For secondary classes

SCIENCE

Fact file

Teaching Guide 2

Anjum Afshan Mannan

OXFORD
UNIVERSITY PRESS

Contents

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 – Photocopyable 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.

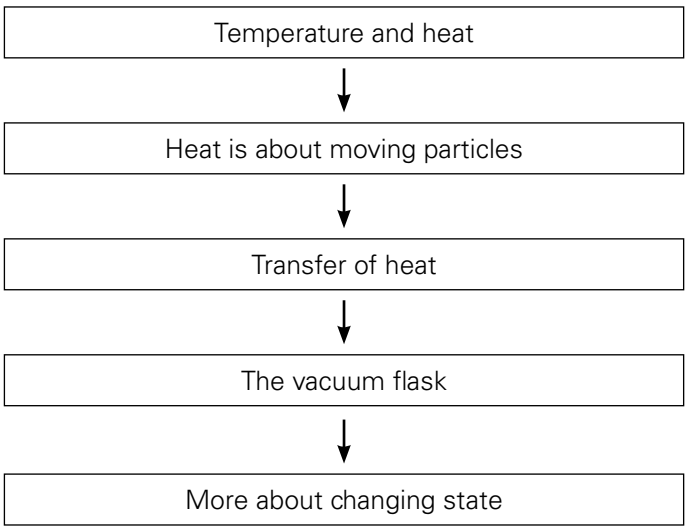
Answers – These provide, where possible, the expected results of any activity and answers to any questions in the units, including the Test yourself section. They also contain answers to questions in the workbook.

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 Heating and cooling

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 1-1

Pages 2-3

OBJECTIVES

- To explain the differences between heat and temperature

LEARNING OUTCOMES

The students should be able to:

- explain differences between heat and temperature.
- understand what is meant by 'absolute zero' and the Celsius and Kelvin scales.

START (10 minutes)

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. a 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 1-1.

Their answers could be something like this:

ice cubes	spoon	Styrofoam	cup of tea
0°C	15°C	30°C	50°C

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 minutes)

- Use Task 2 of worksheet 1-1 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 (5 minutes)

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?

HOMEWORK

Read pages 2-4 of your Student Book and do the questions on page 3.

Lesson 1-2

Page 4

OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to explain:

- kinetic theory.
- changes in state of matter on the basis of the movement of particles.

START (10 minutes)

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, another particles in a liquid, and the third particles in a gas. Discuss how their actions portrayed properties of the state.

MAIN (25 minutes)

- Ask students to complete Task 1 of worksheet 1-2. They can refer to the Student Book (page 4), worksheet 1-1, and what they observed when their classmates modelled the states of matter.
- 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 minutes)

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.

HOMEWORK

Test yourself questions on page 4 of Student Book

Lesson 1-3

Page 5

OBJECTIVES

- To explain about mechanisms of heat transfer

Learning outcomes

The students should be able to:

- explain mechanisms of heat transfer.
- define conduction.
- list examples of good and bad conductors and their applications.

START (15 minutes)

- 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 minutes)

- Ask students to complete Task 1 of worksheet 1-3. 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.
- Ask students to read page 5 of their Student Book and answer the questions in Task 2 of worksheet 1-3.
- 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.
- Ask students to answer the questions in Task 3.

PLENARY (10 minutes)

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.

HOMEWORK

Read page 5 and answer the 'Test yourself' questions.

Workbook page 5, Question 5

Lesson 1-4

Page 6

OBJECTIVES

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- explain methods of heat transfer.
- define convection.
- explain the application of convection.

START (10 minutes)

- 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?

  http://slideplayer.com/slide/6236278/

MAIN (20 minutes)

- Ask students to read page 6 of their Student Book and complete Task 1 of worksheet 1-4.
- 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.

PLENARY (15 minutes)

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.)

HOMEWORK

- Read page 6 and answer the 'Test yourself' questions.

Lesson 1-5

Pages 7–9

OBJECTIVES

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- explain methods of heat transfer.
- define radiation.
- explain the applications of good and poor radiators and absorbers of heat.

START (10 minutes)

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 minutes)

- 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 1-5.
- Read pages 7 and 8 of the Student Book and discuss the concept of emitting and absorbing radiation. Ask class to complete Task 2.
- Read page 9 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 minutes)

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

Read pages 8 and 9 and answer the 'Test yourself' questions.

Workbook page 7, Question 7

Lesson 1-6

Pages 9–10

OBJECTIVES

- To explain about mechanisms of heat transfer.

LEARNING OUTCOMES

The students should be able to:

- describe the effects of heat gain and heat loss.

START (10 minutes)

Elicit responses from the students to these questions:

- What happens to the temperature of a hot cup of tea when it is kept in the open air for some time?
- Where does the heat go from the cup? What is the effect on the surrounding temperature? Are there any other effects of heat?

MAIN (30 minutes)

- Boil water in a beaker with a thermometer.

  Explain that when water is heated beyond its boiling point, the temperature remains the same, but that heat energy is used in changing it from the liquid to the vapour state.
- Hand out worksheet 1-6 on effects of heat gain and heat loss and help the students complete it.

PLENARY (5 minutes)

How will you cool a cup of hot milk quickly without putting it in the refrigerator?

HOMEWORK

Questions 4 and 5 from Exercise of Student Book.

Or

Workbook page 3, Question 3.

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.

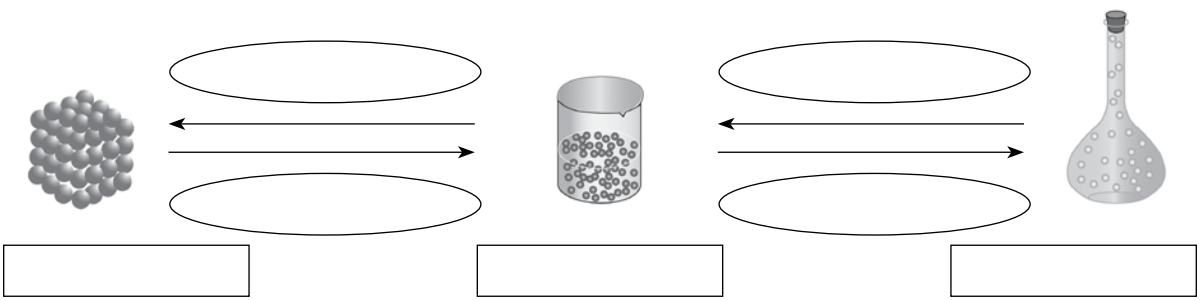
_____

_____

_____

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

Read pages 3 and 4 of your Student Book.

Now you have realised that 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).

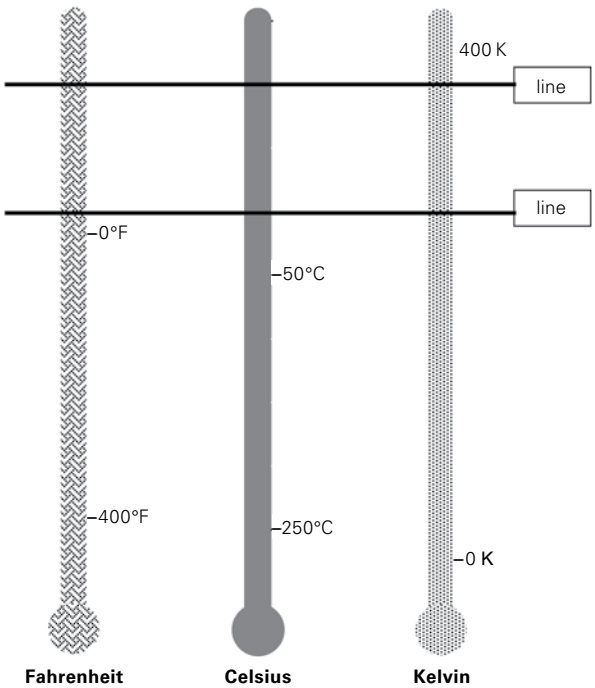
Task 4

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.

Add the following in the correct places.

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



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 _____

Last lesson, you revised the information about particle theory and the states of matter. Let us look into this in more detail.

Task 1

Read page 4 of your student book and consider the table below. Each of the boxes has several options but only one is correct for that box. Please cross out the incorrect options.

property	**solid**	**liquid**	**gas**
shape	fixed OR takes shape of container	fixed OR 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

Having considered the properties of solids, liquids, and gases, you will now consider the changes of state.

Read page 4 on kinetic theory and use this information to answer the questions below.

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

On pages 5, 6 and 7 of your Student Book, three methods of heat transfer are described. Write their names below.

There are three ways of transferring heat:

1. _____

2. _____

3. _____

Task 2

Conduction

Read page 5 to find definitions of the terms below.

Conduction:

_____

_____

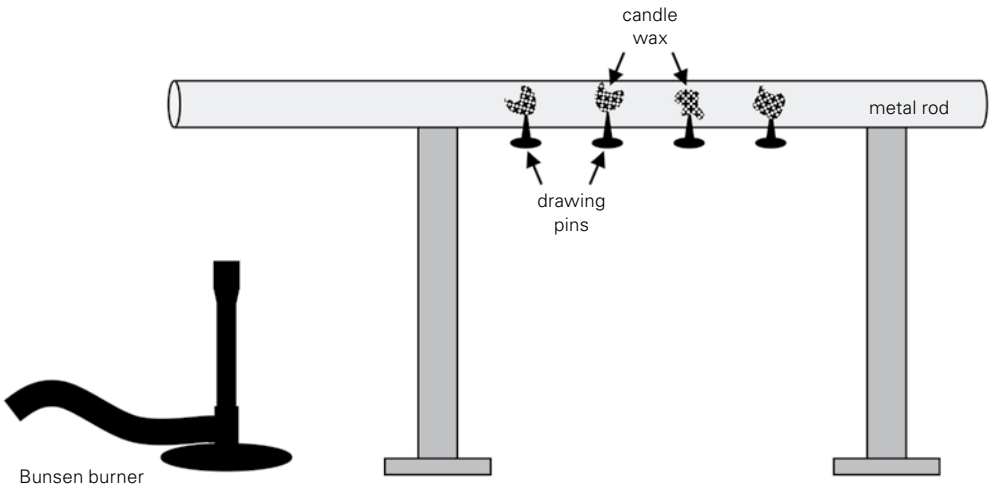
Insulator:

_____

_____

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

Read page 6 of your Student Book and answer the questions below. Cross out the incorrect options.

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.

_____

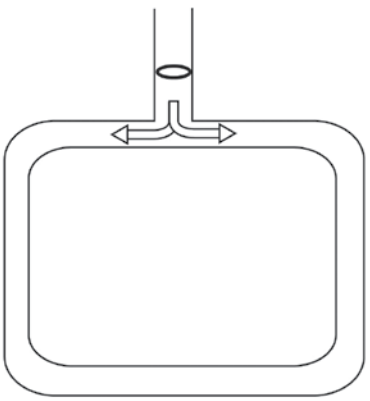
_____

_____

https://www.youtube.com/watch?v=YndXKnzFsbo

Task 3

a. Here you see a diagram of a convection apparatus. It is filled with water. If you were to add a drop of colour at the arrow, what would happen? Write your answer below and draw on the diagram.



_____

_____

You cleaned out this convection apparatus and refilled 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.

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

_____

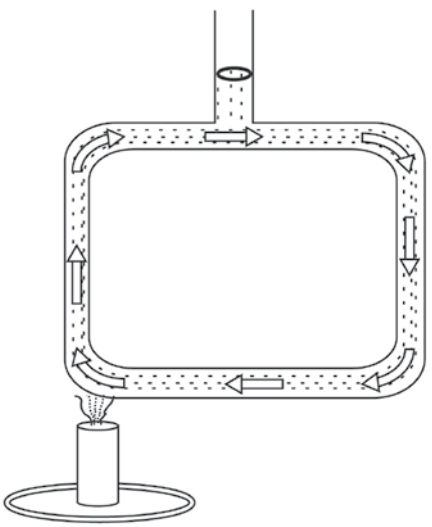
c. What would happen to the temperature of the water on the right side of the apparatus?

_____

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

_____

e. 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

Read pages 7 and 8 of your Student Book.

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

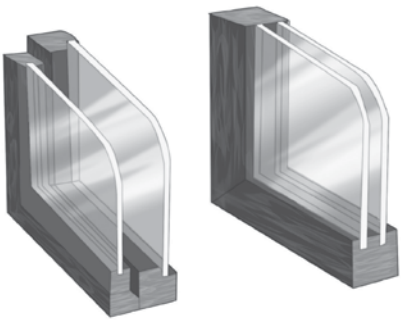
b. What are emitters? What do they look like?

Task 3

Applications of knowledge about heat transfer.

Read page 9 and carefully study the diagram about the vacuum flask.

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?

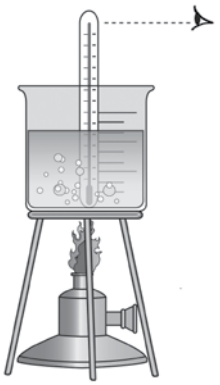
h. convection?

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?

Task 1



i. Boil the water in beaker till it reaches 100°C keep on boiling. Does the temperature increase further?

_____

ii. Where does the heat go when the temperature is not increasing?

_____

Task 2

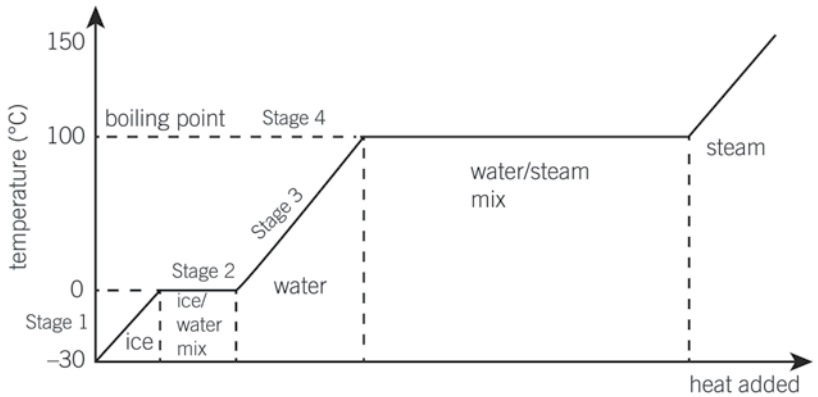


Diagram of heating curve of water

1. Look at the graph and answer the questions:
   i. What is the boiling point of water?

   _____

   ii. What is the melting point of ice?

   _____

   iii. What happens to the temperature when there is a change of state? How it is shown in the graph?

   _____

2. What is the average temperature of the human body?

   _____

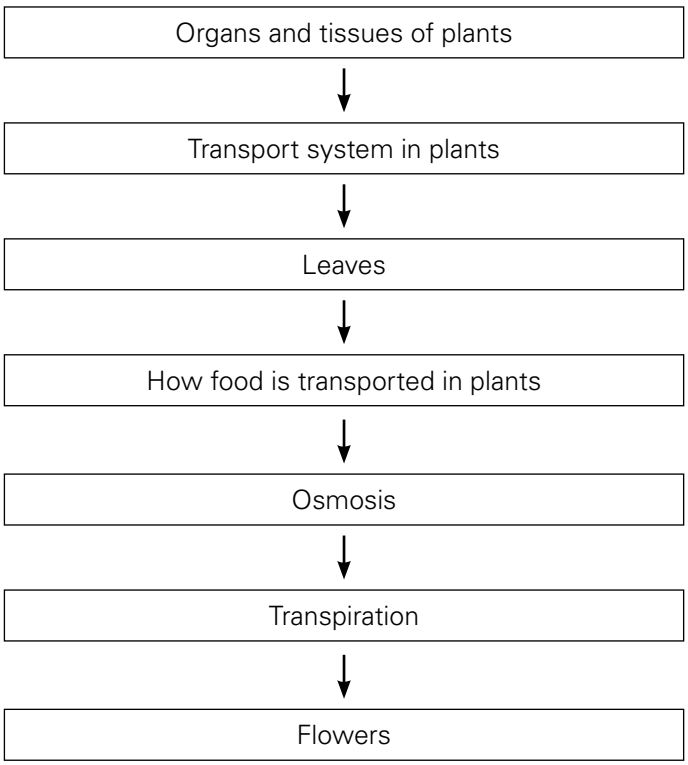
3. What is the difference between boiling and evaporation?

   _____

Chapter

2 Plants and their system

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 2-1

Pages 14 – 15

OBJECTIVE

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

LEARNING OUTCOME

The students should be able to:

- identify the different parts of a plant and explain their functions.

START (10 minutes)

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

MAIN (25 minutes)

- 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.
- Ask 'Test yourself' questions given on page 15.

PLENARY (10 minutes)

Read pages 14 and 15. List the parts of a plant. Ask students to describe the structure of each part. Relate structure to function.

HOMEWORK

Workbook page 13, Question 3 parts (i) and (ii)

Lesson 2-2

Pages 16 – 17

OBJECTIVES

- To explain the 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 structures and functions.

START (10 minutes)

Remind students of the discussion at the end of the last lesson.

MAIN (25 minutes)

- Read pages 16 and 17 of the Student Book.
- Hand out worksheet 2-1 and support the students in completing this sheet.
- Show them slides of xylem, phloem, and leaf structure under the microscope.
- 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.

PLENARY (10 minutes)

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 17 of the Student Book.

Lesson 2-3

Pages 18-19

OBJECTIVES

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

LEARNING OUTCOME

The students should be able to:

- describe the external and internal structure of a leaf.

START (10 minutes)

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 minutes)

- Read pages 18 and 19 and discuss the structure. Relate the structure to functions.
- Ask students to label and colour the diagram on Worksheet 2-2.
- If possible, give students a prepared slide and microscope and ask them to draw and label a cross-section of the leaf; otherwise, show a picture. An internet search on 'leaf structure micrograph' gives a lot of choices.

PLENARY (10 minutes)

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.

HOMEWORK

Workbook page 14, Question 4

Lesson 2-4

Page 22

OBJECTIVES

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

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 minutes)

- Ask students if they remember the 'Particle Model'.
- Ask who remembers anything about diffusion (last year's material).
- 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 minutes)

- Read page 22 of the Student Book.
- Have students carry out the experiment in Worksheet 2-3.

PLENARY (10 minutes)

It is really important to make sure the students have grasped the connections between diffusion and osmosis and understand how osmosis drives transport through the plant. The latter (page 23) is a complex process, so it is vital to ensure that students have understood. Take sufficient time to discuss all aspects and ensure all students are involved in the discussion.

HOMEWORK

Workbook page 15

Lesson 2-5

Pages 23-25

OBJECTIVES

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

LEARNING OUTCOMES

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 minutes)

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 minutes)

- Read page 23 of the Student Book.
- Ask students to complete Worksheet 2-4

PLENARY (10 minutes)

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 30

Lesson 2-6

Pages 26-27

OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to:

- name the different parts of a complete flower and state their functions.

START (10 minutes)

Ask the following questions:

- Which flower do you like most? Why?
- What do flowers symbolize?
- What are the functions of a flower?

MAIN (25 minutes)

- Flowers have different parts, including sepals and petals. The male part of the flower contains pollen which is used for pollination. When pollen falls on the stigma, this is called pollination; the pollen then goes to the style and ovary, which is the female part, where it fuses, and fertilization takes place.
- Handout worksheet 2-5.
- You can show a video-clip of a flower dissection. If you do not know how to download a video from the internet, do a search using the term "flower dissection" and you will find the necessary information.

PLENARY (10 minutes)

Divide the class into four groups. Give one complete flower to each group and ask them to discuss 'Test yourself' questions on page 27.

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.

Task 1

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. Page 14 also has helpful information.

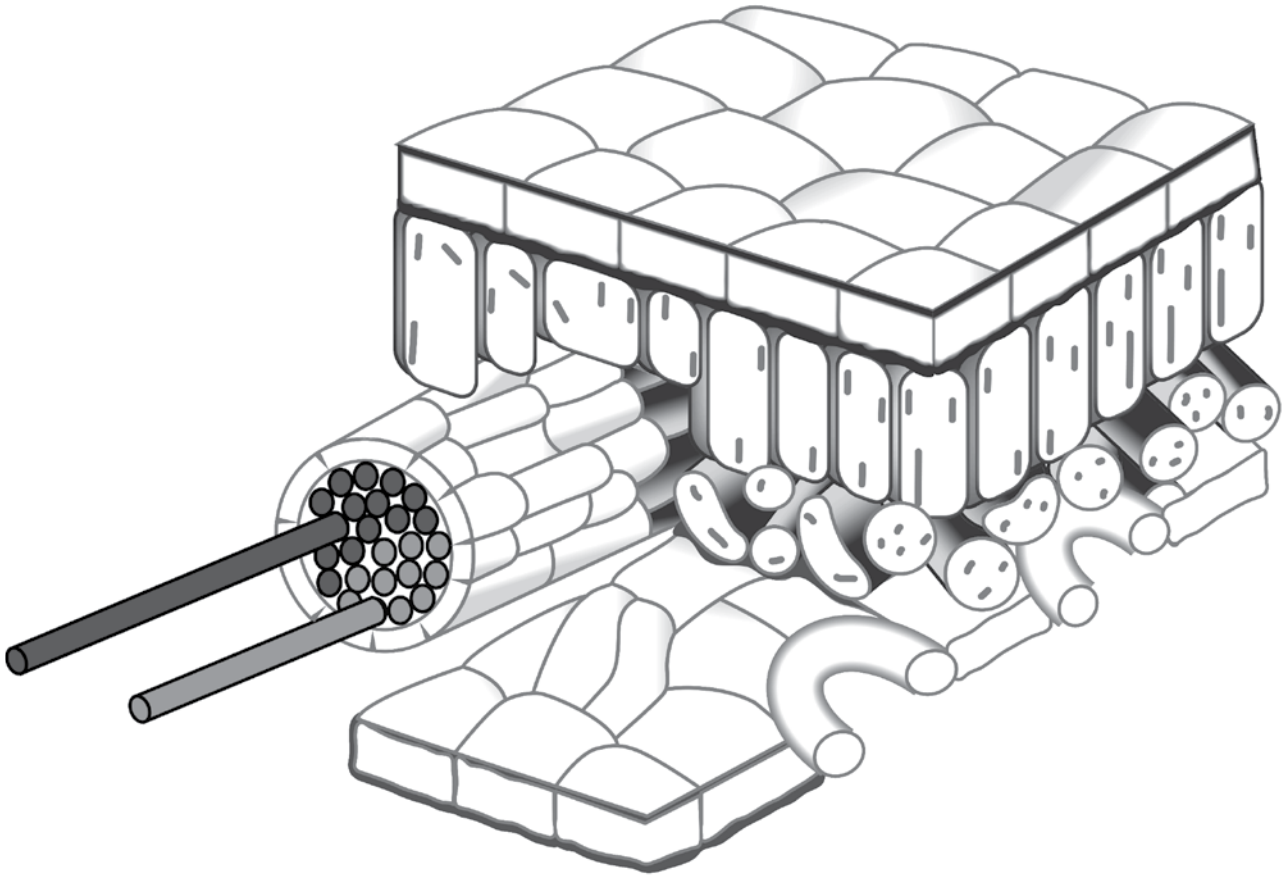
	Name of the organ	**Structure of the organ**	**Function of the organ**
i			
ii			
iii			
iv			

Colour the chloroplasts green.

Colour the guard cells red.

Colour the stomata yellow.

Colour the waxy cuticle blue.



Task 1

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

i. Diffusion is the movement of _____

_____

_____

ii. Osmosis is the movement of _____

_____

_____

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

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

Task 2

Diffusion

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.

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

_____

_____

_____

iv. Use the particle model to explain your observation.

_____

_____

_____

2. Osmosis

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 3						
	bear 4						
colour 3 very salty	bear 5						
	bear 6						

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. _____

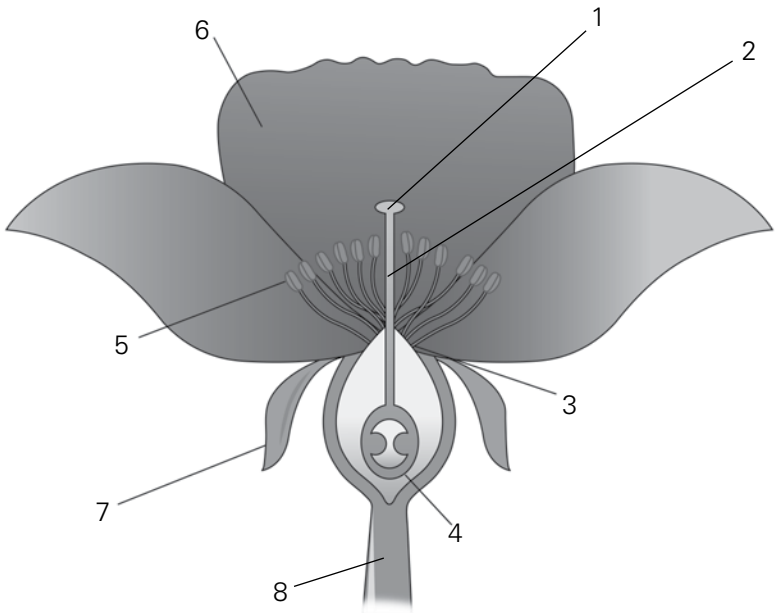
   ii. _____

   iii. _____

   iv. _____

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

1. Label the parts of the flower numbered on the diagram below.



i. Explain the functions of sepals and petals in flowers.

_____

ii. a) What is the male part of a flower called?

_____

b) What is it made up of?

_____

iii. a) What is the female part of a flower called?

_____

b) What does it consist of?

_____

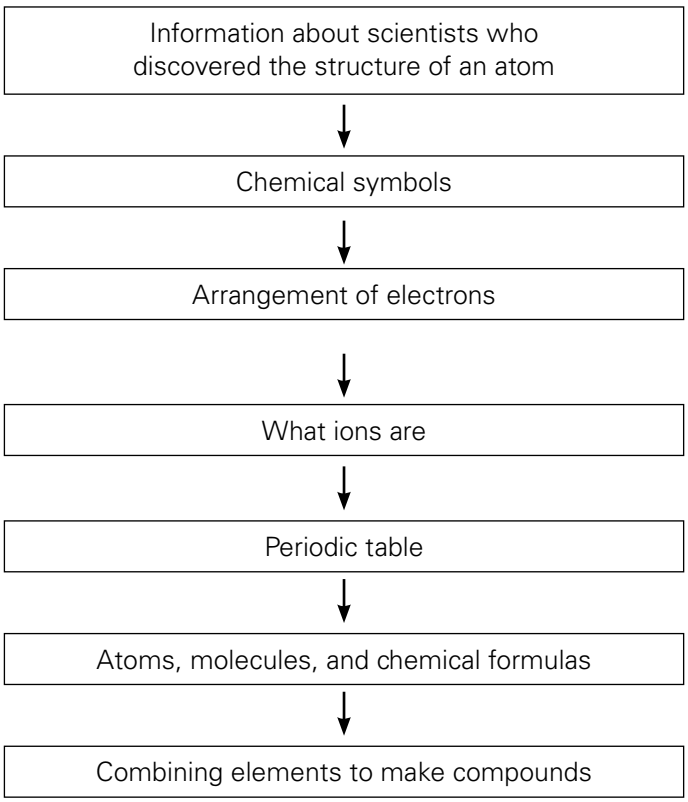
iv. Define pollination.

_____

Chapter 3

The Periodic Table

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 3-1

Pages 32-34

OBJECTIVES

- 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.

START (10 minutes)

- Elicit prior information of atoms from students.

MAIN (20 minutes)

- Read pages 32-34 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.

PLENARY (15 minutes)

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.
- Workbook page no 20, Question 6

Lesson 3-2

Pages 34-36

OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to:

- identify chemical symbols, atomic number and mass number.
- learn about arrangement of electrons.
- differentiate between two types of ions.

START (10 minutes)

- 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 nick names. 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 minutes)

- Read pages 34-36 of Student Book.
- Ask students to work in pairs and learn the symbols given on page 35.
- 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, $_{11}Na^{23}$ Each group leader will explain atomic structure to the whole class.
- Next explain them how ions are formed.

PLENARY (15 minutes)

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

HOMEWORK

- Ask the students to draw electronic arrangement of elements and their ions given on page 35.
- Worksheet 3-1

Lesson 3-3

Pages 36-39

OBJECTIVES

- 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.

START (10 minutes)

- Ask the students the following questions:
  Have you been to the school library? What happens if all the books are mixed together? 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 minutes)

- Read pages 36-38
- 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.
- 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 will attempt pages 22 and 23 of the Workbook.

PLENARY (10 minutes)

- Each group leader will present the properties of one group.
- Students should be assessed on the basis of their observation and communication skills.

HOMEWORK

Worksheet 3-2

Lesson 3-4

Pages 40-43

OBJECTIVES

- To explain how compounds are formed.

LEARNING OUTCOMES

The students should be able to:

- explain that when two or more elements join, they form a compound.
- identify the types and number of elements present in simple molecules and compounds.

START (10 minutes)

- Please ensure that students have read pages 40 – 43.
- 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 minutes)

- 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.
- Task 1 of Worksheet 3-3 is just a quick reminder of the two types of compound.
- In task 2, students learn to write word equations. Point out that some elements have the same name as their ion, while others do not.
- The series of questions in task 3 refers to the steps to write an equation.
- In task 4, we 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.

PLENARY (15 minutes)

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

a. an oxygen molecule.
b. a nitrogen molecule.

HOMEWORK

- Test yourself questions given on pages 41 and 43 of Student Book.

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

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

   i. Name any two ions and two atoms.

   _____

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

   _____

   _____

   iii. What are anions and cations give examples?

   _____

   _____

   iv. Which group represents alkali metals?

   _____

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

   _____

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

   _____

   vii. Name two halogens from the table.

   _____

   viii. Name two noble gases and write their uses.

   _____

   ix. Why does the last group have no ions?

   _____

   x. Why is hydrogen placed separately in the periodic table?

   _____

1. Use the words below to complete the following sentences.

   atom molecule negatively different
   ions same positively

   i. Elements are made up of _____ kind of atoms.
   ii. When an atom loses electrons, it becomes _____ charged.
   iii. Water is a _____ made up of _____ kinds of atoms.
   iv. The smallest particle of an element is called an _____.
   v. When an atom gains an electron, it becomes _____ charged.
   vi. Charged particles are called _____.

2. Aluminum is represented by

   ← Represents 13 Al^{27} Represents →

   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 dot and cross diagram to show the structure of a sodium and chloride ion.
   v. Write symbols of following elements along with their atomic number and mass number.

   oxygen nitrogen iron magnesium
   calcium carbon hydrogen

Elements	Atomic number	Mass number

Task 1

On pages 40 and 42 of your Student Book, two types of compounds are described. Write the name of each type below and give a brief description of it.

_____

_____

_____

_____

Task 2

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 in the boxes below to show how chemists record a chemical reaction. This is called a chemical word equation.

a. [ ] ⟶ [ ]

Use the information from pages 40 and 41 to complete the reactions below.

b. sodium + _____ → _____

c. _____ + oxygen → _____

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.

_____

_____

Chemical reactions take place not only between elements forming a compound. The reactants may be compounds, or a compound and an element. There are also reactions in which a compound splits into its elements.

Task 3

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. Have a look at page 43 of your Student Book and 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 4

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.

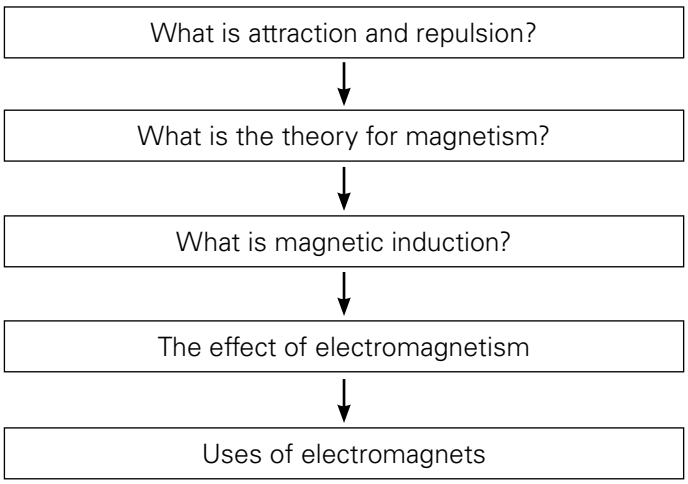
For each element in this compound, write the chemical symbol, the name, and the number of atoms involved.

symbol	name	how many atoms

Chapter 4

Magnets and Electromagnets

UNIT FLOW CHART



INTRODUCTION

Nearly everyone knows something about magnets. You have probably used a magnet to pick up pins, tacks, and other things made of iron or steel. We do not know when and how magnetism was discovered, but different stories are told about how a kind of rock was discovered which would attract pieces of iron towards itself and hold on to them.

For many years, people thought that magnetism was a quality unique to one kind of rock. It was interesting, but it was not really useful. At last, someone discovered that a piece of iron would act like a magnet if it was rubbed on the rock. This was followed by an even greater discovery.

If a magnet made of iron was set on a piece of wood floating in water, the magnet would turn until it pointed towards the north and south. This was the first compass. The rock used to make the iron magnet in the compass was called *lodestone*. Scientists have found that lodestone is made of a kind of iron ore called **magnetite**.

The compass is one of the most important inventions ever made, but for a long time no other uses for magnets were discovered. Magnets were so weak that they could move only small pieces of iron. Finally scientists discovered how to make much stronger magnets by using electric current. They also learned how to use electric current to make electromagnets, where the magnetic force could be turned on or off. From then on, many new uses for magnets were found.

Telephone receivers, loudspeakers and speedometers, all have magnets in them. So do electric bells and buzzers. Magnets are found in every electric motor or generator. Doctors often use magnets to get tiny bits of iron out of a person's eyes or throat. In these and many other ways, magnets are used every day.

The objective of this chapter is to explain the properties and function of magnets and electromagnets. They will be able to identify the different ways they are used.

Lesson 4-1

Pages 48-49

OBJECTIVES

- To identify magnetic materials.

LEARNING OUTCOMES

The students should be able to:

- distinguish between magnetic and non-magnetic materials.
- state the properties of magnets.

Warning

Iron filings should be stored carefully.

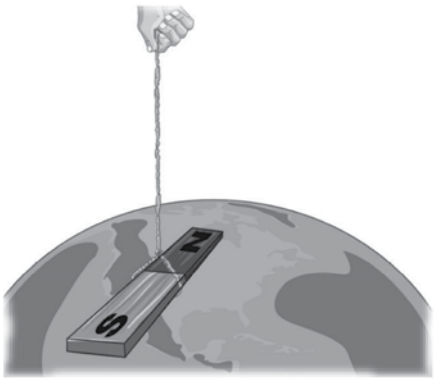
Do not dip your magnets in iron filings – it is difficult to get them clean again. Ensure there is no class room management issues, as inhalation of iron dust is unhygienic.

START (10 minutes)

Show students a magnet and elicit what they already know about magnetism. As usual, do not provide (much) feedback or response but let the students react to each other's comments so that you discover their knowledge and/or possible misconceptions.

MAIN (20 minutes)

- Read pages 48 and 49 and distribute worksheet 4-1.
- Hand out magnets and ask students to investigate whether objects are attracted or repelled by a magnet or if no force is evident. Students should record their findings in worksheet 4-1.
- Ask students to suspend their magnets as shown in the illustration. Place them around the room away from other magnets. The magnets should all orient themselves in the same direction – i.e. the Earth' magnetic field. Draw students' attention to this phenomenon.



It would be useful to know which side of the room is north and which is south.

- Bring a magnet near to one of the suspended magnets and observe how it changes its orientation. Ask students to write down their observations in worksheet 4-1.

PLENARY (15 minutes)

In this lesson, students saw that a magnet attracts objects made of iron or steel but also attracts the opposite pole of other magnets. So how could they prove if something is a magnet or if some material is attracted to a magnet? The proof of a magnet is in repulsion. If an object is attracted to the magnet, it may be a magnet or an object with induced magnetism. However, when the magnet is turned around to test the object with the other pole of the magnet—a real magnet would be repelled while an induced magnet would still be attracted. So the test for magnetism is in repulsion.

HOMEWORK

'Test yourself' questions page 49.

EXTENSION

Visit https://www.exploratorium.edu/snacks/eddy-currents. This experiment shows that a magnet will fall through an aluminum, brass, or copper tube more slowly than through a non-metal pipe. Do not use an iron or steel pipe as the magnet simply attaches to the pipe and will not fall.

This can be done as a demonstration with the students timing the fall of the various objects through different pipes. If you do this, do several repeats of each combination (object and pipe) to obtain some statistical relevance.

Lesson 4-2

Pages 49-50

OBJECTIVES

- To identify magnetic materials.

