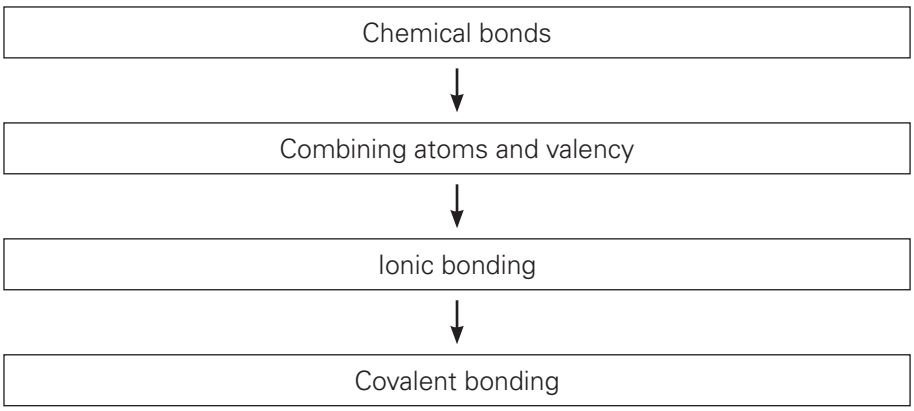
   j. Burning of fuel

Physical change	Chemical change

Chapter 6

Chemical Bonds

UNIT FLOW CHART



INTRODUCTION

A chemical bond is formed due to the reaction between atoms or ions that enables the formation of molecules and other structures. The bond is formed when opposite ions attract each other due to the electrostatic attraction or through the sharing of electrons by two atoms. Chemical compounds are formed when two or more atoms are chemically joined together by chemical bonds. Molecules are formed due to these bonds and these bonds are very strong.

Molecules of elements and compounds come in many different shapes and sizes and can be represented by atomic diagrams, models or a chemical formula.

Lesson 1

Pages 83-84

OBJECTIVE

- To explain how compounds are formed.

LEARNING OUTCOMES

The students should be able to:

- define valency and explain the formation of ions.
- identify the types and number of elements present in simple molecules and compounds.

START (10 min)

- Elicit students' prior knowledge about mixtures and compounds, and physical and chemical changes. Make sure that they understand that a new substance is made (with different properties) when a chemical change takes place. It is likely that some students remember that water is H_2O. They may remember that H is hydrogen – a flammable gas, and that O is oxygen – a gas that is needed for combustion. Together they form water, a liquid which, ironically, can be used to put out fires.

MAIN (20 min)

- Please ensure that students have read pages 83-84.
- Explain by using coloured chalks/ markers in dot and cross diagrams how magnesium and oxygen atoms share electrons to complete their octet and form covalent bonds. Mention the three types of covalent bonds with examples. Also explain how a formula is constructed.
- Learn the two types of compound.
- Learn to write word equations. Point out that some elements have the same name as their ion, while others do not.
- Look at the molecular formula of some compounds to see the number of atoms in each element. Students may need reminding that the number of atoms is indicated behind the chemical symbol of the element.
- explain the formation of cation and anion.

PLENARY (15 min)

Draw structures to show what type of bonds there are within:

a. an oxygen molecule.

b. a nitrogen molecule.

c. a hydrogen molecule

HOMEWORK

- Make models of the following using play dough:

  a. an oxygen molecule.

  b. a nitrogen molecule.

  c. a hydrogen molecule

Lesson 2

Pages 85

OBJECTIVE

- To learn and practice writing chemical formulae.

LEARNING OUTCOME

The students should be able to:

- write chemical formulae on the basis of valency of the constituent elements. such as H_2O, NaCl, NH_3 , CO_2 , CO, etc.

START (15 min)

Ask students to observe the numbers written in subscript in different compounds. Ask them to think logically what do these numbers show.

MAIN (20 min)

- Read page 85 and explain the concept of valency.
- Explain the swap method to write the chemical formula.

PLENARY (10 min)

Answer Q3 on page 91 of student book

HOMEWORK

- Answer questions of Test Yourself page 86 in notebooks.

Lesson 3

Pages 86-87

OBJECTIVE

- To understand chemical bonds.

LEARNING OUTCOMES

- Recognize that a chemical bond results from the attraction between atoms in a compound and that the atoms' electrons are involved in this bonding.

START (15 min)

- Draw the atomic structure of sodium and chlorine on board.
- Remind students that in order to be more stable atoms need to fill their valence shells.
- Ask students to come up with the ways to fill up the valence shells of sodium and chlorine.

MAIN (20 min)

- Explain chemical bonding with the help of textbook.
- Show the following video to further enforce the topic:

  https://www.youtube.com/watch?v=g-tE6MN-wrE

PLENARY (10 min)

Do Test Yourself Page 87 and 89.

HOMEWORK

- Do Q6 on page 92 of student book.

Task 1

1. Answer the questions below from the given periodic table chart:

I	II					VI	VIII	
		1 H+						1 He
3 Li^{+}	4 Be^{2+}		5	6	7 N3-	O^{2-}	9 F^{-}	10 Ne
Na^{+}	Mg^{2+}		13 Al^{3}	14	15	16 S^{2-}	1 Cl^{-}	18 Ar
19 K^{+}	20 Ca^{2+}							

i. Name any two ions with positive charge.

_____

ii. Name any two ions with negative charge.

_____

iii. What are the differences between an atom and an ion?

_____

iv. Explain the term cations with examples.

_____

v. Explain the term anions with examples.

_____

vi. Which group contains atoms which gain only one electron?

_____

vii. Why does the last group have no ions?

_____

viii. Which group contains only one electron in the outer-most shell?

_____

Task 1

Chemical reactions take place between elements forming a compound.

Write the name of each type below and give a brief description of it.

_____

Both types of compound are formed in a chemical reaction. In a chemical reaction, one or more reactants undergo a chemical change and become one or more products. Use these words equation show how chemists record a chemical reaction. This is called a chemical word equation.

a. Magnesium+ sulphur $\longrightarrow$

_____

b. sodium + chlorine $\longrightarrow$

_____

c. hydrogen + oxygen $\longrightarrow$

_____

Sometimes the element and the ion have the same name, sometimes not.

d. From the above example, which two elements have the same name as their ions?

_____

e. Which two elements have slightly different names from their ions? Write the name of the element and then the name of the ion.

_____

You have seen that sodium chloride has the molecular formula NaCl. This means that one atom of sodium reacts with one atom of chlorine to form one molecule of the compound sodium chloride. In a reaction, it is possible that one atom of an element reacts with two atoms of another element. An example is water. Answer the following questions pertaining to the formation of water molecules.

a. Which elements are the reactants?

_____

b Which compound is the product?

_____

c. How many atoms of hydrogen are involved?

_____

d. How many atoms of oxygen are involved?

_____

e. How many molecules of water are formed?

_____

f. Write all this as a chemical word equation.

_____

Task 1

Sometimes, the name of a compound tells you which elements and even how many there are in one molecule. An example would be carbon dioxide which is CO_2: one carbon and two oxygen. This is not always the case, such as in water. CO_2 is called the molecular formula of carbon dioxide.

a. What is the molecular formula of water? If you need help, have a look at page 43 of your Student Book.

_____

Some compounds are made of more than two elements. The molecular formula of baking soda is $NaHCO_3$.

b. List all elements found in baking soda. Give their chemical symbol followed by their name.

symbol	name

c. Only one element has more than one atom in a molecule of baking soda. Which element is this and how many atoms are there?

_____

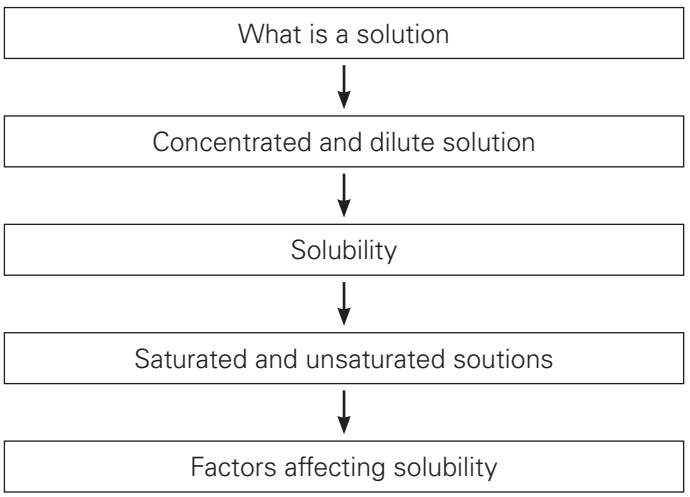
d. Sodium sulphate has the molecular formula Na_2SO_4. For each element in this compound, write the chemical symbol, the name, and the number of atoms involved.

symbol	name	how many atoms?

Chapter

7 Solutions

UNIT FLOW CHART



INTRODUCTION

We know that a material can be a solid, a liquid, or a gas. But materials in the same state, or in different states, are often mixed together. One special kind of mixture of two or more materials is called a 'solution'. The most common type of solution is made by dissolving a solid in a liquid.

If we put sugar in lemonade, we make a solution. Perhaps you have sprayed a solution on plants to keep them from being eaten by insects. Solutions are so important in our body that we cannot stay alive without them. We cannot use the air that we breathe or the food that we eat until they are in our blood in solution.

This unit really requires students to get involved in some hands-on experiments. Please avoid teaching this only theoretically or as demonstrations or videos. It is easy to let students carry out experiments and requires very few resources. The experiments are described in the Student book. The worksheets only include one very simple experiment which requires no lab equipment, but even for this an interactive site provides a virtual alternative.

Lesson 1

Pages 93-95

OBJECTIVE

- To build on work done on solids, liquids, and gases, and extend previous experiences of separating mixtures

LEARNING OUTCOMES

Students should be able to:

- define solubility.
- recognise that the amount of solute which dissolves in a given solvent has an upper limit at a given temperature.

