SCIENCE KEY STAGE 3 PART 2

Lesson Plans for the ClickView Curriculum Library

ALIGNED TO THE **NATIONAL CURRICULUM IN ENGLAND**

ClickView

Science Key Stage 3 Part 2
Lesson Plans for the ClickView Curriculum Library

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Hola again, Science Teachers!

We hope that you've enjoyed using the lesson plans in our KS3 Part 1 book and they've helped to make teaching less stressful and more enjoyable in any way!

We've heard your feedback and queries at ClickView, and we want to thank you for the kind responses that we have received for the previous book as they motivate us to provide you with more valuable and useful content.

Many of you have been wondering if we were going to create similar lesson plans for more topics. Well here we are, happy to present to you the second book of lesson plans for Key Stage 3.

As in the previous book, these 20 brand-new lesson plans are also aligned to the National Curriculum in England to ensure and maximise their usefulness and relevance.

We've had fun creating these lesson plans and we hope you'll have fun with them as well.

Until next time, cheers!

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Key to Icons in Book

 ClickView Video

 Presentation

SCIENCE KEY STAGE 3 **PART 2**
ALIGNED TO THE **NATIONAL CURRICULUM IN ENGLAND**

CONTENTS

Diffusion

OBJECTIVES

In this lesson, students learn about diffusion as well as some of the factors affecting the speed of diffusion.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Cells and organisation

- the role of diffusion in the movement of materials in and between cells

SUBJECT CONTENT - CHEMISTRY

Pure and impure substances

- diffusion in terms of the particle model

SUBJECT CONTENT - PHYSICS

Matter:

Physical changes

- diffusion in liquids and gases driven by differences in concentration

KEYWORDS

concentration gradient, diffusion, gases, liquids, mix, particles, solids, spread, vibrate

LESSON PLAN

Activities	Resources
Activity 1: Properties of Diffusion Give out the *All about Diffusion* worksheet and play Chapter 7 of the video from 00:00 to 01:25. Ask students to try Part A of the worksheet after they have finished watching the video. Review the answers of the cloze passage with students with the answer video. 15	• Photocopies of the *All about Diffusion* worksheet • ClickView video: *Keeping It All Together: Cell Membranes* Chapter 7 • Answer video: *The Great Diffusion Story*
Activity 2: Factors Affecting the Rate of Diffusion Divide students into groups of 3 and give out the materials. Allow time for students to complete the experiment outlined in Part B of the worksheet. Ensure the hot water is handled properly according to safety guidelines. After the experiment, allow time for students to research for information to account for the differences they have observed in the experiment. Discuss the experiment and their findings. If time permits, discuss other factors that might affect the rate of diffusion of dye particles. 45	• *All about Diffusion* worksheet • For each group of 3: 3 beakers, marker, 400 mL of water at room temperature, 200 mL of water at 60°C, red food colouring, stopwatch, stirrer • Laptops

ANSWERS

All about Diffusion

diffusion, liquids, gases, particles, concentration gradient, higher, lower, mixed, solids, vibrate

Factors Affecting Diffusion

Results: Students' answers may vary.

Suggested answers:

Comparing beaker A and B (Room temperature water vs. hot water)	Comparing beakers A and C (No stirring vs. stirring)
The higher the water temperature, the more energy the water particles have. Therefore, the rate of diffusion increases as temperature increases.	It takes a shorter time for the dye particles to be evenly mixed when stirred as stirring moves them around the water at an increased pace.

All about Diffusion

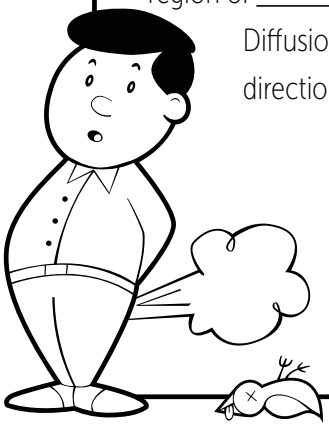
Part A: Properties of Diffusion

After you have watched the video, complete the passage using words from the helping box.

What do flatulence and perfume have in common?

It doesn't take long for us to smell either of them when they are released into the air, does it? This is all due to _____. Diffusion happens in either _____ or _____ as the _____ are free to move around in all directions. These particles move down a _____ _____, from a region of _____ particle concentration to a region of _____ particle concentration. The particles are eventually evenly _____.

Diffusion does not occur in _____ as their particles are not free to move in any direction and only _____ about a fixed position.



HELPING BOX

diffusion	higher	solids	gases	liquids
mixed	lower	concentration gradient	vibrate	particles

Part B: Factors Affecting the Rate of Diffusion

Materials:

- 3 beakers
- marker
- 400 mL of water at room temperature
- 200 mL of water at 60°C
- red food colouring
- stopwatch
- stirrer

Instructions

1. Label the three beakers A, B and C.
2. Add 200 mL of water at room temperature to beaker A.
3. Add three drops of food colouring to beaker A and start the stopwatch.
4. Record the time taken for the red food colouring to be evenly distributed.
5. Add 200 mL of water at 60°C to beaker B.
6. Repeat steps 3 and 4.
7. Add 200 mL of water at room temperature to beaker C.
8. Add three drops of food colouring to beaker C and start the stopwatch as you stir the contents with the stirrer.
9. Record the time taken for the food colouring to be evenly mixed.

Beaker	A	B	C
Time taken (s)			

Research online to explain for the differences in times between the following beakers:

Comparing beakers A and B (water at room temperature vs. water at 60°C)	Comparing beakers A and C (no stirring vs. stirring)

The Human Skeletal System

OBJECTIVES

In this lesson, students will learn about the parts of the human skeletal system, its functions and the different types of joints that connect the bones.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

The skeletal and muscular systems

- the structure and functions of the human skeleton, to include support, protection, movement and making blood cells

KEYWORDS

biomechanics, bone marrow, bones, cartilage, cranium, elbow, forces, joints, knee, ligament, movement, production, protection, red blood cells, ribs, shape, shoulder, skeleton, sternum, storage, synovial fluid, synovial joint, tendon, tissue

LESSON PLAN

Activities	Resources
Activity 1: Colour the Bone Types! Give out the *Colour the Bone Types!* worksheet. Play Chapter 5 of the video from 09:05 - 10:15 and ask students to conduct research to complete the worksheet. Review the answers when students have finished. 20	• Photocopies of the *Colour the Bone Types!* worksheet • Colour pencils • ClickView video: *The Bones of It: An Introduction to the Skeleton* Chapter 3 • Laptops
Activity 2: Joining Bones Together Give out the *Joining Bones Together* worksheet and play from 10:15-13:50 of the same chapter. Ask students to complete Part A of the worksheet while watching the video. Allow time for students to complete Part B of the worksheet. Students are then to share their answers with the class. 20	• Photocopies of the *Joining Bones Together* worksheet • ClickView video: *The Bones of It: An Introduction to the Skeleton* Chapter 3
Activity 3: What Are the Bony Functions? Give out the *What Are the Bony Functions?* worksheet. Play Chapter 2 of the video and ask students to fill in the worksheet with relevant information. Allow students to collate their answers in groups of 3-4. On the whiteboard, ask students to take turns in writing the different functions of the bones. Review the answers. 20	• Photocopies of the *What Are the Bony Functions?* worksheet • ClickView video: *The Bones of It: An Introduction to the Skeleton* Chapter 2

ANSWERS

Colour the Bone Types!

Colour	Type of Bones
Red	clavicle, humerus, radius, ulna, metacarpals, femur, tibia, fibula, metatarsals, phalanges
Blue	carpals, tarsals
Green	rib, sternum, scapula, skull, pelvic girdle
Yellow	maxilla, mandible, vertebral column, sacrum, coccyx
Purple	patella

Joining Bones Together

Part A:

Immovable joints (fibrous joints)	Slightly movable joints (cartilaginous joints)	Freely movable joints (synovial joints)
• are bones that are connected by a firm piece of cartilage or are initially separated but then fused together. • are found in the plates of the cranium.	• allow small amounts of movement. • are joined by broad, flattened discs of fibro-cartilage, and those connected by a thin tissue or ligament. • are found between the ribs and the sternum.	• are the most common type of joint. • are not directly joined. Examples include joints in the shoulders, elbows and knees.

Part B:

Type of joint	Examples
Ball and socket joint	Shoulders, hips
Hinge joint	Elbows, knees

What Are the Bony Functions?

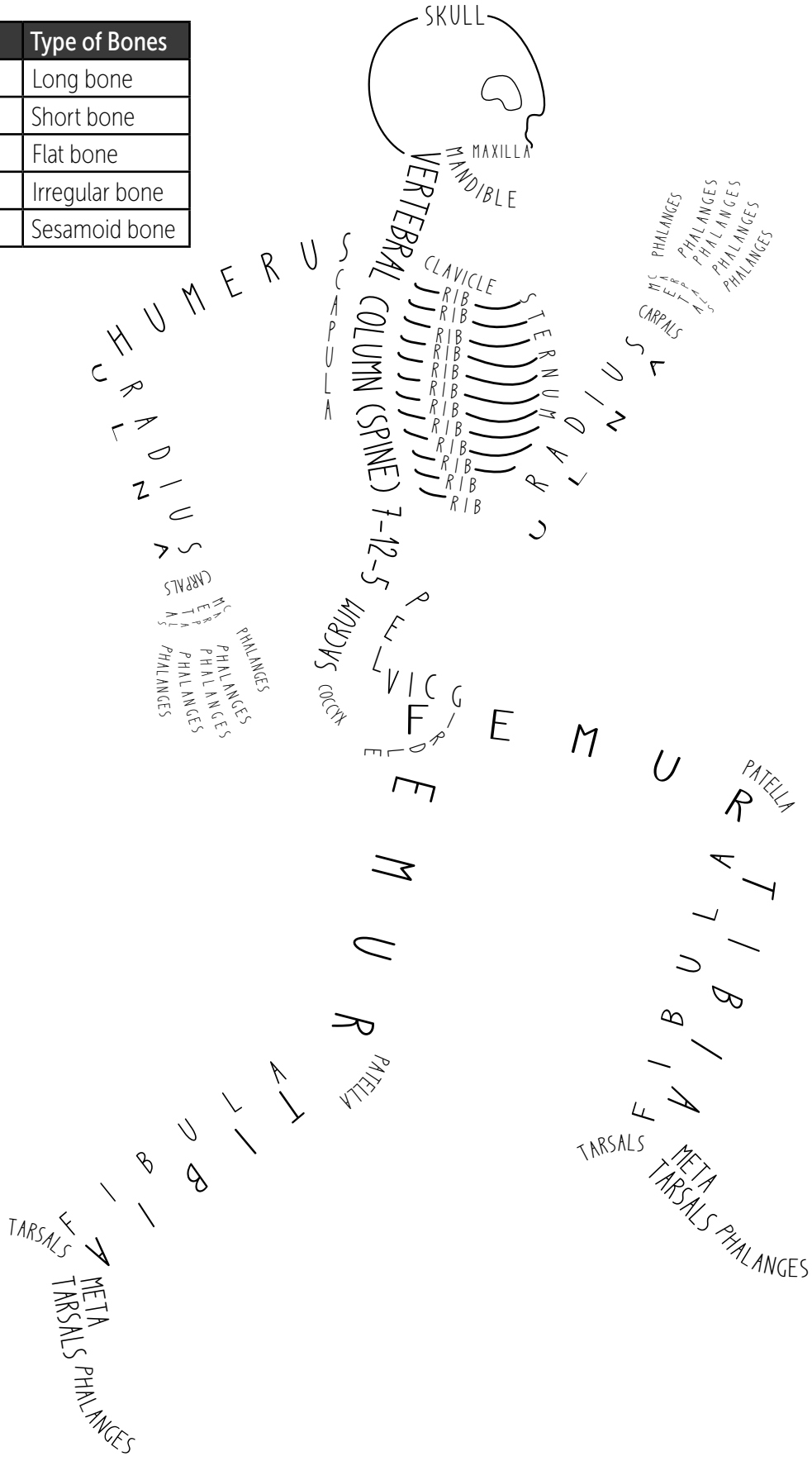
Suggested answers:

Purpose	Elaboration
Shape	Bones prevent us from being squishy and formless. The skeleton supports our softer tissues and provides something for the muscles to hang on to. Our bone structure makes us who we are, giving us shape to our heads and faces.
Protection	The skeleton acts like a cage, armouring our insides against all kinds of dangers. It offers protection for vital organs that keep us alive. Examples include the cranial bone which protects the brain, the vertebrae which protects the spinal cord, and the rib cage which protects the hearts and the lungs.
Movement	Muscles and bones work together to create movement. Bones provide an attachment for muscles to hang on to. The contraction of muscles causes the associated bones to move, allowing other bones to move also.
Storage	Bone tissue stores minerals that keep our bones strong. These minerals include calcium and phosphorous. When required, our bones release these minerals into the blood to keep the balance of minerals evenly throughout our body.
Production	Long and flat bones contain red bone marrow, which is important in the creation of new red and white blood cells, to keep us alive. Diseases such as leukemia attack the bone marrow which prevents new blood cells from being produced.

Colour the Bone Types!

The diagram below shows most of the bones in the skeletal system. There are five different types of bones - long bones, short bones, flat bones, irregular bones and sesamoid bones. After watching the video, conduct research to find out the classification of each bone labelled below, and then colour accordingly.

Colour	Type of Bones
Red	Long bone
Blue	Short bone
Green	Flat bone
Yellow	Irregular bone
Purple	Sesamoid bone

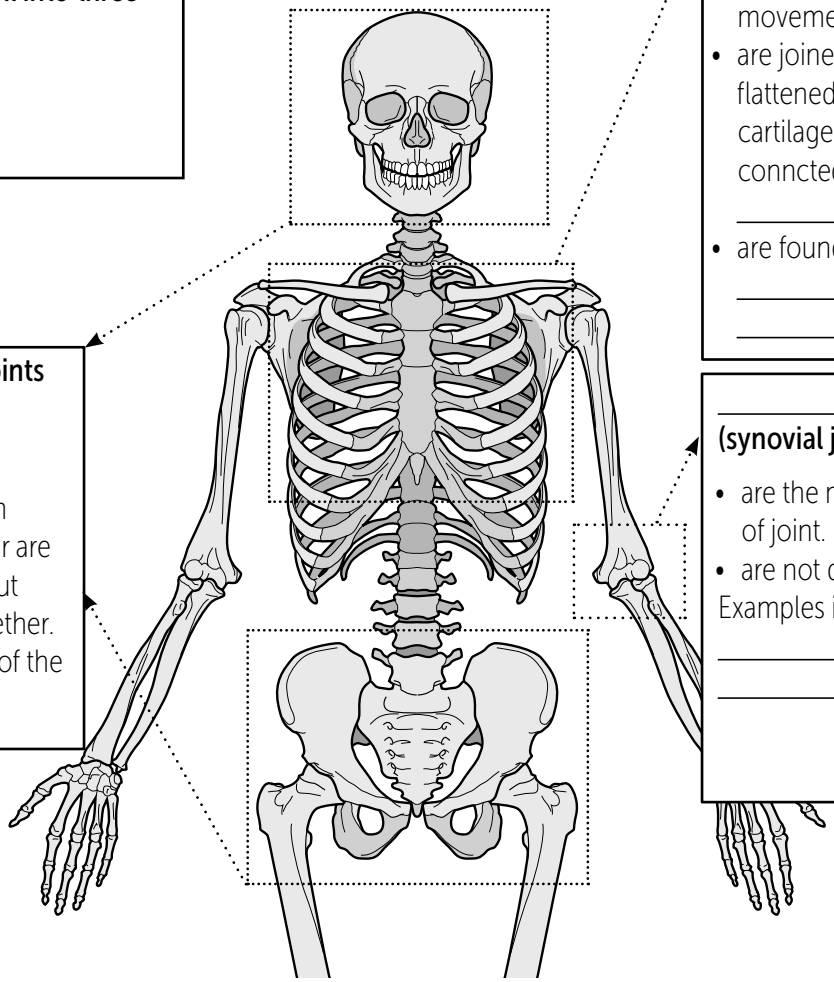


Joining Bones Together

Part A: Complete this section with information from the video.

Joints are the areas where two bones meet. Joints fall into three categories:

- immovable
- slightly movable
- free to move



_____ joints (fibrous joints)

- are bones that are connected by a firm piece of _____ or are initially separated but then _____ together.
- found in the plates of the _____.

_____ joints (cartilaginous joints)

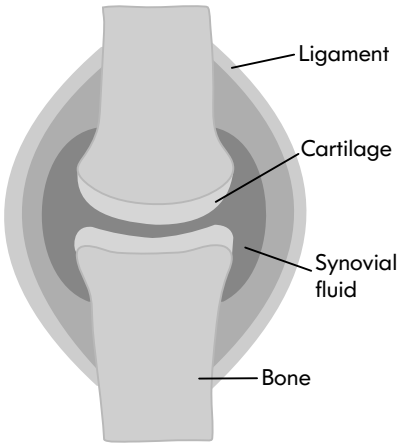
- allow small amounts of movement.
- are joined by broad, flattened discs of fibro-cartilage, and those conncted by a thin _____ or _____.
- are found between the _____ and the _____.