LEARNING OUTCOMES

The students should be able to:

- identify the shape and direction, of the magnetic field around a bar magnet.

START (10 minutes)

Forces cannot always be seen, but to understand them we can draw them. To show how a magnetic field works, we can use iron filings and a magnet. The small pieces of iron will be induced to behave like small magnets as long as they are near the real magnet. Discuss this concept with students and read worksheet 4-2.

Please remember to keep at least one sheet of paper between the magnet and the iron filings. Remind students that they also need to keep the iron filings separated from the magnet by a sheet of paper.

MAIN (25 minutes)

- Support students doing task 1 from the worksheet 4-2. Ensure that the iron filings do not come into direct contact with the magnet by keeping a sheet of paper or a transparency between them at all times.
- When investigating the strength of the magnetic field, students should consider that the iron filings represent the field lines and that a stronger field is indicated by the field lines being closer together.

PLENARY (10 minutes)

Ask students the following questions:

- Where are magnetic forces stronger?
- In which direction do magnetic lines of force move?
- Do they ever cross each other? Explain by considering what happens if they do and if they do not cross.

HOMEWORK

Workbook pages 26-27

Lesson 4-3

Page 52

OBJECTIVES

- To explain the concepts of a magnetic field of a permanent magnet and an electromagnet.

LEARNING OUTCOMES

The students should be able to:

- understand how magnetism can be induced in a piece of iron or steel.

START (15 minutes)

- Review 'Test yourself' questions from previous lessons.
- Show a small piece of a broken magnet to the class and ask if it is a complete magnet? Test the properties of this magnetic piece.

MAIN (15 minutes)

- Explain the domain theory with arrows drawn in the same direction on the board.
- Discuss if a piece of iron is kept near a magnet, what will happen to the domain?
- Ask students to magnetize a piece of iron by stroking it repeatedly with a magnet. Bring an iron nail near to the induced magnet. What happens? Then bring a steel nail near to it.

PLENARY (15 minutes)

Discuss the following in class:

- How can you make a temporary magnet? What happens to the domains before and after making a temporary magnet?
- What is induced magnetism?
- How can you make a permanent magnet?

HOMEWORK

'Test yourself' questions, pg 52 of Student Book.

Lesson 4-4

Page 53

OBJECTIVES

- To show how magnets and electromagnets can be used in a number of devices

LEARNING OUTCOMES

The students should be able to:

- demonstrate how an electromagnet is made.
- describe some uses of magnets and electromagnets.

START (10 minutes)

Elicit responses from students on following questions:

- Have you seen an electromagnetic crane?
- Where is it used?
- Where else do we use electromagnets?

MAIN (25 minutes)

- Read page 53.
- The teacher should show an electromagnet and explain how to make it (as written in the worksheet 4-4). Students should be divided into four groups. Each group should be given an iron nail, copper wire, and batteries. They will be asked to make the electromagnet themselves.
- Hand out worksheet 4-4 after the activity.

PLENARY (10 minutes)

Ask and discuss responses of 'Test yourself' questions given on page 53 of Student Book.

HOMEWORK

- Workbook pages 27-28, Question 7 and 8.
- Students can do research on where electromagnets are used in modern technology.
- Project to construct a working model of an electromagnet can be assigned to the students.

EXTENSION

http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/electricityworld/mainselectricityrev3.shtml

This site allows students to set the allowed maximum for a circuit breaker and then to set the current flowing through it. If the actual current exceeds the maximum set, the circuit breaker will cut the circuit. NB, this circuit breaker is a slightly different design from the one in the Student Book.

Lesson 4-5

Pages 54-55

OBJECTIVES

- To show how magnets and electromagnets can be used in a number of devices.

LEARNING OUTCOMES

The students should be able to:

- describe some uses of magnets and electromagnets.

START (10 minutes)

- Ask students if they can identify the uses of electromagnets.
- Read page 54 and briefly explain the uses of electromagnets.

MAIN (25 minutes)

- Read page 55.
- A relay is an electronically controlled switch. It uses a small current to turn on a separate circuit, which may carry a large current.
- In electronic circuits, small reed relays are used. These have a very thin, flexible piece of metal inside a glass tube. The metal acts like a switch. When a magnet is nearby, the switch becomes magnetized and the contacts touch. The relay can be activated by a small bar magnet or a small coil. Some reed relays have their contacts together under normal conditions. The switch then opens in a magnetic field.

PLENARY (10 minutes)

Ask and discuss responses of 'Test yourself' questions given on page 56 of Student Book.

HOMEWORK

Workbook pages 28-29, Question 8.

Read pages 48 and 49.

Task 1

a. Use the magnet your teacher has provided to test if objects are attracted. Record your findings in the table below. You must record at least 6 objects.

What is the object?	What is it made of?	Is it attracted to the N pole of the magnet?	Is it attracted to the S pole of the magnet?

b. What conclusion can you draw from your findings?

_____

_____

Task 2

With your class, suspend your magnets from a piece of string so that they can move freely. Place them around the room.

a. What do you notice about the orientation of the different magnets?

_____

_____

b. If you bring another magnet near to one of the free moving magnets, what happens?

_____

_____

c. Explain what happened in both of the above situations. Read page 49 of your Student Book if you need some help.

_____

_____

Make sure you have read pages 48 – 50 of your Student Book.

Task 1

a. Place a bar magnet flat on the table and place a thick sheet of paper on top of the magnet. If overhead transparencies are available, these are great too.

b. Gently shake a small amount of iron filings onto the paper or sheet.

c. Give the paper a few very gentle taps to allow the iron filings to settle.

d. Draw the field lines (=patterns you see) below.

e. Repeat using different shaped magnets.

f. Take a good look at the density of the iron filings at various points. There are more filings in some places than in others. You can also see this on page 48 of your Student Book. What could be the reason for this?

_____

_____

g. We indicate a stronger magnetic field by drawing the field lines closer together. Check if you did this in your drawings and adjust them if necessary.

Check with your teacher if you are allowed to place **two** magnets under a sheet to study the interactions on the position of the iron filings. Draw the field lines and compare them with those on page 50 of your Student Book.

1. Make an electromagnet. Take an iron nail. Wind 20 turns of copper wire around the iron nail.

   a. Is it behaving like a magnet?

   b. How many pins are attracted by this electromagnet?

   c. Now connect the ends of the wire to two batteries. What do you observe?

   d. How many pins can be attracted now? Record your observations.

2. Now take the same size of iron nail, but this time wind 40 turns of copper wire with one battery, and then with two batteries. Record your observations.

No. of turns of wire	No. of batteries	No. of pins attracted by electromagnet
20	1	
20	2	
40	1	
40	2	

   a. Which variables have you changed in this experiment?

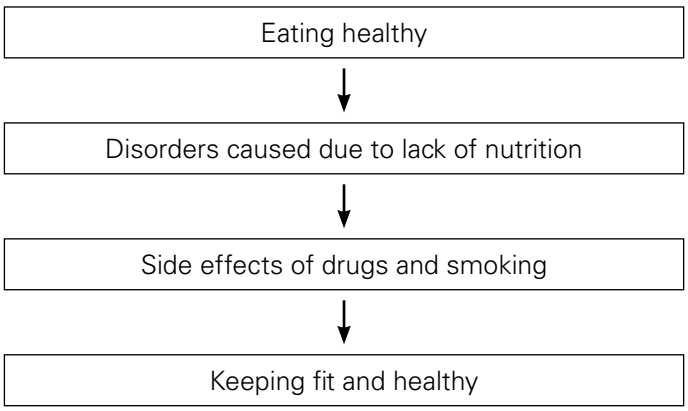
   b. Which variable has been constant?

   c. How can you make an electromagnet stronger? List two ways.

Chapter

5 Fit and Healthy

UNIT FLOW CHART



INTRODUCTION

The food we eat provides our bodies with stores of chemical energy. Most of this is used to provide energy for four things:

1. to keep our bodies working.
2. for growing new cells in our bodies.
3. to keep our bodies at the right temperature.
4. to enable our muscles to do work.

Keeping a healthy body weight is a matter of balancing the energy we take in as food, with the energy we use up. Any unused energy is stored as fat in our bodies. Starchy foods are first converted by digestive enzymes into sugars such as glucose. The chemical breakdown of glucose to release energy takes place inside the body cells. This process is called respiration. We can keep fit by eating reasonable amounts of sensible foods, and by exercising regularly.

The purpose of this chapter is to make the students realize the importance of balanced diet and what diseases are caused due to nutrition disorders and how to keep fit and healthy by taking balanced diet and not using drugs and smoking which have bad effect on health.

Lesson 5-1

Pages 60-61

OBJECTIVES

- To show how diet, exercise, smoking and other drugs affect health.

LEARNING OUTCOMES

The students should be able to:

- describe how the body uses the energy and nutrients in food.

START (10 minutes)

Ask the following questions from the students:

- Did you eat breakfast today?
- What happens if you are ill or if you cannot eat your breakfast in the morning and come to school?
- What is a balanced diet and why is it important?

MAIN (20 minutes)

- Read pages 60-61.
- Show a chart of a balanced diet to the students showing the different nutrients and foods that contain those nutrients. Their importance and the diseases that are caused due to their deficiency will be discussed.
- Ask students to complete the table about types of food in worksheet 5-1. This information is revision of what they learnt last year.
- Complete Task 2 of worksheet 5-1.

PLENARY (15 minutes)

Divide the class into seven groups. Give each group a nutrient and ask them to research its importance, food sources, and deficiency problems and prepare a presentation. One team member from each group will present and class will discuss how food requirements vary from person to person according to size, age, occupation, and climate.

HOMEWORK

Do Question 7 and 8 on pages 35 and 36 of the Workbook.

Lesson 5-2

Pages 62-63

OBJECTIVES

- To show how diet, exercise, smoking and other drugs affect health.

LEARNING OUTCOMES

The students should be able to:

- identify some eating disorders, including diabetes, heart disease, asthma, and arthritis.
- describe some of the results of malnutrition including scurvy, rickets, and anaemia.

START (10 minutes)

Review 'Test yourself' questions given on page 62 of Student Book.

MAIN (20 minutes)

- Read pages 62-63.
- Ask the students: what will be the effect on our bodies if we do not eat a varied diet?

  Explain that if we do not eat a varied diet in the right proportion, we will be under-nourished. This is called malnutrition which means bad nutrition, but the word usually refers to the effects on the body of eating too much, too little or the wrong kinds of food.
- Ask the students: what effect would overeating have on the body?
- Explain that eating too much can cause a person to become fat or obese. There is now clear evidence that obesity contributes to heart disease, high blood pressure, diabetes, diseases of the gall bladder, cancer of the bowels, and breast cancer in women.
- Hand out worksheet 5-2.

PLENARY (15 minutes)

Make a chart about:

Things that can lead to heart disease:

Eating lots of fat
Cigarette smoking
Obesity
No exercise
Stressful way of life

How heart disease can be avoided:

- Cut down on fried foods
- Eat less red meat
- Eat less dairy foods
- Eat more poultry and fish
- Eat more fresh fruit and vegetables
- Do not smoke

HOMEWORK

Workbook pages 31 and 32 , Question 3 and 4.

Lesson 5-3

Pages 64-65

OBJECTIVES

- To show how diet, exercise, smoking and other drugs affect health.

LEARNING OUTCOMES

The students should be able to:

- describe some of the effects on the body of smoking and other harmful drugs.

START (10 minutes)

- Ask students to read pages 64 and 65 of the Student Book.
- Ask the following questions:

  What is a drug?

  What are some harmful effects of taking certain drugs?

MAIN (20 minutes)

- Discuss the use of useful drugs like aspirin, paracetamol, and anesthetics.
- Discuss the effects and risks to human health of taking drugs. Explain to the students that a drug overdose can cause unconsciousness, damage to the heart and other organs, and even death. A drug user may suffer strong feelings of anger and fear or terrifying hallucinations. Drug users become irritable and lose interest in their friends, family, hobbies, and work. They may stop looking after themselves. People taking drugs also run the risk of accidents, because they get confused.
- Hand out worksheet 5-3 to students.

PLENARY (15 minutes)

- Discuss in groups the useful and harmful effects of drugs on the body. What are withdrawal symptoms? Take feedback from groups.

HOMEWORK

Workbook pages 33-34, Question 5 and 6.

Lesson 5-4

Pages 65

OBJECTIVES

- to show how diet, exercise, smoking and other drugs affect health.

LEARNING OUTCOMES

The students should be able to:

- describe some of the effects on the body of smoking and other harmful drugs.

START (10 minutes)

Ask the students why do they think smoking is harmful?

MAIN (20 minutes)

- Read page 65 of Student Book.
- Students should be briefed about the harmful chemicals present in tobacco smoke and the different diseases caused by them.
- Ask students what is passive smoking and who are passive smokers?

PLENARY (10 minutes)

Make a colorful poster to discourage people from smoking with illustrations and warnings written on it.

HOMEWORK

Worksheet 5-4

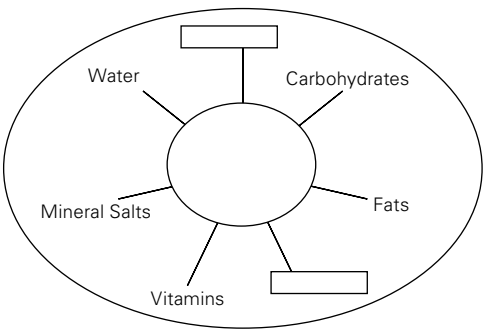
Task 1

You have read in the lesson that a healthy diet is varied and must have a balance between different types of food. Make a food chart as follows:

Type of food	Main nutrient	Example of food rich in this nutrient			
		Breakfast	Lunch	Dinner	Snack
foods that provide energy					
foods that provide building materials					
foods that control chemical reactions in the body					
foods that contain dietary fibre (roughage)					

Task 2

Look at the following chart of a balanced diet and answer the questions.



i. Which two nutrients are missing from the balanced diet?

_____

_____

ii. Give an example of energy foods.

_____

_____

iii. Which nutrient helps chemical reactions to take place?

_____

iv. Which nutrient is essential for growth and the repair of cells?

_____

v. Which nutrient helps to keep our intestines working properly and prevent constipation?

_____

vi. Which nutrient is taken in small amounts for building tissues?

_____

vii. Which nutrient prevents deficiency diseases?

_____

viii. Which nutrient helps to store energy?

_____

Task 1

The word bank below contains a list of vitamins and minerals which are linked to certain conditions. Write the vitamin and/or mineral next to the condition to which it is linked. Some information can be found on page 63 of your Student Book; you also came across some of this last year.

calcium	sodium chloride	vitamin C
iron	vitamin A	vitamin D
protein		

Condition	**Vitamin**
anaemia	
high blood pressure	
kwashiorkor	
night blindness	
rickets	
scurvy	

All but one of the conditions above is caused by not eating enough of the vitamin or mineral. Which one is caused by eating too much of the vitamin or mineral? Write "WHEN EATEN TOO MUCH" beside this vitamin or mineral.

Task 2

1. Write down three things you can do to prevent obesity.

   _____

   _____

   _____

2. State the causes of the following diseases:

   i. arthritis

   _____

   ii. diabetes

   _____

   iii. heart disease

   _____

3. How might eating a banana help an athlete before taking part in a race?

   _____

   _____

4. What is the disadvantage of taking too much salt in one's diet?

   _____

   _____

Task 1

Read pages 64 and 65 of your Student Book.

1. What is a drug? Copy the definition given on page 64 of your Student Book below.

2. Name four types of useful drugs and outline their effects.
   1.
   2.
   3.
   4.

3. Although these drugs are useful, they can still be dangerous when someone takes too much of them. What is another danger?

1. Name three diseases caused by smoking.

2. What chemicals are present in cigarette smoke?

3. Briefly explain the meaning of the term "passive smoking" .

4. Which organs of human body would be damaged due to smoking?

5. What would be helpful to smokers who wish to stop smoking? Do you think there is something you could do to help a smoker quit?

6. Read pages 66 and 67 of your Student book. Think of your lifestyle; consider especially what you eat and how you spend your spare time. What changes would most improve your health? All students are different, so your answer will be different from those of others in your class.

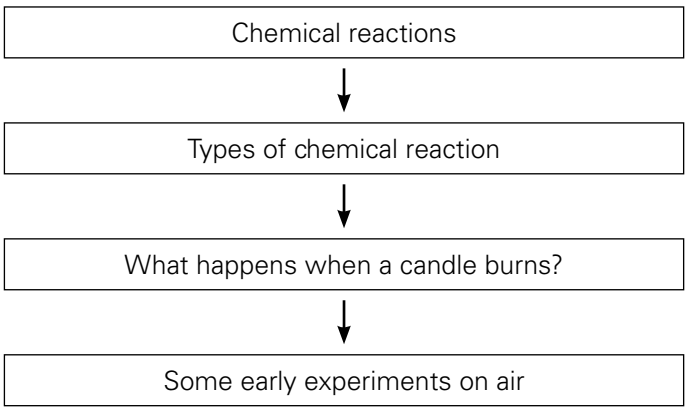
7. How difficult would it be for you to make the changes you have identified above?

8. Can you think of a way you could make it easier for yourself to make these changes?

Chapter 6

Simple chemical reactions

UNIT FLOW CHART



INTRODUCTION

Changes in materials are taking place around us all the time. Most of the changes in materials are of two main kinds. In one kind, the volume or the state of the material is changed. We call this a **physical change**. In the other kind, one material is changed into another material. We call this a **chemical change**.

When a physical change takes place, a material is changed in size or form without actually becoming another material. If we stretch or squeeze a piece of soft rubber, we change its size, but it is still rubber. It springs back when we let it go. When sugar dissolves in water it changes form, from a solid to a liquid, but it is still sugar. Other physical changes occur when ice melts, when water freezes, when wet things become dry.

Explain that when a chemical change takes place, a material is changed into one or more different materials. For example, if we hold a piece of paper next to a lighted match, the paper catches fire and burns. A flame is seen, and some smoke, and then nothing but ashes. The paper has disappeared. Such a reaction cannot be reversed. We cannot get back the paper we have burnt. Similarly, when we heat mercuric oxide, mercury and oxygen are produced. A red powder is changed into a silver-coloured liquid and a colourless, odourless gas is given off. Both of these are examples of chemical changes. Other chemical changes occur when wood rots, iron rusts, milk sours, and cloth fades.

Ensure that the students understand the difference between a physical and a chemical change.

Lesson 6-1

Pages 72-74

OBJECTIVES

- To show the difference between physical and chemical changes.

LEARNING OUTCOMES

The students should be able to:

- define chemical reaction.
- differentiate between physical and chemical changes.
- explain chemical changes thoroughly.

START (10 minutes)

- Review page 72 with students and discuss which picture shows physical and which shows chemical change.

MAIN (25 minutes)

- Students will read pages 73-74.
- Show the students a burning candle. Ask about the two types of change taking place in the burning candle. A candle is made of wax, which is a compound of two elements—carbon and hydrogen.
- Discuss the following questions:

1. What type of change takes place when wax melts?
2. When the wick of a candle burns, what two substances are given out? What type of change is this?
3. Is heat given out? What do you call a reaction in which heat is given out?

As the candle burns, both physical and chemical changes take place. First, heat from a burning match melts the wax in the wick, and then changes some of the melted wax to a gas. The hot gas burns and gives off heat which melts the wax at the top of the candle. As wax burns, it uses oxygen from the air to produce carbon dioxide and water.

- Hand out worksheet 6-1 and go over it so that students understand what they need to do.

PLENARY (10 minutes)

Pair and share activity:

- List the differences between physical and chemical changes while investigating the above examples.
- Write three chemical and three physical changes you observe at home.

HOMEWORK

- Workbook page 39, Question 7 and 8 .

Lesson 6-2

Pages 74-76

OBJECTIVES

- To show the difference between physical and chemical changes.

LEARNING OUTCOMES

The students should be able to:

- name some types of chemical reaction.
- explain synthesis and decomposition reactions with the help of laboratory experiments.

START (10 minutes)

Discuss the following questions with the students:

- What type of reaction takes place when something is formed?
- What is the name of the type of reaction in which something is broken down into simpler substances?

MAIN (25 minutes)

- Students will read pages 74-76.
- Explain to the class that when calcium carbonate is heated, it breaks down into calcium oxide and carbon dioxide. This is an example of a decomposition reaction.
- Experiments can be performed in the lab with the help of worksheets.
- Complete the worksheet 6-2.

PLENARY (10 minutes)

- Discuss the 'Test yourself' questions from page 76.

HOMEWORK

Workbook page 39.

Lesson 6-3

Pages 76-77

OBJECTIVES

- To explain what is meant by synthesis, decomposition, displacement, and combustion.

LEARNING OUTCOMES

The students should be able to:

- explain the displacement and combustion reactions.
- demonstrate displacement and combustion reactions.

START (10 minutes)

Ask the students to study displacement reaction on page 76 of the student's book. Explain that here iron and copper are competing to be the compound in the solution. Here iron wins. It drives out or displaces copper from the copper sulphate solution. Green iron sulphate is formed.

In the same way other metals displace less reactive metals. This means that a metal will always displace a less reactive metal from solutions of its compounds.

MAIN (20 minutes)

- Experiment:

  Put iron nails into copper sulphate solution. Ask the students if they can see any reaction taking place? Explain that iron can displace copper because it is more reactive than copper.

  Now put copper nails into iron sulphate solution. Is there any reaction taking place? Why not? Explain that only a more reactive metal can displace a less reactive metal.

- Hand out worksheet 6-4.

PLENARY (15 minutes)

Discuss the 'Test yourself' questions on page 78.

HOMEWORK

- Write an example of each of the following reactions with a word equation:

  synthesis, decomposition, displacement, and combustion.

Lesson 6-4

Page 78

OBJECTIVES

- To explain what is meant by synthesis, decomposition, displacement, and combustion.

LEARNING OUTCOMES

The students should be able to:

- explain the combustion triangle.
- describe the types of chemical reactions including synthesis, decomposition, displacement and combustion.

START (10 minutes)

Ask the students which materials give out energy when burnt.

MAIN (25 minutes)

- Discuss the following questions:
  1. Name some common fuels you use in everyday life.
  2. What is the chemical name for fuel?
  3. What is formed when fuel is burned?
  4. What are the differences between endothermic and exothermic reactions?
  5. Explain the combustion triangle and how to put out fire.
- Hand out worksheet 6-7

PLENARY (10 minutes)

- Ask the students to identify ways to put out a house fire.

HOMEWORK

- Workbook, page 40, Question 9.

1. Iron filings and sulphur are mixed in a watch glass.
   i. How would you separate the iron from the sulphur?

   ii. What type of change is this?

2. Iron filings and sulphur are put in a test tube and heated.
   i. What new substance is formed?

   ii. What type of reaction is this?

   iii. Can you now separate the iron from the sulphur? Give a reason for your answer.

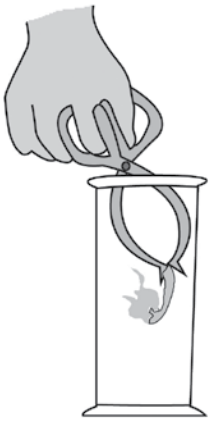
   iv. What do you call the reaction in which heat is taken in, and the reaction in which heat is given out?

3. Iron reacts with oxygen to form iron oxide.
   i. Represent this chemical reaction with a word equation.

   ii. Name the reactant and the product in this chemical reaction.

Task 1

Burn a piece of magnesium ribbon in a jar of oxygen covered with a lid.



i. What new substance is formed?

_____

ii. Is this a chemical reaction?

_____

iii. Represent this reaction in the form of a word equation?

_____

iv. Name the reactant and the product of the above reaction.

_____

v. When any element combines with oxygen, what is the process called?

_____

Task 2

Heat a small amount of sugar in a test tube.

i. What two new substances are formed in this reaction?

_____

ii. Represent the above reaction in the form of a word equation.

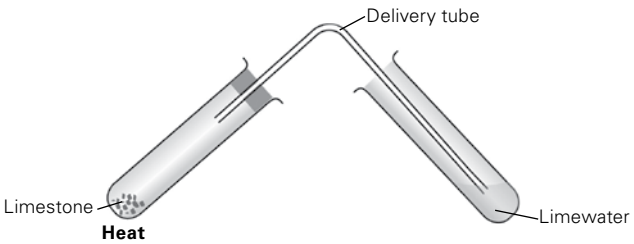
_____

iii. What type of reaction is this?

_____

Task 3

Heat a small amount of calcium carbonate (limestone) in a test tube. Pass the gas produced through some lime water.



i. Write a word equation for the above reaction.

_____

ii. What is the test for carbon dioxide?

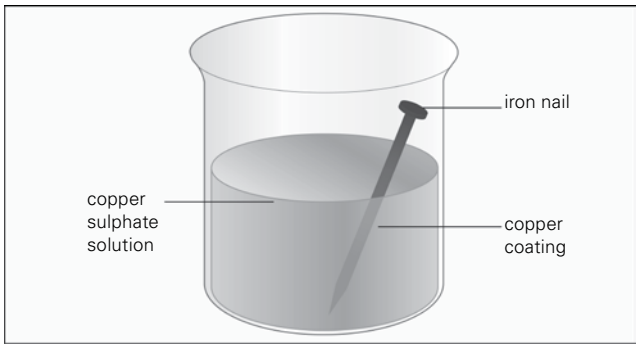
_____

iii. What do you call to the process of breaking a compound into two or more substances?

_____

Task 1

Put an iron nail into copper sulphate solution in a beaker.



i. Is this a chemical reaction? Give reasons to support your answer.

_____

_____

Task 2

Put a piece of copper into iron sulphate solution.

i. Is there any reaction taking place? Why?

_____

_____

_____

ii. What is a displacement reaction?

_____

_____

_____

Task 3

Light a candle and ask the students to observe the flame.

i. What type of reaction is this?

_____

ii. What new substances are formed when a candle burns?

_____

iii. Is this an exothermic or an endothermic reaction?

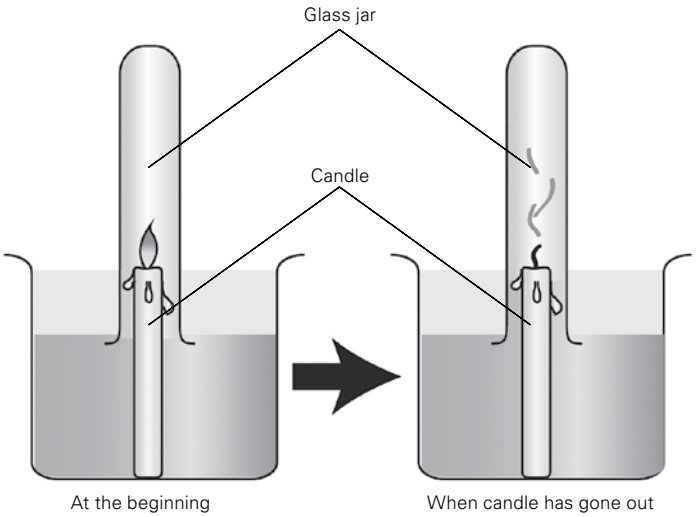
_____

iv. Is respiration an example of combustion? Give reasons for your answer.

_____

Task 4

Place a burning candle in a trough of water and invert a gas jar over it.



i. What happens to the candle?

_____

ii. Why does water rise up in the jar?

_____

iii. How much water has risen up?

_____

iv. What does this indicate?

_____

v. What is the test for oxygen?

_____

Task 5

Complete the following word equations.

i. magnesium + oxygen → _____.

ii. iron + _____ → iron oxide.

iii. iron + _____ → iron sulphide.

iv. carbon +_____ → carbon dioxide.

v. hydrogen + oxygen → _____.

vi. glucose + oxygen → carbon dioxide + _____ + energy.

vii. fuel + _____ → carbon dioxide + water + heat energy.

viii. iron + copper sulphate → iron sulphate + _____.

i. What is fuel?

ii. Name some fuels.

iii. What is the chemical name of fuel?

iv. Which two substances are formed when a fuel is burnt?

v. What is burning of fuel called?

vi. Write an equation for burning of fuel.

vii. Is burning an endothermic or exothermic reaction? Justify your answer.

viii. How can respiration be compared with combustion?

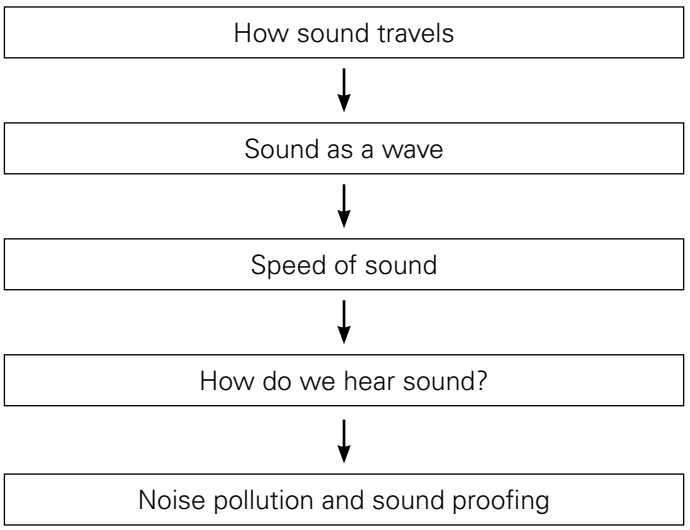
ix. What useful product is formed when fuel burns?

x. How can we cut down the supply of oxygen to a flame to put out fire?

Chapter

7 Sound and hearing

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 7-1

Pages 84-86

OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to:

- describe how sounds are made by musical instruments.
- explain that sound needs a medium to travel through and that it travels at different speeds through different media.

START (10 minutes)

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 minutes)

- Ask students to speak loudly or sing a song. Keep a finger on their throat, what do they feel?
- Use a diagram to explain how sound energy travels in the form of sound waves by compression and rarefaction.
- Search keywords "sound waves, compression, rarefaction, video" and select an appropriate video to be shown to the students.

PLENARY (15 minutes)

- Investigation from page 95 can be conducted in class.

HOMEWORK

Workbook pages 43-44, Question 3 and 4.

Lesson 7-2

Pages 84-85

OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to:

- describe how sounds are made by musical instruments.
- 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 minutes)

- 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 low-pitched 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.
- Ask students to complete Worksheet 7-1.

PLENARY (10 minutes)

Read out 'Speed of sound' on page 87 and explain the speed of sound.

HOMEWORK

'Test yourself' questions page 86.

Please note

As the structure of the ear might be a little complicated to understand, you may wish to show a video which could help.

If you do a video search on "how the ear works" or "how your ears work", there should be several options to choose from. Preview and select the one most suitable for your students.

Lesson 7-3

Pages 87-88

OBJECTIVES

- To show how sound travels through different media

LEARNING OUTCOMES

Students should be able to:

- explain a sound wave and explain an echo.

START (10 minutes)

When we talk about the speed of sound, what do we really mean? What is speed? Is there another word for speed? (Yes, velocity.) What are the units of speed? (Speed is measured as the distance covered per unit time, so the units are, e.g., m/s or km/h.)

MAIN (20 minutes)

- Read pages 87-88

  The speed of sound in air is 330 m/s.

  Speed = Distance / Time

  Average Speed = Total distance travelled / Total time taken

- Ask your students to complete the worksheet 7-2.
- 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.

PLENARY (10 minutes)

- Discuss 'Test yourself' questions from the book.
- Ask students to solve the following question. 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.

HOMEWORK

Workbook, pages 48-49, Question 6.

Lesson 7-4

Page 89

OBJECTIVES

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

LEARNING OUTCOMES

Student should be able to:

- explain how changes in frequency and pitch of a sound wave affect a sound.

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)

- Explain through example of two singers singing songs. One is louder than other. Loudness depends on amplitude. The greater the amplitude, the louder the sound. This can be measured in decibels.
- Worksheet 7-3 to be solved by students.

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.

HOMEWORK

Workbook pages 46-47, Questions 4 and 5.

Task 1

1. How is sound produced? Check page 84 of your Student book if you need some help.

2. What is noise pollution?

3. How can noise level be measured?

4. Write down the noise level of the following:
   i. a whisper _____
   ii. a washing machine _____
   iii. an aeroplane taking off _____
   iv. 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?

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

4. 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?

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.

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. unwanted sound	
10. noise	j. unit of frequency	

Task 2

State whether the following statements are true or false.

i. High pitched sounds have a low frequency sound wave. _____

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

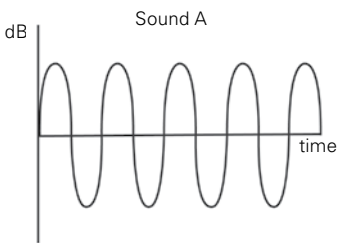
iii. The faster the vibration, the higher the frequency. _____

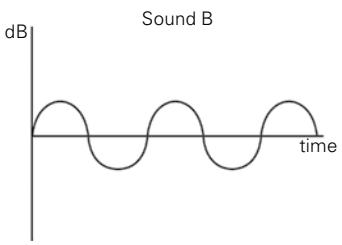
iv. A loud sound carries higher energy than a low sound. _____

v. 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?

_____

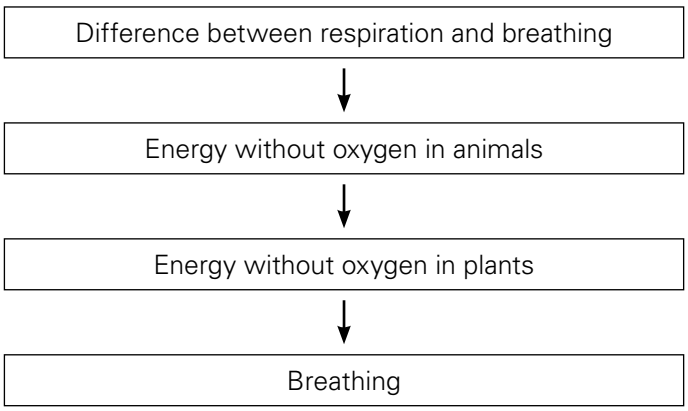
vii. Pitch is also described by a different word. What is this word and what are the units?

_____

Chapter 8

Respiration: it's all about energy

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.

Lesson 8-1

Pages 96-98

OBJECTIVES

- To show how living things release energy.

LEARNING OUTCOMES

The students should be able to :

- define respiration.
- distinguish between respiration and breathing.

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 96 -98. Ask students to answer the questions on worksheet 8-1.
- 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.
- 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 do muscle cells contain many mitochondria?
- Draw a table to show the composition of air. Why does the percentage of nitrogen remain unchanged during breathing?

HOMEWORK

Read pages 96 – 98 and answer the 'Test yourself' questions on pages 97 and 98.

Lesson 8-2

Page 99 – 101

OBJECTIVES

- 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.

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.

START (10 minutes)

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.)

HOMEWORK

Workbook page 53, Questions 3 and 4.

Lesson 8-3

Pages 101 - 103

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.

START (10 minutes)

Review questions from previous lesson on respiration.

MAIN (25 minutes)

- Show the students a chart of the human respiratory system of human beings.
- 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.

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.

HOMEWORK

Workbook pages 54 and 55, Questions 5 and 6.

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 103 of their Student Book.

Task 1

1. Write down the definition of breathing. Use page 98 if you need some help.

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? If you need some help, see page 96.

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

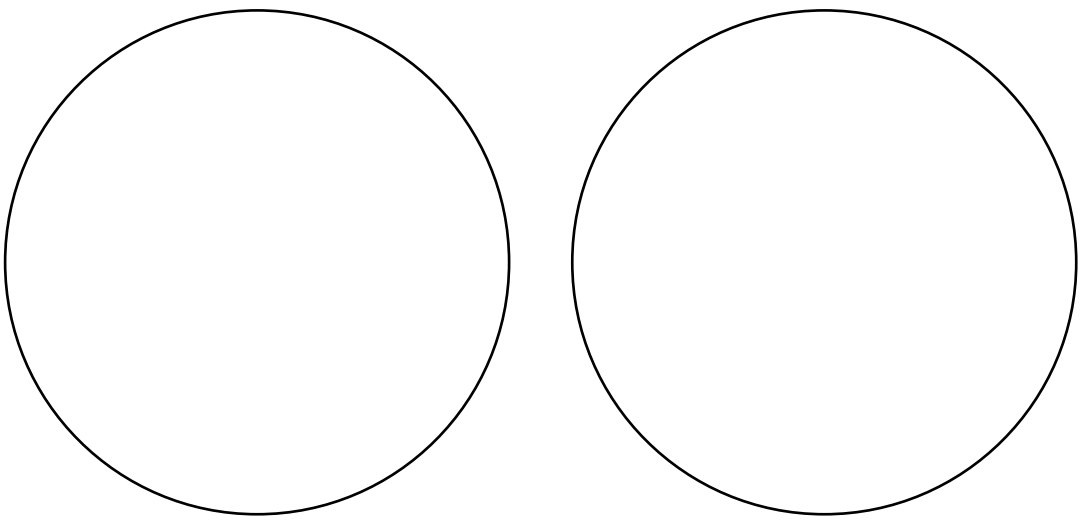
5. What is produced during cellular respiration?