START (10 min)

It would be useful to revise the particle model and use it to quickly go over the three states, the changes between the states (melting, evaporating, etc), and elements, atoms, compounds, molecules, and mixtures. Read pages 164 and 165 from the Student book. Some of the terms in worksheet 1-7 can be defined after reading this section, others will be done as you go through the material.

MAIN (25 min)

Read Pages 93-95

- Explain the difference that a substance that dissolves is said to be soluble. One which will not dissolve is insoluble.
- Demonstrate the process of solution formation (using water as universal solvent).
- Distinguish among solute, solvent and solution.
- Dissolve some sugar crystals and explain what happens when a sugar crystal is dissolved in water.
- Explain that aquatic animals survive by using oxygen dissolved in the water.
- Differentiate between solution and suspension.

PLENARY (15 min)

- It might be useful to revisit the concept of physical and chemical changes. Making a solution is a physical process.
- Test yourself pages 95 of the student book.
- Help students to solve Work sheet 1-7.

HOMEWORK

- Write names of five different solutions used in daily life and mention solute and solvent in them.

Lesson 2

Page 95-96

OBJECTIVE

- Define solubility and explain what is meant by a concentrated and dilute solution.

LEARNING OUTCOMES

Student should be able to

- Define solubility.
- Explain concentrated and dilute solution.

START (15 min)

Bring some food colour and two glasses of water. Add two drops in one glass to give it a lighter colour and add 5-6 drops in the other one. Ask students about why do they look different.

MAIN (30 min)

- Explain students that the one which is darker in colour is actually concentrated solution as it has more solute than the other glass.
- Add a lot of food colouring so that the colour of solution does not change even if u add more food colour.
- Explain solubility, saturated and unsaturated solution with the help of above demonstration.
- Read pages 95-96.

PLENARY

Do Test Yourself on page 96 of student book.

HOMEWORK

- Do Q4 and 5 on page 102 of student book.

Lesson 3

OBJECTIVE

- To explain the factors effecting the solubility.

LEARNING OUTCOMES

Students should be able to:

- Identify the factors which affect the solubility of a solute in a solvent and recognise the importance of these factors in homes and industries.
- Explain what is meant by a concentrated and dilute solution.
- Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e. increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving).

START (5 min)

Today's experiments investigate the following research question: How does temperature affect the time it takes for a set amount of solute to dissolve in a constant volume of solvent? Briefly discuss with students what they expect the answer to be. Make sure you do not accept just blind guesses—they have to explain their reasons for their expectations. You can choose one of the two experiments below or do the bunties experiment in class and ask students to do the virtual lab at home.

MAIN (30 min)

- Hands on experiment: This experiment requires clear plastic cups, water (cold, room temperature, hot) and bunties (every colour except brown). Please make sure students do not eat the bunties. Eating in the lab and/or eating materials meant for science experiments is potentially unsafe. Depending on your students, you could allow them to pour the water or you can give them the filled cups. You could put the different temperatures in thermos flasks (add ice cubes to the cold water). The 'hot' water should not exceed 50°C—some may be spilled and you do not want anyone to get scolded. You may ask your students to take pictures of the bunties after they have been in the water for one minute, or you may take pictures yourself when you try this experiment. They would help when you are discussing the results.
- Discuss the constant and variable and plot a graph on the board.
- Discuss the factors affecting the speeding up the dissolving process.
- Explain that stirring a spoonful of sugar into a hot drink will speed up the time it takes for the sugar to dissolve.
- Differentiate that dissolving sugar in hot drink, is a lot lot quicker than if you add the same amount of sugar to the same volume of cold drink.
- Explain that it takes longer for a sugar cube to dissolve in a hot drink than it does for a spoonful of granulated (crushed) sugar.

VIRTUAL LAB

http://www.learningliftoff.com/high-school-sciencelearning-activity-solubility-experiment/#.WcyXtul03rd This interactive site allows your students to model the activity of dissolving salt in a given amount of water at selected temperatures. The site will also plot the data for the students, but you could have two students paired up to do this: one to drop the salt in the water and the other to clock the time. This way, they could draw their own graph with numbers. (The graph on the site has no numbers.) (Again, this uses Flash, so Chrome will not work. Internet Explorer works well).

PLENARY

Compare students' expectations from the beginning of the lessons with their findings during the (virtual) lab. Did they match? If not, why not? In general, ask students to name one thing they learned in today's lesson.

Help students to solve Work sheet 2-7

Test yourself pages 97 of the student book.

HOMEWORK

- Exercise page 102, Question 3 and 4

Lesson 4

Page 99-100

OBJECTIVE

- To understand the importance of solubility.

LEARNING OUTCOMES

Students will be able to

- Identify the factors which affect the solubility of a solute in a solvent and recognize the importance of these factors in homes and industries.

START (15 min)

Ask students to think of the ways by which solubility is useful in their daily life.

MAIN (15 min)

- Read pages 99-100 to give more examples.

PLENARY (15 min)

Ask about the most interesting application of solubility they have learnt so far.

HOMEWORK

- Do Test Yourself on page 100 of student book.

Lesson 5

Page 104

OBJECTIVE

- To explore the use of solution in daily life.

LEARNING OUTCOME

The students should be able to:

- make rock candy with sugar using crystal seeding technique. (STEAM)

START (15 min)

Materials required: granulated sugar (sucrose), water, food colouring, food flavourings e.g. lemon, orange, strawberry, cherry, cup, small saucepan, wooden spoon, wooden skewers, clothes pegs (clothespins), tall glass jars or drinking glasses, plastic film.

MAIN (15 min)

Read page 104

- Discuss that solute can be separated from the solution by physical method.
- Discuss how salt is obtained from sea water and show pictures or videos.
- Discuss the precautions needed to perform this experiment.
- Make group of students according to your class strength.
- Ask students to perform the experiment and supervise the students.

PLENARY (15 min)

Ask students to compare the crystals obtained by their group and write conclusion in their notebooks.

HOMEWORK

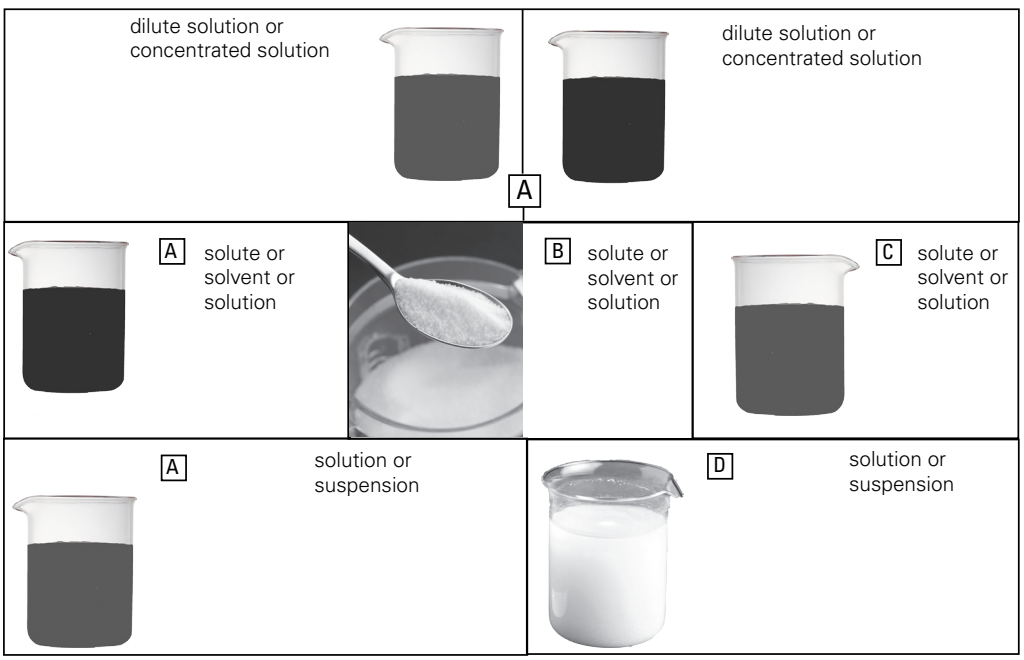
- Exercise page 103, Question 6

1 It is important to have an accurate understanding of the scientific terms used in this unit. Write the appropriate term with each definition.

Solvent, saturated solution, solute, dilute solution, insoluble, solution, soluble, suspension

Definition	Term
the solid which does not go through the filter paper	
a substance which will dissolve	
the liquid which passes through the filter paper	
a mixture of an insoluble solid and a liquid where small particles float around in the liquid	
a mixture of a liquid and a solid	
when the maximum amount of solute is dissolved in the solvent	
a substance which will not dissolve	
the liquid in which a solute is dissolved	
the solid which is dissolved in a solvent	
when less than the maximum amount of solute is dissolved in the solvent	

2. Select the correct option for each picture. Cross out the ones which are not correct.



i. If you drop a buntie into water, some of the colour on the outside of the buntie will dissolve. Does the temperature affect this? If you wanted to find this out, what are your variables?

a. independent variable (= the one you decide to change) _____

_____

b. dependent variable (= the one you measure) _____

_____

c. controlled variable (= the ones you need to keep the same) _____

_____

Prepare three pieces of paper with 'cold', 'room temperature' and 'hot' written on them and put them side by side on the table/desk.

Put three clear plastic cups next to each other on the sheets of papers. Use a ruler and a waterproof marker to mark a line on the cups, 3 cm from the bottom. (Your teacher may tell you to change this, depending on the cups you use).

Put three bunties of the same colour (not brown) on your table/bench.

One lab partner should hold the cup, the other can pour the water.

Pour cold water into the cup on the paper marked 'cold', up to the mark.

Pour room temperature water into the cup on the paper marked 'room temperature' , up to the mark.

Pour hot water into the cup on the paper marked 'hot', up to the mark.

Drop one buntie in each cup. Try to do them at the same time and start the stopwatch.

After one minute, observe how much of the colour is still on the bunties and how much of the chocolate is visible.