_____ joints (synovial joints)

- are the most _____ type of joint.
- are not directly joined.

Examples include joints in the _____, _____ and _____.

Part B: Think of the locations of the common types of synovial joints listed below. Discuss options with your partner and complete the table using the hints provided.



Features of Synovial Joints

There are many classes of synovial joints (freely movable joints) and they all vary in structure. In all synovial joints, the ends of the joining bones are covered with **cartilage**, which prevents the bones from wearing away when they move against each other. Friction between the cartilage is reduced by the presence of **synovial fluid**. The bones are kept in close contact with each other by bands of tissue called **ligaments**.

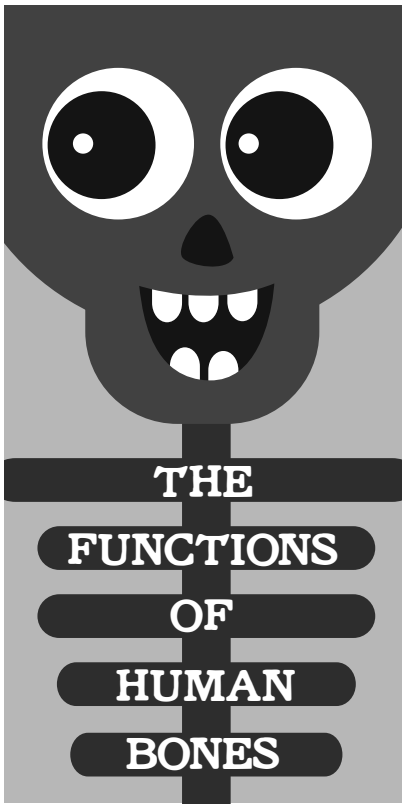
Type of joint	Type of movement	Examples
Ball and socket joint 	Allows movement and rotation in all directions, except gliding	
Hinge joint 	Allows movement like a door hinge, without rotation	

What Are the Bony Functions?

Write explanations of the functions of our bones as you watch the video.

SHAPE

PROTECTION



MOVEMENT

STORAGE

PRODUCTION

The Human Reproductive System

OBJECTIVES

In this lesson, students will learn about the male and female reproductive systems as well as the process invovled in the creation of a fetus.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Reproduction

- reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta

KEYWORDS

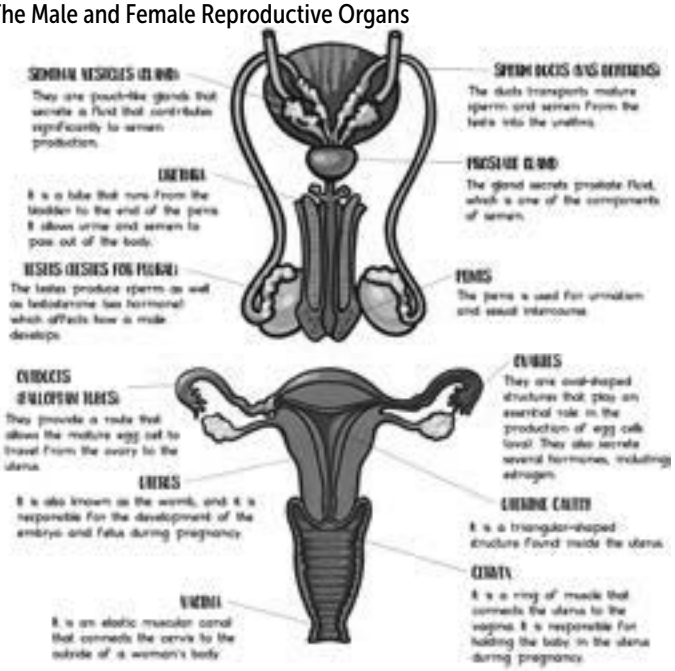
adolescence, cervix, embryo, fertilisation, fetus, gametes, glands, hormones, ovaries, oviduct, penis, puberty, reproductive system, scrotum, sexual intercourse, sperm, sperm ducts, testes, umbilical cord, urethra, uterus, vagina, zygote

LESSON PLAN

Activities	Resources
Activity 1: The Male and Female Reproductive Organs Give out the *The Male and Female Reproductive Organs* worksheet. Allow students to work individually on the worksheet with their laptops or display on projector. Review answers with students when they are finished. 25	• Photocopies of the *The Male and Female Reproductive Organs* worksheet • Presentation: The Human Reproductive System • Laptops/projector
Activity 2: Let's Zoom into the Reproductive Systems Divide the class into groups of 12 and print a copy of the *Let's Zoom into the Reproductive Systems* worksheet for each group. This activity is a game to test students' understanding of the different organs of the male and female reproductive systems. Ask students to follow the instructions on the worksheet to produce 12 individual cards. Each card is labelled with one organ of the human reproductive system. The characteristics of another part of the reproductive system is written on the flip side of the card. >20	• Photocopies of the *Let's Zoom into the Reproductive Systems* worksheet • For each group: scissors, glue, stopwatch
Game instructions: First, the student with the card containing 'START' will read the description to the group. The student who has the paper containing the name of the organ that matches the description will answer, and then read the description found on the back of his paper. The group that takes the least amount time to get through all 12 cards wins the game. This games a minimum 2 groups to proceed. Some students may have to hold on to more than 1 card if class size is not a multiple of 12.	
Activity 3: Fertlisation and Fetal Development Give out the *Fertilisation and Fetal Development* worksheet. Play the video and ask students to complete Part A of the worksheet with information from the video. Allow time for students to work in pairs and research on the Internet for the answers to Part B of the worksheet. Review the answers when students have finished. 25	• Photocopies of the *Fertilisation and Fetal Development* worksheet • ClickView video: *The Development of a Human Embryo* • Laptops/textbooks

ANSWERS

The Male and Female Reproductive Organs



Fertilisation and Fetal Development

Part A:

2.	These sperm cells travel towards the fallopian tubes and approach the ovum (egg cell). The sperm and ovum are known as gametes.
3.	Only one sperm fuses with the ovum. When this happens, the sperm nucleus and the ovum nucleus fuse together.
4.	A zygote is formed. It spends a few days travelling down the fallopian tube, where it multiplies rapidly.
5.	It forms a ball of about 100 cells, known as the embryo.
6.	The embryo travels down the uterus, and gets embedded in the wall of the uterus. This is known as implantation.
7.	The embryo divides and re-divides to form different parts of the body.
8.	At this stage, the embryo is now known as a fetus.
9.	The placenta attaches the fetus to the mother's body. It is responsible for nourishing and maintaining the fetus through the umbilical cord.
10.	When the fetus is fully developed at 38 weeks, it is called a baby. It leaves the body through the vagina.

Part B:

Possible answers:

What it provides to the fetus	What it removes from the fetus
Supplies fetus with nutrition such as oxygen, glucose and amino acids. Provides protection from harmful substances.	Waste substances such as carbon dioxide are removed from the fetus and passed into the mother's blood supply for removal via her kidneys.

The Male and Female Reproductive Organs

Using the presentation slides, label the different parts of the male and female reproductive systems. Be sure to include notes on the function and characteristics of each organ.

Male reproductive system

Female reproductive system

Let's Zoom into the Reproductive Systems

Instructions:

1. Cut out Box A and Box B.
2. Align the boxes and glue them together, with the words facing out.
3. Cut along the dotted lines to produce 12 individual cards.
4. The person with 'START' on their card will read out their clue.
5. The other students will flip over to the grey side and whoever has the answer that matches the clue will proceed to read out their clue. This is repeated until everybody has had a turn.

Box A:

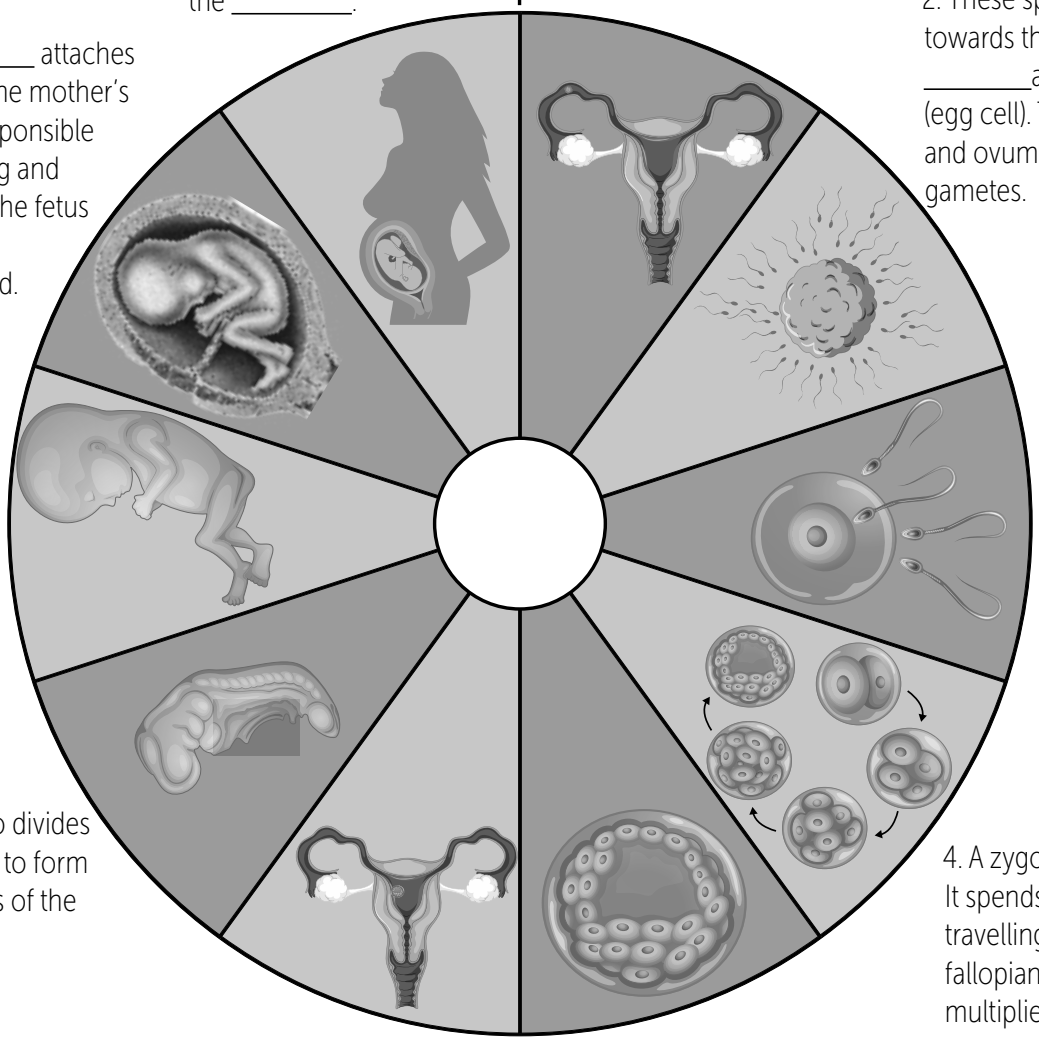
START They are pouch-like glands that secrete a fluid that contributes significantly to semen production.	It is an elastic muscular canal that connects the cervix to the outside of a woman's body	The ducts transport mature sperm and semen from the testes into the urethra.	They provide a route that allows the mature egg cell to travel from the ovary to the uterus.
It is a triangular-shaped structure found inside the uterus.	It is a tube that runs from the bladder to the end of the penis. It allows urine and semen to pass out of the body.	The testes produce sperm as well as testosterone (a sex hormone) which affects how a male develops.	It is also known as the womb, and it is responsible for the development of the embryo and fetus during pregnancy.
It is a ring of muscle that connects the uterus to the vagina. It is responsible for holding the baby in the uterus during pregnancy.	They are oval-shaped structures that pay an essential role in the production of egg cells (ova). They also secrete several hormones, including estrogen.	The gland secretes prostate fluid, which is one of the components of semen.	The penis is used for urination and sexual intercourse.

Box B:

ovaries	uterus	prostate gland	urethra
penis	seminal vesicles (gland)	sperm ducts (vas deferens)	uterine cavity
oviducts fallopian tubes	testes	vagina	cervix

Fertilisation and Fetal Development

Part A: As you watch the video, complete the diagram below.



1. Millions of sperm cells are released into the vagina during coitus.

2. These sperm cells travel towards the _____ _____and approach the (egg cell). The sperm cell and ovum are known as gametes.

3. Only _____ sperm fuses with the ovum. When this happens, the sperm nucleus and the ovum nucleus fuse together.

4. A zygote is formed. It spends a few days travelling down the fallopian tube, where it multiplies rapidly.

5. It eventually forms a ball of about 100 cells, known as an _____.

6. The embryo travels down the _____, and gets embedded in the wall of the uterus. This is known as _____.

7. The embryo divides and redivides to form different parts of the body.

8. At this stage, the embryo is now known as a _____.

9. The _____ attaches the fetus to the mother's body. It is responsible for nourishing and maintaining the fetus through the umbilical cord.

10. When the fetus is fully developed at 38 weeks, it is called a _____. It leaves the body through the _____.

Part B: The Placenta

In your pairs, research online to find out how the placenta helps in fetal development.

What it provides the fetus	What it removes from the fetus

The Human Respiratory System

OBJECTIVES

In this lesson, students will learn about the human respiratory system, including creating a model to understand how air flows in and out of the lungs.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Gas exchange systems

- the structure and functions of the gas exchange system in humans, including adaptations to function

KEYWORDS

alveoli, bronchi, bronchioles, diaphragm, exhale, gas exchange, inhale, intercostal muscles, lungs, respiration, respiratory system, ribcage, trachea

LESSON PLAN

Activities	Resources
Activity 1: Inhalation and Exhalation Give out the *Inlation and Exhalation* worksheet. Play Chapter 8 of the video and give time to the students to attempt Part A of the worksheet in pencil so they can correct their answers. Without revealing the answers, give out the materials required for Part B of the worksheet. Divde the class into groups of 3-4 and ask students to follow the instructions and make a model of the lungs. Using the model, review answers for Part A of the worksheet. Note to teachers: The diaphram is represented by the balloon located on the outside of the bottle. 30	• Photocopies of the *Inhalation and Exhalation* worksheet • ClickView video: *In Focus: Functional Anatomy* Chapter 8 • For each group of 3-4: A 500 mL plastic bottle, with the bottom removed (about 6 cm), scissors, 2 balloons, clear tape, drinking straw, a rubber band, playdough
Activity 2: The Respiratory System Give out the *Zooming into the Respiratory System* and *Learning about the Respiratory System* worksheets. Before playing the same chapter from 01:06, go through the instructions on *Zooming into the Respiratory System* worksheet with students to guide them to complete Part A of *Learning about the Respiratory System* worksheet. Give students some time to research online for the answers to Part B of the worksheet. Ask students to share their answers and what they've learnt about the respiratory system. 30	• Photocopies of the *Learning about the Respiratory System* and *Zooming into the Respiratory System* worksheets • For each student: paper fasteners, scissors • ClickView video: *In Focus: Functional Anatomy* Chapter 8

ANSWERS

Inhalation and Exhalation

Part A:

Inhalation	Exhalation
contracts, downwards, larger, an increase, lower	relaxes, upwards, smaller, a decrease, higher

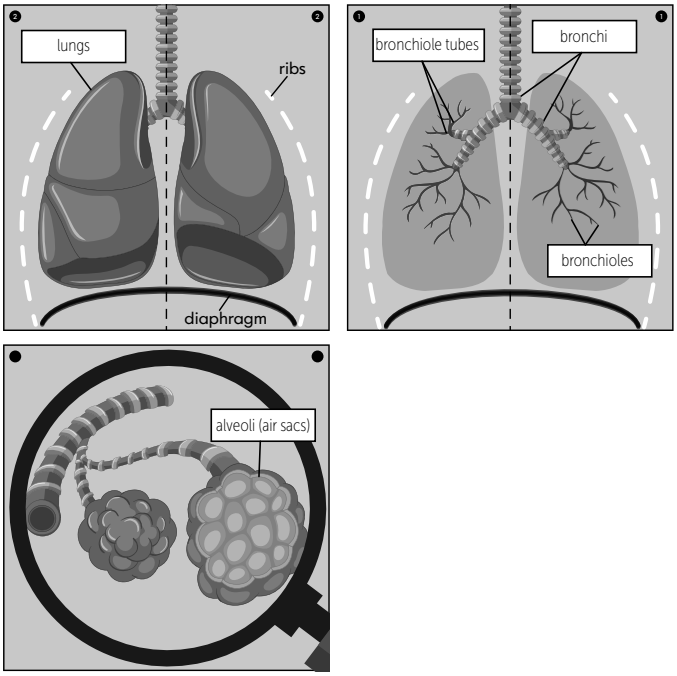
Part B:

Possible answer:

When the balloon was pulled downwards, the balloon inside the body inflated slightly. Subsequently, when the balloon on the outside was released back to the neutral position, the balloon on the inside deflated.