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

Use the information on page 97 to 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**
Before exercise	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

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

_____

_____

_____

2. What is the word equation for aerobic respiration?

_____

3. 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?

_____

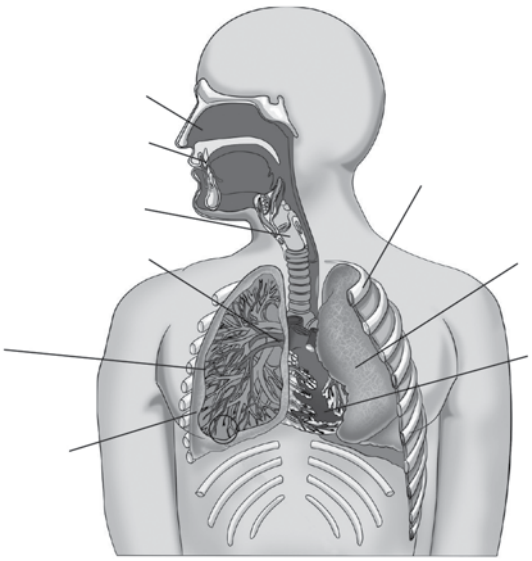
iii. What process was taking place in your ball of dough?

_____

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

_____

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. What effect does smoking have on the cilia?

_____

_____

6. Write down the differences between the following.

Breathing	Respiration

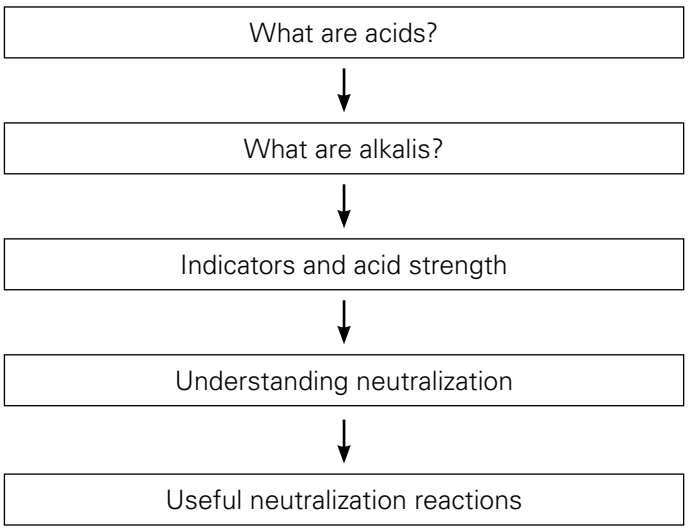
Aerobic Respiration	Anaerobic Respiration

Inhaled Air	Exhaled Air

Chapter 9

Acids and Alkalis

UNIT FLOW CHART



INTRODUCTION

Students are likely to be familiar with acids but a lot less (if at all) with alkalis or bases. It is important to consider the safety aspect of these chemicals and to be aware that alkalis are just as harmful as acids. Please ensure that students working with alkalis are aware of the dangers, just as they would be with acids, and please ensure safety glasses are worn. In general, students this age should not be working with concentrated acids or alkalis.

Another misconception relates to the opposite of acid. If our juice is too sour, we add sugar to make it taste better. Our palate seems to suggest that sweet is the opposite of sour. Please help students understand that in chemistry, we work with acids and alkalis and not with sweet and sour. If students struggle with separating these concepts, you could have two batches of the same juice. Leave one outside the lab and measure the pH of the other in the lab. Take the students out to taste the juice (no eating/drinking in the lab), add a known amount of sugar and have them taste it again. It will taste less sour. Go back into the lab, add the same amount of sugar to the same amount of juice and test the pH. It should not change as the sugar does not impact pH.

Some hazardous chemicals can also be found outside the lab. For example, many chemical drain cleaners are strong alkalis and could cause harm when they come into contact with skin, eyes or when inhaled. Without wanting to scare students, it would be useful if they realized that many of the products we find useful and potentially harmful.

Making soap could be a fun experiment to do in the lab but requires sufficient supervision to ensure the students safety. Also, the product (soap) should be left for a few weeks to ensure all hydroxide has reacted.

Note: If you are doing a neutralization reaction between acid and alkali, it is recommended to put the acid in the burette (rather than the alkali). Acid is easier to clean and alkali may damage the glass of the burette. It may also damage the beaker but burettes are much more expensive.

Lesson 9-1 & 9-2

Pages 108 – 110 + Pages 112 and 115

OBJECTIVES

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to:

- identify some acids and their everyday uses.
- explain the difference between the strength and concentration of an acid.
- explain the difference between a base and an alkali.

START (30 minutes)

- Ask students which food/drink they know of tastes sour? Answers may include vinegar, lemon, fruits. Have a discussion about what sour tastes they enjoy.
- Read pages 108 and 109 and discuss the fact that a sour taste is caused by the presence of acid.
- What do they consider to be the opposite of sour? (Most likely, the answer will be "sweet")
- So what do they do if their orange juice is too sour? (It is likely that answers will include "add sugar".) Explain that while sweet may be the opposite of sour in taste, sugar does not affect the acidity of a solution – it only adds a sweet flavour so we notice the sour less.

MAIN (35 minutes)

- Students should be able to differentiate between a strong acid and a weak acid. Students must be familiar about the pH level of these different acids. Strong acid contain more hydrogen ions in solution than weak acids. Dilute acid contains more water than concentrated acid.
- Show them the test for acids. Let them do the test themselves.
- Handout worksheet 9-1 to be solved by students.

PLENARY (15 minutes)

- Take different substances like lemon juice, pure water, vinegar, sulphuric acid.
- Find out pH from pH paper. Find out whether they are strong weak or neutral.

HOMEWORK

What are acids? Write down its five properties.

Lesson 9-3

Page 110

OBJECTIVES

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to:

- state the sources of acid rain.
- explain how acid rain is formed.
- what are the effects of acid rain.

START (10 minutes)

- Bring in some fizzy and non fizzy water, if possible.

  If you are not in the lab, ask students to taste a little of each. Apart from the bubbles, do they taste a difference? (It is likely that someone will say the fizzy water is a little sour.)

MAIN (20 minutes)

- Go through worksheet 9-3.
- Explain students how carbon dioxide dissolves in rainwater to from carbonic acid.
- Show them a chart of pollutant gases coming out from the factories and vehicles.
- How do these gases combine with rainwater to form acid rain? Discuss the effects of acid rain on plants and animals.

PLENARY (15 minutes)

- Discuss what causes acid rain? How is acid rain produced? What are the main sources of pollution?
- For some years, European governments encouraged people to drive diesel cars due to the lower amount of carbon dioxide produced. However, now, some cities are banning older diesel cars because of the higher amounts of

various nitrous oxides which are harmful to our health. Car owners were angry because they choose their diesel cars some years ago based on government recommendations and were then not allowed to drive into some cities.

- Discuss how we could best use our knowledge of pollution to live our lives as we want without damaging the Earth. The idea is to discuss the concept, not to find a solution (or even many solutions) but to make students aware of their impact on the environment but also of the complexity of these issues.

HOMEWORK

- Answer the following questions:

  What are the effects of acid rain on plants, animals and buildings?

  Why are plants more damaged by acid rain than animals?

Lesson 9-4

Pages 110 - 112

OBJECTIVES

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to:

- identify some everyday uses of alkalis.
- describe the pH scale.

START (10 minutes)

Ask the students if they have ever felt a heartburn, if they have what did they take to cure it? Bring in some antacid tablets and let students check what they contain.

MAIN (20 minutes)

- Write down different alkalis on the board with their formulae. What do all alkalis have in common? How will you define alkalis?
- Test different alkalis with litmus paper and find out the pH of different alkalis.
- Handout worksheet 9-4, for students to solve.

PLENARY (15 minutes)

Discuss the properties of alkalis and their uses in group activity.

HOMEWORK

Write down the properties of alkalis and their uses.

EXTENTION

If you wish to show students one use of alkali, you can involve them in making soap. Internet has many methods for making soap—please try them out beforehand as they can be tricky. Various fats and oils can be used but they will affect the method and result so make sure you find the method with the kind of fat or oil you wish to use. You could invite students to bring food colourants and/or scented oils. Please be aware that the alkali (lye) used is of a concentration that can be harmful. Ensure students wear eye protection.

Lesson 9-5

Pages 112 - 113

OBJECTIVES

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to

- explain what are indicators and how are they made.
- state some of its uses.

START (10 minutes)

- At the start of this topic, we spoke about acids in food, giving it a sour taste. If we want to know if something in the lab is an acid, tasting it may not be very safe. The same goes for alkalis. So we need another method to decide if a solution is an acid or alkali and how acidic or alkaline it is.
- Discuss with students the meaning of the word 'indicator'. An indicator shows something. In chemistry, an indicator is a solution which has a different colour in an acidic solution compared to an alkaline solution.
- Why do we use indicators for acid and alkalis?

MAIN (20 minutes)

- Read pages 112 and 113.
- Different indicators will be shown with their uses and explain how they are formed from different plants. If possible, have students make their own indicator (see "extension" at the end of this lesson.)
- Ask students to test different indicators themselves with acids and alkalis.

PLENARY (15 minutes)

- Name different indicators, their colors in acid and alkalis.
- What is a universal indicator?

HOMEWORK

Read page 114 and answer the 'Test yourself' questions.

EXTENSION

Students can make their own indicator from red cabbage. Chop some leaves of red cabbage as finely as possible. Cook for 10-20 minutes in a small amount of water. Filter out the cabbage leaves. The remaining solution is an indicator. Test it with known acids and bases and with unknown solutions. See page 121 of the Student book.

Lesson 9-6

Pages 115-117

OBJECTIVES

- To demonstrate what happens when an acid is added to an alkali.

LEARNING OUTCOMES

The students should be able to:

- explain neutralization.
- describe some useful neutralization reactions, including the formation of an acid salt.

START (5 minutes)

- A few lessons ago, we talked about antacid tablets which help against heart burn. Read page 115 and discuss with your students the chemical reaction which takes place in stomach when antacid tablet is taken.
- What does tooth paste contain? How does it neutralizes the effect of acid in your mouth? Why it is helpful to neutralise the acid in your mouth?

MAIN (15 minutes)

- Ask students to name any acid and any alkali. Write it on the board. What do you get when acid and alkali react together?
- Workbook, page 62.

PLENARY (15 minutes)

Ask students to write three equations with three acids and three alkalis joined together.

What common things you have got with each equation?

Discuss the uses of alkalis in groups.

Name different neutralization reactions which you use in your daily life.

Discuss the meaning of the word "salt" when we discuss food and when we talk about chemistry.

HOMEWORK

'Test yourself' questions, page 117.

EXTENTION

If you have the materials, give students a solution of dilute alkali with phenolphthalein. This will be bright pink. Students should add acid (e.g. via a burette – tell them how to add approximately so they can do it quickly before adding the acid drop by drop) and from one drop to the next, the solution will go colourless. If you want, you could go round to add a few drops of alkali so they can again create this change. Discuss what actually happened (acid, base, neutralisation, indicators). Students generally find this a very cool experiment and you can teach them how to use a burette.

Task 1

Acids are solutions which contain H^+ ions. The more H^+ ions, the more acid the solution is. Acids are found in many foods and can taste great but other acids are dangerous and can burn your skin or eyes. When working with acids, always wear safety glasses to protect your eyes.

Look at page 115 to help you answer the following questions.

i. a. What is the chemical formula of hydrochloric acid?

_____

ii. As hydrochloric acid is an acid, it must release its H^+ ions. Can you think of what this equation would look like?

_____ → H^+ + _____

iii. Cross out the incorrect word:

If we put a lot of HCl in a little water, we have made a concentrated / dilute solution of HCl.

If we put a little HCl in a lot of water, we have made a concentrated / dilute solution of HCl.

iv. Describe the difference between a concentrated and a dilute solution.

_____

_____

Task 2

Read page 112.

The reaction you completed above is called the *dissociation* of hydrochloric acid: the hydrochloric acid separates into hydrogen ions and chloride ions. When you put hydrochloric acid in water, (almost) all hydrochloric acid molecules will dissociate into hydrogen ions and chloride ions. Acids which (almost) completely dissociate are called *strong* acids. Examples of strong acids are hydrochloric acid (HCl) and nitric acid (HNO_3).

Some other acids are *weak* acids. They do not dissociate completely in water. Examples are carbonic acid (H_2CO_3) and acetic acid (CH_3COOH).

For example, when acetic acid is placed in water, a few of the molecules will dissociate:

$CH_3COOH \rightarrow H^+ + CH_3COO^-$

but many CH_3COOH molecules will not dissociate and just remain as they are.

The strength of an acid (strong or weak) is a property of the acid and we cannot change this.

We can decide the concentration of any acid. So we can have a concentrated solution of a strong acid or a concentrated solution of a weak acid. The same for a dilute solution of a strong acid or a dilute solution of a weak acid.

i. Describe the difference between a strong and a weak acid. Give an example of each.

_____

_____

ii. You have concentrated solution in the laboratory. You want to make it dilute. How will you dilute this concentrated solution?

_____

_____

iii. You have two beakers of acids with different strengths. How will you find out the strength of these acids?

_____

_____

Task 3

Test the pH values of the following substances and classify them as strong acid, weak acid or neutral.

Substances	pH values	Strong/Weak/Neutral
1. Lemon juice		
2. Pure water		
3. Vinegar		
4. Sulphuric acid (concentrated)		
5. Acid rain		

Task 4

Write down the formulae of following acids.

i. Hydrochloric acid _____

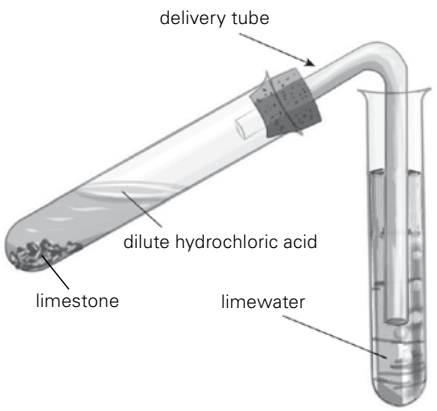
ii. Nitric acid _____

iii. Sulphuric acid _____

Task 5

EXPERIMENT

Put some limestone in a test tube and add some dilute hydrochloric acid. Pass the gas through lime water as shown in the diagram.



i. What is the chemical name of limestone?

_____

ii. What happens when acid reacts with carbonate?

_____

iii. Which gas is produced?

_____

iv. What is test for this gas?

_____

v. What three substances are formed when an acid reacts with carbonate?

_____

vi. What is the equation for the above reaction?

_____

vii. What is the chemical property of acids?

_____

i. Compare the taste of fizzy water with non-fizzy water. What is the difference in taste? Try to ignore the bubbles.

_____

ii. Fizzy water has gas added to it. Name this gas.

_____

iii. The taste of fizzy water is a result of a reaction of the gas with water. The result of this reaction is carbonic acid. Go back to worksheet 9-1 and find the formula of carbonic acid.

_____

iv. What kind of acid is carbonic acid?

_____

Since air contains carbon dioxide and water vapour, the same reaction will take place naturally. As a result, rain is naturally slightly acidic, due to the presence of H^+ from carbonic acid, and this is not harmful.

v. What gas is produced by burning coal and oil in power stations, as well as by cars?

_____

vi. What is produced when this gas dissolves in water?

_____

vii. Acid rain has a little dissolved carbonic acid, but also some sulfuric acid and even nitric acid. Most sulfur dioxide is produced by electrical power stations but most nitrous oxides are produced by cars and trucks running on diesel. When comparing similar cars running on diesel or on petrol, we find that petrol cars produce about 30% less nitrous oxides than diesel cars. However, diesel cars produce about 40% less carbon dioxide than cars running on petrol. Both of these gases pollute the environment in different ways.

Suggest some realistic changes which could reduce acid rain.

_____

_____

1. Write down the formulae and uses of the following alkalis:

Alkalis	Formulae	Uses
Sodium hydroxide		
Calcium hydroxide		
Magnesium hydroxide		
Ammonium hydroxide		
Potassium hydroxide		

2. Test the following substances with universal indicator or pH papers and write their pH values. State whether they are strong or weak alkali.

Alkalis	pH	Strong or Weak Alkali
Baking soda		
Ammonia		
Mineral water		
Tooth paste		

3. What is the difference between strong and weak alkali?

_____

_____

4. What two substances are formed when an acid reacts with an alkali?

_____

_____

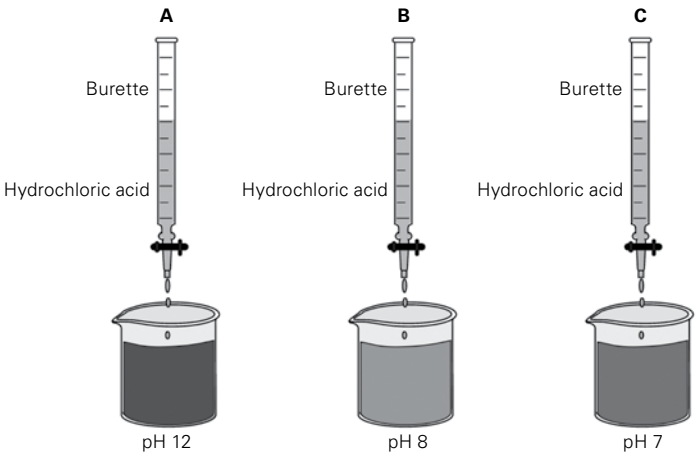
5. Write down three physical properties of alkalis.

_____

_____

_____

1. Setup the experiment as shown in the diagrams below.



i. What is the effect on pH when acid is added from the burette into the beaker with sodium hydroxide and universal indicator in diagram A?

_____

ii. What does pH 7 indicates in diagram C?

_____

iii. What does pH 8 indicates in diagram B?

_____

iv. What is neutralization?

_____

v. Write three uses of neutralization.

_____

_____

_____

vi. What types of salts are produced when acid reacts with:

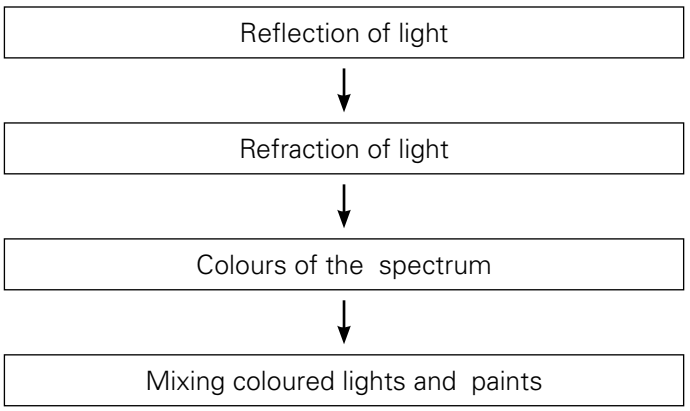
Hydrochloric acid _____

Nitric acid _____

Sulphuric acid _____

Chapter 10 Light

UNIT FLOW CHART



INTRODUCTION

Most people consider vision their most important sense. But what is needed for us to see? What are the characteristics of light? What about people who do not see clearly? How wonderful is it that it simply takes a pair of glasses and they also have good vision.

For many people, colours are very important. Just imagine living in a house where everything (floor, walls, ceiling, furniture) is black. Most of us would not want to live in such a house. Although we know there is no pot of gold at the end of the rainbow, it still is a beautiful sight which puts a smile on your face. But what are colours? Colours of light behave differently than colours of e.g. paint and their interaction is described in this chapter.

This topic is very practical and students should have no problem linking it to their daily lives outside school. Please make sure to help them see these connections where possible.

Lesson 10-1

Pages 122-124

OBJECTIVES

- To explain how we see objects.

LEARNING OUTCOMES

The students should be able to:

- explain that light travels in straight lines and at very high speeds.
- explain the terms, luminous, non-luminous, transparent, opaque, and translucent.

START (10 minutes)

Take students to a dark room with a lamp or some torches and let them make shadow puppets. One example is given in Worksheet 10-1.

Ask students:

- Can you see light coming from the window?
- Can you see through the wall?
- Look through the tracing paper, how much light can pass through it? Name the term used for three objects and explain them.
- Can light pass through vacuum? How can you prove this?

MAIN (20 minutes)

- Find out from the Student book different terms used for light. Write as many as you can. Now ask the students to name their list. Write these words on the board. Now ask the students to define these terms.
- Let the student investigate some properties of light with the help of torch, candle rubber tube and a white sheet of paper.

PLENARY (15 minutes)

- Define the following terms.

  Luminous, non-luminous, transparent, translucent, opaque, shadow, umbra, pen umbra, laterally inverted.

HOMEWORK

Remaining worksheet if left incomplete in class or 'Test yourself' questions on page 124.

Lesson 10-2 & 10-3

Pages 124 - 126

OBJECTIVES

The students should be able to:

- State the characteristics of an image formed by a plane mirror.
- Define and explain the reflection of light.
- State the laws of reflection.

START (10 minutes)

Ask the students:

- What type of image is formed on the mirror when they observe themselves on the mirror daily? Explain it.
- Why is the word 'ambulance' written laterally inverted on the wind screen?

MAIN (15 minutes)

- Show the students a model of periscope with a wooden tube with two mirrors keeping at 45 degree facing each other. Ask one of the student to look at the down mirror and see what is going up. Where the periscopes are used?
- Show a kaleidoscope also which is a tube containing three plane mirrors placed vertically at a certain angle with each other and join with a tape, small pieces of colored bangles are put on one side which is closed. Then look through the other end with eye piece by turning the tube. How many images are formed? How you are able to see different designs?

PLENARY (15 minutes)

- Give students a wooden board, white sheet of paper and a strip of plane mirror with stand.

  Student will place a graph paper on the wooden board. Place the mirror with the mirror stand in the center of graph paper. Now ask them to write their name in such a way that on the mirror it seems straight.

  - What type of image is formed by the plane mirror?
  - Is it upright?
  - How far away is the image formed inside the plane mirror?
  - Write down five characteristics of the image formed by the plane mirror.

- Worksheet 10-2 will be given to the students.

HOMEWORK

- Make your own periscope or kaleidoscope.
- Workbook page 65, Question 3 and 4.

Lesson 10-4

Pages 126 - 128

OBJECTIVES

- To represent light as a ray and use this concept to explain reflection and refraction.

LEARNING OUTCOMES

The students should be able to:

- describe how light is reflected and refracted at plane surfaces.
- describe the spectrum and explain how the different colours of the spectrum are produced.

START (10 minutes)

Before starting the lesson conduct this experiment:

Put a pencil in a glass of water, what do you observe? Why does the pencil appear bent in the water?

MAIN (20 minutes)

- When a ray of light travels from air to glass, something happens to light. When light travels from glass into air, again something happens to the direction of the light. Explain what happens and use diagrams to clarify your explanation.
- Ask students to name the incident ray, refracted ray, and emergent ray in the diagrams above.
- Take a glass prism and place it in front of a light. Let the student investigate what happens when light enters the prism. Explain the prism diagram on board. Explain the primary colors of light and different filters of light to the students.
- Worksheet 10-3

PLENARY (15 minutes)

Make a project of rainbow wheel by painting seven VIBGYOR colors on a circular cardboard and pass a string through the center. What do you observe? How are rainbows formed?

HOMEWORK

Workbook page 66, Question 5, page 67, Question 6.

Lesson 10-5

Page 126

OBJECTIVES

- To explain how we see objects.

LEARNING OUTCOMES

The students should be able to:

- distinguish between convex and concave lenses.
- state uses of convex and concave lenses.

START (10 MINUTES)

Ask the class:

What type of lenses are there in your glasses? Can you see distant objects clearly without glasses if your eyesight is weak? What type of lenses does your grandmother have in her glasses? Can she see near objects clearly without glasses?

MAIN (15 MINUTES)

Show two types of lenses to the students. Make them feel which part of the lenses is thicker and which part is thinner. Draw two types of lenses on the board with ray diagrams. Show them a spoon with concave and convex side.

Handout Worksheet 10-4

PLENARY (15 MINUTES)

Make groups in class and give them different topics to present e.g :

- What happens when a ray of light passes through a convex lens? Explain with a ray diagram.
- Why convex lens is called a converging lens and concave lens a diverging lens?
- What type of lens in worn by the people suffering from short sightedness and long sightedness?

HOMEWORK

Workbook page 67, Question 7.

Can you make a bird with your hands? Try this one

Another way of creating shadow puppets is to use objects.

1. a. Can you make shadow of something which is transparent?

_____

_____

You have now demonstrated some properties of light. Read pages 122 and 123 and answer the questions.

b. How did you demonstrate that light travels in a straight line?

_____

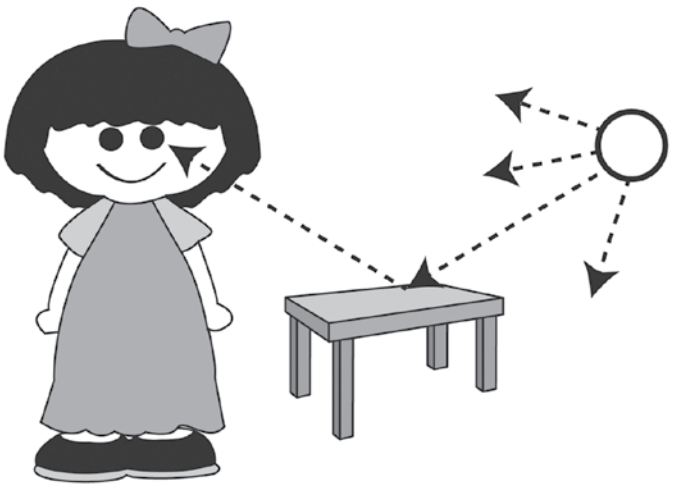
_____

c. How did you demonstrate that the lamp is luminous and your hand and/or the cut out is not?

_____

_____

d. The diagram shows how we see things. Describe this process.



Use the following words:

- light detected
- all directions
- opaque object
- luminous light source
- reflect light

_____

_____

_____

_____

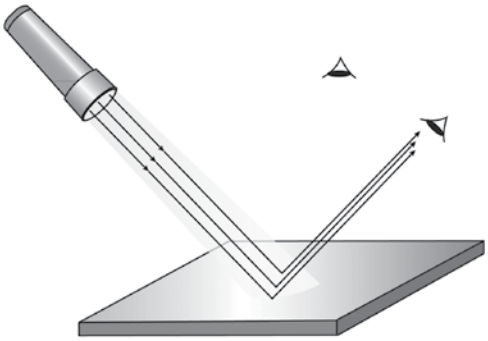
e. It is important that you understand and can use the right terms, so please find the most important ones below. Fill them out as you progress through the chapter.

Define the following terms. They are all defined in Chapter 10.

luminous	
non-luminous	
transparent	
translucent	
opaque	
reflection	
refraction	
dispersion	
incident ray	
reflected ray	
concave lens	
convex lens	
spectrum	

Task 1

1. Shine a torch light on a mirror as shown in the diagram below.



i. What do you call to the ray that strike the mirror at the point of incidence?

_____

ii. Draw a reflected ray at the point of incidence. What is this ray called?

_____

iii. Draw a perpendicular at the point of incidence. What does this represent?

_____

iv. Measure the angle of incidence and angle of reflection.

_____

v. What can you say about these two angles?

_____

vi. Are all the rays and normal in the same plane?

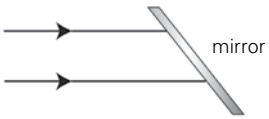
_____

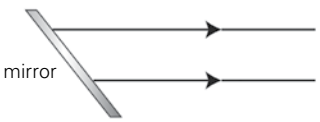
vii. What are the two laws of reflection?

_____

Task 2

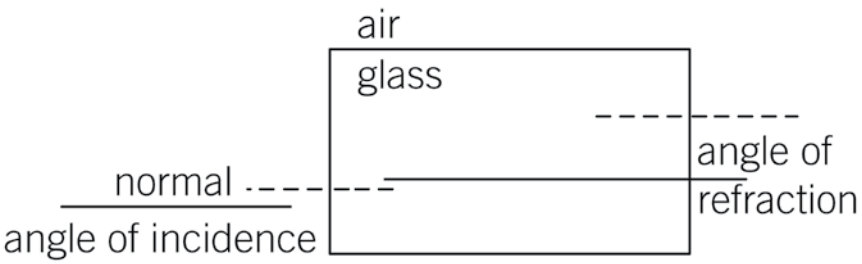
2. Complete the following ray diagram of periscope.





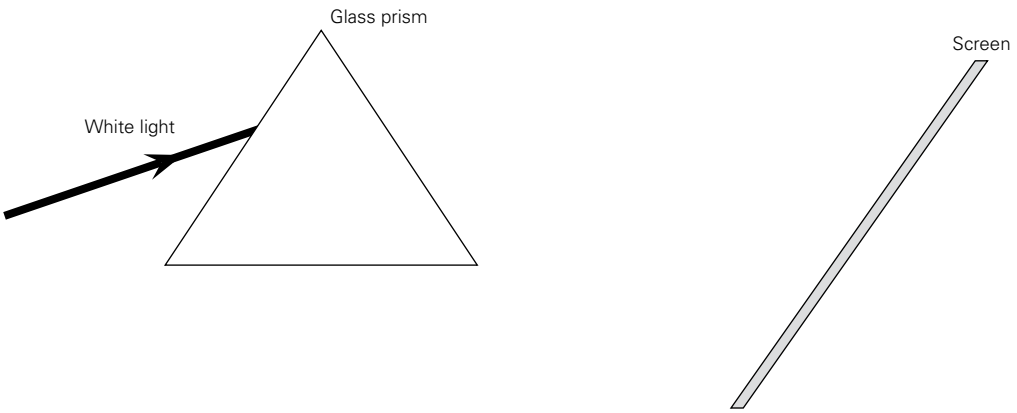
Task 1

Complete the following ray diagram to show refraction of light. Label refracted ray and emergent rays in the diagram.



Task 2

Below is a diagram of dispersion of white light by a glass prism. What happens to the rays of light when it passes through the glass prism? Use color to draw the rays you observe on the screen.



Task 3

Complete the following sentences.

i. The splitting up of white light into seven colors is called _____.

ii. The band of seven colors is called _____.

iii. When a ray of light passes from a rarer medium to denser medium, it bends _____ the normal.

iv. When a ray of light passes from a denser to a rarer medium, it bends _____ from the normal.

v. A rainbow is formed due to _____ of light.

vi. The three primary colors of light are red, blue and _____.

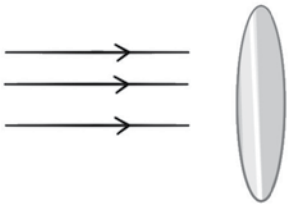
vii. A red filter absorbs all other colors of light and reflects _____ colours.

viii. Red light + _____ light → yellow.

ix. A yellow car will appear black in _____ light.

x. An object appears black in color because it _____ all the colors of white light.

1. Complete the following diagram of rays of light passing through a convex lens.

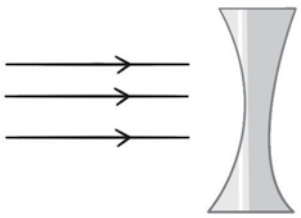


i. Why the above lens is called a converging lens?

_____

_____

2. Complete the following diagram of rays of light passing through a concave lens.



i. Why the above lens is called diverging lens?

_____

_____

ii. Which lens is used in magnifying glass?

_____

iii. Where is the image formed in your eye?

_____

iv. What is short sightedness?

_____

v. What is the solution for short sightedness?

_____

vi. What is long sightedness?

_____

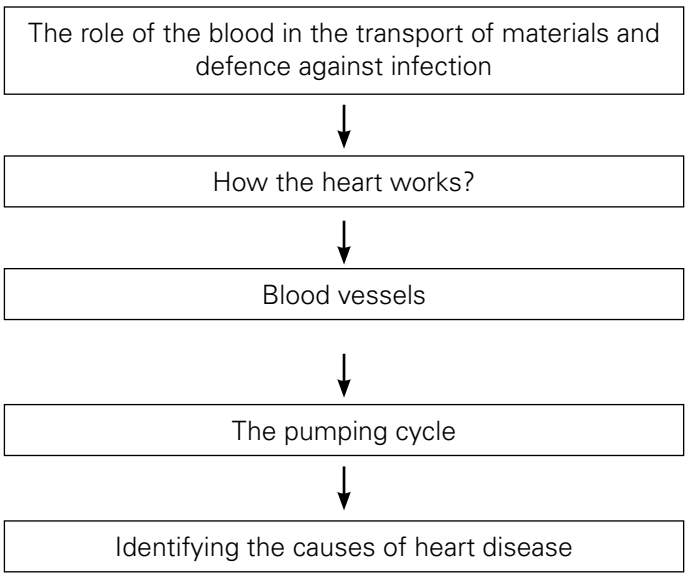
vii. What is the solution for long sightedness?

_____

Chapter

11 Transport in humans

UNIT FLOW CHART



INTRODUCTION

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 11-1

Pages 136 and 137

TEACHING OBJECTIVES

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

LEARNING OUTCOMES

The students should be able to:

- understand how the heart works and how blood is pumped around the body.

START (20 minutes)

Help the students find a place on their neck or wrist to feel their pulse. See Worksheet 11-1.

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.)

Lesson 11-2

Pages 136 - 137 and 144 - 145

TEACHING OBJECTIVES

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

Learning outcomes

The students should be able to:

- explain how the heart works and how blood is pumped around the body.
- describe the human circulatory system.

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. As you know your students, you can decide if you wish to bring in a real heart. If you decide to go ahead, it might be a good idea to tell students beforehand that they need to leave the room if they feel strange or unwell.

START (10 minutes)

Discuss what was taught 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)

Go over the diagram on page 137 and Worksheet 11-2 task 1. 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.

DEMONSTRATION (15 minutes)

Cow/goat heart demonstration.

HOMEWORK

Workbook page 71

Lesson 11-3

Pages 138 - 139

TEACHING OBJECTIVES

- 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.

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 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 11-3.

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

Workbook pages 73 and 75

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 = _____ beats per year

vi. By the time you are 70 years old, you 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

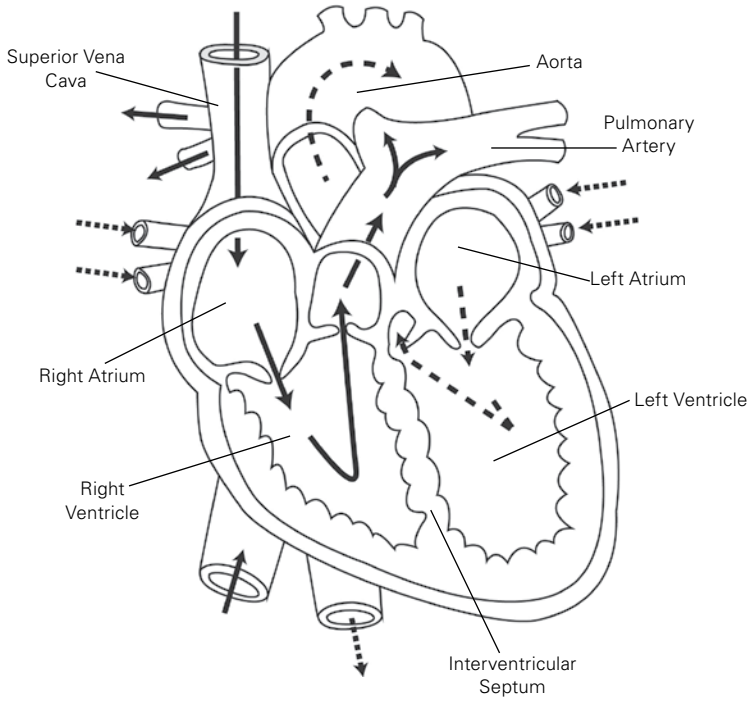
x. What happened to your cardiac frequency after exercise?

_____

Task 1

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.

HEART ANATOMY



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.

_____

Draw a blue arrow to show how the blood goes from the chamber in iii. to the chamber in iv.

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

vi. In the Student book and 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. (See the diagram above.)

Draw the arrows from the chamber in d, via the four arteries.

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. 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.

vii. Blood arriving from the lungs enters the heart in a certain chamber. What is the name of this chamber?

_____

Colour it pale red. Draw 4 red arrows showing how oxygenated blood from the lungs enters the heart.

viii. From the chamber in g, the blood flows into a chamber with a thick wall. What is the name of this chamber?

_____

Colour it pale red. Draw a red arrow showing the movement of the blood from the chamber in g. to the chamber in h.

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

Task 2

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?