Describe and/or draw what your observations:

cold water	room temperature water	hot water

1. Does the temperature affect the speed with which the colour of the buntie dissolves? YES / NO

2. How do you know this? _____

_____

3. Using the particle model, what happens when any solute dissolves in a solvent? _____

_____

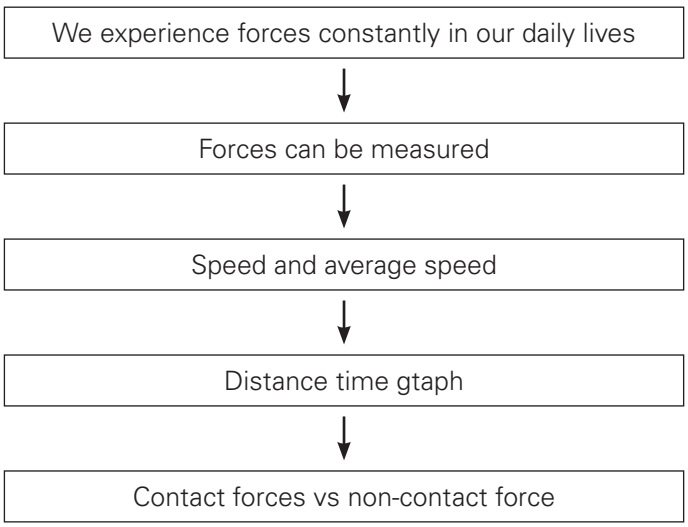
4. Why could temperature affect the speed of this process? _____

_____

Chapter

8 Force and Motion

UNIT FLOW CHART



INTRODUCTION

We should consider that forces cannot be seen and this may lead to incorrect assumptions, such as that an object will stop by itself unless a force continues to move it.

This topic will introduce an idea about the measurement of force. Forces are measured in units called newtons (N). These are named after the famous scientist, Sir Isaac Newton.

As with other sections, please attempt to allow students to engage in experiments and hands-on activities as this is the basis of an inquiry-based subject such as science. It also provides opportunities for co-teaching with an IT colleague and showing that subjects do not exist in isolation.

Lesson 1

Pages 106 and 107

OBJECTIVE

- To build the concept of force and measurement of force.

LEARNING OUTCOMES

After this lesson, students should be able to:

- describe the effect of force on changing the speed and direction of motion with time.
- define and state the SI unit of force.

START (10 min)

- Ask a student to push a book across the table, another to hold a pencil above the table, and someone to crumple up a piece of paper.
- Imagine that the book was made of a special material and weighed 1000 kg and the student wanted to push it, what would need to be different? What if the pencil weighed 1000 kg? What if the paper were a sheet of steel? In the discussion, the concept of 'force' will come up. So ask what a force is? Can forces be seen? Then, how do we know they exist?
- Forces cannot be seen but their effects are visible; e.g., the book is in a different position, the paper is crumpled, and the pencil did NOT fall down.
- Ask students to write examples of forces on a sheet of paper to display on the wall.

MAIN (20 min)

Read page 106 and 107

- Ask students how they would portray the concept 'force'. They can either draw it or act it, but no written or spoken words. This should lead to the conclusion that 'a force is a push or a pull'. Add this sentence as a heading to the examples of forces displayed on the wall.
- Explain that the Forces cannot be seen—but their results can be seen.
- Discuss that the Forces can be represented by arrows since they have a direction and a magnitude (i.e. the length of the arrow represents how strong the force is).
- Ask students to perform different types of forces and see their results.
- Perform in the class and explain when a moving cricket ball is hit by a bat, off in the direction it is kicked, a force is produced that can cause a stationary object to start moving.
- Ask students to kick a stationary ball and explain force can cause a moving object to decease speed.
- Show a force meter and explain Force can be measured by a force meter, also known as a spring balance. Ask students to measure the force using force meter.

PLENARY (15 min)

A lot of things were covered in this worksheet. Ask students to list them, summarize what they learned, and ask for clarification or pose additional questions. This could be done in a plenary session.

Test yourself page 108

HOMEWORK

- Draw a force meter in notebooks.
- Paste pictures in the notebooks showing different forces.

Lesson 2

Page 108 and 109

OBJECTIVE

- To calculate the speed and average speed.

LEARNING OUTCOMES

The students should be able to:

- formulate the relationship between speed, distance, and time.
- state SI (System International) unit of speed.
- calculate average speed.

START (15 min)

Ask two students to run from one side to another side of the class and note down the time using a stop watch.

MAIN (15 min)

- Ask students to read Page 108 and 109
- Explain that the Speed is a measure of how fast an object is moving.

- Write the formula of the average speed on the board and explain the units.
- Explain that the average speed of an object can be calculated if you know the distance travelled in metres (m) and the time taken in seconds (s).
- Discuss that the SI (System International) unit for speed is metres per second (m/s).
- Solve few examples on the board.
- Worksheet 1-8

PLENARY (10 min)

Test yourself page 109

HOMEWORK

- Ideas for investigation page 119

Lesson 3

Pages 110-11

OBJECTIVE

- To plot a distance-time graph

LEARNING OUTCOME

The students should be able to:

- interpret a distance-time graph.

START (15 min)

Show a graph paper and discuss the variables and constants. Ask students to draw axis on the graph. The horizontal axis of a distance-time graph is the time taken to travel from the start. The vertical axis is the distance travelled from the start.

MAIN (15 min)

Read pages 110-11

- Explain that the distance-time graph tells you how far something travels over a period of time and whether or not its speed is changing.
- Draw and explain different graphs on the board and ask students to differentiate the graphs
- Worksheet 2-8.

PLENARY (10 min)

Test yourself page 112

HOMEWORK

- Exercise question 3 and 4 page 117

Lesson 4

OBJECTIVE

- To differentiate the contact forces and non-contact forces

LEARNING OUTCOMES

The students should be able to:

- give examples of contact forces and non-contact forces.
- demonstrate that forces always work in action and reaction pairs (equal in magnitude, opposite in direction).

START (15 min)

Ask a student to do as directed and note the changes:

- bend a metal scale
- rub your hands
- compress the spring in ball point
- pull some pins with magnet

MAIN (15 min)

- Ask students to read and see illustrations on page 113-115
- Explain that contact forces are forces that act between two objects that are physically touching each other.
- Discuss about Non-contact forces. These are forces between two objects that are physically separated from each other – they are not touching.
- Ask students to differentiate contact forces and non-contact forces.
- Explain that every action has a reaction.
- Forces can be represented by arrows since they have a direction and a magnitude (i.e. the length of the arrow represents how strong the force is).
- Ensure students understand that more than one force can act on an object at the same time and that balanced forces (equal but in opposite directions) cancel each other. Gravity is one type of force. If you wish, you can provide additional information about Newton and/or his work leading to his law about gravity. Information is easily available on the internet.
- Worksheet 3-8.

PLENARY (5 min)

Ask students to list them, summarize what they

learned, and ask for clarification or pose additional questions. This could be done in a plenary session.
Worksheet 4-8

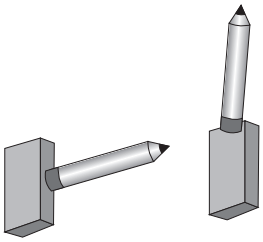
HOMEWORK

- Exercise questions 5 and 6 page 118

Exercise questions 5 and 6 page 118

1. You cannot see a force, but you can see the result of a force. A force can change the direction or the speed of an object, or it can change its shape.

   Place an eraser on your table. With a pencil, push the eraser as shown in the pictures.



a. Which way does the eraser move?

_____

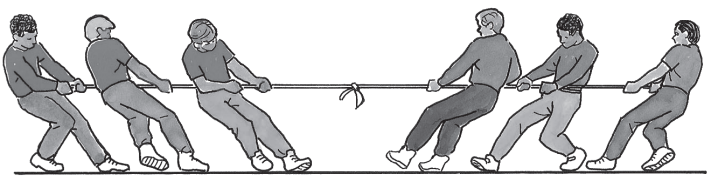
b. Consider what would happen if you give the eraser a light push? What would happen if you give it a harder push?

_____

c. Look at what you wrote above and complete the conclusion about a force. A force has a _____ and a _____.

   This is the reason that forces are often drawn as arrows. The direction of the arrow indicates the direction of the force and the size of the arrow shows the magnitude (= strength) of the force.

2. Consider the picture below.

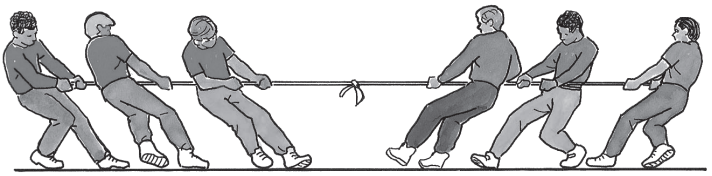


a. In words, describe what is happening. Use words like 'force' and 'pull'.

_____

b. If both teams are equally strong, what happens to the handkerchief tied to the middle of the rope?

_____



c. If both teams stop pulling, will there be a difference to what happens to the position of the handkerchief?

_____

d. We started this worksheet by saying that a force can change the direction or speed of an object or it can change its shape. Did the handkerchief change speed or direction or did its shape change?

_____

So, even though two teams were putting in a lot of effort, as the forces they generated were equal in size but opposite in direction, they cancelled each other out. These are called balanced forces.

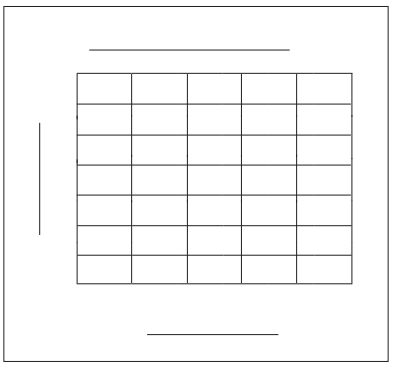
Elastics are all materials that will become longer (or shorter) when a force acts upon them, but will return to their original shape when the force is no longer applied. We are mainly thinking of elastic bands and springs for use in the lab, but outside the lab, diving boards and bows (to shoot arrows) are also good examples.