Learning about the Respiratory System

Part A:



Air enters the lungs via the trachea, which divides into two bronchi. These bronchi branch into bronchiole tubes, which then branch into smaller bronchioles. Air passes through these bronchioles which are connected to alveoli (air sacs). In the alveoli, oxygen is extracted from the air and passes into the blood stream. There are millions of alveoli in our lungs. The alveoli are surrounded by capillaries, which allow the exchange of gases.

Part B:

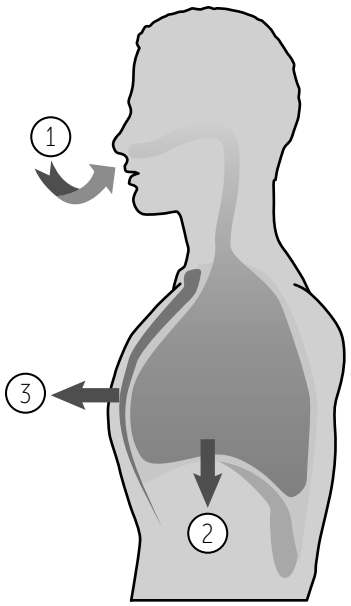
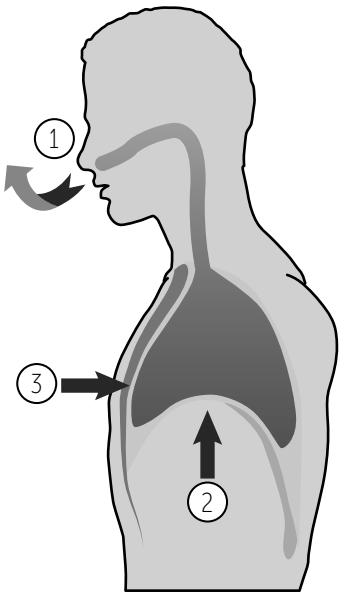
Possible answers:

Feature	How does it helps to make gas exchange effective?
The wall of each alveolus is one cell thick.	This reduces the diffusion distance the gas has to travel.
The combined surface area of all the alveoli in one lung is about the size of half a tennis court.	This allows larger volumes of air to be exchanged at any one time.
The alveoli is surrounded by many capillaries.	This provides a good supply and network for oxygen to be exchanged for carbon dioxide.

Gases move across the walls of the alveoli through diffusion, from a region of higher concentration to a region of lower concentration.

Inhalation and Exhalation

Part A: Complete the following sentences by circling the correct words.

	
INHALATION	**EXHALATION**
When you inhale, the diaphragm **relaxes/contracts** and moves **upwards/downwards**. This makes the chest cavity **smaller/larger**, resulting in **an increase/a decrease** in the volume of the ribcage. The air pressure is **lower/higher** in the lungs, causing air to be drawn in naturally.	When you exhale, the diaphragm **relaxes/contracts** and moves **upwards/downwards**. This makes the chest cavity **smaller/larger**, resulting in **an increase/a decrease** in the volume of the ribcage. The air pressure is **lower/higher** in the lungs, causing air to be forced out.

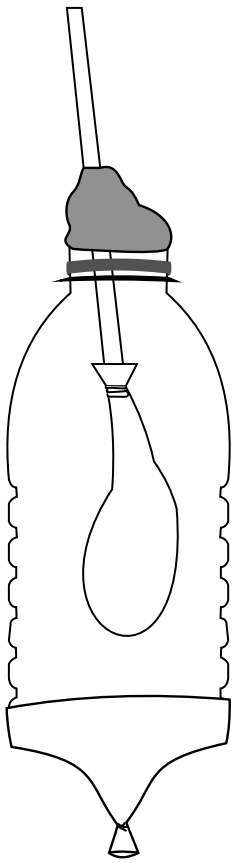
Part B: Making a Lung!

Materials:

- 500 mL plastic bottle, with the bottom removed (about 6 cm)
- scissors
- 2 balloons
- clear tape
- a drinking straw
- a rubber band
- playdough

Instructions:

Step 1: Tie a knot to one of the balloons and snip off with scissors half of the balloon, away from the knot.
Step 2: Stretch the balloon so it covers the bottom of the plastic bottle. If the edge of the bottle is too sharp, use tape to cover it.
Step 3: Insert a straw into the neck of the second balloon and secure it tightly with the rubber band. When you blow into the balloon, it should still inflate.
Step 4: Insert the end of the straw with the balloon into the bottle.
Step 5: Make a secure seal around the bottle with the playdough. Take care to not crush the straw.



What happens when you pull the balloon that is on the outside of the bottle? Write your observations below.

Zooming into the Respiratory System

Materials:

- scissors
- a pair of paper fasteners

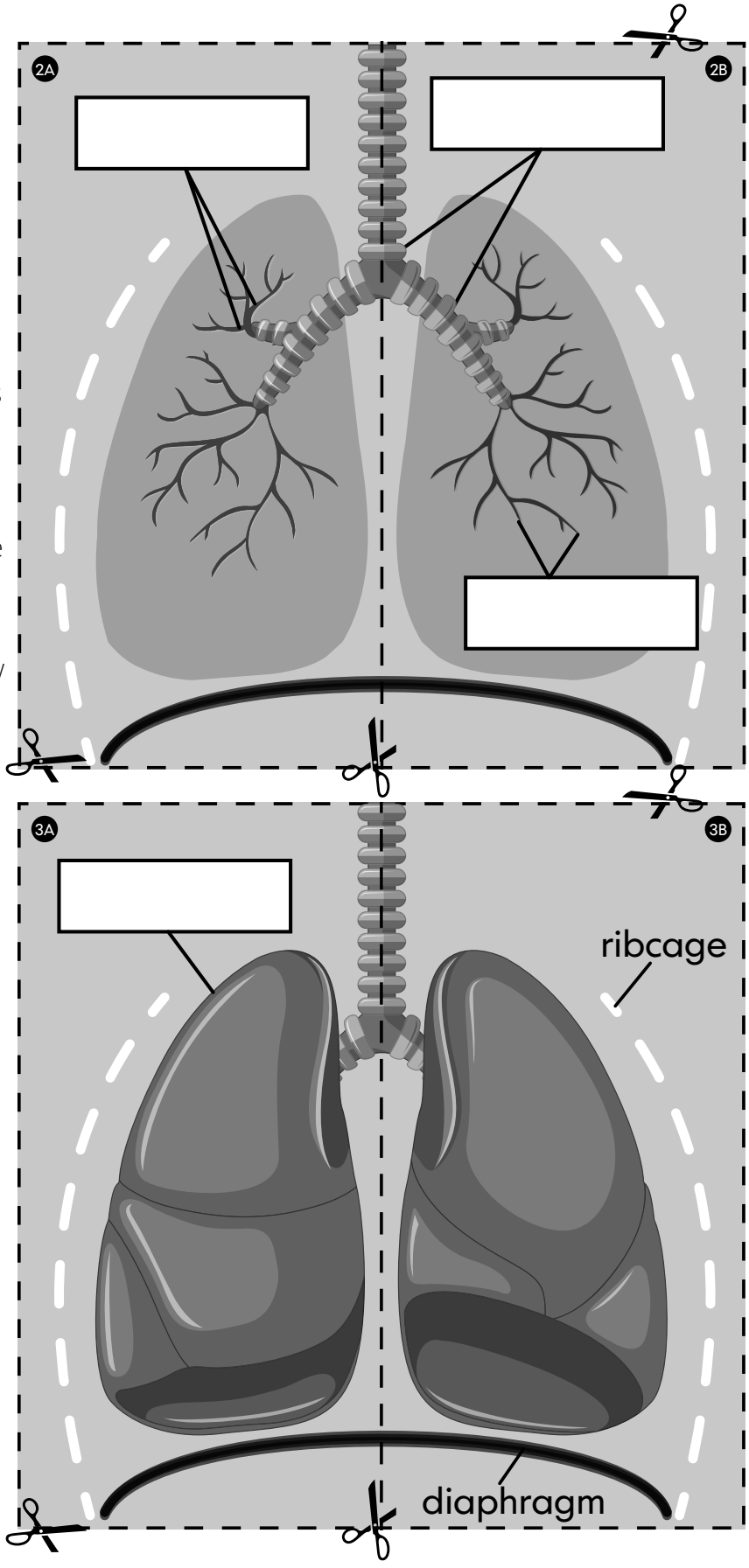
Instructions:

Step 1: Cut out the boxes along the dotted lines.

Step 2: On Part A of the 'Learning about the Respiratory System' worksheet, align the rectangle boxes with '2A' on top of '1A' followed by '3A' and attach the pieces of paper at the black circles with a paper fastener.

Step 3: Repeat the same for the '2B' on top of '1B' followed by '3B' and attach the pieces of paper together.

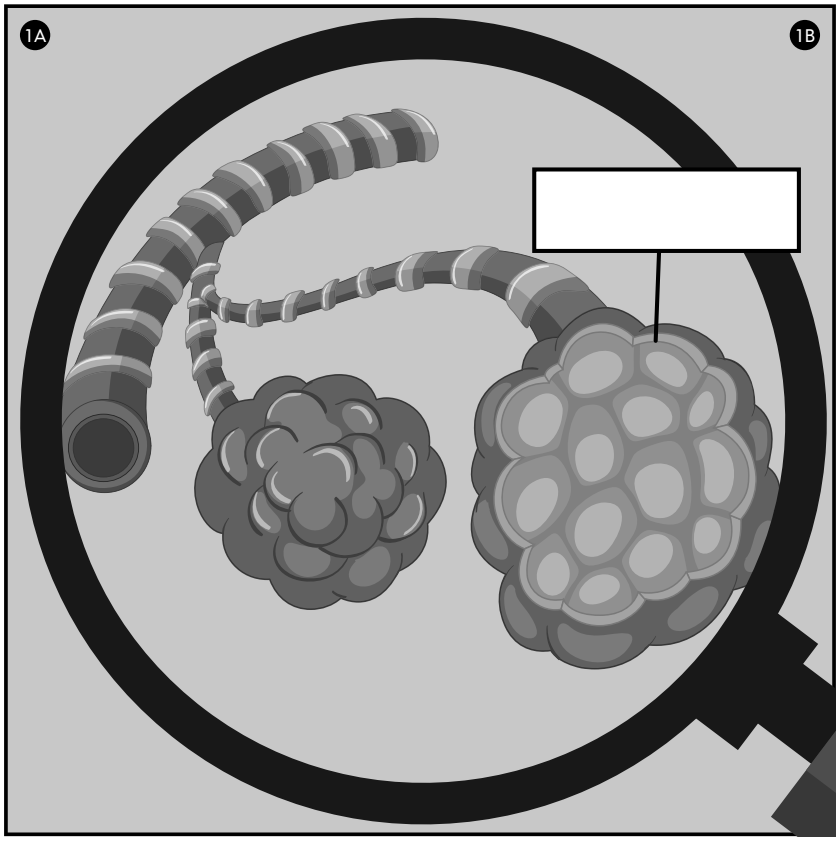
Step 4: As the video is played, label the various structures found in the respiratory system and complete the passage. Use the helping words found in the helping box.



Learning about the Respiratory System

Part A: Parts of the Respiratory System

Complete this section following the instructions on the 'Zooming into the Respiratory System' worksheet.



HOW DO THE LUNGS WORK?

Air enters the _____ via the _____, which divides into two _____. These bronchi branch into _____ _____, which then branch into smaller _____. Air passes through these bronchioles which are connected to _____. In the alveoli, oxygen is extracted from the air and passes into the blood stream. There are millions of alveoli in our lungs. The alveoli are surrounded by _____, which allow the exchange of gases.

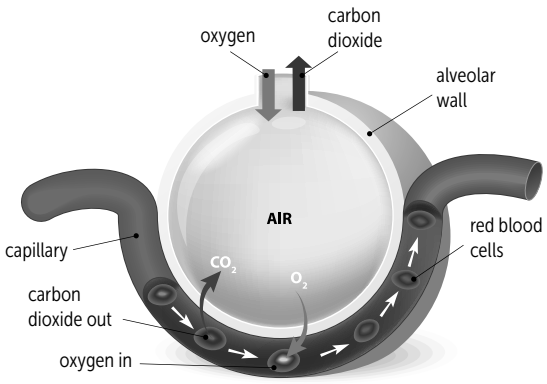
Trachea	Lungs	Alveoli (air sacs)	Bronchiole tubes
Bronchi	Bronchioles	Capillaries	

Part B: The Alveoli (Air Sacs)

Each alveolus has features that allows effective gas exchange in the lungs. In pairs, research and find out more about the features of alveoli.

Feature	How does it helps to make gas exchange effective?
The wall of each alveolus is one cell thick.	
The combined surface area of all the alveoli in one lung is about the size of half a tennis court.	
The alveoli are surrounded by many capillaries.	

Cross Section of an Air Sac



Gases move across the walls of the alveoli through _____, from a region of _____ concentration to a region of _____ concentration.

The Human Digestive System

OBJECTIVES

In this lesson, students will learn about the different parts of the digestive system, including their location and function in the digestion process.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Nutrition and digestion

- the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)

KEYWORDS

absorbed, anus, appendix, bile, catalysts, enzymes, digestion, digestive system, gall bladder, large intestine, liver, mouth, oesophagus, pancreas, rectum, salivary glands, small intestine, stomach

LESSON PLAN

Activities	Resources
Activity 1: Learning about the Digestive System Give out the *Organs of the Digestive System* worksheet to each pair of students and ask them to cut out and fold the individual labels in preparation for the task. Give out the *Label the Digestive System* worksheet to students. Play Chapter 5 of the video and ask students to complete the worksheet after watching the video. Give students some time to research the organs not mentioned it the video online. Review answers using the presentation slides. 35	• Photocopies of the *Organs of the Digestive System* and *Label the Digestive System* worksheets (printed in A3) • Scissors and glue • ClickView video: *The Human Body: How It Works* Chapter 4 • Laptops • Presentation: The Human Digestive System
Activity 2: Digestion and Absorption Give out the *Digestion and Absorption* worksheet and divide students into pairs. Ask students to research online to find the answers for Part A and Part B of the worksheet. Ask students to share their findings once they have finished. 25	• Photocopies of the *Digestion and Absorption* worksheet • Laptops

ANSWERS

Label the Digestive System

Students' answers may vary.

Possible answers:

Organs and Processes	Function
Mouth (ingestion, digestion)	Food starts to be digested here. The mouth produces saliva which helps to break down the food.
Oesophagus (ingestion)	It is a muscular tube that pushes the food down into the stomach. The walls of the oesophagus contract (squeeze together) to aid the movement of food from the mouth to the stomach. This allows food to be swallowed even while we are lying down!
Stomach (digestion)	The stomach has muscles that crush and squash what we eat and drink. The food also mixes with digestive juices.

ANSWERS

Label the Digestive System - continued

Organs and Processes	Function
Liver (digestion)	It produces bile required to emulsify lipids (fats) in the small intestine.
Gall bladder (digestion)	It stores bile between meals and releases it through the bile duct into the small intestine to help in the digestion of lipids (fats).
Pancreas (digestion)	It produces pancreatic juice required to digest proteins and carbohydrates. The juice is released through the pancreatic duct into the small intestine.
Small intestine (digestion, absorption)	The small intestine is a long (about 7.5m), hollow tube that snakes around the abdomen. The lining of the small intestine is made up of tiny fingers called villi. Villi contain small blood vessels that collect nutrients. In the small intestine, proteins are further broken down by enzymes produced in the pancreas and fats are emulsified by bile produced in the liver.
Large intestine (absorption, excretion)	The food not taken into the bloodstream by the small intestine travels into the large intestine. It is shorter than the small intestine, at about 1.5 m. Water is absorbed here as well.
Appendix	Recent research suggested that the appendix serves as a reserve for good bacteria that the body can use when required.
Rectum and anus (Excretion)	Undigested food is stored in the rectum as waste, this comes out of the anus as faeces.

Digestion and Absorption

Students' answers may vary.

Possible answers:

Part A:

Product	Carbohydrates	Lipids	Proteins
What the product is broken into	Simple sugars	Fatty acids and glycerol	Amino acids
Type of enzymes used in the digestive process	Amylase	Lipase	Protease
Location(s) where the digestion takes place	• mouth • stomach • small intestine	• small intestine	• stomach • small intestine

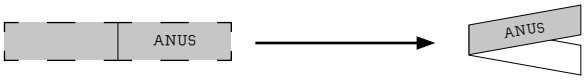
Part B:

Question #1	This decreases the diffusion distance required for nutrients to be absorbed, increasing efficiency of absorption.
Question #2	This increases the surface area for absorption, ensuring that the maximum amount of nutrients can be absorbed.

Organs of the Digestive System

The organs found in the digestive system are labelled in the boxes below.