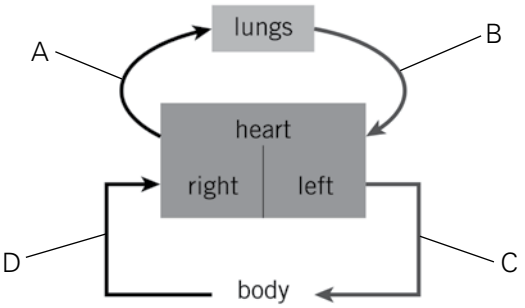
_____

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

_____

Task 3

1. 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 is the chamber X 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.

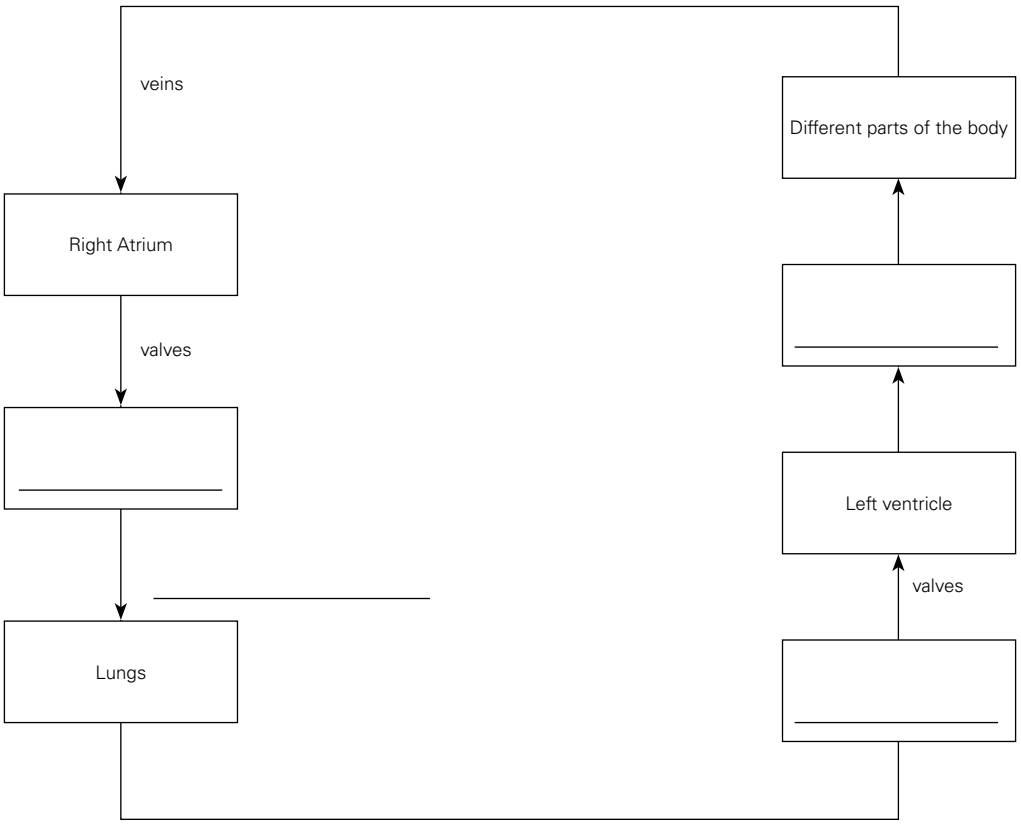
   ii. The exchange of gases takes place through the thin walls of the capillaries.

   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.



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 hemoglobin?

_____

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?

_____

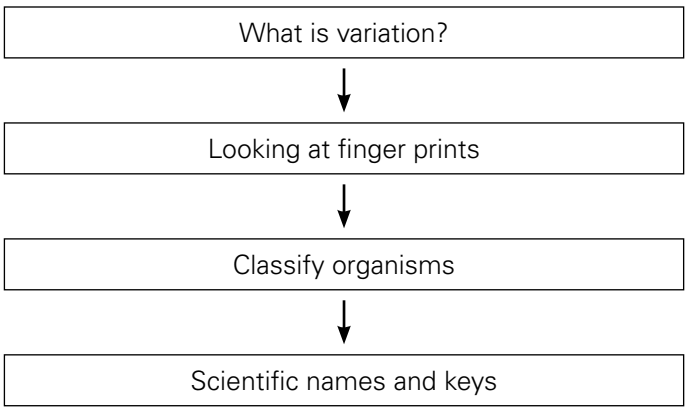
x. is a chamber of the heart?

_____

Chapter

12 Variation and classification

UNIT FLOW CHART



INTRODUCTION

When we have a large pile of items, we have no idea what it contains nor how many of each thing. So we start sorting the items. In a toolbox, the different sizes of screwdrivers will be placed together but separated from the hammer, the saw, and the wrench. Once they are all sorted, it will be easier to remember roughly which tools we have. Some very young children will already sort their building blocks so they know what they can build.

We classify living organisms for the same reason. Maybe, once upon a time, people mainly sorted them into 'edible' and 'non-edible', but nowadays we focus more on evolutionary relationships. When you talk to your students about classifying living organisms, they are likely to come up immediately with 'plants' and 'animals'. While these two kingdoms are the most visible, other kingdoms also exist, e.g., for bacteria.

When presented with a pile of different children's building bricks, one could sort them by colour or by size. In the same way, not everyone agrees on the system of classification, and while the 5 kingdom system is common, the 6 kingdom system is also well known.

Fortunately, the system of naming living things (nomenclature) is universal. All species have a Latin name, consisting of two parts, e.g. Felis catus—our common domestic cat. The first word of the name should start with a capital letter, the second word is all in lower case.

A small history lesson illustrates the importance of variation. In the middle of the 19th century, a fungus-like micro-organism infected potato crops in Northern Europe. In most countries this led to some problems, but with a variety of potatoes in most countries, it did not lead to disaster. However, due to a unique economic system and an overwhelming dependence on only one type of potato—which was very susceptible to this particular micro-organism—the potato blight destroyed most of the crop in Northern Ireland and lead to a million people dying of starvation and another 2 million emigrating (mainly to the UK and USA). The population of Ireland took 100 years to grow back to its former size.

Lesson 12-1

Pages 150 - 153

TEACHING OBJECTIVES

- to develop an appreciation of variation in humans and other organisms.
- to introduce the scientific classification of living things and to consider the importance of classification.

LEARNING OUTCOMES

The students should be able to:

- suggest ways in which individuals of the same species differ from each other.
- identify characteristics that are inherited.
- suggest ways in which variation can be acquired within a species.

START (15 minutes)

- Collect a range of pens and pencils. Put them together and ask students how they would divide them into two or three groups and then subdivide each group into two or three sub-groups. Students can do this individually or in small groups.
- Ask a few students to explain how they made their groups and why. Then discuss the fact that different ways of sorting may all be valid. (Bigger concept: if one thing is right, all others are not necessarily wrong.)

MAIN (20 minutes)

- Go through Worksheet 12-1.
- Variation is more likely to be continuous if it is affected by more than one gene and/or is heavily influenced by the environment; e.g. skin colour is regulated by at least 6 genes; height is affected by nutrition; blood groups are regulated by one gene and do not seem to be affected by the environment.

PLENARY (10 minutes)

- Can two people have identical fingerprints? How do you prove your identity?
- Your passport may state height, hair and/or eye colour, and contain your signature, photograph, or fingerprint. Other options are facial recognition, DNA, and voice recognition. These all focus on traits which are unique to each of us, so they show variation between humans.

HOMEWORK

Workbook Pages 81 and 82.

Lesson 12-2

Pages 155 - 158

TEACHING OBJECTIVES

- To introduce the scientific classification of living things and to consider the importance of classification.

LEARNING OUTCOMES

The student should be able to:

- devise a way of sorting things into groups.
- explain why scientists classify living things.
- identify some of the main classification groups.

START (10 minutes)

Give students 3 post-it notes each and ask them to write the name of one living organism on each note. Sort the notes. Are there any that do not describe plants or animals? When we think of living things, we generally think of things like cats, palm trees, lions, and broccoli. If you have any that cannot easily be classified, put them aside to return to them later (extension activity).

MAIN (20 minutes)

- Refer to pages 156 to 158 of the Student Book. Can the students classify the organisms named further than just 'plants or animals'? Either at school or at home, can they find the scientific name of at least one of the organisms they named?
- In order to remember the order 'kingdom, phylum, class, order, family, genus, species', ask students to make up a mnemonic, making a sentence of words starting with K, P, C, O, F, G, S, or another way to remember the groups such as putting them into a song.
- Worksheet 12-2

PLENARY (15 minutes)

Make classification charts showing the plant kingdom and the animal kingdom.

HOMEWORK

Workbook pages 83 and 84.

Lesson 12-3

Pages 160 - 161

TEACHING OBJECTIVES

- To develop an appreciation of variation in humans and other organisms.
- To introduce the scientific classification of living things and to consider the importance of classification.

LEARNING OUTCOMES

The students should be able to:

- use a simple key to identify an unknown organism.

START (10 minutes)

Ask the students to:

- Find out through a key the student who achieved highest position in Grade VII in the last examinations.
- Is the student from your class?
- If yes, then go to the next question.
- Is the student male?
- If no, then go the next question.
- Is she the head girl of your school?
- Yes.

MAIN (20 minutes)

- A key is used to identify an organism by asking a series of questions related to the characteristics of organisms.

  Identifying an animal through a dichotomous key.

  Is the animal a vertebrate?

  If yes, then go to question 2.

  Is the animal cold-blooded?

  If no, then go to question 3.

  Does the animal have legs?

  If no, then go to question 4.

  Does it fly?

  If yes, then it is bat.

PLENARY (15 minutes)

Worksheet 12-3

HOMEWORK

Workbook page 85.

Task 1

In normal circumstances would the following traits be purely genetic or would the environment and/or a person's behaviour affect them? Are they examples of continuous or discontinuous variation?

Trait	Only genetic or also environmental	Continuous or discontinuous
gender		
height		
blood type		
left handedness		
eye colour		
fingerprint		
heart rate		
ability to roll tongue		

2. What is biometric verification and why is it necessary?

Task 1

1. What are vertebrates?

2. Classify the following into five classes of vertebrates.

turtle	shark	dolphin	bat	lizard
frog	snake	sparrow	crocodile	toad

Reptiles	Birds	Fish	Amphibians	Mammals

3. What are cold-blooded animals?

4. List the classes of vertebrates which are cold-blooded.

5. What are warm-blooded animals?

6. List the classes of vertebrates which are warm-blooded.

7. Write down three characteristics of each of the following vertebrates.

   i. Mammals

   ii. Amphibians

iii. Reptiles

iv. Birds

v. Fish

Task 2

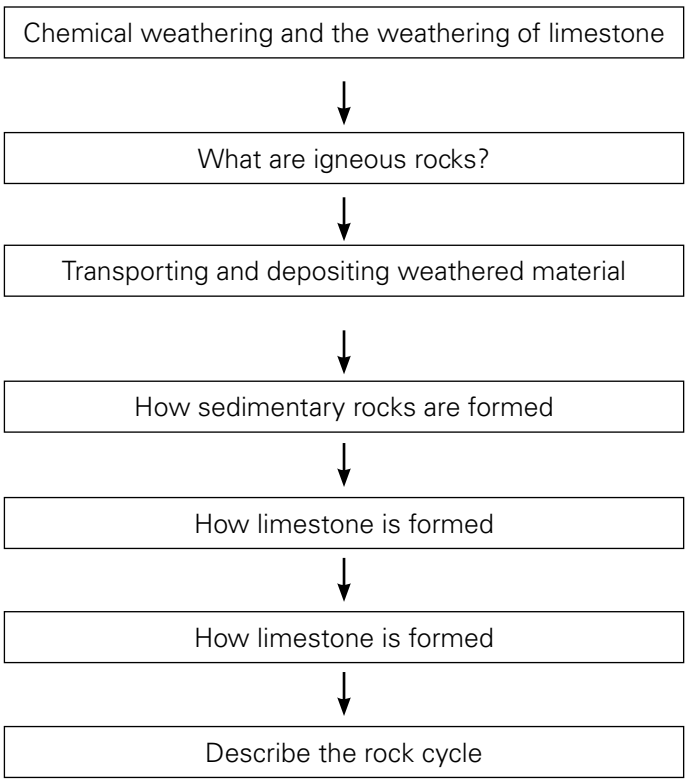
1. What are invertebrates?

2. Give one example of each of the following invertebrates.
   i. protozoa
   ii. coelentrates
   iii. annelids
   iv. echinoderms
   v. molluscs
   vi. arachnids
   vii. crustaceans
   viii. insects

Your friend from another planet is visiting Earth. He wants to visit your uncle's farm but you do not have time to go with him. You make a key which he can use to identify four of the animals from the illustration.

Chapter 13 The rock cycle, rocks, and weathering

UNIT FLOW CHART



INTRODUCTION

One of the great things of science is questioning the things we have always taken for granted. Rocks exist and do not change, right? In this chapter, students will learn that this is not correct if we look beyond the life span of humans. Students have already learnt about the water cycle and this is a chance to show them another cycle, but one which operates at a different speed. Share the excitement with your students when they discover that rocks are formed and eventually weather down to sand, but also the awe when thinking about how hot the core of the Earth must be in order to melt rocks.

Some of the key points of this chapter are the cyclic processes involving rocks, how the different types of rocks are formed, and the factors which cause them to break down. All of this directly relates to the properties of rocks.

Lesson 13-1

pages 166 - 168

TEACHING OBJECTIVES

- To introduce the major rock-forming processes and show how these are linked together in the rock cycle.

LEARNING OUTCOMES

The students should be able to:

- define rocks.
- name different types of rock.,
- explain how igneous rocks are formed.

START (10 minutes)

Rocks must be boring to study as they never change. However, your students may prefer to study something exciting like volcanoes?

If at all possible, start by showing your students a video clip about volcanoes. Using the search term 'National Geographic volcanoes' gives you a plethora of videos, ranging from a few minutes to well over an hour long. Please preview to ensure you choose the one most appropriate for your students.

MAIN (25 minutes)

Read pages 166 and 167 and complete Task 1 of Worksheet 13-1. It is important that students actively engage with the exercise. They need to extract the information from one diagram and apply it to another one. As not all the terms are given, students need to work out what they mean and label the correct structures. Since no 'boxes' are given, students need to decide exactly what to label.

PLENARY (10 minutes)

- Go through Task 2 of Worksheet 13-1
- Discuss:
  - What are the three types of rock? How are igneous rocks formed?
  - What two types of crystals are formed by slow cooling and rapid cooling?
- Ask students to put the different rocks in water and find out which one floats in water and why?

HOMEWORK

'Test yourself' questions on page 168.

EXTENSION

You can demonstrate the process of growing crystals from a saturated sugar solution. An internet search will show you how to do it; use, e.g., the search terms 'How to make rock candy'. Challenge your students to try this at home. The student who grows the largest crystals will have their picture displayed on the class or school notice board!

You may decide to let students find out how to grow the largest crystals or you may suggest that they look at page 167 of their Student Book and consider the information about how the largest crystals in rocks are formed.

Lesson 13-2

Pages 168 - 169

TEACHING OBJECTIVES

- To show how the processes of weathering, erosion, transportation, and sedimentation are involved in the formation of sedimentary rock.

LEARNING OUTCOMES

The students should be able to:

- define weathering.
- explain two types of weathering .

START (10 minutes)

Give each student 2-3 sugar cubes. Tell them to have a good look at the sugar cubes and to measure them. See worksheet 13-2.

MAIN (25 minutes)

- Discuss and explain:
  - What are the two types of changes to the marble statue?
  - What happens when acid rain falls on the marble?

  Classify them into two changes.
- Worksheet 13-2

PLENARY (10 minutes)

- Describe the two changes that take place in the marble statue.
- Put some marble pieces in a test tube. Add some hydrochloric acid t. What happens? Pass the gas produced through lime water. What do you observe?

HOMEWORK

Read pages 168 – 169 and answer the questions on page 170.

Lesson 13-3

Pages 170 - 173

TEACHING OBJECTIVES

- To show how the processes of weathering, erosion, transportation and sedimentation are involved in the formation of sedimentary rock.

LEARNING OUTCOMES

The students should be able to:

- show how rock texture can be used to identify igneous, sedimentary and metamorphic rocks.
- explain how weathered materials are transported to form sediment.
- describe how sedimentation and compaction form sedimentary rocks.

START (10 minutes)

Ask questions about how rocks are transported from one place to another.

MAIN (20 minutes)

Discuss different ways to carry particles of weathered rocks by wind, water, and glaciers, and how, as result of sedimentation and compaction, they form sedimentary rocks.

PLENARY (15 minutes)

- Divide the students into five groups. Give one rock to each group from sandstone, limestone, conglomerate, coal, and shale. Ask them to list their characteristics and find out how they are formed by reading from the Student book, pages 171-172.
- Each group should make a poster and explain their findings to their classmates in a 2-minute presentation during the next lesson.

HOMEWORK

How are sedimentary rocks formed?

What are the characteristics of sedimentary rocks? Give examples.

Lesson 13-4

Pages 173 - 176

TEACHING OBJECTIVES

- To show how rock texture can be used to identify igneous, sedimentary and metamorphic rocks.
- To introduce the major rock-forming processes and show how these are linked together in the rock cycle.

LEARNING OUTCOMES

The students should be able to:

- explain how metamorphic rocks are formed by heat and pressure.

START (15 minutes)

Each group presents their work/poster on one type of rock. Maximum time: 2 min per group.

MAIN (15 minutes)

Show them the chart of how metamorphic rocks are formed from igneous or sedimentary rocks.

- Slate is transformed from shale.
- Marble is transformed from limestone.
- Quartzite is transformed from sandstone.
- Gneiss is transformed from granite.

PLENARY (15 minutes)

Compare samples of limestone and marble on the bases of porous, non-porous, harder or hardest, with grains or without grains.

- What is the difference between shale and slate? Granite and gneiss?
- Which are foliated? Which are non-foliated?

HOMEWORK

NONE

Lesson 13-5

Pages 176 - 177

TEACHING OBJECTIVES

- To introduce the major rock-forming processes and show how these are linked together in the rock cycle.
- To show how the processes of weathering, erosion, transportation, and sedimentation are involved in the formation of sedimentary rock.
- To show how rock texture can be used to identify igneous, sedimentary, and metamorphic rocks.
- To introduce the major rock forming processes and show how these are linked together in the rock cycle.

LEARNING OUTCOMES

The students should be able to:

- explain the rock cycle.

START (10 minutes)

This summary of the types of rocks and the rock cycle is helpful. If possible, have students interact with this site individually or show it to the entire class.

http://www.bbc.co.uk/bitesize/ks3/science/environment_earth_universe/rock_cycle/activity/

Discuss why, when the rocks are weathering continuously, the continents do not disappear?

MAIN (25 minutes)

- What are the three types of rock? How is one type of rock changed into another rock? This is called the rock cycle. Show the chart of the rock cycle and ask questions about it.
- Go over pages 174 – 178 of the Student book.
- Worksheet 13-3

PLENARY (10 minutes)

Suppose you are a piece of granite rock. Imagine your path from igneous to sedimentary, then to metamorphic rock, and back to igneous rock.

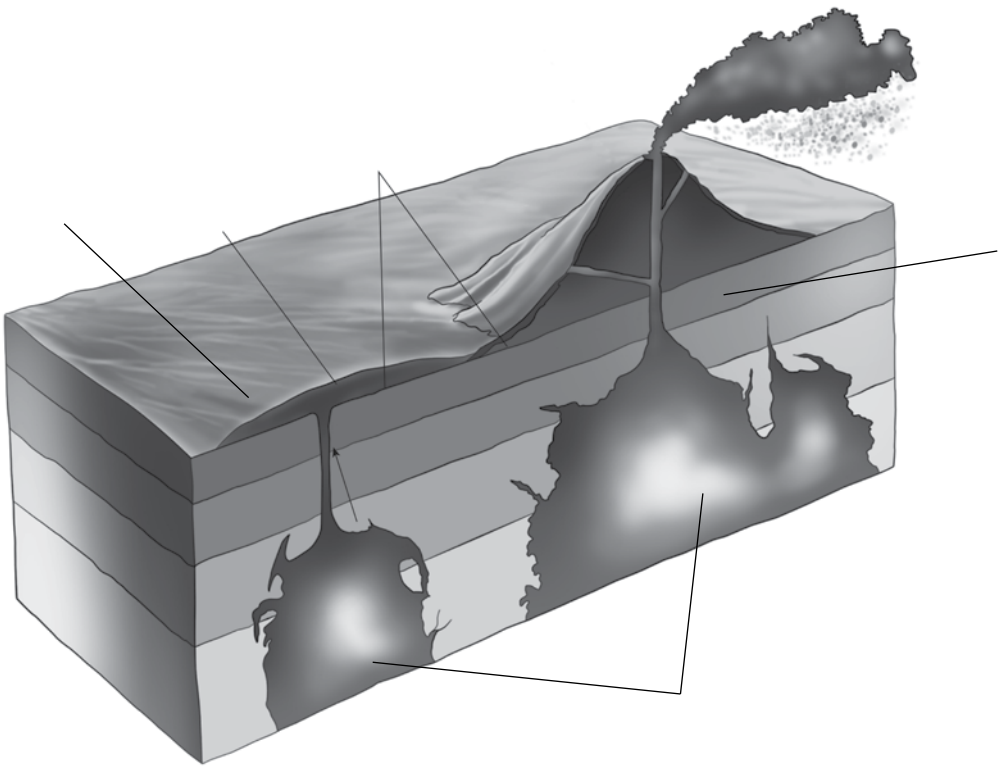
HOMEWORK

Workbook pages 91-92, Questions 6, 7, and 9.

Task 1

Use the following terms to label the diagram of a volcano. If you need some help, use page 167 of your Student book.

hot rock	granite	magma
basalt	lava	



Task 2

i. Give one difference and one similarity between granite and basalt.

ii. Do you think granite or basalt is formed more quickly? Give your reasons.

iii. Why is igneous rock also known as volcanic rock?

Task 3

1. Make a hot saturated solution of copper sulphate. Divide the solution into two beakers.

   Mark them A and B.

   Beaker A is cooled fast by putting it in ice. Beaker B should be cooled slowly at room temperature. Keep both beakers safely and after two days, observe the crystals in them.

   i. In which beaker are large crystals formed? Why?

   _____

   _____

   _____

   ii. What type of crystals are formed by slow cooling of lava in igneous rocks? Give an example.

   _____

   _____

   _____

   iii. What type of crystals are formed by rapid cooling of lava in igneous rocks? Give an example.

   _____

   _____

   _____

Task 1

Your teacher gave you a few sugar cubes. Record the measurements below.

i. The sugar cubes measured _____ x _____ x _____ cm.

Hold one hand with the palm up. Put the sugar cubes in your hand and put your other hand on top. Rub your hands together – this will rub the sugar cubes too. Continue for several minutes until your teacher tells you to stop. Rub with some force but do not hurt your hands.

Have a look at your sugar cubes. Do they look different? Measure them again and record your result below.

ii. The sugar cubes measured _____ x _____ x _____ cm.

iii. In the space below describe the difference and explain the reasons for the difference.

_____

_____

_____

iv. What did your hands feel and look like after rubbing the sugar cubes?

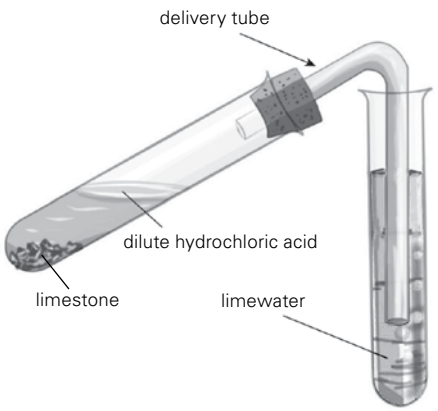
_____

v. If your sugar cube had been a rock or pebble, what would have been on your hands?

_____

Task 2

1. Take a test tube containing limestone and hydrochloric acid. Pass the gas produced through lime water as shown in the diagram below.



i. What is the chemical name of limestone?

_____

_____

ii. What is the effect of putting acid on marble?

_____

_____

iii. Is this a physical or a chemical reaction?

_____

iv. Which gas is produced?

_____

v. How will you test the gas?

_____

vi. What is the effect of acid rain on rocks?

_____

Task 1

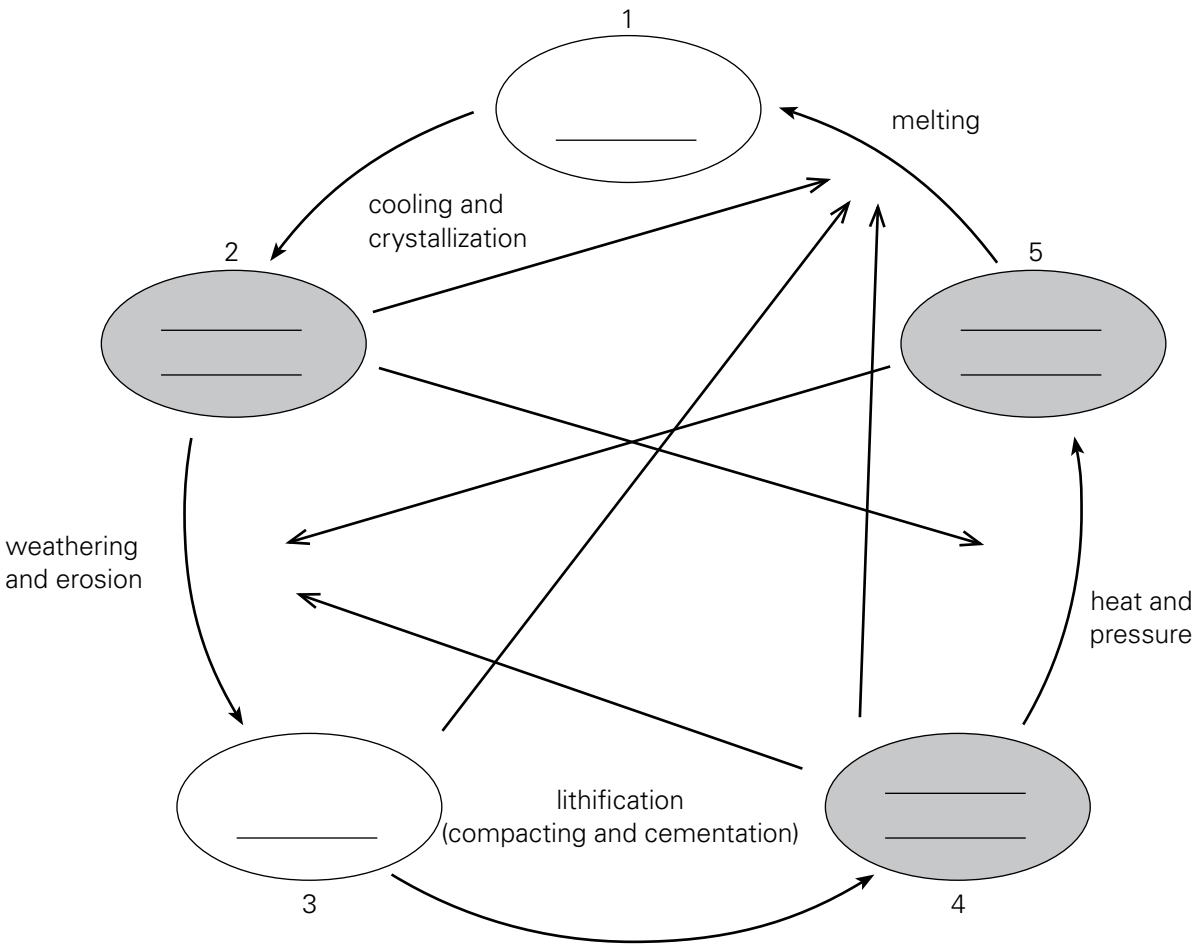
Classify the following into igneous, sedimentary, and metamorphic rocks.

pumice	chalk	sandstone	granite	coal
shale	quartzite	marble	basalt	slate
limestone	conglomerate	gneiss		

Igneous	Metamorphic	Sedimentary

Task 2

Complete the diagram of the rock cycle.



Answers

Chapter 1 Heating and cooling

Page 3

1. A firecracker may be very hot but it does not contain much heat energy. However, a cup of hot tea would cause more damage owing to the amount of heat energy it contains.
2. Heat is the amount of energy that something has. It is measured in Joules (J) or kilojoules (kJ).
3. Temperature is a measure of how hot or cold something is. It is measured with a thermometer in degrees Celsius (°C).
4. The particles of a substance move with respect to the amount of energy they have. At higher temperatures, the particles move about very vigorously. As temperature falls, this energy is lost and the particles move more slowly.
5. The temperature at which the particles of a substance stop moving is called absolute zero (-273°C).
6. The Kelvin scale is a temperature scale with degrees the same size as the Celsius scale, starting from absolute zero.

Page 4

1. In a liquid, the particles move faster as the temperature rises. At the surface the faster particles break free to form a gas above it.
2. a. evaporation
   b. melting
   c. condensation
   d. freezing
3. From the atmosphere.

Page 5

1. Metals
2. Substances that do not allow heat to pass through them are called insulators. For example, glass, plastic, and wood.
3. If one end of a metal bar is heated, the particles there gain energy and vibrate faster. This causes the particles next to them to vibrate faster as well. The increased vibration of particles is passed along the bar until the whole bar is hot.
4. a. Heat energy flows quickly through the metal base of the saucepan to reach the food item that needs to be cooked or warmed.
   b. Plastic is a poor conductor of heat so it will not burn the hand when the saucepan is held.
   c. Fur traps air which is a very good insulator. Therefore, the fur helps the bear to retain its body heat.
   d. Air is trapped between the bird's feathers. Air is a very good insulator so the bird retains body heat.

Page 7

1. Liquids and gases can carry heat because their particles are free to move.
2. Warm air is less dense than cold air, so the warm air above the heater rises and is replaced by the colder denser air. In this way, a convection current is set up and air circulates around the room.
3. In rooms with high ceilings, it takes longer for the warm air to rise to the ceiling, and for the colder air to come to take its place.
4. Convection cannot happen in solids because the particles are held in a framework and they cannot move around as freely as they do in liquids and gases.

Page 8

1. a. White or silvery surfaces are poor absorbers because they reflect most of the radiation. That is why in hot sunny countries houses are often painted white to keep them cool inside.
   b. Black absorbs heat more quickly than white.
   c. The silvery surface of aluminium reflects heat back into the food so the food remains warm.
   d. A dark surface radiates heat better than a shiny one.

Page 9

1. There is a vacuum in the walls of the flask.
2. Heat from the surroundings is prevented from entering the flask in the same way as heat is prevented from leaving.
3. It reduces heat loss by radiation.

Page 10

1. a. the particles move faster.
   b. the particles move faster still.
2. It begins to change to water.
3. It begins to change to steam (water vapour).
4. The thermal energy is being used to change water to water vapour. The more heat is applied, the faster this happens.

Page 11

Exercise

1. Multiple choice questions

i. c ii. b iii. c
iv. d v. d

2. True or False

i. True ii. False iii. True
iv. False v. True

3. Ice is a solid. When it is heated, it **melts** and becomes water. Water is a **liquid** which boils at 100°C. At this temperature, it turns into a **gas** called steam. When steam cools, it **condenses** and turns back into water. At 0°C, water **freezes** and turns back into ice. These are examples of changes of **state**.
4. i.

Celsius	Kelvin
200	**473**
100	373
0	**273**
–100	173
–200	**73**
–273	0

   ii. Add 273 to the degrees on the Celsius scale to convert into the Kelvin scale.
   iii. i. 573K ii. 423K iii. 223K
   iv. Absolute zero is the temperature at which a material has no heat energy.
5. i. The particles are gaining kinetic energy. Some of them are able to escape from the surface.
   ii. heat energy
   iii. The Sun
   iv. Boiling water in a kettle/pan, drying clothes etc.
6. a. convection b. radiation
   c. conduction d. convection/radiation

Ideas for investigations

In investigation 1, students are able to find out that the rate of conduction in different materials is not the same. The drawing pins will fall as the wax melts on each rod due to conducted heat. Copper will be quickest followed by iron. It is highly unlikely that the drawing pin will fall from the glass rod due to it being a very poor conductor. In fact, it is possible that the glass will begin to melt if too much heat is applied for too long.

SAFETY NOTE: put on safety glasses. Take care when using hot apparatus.

Investigation 2 provides the opportunity for students to compare the rates of radiation from dull and shiny surfaces. Students should find that the container with the dull surface will lose heat faster than the one with a shiny surface. Taking readings every 10 seconds for two minutes should give sufficient data to enable students to complete the table and even draw a graph of their results.

SAFETY NOTE: Put on safety goggles. Take care when using hot apparatus.

Chapter 2 Plants and their systems

Page 15

1. Roots hold a plant in the ground and take in water and minerals from the soil.
2. Leaves are held above the ground so leaves can get sunlight and exchange gases with the surrounding air. Flowers are held above the ground so insects can get to them easily.
3. Tissue
4. Xylem, Phloem, Photosynthetic tissue, Protective tissue
5. Growth takes place at the tips of roots and shoots.

Page 16

1. Different tissues combine to make an organ.
2. Photosynthetic tissue, xylem tissue, phloem tissue, protective tissue.

Page 17

1. A transport system enables water from the roots and food from the leaves to be moved to the rest of the plant.

2. A vascular bundle is made of xylem and phloem tubes.
3. i. They are thin tubes that carry liquids up and down the plant.
   ii. Xylem is dead while phloem is alive.
4. Xylem has thickened walls which help support the plant.
5. The root tip is where the root grows.
6. The root cap protects the root tip as it grows through the soil.

Page 19

1. Leaves are where the plant makes its food during photosynthesis.
2. a. They are broad and flat.
   b. They are thin and have lots of air spaces inside.
   c. They have stomata on the underside.
   d. They have vascular bundles made of xylem and phloem.
3. a. Leaf veins are vascular bundles which form a kind of 'skeleton'.
   b. They help to support the leaf, keeping it flat and facing the light.
4. Narrow leaves are usually very thin so gases can get to every cell.
5. A waxy cuticle makes the leaf waterproof.
6. To allow light to pass through to the cells below for photosynthesis.
7. This is where most photosynthesis takes place.

Page 21

1. Growing shoots need sugar to produce the energy for growth.
2. Because sugar is stored in fruits.
3. The holes let sugar solution pass from phloem cell to phloem cell.
4. It depends on how much sugar is needed by different parts of the plant and when.
5. In winter when a plant has no leaves, the movement of sugar stops. The plant goes into 'hibernation'.
6. In the spring the sugar stored in the roots is used by the plants to start growing again.

Page 22

1. Osmosis is the movement of water from a region of high water concentration to a region of low water concentration across a partially permeable membrane.
2. Osmosis is the diffusion of water only.
3. A partially permeable membrane has very tiny holes in it which only allow small molecules, like water, to pass through.
4. The concentration of water is higher in the weak sugar solution than in the strong sugar solution. Water therefore moves by osmosis into the bag tied to the glass tubing causing the volume to rise and so move the solution up the tubing.

Page 24

1. Transpiration is the process by which a plant loses water from its leaves into the surrounding air.
2. Stomata are tiny holes usually found on the underside of leaves through which water vapour passes out.
3. When a plant has plenty of water the pressure inside the guard cells rises and the stoma open. When the guard cells lose water, the pressure inside them falls and the stoma close.
4. i. Temperature ii. Wind
   iii. Humidity iv. Time of day.
5. The sun will raise the temperature therefore increasing the rate of transpiration. More water will be lost than can be taken up by the roots. The cells become flaccid so the plant has no support and wilts.

Page 25

1. They need support to hold them in a position to catch as much sunlight as possible for photosynthesis. Flowers must be held up in the air to attract insects for pollination.
2. The xylem tubes in vascular bundles have thick, strong walls which make them ideal for supporting a plant. The vascular bundles make a framework around which the cells are held.
3. a. middle of the roots.
   b) around the outside of the stem.
4. Plant cells get turgid by the pressure inside them increasing. This pressure is created by the inflow of water by osmosis.
5. Wilting is when a plant loses its support and flops over. The cells of the plant have lost their turgidity and become flaccid because more water is being lost than taken in.

Page 27

1. Flowers contain the reproductive organs of the plant. Without them the plant would not be able to reproduce itself.
2. The carpel.
3. The stamen.
4. They are brightly coloured and sweet smelling.
5. Nectar is a sweet smelling liquid that attracts insects.
6. Sepals protect the flower when it is in bud.