1. A student has carried out an experiment where she put different masses on a spring and measured the length of the spring.

   She obtained the following results:

mass in g	length in mm
0	20
10	25
20	30
30	35
40	41
50	50

a. Plot a graph of the length of the spring vs the force. First calculate the force put on the spring when these masses are attached.



You will need to decide the following:

mass in g	force in N	length in mm
0		20
10		25
20		30
30		35
40		41
50		50

b. What is the dependent variable (the one that is measured)? This goes on the Y axis.

_____

c. What is the independent variable (the one which the student changed)? This goes on the X axis.

_____

1. Forces are an inevitable part of our daily lives. When you make use of a bridge, you are benefitting from the knowledge about forces which the engineer used to design the bridge. Maybe the simplest bridge is a piece of wood, supported on either end.

Answer these questions.

a. Describe what happens to a wooden plank bridge when a person walks over it?

_____

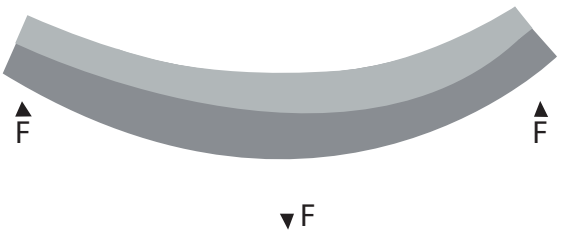
b. How much force would you estimate the person puts on the plank? Explain your reasons.

_____

c. What would happen if a second person joined him/her on this plank? What if we kept adding people?

_____

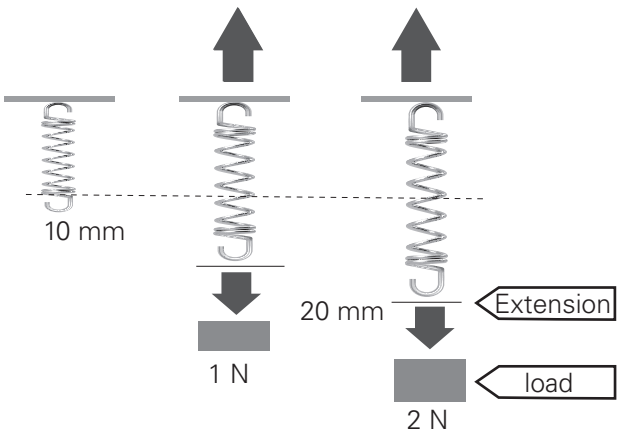
This picture shows how the plank would bend, when a force acts on it.



In many places, students compete to build the strongest bridge from uncooked spaghetti. They use different structures and the record is that a bridge built from less than 1 kg of spaghetti could hold 4660 N of force before it broke. If you are interested, look up more information on the internet and/or organize your own spaghetti bridge competition.

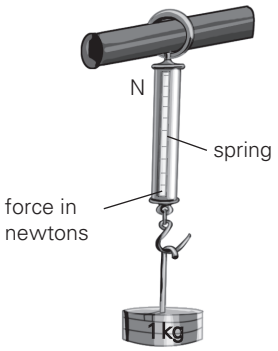
2. Springs will also change shape when a force acts on them. If you pull a spring, or put a weight on it, it will extend. However, it will return to its original shape when the force is removed.

   This happens in a predictable way; i.e., if you put a certain weight on a specific spring, it will extend by a certain length. If you repeat it the next day with the same spring and weight, you will find the same length of extension.



http://www.schoolphysics.co.uk/age11-14/Matter/text/Stretching_things/index.html

So spring is used in force meters or Newton meters. Newton meters have a spring inside which extends a certain length with a certain weight.



a. Why would there have to be different meters for different maximum masses?

_____

b. What would happen if you put too much force on the Newton meter, e.g., if you attach a mass of 50 kg to a meter designed for 250 g or less?

_____

c. What would happen if you put a mass of 10 g on a meter designed for 5 kg?

_____

1. Friction costs us a lot of energy, both from our legs on the bike and from the fuel in the car. It is mainly found between the tyres and the road.

a. Have a look at the tyres of the racing bicycles crossing the finish line. What do you notice about the tyres?

_____

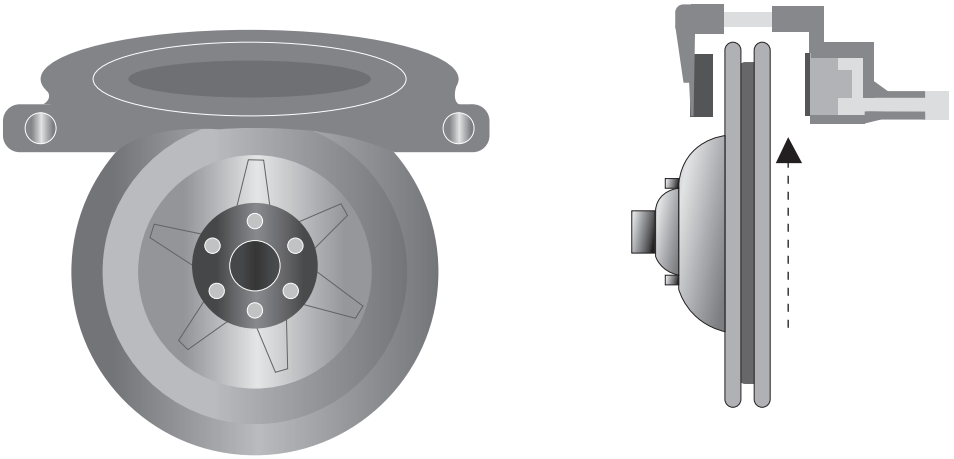
b. What do you notice about the tyres on this bicycle?

_____

2. We need friction!

Not only polar bears find it difficult to walk on ice. We all risk falling over on a surface with little friction. Countries with winter frost spend a lot of money trying to keep ice off their roads because cars slip on ice and this results in serious accidents.

When you look closely at the wheels of some cars, you can see a coloured part. These are the car's brakes. As you know, you want your car to move, but it also needs to slow down. For this, a car has brakes. But how do they work?



The part indicated by the arrow can move to the left so that is is pressed firmly against the circular metal part of the wheel. This happens when the driver of the car pushes down the brake pedal.

a. What happens to the friction on the wheel when the movable part of the brake is pushed hard against the metal part of the wheel?

_____

b. What would be the result on the speed of the car?

_____

c. Put your hands together. Rub them for a few seconds with a verylittle force. What do you feel?

_____

d. Repeat the action, but this time, press your hands together quite strongly. What do you feel now?

_____

e. If you were to put some oil on your hands and repeat the last action, would you feel the same?

_____

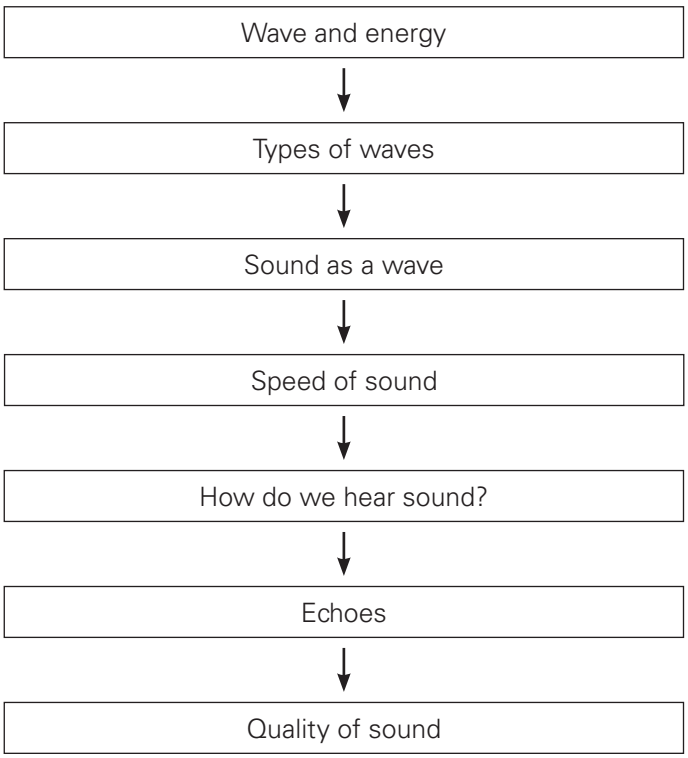
f. When cars go to a garage for maintenance, the mechanics will ensure parts of the engine are oiled sufficiently. However, they will never oil the brakes. Why not?

_____

Chapter

9 Waves and Energy

UNIT FLOW CHART



INTRODUCTION

For most people, seeing is more important than hearing. Blind people need more help to function in our world than deaf people, but sound might be more important to us than we realize. You may have a student who has trouble seeing or hearing, or you could invite a blind person and a deaf person to talk about how they experience life.

You could ask students about situations where sound is important. For example, an ambulance has a siren so we know it is coming before we see it. Music is very important in our lives and some people spend a lot of time learning how to play an instrument. The person who wins a gold medal at the Olympics often becomes emotional when his/her national anthem is played, and most of us are able to recognize the voices of those closest to us.

In this chapter, we look at how sound is produced, how it travels, and how we hear it. We also look at the amplitude and frequency of different sounds .

Lesson 1

Pages 120-123

OBJECTIVE

- To analyse different types of waves.

LEARNING OUTCOMES

The students should be able to:

- define a wave.
- compare the types of waves (mechanical and electromagnetic) with daily life examples.
- distinguish between longitudinal and transverse waves.
- identify: (1) water wave and sound wave as mechanical wave; (2) light wave as electromagnetic wave.
- define the terms: wavelength, frequency, and time period of wave.

START (15 min)

Drop a stone in a trough filled with water and ask students to observe the waves formed in the trough. Give a chance to the students to make and observe waves in the trough.