Instructions:
Cut out each individual label along the dashed lines, then fold along the dotted lines to create a mini book with the name of the organ appearing on the outside.



Task A
As you watch the video, paste each label on the correct organ on the 'Label the Digestive System!' worksheet. Write the function of each organ inside the mini book. For organs not mentioned in the video, research to find out how they also contribute to the digestive process.

Task B
There are four stages of food processing: ingestion, digestion, absorption and exretion. They occur in different organs. In your groups, research which stage(s) each organ is part of and write your findings on the same pieces of paper from Task A.

GALL BLADDER

APPENDIX

LARGE INTESTINE

LIVER

MOUTH

OESOPHAGUS

PANCREAS

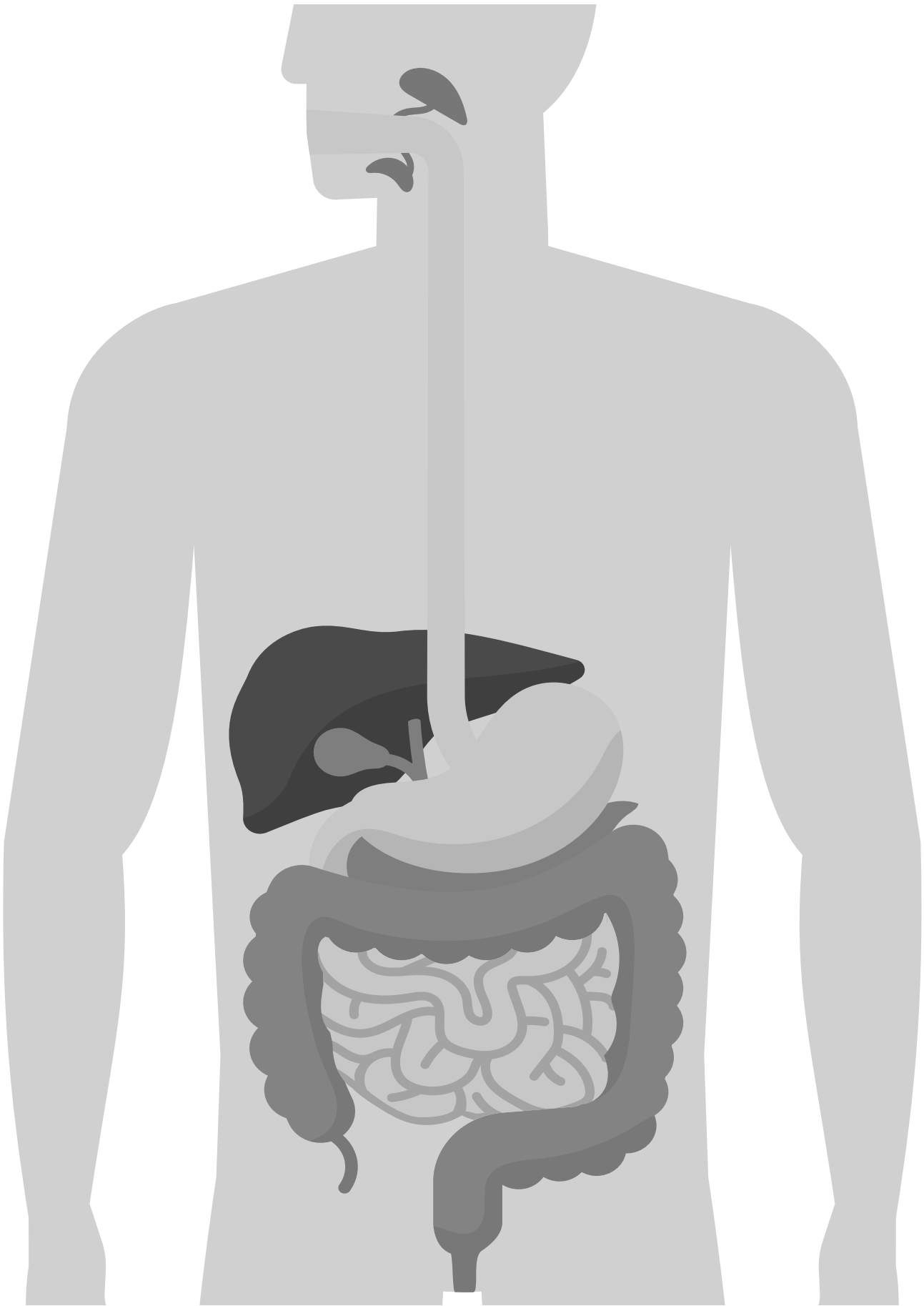
RECTUM AND ANUS

STOMACH

SMALL INTESTINE

Label the Digestive System!

Task A: Complete the diagram using the labels from the 'Organs of the Digestive System' worksheet.



Digestion and Absorption

Part A: Digestion and Enzymes

The foods we eat have to be broken down chemically into really tiny particles before the body can absorb them. The breakdown is carried out by special proteins called enzymes. Different types of enzymes are required to break down different types of nutrients. In pairs, conduct research to complete the table below.

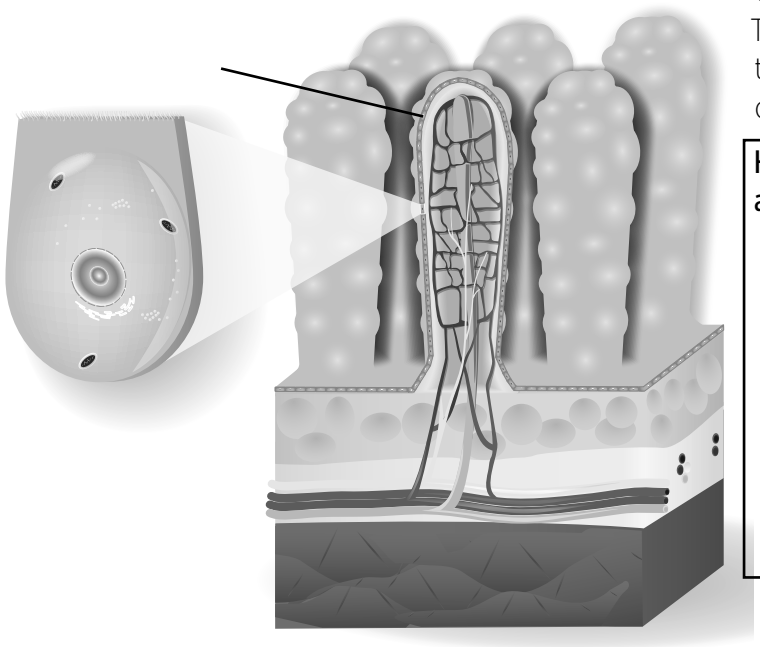
Product			
	Carbohydrates (starch, sugar and fibre)	Lipids (fats and oils)	Proteins (meat, eggs, dairy products, fish, nuts and beans)
What the product is broken into			
Type of enzymes used in the digestive process	a__y|__ __ __	|__p__ __ __	__ro__ __ __ __ __
Location(s) where the digestion takes place			

Part B: Absorption and Villi

Most of the nutrients in the food you eat are absorbed into the blood as they pass through the lining of the small intestine. The lining of the intestine is made up of an important feature that aids the absorption of nutrients. Research to find answers to the questions below.

Question #1:
Villi have very thin walls that are only one cell thick.

How does this help in absorption?



Question #2:
There are millions of tiny villi lining the walls of the small intestine.

How does this help in absorption?

Imbalances in the Diet

OBJECTIVES

In this lesson, students will learn about imbalances in the diet, and research a diet-related disease.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Nutrition and digestion

- the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases

KEYWORDS

deficiency diseases, diabetes, malnutrition, nutrition, obesity, starvation

LESSON PLAN

Activities	Resources
Activity 1: Exploring Obesity! Give out the *We Are What We Eat!* worksheet to students. Give time to students to work on Part A in pairs. Encourage class discussion on the topic once every pair of students has recorded an answer to the question. List the varied responses on the board. Play Chapter 3 of the video to wind up discussion. 25	• Photocopies of the *We Are What We Eat!* worksheet • ClickView video: *Diet Related Disorders* Chapter 3
Activity 2: Exploring Diet-Related Diseases Allow students time to individually research a diet-related disease of their choosing. Once they have conducted their research, they must create an A4 brochure to present their findings. 45-50	• *We Are We What Eat!* worksheet • Laptops • A4 paper

ANSWERS

We Are What We Eat!

Part A:

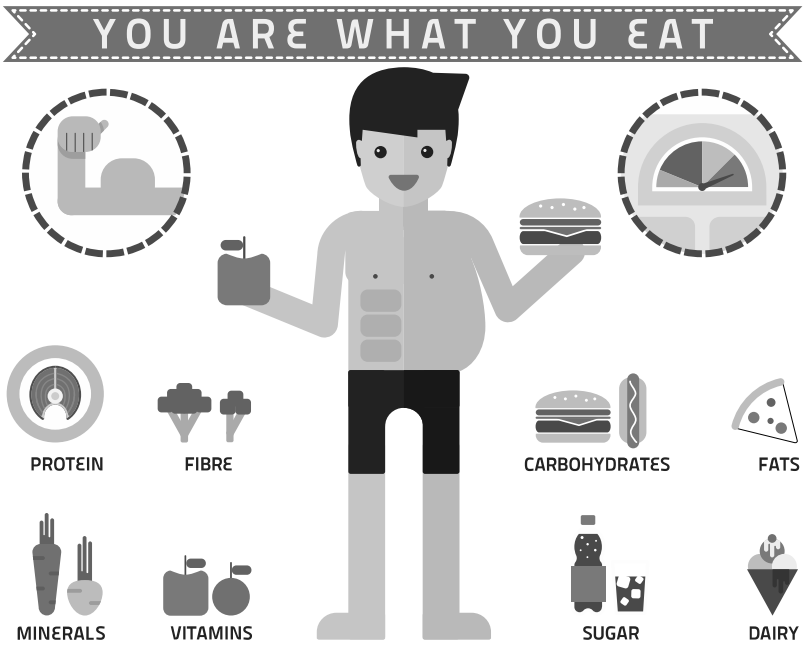
1. Malnutrition is the lack of proper nutrition, It can be caused by not having enough to eat or not eating enough of the right things.
2. Students' answers may vary.
3. Possible answer:
   Yes, it can. Although malnutrition more commonly leads to starvation, too much of the wrong foods can also cause malnutrition. People who eat a lot of junk food consume too many calories. The excess calories do not provide the nutrition that the body needs, instead the calories contribute to weight gain, commonly resulting in obesity.

Part B:

Students' answers may vary.

Possible answer:

Anaemia		
Causes	Iron deficiency anemia is caused by a decrease in the number of red blood cells. Without sufficient iron, the body cannot produce enough haemoglobin for our red blood cells. Haemoglobin is required to carry oxygen around the body.	
Symptoms	• fatigue • breathlessness • drop in blood pressure • frequent headaches • loss of appetite	• hair loss • tinnitus • nail changes • racing heart or palpitations
Prevention	• eat a balanced diet rich in iron • increase vitamin C intake to help iron absorption	
Treatment	• take iron supplements • increase intake of iron through diet	



We Are What We Eat!

> "Americans are overfed and undernourished. That's right, the most obese children and adults in the country are also the most nutritionally deficient!"
>
> \- Mark Hyman, MD
> Hungry For Change, 2017

Part A: Complete the questions below.

1. What is malnutrition?

____

____

2. Do you think malnutrition can cause obesity? In pairs, discuss and record your response below.

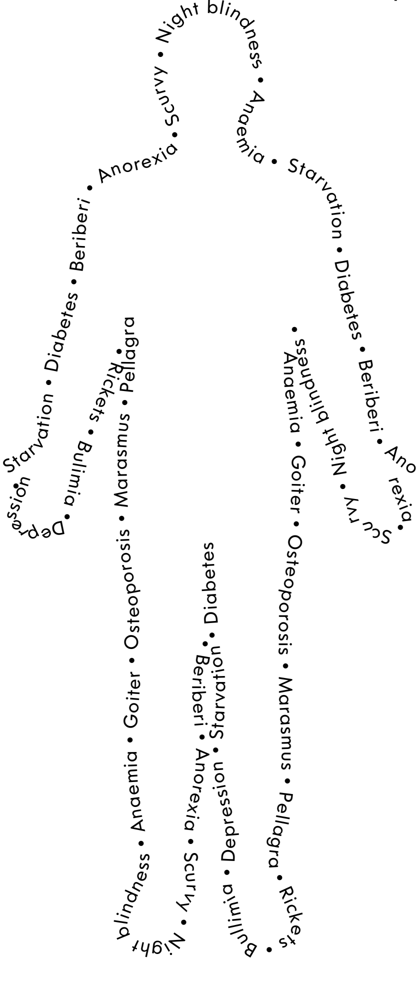
____

____

____

____

Part B: Research the cause(s), symptoms, treatment(s) and prevention options for one of the diseases outlining the human body below. Record your findings in the table, then create an informative brochure for the disease on a piece of A4 paper.



CAUSES:	TREATMENT:
SYMPTOMS:	**PREVENTION:**

Recreational Drugs and Their Effects

OBJECTIVES

In this lesson, students will learn about the three main classifications of drugs (stimulants, depressants and hallucinogens) and understand the effects of these drugs on the human body.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Health

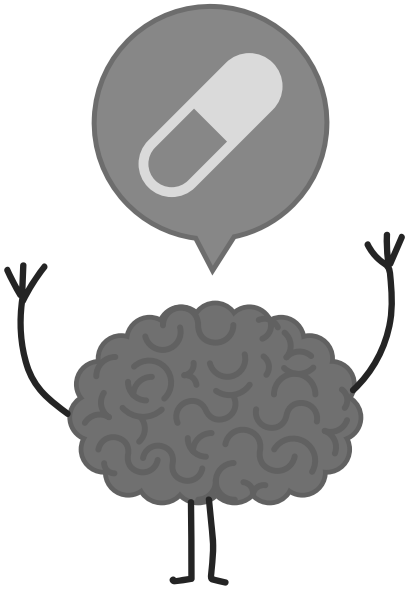
- the effects of recreational drugs (including substance misuse) on behaviour, health and life processes

KEYWORDS

addictive, alcohol, caffeine, cannabis, cigarettes, cocaine, depressants, ecstasy, effects, hallucinogens, heroin, ice, illegal, legal, meth, methamphetamines, nicotine, recreational drugs, solvents, stimulant

LESSON PLAN

Activities	Resources
Activity 1: Different Types of Recreational Drugs Give out the *Recreational Drugs and their Effects* worksheet. Play Chapter 2 of the video and allow students to work on Part A of the worksheet as they watch the video. Review answers with students using the presentation slides. 25	• Photocopies of the *Recreational Drugs and Their Effects* worksheet • ClickView video: *Depressants, Hallucinogens and Stimulants* Chapter 2 • Presentation: Drugs
Activity 2: The Effects of Recreational Drugs Divide the students into groups of 3. Ask each trio to research a chosen recreational drug and its effects on the human body. Label the effects on the different body systems on Part B of the worksheet. When students have finished researching, allow groups to share their findings with the class. Play Chapter 3-5 of the video to show the effects of different drugs from each classification. 35	• *The Recreational Drugs and Their Effects* worksheet • Laptops • ClickView video: *Depressants, Hallucinogens and Stimulants* Chapter 3 Chapter 4 Chapter 5



ANSWERS

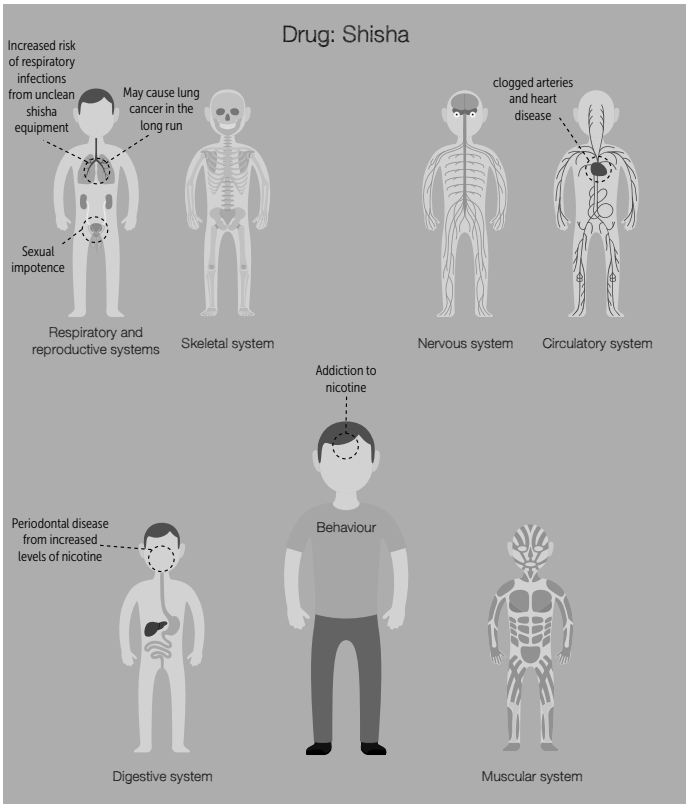
Recreational Drugs and their Effects

Part A:

Drug	Classification/s
Cannabis	depressant
Alcohol	depressant
Ecstasy	stimulant, hallucinogen
Nicotine in cigarettes	depressant, stimulant
Shisha	depressant, stimulant
LSD	hallucinogen
Cocaine	stimulant
Magic mushrooms	hallucinogen
Heroin	depressant
Methamphetamines	stimulant

Part B:

Students' answers may vary.