Page 28

Exercise

1 Multiple choice questions

i. c ii. d iii. b
iv. c v. a

2 True or false

i. True ii. False iii. False
iv. True v. True

Page 29

3. i. A - vascular bundle
   B - xylem
   C - phloem
   D - root hair
   E - growing tip
   F - root cap
   ii. Two from xylem, phloem, vascular bundles
   iii. i. xylem ii. phloem
   iii. root hair iv. root cap
4. Leaves are where a plant makes food during **photosynthesis**. Leaves are usually **green** although other colours exist. Whatever their colour, all leaves contain **chlorophyll**, the chemical that absorbs **light** energy from the Sun. Leaves are thin so **gases** can get to the cells easily. They have holes called **stomata** to let gases in from the surrounding air. Veins, made from **vascular** bundles, carry water and sugar to and from the leaf. They also help to **support** the plant.

Page 30

5. i. a. The piece has got longer
   b. The piece has got shorter.
   ii. Osmosis. The movement of water from a region of high water concentration to a region of low water concentration across a partially permeable membrane.
   iii. There is a greater concentration of water molecules outside the cells of the piece than inside. Water therefore moves into the cells by osmosis making the chip firm and rigid (turgid).
   iv. Water is lost from a plant by transpiration. If there is no water available for the roots to take in the plant will start to wilt. If it has plenty of water a plant will replace the water lost in transpiration and remain upright.
6. i. a. moving air b. moist air
   ii. 10 mm/min iii. 6 mm/min
   iv. a warm, windy day.

Ideas for investigations

This investigation enables students to compare the rate of transpiration from a leafy twig in different weather condition. It is important that the apparatus is assembled in a bowl of water to prevent air getting between the twig and the rubber tube seal on the capillary tube. Petroleum jelly is smeared around the joints to ensure air-tight seals. Moving air can be simulated by wafting the air around the twig with a piece of stiff card made into a simple fan. Warm moving air can be simulated with a hair dryer or fan heater set on its lowest heat setting. Students will put their results in a table and then could draw a bar chart to display the results they have obtained.

Chapter 3 The Periodic Table

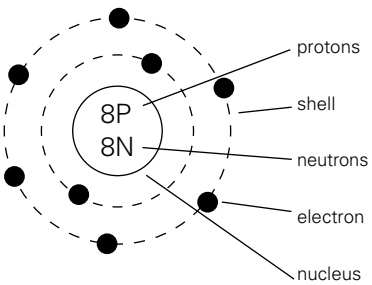
Page 34

1. A tiny positively charged nucleus surrounded by a cloud of rapidly moving electrons.
2. Water could only evaporate into the air if water and air were made of particles which could not be broken down into anything smaller.
3. Particles which are smaller than an atom.
4. In Thomson's atomic model (called the 'Plum pudding' model), most of the space in an atom is made up of positively charged material with lots of tiny negatively charged electrons scattered through it.
5. Some particles were repelled instead of passing straight through. It proved there must be a very small positive bit in the centre of each atom.

Page 35

1. a. proton, neutron, and electron
   b. proton (+ve), neutron (no charge/neutral), electron (-ve)
2. neutrons and protons
3. a. in layers/orbits around the nucleus
   b. Electrons take up most of the space in an atom because they are moving rapidly in orbits and orbits build up in layers as they become full.
4. Symbols are a kind of chemical shorthand recognised all over the world.
5. a. The number of protons in an atom.
   b. The number of protons plus the number of neutrons in an atom.

Page 36

1. An atom which has lost or gained one or more electrons.
2. 79 protons and 118 neutrons
3. 

4. a. Both have the same number of protons (6)
   b. Each one has a different number of neutrons. (6 and 8)

Page 39

1.

Element	Group
carbon	IV
oxygen	VI
nitrogen	V
sulphur	VI

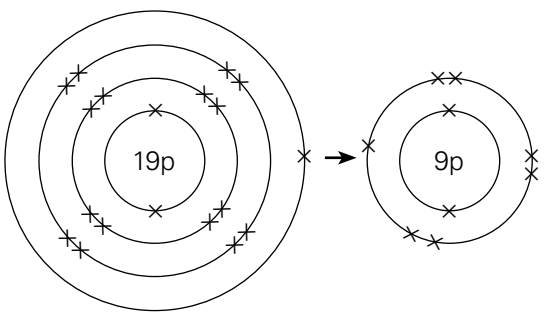
2. The metals lie between group II and III.
3.

Symbol	Element
Pb	lead
Sn	tin
W	tungsten
K	potassium
P	phosphorus
Hg	mercury

4. a. i. 5 ii. 4 iii. 2
   b. By checking in which Group they were in the periodic table.
5. a. They belong to Group I of the periodic table, as they have only one electron in their outermost shell.
   They are metals which are soft and react violently with water.
   b. They belong to group VII of the periodic table as they have seven electrons in their outermost shell.
   They are coloured, poisonous gases that are very reactive.
   c. They do not react because their outer electron shells are completely full.

Page 41

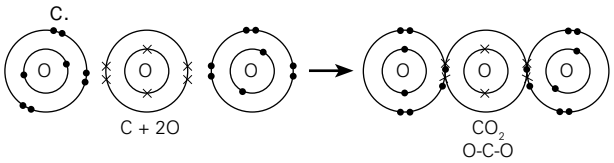
1. Positive charge
2. Negative charge
3. Sodium is a solid metal, whereas chlorine is a greenish-yellow gas. When both of them combine, they form sodium chloride which is a white crystalline salt.
4. Two electrons are lost by magnesium and gained by the oxygen.
5. Potassium atoms lose an electron forming positive potassium ions. Flourine atoms gain an electron forming negative fluoride ions. One molecule of potassium fluoride has the formula KF and contains one potassium atom and one fluorine atom.



Page 43

1. electron
2. A covalent bond is formed by the sharing of electrons between atoms.
3. molecule
4. In an ionic bond, electrons are either lost or received from atoms. The atoms become charged particles called ions and are held together by electrostatic forces. In a covalent bond, atoms share electrons to form a neutral molecule or compound.

5. a. Carbon and oxygen
   b. One atom of carbon and two atoms of oxygen.
   c.



Page 44

Exercise

1. Multiple choice questions

i. a ii. b iii. a
iv. d v. b

2. True or false

a. True b. False c. False
d. False e. False

Page 45

3. elements
   elements
   compounds
   elements
   compounds
   elements

4. i. 12 ii. 6 iii. 6
   iv. 6 v. 6

5. i. a. Group 0 b. Group VII
   c. Group I d. Group II
   ii. B iii. E iv. C
   v. C & D vi. F

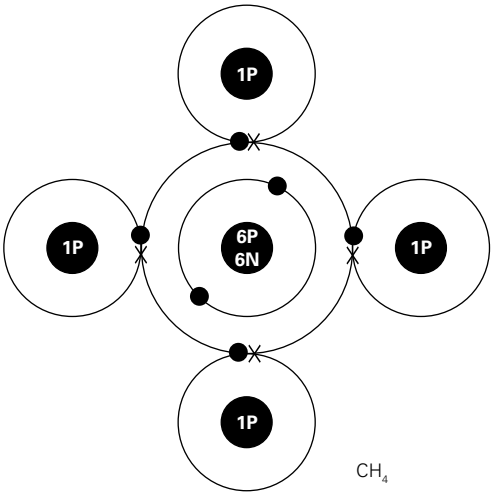
Page 46

6. i. A, B & E ii. B
   iii. D, -2 iv. C, +2
   v. Magnesium

7. i. a. Al, N b. O_2, CH_4
   c. Na^+, I^-
   ii. a. sodium ion b. iodine ion
   iii. a. sodium iodide b. NaI
   c. ionic

Page 46

8.



Page 47

Ideas for investigations

Both of these investigations give students the opportunity to compare the properties of ionic and covalent compounds.

In investigation 1 students use a simple electrical circuit to find out whether sugar and salt conduct electricity. Salt, being an ionic compound, should enable the bulb to glow when the circuit is switched on. Sugar, on the other hand, being a covalent compound, will not.

Investigation 2 requires students to carefully heat sugar and salt in separate test tubes. The sugar will quickly melt and start to burn. The salt will not. If both test tubes are heated at the same time with the same amount of heat, students should easily see which compound has the lowest melting point.

SAFETY NOTE: Put on safety goggles. Take care when using hot apparatus. Melted sugar may spit out of the test tube.

Chapter 4 Magnets and electromagnets

Page 49

1. Magnetism is a mysterious force of attraction which appears between magnets, and between magnets and materials such as iron and steel.
2. Iron nails, steel pin

3. A permanent magnet is a piece of iron or steel which has been magnetized so that it keeps its magnetic properties. A magnet that can be switched on and off using electricity is called an electromagnet.
4. In a can opener, and in a loud speaker.
5. In an electric drill, and in headphones.

Page 50

1. The Earth affects magnets. If a bar magnet is hung by a thread, it eventually settles roughly north to south. The end of the magnet which points north is called the north-seeking pole or 'N' and the other end is called the south-seeking pole or 'S'.
2. A suspended bar magnet will point roughly north-south.
3. a. It would attract the magnet.
   b. Nothing would happen.
   c. If it were brought close to the south pole of the suspended magnet it would be repelled. If it were brought close to the north pole of the suspended magnet it would be attracted.
4. First a bar magnet would have to be placed under a white sheet of paper. Then some iron filings would be sprinkled on the paper. The filings will arrange themselves in a sort of pattern of lines. Near the poles the filings will be very close together. The spacing of the lines shows the strength of the field.

Page 51

1. a. If a magnet is broken into two pieces, each piece will have its own N and S poles.
   b. Breaking a magnet into smaller and smaller pieces produces smaller and smaller magnets.
2. Energy from heating causes molecules to move faster causing the domains to become unaligned.

Page 52

1. When a piece of iron or steel is placed near a magnet, the magnetic domains line up and it becomes magnetized. This is called induced magnetism.
2. A temporary magnet loses its induced magnetism when it is pulled away from a magnet.
   A permanent magnet does not lose its magnetism even when it is pulled away from a magnet.
3. A soft magnetic material is easy to magnetize but it loses its magnetism easily. e.g. iron.
   A hard magnetic material is difficult to magnetize but it does not lose its magnetism easily. e.g. steel.

Page 53

1. If a compass is held near a wire carrying an electric current, the compass needle will move showing that the wire has a magnetic field around it. This effect is called electromagnetism.
2. a. The field pattern caused by a current flowing in a wire consists of concentric circles around the wire. The direction of the field will be clockwise when viewed in the direction of the current. If the current is reversed, the magnetic field also reverses.
   b. The magnetic field is strongest close to the wire and gets weaker as you move further away.
   c. i. If the size of the current is increased, the magnetic field gets stronger.
   ii. If the current is reversed the magnetic field is also reversed.

Page 56

1. The amplifier in the device.
2. By sound/longitudinal waves.
3. A small current can be used safely to switch on a separate circuit which may carry a much larger, dangerous current.
4. A circuit breaker is an automatic safety device which cuts off the electricity if the current gets too high.

Page 57

Exercise

1 Multiple choice questions

i. a	ii. c	iii. b
iv. a	v. d	

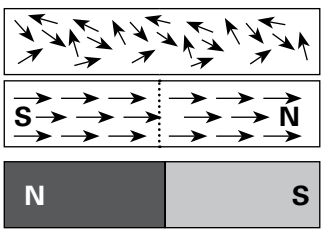
2 True or false

i. True	ii. False	iii. True
iv. True	v. True	

Page 58

3. The student places the compass close to all three metal bars. The copper bar and the iron bar will cause no response from the compass needle. When placed alongside the permanent magnet, the compass needle will align itself according to the poles of the magnet.

4. i. **N**
   S
   ii. When a magnet is placed near an unmagnetized iron bar, the molecular magnets in the bar line up in groups to form domains. These domains are sensitive to magnetic fields. As a result the iron bar becomes magnetized.
5. a. i. By stroking the steel rod with one pole of a magnet.
   ii. By placing a piece of steel inside a coil of wire, and passing an electric current through the coil.
   Strong magnetic poles will be induced in the steel.
   b. i. By heating
   ii. By hitting a magnet with a hammer or dropping it on a hard floor.
6. i. & iii.



ii. Induced magnetism.
iv. When the magnet is taken away from the iron piece, the iron retains its induced magnetism although this is weak.
7. i. A long, tightly wound coil is called a solenoid.
   ii. The magnetic field looks like that of a bar magnet.
   iii. It can be made stronger by:
   - increasing the current
   - making more loops of the same length of the wire
   - putting a core of iron or steel inside the coil.
8. The circuit can be placed on the frame of a door with the magnet fixed to the door. When the door is closed the reed switch is open because of the magnetic field produced by the magnet. As soon as the door is opened, the magnet will cause the reed switch to close and complete the circuit. The alarm will be triggered.

Ideas for investigations

Investigations 1 enables students to study the magnetic field patterns produced by permanent magnets. Careful sprinkling of iron filings onto the paper will usually give good results. These patterns may be recorded as drawing or photographs.

Investigation 2 enables students to study the magnetic field pattern produced by a wire carrying an electric current. Setting up this experiment is a bit tricky. Placing the paper on a tripod with the wire running down the centre usually works. The wire can be suspended from a stand above the paper. Once again, the patterns may be recorded as drawing or photographs.

SAFETY NOTE: Put on safety goggles. Take care, the wire may get hot.

Investigation 3 enables students to study the effects of several factors on the strength of a magnetic field produced in a solenoid. Only one variable should be tested at a time. A simple but effective way of comparing the strength of an electromagnet is to see how many paper clips can be picked up and held on each occasion. By changing the current through the wire, the number of turns on the coil and changing the material used in the core, students should get a good idea of how the strength of an electromagnet can be changed.

SAFETY NOTE: Put on safety goggles. Take care, the wire may get hot.

Chapter 5 Fit and healthy

Page 61

1. Adults don't grow further. Their bodies may become fat. They need to exercise to maintain a healthy body. Children are growing so they need more food and energy and hence they need to exercise more.
2. Good health is when you feel good both physically and mentally.
3. We can ensure good health by:
   eating a balanced diet
   exercising regularly
   not abusing our body with drugs.

Page 62

1. Each year a human being eats over 1 tonne (1000 kg) of food and drinks about 500 litres of liquid.
2. A balanced diet should contain:
   foods that provide energy
   foods that provide building materials
   foods that control chemical reactions
   foods that contain dietary fibre.
3. Too much salt can cause high blood pressure.
4. a. Fibre or roughage is made up of plant cells which pass through the digestive system, without being digested and absorbed.
   b. Fibre is important because it gives the muscles in the walls of the digestive system something to push on. Food containing a lot of fibre helps prevent constipation and other disorders of the digestive system such as piles.

Page 64

1. A person becomes fat or obese when they eat too much or take too little exercise.
2. a. Type 2 diabetes is a condition where the body doesn't make enough insulin to control the level of sugar (glucose) in the blood.
   b. heart disease, blindness.
3. angina, heart attack
4. In cold weather an asthma sufferer finds it hard to breathe because the lining of the tubes in the lungs become inflamed and narrow. This restricts the flow of air into the lungs.
5. Excess body weight puts more pressure on body joints making them inflamed. This inflammation of the joints is arthritis.
6. a. Leafy vegetables such as spinach and citrus fruits.
   b. A disease called scurvy is caused by too little vitamin C. Scurvy causes bleeding of the gums, loose teeth, muscle weakness and eventually death.
7. a. Rickets is a disease which affects bones, making them soft so they become bent and twisted.
   b. Rickets is caused by the deficiency of calcium or vitamin D in the body.
8. A person affected with anaemia looks pale and feels weak and tired.
9. a. Kwashiorkor is a disease caused by deficiency of proteins in the diet.
   b. A child with kwashiorkor may not have received enough of his/her mother's milk and may have been forced on to a high carbohydrate diet too early.

Page 65

1. Drugs are substances that change the way the body works. They can act on the nervous system by affecting the movement of nerve impulses along the fibres of nerve cells.
2. Pain killers are drugs which are used for headaches and other pains. They can be bought at the chemist.
   Tranquillizers are drugs that calm people down. They should only be obtained on prescription by a doctor.
3. Anaesthetics are drugs that are used to numb parts of the body.
4. A drug addict is a person who uses drugs to give pleasant short-term effects.
5. Illegal drugs such as cannabis, cocaine and heroine can affect behavior and personality as well as having long-term effects on the brain (brain damage).

Page 66

1. nicotine, tar, carbon monoxide, cyanide
2. Nicotine in the tobacco is an addictive drug.
3. Chemicals in tobacco smoke kill the cilia which clean the lungs. The lungs can quickly be affected by bacteria. This causes bronchitis.
4. lung cancer and emphysema

Page 67

1. Heart disease is caused when the blood vessels carrying blood to the heart become blocked by cholesterol. Cholesterol is a fatty substance produced by eating too much fat in the diet. Fried food, red meat and butter and cream all contain a lot of fat.
2. Brisk walking moves more oxygen into the brain and triggers the release of endorphins into the blood-stream.
3. Regular exercise helps the body and mind to be fit and healthy.

Page 68

Exercise

1. Multiple choice questions

i. c ii. c iii. c
iv. b v. b

2. True or false

i. True ii. False iii. True
iv. True v. False

Page 69

3. i. a. OK
   b. very fat, treatment required
   c. overweight
   d. underweight
   ii. a. Clive is overweight
   b. He needs to lose weight by eating less fatty food and by exercising more.
4. i. a. scurvy b. rickets
   c. anaemia d. kwashiorkor
   ii. a. A person affected with anaemia looks pale and feels weak and tired.
   b. The bones of a person affected by rickets are bent and twisted.

Page 70

5. i. The graph shows that the risk of dying from lung cancer is increased with the number of cigarettes smoked per day.
   ii. a. more than 5 times but less than 10 times
   b. more than 30 times
   iii. Smoking can damage health because tobacco smoke contains many harmful chemicals like nicotine and tar. It also contains harmful gases like carbon monoxide, ammonia, and cyanide.
   iv. Young people should be advised by their teachers and parents about the harmful effects of smoking cigarettes. They should be encouraged to eat healthy foods and take plenty of exercise. They should play outdoor games, ride bikes or work out at gyms. They should not try smoking a cigarette even if it is for fun, as it can become an addiction.
6. Students should give their own suggestion.
7. i. It is a painkiller and does not cause addiction.
   ii. Anaesthetics numb areas of the body e.g. the mouth. Dentists can work on teeth without the body feeling pain.
   iii. It is an addictive, depressant illegal drug.
   iv. Not all drugs are dangerous if used sensibly and by following intructions given. For example, some drugs like painkillers are useful in relieving pain. However some drugs are addictive and if taken in large doses can be very dangerous for the body.

Page 71

Ideas for investigations

Investigation 1 gives students the opportunity to learn how to take a pulse, either their own or someone else's. It is important that only the fingers are used to find a pulse, never use the thumb since it has its own pulse and will cause confusion. By following the instructions, students should be able to discover a difference in pulse rate after the three contrasting activities. Starting with sitting, the pulse rate for this activity will be lowest. Walking should show a small increase and running will produce the highest pulse rate.

Chapter 6 Simple chemical reactions

Page 73

1.

Physical change	Chemical change
No new substances are made.	One or more new substances are formed.
Energy is not always given out or taken in.	Energy is always given out or taken in.
It can be reversed.	It is usually very difficult to reverse.

2. Crushed can, chopped food, ice melting are examples of physical change. No new substance is made
   Fuel burning, toast burning, food cooking are examples of chemical change. Cannot be reversed.
3. During a chemical reaction.

Page 74

1. As a word equation
2. Reactants
3. Products
4. Chemical reactions which give out heat are exothermic reaction. Endothermic reactions need heat to get them started.

Page 76

1. i. Synthesis
   ii. Endothermic. It needs heat to get the magnesium burning.
2. i. Endothermic
   ii. calcium carbonate → calcium oxide + carbon dioxide
3. The copper displaces the iron from the copper sulphate solution.

Page 78

1. Exothermic. Heat energy is given off.
2. An oxide is produced when a fuel reacts with oxygen.
3. wood, coal, oil.
4. Contain hydrogen and carbon. When they burn, water, and carbon dioxide are produced.
5. To produce energy to keep the body working properly. Fuel comes from food.
6. i. Energy is produced by combining a fuel with oxygen.
   ii. In combustion a lot of heat energy is produced (flames). Respiration is a much slower reaction.

Page 79

1. i. The candle would take 4 seconds to go out.
   ii. The candle would take 10 seconds to go out.
2. Stays in the test tube and dissolves in the water
3. Things burned more brightly in 'oxygen'.
4. i. He burned things in 'oxygen.
   ii. Lavoisier burned things in an enclosed space.
5. air/oxygen, fuel, and heat
6. Water removes heat from the fire.

Page 80

Exercise

1. Multiple choice questions

i. d ii. b iii. b
iv. c v. a

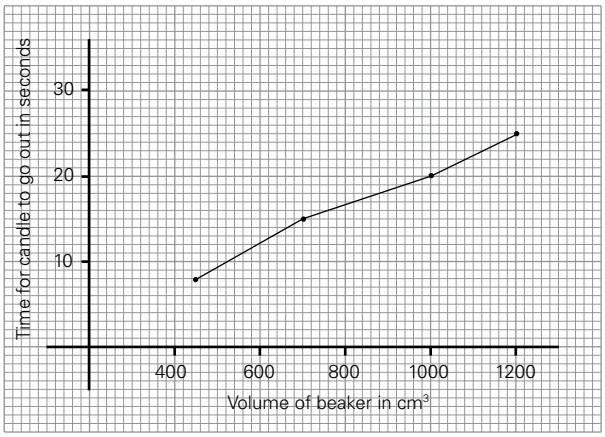
2. True or false

i. True ii. True iii. True
iv. True v. True

3. i. a. bending a ruler, cutting paper, melting ice cream
   b. baking a cake, ripening of fruit, souring of milk
   ii. a. souring of milk
   b. ripening of fruit, baking a cake.
4. i. I methane + oxygen → water + carbon dioxide
   II iron + water + oxygen → iron oxide
   III magnesium + copper sulphate → magnesium sulphate + copper
   ii. a. I b. II c. III
5. i. To test the presence of carbon dioxide. Lime water turns milky.
   ii. Carbon dioxide is produced as a result of respiration in our body, so there is more carbon dioxide in exhaled air as compared to inhaled air.
   iv. To carry out a fair test and get accurate results.

Page 82

6. i. The pump pulls the gas being produced through the apparatus, thereby ensuring that the gas passes through the soda lime.
   ii. This means that the candle contains hydrogen and carbon.
   iii. a. Water is produced from the oxidation of hydrogen present in the hydrocarbon.
   b. It evaporates.
   iv. As the hydrocarbon is burning and forming carbon dioxide and water, the candle loses weight.
   v. The weight of the soda lime will increase due to the formation of sodium carbonate which is a salt.
7. i. To get an average reading of the results and improve accuracy.
   ii. 8.3 s, 14.8 s, 19.5 s, 25 s
   iii. To get accurate results; a different type of candle may burn at a different rate, etc.
   iv.



Page 83

Ideas for investigations

Investigation 1 enables students to investigate some displacement reactions. Students should observe displacement reactions between the following:
magnesium and copper sulphate
magnesium and iron sulphate
magnesium and lead nitrate
iron and copper sulphate
iron and lead nitrate

All of the other combinations will have no reaction and are therefore not displacement reactions.

SAFETY NOTE: Put on safety goggles when doing this investigation.

Investigation 2 is an interesting and amusing example of a decomposition reaction. When potassium iodide is added to hydrogen peroxide, the decomposition of hydrogen peroxide increases rapidly and lots of oxygen gas is released in a short period of time. By adding washing up liquid to the mixture. oxygen bubbles are created and produce a long column of foam which erupts from the measuring cylinder rather like toothpaste being squeezed from a tube. Students are advised to stand clear once the potassium iodide has been added.

At the end of the experiment, students should feel the outside of the measuring cylinder and note that it is warm. The reaction is exothermic.

SAFETY NOTE: Put on safety goggles when doing this investigation.

Chapter 7 Sound and hearing

Page 85

1. their ears can detect sound energy
2. Sounds are made when something vibrates.
3. a. Guitar and violin
   b. Clarinet and flute
   c. Drum and tambourine
4. Humans produce speech sounds by the vibration of their vocal chords.

Page 86

1. When the drummer hits the drum, the drum skin vibrates rapidly up and down. The vibrating drum skin makes air molecules vibrate backwards and forwards. These molecules affect the molecules next to them.
   The sound spreads out. Within a split second, all the air molecules will be vibrating. We hear the sounds when the air inside our ears starts vibrating our eardrums.
2. a. We can hear sounds all around us.
   b. Dolphins communicate by sending out high pitched squeaks and clicks which travel through the water.
   c. We can hear someone knocking on the door and the sound of a beating drum.
3. Sound can only move when there is something to move through. It means that sound can pass anywhere there are particles, and the more tightly packed the particles are, the further the sound travels.
   Sound cannot travel in a vacuum because there are no particles in it.

Page 87

1. Sound waves are stretches and squashes of the air spread out from the source of the sound.
2. The distance between two compressions is called a wavelength.
3. In a longitudinal wave the vibrations move backwards and forwards.
4. The waves on a sea or the ripples on water move up and down, not backwards and forwards like longitudinal waves.

Page 88

1. In air, the speed of sound is about 330 metres per second.
2. No. In general, sound travels faster in liquids than in gases. It travels fastest of all in solids.
3. Light travels faster than sound so we see the lightning first and hear the sound of thunder after some time. A person standing 1600 m away will hear the thunder after five seconds because: The speed of sound = distance/time = 1600/5 = 320 m/s
4. An echo is the reflected sound from walls and other hard surfaces. It is heard a short time after the original sound.

5. Echo time is the time for a sound to travel from its source to a hard surface and back again.
6. Speed = distance/time = 160/0.5s = 320 m/s

Page 90

1. a. The pitch of a sound means how high or low the sound is. It depends on how rapidly the sound producer vibrates.
   b. The frequency of sound is the number of vibrations set up in one second. It is measured in Hertz (Hz)
2. The skin of the drum vibrates 20 times in a second.
3. a. When the drum is hit hard, a loud sound is produced (high volume). When it is hit softly a quiet sound is produced (low volume).
   b. When the drum is hit hard the skin of the drum vibrates with a high amplitude. When it is hit softly the amplitude of the vibrations are smaller.
4. 330/330 = 1 m

Page 92

1. a. Too much noise.
   b. Traffic, noise from radios, TVs, and machinery.
2. a. Noise levels can be measured with a sound meter. A sound meter converts sound energy into electrical energy which can be displayed on a scale.
   b. decibels (dB)
3. a. 30 dB b. 20dB
4. The walls, floor, and ceiling are hard, flat solid surfaces and reflect the smallest sound.
5. a. Soft foams, wadding and fabric b) They contain lots of air which absorbs sound energy. Sound travels much quicker through solids than through air.

Page 93

Exercise

1. Multiple choice questions

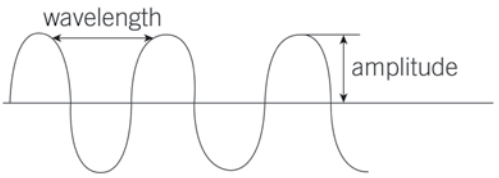
i. d ii. d iii. d
iv. a v. a

2. True or false

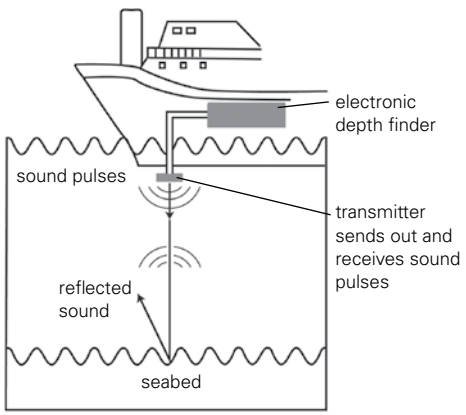
i. True ii. False iii. True
iv. False v. True

Page 94

3. i. When the drummer hits the drum, the drum skin vibrates rapidly up and down. The drum skin makes air molecules vibrate backwards and forwards. These molecules affect the molecules next to them. The sound spreads out. We hear the sound when the air inside our ears starts to vibrate our eardrums.
   ii. By tightening the skin tensioners and by hitting the drum harder, the sound of the drum can be changed.
   iii. The skin on a small drum will vibrate more quickly when hit so the frequency of the sound is higher than with a large drum. A high frequency sound has a higher pitch.
4. i.



   ii. In 1/10 of a second it vibrates 4 times. In 1 second it vibrates 40 times. Therefore frequency of the sound is 40 Hz .
5. i. An echo is a reflected sound.
   ii.



   iii. Using the formula:
   speed = distance/time
   speed × time = distance
   330 × 0.5 = 165 m
   But this is the total distance travelled to and back from the rock face. So, the rock face is 82.5 m away.

6. i. Sound 1 has a lower amplitude than sound 2
   ii. Sound 3 has a higher frequency than sound 1.
   iii. Sound 2 has the highest amplitude.
   iv. Sound 3 has the highest frequency.
   v. Speed = frequency × wavelength
   wavelength = speed/frequency
   = 330/220 = 1.5m
   vi. 7Hz

Page 95

7. a. To catch and direct the sound waves to the middle ear
   b. They make the eardrum vibrate.
   c. They transfer the sound waves to the inner ear.
   d. Nerve impulses.
   e. Nerve endings become desensitized. Can cause ringing in the ears.

Ideas for investigations

In investigation 1 students study the relationship between the amount of water in a bottle and the sound it makes when tapped. By carefully adjusting the amount of water in each bottle, students should be able to make a musical scale and perhaps even play recognizable tunes on their 'instrument'.

Investigation 2 is all about sound insulation. Student can develop their knowledge and understanding of this topic by choosing from a wide range of materials to see which material is the better absorber of sound. Usually, the material which is softest and holds the most air will prove to be the best insulator of sound.

Investigation 3 enables students to study the topic of echoes. It is recommended that students do this experiment at least three times before calculating the average of the results. The more times this experiment is carried out the closer the average will be to the actual speed of sound.

Chapter 8 Respiration: it's all about energy

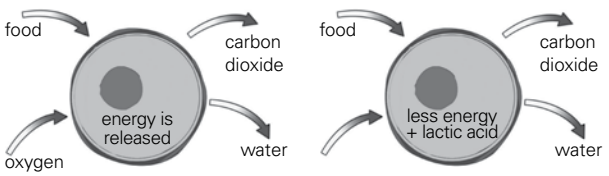
Page 97

1. Living things need energy to carry out the different life processes in their body.
2. glucose + oxygen → carbon dioxide + water + energy
3. We breathe in fresh air which contains the oxygen required for respiration. When we breathe out air we get rid of the carbon dioxide and water vapour.
4. Our exhaled air contains water vapour which condenses when it touches the cold window.

Page 98

1. Breathing is simply a way of exchanging gases between the lungs and the surrounding air. Respiration is the process by which energy is released by the chemical breakdown of glucose. It takes place in the body cells.
2. Respiration occurs in the every living cell of the body.
3. Mitochondria are the tiny rod-shaped structures present inside the cells where respiration takes place.
4. There are more mitochondria in the muscle cells because they have to release large amounts of energy quickly for movement.

Page 100

1. The kind of respiration in which oxygen is used to release energy from food is called aerobic respiration. Respiration which takes place without oxygen is called anaerobic respiration.
2. glucose + lactic acid → carbon dioxide + water + energy (small amount)
3. a. walking b) running fast
4. 

Page101

1. Plants produce alcohol and carbon dioxide.
2. glucose → ethanol + carbon dioxide + energy
3. fermentation
4. i. glucose ii. water iii. warmth

5. Watering potted plants too often is harmful because the soil becomes waterlogged. The roots of plants living in waterlogged soil have to use anaerobic respiration. The end product of anaerobic respiration is alcohol. If the level of alcohol in the cells becomes too high it can kill the plants.
6. Carbon dioxide is produced during anaerobic respiration. If the sealed container of yoghurt is left for a long time, its lid bulges due to the accumulation of too much carbon dioxide.

Page 103

1. Breathing is the taking in of oxygen and the removal of carbon dioxide from the body.
2. Blood carries oxygen from the lungs to the cells and the carbon dioxide from the cells back to the lungs.
3. From the nose and mouth, through the wind pipe or trachea, bronchi and bronchioles.
4. The alveoli are surrounded by blood capillaries which enable oxygen to pass from the air in the lungs into the blood in the capillaries.
5. Alveoli are excellent for gas exchange because:
   There are millions of them which provide a large surface area.
   They have thin, moist walls for gas exchange.
   They are surrounded by blood capillaries.
6. a. i. Mucus is a sticky liquid produced by cells which line the air passages.
   ii. Cilia are tiny hairs which line the air passages.
7. More oxygen is required during exercise than when you are asleep. An increase in breathing rate and lung capacity gets more air into the lungs from which oxygen can be removed.

Page 104

Exercise

1. Multiple choice questions

i. d ii. c iii. b
iv. c v. c

2. True or false

i. True ii. False iii. True
iv. True v. True

Page 105

3. i. Respiration is the oxidation of food to release energy.
   ii. It takes place in the mitochondria living cells.
   iv. a. glucose b. oxygen
   c. carbon dioxide and water d. energy
   e. aerobic respiration
   f. Oxygen is being used.
4. i. Carbohydrates and fats.
   ii. Starch is broken down into glucose by the action of enzymes.
   iii. Fat; it is stored as a layer under the skin.
   iv. Pasta has all the food substances in the right proportions and has a high energy value.
5. i. A capillary is a tiny blood vessel having very thin walls.
   ii. oxygen
   iii. carbon dioxide.
   iv. a. to dissolve the gases diffusing through its walls.
   b. so that gases can easily diffuse through its walls.

Page 106

6. i. Fermentation is the process by which yeast breaks down glucose into ethanol and carbon dioxide in the absence of oxygen to release energy.
   ii. a. carbon dioxide b. alcohol
   c. Yeast cells die.
7. i. Air is less dense at high altitudes so there is less oxygen.
   ii. During a race, runners are unable to produce enough energy by aerobic respiration so they obtain their energy anaerobically. This leads to a build up of lactic acid in their body/muscle cells causing cramps. Only by taking in more oxygen can the lactic acid be converted into carbon dioxide and water. This is called repaying the oxygen debt.
   iii. Oxygen is not diluted with nitrogen and carbon dioxide. Oxygen will diffuse through the alveoli and into the blood more quickly because of its high concentration.

Page 107

Ideas for investigations

Investigation 1 aims to enable students to study the effects of temperature on the rate of fermentation in yeast. At each temperature interval students should give a few minutes for the temperature of the apparatus to stabilize before taking their readings. Starting at 10°C, readings should be taken at 10°C intervals up to maximum of 60°C. Students should gain sufficient data to complete the table and even draw a graph of their results.

SAFETY NOTE: Put on safety goggles. Take care when handling hot apparatus.

Investigation 2 is designed to enable students to find their own lung capacity. Despite the simplicity of the apparatus, careful use will produce very worthwhile results. An element of competition usually enters into this investigation. It is surprising just how large the lung capacity of students can be.

Chapter 9 Acids and alkalis

Page 111

1. Acids in food give them a slightly sour or sharp taste.
2. Fizzy drinks are made by adding carbon dioxide gas to the drink under pressure.
3. a. Sulphuric acid is used in car batteries and as a raw material for making many other chemicals such as plastics, paints and soap.
   b. Nitric acid is used to make fertilizers and explosives.
4. When coal and oil burn, sulphur dioxide is produced and released into the atmosphere. It dissolves in rain water to form sulphuric acid. This is a strong acid and it makes the rain very acidic. When acid rain falls, it harms plants and water life. It also eats into stonework, especially limestone.

Page 113

1. The strength of an acid is measured by its pH. The lower the pH number, the stronger the acid. The higher the pH number, the weaker the acid.
2. The stronger the acid the more hydrogen ions there are.
3. a. 7 b. 6 to1 c. 8 to14.
4. The concentration of an acid depends on the amount of water present in it. If there is more water, the concentration will be low and vice versa. Comparatively, the strength of an acid refers to the number of hydrogen ions in it. The higher number of hydrogen ions the stronger the acid.
5.

Indicator	Colour in acid	Colour in alkali
litmus	red	blue
phenolphthalein	colourless	pink
methyl orange	orange	yellow

Page 114

a. The indicator changes colour as the pH of the solution gradually changes to neutral.
b. i. strong alkali pH14
   ii. weak alkali pH10
   iii. neutral pH7
   iv. weak acid pH3

Page 116

1. When an acid and an alkali are mixed together, they cancel each other out or neutralize each other
2. acid + alkali → salt + water.
3. The alkali is twice as concentrated as the acid.
4. a. hydrochloric acid b. sulphuric acid
   c. nitric acid

Page 117

1. a. Our teeth get coated with sugar as we eat food during the day. Bacteria feed on the sugar and produce acid as waste. This acid causes tooth decay.
   b. Most toothpastes that we use are slightly alkaline. Not only do they remove the bacteria but they also neutralize the acid.
2. a. Hydrochloric acid is produced in our stomachs to help in the digestion of food. Sometimes, during a big meal, too much acid is produced and this causes indigestion.
   b. Indigestion tablets or antacids contain metal carbonates or hydroxides which neutralize the excess acid.