MAIN (15 min)

Read pages 120-123

- Differentiate the mechanical and Electromagnetic waves and draw the diagram on the board.
- Differentiate the Transverse waves and Longitudinal waves.
- Explain the term time period that is the time between one wave and the next.
- Explain the wave equation that is the relationship between the speed, frequency, and wavelength.

PLENARY (10 min)

Ask students to draw a labelled diagram of a wave.

Test yourself page 123 of the students' book.

HOMEWORK

- Draw different types of waves.

Lesson 2

Pages 124 and 125

OBJECTIVE

- To extend knowledge of sound and hearing by introducing the concepts of frequency and amplitude.

LEARNING OUTCOMES

The students should be able to:

- define the terms: wavelength, frequency, and time period of wave.
- define and relate: pitch and frequency. amplitude and frequency.
- explain the factors affecting pitch and loudness of sound.

START (10 min)

Show the students a tuning fork and strike it on a rubber pad. Bring it near to the students to listen. What is produced? Why is it produced? Name other things which produce sound. Strike the tuning fork again and place the end of the tuning fork gently on a window pane. This will increase the volume of the sound. Discuss why this happens. (The tuning fork will make the window pane vibrate. This much larger surface will cause the vibration of more air molecules, so it will be easier to hear. If a student puts his/her hand on the window, the vibrations, and therefore the sound, will stop.)

MAIN (20 min)

Read pages 124 and 125

- Ask students to speak loudly or sing a song. Keep a finger on their throat, what do they feel?
- Draw a wave on the board and lable the Crest, Trough, Amplitude, Wavelength, Frequency.
- Define each term related to the waves.
- Use a diagram to explain how sound energy travels in the form of sound waves by compression and rarefaction.
- Search video with these keywords: "sound waves, compression, rarefaction," and select an appropriate video to be shown to the students.

PLENARY (15 min)

Investigation 1 and 2 from page 133 can be conducted in class.

Worksheet 1-9

Test yourself page 125

HOMEWORK

- Exercise question 4 page 132

Lesson 3

Pages 126 -127

OBJECTIVE

- To extend knowledge about electrical circuits and use the concepts of electric current and energy transfer to explain how electrical devices work.

LEARNING OUTCOMES

The students should be able to:

- relate common phenomenon (e.g. echo, hearing thunder after seeing lightning) to the properties of sound.
- explain that sound needs a medium to travel through and that it travels at different speeds through different media.

START (10 minutes)

Revise the previous lesson. Focus on the fact that sound requires particles in a medium to vibrate. Sound does not travel in a vacuum but can travel through gas (e.g. air), liquids, and solids. The vibrations of one particle are passed on to another, maybe a similar particle, maybe very different.

MAIN (25 min)

- Get some help from either the music department or a technician for this activity. Connect a large loudspeaker to a computer or a musical instrument. If necessary, remove the cover so the diaphragm (or cone) of the speaker can be seen.
- Play different sounds and ask students to observe the loudspeaker. They should be able to see the vibrations of the diaphragm. It may be possible to see that a lowpitched sound produces slower vibrations than a very high-pitched sound. Now that they have "seen" that sound is vibration and that vibrations are passed on from the diaphragm to the air (and to their ears), they can apply this knowledge in building their own telephone.
- Students can make a "telephone" using two cans with a hole in the bottom and a length of string between them. When one student speaks, the can will vibrate. The vibrations are passed along the string to the other can which will vibrate, and the other student will hear what is said.
- The string must be taut, not hanging down, for the best results.
- Remind them of the following: in order to hear an echo, the sound has to travel from the person/object making the sound to the surface which reflects the sound and back to the person/object. This means that the distance travelled by the sound is twice the distance between the person/object and the reflecting surface.
- Ask students to complete Worksheet 2-9.

PLENARY (10 minutes)

A ship on the surface of the water sends a signal and receives an echo after 5 seconds from a submarine under the water. Calculate the distance of the submarine from the ship. (Speed of sound in water is 1450 m/s).

Worksheet 2-9

Test yourself page 128

HOMEWORK

- Exercise question 5 page 132
- Investigation 3 from page 133.

Lesson 4

Page 128-130

OBJECTIVE

- To extend knowledge of sound and hearing by introducing the concepts of frequency and amplitude.

LEARNING OUTCOMES

Student should be able to:

- Compare and interpret waveforms in terms of pitch and loudness.
- construct the inverse relation between time period and frequency.

START (10 minutes)

Ask students to hum a tune. If you wish, you can use a tuning fork. Asking them to hum (rather than sing) is likely to keep the volume down. If you asked them to hum again but change something, what could they change? (pitch or amplitude, i.e. they could

hum higher or lower and/or they could hum more or less loudly.)

MAIN (20 minutes)

Read pages 128-130

- Explain that the loudness of a sound depends on the height of the sound waves, called amplitude.
- Discuss that the greater the amplitude, the louder the sound.
- Explain that sound can be measured in decibels (dB).
- Differentiate between frequency and amplitude.
- Explain that the amplitude increases but wavelength and frequency stay the same.
- Discuss that frequency increases but wavelength and amplitude stay the same.

PLENARY (15 minutes)

Ask the students to recall all the definitions of the terms used in the chapter and discuss them in pairs.

Ask the students to differentiate between frequency and amplitude.

Worksheet 3-9

HOMEWORK

- Exercise questions 6 page 132.

Task 1

1. How is sound produced?

_____

_____

2. What is noise pollution?

_____

_____

3. How can noise level be measured?

_____

_____

4. Write down the noise level of the following:

   a whisper

   a washing machine

   an aeroplane taking off

   a rock concert

Task 2

Exposure to loud noises can cause permanent damage to your ears. Working with noisy equipment can cause damage after only a few hours or minutes, depending on the loudness. A large machine like a bulldozer will produce 85 dB when it just has its engine running without doing anything, enough to permanently damage your ears after one day. But also music from your telephone or sound system, either via earphones or a loudspeaker, can be up to 100 dB and may cause damage after as little as 15 minutes.

1. So if you enjoy music and want to continue to enjoy it, even when you are older, what should you do when going to a place with loud music?

_____

_____

2. What are the ways to control noise in our environment?

_____

_____

1. If a person is jogging on a track and covers a distance of 120m in 20 seconds, what is his/her speed?

_____

_____

2. If an aeroplane travels 432km in 6000 seconds, what is its speed in m/s?

_____

_____

3. If a car travels 900m in 30 seconds, how fast is it going?

_____

_____

4. An echo is heard 10 seconds after a sound is produced. Calculate how far away the reflecting surface is.

_____

_____

5. A boy standing in front of a cliff shouts and hears the sound back after 3 seconds. The cliff is 500m away from him. What is the speed of sound? Include your calculation.

_____

_____

6. What is the speed of sound in the air?

_____

_____

7. The speed of light (in air) is almost 300,000,000 m/s. If you see a flash of lightning and hear the clap of thunder 3 seconds later, how far away is the thunderstorm?

_____

_____

Task 1:

Match column A with Column B and write the correct letter in Column C.

Column A	Column B	Column C
1. hertz	a. region where molecules are closer together	
2. frequency	b. reflected sound	
3. compression	c. unit to measure loudness	
4. rarefaction	d. instrument to measure sound waves	
5. echo	e. height of sound waves	
6. amplitude	f. distance from one wave crest to another	
7. decibel	g. number of vibrations per second	
8. wave length	h. region where molecules spread out	
9. oscilloscope	i. unit of frequency	

Task 2

State whether the following statements are true or false.

High pitched sounds have a low frequency sound wave.

The wavelength of a high-pitched sound wave is shorter than the wavelength of a low pitched sound wave.

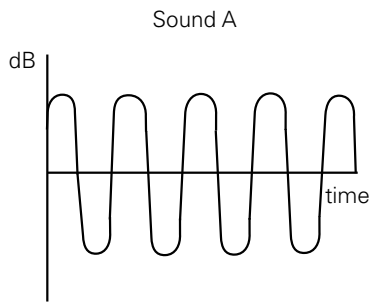
The faster the vibration, the higher the frequency.

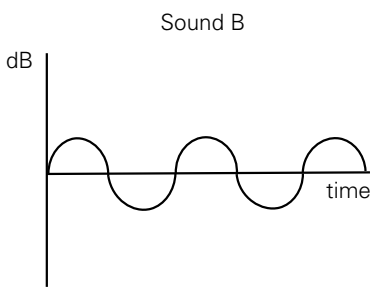
A loud sound carries higher energy than a low sound.

Sounds above 20000 Hz are called infra sounds.

Task 3

Look at the following diagrams of the waves of sounds A and B and answer the questions below. Both the X and Y axes of both graphs have the same scale.





i. Describe the differences you can see between sound A and sound B.

_____

_____

ii. What are the units of the Y-axis? What is being measured?

_____

_____

iii. Draw a two sided arrow on each graph showing the wavelength of the sound.

_____

_____

iv. Which sound has the shorter wavelength?

_____

_____

v. Which sound is louder? How do you know this?

_____

_____

vi. Which sound is higher pitched? How do you know this?

_____

_____

vii. Pitch is also described by a different word. What is this word and what are the units?

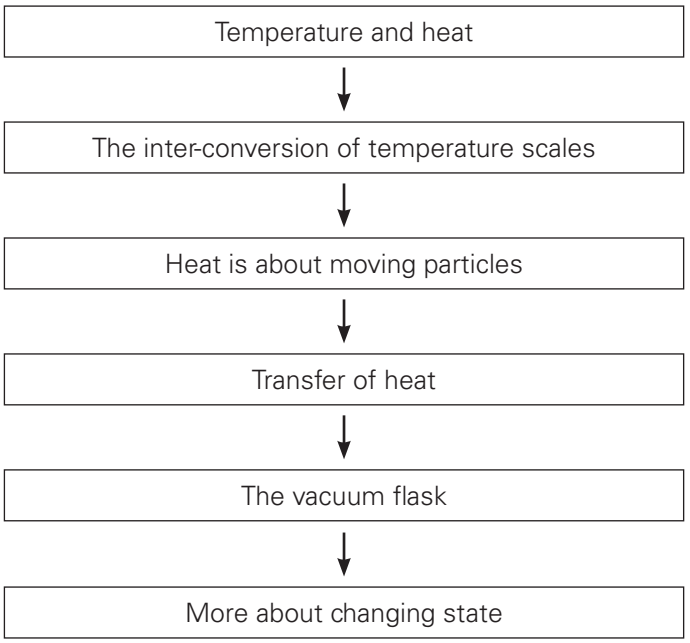
_____

_____

Chapter 10

Heat and Temperature

UNIT FLOW CHART



INTRODUCTION

The purpose of this chapter is that students should be able to understand the concepts of transfer of heat by three methods and can apply the knowledge attained, in daily life.