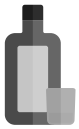


Recreational Drugs and Their Effects

HOW RECREATIONAL DRUGS AFFECT THE BODY

Part A: Determine which classification (depressant, stimulant or hallucinogen) each drug falls under as you watch the video.
Note: Some drugs belong to more than one classification.


Cannabis

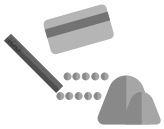

Alcohol


Ecstasy


Cigarettes


Shisha


LSD


Cocaine


Magic mushrooms

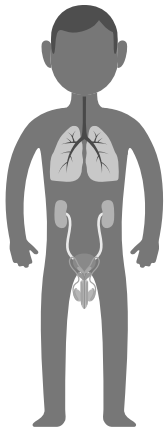

Heroin

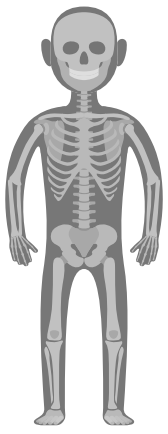

Methamphetamine

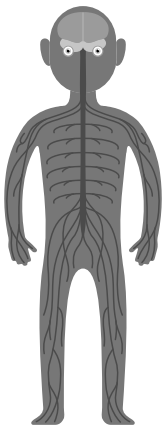
Drug	Classification/s
Cannabis	
Alcohol	
Ecstasy	
Nicotine in cigarettes	
Shisha	
LSD	
Cocaine	
Magic mushrooms	
Heroin	
Methamphetamines	

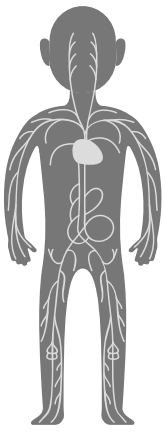
Part B: Pick a drug to research and find out what effects it has on the body and human behaviour. Label the effects below.

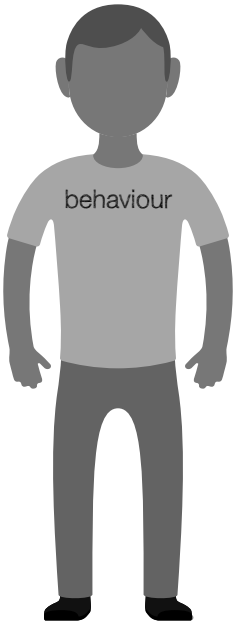
Drug:_____

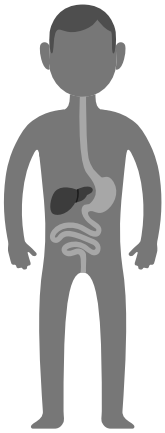

respiratory and reproductive systems

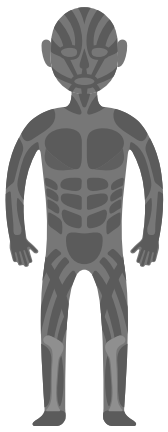

skeletal system


nervous system


circulatory system




digestive system


muscular system

The Atom

LAB LESSON

OBJECTIVES

In this lesson, students will learn about the atom, a brief history of its discovery with special reference to John Dalton, the scientist who developed the modern atomic theory.

SUBJECT CONTENT - CHEMISTRY

Atoms, elements and compounds

- a simple (Dalton) atomic model

KEYWORDS

atomic theory, atoms, Dalton, electron, elements, neutron, proton, subatomic particles

LESSON PLAN

Activities	Resources
Activity 1: Dalton's Atomic Theory Give out the Dalton's Atomic Theory worksheet and allow time for students to read through the activities. Ask each student pair to research information for Part A. Allow students to share their findings. In pairs, students must create a poster about John Dalton. Showcase the posters in class when students have finished. 25	• Photocopies of the *Dalton's Atomic Theory* worksheet • Laptops
Activity 2: Deconstructing the Atom Give out the *Deconstructing the Atom* worksheet to students. Play Chapters 2 and 3 of the video and ask students to complete the worksheet. Allow students to share their answers with their partners. 15	• Photocopies of the *Deconstructing the Atom* worksheet • ClickView video: *What Are Atoms Made of?* Chapter 2 Chapter 3
Activity 3: Making Edible Atoms Divide students into groups of 4 and give out the *Making Edible Atoms* worksheet. Provide the materials to each group and ask students to complete their models. Remind students to take a picture of their models with a camera. 20	• Photocopies of the *Making Edible Atoms* worksheet • For each group of 4: a packet of multicoloured sweets, camera • Periodic table

ANSWERS

Dalton's Atomic Theory

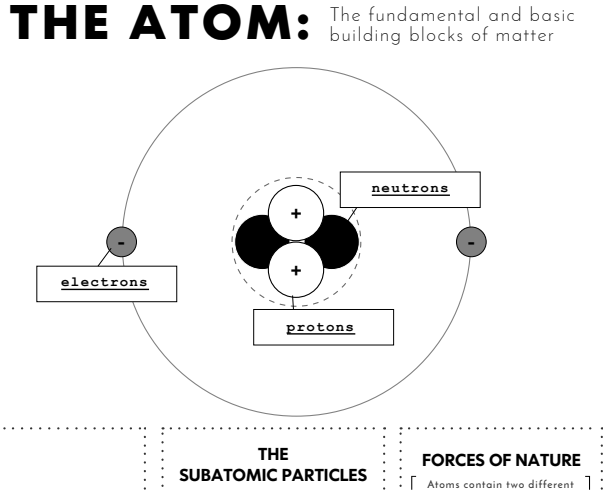
Part A:

Students' answers may vary depending on the source (between 3-5 conclusions).

Possible answers

1. Everything is made of atoms
2. Atoms are indivisible and cannot be destroyed.
3. All atoms of a given element are identical.
4. Compounds are formed by a combination of two or more different kinds of atoms.
5. A chemical reaction is a rearrangement of atoms in the reactant and product components.

Deconstructing the Atom



Making Edible Atoms

Helium atom

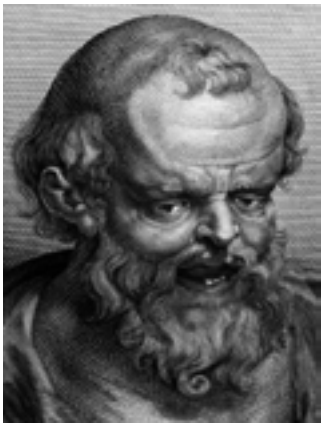
Number of protons:	2
Number of electrons:	2
Number of neutrons:	2

Helium atom

Number of protons:	6
Number of electrons:	6
Number of neutrons:	6

CHEMISTRY

Dalton's Atomic Theory



Democritus and John Dalton

Democritus was a Greek philosopher and was credited to be one of the first few, together with his mentor Leucippus, to suggest the existence of the atom. Astonishingly, it wasn't until approximately 2000 years later that a scientist by the name of John Dalton developed the atomic theory to explain all matter in terms of atoms and their properties. The essence of Dalton's theory remains valid in today's world.

Part A: Dalton postulated a number of conclusions for his atomic theory. In your pairs, research the conclusions and write about them below.

John Dalton's Atomic Theory

His Conclusions

Part B: In pairs, research John Dalton and create an A4 poster about him.

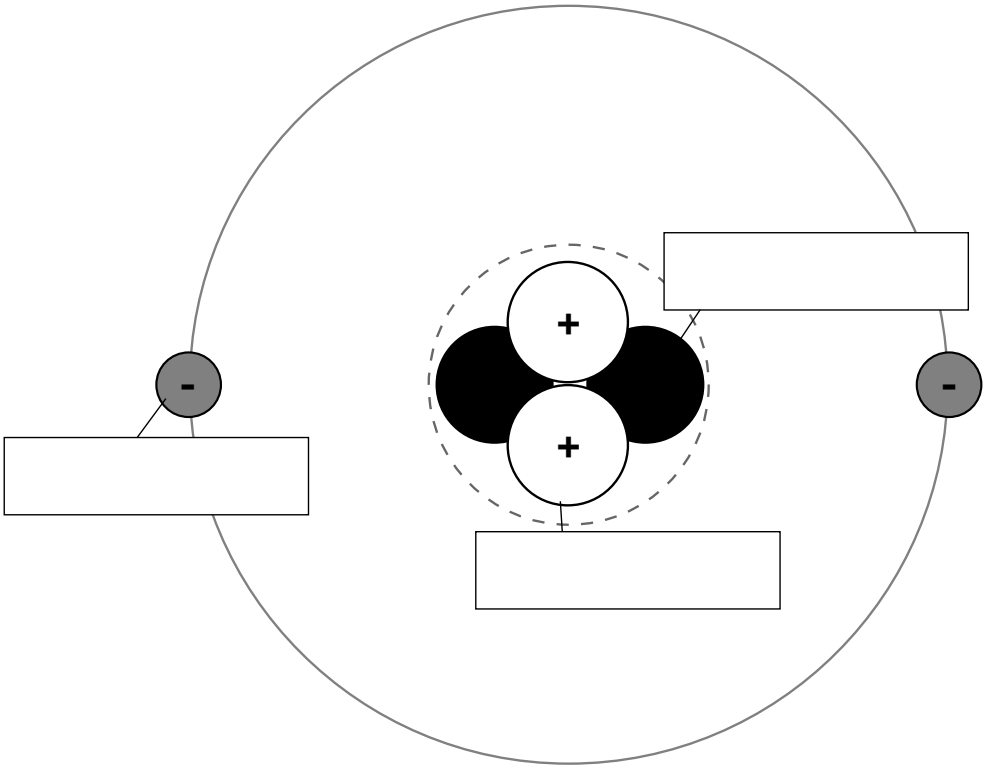
Your poster should include the following:

- his portrait
- the conclusions of his atomic theory
- why Dalton's model was a success and widely accepted
- why it was eventually replaced by the nuclear model

Deconstructing the Atom

Fill in the blank boxes on the poster below with information from the video. Research online for the answers to the 'Forces of Nature' section.

THE ATOM: The fundamental and basic building blocks of matter



CHEMISTRY

> **"Never trust an atom. They make up everything!"**

All matter is made up of tiny, indivisible particles called atoms. The word atom comes from the Greek word "atomos", which means "cannot be divided".

THE SUBATOMIC PARTICLES

An atom contains mainly three types of particles.

form the nucleus

orbit around the nucleus

CHARGE

The subatomic particles each have their own unique charge

FORCES OF NATURE

Atoms contain two different types of force that hold the atom together.

What is Electromagnetic Force?

What is Nuclear Force?

Making Edible Atoms

Materials:

- a packet of sweets (M&Ms or skittles)
- camera

Instructions:

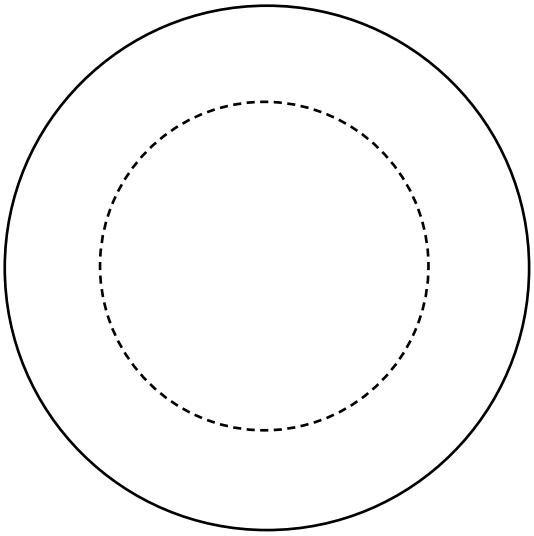
1. In your groups, choose three different coloured sweets, then collect 5 of each colour from the packet. Each colour represents a different subatomic particle.
2. Fill in the key.
3. Use the periodic table to find the number of protons, electrons and neutrons in a hydrogen atom and a helium atom.
4. Represent each on the diagrams below.
5. Take a picture of your atoms when you have finished.
6. Enjoy the sweets!

Key

Sweets' colour	Subatomic particle
	proton
	electron
	neutron

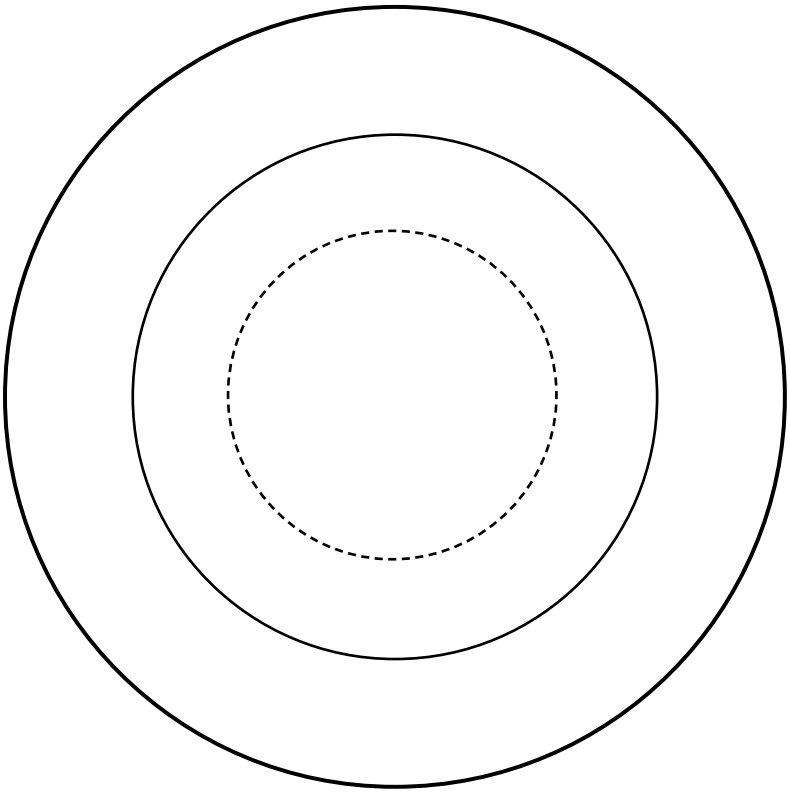
Helium atom

Number of protons:	
Number of electrons:	
Number of neutrons:	



Carbon atom

Number of protons:	
Number of electrons:	
Number of neutrons:	



Pure Substances & Mixtures

OBJECTIVE

In this lesson, students will learn that all matter is classified as either a pure substance or a mixture.

SUBJECT CONTENT - CHEMISTRY

Pure and impure substances

- the concept of a pure substance
- mixtures, including dissolving
- the identification of pure substances

KEYWORDS

compound, element, impure, impurities, mixture, pure

LESSON PLAN

Activities	Resources
Activity 1: What Makes up Our Air? Open the presentation to the first slide and discuss the following question with students: • What makes up our air? Students might not be able to name all of the different gases that make up air, but most should be able to acknowledge that oxygen and carbon dioxide are present. Use the next two slides of the presentation to reiterate the fact that air is a mixture of gases and not a pure substance. 10	• Presentation: Pure Substances and Mixtures
Activity 2: Pure Substances vs. Mixtures Play Chapters 1 and 3 of the video and encourage students to take notes. By the end of the video, students should have developed an understanding of some of the features of pure substances and mixtures. Using the remaining slides of the presentation, discuss the key features of pure substances and mixtures and how their particles differ in terms of: - types of particles present - the two possible kinds of pure substances (elements and compounds) 15	• ClickView video: *Types of Pure Substances, Solutions and Mixtures* Chapter 1 Chapter 3 • Presentation: Pure Substances and Mixtures
Activity 3: Classify Them! Give out the *Classify Them! 1 and 2* worksheets and have students work in pairs to complete the cut-and-paste activity. Students can paste their work on a blank sheet of paper or in their notebooks. Once students have completed the worksheets, encourage them to share their classifications from the Classify Them! 2 worksheet. 25	• Photocopies of the *Classify Them! 1 and 2* worksheets • For each group of students: Scissors, glue, blank sheets of paper/notebooks
Activity 4: Is It True or False? Give out the *Is It True or False?* worksheet to each student pair. Ask them to cut the worksheet in half. Have students do the worksheet individually to assess their understanding of the topics taught. 10	• Photocopies of the *Is It True or False?* worksheet

ANSWERS

Classify Them!