3. Bee stings contain acid. Sodium hydrogen carbonate is alkaline, so it can be used to neutralize the acid, thereby relieving the painful effects of a bee sting.
4. Wasp stings are alkaline, so vinegar, a weak acid, will take away the painful effect of a wasp sting.

Page 118

Exercise

1. Multiple choice questions

i. c ii. a iii. d
iv. c v. b

2. True or false

i. True ii. False iii. True
iv. False v. True

3. i. Fizzy drinks are made by adding carbon dioxide to the drink, which dissolves in water to form a weak acid called carbonic acid.
   ii. Vinegar preserves fruits and vegetables.

Page 119

4. i. a. lemonade b. still mineral water
   ii. Less acidic than cola because it has a higher pH value.
   iii. It contains dissolved carbon dioxide in it so it is slightly acidic.
   iv. a. They could be right as fizzy drinks are acidic in nature so they could cause the calcium of the teeth to dissolve.
   b. They could be wrong as still drinks contain sugar which could cause tooth decay.
5. i. a. red grape juice b. litmus
   c. beetroot juice d. red cabbage
   ii. a. red
   b. The medium will be slightly alkaline as sodium hydroxide is an alkali.
   iii. The pH scale is used to show the strength of an acid or alkali.
   iv. Dissolve the aspirin in 5ml of water and test it with litmus. The litmus paper will turn red if it is an acid or blue if it is an alkali.

Page 120

6.

Name of substance	pH	Colour of universal indicator
hydrochloric acid	pH1	**red**
Lemonade	**pH3**	orange
Pure water	**pH7**	**green**
Sodium hydroxide	**pH14**	purple

7. The concentration of an acid depends on the amount of water present in it, whereas the strength of an acid refers to the number of hydrogen ions present in it.

Experiment

Take two antacid tablets. Put each tablet into a test tube. Add some dilute HCl to one tablet, and an equal amount of vinegar to the other tablet. Observe the changes. The tablet in the hydrochloric acid will fizz rapidly whereas the tablet in the vinegar will not fizz much at all. This proves that HCl is stronger than vinegar.

8. i. All acids contain hydrogen ions.
   ii. All alkalis have hydroxide ions.
   iii. It contains hydrogen as well as hydroxide ions.
   iv. Salt and water
9. a. chloride b. nitrate
   c. chloride d. sulphate

Page 121

Ideas for investigations

Investigation 1 enables students to develop their knowledge and understanding of indicators. Students will make their own indicators from a variety of plant materials and use them to see what colour they go in acid, neutral and alkaline conditions. Hopefully students will recognise that not all indicators work in the same way and that the colours produced vary considerably from plant material to plant material.

In investigation 2 students carry out experiments to compare the effectiveness of three different kinds of indigestion tablets. This investigation tests the student's understanding of variables. Only one variable must be changed at any one time. All of

the others must remain constant. This investigation can be as simple or as complex as each student wants it to be and the results are usually very rewarding.

SAFETY NOTE: Put on safety goggles. Take care when handling acids, they are corrosive.

Chapter 10 Light

Page 123

1. Light travels one million times faster than sound.
2. Because light travels in straight lines, we can represent them using lines drawn with a ruler.
3. Rays of light can pass through transparent materials. Translucent materials allow only some light to pass through.
4. a. Transparent materials: acetate, paper and glass
   b. Translucent materials: frosted glass and greaseproof paper
   c. Opaque materials: wood and metal

Page 124

1. A plane mirror is a flat mirror.
2. A piece of paper has a rough surface so reflected light is diffused in all directions.
3. The incident ray is the incoming ray which strikes the mirror. The reflected ray is the outgoing ray which is reflected by the mirror.
4. A normal is a line drawn between the incident ray and the reflected ray at 90 degrees to the mirror.
5. The angle of incidence equals the angle of reflection.
6. a. When light rays from an object strike a plane mirror, the image appears to be the same distance behind the mirror as the object is in front. This is a virtual image because no rays of light actually pass through it.
   b. The image of an object in a plane mirror seems to be laterally inverted, which means it appears changed from left to right.

Page 126

1. a. When a ray of light passes from air into a material such as glass or water, it slows down and bends towards the normal. This bending of light is called refraction.
   b. Light entering the glass block slows down and bends towards the normal. As it leaves the glass, it speeds up again and bends away from the normal. The ray emerging from the rectangular block is parallel to the ray going in.
2. Because diamond is more dense, refraction is greater.
3. Since a refracted ray is parallel to a ray of light entering the water, the object appears to be in a different position.

Page 127

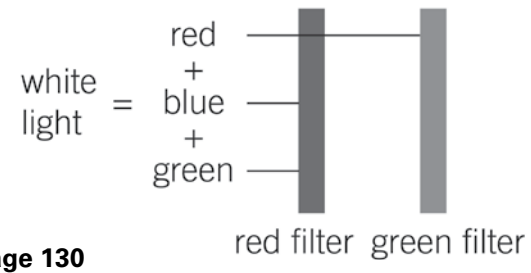
1. a. A concave lens is thinner in the middle than at the edges.
   b. A convex lens is thicker in the middle than at the edges.
2. A convex lens.
3. a. The focal point of a lens is the point at which all the rays passing through a lens seem to meet.
   b. The focal length is the distance between the focal point and the middle of the lens.
4. A convex lens focuses the light rays to a point, whereas a concave lens spreads the light rays. To find the focal length of a concave lens the refracted rays have to be traced back through the lens.

Page 128

1. When a ray of white light is passed through a triangular prism it is split into different colours. The continuous spread of colour is called a spectrum.
2. a. Blue light is refracted more than red light.
   b. Red light has a longer wavelength than blue light so it is refracted at a greater angle than blue light which has a smaller wavelength and is refracted at a smaller angle.
3. a. Red, orange, yellow, green, blue, indigo, violet.
   b. '**R**est **o**f **y**ou **g**o **b**ack **i**n **v**an' or 'Roy G. Biv'
4. The different colours of the spectrum are produced because different wavelengths of light are refracted at slightly different angles. This is called dispersion.

5. a. A rainbow is an example of a spectrum that occurs naturally. It is caused when sunlight from behind you is refracted through raindrops in front of you. Rain drops act like tiny prisms splitting sunlight into different colours of the spectrum.
   b. In front.

Page 129

1. The primary colours of light are red, blue, and green.
2. a. The secondary colours of light are cyan, yellow and magenta.
   b. Red light mixed with blue gives magenta; red light mixed with green light gives yellow; green light mixed with blue light gives cyan.
3. If you shine a ray of light through a coloured filter, some colours are blocked, or absorbed. Other colours are allowed to pass through or transmitted.
4. a. A blue filter will absorb the colours red and green light.
   b. It will transmit blue light.
5. 

Page 130

1. a. Pigments are chemicals which cause colours.
   b. Paints, inks, coloured crayons, petals of flowers, leaves of plants, and skins of animals.
2. The primary pigment colours are red, blue, and yellow.
3. a. The secondary pigment colours are magenta, green, and orange.
   b. Red mixed with blue gives magenta; blue mixed with yellow gives green; yellow mixed with red gives orange.
4. a. A red surface absorbs blue and green, and reflects red light.
   b. A green surface absorbs red and blue light, and reflects green light.
   c. A blue surface absorbs red and green, and reflects blue light.
5. a. White surfaces reflect all the colours of the spectrum.
   b. Surfaces that absorb all the colours of the spectrum appear black.

Page 131

1. Blue and yellow.
2. Magenta and orange.
3. a. Green and blue.
   b. The shirt will look green; the trousers will look blue.
4. They will not be able to make their food as green light is reflected from the leaves

Page 132

Exercise

1. Multiple choice questions

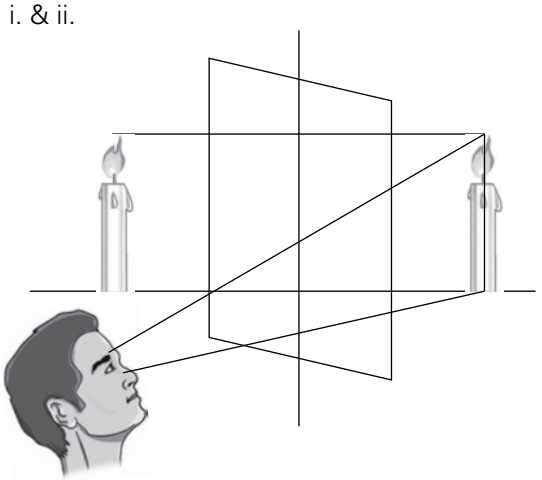
i. a ii. c iii. b
iv. c v. a

2. True or false

a. True b. True c. True
d. False e. False

Page 133

3. a. glass, snow, water
   b. coal, tracing paper
   c. glass, water
   d. coal, snow
   e. tracing paper
4. i. & ii.

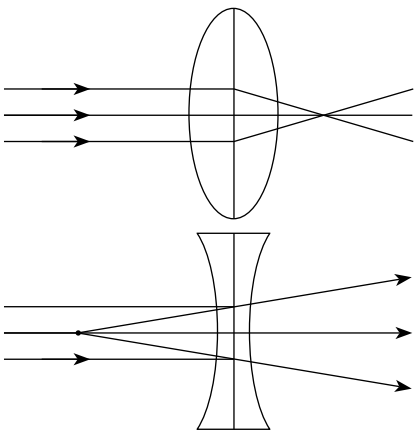


iii. Laterally inverted means that a mirror turns the image around from left to right and vice versa. For example when you raise your right hand in front of the mirror you will find that the left hand of your image is raised.

iv. No rays of light actually pass through the mirror. If you look behind a mirror, you will not be able to see the image even if it appears to be there.

Page 134

5. i. a. Convex lens
   b. Concave lens
   ii.



   iii. The focal point is the point upon which light rays passing through a convex lens are focused.
   iv. spectacles, microscope, hand lens etc.
6. i. Red, orange, yellow, green, blue, indigo, violet.
   ii. Violet light refracts at a larger angle than red because it has a shorter wavelength.

Ideas for investigations

Investigation 1 gives students the opportunity to make a pinhole camera. This simple device develops students knowledge and understanding of the nature of light travelling in straight lines and the formation of inverted images. The addition of a convex lens introduces the concept of focusing an image.

The pinhole camera is best used on a bright sunny day.

Investigations 2 enable students to study the refraction of light in more detail. Accurate tracing of the shapes of the glass block and prisms and drawing of lines to represent the light rays is essential if useful, meaningful results are to obtained. With care students should obtain results that support what they will have read earlier in this chapter.

Chapter 11 Transport in humans

Page 140

1. About 5.5 litres
2. Red cells, white cells, plasma and platelets.
3. Digested food, carbon dioxide, urea (waste) and hormones.
4. Carry oxygen from the lungs to the rest of the body.
5. Red blood cells contain a chemical called haemoglobin. At the lungs, haemoglobin joins with oxygen to make oxyhaemoglobin which is bright red. As it travels round the body, the oxyhaemoglobin changes back to haemoglobin, releasing the oxygen to the cells.
6. White cells have a nucleus, red cells do not. White cells can change their shape, red cells can't.
7. Chemicals that destroy microrganisms by dissolving them.
8. Antibodies destroy microorganisms by dissolving them. Antitoxins break down the toxins (poisons) that microorganisms produce.
9. Platelets cause tiny fibres to form a net across the cut. Red cells get caught in the net forming a blood clot. The surface of the clot hardens to form a scab. This keeps the cut clean while new skin grows.

Page 141

1. Tissue fluid is mainly water. It forms a continuous link between the water in the blood plasma and the water in the cell cytoplasm
2. The walls of the smallest blood vessels (capillaries) are very thin with tiny holes in them.
3. It is covered with tissue fluid coming from the meat (muscle) tissue.
4. Diffusion is the movement of a substance from a high concentration to a low concentration. In the body cells there is more urea than in the blood, so it moves from the cells to the blood through the tissue fluid.

Page 143

1. It carries blood around the body.
2. Tubes called arteries, veins and capillaries.
3. It means that blood passes through the heart twice as it goes once around the body.
4. Arteries have thick, muscular walls, veins have thinner walls. Veins are wider than arteries. Arteries carry blood from the heart, veins carry blood to the heart.

5. Capillary walls are very thin so that tissue fluid carrying things such as oxygen, and carbon dioxide can pass between the blood and the cells.
6. Arteries carry blood from the heart so they are closest to it. The pressure is therefore higher.

Page 145

1. Vena Cava
2. Through the coronary artery and coronary vein.
3. Blood from the body enters the right atrium through the vena cava. Blood from the lungs enters the left atrium through the pulmonary vein. The atria contract together pushing blood into the ventricles. From the left ventricle, blood is pumped to the body through the aorta, and from the right ventricle to the lungs along the pulmonary artery. Both ventricles contract at the same time.
4. There is a double beat since the atria contract just before the venticles.

Page 146

Exercise

1. Multiple choice questions

i. b ii. b iii. a
iv. b v. d

2. True or false

i. True ii. False iii. True
iv. False v. False

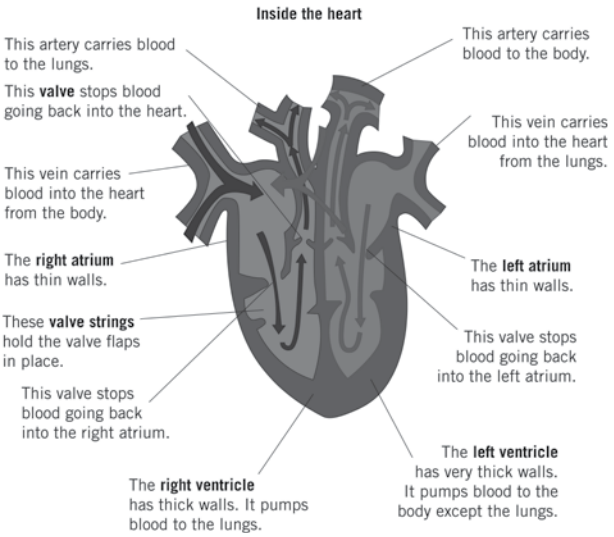
Page 147

3. Arteries carry blood **away** from the heart. They have thick **muscular** walls to cope with the **high** pressure as it leaves the heart. Arteries divide into smaller tubes called **capillaries** which spread through the **tissues** of the body. This makes sure blood gets to every cell. The walls of these blood vessels are very **thin** so materials can pass between the blood and the cells.
   Blood is carried back to the heart by **veins**. These are **wide** and have thinner walls than arteries. This is because the blood pressure is **low** and the blood flows slowly. These blood vessels have **valves** to keep the blood flowing in the right direction.
4. i. Right ventricle into the pulmonary artery and on to the lungs.
   From the lungs to the left atrium.
   Left atrium into the left ventricle.
   Left ventricle out the body through the aorta.
   Back from the body into the right atrium via the vena cava.
   Right atrium into the right ventricle.
   ii. Blood passes through the heart twice as it goes once around the body.
   iii. 1 circulation in 30 s
   = 2 circulations in 1 min.
   = 120 circulations in 1 hour
   = 120 x 24 = 2880 circulations in 1 day
5. i.

platelets	plasma
antibodies	antitoxins
haemoglobin	red blood cells
white blood cells	

Page 148

   ii. Two from digested food, carbon dioxide, urea and hormones.
   iii. White blood cells squeeze through the walls of the capillary and move towards invading micro-organisms and eat them.
6. i.



   ii. a. left ventricle b. right ventricle
   iii a. aorta b. pulmonary artery

Page 149

7. i. Round with a hollow on both sides.
   ii. a. Red blood cells do not have a nucleus.
   b. They only live for a few months.
   iii. The shape of red blood cells gives a large surface area to absorb oxygen. They also contain a chemical called haemoglobin which combines with oxygen to make oxyhaemoglobin. In this way oxygen can be transported efficiently around the body.

iv. At high altitudes there is less oxygen in the atmosphere. So, more red blood cells are needed to collect the required amount of oxygen for everyday life.

Ideas for investigations

This investigation gives students the opportunity to learn how to take a pulse, either their own or someone else's. It is important that only the fingers are used to find a pulse, never use the thumb since it has its own pulse and will cause confusion. By following the instructions, students should be able to discover a difference in pulse rate after the three contrasting activities. Starting with sitting, the pulse rate for this activity will be lowest. Walking should show a small increase and running will produce the highest pulse rate.

Chapter 12 Variation and classification

Page 151

1. Homo sapiens
2. They have the same general body shape, all of them have two eyes, a head, two hands, two arms, two legs, they have hair etc.
   They have different face shapes and features, hair colour, eye colour and heights.
3. a. They inherit their characteristics from their parents.
   b. variations

Page 152

1. a. 158 cm b. brown c. black
2. a. 5, 6 & 8 b. brown
3. a. Mark: height 170 cm, shoe size 8, hair colour brown, eye colour brown, left handed, has freckles.
   b. Janine: 162 cm, shoe size 6, hair colour black, eye colour brown, right handed, no freckles.
4. Height and shoe size might change. Freckles may fade and not be so obvious.

Page 153

1. differences between members of the same species
2. A normal distribution curve is in the shape of a bell. The average measurement is shown in the middle of the curve. Most of the measurements will be close to this average on either side of the curve.
3. a. continuous variations: weight, height, freckles
   b. tongue rolling, eye colour, ear lobes

Page 155

1. The patterns of ridges in the skin of the fingertips.
2. These ridges help us to grip things firmly.
3. Types of fingerprint patterns:
   arch: the lines run like waves across the fingertip
   whorl: the lines make circles on the fingertips
   loop: the lines from one side form a loop in the middle of the fingertip then return to the same side mixed: this is a combination of arches, loops, and whorls
4. Press a finger on a glass surface. With the right light you can see your fingerprint.
5. No two prints made by different fingers are the same so fingerprints of the complete hand must be made in order to identify the person.
6. Police databases contain billions of unique fingerprints so that any fingerprint detected at the scene of a crime can be checked with those on police records. This way it might be possible to identify a criminal even in the absence of witnesses.

Page 157

1. Vertebrates have a backbone, invertebrates do not.
2. Coelenterates
3. a. Insects b. Arachnids
4. Fish scales are soft, reptile scales are hard.
5. Wings
6. 'Deca' means ten, 'pod' means leg. Decapod means ten legs.

Page 159

1. Plants with seeds and plants without seeds
2. a. both are seedless plants b) The leaves of the mosses are arranged in a spiral. In ferns the leaves are arranged in branches.
3. Conifers have no ovary and they produce naked seeds.
4. a. Monocotyledons and dicotyledons

b. Monocots have narrow leaves and the seeds have a single cotyledon. Dicots have broad leaves and the seeds have two cotyledons.
c. monocot: tulip, dicot: rose

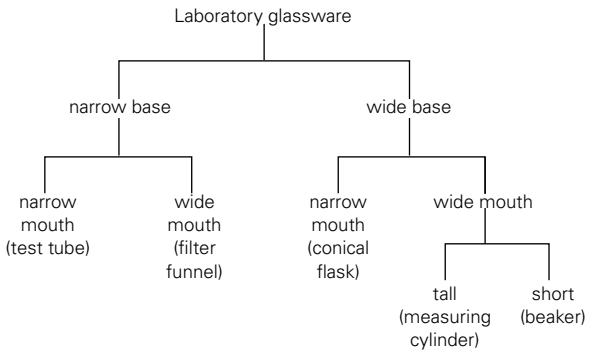
5. Moss plants grow together in clumps for support and to prevent themselves from drying out.

Page 160

1. Classification is necessary for all known living things found on Earth as no one can ever hope to know the names of all of them.
2. a. species b. kingdom
3. a. Latin was chosen because it was the international language of science.
   b. Latin names avoid confusion especially if an organism has more than one common name.

Page 161

1. Keys are useful for finding the names of organisms that we cannot recognize.
2. A key is a series of questions. Each answer leads on to another question. This continues until the name of the organism is found.
3. A bat, B dolphin, C squirrel, D otter, E vetch, F sundew, G charlock, H bluebell, I bell heather.
4. Sample answer.



5. Classification of living organisms is difficult because there are millions of them and some have still not been found, identified or named.

Page 162

Exercise

1. Multiple choice questions

i. a ii. a iii. c
iv. c v. d

2. True or false?

i. True ii. True iii. False
iv. True v. False

Page 163

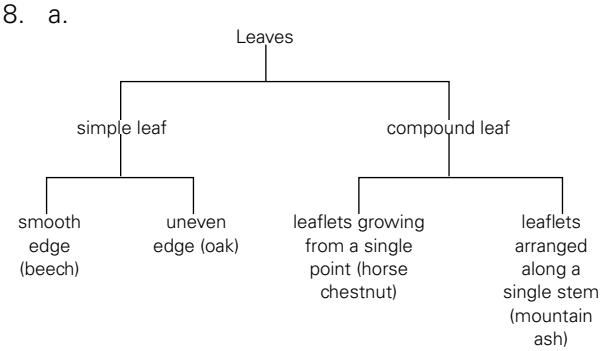
3. i. mother ii. mother iii. 2
   iv. Alison, Tom and Jane
   v. This is an aquired variation. The length of one's hair is dependent on preference rather than inheritance.
4. i. They have two pairs of wings, a pair of antennae, and their bodies are divided into three parts.
   ii. They differ in colour, wing, shape, and size.
   iii. It is a continuous variation.
   iv. It is a discontinuous variation.
   v. The eye factor makes the peacock butterfly look larger and more dangerous to its predator. The dead leaf effect provides a camouflage which helps brimstone butterflies to hide from enemies.

Page 164

5. i. 32
   ii. a. 160 - 169 cm b. 135 - 154 cm
   iii. 150 - 4 cm
   iv. Normal distribution curve
   v. weight, hand span size
6. i. An insect has 6 legs and the body is divided into three parts. A spider has 8 legs and the body is divided into two parts.
   ii. Millipedes have long thin bodies, whereas crabs have a hard, chalky shell.
   iii. a. 4 b. insects c. crustacean

Page 165

7. a. A wasp b. B housefly
   c. C earwig d. D butterfly
8. a.



b. Answers depend on students

Ideas for investigations

This investigation requires student to gather scientific data about the height of students in their class. The larger the sample, the better the outcome of this investigation. Accurate measurement is important. Students may wish to use a tape measure attached to a wall against which other students stand in turn to have their height measured. A ruler place horizontally on the top of the head of each student will help in taking readings from the tape measure. Once all measurements have been listed in the table, a bar graph can be drawn. With a sufficiently large sample the shape of the graph should be similar to the normal distribution curve shown in this chapter.

Chapter 13 The rock cycle, rocks and weathering

Page 168

1. Igneous rocks are formed from molten rock called magma deep in the very hot mantle of the Earth's crust.
2. a. Magma is molten rock.
   b. It comes from the mantle of the Earth.
3. High pressures build up beneath the Earth's crust and this eventually causes a volcano to erupt.
4. The size of the crystals depends upon how long the magma takes to cool down. Slow cooling produces big crystals and rapid cooling produces small crystals.
5. Molten rock inside the Earth is called magma. Once on the Earth's surface, molten rock is called lava.
6. Volcanoes are formed when lava and ash are thrown violently from the Earth.
7. Granite and basalt are formed by the cooling down of molten rocks from the mantle of the Earth.
   Granite and basalt are both igneous rocks which are very hard.

Page 169

1. Weathering is the breaking down of rocks by air, water, and the heat of the Sun.
2. Types of weathering: physical, chemical, biological.
3. Erode means to be worn away by the action of physical, chemical or biological weathering.
4. In very cold weather, water seeps into cracks in the road surface and then freezes. As it turns into ice, it expands and forces the surface to split.
5. Plant roots spread into and under rocks causing stresses and strains to build up. Eventually cracks appear which become larger as the plant continues to grow. This process is called biological weathering.

Page 170

1. Carbon dioxide in the soil comes from the bacteria which feed on dead plant and animal material and from respiration of plants roots and animals living in the soil.
2. When carbon dioxide dissolves in water it forms carbonic acid.
   carbon dioxide + water → carbonic acid
3. When carbonic acid reaches limestone a chemical reaction takes place. Limestone is mainly made up of calcium carbonate. When it reacts with carbonic acid it erodes.

Page 171

1. The carrying away of weathered rocks such as pebbles, sand, mud and clay.
2. Tiny pieces of weathered rock are washed by rain into streams and rivers.
3. The flowing water causes the heavier rocks to roll along the river bed and form smooth round pebbles.
4. The faster the river, the larger the stones it can carry.
5. During floods, larger pieces of materials like trees, cars, and huge boulders can be carried along as the water has a lot of energy.

Page 172

1. The faster the river, the greater the energy it has therefore the larger the size of rock fragments it can transport.
2. a. Sorting is the deposition of different sized rock fragments in different places due to the changes in the speed of a river.
   b. Fast flowing river water carries most sizes of rock fragments. A sudden slow down, will cause the deposition of larger, heavier material such as large stones; only the lighter, finer particles will be transported further.

3. When a river slows down, it loses energy. As a result, it deposits the transported material as sediment. If the river has enough energy, it will carry material out to sea, where it eventually falls to the sea floor.

Page 173

1. Over millions of years.
2. Over millions of years sediment will build up on river beds and at the bottom of the sea. With increasing pressure from the weight of the sediment above, water is forced out of the lower layers compacting the particles to form sedimentary rock.
3. The type of sediment determines the type of sedimentary rock e.g. sand particles make sandstone, clay and mud particles make shale.
4. The pebbles in conglomerate rock are held together with calcium carbonate.

Page 174

1. Limestone is different from other sedimentary rocks because it is made from the shells and bones of sea creatures instead of from rock particles.
2. Calcium carbonate
3. a. Flint is a very hard rock which our ancestors used for making tools and weapons.
   b. In the ancient seas, sea sponges had skeletons made of silica. When they died, their skeletons built up in layers. The silica dissolved then re-crystallized as flint.

Page 175

1. Metamorphism means change of form.
2. They must be subjected to different conditions of temperature and pressure.
3. Marble, sandstone and quartzite.
4. Marble is formed by the intrusion of magma into beds of limestone.
5. a. Slate is made by sedimentary shale being compressed deep underground. Under pressure the tiny mud grains in the shale were changed into flat crystals which grew into layers.
   b. Slate is useful as a roofing material because it splits easily into flat sheets.

Page 176

1. Because it goes round and round. Igneous rocks are weathered and eroded. The debris is transported then dumped to eventually become sedimentary rock. This may be buried deep and changed by heat and pressure and then be lifted to form a mountain range only to be eroded again. The rock cycle goes on and on.
2. a. Lava from volcanoes flows along mountain slopes, sediment is transported by rivers to the sea, where it gets buried under layers of more sediment and eventually becomes molten due to immense heat and pressure.
   b. It would take millions of years.
3. Water erodes rocks and transports sediment in rivers to the sea.
4. Answers depend on students.

Page 177

Exercise

1 Multiple choice questions

i. a ii. b iii. b
iv. b v. c

2 True or false

i. True ii. False iii. True
iv. True v. True

Page 178

3 i. High pressure beneath the Earth's crust pushes the molten rock to the surface of a volcano.
   ii. a. Bubbles of gas released from molten lava make it frothy and sponge-like.
   b. Pumice floats on water because it has sponge-like holes in it making it less dense than water.
   iii. They contain lots of different crystals.
   iv. The crystals of granite are larger than those of basalt because granite took longer to cool down.

4. i. Physical and chemical weathering of igneous rocks
   ii. Particles of igneous rocks transported by a river.
   iii. The river slows down as it reaches the sea. Sand, gravel and pebbles settle as sediment on the sea bed.
   iv. Layers of sediment build up over millions of years to form sedimentary rocks.

Page 179

5. i. An intrusion is very hot magma that is pushed into rock.
   ii. Molten rock comes from the mantle.
   iii. a. marble
   b. Limestone is a sedimentary rock, marble is metamorphic.
   c. It is used for making statues.
   iv. The area of contact between the limestone and the magma is greater at X than at Y.

6.

Rock	Type
sandstone	sedimentary
granite	igneous
marble	metamorphic
limestone	sedimentary
slate	metamorphic
pumice	igneous

Page 180

7. i. a. igneous rock b. granite or basalt
   ii. Molten lava flowing down and solidifying.
   iii. a. sedimentary rock
   b. limestone or sandstone or shale.
   iv. a. metamorphic rock
   b. marble or slate
   v. By rivers
   vi. The energy needed to drive the rock cycle comes from the very hot mantle.

Page 181

Ideas for investigations

Investigations 1 and 2 enable students to look at the effects of weathering on rock.

In investigation 1 students use a variety of strengths of acid on limestone. It is important that similar pieces of limestone are used otherwise this does not become a fair test. Students should find the limestone will dissolve quickest in the strongest acid. The experiment can be repeated with students stirring the limestone acid mixture. This should result in quicker times for the limestone to dissolve. Stirring removes the carbon dioxide bubbles from the surface of the limestone allowing acid to come into contact with the limestone more quickly.

SAFETY NOTE: Put on safety goggles. Take care when handling acids, they are corrosive.

In investigation 2 a house brick (metamorphic clay) is thoroughly soaked in water and then subjected to frost action by putting it in a freezer. Students should observe cracking and fracturing of the brick after a few days.

Investigation 3 is a simple experiment which looks at the relationship between the size of rock particles and settlement time in water. Stirring of water in the beakers simulates the action of a stream or river as it carries particles along. Students should soon discover that the smaller the particles, the longer they take to settle.

Investigation 4 requires students to use a simple scratch test to compare the hardness of various types of rock. A finger nail will make a mark on softer rocks such as sandstone, whereas a knife blade is needed to scratch hard rocks such as granite.

SAFETY NOTE: Put on safety goggles. Take care when using a sharp knife

Answers (Workbook)

Chapter 1 Heating and cooling

Page 2

1 True or false

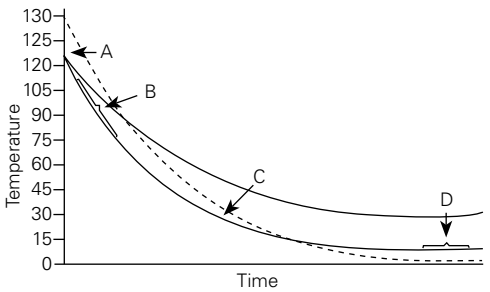
i. True ii. False iii. False
iv. True v. False

2 Multiple choice questions

i. a ii. a iii. a
iv. a v. a

Page 3

3 i. a. B b. D c. 30°C
ii. 15 °C
iii.



Melting	When a solid is warmed the particles move faster, until some break and become part of the liquid.
Evaporation	When heat is applied to a liquid, the particles move faster. At the surface, the faster particles break free to form a gas above it.
Condensing	When heat energy is removed from a gas, its temperature falls. The gas particles slow down and move closer together. Eventually they will come close enough to form a liquid.
Freezing	As a liquid cools, its particles slow down. Eventually they will start to form a framework which is typical of a solid.
Mass is conserved	In a change of state, only the behaviour of the particles changes. The actual particles remain the same.

5 i.

Article	What is it made of?	What is its job?
table mat	cork	prevents heat from a hot utensil reaching the table
frying pan	steel	allows heat to get from burner to food
handle of kitchen-turner	wood	stops heat reaching the hand from the heated utensil
base of iron	aluminium	allows heat to pass from iron to clothes
blanket	wool	traps air so keeping you warm by retaining warm air
hot water cylinder	copper	allows heat to get from burner to water in boiler

ii.

Conductors	Insulators
steel	cork
copper	wood
aluminium	plastic

iii. a. To hold hot pans or hot oven tray.
b. An insulator.
c. An insulator would not allow heat to pass through it.

6 i. Cold water is denser than warm water so settles at the bottom of the tank.
ii. A
Hot water is less dense and would rise to the top of the tank. Therefore, point A would be best.
iii. Hot air rises pulling along with it dust particles from the floor.

7 i. a. Screw top made of plastic stops heat loss by conduction.
b. Vacuum between the inner and outer layers of the bottle stops heat loss by convection.
c. Silvery inside surface would prevent heat loss by radiation as the heat rays are reflected back.
ii. It prevents heat loss to the outside and stops outside heat from coming in.

iii. The design will vary depending upon the student. However answers should show an understanding of conduction, convection and radiation. Methods of preventing heat loss by these processes should be suggested in the design.

8 i. a. White reflects heat and is a poor absorber of heat. It helps to keep houses cool.
b. Black is a better emitter of thermal radiations than a shiny surface.
c. Hot air rises from the bonfire causing cool air to take its place. A convection current is set up and the person can feel a draught.
d. Cold air being denser than hot air settles at the bottom of the refrigerator. This escapes as the refrigerator door is kept open.
e. By fluffing up, birds trap air between their feathers forming an insulation layer.
f. A saucepan has a copper bottom (a conductor) to absorb heat from the cooker, but it has a plastic handle (an insulator) so that our hands do not get burnt.
g. Air gets trapped between the holes of the string vest and the tight shirt preventing heat loss.
h. Ploughed fields are dark and absorb heat from the Sun. This warms the air above causing convection currents which the glider pilot can use to gain height.
i. Black is a good absorber of heat. Heat is required for germination of seeds.
j. Convection currents of air are produced by the heater. As the warm air rises, it makes the paper decorations flutter.

ii. a. Saucepan with a plastic handle, fluffed out feathers in birds, wearing a tight shirt over a string vest.
b. Glider pilots, fluttering of paper decorations, cold air from refrigerator door.
c. Car radiators painted black, houses painted white, soil covered with black plastic sheet.

9 i. C ii. D iii. A iv. B

10 Temperature and heat are not the same thing. Temperature is a measure of how **hot** or **cold** something is. It is measured in **degrees** Celsius using a **thermometer**.
Heat is the transfer of **energy** from a **high** temperature to a **low** temperature. It is measured in **joules**.

Chapter 2 Plants and their system

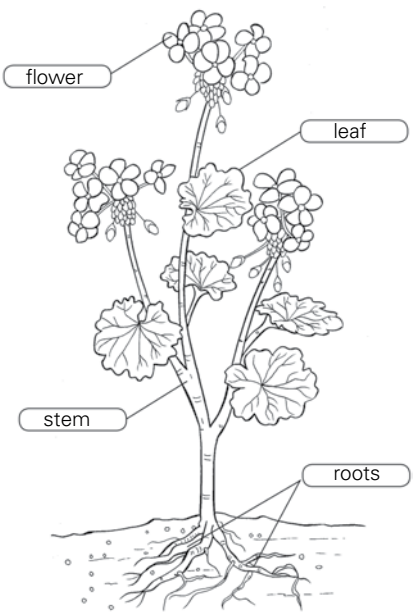
Page 12

1 True or false
i. True ii. False iii. False
iv. True v. False

2 Multiple choice questions
i. c ii. b iii. c
iv. d v. a

Page 13

3 i.



ii. flower: to attract insects for pollination
leaf: to make food by photosynthesis
roots: to absorb water and to anchor the plant to the soil
stem: to hold the leaves and flowers above the ground.

Page 14

4 i. A waxy cuticle B leaf tissue
C stoma D upper skin
E chloroplast F guard cell
ii. B iii. A
iv. C v. E

Page 15

5 Osmosis is a special kind of **diffusion**. Osmosis is defined as the movement of **water** molecules from a region of **high** water concentration to a region of **low** water concentration across a partially **permeable** membrane. This membrane has very tiny **holes** in it which only allow some molecules to pass through. Water molecules will fit through these holes because they are very **small**. Molecules such as **sugar**, are too **large** to get through the holes.

6 i. Mainly on the underside of leaves.
ii. Allow the exchange of gases between the air and air spaces in the leaf.
iii. 1 Guard cells have chloroplasts, leaf skin cells don't.
2 The walls of guard cells are irregularly thickened. The walls of leaf skin cells are the same thickness all over.
iv. Control the opening and closing of stomata.
v. Guard cells have chloroplasts which is where photosynthesis takes place.

Page 16

7 i. Tissue is a collection of similar cells doing the same job.
ii. a. Both tissues form tubes.
b. The walls of xylem are thickened, the walls of phloem are not. Phloem has sieves plates, xylem doesn't.
iii. a. In one the thickening is arranged as a spiral. In the other it is in rings.
b. To strengthen the walls of the tubes.
iv. To allow/control the flow of sugar solution through the tubes.

Page 17

8 i. Transpiration is the loss of water vapour from the leaves of a plant into the surrounding air.
ii. If air gets into the tube, water cannot be taken up by the leafy shoot.
iii. So that air doesn't get into the xylem of the plant and break the water supply.
iv. Place the apparatus in different places where the shoot will be exposed to different conditions.