According to the kinetic theory, molecules move more quickly when a substance is heated. The energy from the heat source is transferred to the molecules as kinetic energy increases. At the same time, the temperature of the substance rises.

Temperature can be explained as a measure of the (average) kinetic energy of the molecules. A temperature scale gives us a simple way of comparing how hot objects are. The most commonly used temperature scale is the Celsius scale.

Lesson 1

pages 126 and 127

OBJECTIVE

- To explain the differences between heat and temperature.

LEARNING OUTCOMES

The students should be able to:

- define the terms heat and temperature on the basis of Kinetic Molecular Theory.
- compare all three scales of temperature (including inter-conversion of temperature scales).

START (10 min)

Ask students to hold the objects listed below:

- Something quite warm (but not hot enough to cause damage), e.g. a warm (but NOT hot) cup of tea • something cold, e.g. ice cubes • a good insulator, e.g. piece of Styrofoam
- A good conductor, e.g. metal spoon. Ask students to rank them from coldest to warmest. Inform the students about the temperature in the room and ask them to estimate the temperature of the items and record them on worksheet 1-10.
- Have four thermometers ready and put them with each object. You will see that the ice is indeed colder and the cup of tea, warmer than room temperature, but the spoon and Styrofoam are both the same, i.e. room temperature.

MAIN (30 min)

Read pages 134 and 135

- Explain the term heat that is the transfer of energy from a higher temperature object to a lower temperature object. It is measured in joules (J) or kilojoules (kJ).
- Explain the temperature at which the particles stop moving is called absolute zero. Absolute zero is the temperature at which a material has no heat energy. This temperature is –273.15 °C, usually rounded of as –273 °C, and 0 K.
- Explain the inter-conversion of temperature scales.
- Use Task 2 of worksheet 1-10 to revise the states of matter and the names of the changes of state.
- Ask students to copy the definitions of temperature and heat from the student book. This will help them understand and remember these definitions. Discuss what they mean and ask students to give examples.
- Task 4 will take some time and needs accuracy (possibly a calculator). Students should measure the distance between the given points on the temperature scales. Starting with Kelvin might be the easiest way. They then have to calculate how many millimetres represent a certain change in temperature and put in the requested temperatures. This task requires arithmetic and attention, a good ruler, and a sharp pencil. It will help the students understand that 1°C is the same temperature change as 1 K, but much greater than a change of 1°F. Ice melts and water boils at the same temperatures, regardless of the scale, but this temperature has a different value on each scale.

PLENARY (15 min)

In this lesson, students learned the difference between heat and temperature. Now ask students to describe the connection between these concepts. Answers are likely to include: "If you add heat to an object, the temperature increases." or "If objects are the same temperature, there is no transfer of heat." You can ask students to consider the three temperature scales they have studied. On each scale, how many degrees Fahrenheit, degrees Celsius, and Kelvin are between the melting point of ice and the boiling point of water?

Test yourself page 134 and 135

HOMEWORK

- Exercise question 4 on page 147.

Lesson 2

Page 136 and 137

OBJECTIVE

- To apply kinetic theory to explain changes in the states of matter.

LEARNING OUTCOMES

The students should be able to.

- describe the expansion of the three states of matter on heating, and contraction on cooling, in terms of particles.
- predict the effects of heat gain and heat loss.

START (10 min)

Recall the states of matter and changes of state and what was learnt in the previous lesson. Divide students into three groups and ask them to pretend that they are particles. One group will pretend to be particles in a solid, other particles in a liquid, and the third particles in a gas. Discuss how their actions portrayed properties of the state.

MAIN (25 min)

Read Page 136 and 137

- Explain the terms boiling, melting, condensation and evaporation.
- Explain that the movement of particles is affected by temperature. The higher the temperature, the faster the particles move.
- Explain the process of turning of water to steam in this kettle because heat is making its particles move faster.
- Ask students to complete Task 1 of worksheet 2-10.
- If students found it difficult to act out the particle model, they can try again after completing Task 1.
- Use the knowledge of the particle model and apply it to the changes of state. In Task 2, students are asked to explain how through the particle model, kinetic energy changes properties with change of state.

PLENARY (10 min)

Ask students to discuss how condensing and freezing can be explained using kinetic theory. (It is the opposite of evaporating and melting.) Ensure students have understood this thoroughly.

Worksheet 2-10

HOMEWORK

- Test yourself page 137

Lesson 3

Page 138-141

OBJECTIVE

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- construct the concept of heat conduction, convection and radiation by applying particle theory including daily life examples.

START (15 min)

Boil some water and fill a cup up to 1/3 or 1/2. Using a metal teaspoon, take half a teaspoon of butter. Place the handle of the spoon in hot water so that the head of the spoon, containing the butter is sticking up. Soon, the butter will melt off the spoon because the heat energy has been transferred from the handle of the spoon in the hot water to the head of the spoon. This is an example of how conduction works.

Ask students if they have been inside a vehicle on black asphalt (on the road) on a hot day. Presumably most students have. Ask them what they observe if they look at the road some distance ahead? It is likely that students will say it looks wet or that it looks like water is on the road. Ask them what happens as they come closer? Is there actual water? No. This is an example of a mirage caused by convection. Both of the above mentioned examples depend on heat being transferred by particles. Ask students what they feel when they face the Sun on a pleasant day. Most likely the responses will refer to feeling the heat or warmth of the Sun. Then ask them what is in space, between us and the Sun? The responses may include space, no air, or particles. Hence, the Sun's heat energy reaches us via radiation.

MAIN (20 min)

- Read pages 138-141
- Ask students to complete Task 1 of worksheet 3-10. The task requires students to recall the three methods of heat transfer. It is not necessary that all the topics be read in detail, only the correct terminology is required.
- Discuss the diagram in Task 3 with the students. If you wish, you can show a video of a similar experiment. If you search terms like 'heat conduction activity', online, you should come up

with a variety of videos based on heat conduction. Please preview; some of them take 10 minutes with little action.

PLENARY (15 min)

Hand students two Post-it notes (or small pieces of paper) and ask them to write an example of an item which is a good conductor of heat and its application. They shall do the same for insulators. Make sure students do not copy each other. Stick their notes on two posters with the heading Conductors and Insulators. Ensure only good examples are used: either ask students to modify poor examples or just leave them out.

Test yourself page 139

HOMEWORK

- Exercise questions 5 page 147

Lesson 4

Page 138

OBJECTIVE

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- explain why metals are good thermal conductors and fluids are poor conductors of heat using the particle mode.

START (10 min)

Remind students that at the start of the last lesson, you briefly looked at three methods of heat transfer. Last lesson was about conduction, this lesson is about convection. What do they already (think they) know?

Discuss the following ideas. Please encourage students to brainstorm but do not tell them whether their answers are right or wrong. If possible, encourage students to discuss their ideas. Bring an empty electric kettle to the classroom and let the students look at it. The metal element which warms the water is at the bottom of the kettle. How does it warm the water at the top?

MAIN (25 min)

- Ask students to read page 138
- Ask students to complete Task 1 of worksheet 4-10.
- Have a look at Task 2. If you search for videos on convection currents ice cubes, you should be able to find one illustrating Task 2. Show the video after students have performed the activity and elicited an explanation.
- You could look for a video on the convection apparatus for Task 3 but they tend to be long, without much happening.
- Task 4: Divide your class into groups of 3 students each and ask them to present an annotated drawing explaining an example of convection as given in their worksheet. If you wish, either you or the students can come up with other examples.
- Test yourself page 145

PLENARY (15 min)

A hot air balloon has a small vent at the top which can be opened briefly to let some air out. This will slow down the balloon's ascent or even make it go down. It is not easy to operate this vent since it is on top of the large balloon and the pilot is below the balloon. Why do they not make this vent near the bottom? (The hottest air in the balloon is at the top, so only a small amount would have to be released to make a change. The air near the bottom is much cooler and opening a vent would not have as much of an effect.)

Lesson 5

Pages 142-146

OBJECTIVE

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- identify the effects of thermal expansion and contraction with their applications in daily life.
- state and explain practical methods of thermal insulation used for constructing buildings.

START (10 min)

The last lesson was about convection, this lesson is about radiation. Ask the class what do they already (think they) know? Since the word 'radiation' is usually associated with dangerous types of radiation, it might be useful to remind students that sound and

light are also types of radiation, as is heat (and even the microwaves in the microwave oven at home).

MAIN (25 min)

Read page 142-146

- Everyone loves barbecue so share this idea with students, explaining about heat transfer in a situation they are familiar with in Task 1 of worksheet 5-10.
- discuss the concept of emitting and absorbing radiation. Ask class to complete Task 2.
- Explain the process of thermal expansion in solid, liquids and gases.
- Read page 142 about the vacuum flask and then consider the concept of double glazing in Task 3. This is much more common in colder climates than in warmer climates, although effective in both since double glazing reduces heat transfer in both directions. Please make sure to include this idea so that it is relevant to students' lives and they do not think they are learning something designed for students in a different part of the world.

PLENARY (10 min)

It may also be a good opportunity to stress that insulation (including double glazing) improves comfort and reduces electricity bills and carbon emissions, which is the responsibility of every person on Earth.