Example	Pure Substance		Mixture	If it is a mixture, what different components does it contain?
	Element	Compound		
Chocolate chip ice-cream			✓	cream, milk, sugar, chocolate flavouring, chocolate chips
Sugar		✓		
Strawberry jam			✓	sugar, strawberries, pectin, citric acid
Mercury	✓			
Air			✓	water vapour, nitrogen, oxygen, argon, carbon dioxide
Cake			✓	flour, eggs, milk, butter, sugar
Diamond	✓			
Water		✓		
Helium	✓			
Neon	✓			
Salt water			✓	salt, water
Baking soda		✓		
Gold	✓			
Salt		✓		
Sand			✓	silicon dioxide with other rocks and minerals

Is It True or False?

	Statement	True	False
1	Air is a mixture of several gases.	✓	
2	Water collected from the ocean is a pure substance.		✓
3	A pure substance contains more than one kind of particle.		✓
4	Vegetable soup is a mixture.	✓	
5	An element is a pure substance.	✓	
6	A compound is a mixture.		✓
7	When you combine two different pure substances, it is still a pure substance.		✓

Classify Them! 1

Instructions:

1. Cut out Box A and paste it on the top of a blank sheet of paper or a page in your notebook.
2. Cut out each example in Box B.
3. Decide if each example is a pure substance or a mixture and paste it under the correct heading.
4. Complete the 'Classify Them! 2' Worksheet.

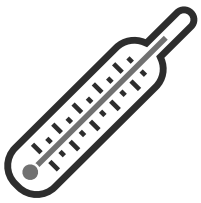
① Box A

MATTER

Pure Substance | **Mixture**

② Box B

cut along this line

Chocolate chip ice-cream 	Helium 	Baking soda 
Sugar 	Neon 	Air 
Strawberry jam 	Salt water 	Gold 
Mercury 	Diamond 	Salt 
Water 	Cake 	Sand 

Classify Them! 2

Decide whether each example is a pure substance or a mixture. Classify them according to the table below. If it is a mixture, list its components.

Example	Pure Substance		Mixture	If it is a mixture, what different components does it contain?
	Element	Compound		
Chocolate chip ice-cream				
Sugar				
Marmite				
Mercury				
Air				
Cake				
Diamond				
Water				
Helium				
Neon				
Salt water				
Baking soda				
Gold				
Salt				
Sand				

Is It True or False?

Indicate whether each statement is true or false.

	Statement	True	False
1	Air is a mixture of several gases.		
2	Water collected from the ocean is a pure substance.		
3	A pure substance contains more than one kind of particle.		
4	Vegetable soup is a mixture.		
5	An element is a pure substance.		
6	A compound is a mixture.		
7	When you combine two different pure substances, it is still a pure substance.		

Indicate whether each statement is true or false.

	Statement	True	False
1	Air is a mixture of several gases.		
2	Water collected from the ocean is a pure substance.		
3	A pure substance contains more than one kind of particle.		
4	Vegetable soup is a mixture.		
5	An element is a pure substance.		
6	A compound is a mixture.		
7	When you combine two different pure substances, it is still a pure substance.		

Types of Mixtures

LAB LESSON

OBJECTIVE

With the help of an experiment, students will learn how to differentiate between homogeneous and heterogeneous mixtures.

SUBJECT CONTENT - CHEMISTRY

Pure and impure substances

- the concept of a pure substance
- mixtures, including dissolving

KEYWORDS

compound, element, heterogeneous, homogeneous, impure, impurities, mixture, pure

LESSON PLAN

Activities	Resources
Activity 1: How Is Matter Classified? Open the presentation to the second slide and review concepts taught in the previous lesson by asking students the following question: • How is matter classified? (Pure substances and mixtures) Use the question found on slide 3 to assess students' understanding of mixtures. 5	• Presentation: Types of Mixtures
Activity 2: Let's Make Some Mixtures Give out the *Let's Make Some Mixtures 1 and 2* worksheets and divide students into groups. Briefly go through the instructions before allowing them to work through the investigations. 30	• Photocopies of the *Let's Make Some Mixtures 1 and 2* worksheets • For each group of 3: Sugar, iron filings, carbon dioxide, oil, water, sand, flour • For each group of 3: 3 test tubes, straw, stirrer, paper towel, teaspoon
Activity 3: Is It Homogeneous or Heterogeneous? Before reviewing the answers for Activity 1, give out the *All about Mixtures* worksheet and play the video. The video will introduce students to the two different types of mixtures: homogeneous and heterogeneous. Ask them complete the worksheet after watching the video. Review all answers as a class with slide 5 of the presentation. 25	• Photocopies of the *All about Mixtures* worksheet • ClickView video: *Mixtures* • Presentation: Types of Mixtures

ANSWERS

Let's Make Some Mixtures 2

Test	What kind of mixture is this?	Can you see the individual components of each substance?	♠
A	solid-solid mixture	yes	heterogeneous
B	solid-liquid mixture	no	homogeneous
C	gas-liquid mixture	no	homogeneous
D	solid-liquid mixture	yes	heterogeneous
E	solid-liquid mixture	yes	heterogeneous
F	solid-liquid mixture	yes	heterogeneous
G	liquid-liquid mixture	no	heterogeneous

All about Mixtures

1. A homogeneous mixture is a mixture that does not allow you to see the individual particles easily as it has a uniform composition.

   A heterogeneous mixture is a mixture that is composed of particles that are not uniform in composition and can be seen easily.

2. Refer to table above.

3. a) 4
   b) 2
   c) 1
   d) 1
   e) 4
   f) 1
   g) 5
   h) 2

4. SOLUTION

5. Possible answers:

Homogeneous mixture	apple juice, coffee, gravy
Heterogeneous mixture	cereal with milk, trail mix, muesli, salad, oil in water

CHEMISTRY

Let's Make Some Mixtures 1

Materials required:

Substances:

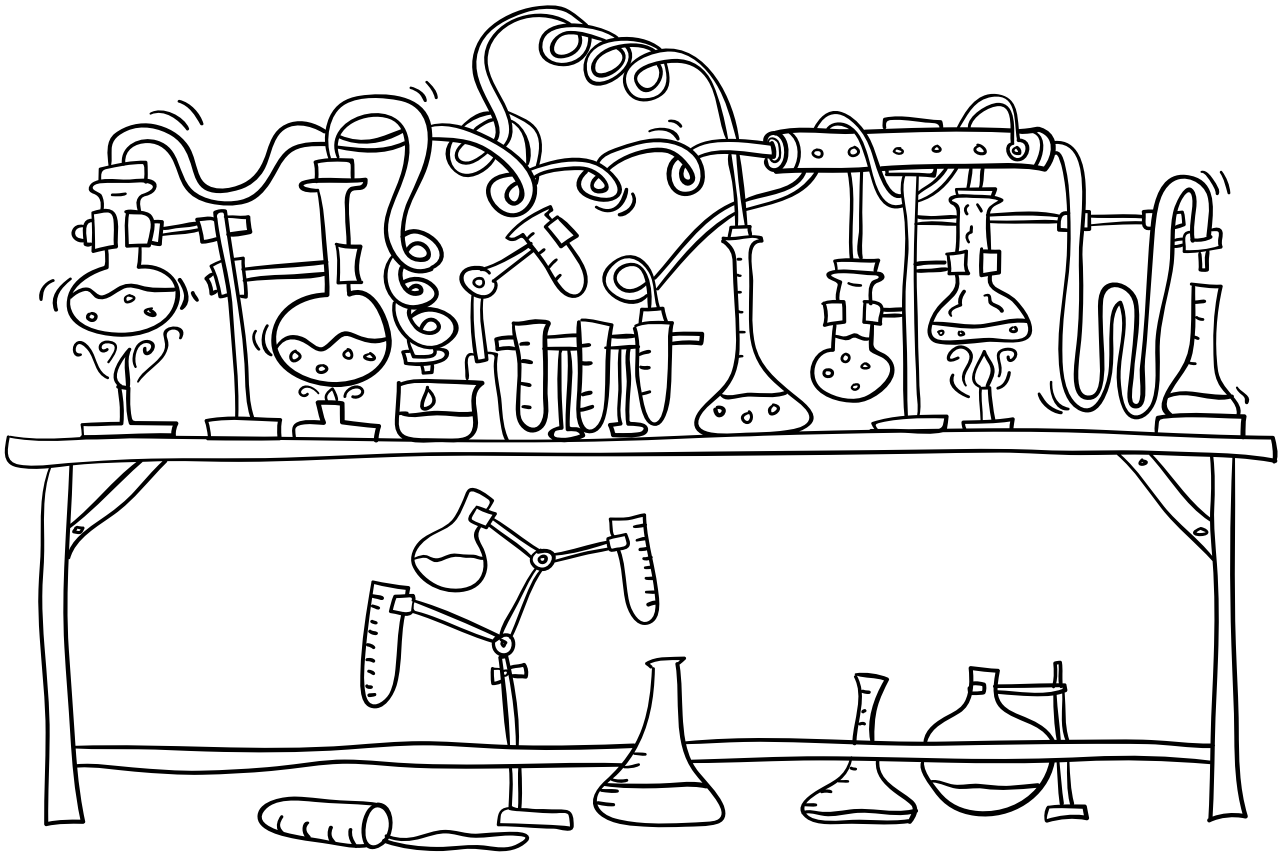
- sugar
- iron filings
- carbon dioxide
- oil (any type)
- tap water
- sand
- flour

Equipment:

- 3 x 15 mL test tubes
- straw (for blowing carbon dioxide)
- stirrer
- paper towel
- teaspoon

Instructions:

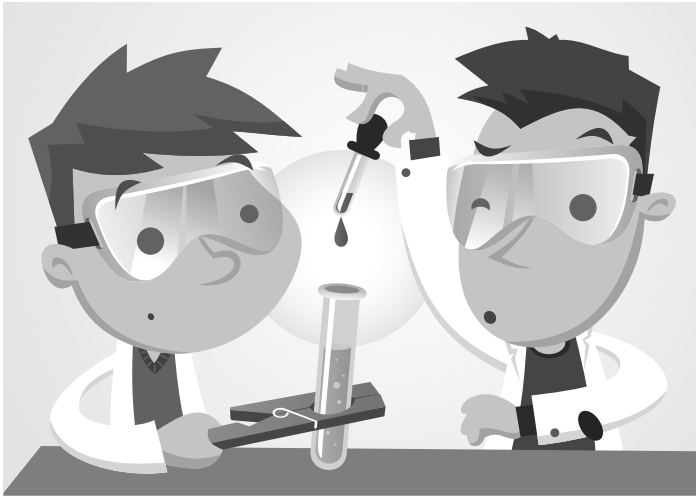
1. Complete Test A by mixing half a teaspoon of sugar with half a teaspoon of iron filings in a test tube. Use the stirrer to combine well.
2. Record your observations by completing the table found on the Let's Make Mixtures 2 worksheet.
3. Empty the contents of the test tube into the sink before rinsing and drying it with the paper towel.
4. Complete Tests B-G using the same method described above.



Let's Make Some Mixtures 2

Complete Tests A-H by mixing substance 1 with substance 2 in a test tube. Fill in the table with your observations and results.

Test	Substance 1	Substance 2	What kind of mixture is this? (solid-solid, solid-liquid, etc.)	Can you see the individual components of each substance?	♠
A	½ tsp. sugar	½ tsp. iron filings			
B	½ tsp. sugar	10 mL tap water			
C	Carbon dioxide	10 mL tap water			
D	½ tsp. iron filings	10 mL tap water			
E	½ tsp. sand	10 mL tap water			
F	½ tsp. flour	10 mL tap water			
G	2 mL oil	10 mL tap water			



All about Mixtures

Questions and Discussion

1. Complete the sentences using your own words.

A **homogeneous** mixture is a mixture that _____

_____

A **heterogeneous** mixture is a mixture that _____

_____

2. In the last column of the table (♠) in the 'Let's Make Some Mixtures 2' worksheet, state whether the mixture is a heterogeneous or homogeneous mixture.
3. By referring to your results from the experiment, indicate the correct answer to each question by shading the correct box. The first question has been answered for you.

a) How many different solid substances were used in total?	5 B	4 O
b) How many different liquid substances were used in total?	2 L	1 B
c) How many different gas substances were used in total?	0 C	1 S
d) How many solid-solid mixtures were formed?	1 U	3 Z
e) How many solid-liquid mixtures were formed?	3 R	4 O
f) How many liquid-liquid mixtures were formed?	1 T	2 P
g) How many heterogeneous mixtures were formed?	6 J	5 I
h) How many homogeneous mixtures were formed?	2 N	3 G

4. Use the letters found next to your answers above to complete the sentence below. Hint: the letters are not in the order they will be used.

A HOMOGENEOUS MIXTURE IS ALSO KNOWN AS A:

5. Write two examples of homogeneous and heterogeneous mixtures you see in your daily lives.

Homogeneous mixture	
Heterogeneous mixture	

Solutions

LAB LESSON

OBJECTIVE

In this lesson, students will learn to identify the solvent and solute in solutions. They will begin to use words such as diluted, concentrated and concentration.

SUBJECT CONTENT - CHEMISTRY

Pure and impure substances

- the concept of a pure substance
- mixtures, including dissolving

KEYWORDS

compound, element, homogeneous, heterogeneous, impure, impurities, mixture, pure, solution

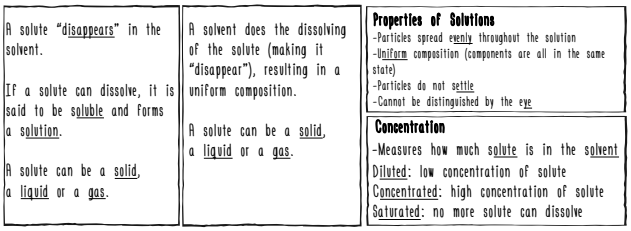
LESSON PLAN

Activities	Resources
Activity 1: Homogeneous Solutions vs. Heterogeneous Solutions Start the lesson by posing and discussing the following questions: • What is the difference between homogenous and heterogenous mixtures? • What are some examples of each that you encounter in your daily life? Link the questions to this lesson's topic on solutions, otherwise known as homogeneous mixtures. 5	
Activity 2: The World of Solutions Give out the *The World of Solutions* worksheet. Note that the answers are found in both the video and the presentation. Use the first 4 slides of the presentation to explain key concepts of solutions, and allow students to fill in the worksheet as much as possible. Play the video and ask students to complete the worksheet. Go through the answers with the students. Open the presentation to slide 5 and have students complete the task as a class. 20	• Photocopies of the *The World of Solutions* worksheet • Presentation: Solutions • ClickView video: *Solutions*
Activity 3: Fireworks in a Beaker Give out the *Fireworks in a Beaker* worksheet. Separate students into groups of 3-4 and read the instructions aloud. Allow approximately 20 minutes for students to complete the experiment and answer the questions. Discuss answers as a class. 20	• Photocopies of the *Fireworks in a Beaker* worksheet • For each group of 3-4: 50 mL of oil, small beaker (approx. 100 mL), food colouring, toothpick, large beaker (approx. 500 mL), warm tap water
Activity 4: Bingo Mate! Give out the *Bingo Mate!* worksheet and explain the rules below. Open the presentation to the first slide to provide hints if students cannot think of the answers. Rules of Bingo Mate!: • Students are to approach 9 other students to answer a question each • Whoever gets all of the questions correct wins 15	• Photocopies of the *Bingo Mate!* worksheet • Presentation: Solutions

ANSWERS

The World of Solutions

1. When a solute is added into a solvent, it forms a solution or homogeneous mixture.



2. a) concentrated
   b) diluted
3. sugar: solute
   water: solvent

Fireworks in a Beaker

1. Suggested answer:
   When the food colouring was stirred into the oil, the food colouring droplets separated into smaller droplets. As oil does not dissolve in water, the oil-food colouring mixture floated on top of the water when it was added. The coloured droplets sank to the bottom of the oil and they mixed with the water, causing bursts of colours. The food colouring dissolved in water but not in oil.
2. oil, water;
   food colouring, water
3. water; food colouring

Bingo Mate!

Possible answer:

solvent solute	less	It measures how much solute is in the solution
homogeneous	It dissolves the solute	salt solution
The substance that a solvent can dissolve	A saturated solution	Particles: • have uniform composition • are evenly distributed • do not settle

CHEMISTRY

The World of Solutions

Use the presentation and the ClickView video to complete this worksheet.

1. Fill in the missing words.

When a s_____  is added into a s_____  , it forms a solution or 

h_____

m_____.

A solute "d_____" in the solvent.

If a solute can dissolve, it is said to be s_____ and forms a s_____.

A solute can be a _____, a _____ or a ___.

A solvent does the dissolving of the solute (making it "disappear"), resulting in a uniform composition.

A solvent can be a _____, a _____ or a ___.