Chapter 3 The Periodic Table

Page 18

1 True or false

i. True ii. False iii. True
iv. False v. True

2 Multiple choice questions

i. c ii. b iii. b
iv. c v. d

Page 19

3 Some atoms lose or gain **electrons** easily to become charged ions. Positive and negative ions can be held together by electrostatic attraction. Positive sodium ions are attracted to **negative** chloride ions. They bond to produce **sodium chloride**. This is called **ionic** bonding. When two **non-metallic** elements react they do not form ions. Instead their atoms overlap so they can **share** electrons. This is called **covalent** bonding.

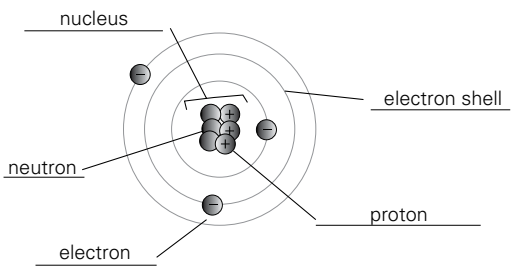
4 i. A
ii. a. D b. –1
iii. a. C b. +1

5

bromine	Br
carbon	C
calcium	Ca
copper	Cu
hydrogen	H
iron	Fe
magnesium	Mg
mercury	Hg
silver	Ag
zinc	Zn

Page 20

5 i.



ii. It is only a theoretical way of describing an atom because an atom is so small that no one has seen its actual form.

iii. 3

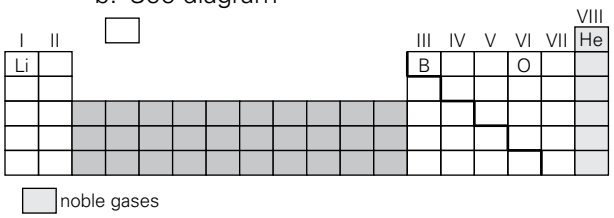
iv. 4

Page 21

7 (A) H_2O
(B) CH_4
(C) CO_2
(D) HCl
(E) NH_3
(F) N_2
i. (C) ii (D)
iii. (A) iv. (F)

Page 22

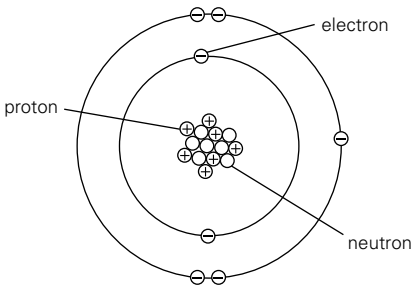
8 i. Elements are arranged in order of their atomic numbers.
ii. a. left
b. See diagram



iii. See diagram
iv. See diagram
v. Hydrogen
vi. See diagram

Page 23

8 Diagram must show correct number of neutron, protons and electrons. Also, two electron shells must be clearly shown with the inner shell containing only two electrons.



Chapter 4 Magnets and electromagnets

Page 24

1 True or false
i. True ii. True iii. False
iv. False v. True

2 Multiple choice questions
i. a ii. c iii. b
iv. a v. c

Page 25

3 i. They seek the North and South poles of the Earth.
ii. a. South pole b. South pole
iii.
iv. Steel nail, iron gate

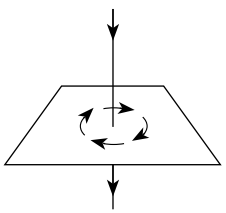
4 i.

ii. They will attract each other.
iii. Each piece would be a magnet.

Page 26

5 We can think of magnetic materials as containing molecular magnets. Inside a magnetic material like **iron** the molecular magnets line up in groups called **domains**. When a piece of magnetic material is **stroked** repeatedly with a **permanent** magnet, the molecular magnets start to line up. The iron becomes **magnetized**. A magnet can become **demagnetized** by heating it up and then quickly cooling it down. When this happens the molecular magnets move about and change their **positions**.

6 i. By using a plotting compass.
ii.



iii. Closest to the wire.
iv. a. It would also be reversed.
b. It would remain the same.

Page 27

7 i. B has an iron rod inside it.
ii. a. By increasing the current.
b. By making more loops of the same wire.
iii. They become opposites of what they were.
iv. Steel makes a permanent magnet.
v. solenoid

Page 28

8 i. An electromagnet loses its magnetism as soon as the current is switched off. It can be used again and again.

ii. Ferrous metals like iron and steel can be sorted from other kinds of non-ferrous metals such as aluminium.

iii. a. Radio, TV, computers etc.

b. A coil (electromagnetic) is attached to a paper cone
An amplifier sends a variable electric current to the coil (electromagnet)
A magnet produces a strong magnetic field
The magnets repel and attract and the coil moves
The coil makes the paper cone vibrate.
Vibrations travel through the air to the ear

Page 29

9 i. Huge amounts of data can be stored in a small space.

ii. As the credit card slides through the machine, the varying magnetic field of the particles on the magnetic strip induces a small current in the wires around the read/write head. The signal is amplified and can be read on the machine.

iii. Since the data stored on the strip is induced magnetism, it can be demagnetized by bringing a magnet close to it, and the read/write head will not be able to read the information stored on it.

Chapter 5 Fit and healthy

Page 30

1 True or false

i. True ii. True iii. True
iv. True v. True

2 Multiple choice questions

i. d ii. c iii. a
iv. a v. c

Page 31

3 i. Breakfast 1 = 780kJ
Breakfast 2 = 1560kJ

ii. A building site worker needs more energy than an office worker.

iii. They have fats.

iv. a. Food containing a lot of fibre helps prevent constipation and other disorders of the digestive system.

b. Breakfast 2

c. Porridge and bread contain a lot of fibre as they are made of cereals.

Page 32

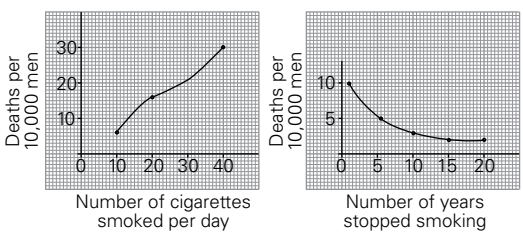
4 A person who eats too much becomes fat or **obese** and is at risk from a number of serious diseases such as **diabetes** and arthritis. A person who eats too little however, becomes **malnourished**. This can cause **deficiency** diseases. A disease called **rickets** causes bones to develop incorrectly. Vitamin D is needed by the body to develop strong bones. Leafy vegetable such as spinach and citrus fruits such as oranges and lemons contain vitamin C. A disease called **scurvy** is caused by too little vitamin C.
A deficiency of iron causes a disease called **anaemia**.
The most obvious sign of malnutrition is often caused by lack of **protein** in the diet. A disease caused by this deficiency is kwashiorkor.

Page 33

5

Drug	**Effect**
anaesthetic	numbs parts of the body
caffeine	mild stimulant
heroine	addictive dangerous drug
paracetomol	painkiller
sleeping pills	sedative
tranquilzers	calms a person down

6 i.



ii. a. 21 b. 4

iii. a. The death rate increases with the number of cigarettes smoked per day.

b. The death rate decreases with the number of years men stopped smoking.

iv. Gases such as ammonia and cyanide irritate the insides of the air passages. This causes smoker's cough.

Page 35

8 swimming
boating
cycling
playing football
riding a scooter
skating
jogging
walking
sitting in the open air
playing on the slide

Chapter 6 Simple chemical reactions

Page 36

1 True or false

i. False ii. False iii. False
iv. True v. True

2 Multiple choice questions

i. c ii. c iii. a
iv. d v. a

Page 37

3 i. mixture ii. element
iii. compound iv. molecule

4 i. a. C b. D c A
ii. a. B
b. The atoms have not combined completely.

Page 38

5. ii. HCl iii. $MgCl_2$ iv. NH_3
v. CH_4 vi. CO_2

6 i. C ii. B
iii. a. A b. magnesium oxide
iv. a. B b. It has lost weight after heating.

Page 39

7 i.

Physical changes	**Chemical changes**
boiling water	frying an egg
breaking a match stick	acid dissolving limestone
crushing a can	rusting nail
tearing clothes	striking a match

ii. Any two except acid dissolving limestone and rusting nail.
iii. 1 Dissolving limestone
2 Rusting iron

8

Exothermic reactions	**Endothermic reactions**
respiration in animal and plant cells	frying an egg
a burning match	plants using sunlight to make food
a firework exploding	sucking a mint to cool your mouth

Page 40

9 i. 1 air/oxygen 2 heat 3 fuel
ii. Three things are needs for combustion
iii. burning
iv. carbon dioxide/water
v. A blanket prevents air/oxygen from getting to the fire.
vi. Electrical fire
vii. There will be little oxygen and a lot of carbon dioxide.

Page 41

10 i. a. magnesium b. silver
ii. a. magnesium, lead
b. Put X into a solution of lead nitrate. Magnesium will react, lead will not.
iii. During a displacement reaction, one substance pushes out another substance to take its place.

Chapter 7 Sound and hearing

Page 42

1 True or false

i. False ii. True iii. True
iv. True v. False

2 Multiple choice questions

i. b ii. d iii. b
iv. a v. b

Page 43

3 i.

Group 1	**Group 2**	**Group 3**
mouth organ	harp	tambourine
saxophone	guitar	drum
flute	cello	xylophone
trumpet	tubular bells	

ii. a. flute - the air column vibrates
b. guitar - the strings vibrate
c. drum - the skin vibrates
iii. It plays a higher note by tightening the skin.

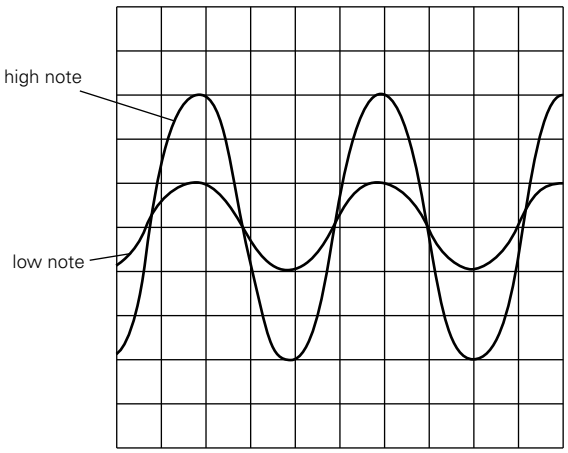
iv. a. By tightening the strings.
b. By slackening the strings.
v. The sound waves produced by the piano travel through the open lid instead of being reflected and absorbed inside the closed piano.

Page 44

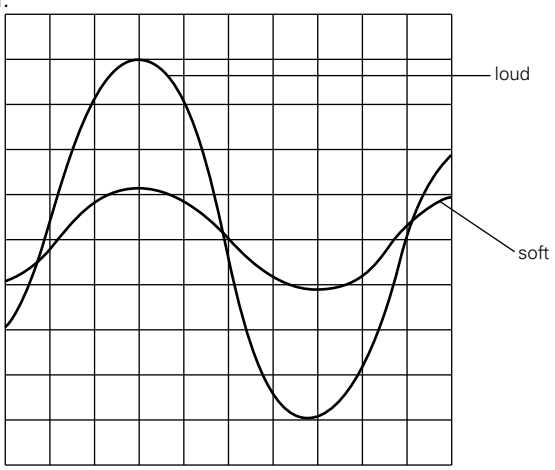
4 C, E, A, D, B

Page 45

5 i.



ii.



Page 46

6 i. To get an average and therefore a more accurate result
ii. 1.2 + 1.1 + 1.3 = 3.6
Average time = $\frac{3.6}{3}$ = 1.2 seconds
iii. Speed of sound = $\frac{400}{1.2}$ = 333.33 m/s approximately.

Page 47

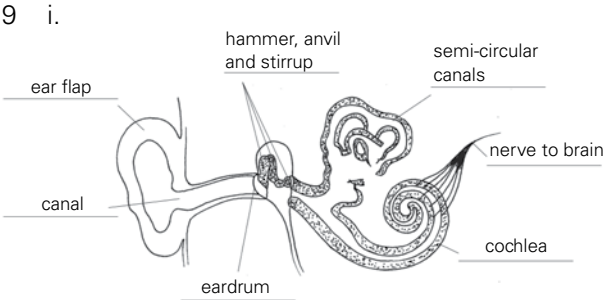
7 i. decibel
ii. Because of the vibrations caused by the metal banging against each other.
iii. A rock concert.
iv. a. By wearing earmuffs.
b. It would stop loud noise vibrations from entering the ear and hitting against the eardrum.
v. They amplify the sound waves according to the hearing capacity of the deaf person.

Page 48

8 i. C ii. D iii. B iv. D
v. a. B b. C

Page 49

9 i.



ii. Ear flap → canal → eardrum → hammer, anvil, stirrup → cochlea → nerve to the brain.
iii. a. Too much noise.
b. Examples such as machinery, aircraft, traffic, firing range etc.

Chapter 8 Respiration: its all about energy

Page 50

1 True or false

i. False ii. False iii. True
iv. False v. True

2 Multiple choice questions

i. d ii. c iii. b
iv. d v. c

Page 51

3 During respiration, **glucose** is broken down to release energy. If there is plenty of **oxygen**, the respiration is called aerobic respiration. In aerobic respiration, **carbon dioxide**, **energy**, **water** are given off as waste products. Anaerobic respiration is not as efficient but is useful in an **emergency**. The waste product of anaerobic respiration in animals is **lactic acid**. This causes painful **cramp** in the **muscles**. The animal stops moving and breaths deeply until an **oxygen debt** has been repaid.

4 i. Fermentation is he process of the breaking down glucose into ethanol and carbon dioxide with the release of energy.

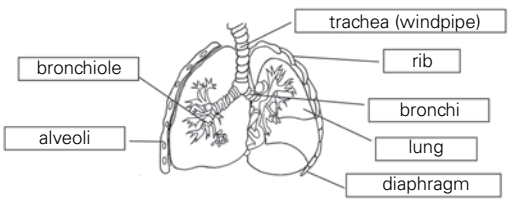
ii. a. It will turn milky.
b. Carbon dioxide is produced by the yeast during anaerobic respiration.

iii. This is the optimum (best) temperature at which the enzymes in the yeast work.

iv. a. The reaction will stop as the yeast cells will die.
b. The reaction will slow down.

Page 52

5 i.



ii. a. Oxygen is taken in and carbon dioxide is given out.
b. The blood capillaries.

iii. a. Gases can easily diffuse through the thin walls.
b. Gases diffuse in and out from the lining in solution.
c. Maximum absorption of oxygen can take place by the red blood cells of the blood vessels.

Page 53

6

Breathing in	**Breathing out**
diaphragm contracts	diaphragm relaxes
chest gets bigger	rib muscles relax
rib muscles contract	chest gets smaller
air is sucked into the lungs	air is pushed out of the lungs

Page 54

7 i. a. 4 b. 6

ii. a. 3.4 cm^3 b. 5 cm^3

iii. During the race the muscles have been respiring anaerobically and a lot of lactic acid is produced from the glycogen which is stored in the muscles. This causes the feeling of tiredness. The lungs have to breathe much faster for a longer time so that most of the lactic acid is changed back into glycogen and stored in the muscles again.

iv. Volume of air in 1 breaths after running = 5 – 1.8 = 3.2 cm^3
Volume of air in 9 breaths after running = 9 x 3.2 = 28.8 cm^3

Page 55

8 i. It tests for the presence of carbon dioxide.

ii. Air contains less carbon dioxide as compared to air that is breathed out.

iii. Water is produced as a by-product of aerobic respiration.

iv. Carbon dioxide, water, energy.

v. Breathing is a mechanical process by which air enters and leaves the lungs. Respiration is a chemical process by which the oxidation of food takes place to release energy.

vi. The mouse will die as oxygen will have been used up and carbon dioxide will have collected in the jar.

Page 56

i. It turns milky.

ii. a. B
b. This shows that the air we breathe out contains more carbon dioxide than is in the air breathed in.

iii. Carbon dioxide from the mouth will go in both the test tubes at the same time, so we will not get accurate results. Limewater will be forced out of the test tubes.

Page 57

10 i. Limewater

ii. Orange red to Yellow

iii. A lot.

Chapter 9 Acids and alkalis

Page 58

1 True or False

i. True ii. False iii. False
iv. False v. False

2 Multiple choice questions

i. a ii. c iii. c
iv. b v. c

Page 59

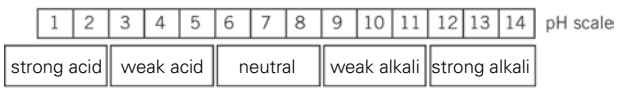
3

lemonade	acid
water	neutral
washing powder	alkali
lime	alkali
bleach	alkali
apple	acid

Page 60

4 Rain dissolves **carbon dioxide** from the air, making carbonic acid. Other gases produced by industry cause rain to be more acidic. These gases are **sulphur dioxide** and nitrogen dioxide. When they dissolve in water they form sulphurous acid and **nitrous acid**. Burning fossil fuels such as **coal** and oil give off these gases causing acid rain. Acid rain damages **buildings** and **plants**. It also pollutes water, killing **fish**.

5 i. litmus
ii. a. red b. blue
iii. It gives an indication of the strength of the acid or alkali.
iv. a. Refer to the coloured diagram on Page 112 (?) of the student's book.
b.



Page 61

6

Household item	pH	Colour of universal indicator	Acid, alkali or neutral
oven cleaner	13	purple	strong alkali
tap water	7	green	neutral
vinegar	1	red	strong acid
lemon juice	3	orange	weak acid
baking powder	9	blue	weak alkali

7

hydrochloric acid	chloride
nitric acid	nitrate
sulphuric acid	sulphate
phosphoric acid	phosphate
ethanoic (acetic) acid	ethanoate (acetate)

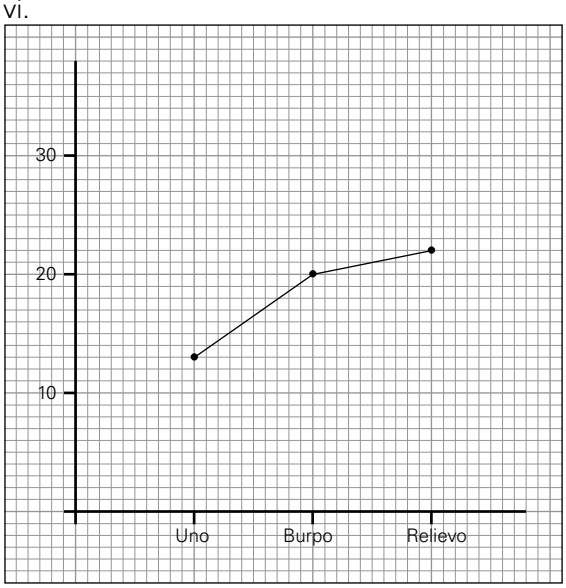
8 i. alkali
ii. To cancel the affect of an acid or alkali when they are mixed together.
iii. salt and water
iv. sodium hydroxide + hydrochloric acid → sodium chloride + water

Page 62

9 i. So that the tablets would dissolve quickly
ii. To make it a fair test and therefore get accurate results
iii. when the indicator used changed colour
iv. To get more accurate results.
v. Ono 12 +12+ 14= 38 / 3 = 12 .66
Burpo 18 + 19 + 22 = 37 / 3 = 19.66
Relievo 22+ 21+ 24 = 67 / 3 = 22.33

Indigestion tablet	number of drops of acid needed to neutralize tablet			
	1st Exp	2nd Exp	3rd Exp	Average
Ono	12	12	14	12.67
Burpo	18	19	22	19.67
Relievo	22	21	24	22.33

vi.



Note: A bar chart will also be suitable for displaying the information.

vii. Ono, because it took the least number of acid drops for neutralization. This means that it will take the shortest time to relieve indigestion.

Chapter 10 Light

Page 64

1 True or false

i. True ii. True iii. True
iv. True v. False

2 Multiple choice questions

i. c ii. b iii. c
iv. b v. a

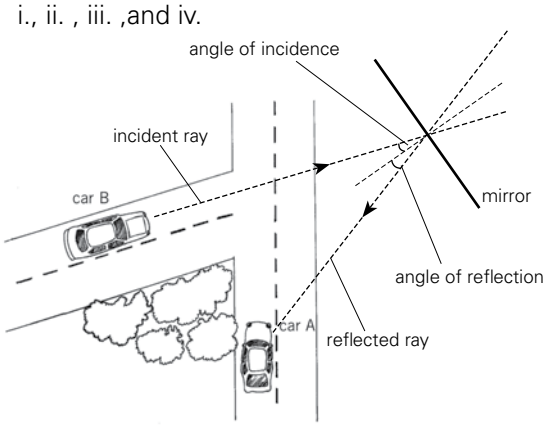
3 Rays of light are **transmitted** through materials such as glass. **Opaque** materials such as wood absorb light. When a piece of wood is placed in a beam of light, a **shadow** is formed. This is because the light is **absorbed** by the wood. There are other materials, such as greaseproof paper which let some light through. These are called **transluscent**.

Page 65

4 i. Light from the window reflects light from the pages into her eyes.
ii. The pages of the book absorb light and do not reflect light.
iii. opaque

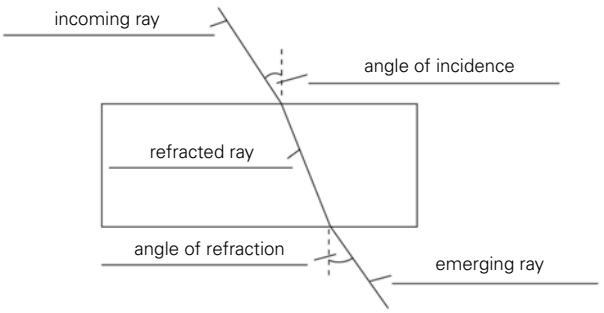
Page 66

5 i., ii. , iii. ,and iv.



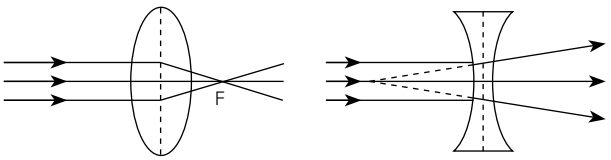
v. 30°.

6 i.



ii. They are travelling in the same direction

7 i.



ii. a. magnified b. diminished
iii. As a corrective lens for short-sightedness.
d) i) The image is smaller than the object.

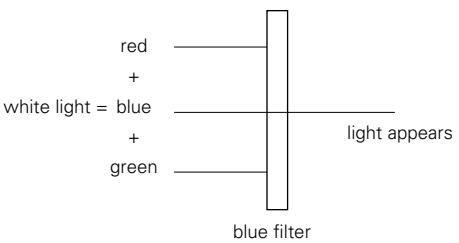
Page 68

iv. The image is inverted or upside down.

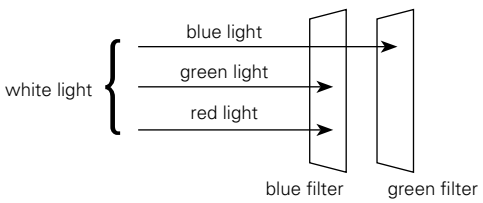
8. i. Red, orange, yellow, green, blue, indigo, violet.
ii. a. red b. violet

9 i. A colour filter absorbs some colours and transmits others

ii.

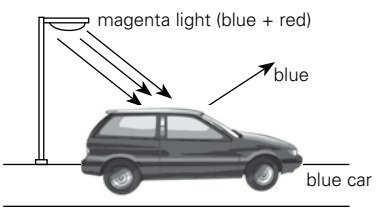


iii.

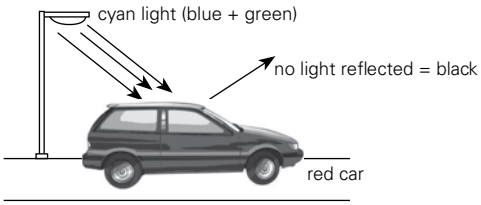


10 i. The car appears red

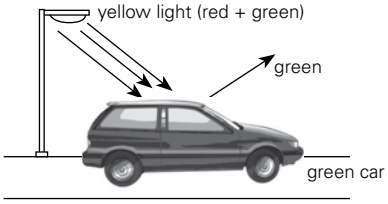
ii. a.



ii. b.



iii. c.



Chapter 11 Transport in humans

Page 70

1 True or false

i. True ii. True iii. True
iv. True v. True

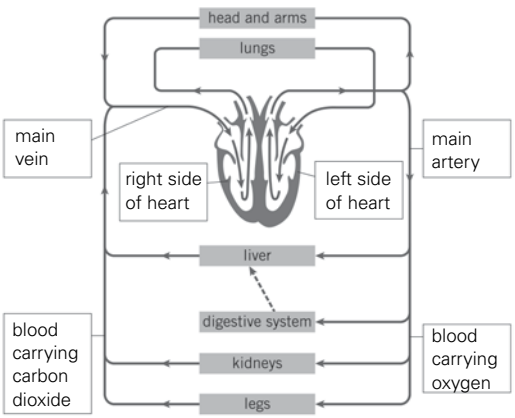
2 Multiple choice questions

i. a ii. a iii. c
iv. b v. a

Page 71

3 Blood from the body enters the right **atrium** through a large blood vessel called the vena cava. Blood from the lungs enters the left atrium through the **pulmonary** vein. The atria contract together pushing blood into the ventricles. From the **left** ventricle, blood is pumped to the body through the **aorta**, and from the **right** ventricle to the lungs along the pulmonary **artery**.
Both ventricles contract at the same time. Every contraction of the atria and ventricles is called a **heartbeat**. This can be measured by taking your **pulse**.

4 i.



Page 72

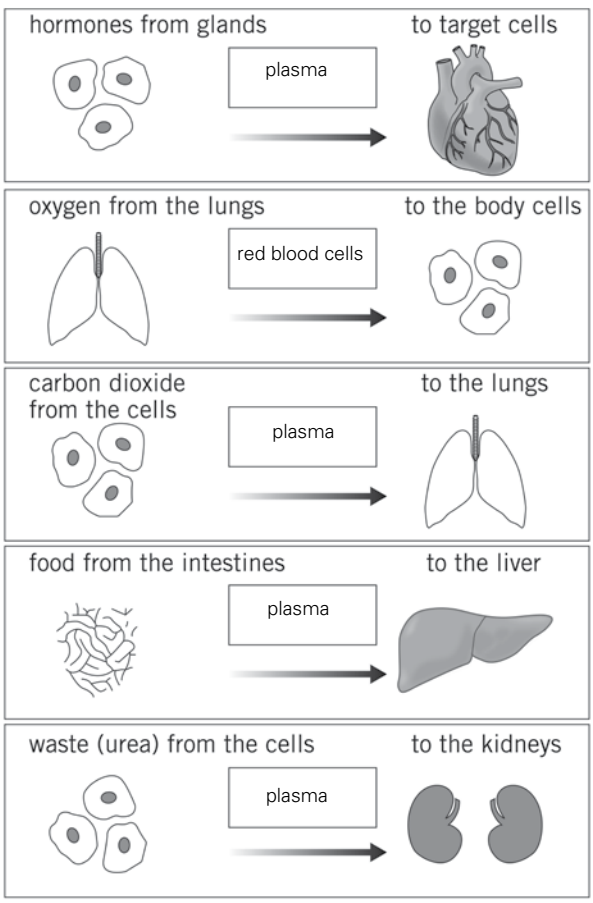
ii. Blood passes through the heart twice as it goes once around the body.
iii. It has more muscle because it has to pump blood all around the body.

5. i. a. artery b. capillary
ii. a. vein b. capillary
iii. due to the higher pressure caused by the stronger right ventricle. Also they are narrower than veins.
iv. To allow more time for the exchange of substances between blood and the tissues.

Page 73

6 i. Circular with a hollow on both sides.
ii. Red blood cells have no nucleus
iii. They have differently shaped nuclei. One has an irregular shape the other has a regular shape.
iv. They have a nucleus. The nucleus controls all of the cells activities.

Page 74



Page 75

8 i. Red cells caught in a net of fibres.
ii. a. Bits of cell broken off from larger cells in the bone marrow.
b. Create a net from tiny fibres in which red cells get caught.
iii. Fibres are produced by platelets. Red blood cells get caught in these fibres forming a blood clot.
iv. a. a scab.
b. Keeps the wound clean while new skin grows.

Page 76

v. When red cells die they lose their colour and become dull red. The liver removes lots of red cell so it takes on the dull red colour from the dead red cells.

9 i. a. 110 beats/min b. 65 beats/min
ii. 15 seconds
iii. The exercise causes the student's pulse rate to rise.
iv. a. A pulse is a surge of blood produced every time the ventricles contract.
b. Place your fingers (not thumb) over the wrist where an artery passes between a bone and the surface of the skin.

Chapter 12 Variation and classification

Page 78

1 True or false

i. False ii. False iii. True
iv. False v. False

2 Multiple choice questions

i. b ii. b iii. d
iv. c v. d

Page 79

3 i. Similarities: both holding a book, carrying a bag, wearing belts, smiling.
Differences: different genders, hair of different lengths, dresses different, heights different.
ii. Answers depend on students.

Page 80

4 i. 1 ii. 13 cm iii. 20
iv. continuous variation

Page 81

5

dog	mammals
snake	reptiles
hen	birds
shark	fish
seal	mammals
lizard	reptiles

Page 82

6

algae	No stem, leaves and roots. Produces spores.
moss	Simple stem, leaves and roots. Produces spores.
fern	Has stem, leaves and good root system. Produces spores.
conifer	Has stem, leaves and good root system. Produces cones.
flowering plant	Has stem, leaves and good root system. Produces seeds inside an ovary.

Page 83

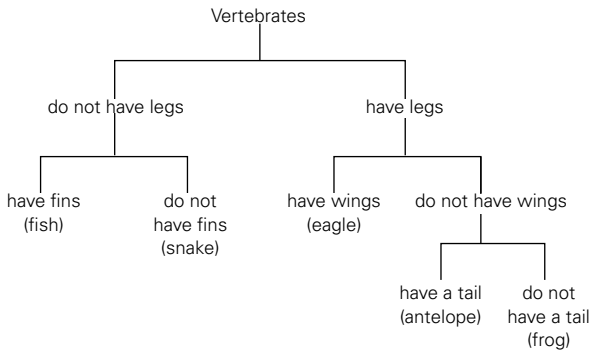
7 A = dolphin B = squirrel
C = bat D = otter

Page 84

8 Top left - Eastern cat
Top right - Anteater
Bottom left - Cuscus
Bottom right – Opossum

Page 85

9 Posible answers



Chapter 13 The rock cycle, rocks, and weathering

Page 86

1 True or false

i. False ii. False iii. True
iv. False v. True

2 Multiple choice questions

i. a ii. b iii. c
iv. a v. b

Page 87

3 i. a. Sedimentary rocks b. Igneous rocks
c. Metamorphic rocks
ii. a. Sedimentary rock b. Igneous rock
c. Metamorphic rock

4 i. **Physical weathering**
water creeping into cracks in a rock face and freezing
gales blowing sand across the surface of a stone pillar
Chemical weathering
Stalactites forming in a limestone
Granite being broken down to form china clay
Biological weathering
Rabbits digging burrows under a rock causing it to collapse
A tree growing out of a crack on a rock face
ii. a. Physical weathering
b. It is a similar physical action to that caused by wind, water, ice etc.

Page 88

5 i. a. A b. D
ii. The lowest layer must have been deposited first. Subsequent layers were deposited later.
iii. a. The middle of the pillar is narrower than the top and bottom.
b. Rocks in layers A and D are harder than the rocks in the middle. Rock type B is softest and has eroded more easily.

Page 89

6 i. a. slate b. chalk
c. sandstone d. marble
ii. Both are affected by acid.
iii. Sandstone has grains in it. Granite is made of crystals.

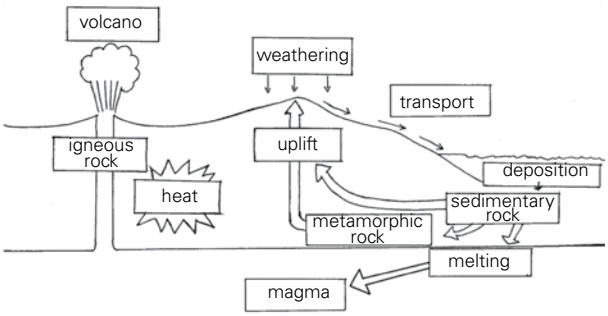
Page 90

7 i. a. It will become hot
b. It will change into marble.
ii. a. They both the same material (ones and shell of dead sea creatures) and will both react with acid
b. Compared to limestone, the new rock will be harder.
iii. a. metamorphic rock
b. quartzite or slate

8 i. a. magma
b. It comes from deep within the mantle of the Earth.
ii. Bubbles of gas are released from molten lava making it frothy. Pumice is formed when this solidifies.
iii. a. They are made of crystals.
b. The size of the crystals is different.
c. Slow cooling of crystals produce big crystals. Rapid cooling produces small crystals.

Page 91

9



Answers (Worksheets)

Chapter 1

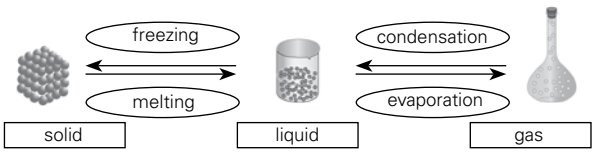
Worksheet 1-1

Task 1

a. Answers could be

coldest	ice cubes	spoon	styrofoam	tea	warmest
temperature	0°C	15°C	35°C	50°C	

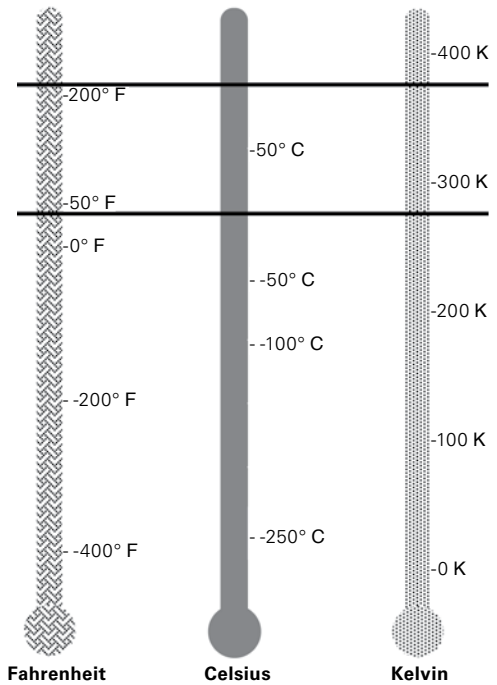
Task 2



Task 3

Temperature is a measure of how hot or cold something is. It is measured in degrees Celsius, degrees Fahrenheit or Kelvin.
Heat is the transfer of energy from an object with a higher temperature to that of a lower temperature. It is measured in joules or kilojoules.

Task 4



b.

	Fahrenheit	Celsius	Kelvin
line A	212°F	100°C	373 K
line B	32°F	0°C	273 K

c. Line A is the boiling point of water. Line B is the melting point of ice.

Worksheet 1-2

Task 1

property	solid	liquid	Gas
shape	fixed ~~OR takes shape of container~~	~~fixed OR~~ 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. melting
b. shape, particle arrangement, particle movement, speed of particles
c. The heat energy will be absorbed by the particles, which start to move faster. They will break away from their fixed positions and move

around each other at a reasonably fast speed but still remain close to each other.

Liquid to gas

d. evaporating
e. can be compressed, space between particles, particle speed
f. The heat energy will be absorbed by the particles which start to move faster and farther apart, with large empty spaces in between. Under pressure, they can be pushed into these empty spaces which compresses the gas.
g. gas → liquid: condensation
liquid → solid: freezing

Worksheet 1-3

Task 1

1. conduction
2. convection
3. radiation

Task 2

Conduction is the movement of heat through a solid such as a metal.
Poor conductors of heat are called insulators.

Task 3

a. The metal rod will become warmer; the end near the flame will become warmer first.
b. Candle wax melts when it becomes warm so the pins will no longer be held on the metal rod.
c. The pin closest to the Bunsen burner will drop first because the heat will reach that wax first.
d. Plastic is an insulator so conducts heat poorly. The wax might not melt or it would take a long time. (Do not try this experiment; it is likely that the plastic will burn.)

Worksheet 1-4

Task 1

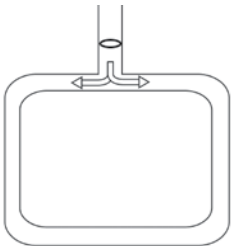
a. Conduction takes place in solids~~/liquids/gases~~ and convection takes place in ~~solids/~~liquids/gases.
b. When a liquid is warmed , the particles move ~~more slowly/~~faster.
c. This causes the particles to move farther apart/ ~~closer together~~.
d. This makes the warmer liquid ~~denser~~/less dense than the colder liquid.
e. As a result, the warmer liquid goes ~~down/~~up.