HOMEWORK

- Draw a labelled diagram of a vacuum flask

Task 1

Take four objects to feel.

a. Write down in order how cold/hot they are. Estimate the temperature of each object and write it below the object. Remember to include the units.

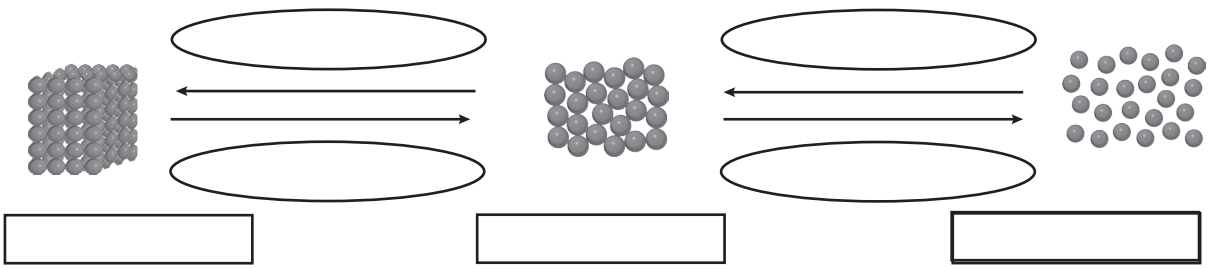
Coldest					**Warmest**
Temperature					

b. Did you write the order of the objects (from coldest to warmest) correctly?

c. Did you estimate the temperatures correctly? If not, explain the difference between your thinking and the actual values.

Task 2

You may remember learning about particle theory. It explains how substances change state. Complete the diagram below by writing the names of the states of matter in the rectangular boxes and the names of the changes of state in the oval areas.



Task 3

The temperature and heat are related but not the same thing. Use page 3 of your Student book and write the definitions of heat and temperature below:

Temperature is: _____

Heat is: _____

We measure temperature with a thermometer, but what units do we use? Three scales are commonly used: Celsius, Fahrenheit, and Kelvin.

The Fahrenheit scale took the temperature of the human body to be 100°F and the freezing temperature of very salty water as 0°F.

The Celsius scale takes 0°C for the freezing point of water and 100°C for the boiling point of water. The Kelvin scale considers 'absolute zero' to be 0 K.

(Please note, the units are °F (degrees Fahrenheit), °C (degrees Celsius) but K (Kelvin – without degrees, e.g.

water boils at 373 K).

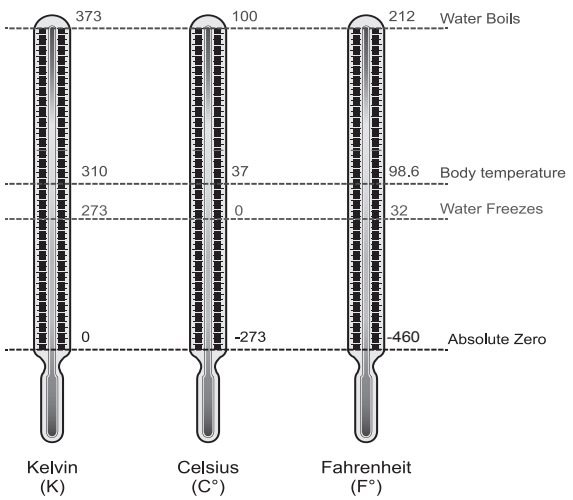
Task 4

Each of the thermometers below has a different scale. A few numbers are given but the others need to be put in.

a. You need to measure the distance between the numbers given and divide the space equally to put in the missing numbers, and this needs to be done precisely.

200°F	125°C	300 K
50°F	50°F	200 K
-200°F	-100°C	100 K

Add the following in the correct places



b. What temperatures do the two horizontal lines indicate? Write them in the table below for each temperature scale.

	Fahrenheit	**Celsius**	**Kelvin**
Line A			
Line B			

c. What do these two lines represent?

Line A _____

Line B _____

Task 1

Choose the correct option given in the table below:

Property	solid	liquid	gas
shape	fixed OR takes shape of container	takes shape of container fixed OR takes shape of container	takes shape of container fixed OR takes shape of container
can be compressed	yes OR no	yes OR no	yes OR no
space between particles	close together OR far apart	close together OR far apart	close together OR far apart
particle arrangement	random OR regular	random OR regular	random OR regular
particle movement	move around each other OR vibrate back and forth	move around each other OR vibrate back and forth	move around each other OR vibrate back and forth
particle speed	move fast OR move very fast OR do not leave their place	move fast OR move very fast OR do not leave their place	move fast OR move very fast OR do not leave their place

Task 2

Solid to liquid

a. What is the name of the process?

b. Which properties change?

c. Explain how adding heat energy will cause these changes

Liquid to gas

d. What is the name of the process?

e. Which properties change?

f. Explain how adding heat energy will cause these changes.

g. When heat is transferred out of the gas or liquid, these processes reverse. What are the names of these changes of state?

gas ⟶ liquid: _____

liquid ⟶ solid: _____

If you have been in the desert on a hot day, you may have been surprised to see water some distance away. If you go to investigate, you will realise that there is no water. It was a mirage and caused by one method of heat transfer.

Task 1

There are three ways of transferring heat:

1. _____

2. _____

3. _____

Task 2

Write definitions of the terms below.

Conduction:

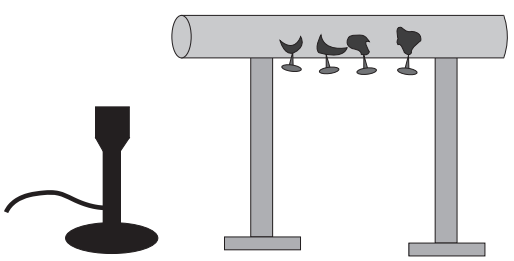
_____

Insulator:

_____

Task 3

Consider this experiment.



a. When the Bunsen burner is lit, what happens to the metal rod?

_____

b. What happens to candle wax when it becomes warm?

_____

c. Which pin will drop first? Explain your answer.

_____

d. If we replaced the metal rod with a plastic one, what would happen? Explain your answer

_____

Convection

Cross out the incorrect options from the following statements.

Task 1

a. Conduction takes place in solids/liquids/gases and convection takes place in solids/liquids/gases.

b. When a liquid is warmed, the particles move more slowly/faster.

c. This causes the particles to move farther apart/closer together.

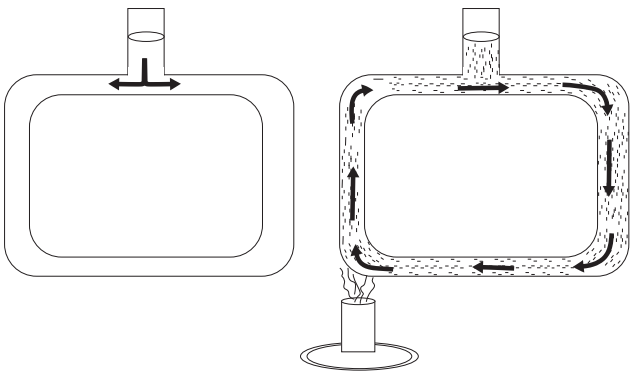
d. This makes the warmer liquid denser/less dense than the colder liquid.

e. As a result, the warmer liquid goes down/up.

Task 2

Place some ice cubes with added food colouring in a tank of water. Consider your answers above and explain what you see.

Task 3



You cleaned out this convection apparatus and filled it with clean water. This time you put a lighted candle on one side, as shown in the diagram, and left it for a few minutes.

a. What would happen to the temperature of the water on the left side of the apparatus?

_____

b. What would happen to the temperature of the water on the right side of the apparatus?

_____

c. What would the water on the left side of the apparatus do?

_____

d. Think what this means for the water in the horizontal tubes, both at the top and bottom. If you now put a drop of colour at the arrow, what would you see? Write your answer below and draw on the diagram.

_____

Task 4

Convection is very common and numerous examples can be found. Can you explain how convection is involved in the following situations? Work in a small group and present your ideas as an annotated drawing on A-4 paper.

a. hot air balloons

b. a fridge with a freezer compartment at the top

c. a cooling sea breeze on a hot day

d. a lava lamp

e. air conditioning

f. fire men entering a burning building on hands and knees

g. conventional oven

Task 1

You know a barbecue is hot, but have you ever thought about the methods of heat transfer related to a barbecue?

a. At your barbecue party, what would be an example of heat transfer by conduction?

_____

b. At your barbecue party, where would heat be transferred by convection?

_____

c. There is also radiation from the barbecue. Where would you best feel this?

_____

d. In some grill ovens, you put your meat under the heating element. Your meat is grilled by the heat coming from above. It will take longer to cook this meat than a similar piece on the barbecue. Can you explain this?

_____

Task 2

a. What is the name of the type of wave which transfers heat?

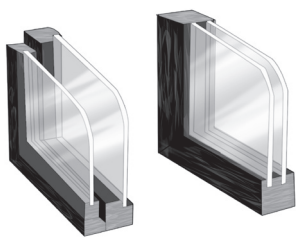
_____

b. What are emitters? What do they look like?

_____

Task 3

Applications of knowledge about heat transfer. Double glazing can be installed in houses to reduce heat transfer through the window.



Consider heat transfer through a window with a single pane of glass. What happens in terms of

a. conduction?

_____

b. convection?

_____

c. radiation?

_____

Now consider a window with two panes of glass and air trapped between the panes. What happens in terms of:

d. conduction?

_____

e. convection?

_____

f. radiation?

_____

It is possible to remove the air between the panes of glass and seal the space so it remains a vacuum. How would this affect heat transfer by:

g. conduction?

_____

h. convection?

_____

i. radiation?

_____

j. Do you think double glazing is equally effective in colder and in warmer climates? In other words, when it is cold, would it keep the heat in, but also keep the heat out when it is too warm outside? Explain your answer.