Properties of solutions

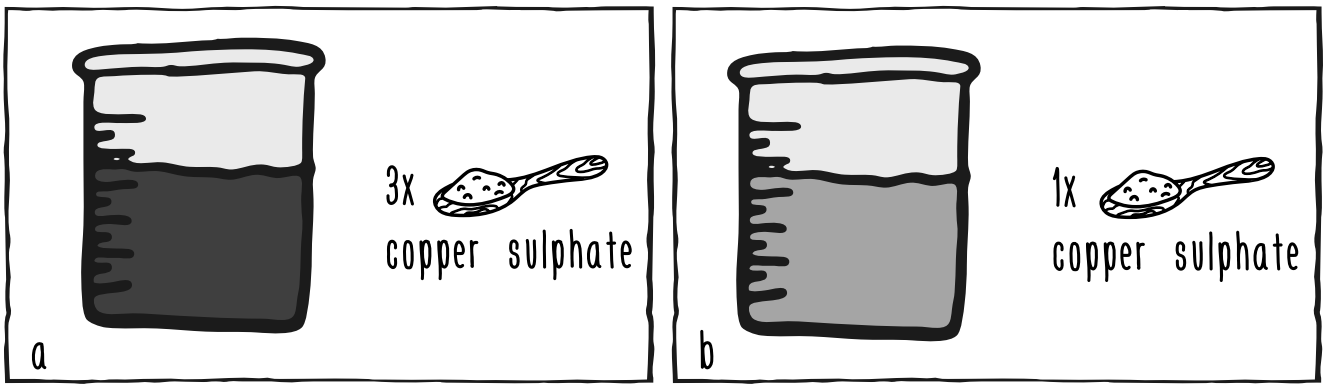
-Particles spread e_____ throughout the solution
-U_____ composition (components are all in the same state)
-Particles do not s_____
-Cannot be distinguished by the e__

Concentration

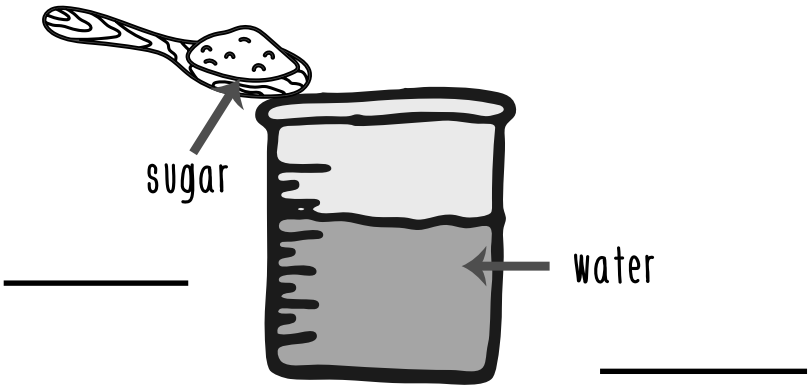
-Measures how much s_____ is in the s_____

D_____: low concentration of solute
C_____: high concentration of solute
S_____: no more solute can dissolve

2. Label the solutions below as diluted or concentrated.



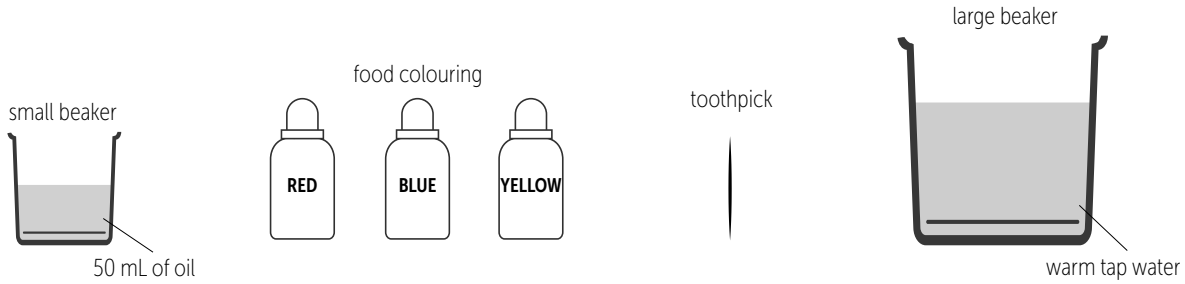
3. Label the solvent and solute in the diagram below.



CHEMISTRY

Fireworks in a Beaker

Materials:



- 50 mL of oil
- small beaker (approx. 100 mL)
- red, blue and yellow food colouring
- toothpick
- large beaker (approx. 500 mL)
- warm tap water

Method:

1. Pour 50 mL of oil into the small beaker.
2. Add three drops of each food colouring into the small beaker.
3. Stir the mixture well with the toothpick.
4. Fill the large beaker ¾ full with warm tap water.
5. Pour the contents of the small beaker into the large beaker.
6. Observe what happens.

Observations

1. Describe what happened in the large beaker.

_____

_____

_____

_____

Questions

2. A heterogeneous mixture and a homogeneous mixture were formed during this experiment. Use words from the box below to describe which two components made up each mixture.

water	oil	food colouring

Heterogeneous mixture: _____ and _____

Homogeneous mixture: _____ and _____

3. Which substance was the solvent and solute in the homogeneous mixture?

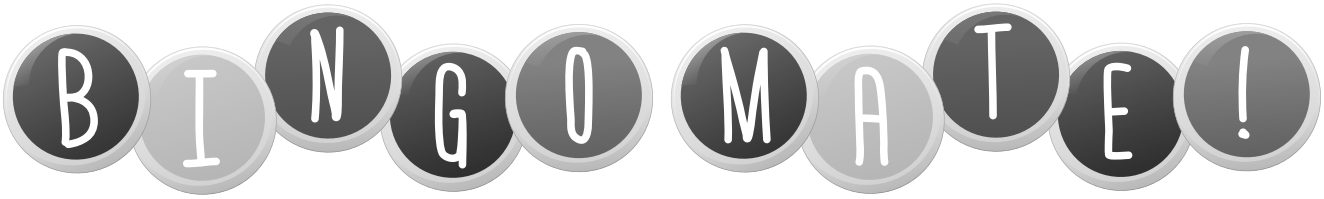
Solvent: _____

Solute: _____

CHEMISTRY

Bingo Mate!

Instructions:
Approach 9 different classmates and have each of them answer a question below. The first person in the class to get all boxes answered correctly WINS!



Name the components that make up a solution. Answer: Name:	A diluted solution has ____ solute than a concentrated solution. Answer: Name:	What does concentration measure? Answer: Name:
What type of mixture is a solution also known as? Answer: Name:	What does a solvent do? Answer: Name:	Name an example of a solution. Answer: Name:
What is a solute? Answer: Name:	What do you call a solution when it is not able to dissolve any extra solute? Answer: Name:	What is one characteristic of a solution? Answer: Name:

Chromatography

LAB LESSON

OBJECTIVE

Students will learn how to apply the technique of chromatography to solve a fictional crime.

SUBJECT CONTENT - CHEMISTRY

Pure and impure substances

- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography
- the identification of pure substances

KEYWORDS

chromatogram, chromatography, impure, mixture, pure

LESSON PLAN

Activities	Resources
Before the lesson, choose one black marker pen to be used as the culprit's pen in Activity 2. You will need to conduct chromatography on the pen before the lesson begins.	• Chosen black marker pen • Filter paper
Activity 1: Ink and Chromatography Open the presentation to the first three slides. Give out the *Ink and Chromatography* worksheet and ask students students to complete Part A. Play the video to students and ask students to complete Part B of the worksheet. The video demonstrates how chromatography is conducted. Encourage students to research on the Internet for their answers. 10	• Presentation: Chromatography • Photocopies of the *Ink and Chromatography* worksheet • ClickView video: *Chromatography* • Laptops (if students do not have their own, conduct this lesson in a computer lab)
Activity 2: Who Kidnapped Kevin Bacon? Open the presentation and show the first 4 slides. Introduce *The Curious Case of Kevin Bacon*. This is a fictional crime for students to solve using chromatography. Give out the *Who Kidnapped Kevin Bacon?* worksheets and divide students into groups of 3. Briefly go through the instructions as a class. Walk around and check on the experiments. Remind students to make sure that only the tip of the filter paper touches the solution. Review the results as a class and conduct a discussion about the advantages and disadvantages of chromatography. 50	• Presentation: Chromatography • Photocopies of the *Who Kidnapped Kevin Bacon?* worksheets • For each group of 3: A 12 cm x 10 cm sheet of filter paper • 4 different brand black marker pens labelled 1, 2, 3 and 4 (two permanent and two non-permanent pens) • Salt water solution (for every 3 cups of water, add ⅛ teaspoon of salt and stir until completely dissolved) • Chromatogram prepared before class

ANSWERS

Ink and Chromatography

Part A:

Question	Answers
1. What kind of mixture is an ink that is make up of a combination of coloured dyes? Circle your answer.	c) liquid-liquid
2. Why do you think it's difficult to separate the different dyes in an ink? Circle your answer.	a) The liquid dyes are miscible (can be mixed).

Part B:

Question	Answers
1. How does chromatography separate inks and dyes?	Suggested answer: Chromatography is able to separate inks and dyes as different dye colours are carried up filter paper to different distances. This capillary action is due to their different solubilities. The higher the solubility, the further the component will travel up the filter paper.
2. After learning how chromatography works, can you think of some possible uses of chromatography?	Possible answer: Chromatography can be used to separate colour additives in food, to test for banned or illegal substances in urine and in forensic testing.

Who Kidnapped Kevin Bacon?

1. Students' answers may vary.
2. Students' answers may vary.
3. Students' answers may vary.
4. Possible answer:
   Not all black pens use the same ink, companies may buy their inks from different manufacturers and the inks may consist of different dyes of different colours.

CHEMISTRY

Ink and Chromatography

Part A: Ink

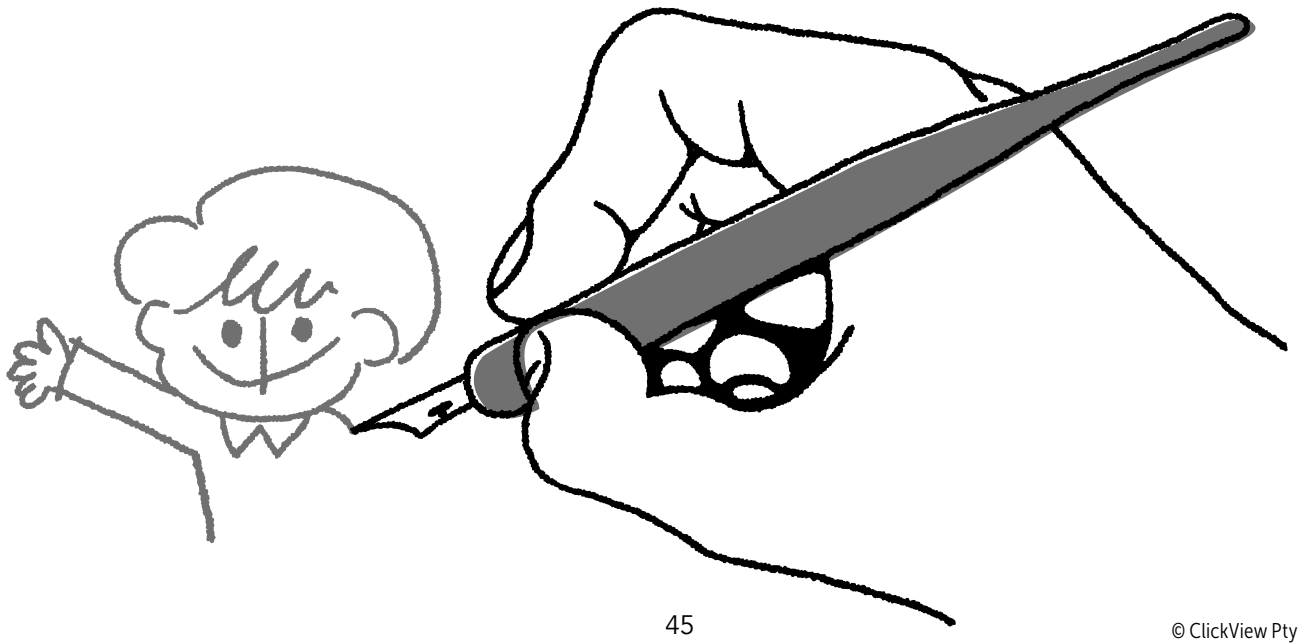
Have you ever wondered what the ink in pens consists of? Are all inks in different black pens the same? No! If you have two different black pens, one might be made up of a pure black dye and the other might be made up of a mixture of coloured dyes that appear black.

Question	Answers
1. What kind of mixture is an ink that is made up of a combination of coloured dyes? Circle your answer.	a) solid-solid b) solid-liquid c) liquid-liquid d) liquid-gas
2. Why do you think it's difficult to separate the different dyes in an ink? Circle your answer.	a) The liquid dyes are miscible (can be mixed). b) The liquid dyes are immiscible (cannot be mixed).

Part B: Chromatography to the Rescue!

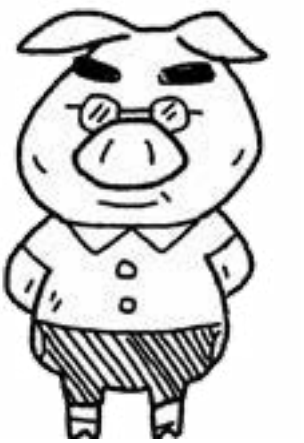
Complete the following questions after watching the video.

Question	Answers
1. How does chromatography separate ink dyes?	
2. After learning how chromatography works, can you think of some possible uses of chromatography?	



Who Kidnapped Kevin Bacon?

You are a forensic scientist investigating the kidnapping of Kevin Bacon. The police have identified a ransom note written with a black marker pen. They have collected a marker from each of the four suspects. The forensic scientists in the laboratory have already conducted a chromatography test on the ransom note. After you have tested the four pens from the suspects, compare it with the original ransom note to determine who the culprit is.



Materials:

- filter paper
- pencil
- 4 different black marker pens labelled 1, 2, 3 and 4
- beaker
- salt water
- straw/chopstick
- sticky tape
- scissors

Let's Predict!

What do you think you will be able to see on the filter paper once the chromatography investigation has concluded?

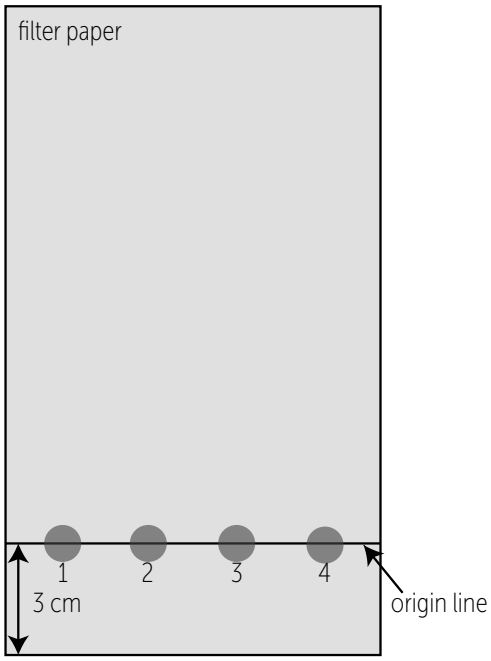
_____

_____

_____

Method:

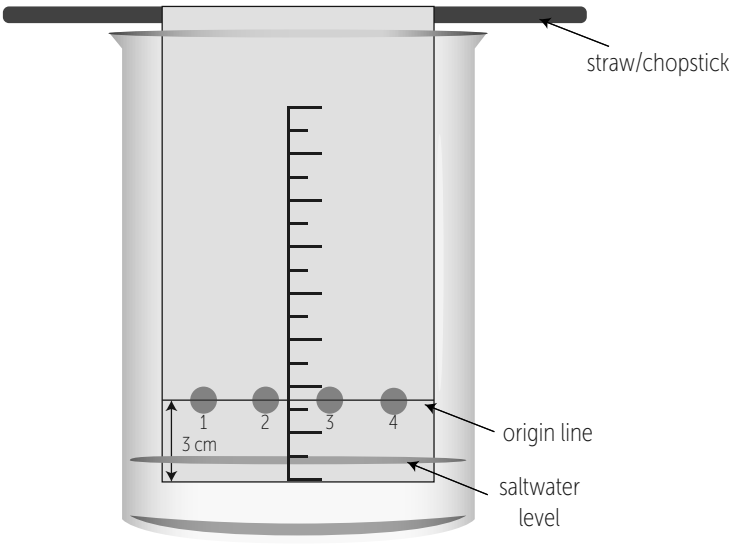
1. Draw a line in pencil 3 cm from the bottom of the filter paper. This is known as the origin line.
2. Use the pencil to write the numbers 1–4 below the origin line, leaving about 1-2 cm between each number.
3. Draw 4 small circles on the origin line using the corresponding pens. Allow the ink circles to dry completely.



CHEMISTRY

Who Kidnapped Kevin Bacon?