Task 2

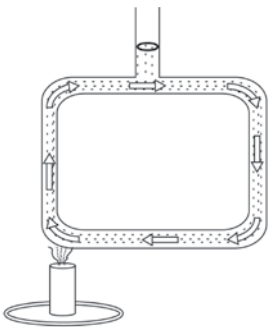
The ice cubes are melting and the coloured water they are in is becoming very cold, colder than the water in which the ice cubes float. So this coloured water sinks straight to the bottom.

Task 3

a. The colour would slowly sink and spread to both sides.



b. The temperature would go up (become warmer).
c. It would not change much initially and only become warmer after some time.
d. The water on the left side would rise because it would be less dense.
e. (The water in the top horizontal tube would move to the right because it would be pushed by the warm water rising in the left vertical tube.
The water in the bottom horizontal tube would move to the left because it would take the place of the water that had risen. The colour would move to the right because it would be carried by the convection current in the water.



Task 4

Answers depend on how students respond.

Worksheet 1-5

Task 1

a. conduction: If you stir the hot coals with a metal spoon, you will burn your hands as the handle of the spoon will become hot through conduction.

b. Hot air will rise from the coals and cook your meat.
c. Radiation from the hot coals will be in all directions but the heat you feel below or to the side of the barbecue will be transferred by radiation.
d. On the barbecue, the meat will be cooked by heat transferred by convection and radiation; meat under the grill will only be cooked by heat transferred by radiation.

Task 2

a. infrared waves
b. Emitters are good at giving off thermal radiation. They are often black.

Task 3

a. The particles in the glass will conduct the heat through the glass.
b. Since the particles in a solid (glass) do not move, there is no convection.
c. Most of the radiation will go through the glass.
d. The first pane of glass will conduct heat to the space between the panes. Since this is filled with air, which is a poor conductor, the heat will not travel farther and conduction across double glazing is very small.
e. There will be some convection by the air between the glass panes.
f. Radiation occurs through glass and air so it will remain the same (unless one or both panes of glass are coated to reduce radiation).
g. Conduction through the first pane of glass would remain unchanged.
h. Convection would be almost zero since there are no particles to transfer heat in this way.
i. Radiation would remain unchanged.
j. Yes, double glazing is effective in reducing heat transfer both ways.
k. Both reduce the transfer of heat, both have two layers, both have either trapped air or a vacuum between the layers. The vacuum flask can have a silvery surface which would block light so would not be suitable for windows.

Worksheet 1-6

Task 1

i. No
ii. Molecules in liquid change into vapours

Task 2

1. i. 100 °C
   ii. 0 °C
   iii. No change in temperature
2. 37 °C
3. Boiling takes place at a definite temperature. Evaporation takes place at all temperatures.

Chapter 2

Worksheet 2-1

Task 1

1.

	Name of the tissue	Structure of the tissue	Function of the tissue
1	photosynthetic tissue	contains a lot of chloroplasts	carries out photosynthesis (to make food for the plant)
2	xylem	tube with strong walls	carries water and minerals from the roots to the leaves
3	protective tissue	thin, transparent, no gaps between cells	protects the plant from damage or infection
4	phloem	tube with partitions with many large gaps	carries food from the leaves to other parts of the plant

2.

	Name of the organ	Structure of the organ	Function of the organ
1	roots	many branches	holds the plant in the ground; takes up water
2	stem	upright	keeps plant upright; holds the leaves
3	leaf	large surface area	makes food by photosynthesis
4	reproductive organs	surrounded by colourful flowers	reproduction take place and seeds are formed to grow new plants the following year

Worksheet 2-3

Task 1

i. Diffusion is the movement of any kind of molecule from a region of high concentration to a region of low concentration.
ii. Osmosis is the movement of water molecules from a region of high water concentration to a region of low water concentration across a partially permeable membrane.

Task 2

iii. The colours of the sweets diffused out from the skittles towards the centre of the plate.

iv. The colour particles dissolved, i.e. moved in between the water molecules. Due to the random movement of particles in a liquid, the colours spread out towards the centre of the plate.

2. Results will vary. An example could be

		before the experiment			after the experiment		
		length (cm)	width (cm)	height (cm)	length (cm)	width (cm)	height (cm)
colour 1 water	bear 1	2 cm	1.4 cm	1.3 cm	6 cm	4.0 cm	3.5 cm
	bear 2	2 cm	1.4 cm	1.3 cm	2 cm	1.4 cm	1.3 cm
colour 2 slightly salty	bear 3	2 cm	1.4 cm	1.3 cm	2.5 cm	1.6 cm	1.4 cm
	bear 4	2 cm	1.4 cm	1.3 cm	2 cm	1.4 cm	1.3 cm
colour 3 very salty	bear 5	2 cm	1.4 cm	1.3 cm	1.8 cm	1.3 cm	1.3 cm
	bear 6	2 cm	1.4 cm	1.3 cm	2 cm	1.4 cm	1.3 cm

i. Bear 1 changed the most.
ii. Bear 3 and bear 5 were in salt water. The difference in the concentration of water molecules inside the bear and in the water was smaller, so osmosis was less too. It is possible that the water concentration inside bear 5 was even higher than the water concentration in the very salty water. In that case, bear 5 would shrink.
iii. Bears 2, 4, and 6 were "control bears". They were not put in water but they were there to make sure that gummy bears do not grow for other reasons, e.g. by being left in the light.

Worksheet 2-4

1. Transpiration is the process by which a plant loses water from its leaves into the surrounding air.
2. Transpiration would be highest when it is
   i. warm
   ii. windy
   iii. dry
   iv. daytime
3. roots (absorbing water), stem (transporting water), and leaves (from which water evaporates)

Worksheet 2-5

i. Sepals protect the flower. Petals attract insects for pollination.
ii. a) Stamen is the male part of the flower.
    b) It consists of anther and filaments.
iii. a) Female part of a flower is called carpel.
    b) It consists of stigma, style, and ovary.
iv. Transfer of pollen grains from anther to stigma is called pollination.

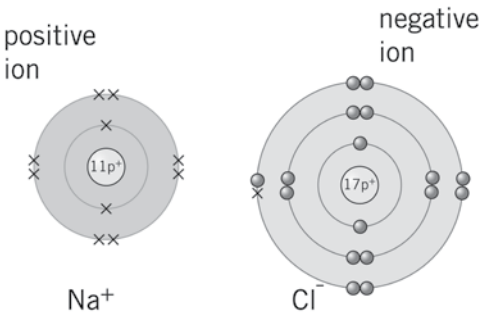
Chapter 3

Worksheet 3-1

i. Na and Cl are atoms, Na^+ and Cl^- are ions.
ii. An atom has no charge whereas ions are charged particles.
iii. When an atom loses electrons it forms positive ion called cation whereas when an atom gains electrons it forms negative ion called anion.
iv. Group I
v. Group I
vi. Group VII
vii. Chlorine, Fluorine or Bromine
viii. Helium (He) is used to fill balloons. Argon is used in bulb. Neon is used in advertising signs.
ix. Because it has eight electrons in the outermost shell. It does not need to give or take any electron.
x. Hydrogen behaves differently than other non-metals so it is placed separately.

Worksheet 3-2

1. Use the words below to complete the following sentences.
   i. same
   ii. positively
   iii. molecule, different
   iv. atom
   v. negatively
   vi. ions
2. i. 27 is mass number and 13 is atomic number
   ii. Number of protons 13
   number of electrons 13
   number of neutrons 14
   iii. 1st shell: 2
   2nd shell: 8
   3rd shell: 3
   iv.



Sodium chloride has the formula NaCl.

   v.

Elements		Atomic number	Mass number
Oxygen	O	8	16
Nitrogen	N	7	14
Iron	Fe	26	56
Magnesium	Mg	12	24
Calcium	Ca	20	40
Carbon	C	6	12
Hydrogen	H	1	1

Worksheet 3-3

Task 1

i. Ionic compound : when an atom of one element loses an electron which goes to an atom of another element. The resulting cation and anion are attracted by electrostatic attraction (attraction between a positively and a negatively charged particle)
ii. Covalent compound: when two atoms share electrons (at least one from each atom)

Task 2

a. reactants → products
b. sodium + chlorine → sodium chloride
c. magnesium + oxygen → magnesium oxide
d. sodium, magnesium
e. chloride, oxide

Task 3

a. hydrogen and oxygen
b. water
c. two
d. one
e. water
f. 2 hydrogen + oxygen → water (the number "1" is not written)

Task 4

a. H_2O

b.

Na	sodium
H	hydrogen
C	carbon
O	oxygen

c. oxygen, O, three

d.

symbol	name	how many atoms
Na	sodium	2
S	sulphur	1
O	oxygen	4

Chapter 4

WORKSHEET 4-1

Task 1

a. Answers will differ depending on objects chosen.
b. Magnets attract objects made of iron or steel and will attract other magnets.

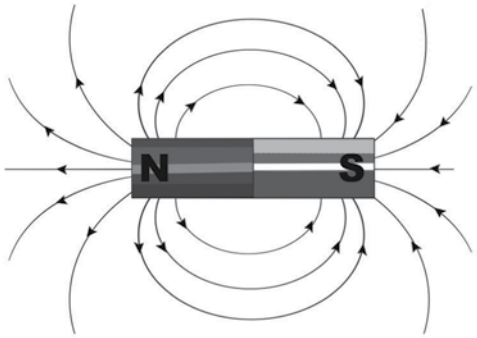
Task 2

a. All magnets should orient so that their N pole points north and their S pole points south.
b. The suspended magnet will orient itself to the magnet nearby.
c. The suspended magnet will orient to the strongest magnetic field. This will be the Earth's magnetic field or the stronger field of a nearby magnet.

WORKSHEET 4-2

Task 1

The filings will form field lines around the magnet as shown in the illustration below:



WORKSHEET 4-3

1. a. No
   b. None
   c. Electromagnet attracted pins
   d. Number varies
2. a. wires, batteries
   b. iron nail
   c. making more loops of wire using more batteries

Chapter 5

Worksheet 5-1

Task 1

Answers depend on students

Task 2

i. Proteins and fibre
ii. Carbohydrates
iii. Water
iv. Proteins
v. Fibre
vi. Minerals
vii. Vitamins
viii. Fats

Worksheet 5-2

Task 1

anaemia	iron
high blood pressure	sodium chloride WHEN EATEN TOO MUCH
kwashiorkor	protein
night blindness	vitamin A
rickets	vitamin D and calcium
scurvy	vitamin C

Task 2

1. Eating balanced diet, avoiding fat, exercising regularly
2. **Arthritis:** excess body weight puts pressure on the joints which make them inflamed.
   Diabetes: a condition where the body does not make enough insulin which control glucose level in the blood.
   Heart disease: Coronary arteries get blocked by fatty substance called cholesterol.
3. Eating a banana gives energy to the athlete for taking part in race.
4. It may cause high blood pressure which may affect heart.

Worksheet 5-3

1. Drugs are substances that change the way the body works.
2. painkillers – numb pain, e.g. headaches
   tranquillizers – calm people down
   sedatives – help people sleep
   anesthetics – numb part of your body or put you into a deep sleep before an operation
3. People may become dependent on them; e.g., they cannot sleep without sleeping pills.

Worksheet 5-4

1. Bronchitis, liver cancer, emphysema
2. Nicotine, tar and carbon monoxide
3. Non-smokers who live or work with smokers getting risk of the diseases of smoking are called Passive smokers.
4. heart, blood vessels, and nerves, lungs
5. Cutting down the number of cigarettes each day. Nicotine replacement can help too.

6-8. Answers depend on students.

Chapter 6

Worksheet 6-1

1. i. By magnet
   ii. Physical change
2. i. Iron sulfide
   ii. Chemical
   iii. No, because it is a chemical change
   iv. Endothermic and exothermic
3. i. Iron + oxygen → iron oxide
   ii. Iron and oxygen are reactants whereas iron oxide is the product.

Worksheet 6-2

Task 1

i. Magnesium oxide
ii. Yes
iii. Magnesium + oxygen → magnesium oxide
iv. Magnesium and oxygen are reactants whereas magnesium oxide is the product.
v. oxidation

Task 2

i. carbon and water
ii. sugar $\xrightarrow{heat}$ carbon + water
iii. chemical reaction

Task 3

i. calcium carbonate $\xrightarrow{heat}$ calcium oxide + carbon dioxide
ii. Lime water turns milky with carbon dioxide.
iii. decomposition

Worksheet 6-3

Task 1

i. Yes because bubbles are formed.

Task 2

i. No, because copper is less reactive than iron.
ii. Only a more reactive metal can displace a less reactive metal from its compound.

Task 3

i. Chemical reaction
ii. Carbon dioxide and water
iii. Exothermic reaction because heat is given off.
iv. Yes, because like combustion food is burnt with oxygen to give out carbon dioxide and water.

Task 4

i. It will stop burning after sometime and water level rises.
ii. Because oxygen ended inside the jar.
iii. $1/5^{th}$
iv. $1/5^{th}$ of air is oxygen
v. Bring a lighted splinter near the gas it burst into flame.

Task 5

i. Magnesium oxide
ii. Oxygen
iii. Sulphur
iv. Oxygen
v. Hydrogen oxide (water)
vi. Water
vii. Oxygen
viii. Copper

Worksheet 6-4

i. Anything that burns to give energy.
ii. Oil, petrol, wood, gas, diesel, coal.
iii. Hydro carbon
iv. Carbon dioxide and water
v. Combustion
vi. Fuel + oxygen → carbon dioxide + water
vii. Exothermic because heat is given off.

viii.

	Respiration	Combustion
	Oxygen is used up	oxygen is used up
	Carbon dioxide, water and energy are given off	CO_2, water and energy are given off

ix. Energy
x. Cut down supply of oxygen by putting a blanket or sand or spraying CO_2 with the help of fire extinguisher.

Chapter 7

Worksheet 7-1

Task 1

1. Sound is produced by vibrations.
2. Noise which vibrates in irregular pattern.
3. In decibels.
4. i. 40 dB
   ii. 60 dB
   iii. 130 dB
   iv. 120 dB

Task 2

1. Wear ear protection. Special ear plugs allow you to hear everything but reduce the loudest of sounds to acceptable levels.
2. Limit noisy work such as construction, to certain time. Factories should be located away from residential places. Don't use horns in vehicles unless very important, don't play loud music.
3. 340 m/s
4. Since the speed of light is very fast, we assume that the lightning happens at the moment we see it. The sound of thunder takes 3 seconds so it travelled a distance of 3 * 340 m = 1020 m so just over 1 km away.

Worksheet 7-2

1. Speed = distance/time
   120/20= 6 m/s
2. Speed = distance/time
   432 x 1000 / 6000 = 72 m/s
3. Speed= distance/time
   900 / 30 = 30 m/s
4. distance= speed x time
   330 x 10 / 2 = 1650 m/s
5. speed = 2x distance / time
   2 x 500 / 3 = 333.3 m/s

Worksheet 7-3

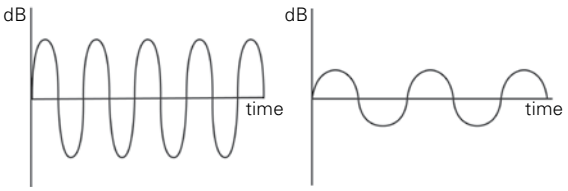
Task 1

1. j
2. g
3. a
4. h
5. b
6. e
7. c
8. f
9. d
10. i

Task 2

i. false
ii. true
iii. true
iv. true
v. false

Task 3

i. The waves of sound A are higher (amplitude) and shorter (frequency) than those of sound B.
ii. dB = decibel. It is a measure of the amplitude (=loudness) of the sound.
iii. 

iv. sound A has a shorter wavelength.
v. A because the amplitude (measured in dB) is bigger.
vi. also A because the frequency (number of waves per unit time) is higher.
vii. frequency, Hertz (Hz)

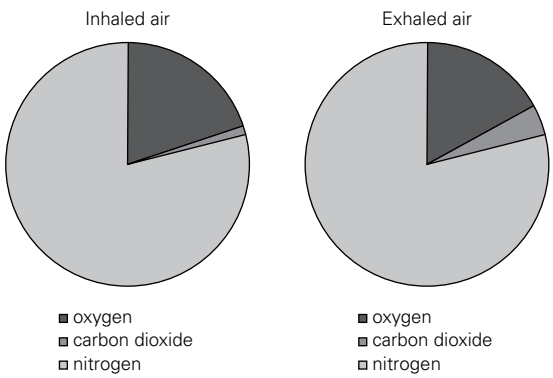
Chapter 8

Worksheet 8-1

Task 1

1. Breathing is simply a way of exchanging gases between the lungs and the surrounding air, i.e. taking in oxygen and getting rid of carbon dioxide.
2. oxygen and carbon dioxide
3. cellular respiration is the chemical reaction taking place in all cells by which they release energy required for life processes.
4. oxygen and glucose are needed; glucose comes from food and oxygen is taken in via the lungs during breathing.
5. cellular respiration produces carbon dioxide and water.
6. Breathing is the process of taking air into the lungs. Some of the oxygen in this air is taken up by the body and will be used in cellular respiration. Respiration also produces carbon dioxide which leaves the body with the air that is exhaled.
7. mitochondria

Task 2



Worksheet 8-2

Task 1

i. student A
ii. student B

Task 2

1. Walking is an aerobic exercise because the body gets enough oxygen. Running is an anaerobic exercise because the body does not get enough oxygen.

2. Glucose+ oxygen → carbon dioxide + water + energy
3. Glucose $\xrightarrow[\text{No oxygen}]{\text{Broken down}}$ ethanol + carbon dioxide

Task 3

i. The weight did not change (or a very small amount)
ii. the ball became significantly bigger
iii. anaerobic respiration (glucose → ethanol and carbon dioxide)
iv. the carbon dioxide gas produced created bubbles in the dough and made it bigger (but not really heavier)

Worksheet 8-3

1. as labelled in student book page 102
2. it is a process by which energy is released during chemical breakdown of glucose.
3. Air → trachea → bronchus → lungs
4. The function of cilia is to filter out dust particles that enter the nose when we breathe air and to keep the lungs healthy.
5. Smoking damages cilia.
6.

Breathing	**Respiration**
Breathing is a simple way of taking in oxygen and giving out carbon dioxide	It is the process in which glucose is broken down to release energy.
It is a physical process	It is a chemical process
Aerobic respiration	**Anaerobic respiration**
Respiration with oxygen	Respiration without oxygen
Give out more energy	Less energy is produced
No lactic acid	Lactic acid is produced
Glucose is completely broken down	Glucose is not completely broken down
Inhaled air	**Exhaled air**
has more oxygen	Has less oxygen
Has less carbon dioxide	Has more carbon dioxide
Has less temperature	Has more temperature
Contains less water vapours	Contains more water vapours

Chapter 9

Worksheet 9-1

i. HCl (make sure the *H* and *C* are in capitals and the *l* is small print)
ii. $HCl \rightarrow H^+ + Cl^-$
iii. If we put a lot of HCl in a little water, we have made a concentrated ~~/ dilute~~ solution of HCl. If we put a little HCl in a lot of water, we have made a ~~concentrated /~~ dilute solution of HCl.
iv. A concentrated solution has more acid and less water than a dilute solution.

Task 2

i. In a strong acid, (almost) all molecules dissociate to release H^+ while in a weak acid, only some of the molecules dissociate, the others remain as they are without releasing H^+. Examples of strong acids are hydrochloric acid (HCl) and nitric acid (HNO_3). Examples of weak acids are carbonic acid (H_2CO_3) and acetic acid (CH_3COOH).
ii. Add concentrated acid in water to make it dilute.
iii. Use universal indicator which give different pH values with different strengths.

Task 3

1. 2, strong
2. 7, neutral
3. 6, weak
4. 0, strong
5. 6, weak

Task 4

i. HCl
ii. HNO_3
iii. H_2SO_4

Task 5

i. Calcium carbonate
ii. Bubbles (carbon dioxide) are formed.
iii. Carbon dioxide
iv. Limewater turns milky with carbon dioxide gas.
v. Calcium chloride, carbon dioxide and water are formed.
vi. Calcium carbonate + dilute Hydrochloric acid → calcium chloride + carbon dioxide + water
vii. Acids react with carbonates to give out carbon dioxide, water and salt.

Worksheet 9-3

i. Answer depends on students
ii. Carbon dioxide
iii. H_2CO_3
iv. Weak acid

v. Carbon dioxide
vi. Carbonic acid
vii. Students can explore the changes.

Worksheet 9-4

1.

Alkalis	Formulae	Uses
Sodium hydroxide	NaOH	Making soap
Calcium hydroxide	$Ca(OH)_2$	Reducing acidity
Magnesium hydroxide	$Mg(OH)_2$	Preparation of indigestion medicine
Ammonium hydroxide	NH_3	Making fertilizer
Potassium hydroxide	KOH	Making paint

2.

Alkalis	pH	Strong OR Weak Alkali
Baking soda	10	Strong
Ammonia	12	Strong
Mineral water	7.5	Slightly alkaline
Tooth paste	8	weak

3. The stronger an alkali more hydroxide ions it has, the weaker the alkali less hydroxide ions it has.
4. Salts and water
5. Alkalis have bitter taste, alkalis are corrosive, alkalis are soapy to touch.

Worksheet 9-5

i. The pH goes down
ii. pH 7 is neutral, all alkali has been neutralised and normally this is the end of the titration.
iii. This indicates that neutralisation of the alkali by the acid is taking place but has not been completed yet. The solution is still alkaline but less so than when we started.
iv. When an acid and an alkali react together they cancel the effect of each other.
v. Clean our teeth, cure indigestion, take the sting out.

Hydrochloric acid	chloride salts
Nitric acid	nitrate salts
Sulphuric acid	sulphate salts

Chapter 10

Worksheet 10-1

1. a. No because the light would go through them and you would not see a shadow.
   b. The hand stops the light so the area behind them is dark (shadow). If light was able to go round corners, there would not be such a precise shadow.
   c. The lamp gives out light so it is luminous. Our hands blocked the light. If they had been luminous, they would not have cast a shadow.
   d. A luminous light source emits light in all directions. Some of the light falls on the opaque object (the table) which reflects light. The reflected light is detected by the eye and the table is seen.

e.

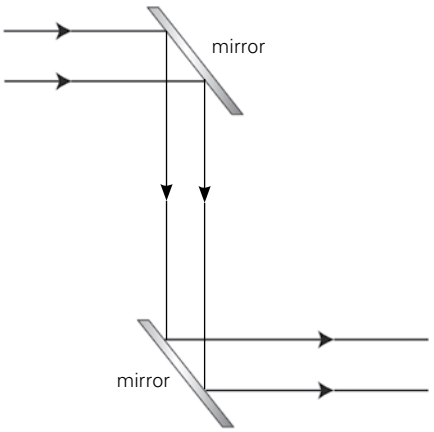
luminous	objects which give out their own light
non-luminous	objects which do not give out their own light; they may reflect light from a luminous object
transparent	an object through which light passes
translucent	an object which lets some but not all light through
opaque	an object which does not let light through; when placed near a source of light, it casts a shadow
reflection	when light bounces off an object
refraction	when light passes through an object but the path of the beam is changed
dispersion	the separation of visible light into its different colors as it goes through a prism
incident ray	the incoming light ray
reflected ray	the light ray which leaves the object as it has been reflected
concave lens	lens which is thicker at the edges than in the middle
convex lens	lens which is thicker in the middle than near the edges
spectrum	the continuous spread of colour produced when white light passes through a prism

Worksheet 10-2

Task 1

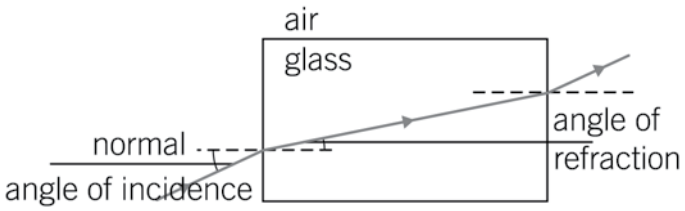
i. Incident ray
ii. Reflected ray
iii. Normal
iv. Answer depends on student
v. Both are equal
vi. Yes
vii. Angle of incidence is equal to angle of reflection. Incident ray reflected ray and normal all lie in the same place.

Task 2

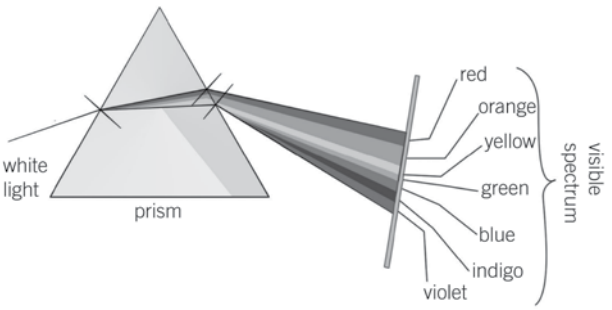


Worksheet 10-3

Task 1



Task 2

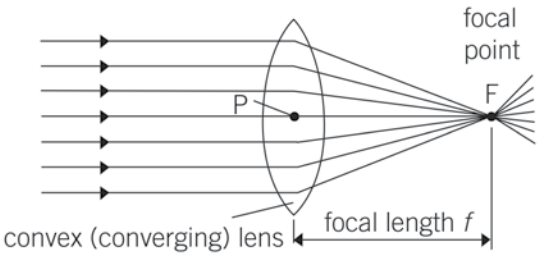


Task 3

i. dispersion
ii. spectrum
iii. towards
iv. away
v. refraction
vi. yellow
vii. red
viii. green
ix. blue
x. absorbs

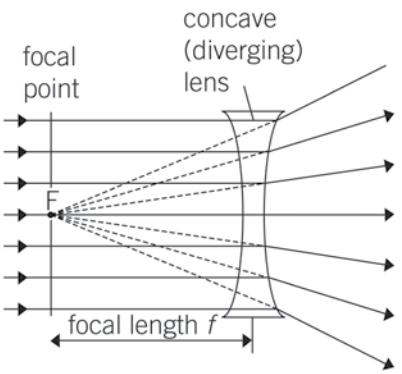
Worksheet 10-4

1.



i. Because rays after passing through this lens converge

2.



i. Because the rays after passing through the lens diverge
ii. Convex lens
iii. On the retina
iv. Image is formed before retina and people can't see distant images clearly
v. Wear concave lenses
vi. Image is formed after retina and people can't see nearby images clearly
vii. Wear convex lenses

Chapter 11

Worksheet 11-1

Task 1

i. Answers will vary but will most likely be between 20 and 30. Eg. 25 beats

i. Use the answer given in i e.g. 25 x 3 = 75 beats per minute

ii. 75 x 60 = 4500 beats per hour

iii. 4500 x 24 = 10,800 beats per day

iv. 10,800 x 39,420,000 beats per year

v. 39,429,000 x 70 = 2,759,400,000 beats in 70 years.

vi. they should expect the pulse to go up

vii. Answers will vary depending on size, fitness and the vigour and length of the exercise. E.g. 40 beats.

viii. use the answer given in i. e.g. 40 x 3 = 120 beats per minute

ix. it increased

Worksheet 11-2

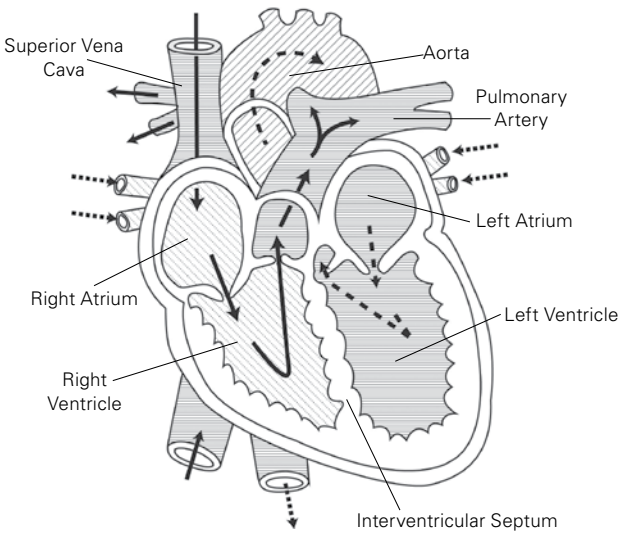
The right side of the heart, the vena cava and the pulmonary arteries all carry deoxygenated blood and have horizontal or vertical shading. Student should colour this light blue.

The left size of the heart, the pulmonary veins and the aorta all carry oxygenated blood and have diagonal shading. Students should colour this pale red.

The black arrows show the path of deoxygenated blood. Students should draw them in blue.

The dashed arrows show the path of oxygenated blood. Students should draw them in red.

HEART ANATOMY



Task 2

i. the left and right atrium receive and collect the blood

ii. the left and right ventricles pump the blood so it has enough speed to go round and return to the heart

iii.

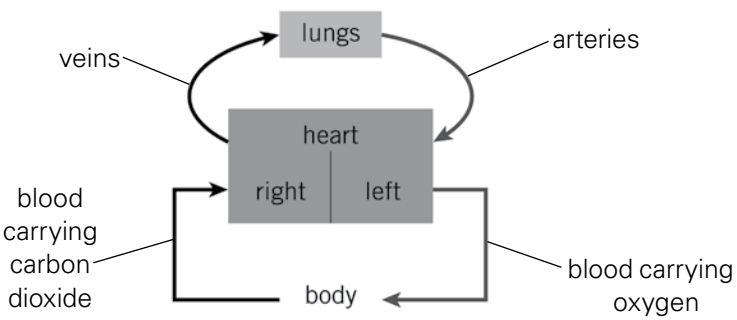
blood vessel	blood pressure: high or low	oxygenated or deoxygenated blood
vena cava	low pressure	deoxygenated
pulmonary artery	high pressure	deoxygenated
pulmonary vein	low pressure	oxygenated
aorta	high pressure	oxygenated

iv. blood in all arteries is oxygenated except in the pulmonary artery where it is deoxygenated (because it is on its way to the lungs)

v. blood in all veins is deoxygenated except in the pulmonary vein where it is oxygenated because it comes from the lungs.

Task 3

1. i.



ii. Aorta carries oxygenated blood to the body.

iii. Left ventricle

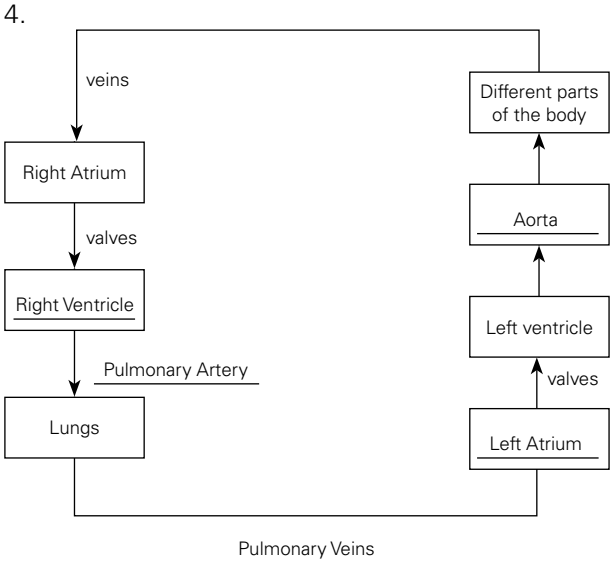
iv. Heart pumps the blood to the whole body as well as blood goes to the lungs also therefore it is called double circulation.

2.

	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. i. true
ii. true
iii. false
iv. false
v. true

4.



Worksheet 11-3

i. red blood cells
ii. platelets
iii. arteries
iv. white blood cells
v. veins
vi. capillary
vii. valves
viii. plasma
ix. heart
x. ventricle

Chapter 12

Worksheet 12-1

Task 1

1.

trait	only genetic or also environmental	continuous or discontinous
gender	genetic	discontinuous
height	both	continuous
blood type	genetic	discontinuous
left handedness	most likely genetic but not fully understood	continuous (some people do different tasks with different hands; others can use both hands although usually not equally well)
eye colour	genetic	discontinuous (although many shades exist)
fingerprint	genetic	continuous
heart rate	both	continuous
ability to roll tongue	genetic	discontinuous

2. Biometric verification is a mean by which a person can be identified by his/her finger prints. A record of a person is kept in a database. If the data in the new record matches with previous database the person's identity is confirmed.

Worksheet 12-2

Task 1

1. Animals which have backbone.
2.

Reptiles	Birds	Fish	Amphibians	Mammals
Turtle	Sparrow	Shark	Frog	Bat
Lizard			Toad	Dolphin
Crocodile				
snake				

3. Animals whose body temperature changes with the surrounding temperature.

4. Fish, reptiles and amphibians.
5. Animals whose body temperature remains the same.
6. Mammals, birds
7. i. Mammals : have hairs, give birth to young ones, female feed their babies with milk.
   ii. Amphibians: live both on land and water, have moist skin, lay eggs
   iii. Reptiles: have dry skin, lay eggs, breathe by lungs.
   iv. Birds: have feathers, a strong beak, birds breath using lungs and lay eggs.
   v. Fish: Have gills for breathing, have scales, have fins to swim.

Task 2

1. Invertebrates are animals which have no backbone.
2. i. protozoa — amoeba
   ii. coelenterates — jelly fish, corals
   iii. annelid — earthworms, leeches
   iv. echinoderm — star fish, sea urchin
   v. molluscs — octopus, snails
   vi. arachnid — scorpions, spider
   vii. crustaceans — crab, shrimp
   viii. insect — ant, bee

Worksheet 12-3

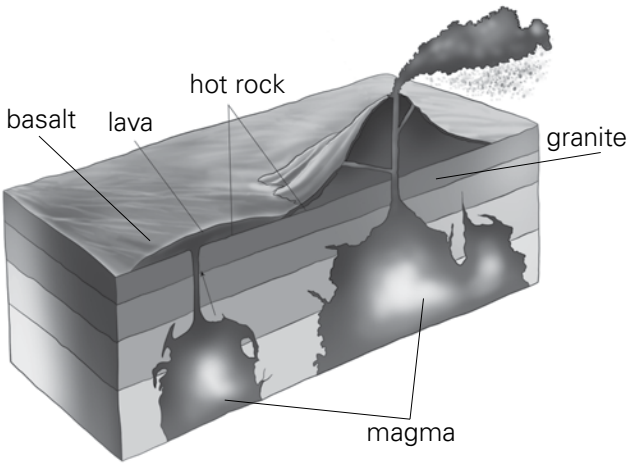
Answers will vary, depending on the chosen animals but please find an example below.
The animals chosen for this example are cow, donkey, duck, chicken

1. Does the animals have feathers?
   a. if yes, go to 2.
   b. if no, go to 3.
2. Does the animal have a sharp beak?
   a. yes, the animal has a sharp beak – it is a chicken
   b. no, the animal has a rounded beak – it is a duck
3. Does the animal have a large udder?
   a. yes, it has a large udder – it is a cow
   b. no udder is visible – it is a donkey.

Students may also choose to use the style of the diagram, as on page 161 of Student Book.

Chapter 13

Worksheet 13-1
Task 1



Task 2

i. Granite has large crystals and basalt has small crystals.
ii. Basalt is formed the quickest so that the crystals have less time to grow and remain smaller.
iii. Because they are produced by the solidification of molten rock from volcanoes.

Task 3

i. Large crystals will be formed in beaker B because slow cooling forms large crystals.
ii. Slow cooling of lava in igneous rocks form large crystals. Example is granite.
iii. Rapid cooling of lava forms small crystals. Example is Basalt.

Worksheet 13-2

Task 1

i. Sugar lumps come in different sizes. However, if you get all sugar lumps from the same brand, they should all be very similar. It would be useful if you measured them first so you know what answer to expect.
ii. The measurements will not have changed (much) because students only rubbed them for a few minutes but you can imagine that it would be possible to rub them down to grains of sugar.

iii. After rubbing, the corners and edges of the sugar lumps will have worn off a bit due to friction. This process is similar to physical weathering (or erosion) as described on page 168.
iv. Your hands will be covered in sugar.
v. Your hands would have been covered in sand or clay (but it would have taken much longer and you would have had to rub much harder to get the same amount.

Task 2

i. Calcium carbonate
ii. Bubbles are formed
iii. Chemical reaction
iv. Carbon dioxide
v. By passing gas through lime water which turns it milky
vi. Rocks are eroded by acid rain

Worksheet 13-3

Task 1

Igneous	Metamorphic	Sedimentary
Granite	Marble	Sandstone
Basalt	Quartzite	Limestone
pumice	Slate	conglomerate
	gneiss	Shale
		Coal
		Chalk

Task 2

1. Magma
2. Igneous
3. Sediments
4. Sedimentary rocks
5. Metamorphic rocks