_____

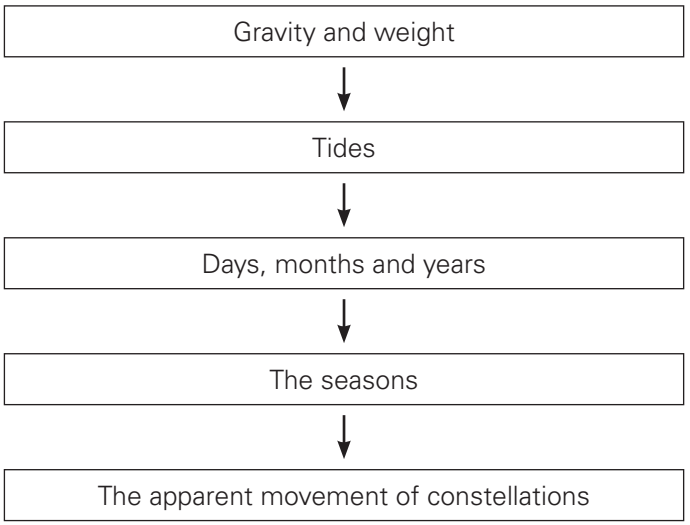
k. What are the similarities and differences between the concepts of double glazing and a vacuum flask?

_____

Chapter

11 Earth and Space

UNIT FLOW CHART



INTRODUCTION

This unit tells about the Earth, space and heavenly bodies present in the space. This unit will help to explore the interconnections between the Earth, ocean and formation of tides.

Mass and weight is different from each other. The force of gravity keeps planets and moons in their orbits. Tides are the continuous rising and falling of water caused by the gravitational pull of the Moon and Sun. Seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun.

The gravitational pull of the Moon causes high tides on the opposite side of the Earth. When the moon and the sun are in alignment, they create extremes in tides called spring tides. Different seasons, different constellations visible at different times of the year are caused by the effects of the Earth's annual revolution around the Sun, given the tilt of its axis.

Lesson 1

Page 149-150

OBJECTIVE

- To find difference between mass and weight.

LEARNING OUTCOMES

The students should be able to:

- Recognise that the force of gravity keeps planets and moons in their orbits.
- Differentiate between mass and weight, using examples of weightlessness experienced by astronauts on the surface of the Moon.

START (15 min)

Explain how solar and lunar eclipses occur. Collect, record, and report data on the beliefs and practices of the community in relation to eclipses

Show a force meter and find weight of few objects like a book, a pencil case and then explain the concept of mass and weight.

MAIN (15 min)

Read page 149-150

- Explain about weight and mass
- Discuss the units of weight and mass
- Explain the term gravity. On Earth, the strength of the gravitational field is about 10 N/kg. This means that it gives a force of 10 N on every kilogram.
- Solve some examples on the board.

PLENARY (10 min)

Test yourself page 151

HOMEWORK

- Exercise question 3 page 157

Lesson 2

Page 152-155

OBJECTIVE

- To compare the tides and effects of the Earth's annual revolution around the Sun.

LEARNING OUTCOMES

The students should be able to:

- Recognise that tides are caused by the gravitational pull of the Moon.
- Describe the effects of the Earth's annual revolution around the Sun, given the tilt of its axis (e.g. different seasons, different constellations visible at different times of the year).

START (10 min)

Ask students about what they already know about how season change.

MAIN (15 min)

Page 152-155

- Discuss that the Tides are the continuous rising and falling of water caused by the gravitational pull of the Moon and Sun.
- Explain that the gravitational pull of the Moon causes high tides on the opposite side of the Earth.
- When the moon and the sun are in alignment, they create extremes in tides called spring tides.
- Show a chart showing pictures of high tides and low tides.
- Use a torch and balls and explain how days and months are changed.
- Divide students into group of four and ask them to role play about formation of seasons.
- Investigation 2 page 159 and write conclusions.

PLENARY (15 min)

Ask students to draw a poster showing different types of tides.

Test yourself page 155

HOMEWORK

- Exercise question 4 page 157

Lesson 3

Page 156

OBJECTIVE

- To compare the apparent movement of constellations.

LEARNING OUTCOME

The students should be able to:

- Describe how seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun.

START (15 min)

Ask a question:

- What do you observe when you go outside at night and look up at the sky?
- Listen to the students' responses and write them on the board.

MAIN (15 min)

Read Page 156

- Discuss that the Earth's tilted axis also affects how constellations and other heavenly bodies appear to move across the night sky.
- Explain that the Pole Star stays in the same position because it is in line with the Earth's axis.
- Give seven bunties of different colour or play dough and ask students to make different arrangements of constellations.
- Discuss that in the Northern Hemisphere, the whole night sky appears to rotate around the Pole Star.
- Investigation 3 page 159 and write conclusions.
- Worksheet 1-11

PLENARY (15 min)

Exercise question 5 page 158

HOMEWORK

- Exercise question 6 page 159

Task 1

We use a number of units to keep track of time, but you may wonder about their duration and how we decided them. Answer the following questions.

a. What is one day?

_____

b. Explain why you experience night and day.

_____

c. How long does it take for the Earth to complete one orbit around the Sun?

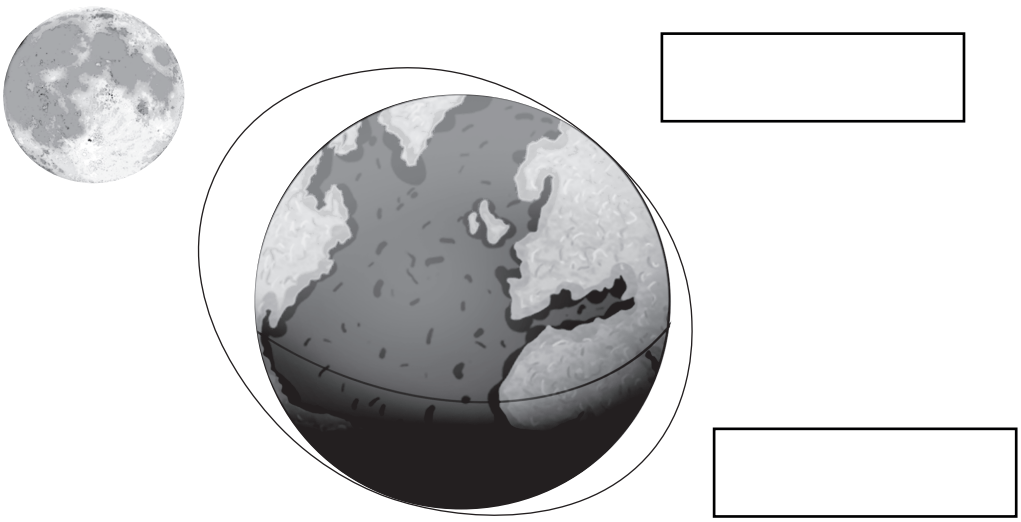
_____

d. Explain the number of days in a 'normal' year and compare it to a leap year.

_____

Task 2:

Mention the high tide and low tide in the following diagram:



Chapter 12

Technology in Everyday life

Lesson 1

Page 161-162

OBJECTIVE

- To encourage students about plantation.

LEARNING OUTCOME

The students should be able to:

- Design a model to demonstrate drip & sprinkler irrigation system for conservation of water.

START (10 min)

Materials required: 1 m of cotton string, piece of plastic tubing 50 cm long, thin wire, scissors, plastic bottle with plastic top, clothes peg, potted plant

MAIN (25 min)

Read Page 161-162

- Discuss that drip irrigation system replicates rain by spraying water under pressure.
- Explain that the water is distributed over the entire soil surface by spray heads at the terminals.
- Explain that drip irrigation system save water since they irrigate plants with a small amount of water.

PLENARY (10 min)

Ask the importance of water for plants.

HOMEWORK

- Design a Sprinkler Irrigation system

Lesson 2

Pages 163-164

OBJECTIVE

- To note down the heartbeat of a person.

LEARNING OUTCOME

The students should be able to:

- Make a simple Stethoscope.

START (15 min)

Materials required: plastic tray, ketchup bag, pipe, two sketch pen, soil, glue gun, iron nail

MAIN (30 min)

Read Pages 163-164

- Discuss that the stethoscope is used to hear heartbeat.

PLENARY (15 min)

Ask students about to check their pulse.

HOMEWORK

- Use your stethoscope and note heartbeat of three family memebers.

Lesson 3

Pages 165

OBJECTIVE

- To practice about cleaning of hands.

LEARNING OUTCOME

The students should be able to:

- Make a sanitizer using suitable substances

START (15 min)

Materials required: 90% Isopropyl alcohol (rubbing alcohol), Aloe vera gel, essential

oil e.g. lavender oil. Beaker, measuring cylinder, stirrer, funnel, small plastic bottle, sticky label food colouring.

MAIN (15 min)

Read pages 165

- Discuss about the use and importance of sanitizer.
- Tell the importance of cleaning hands.
- Ask students to improve the habbit of washing hands.

PLENARY (15 min)

Discuss about the use and importance of sanitizer.

HOMEWORK

- Try making another sanitizer, but this time adding 40 ml of Aloe Vera to the mixture.

Lesson 4

Pages 165-168

OBJECTIVE

- To describe the process of preservation of food.

LEARNING OUTCOME

The students should be able to:

- Use different techniques of preserving foods like orange juice, apple jam and pickles.

START (15 min)

Materials required: 1 kg oranges, 1 litre of water, 750 g of sugar, knife, saucepan, wooden spoon, blender, sieve, large bowl, measuring jug, sterilized bottle or jug with lid.

MAIN (15 min)

Pages 161-162

- Explain the several methods of preserving food.
- Explain that sugar causes any microoganisms present in the fruit to lose water by osmosis and die.
- Discuss that the vinegar creates a strong acidic environment in which few microorganisms can survive.

PLENARY (15 min)

Suggest why the orange juice should not be kept for more than a few days in the fridge?

HOMEWORK

- Ask students to make apple jam/ mango pickle under the supervision of an adult.