4. Add the salt water to the bottom of the beaker, it should reach about 1.5 cm from the bottom.
5. Hang and secure the filter paper with sticky tape over the straw/chopstick, then lower it into the beaker until the tip touches the bottom. Make sure the salt water does not reach the ink circles on the paper.
6. Leave the paper to soak for about 10-15 minutes.
7. Take a picture of your results.
8. Compare your results with the sample obtained from the crime scene to identify who the culprit is.



Questions

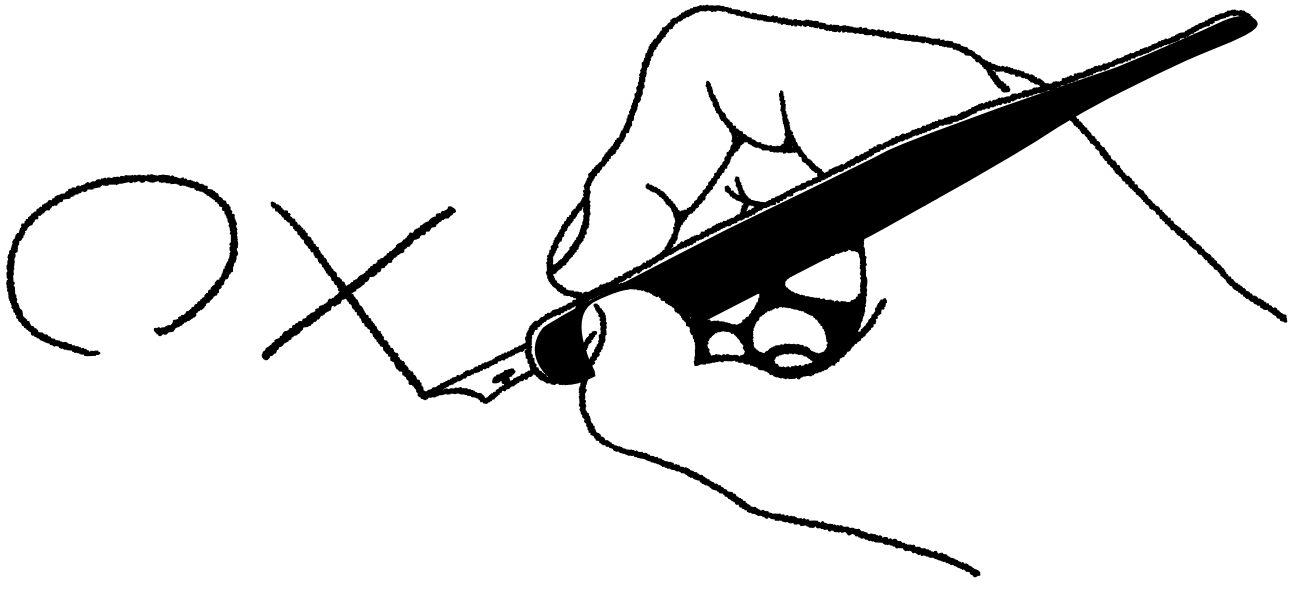
1. The culprit is the owner of pen #_____.
2. Were you able to see a different pattern for each pen? Circle your answer.

   Yes/No
3. Did you see more than one colour in any of the pens? Circle your answer.

   Yes/No
4. Why do you think different patterns of colours were seen even though they were all black pens?

   _____

   _____



CHEMISTRY

Oxidation Reactions

OBJECTIVES

In this lesson, students will learn about oxidation reactions. They will explore oxidation reactions found in our daily lives and conduct an experiment to witness the effects of oxidation.

SUBJECT CONTENT - CHEMISTRY

Chemical reactions

- representing chemical reactions using formulae and using equations
- combustion, thermal decomposition, oxidation and displacement reactions

KEYWORDS

chemical formulae, chemical reaction, combustion, displacement reaction, oxidation, oxidising agent, oxygen, thermal decomposition

LESSON PLAN

Activities	Resources
Activity 1: What Is Happening to My Apple? Give out the *What Is Happening to My Apple?* worksheet to students. Give students some time to complete Part A of the worksheet in pairs. Allow students to share their answers. Engage students in a discussion regarding their past experiences involving oxidation. Give out the materials found in Part B of the worksheet and asks students to complete the experiment in groups of 3. Allow the experiment to stand for 45 minutes while you proceed with the other tasks. 15	• Photocopies of the *What Is Happening to My Apple?* worksheet • For each group of 3: 4 beakers labelled A, B, C and D, 4 apple slices, tongs
Activity 2: The Rancidity in Food Give out the *Rancidity in Food* worksheet to each pair of students. Play Chapter 5 of the video and ask students to complete the worksheet. Review answers. 15	• Photocopies of the *Rancidity in Food* worksheet • ClickView video: *Rancidity in Food*
Activity 3: Oxidation in Our Daily Lives Give out the *Oxidation in Our Daily Lives* worksheet and allow time for students to read through the information. Ask pairs of students to research two other examples of oxidation reactions in their daily lives. Allow time for students to share their answers with the class. 30	• Photocopies of the *Oxidation in Our Daily Lives* worksheet • Laptops
Activity 4: What Is Happening to My Apple? - Continued Ask each group to check on their experiment and give them time to complete Part B of the worksheet. Discuss findings with students. 20	• *What Is Happening to My Apple?* worksheet

ANSWERS

What Is Happening to My Apple?

Part A:

Students' answers may vary.

Part B:

Results: Students' answers may vary.

Note: The apple slices that were dipped in the water and soda should have some browning, but not as much as the control (Beaker A) as the water restricts the amount of oxygen coming in contact with the fruit.

Questions:

1	Beaker A
2	The apple slice in beaker A is the most exposed to the oxygen in air, which quickens the oxidation process.
3	Beaker C
4	Lemon juice contains ascorbic acid, which prevents the oxidation in apples.

Rancidity in Food

1. Food absorbs the moisture and oxygen from the air and starts oxidising. This spoils the food.
2. Food that has spoiled has an unpleasant smell and tastes bad.
3. Airtight containers can slow the process of oxidation down by preventing the food from further being exposed to atmospheric oxygen.
4. As the temperature in the fridge is low, the temperature of the food also decreases which slows down the process of oxidation which causes the spoiling of food.
5. Nitrogen gas is unreactive. In the absence of oxygen, the food does not get oxidised.

Oxidation in Our Daily Lives

Male: Oxidising agent

Female: Substance that is oxidised

Possible answer:

- formation of carbon dioxide
- corrosion of metals

	Example: Burning of candle (combustion)
1.	ethane + oxygen ⟶ carbon dioxide + water
2.	oxygen (from air)
3.	hydrocarbons in candle wax
4.	Yes, it can be prevented. Put a glass jar over the candle to prevent oxygen from reaching the candle. This will stop the candle from burning.

CHEMISTRY

What Is Happening to My Apple?

Part A: What do you see in the picture below? Do you know why and how this happens to an apple? Discuss the question with your partner and write down your thoughts in the box below.

WHAT HAPPENED TO THE APPLE?!

Part B: Save My Apple Slices!

Materials:

- 4 beakers labelled: A, B, C and D,
  - » Beaker A: empty
  - » Beaker B: 200 mL of tap water
  - » Beaker C: 200 mL of lemon juice
  - » Beaker D: 200 mL of coke
- 4 apple slices
- tongs

Instructions:

1. Prepare and label the 4 beakers: A, B, C and D
2. Collect the apple slices from your teacher.
3. Use tongs to place a slice of apple into each of the beakers.
4. Leave to stand for 45 minutes.
5. Record the appearance of the apple before and after 45 minutes and answer the questions.

Results:

	Beaker A	Beaker B	Beaker C	Beaker D
Appearance before putting apple slices into the beaker				
Appearance after 45 minutes				

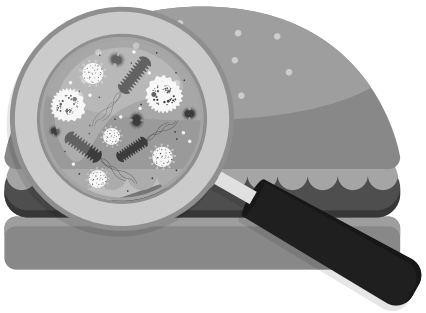
Questions:

	Question	Answer
1	In which beaker did the apple slice change the most in apperance?	
2	Why did the apple slice change the most? (You may research your answer.)	
3	In which beaker did the apple slice change the least?	
4	Why did the apple slice change the least? (You may research your answer.)	

Rancidity in Food

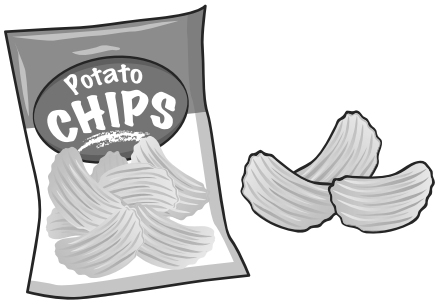
As you watch the video, answer the following questions.

1. Why does food go bad when exposed to air?



2. How do you know food has spoilt?

3. How does storing food in airtight containers help to prevent the onset of rancidity?

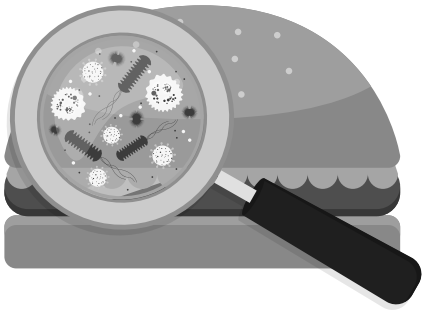


4. How does keeping food in the fridge help to prevent food spoilage?

5. Why is nitrogen gas used to prevent oxidation in pre-packaged foods?

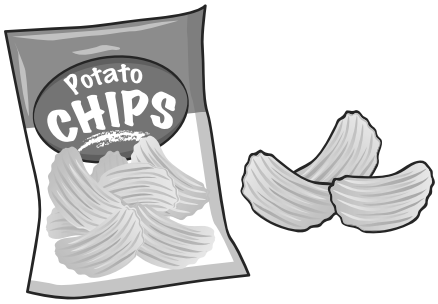
As you watch the video, answer the following questions.

1. Why does food go bad when exposed to air?



2. How do you know food has spoilt?

3. How does storing food in airtight containers help to prevent the onset of rancidity?



4. How does keeping food in the fridge help to prevent food spoilage?

5. Why is nitrogen gas used to prevent oxidation in pre-packaged foods?

Oxidation in Our Daily Lives

-OXIDATION DAILY NEWS-

When we talk about an oxidation reaction, we are referring to the transfer of oxygen from one reactant to another. This is a chemical reaction!

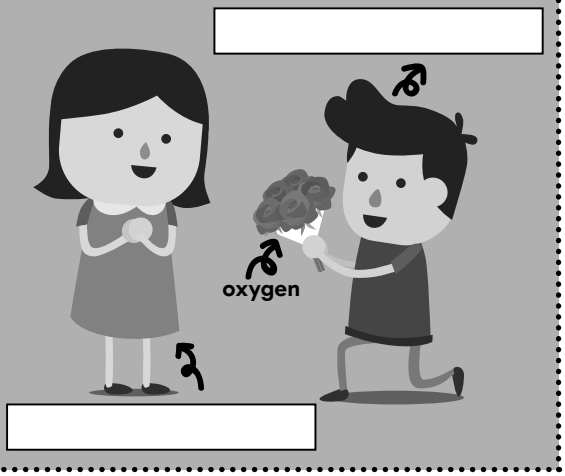
There are two important participants in an oxidation reaction: **the oxidising agent** and **the substance that is oxidised**.

An oxidising agent is the substance, or reactant, that **provides** the oxygen for the reaction to be able to occur. **The substance that is oxidised** is the substance, or reactant, that **receives** the oxygen.

coal + **oxygen** → carbon dioxide + water

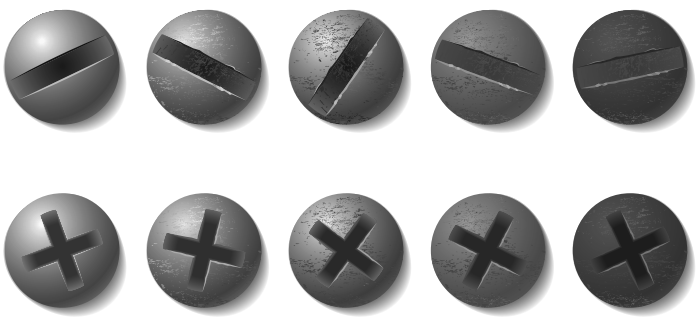
When coal burns in air, it reacts with oxygen to produce carbon dioxide and water. In this reaction, oxygen is **the oxidising agent** and coal is **the substance that is oxidised.**

Look at the picture to the right. If the bouquet of roses represents oxygen, which character is symbolic of the **oxidising agent**? And which character represents **the substance that is oxidised**?



There are many examples of oxidation in our daily lives. Take rancidity in food for example. The oxygen present in the air is the oxidising agent (provides oxygen) while food is the substance that is oxidised (receives oxygen). Research two examples of oxidation online and fill in the table with your findings. An example you can use would be the burning of wood.

	Example 1:	Example 2:
1. Write a word equation and chemical equation (if any) for the oxidation reaction.		
2. Identify the oxidising agent.		
3. Identify the substance that is oxidised.		
4. Can this reaction be prevented? How?		



CHEMISTRY

The Two Types of Waves

LAB LESSON

OBJECTIVES

In this lesson, students will learn about the two different types of waves and their properties.

SUBJECT CONTENT - PHYSICS

Waves

Observed waves

- waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition

Sound waves

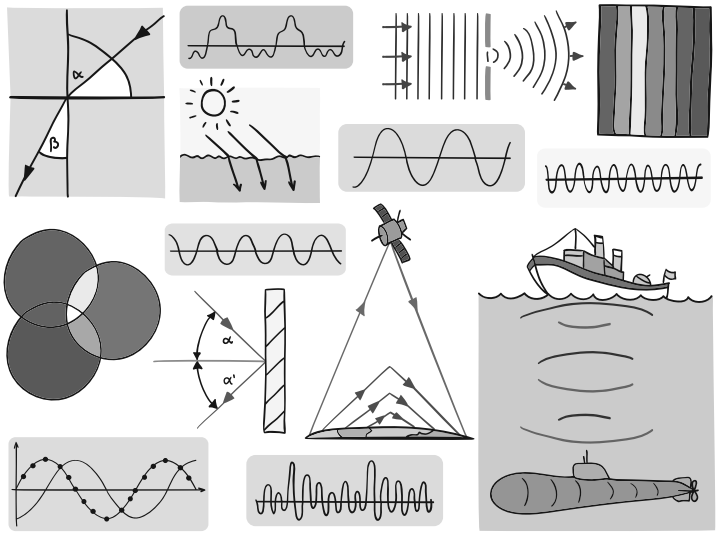
- sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal

KEYWORDS

compression, frequency, hertz, interference longitudinal wave, loudspeaker, microphone, peak, rarefaction, reflection, superposition, transverse wave, trough, vibrations, wave speed, wavelength, waves

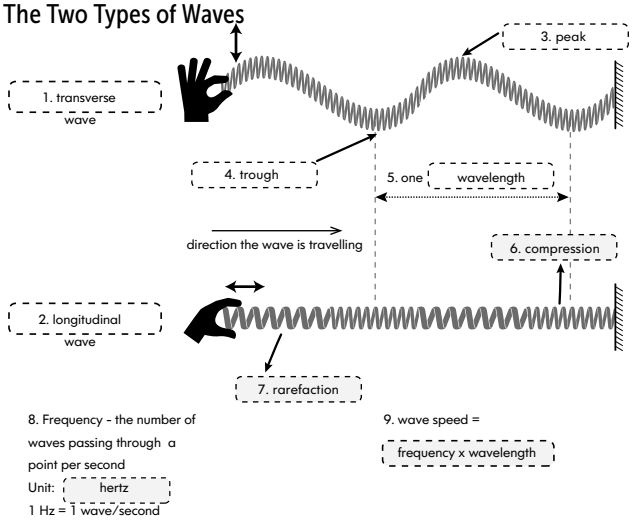
LESSON PLAN

Activity	Resources
Activity 1: The Two Types of Waves Give out *The Two Types of Waves* worksheet to students. Ask students to complete Part A of the worksheet as they watch Chapter 3 of the video. Give time to students to complete the accompanying tasks. Divide students into groups of 3-4 and give out the materials to each group to complete the challenge in Part B. Review the answers with students when they have finished. 45	• Photocopies of *The Two Types of Waves* worksheet • ClickView video: *Light and Sound* Chapter 3 • For each group of 3-4: slinky spring, camera, laptop
Activity 2: Properties of Waves Give out the *Illustrated Guide to Waves* poster and *Properties of Waves* worksheet to students. Ask students to complete the questions of Properties of Waves worksheet with information from the poster. Allow students time to share their answers with the class when they have finished. 25	• Photocopies of the *Illustrated Guide to Waves* poster and *Properties of Waves* worksheet



ANSWERS

The Two Types of Waves



1. Refer to diagram above.
2. 0.056 m (5.6 cm)
3. 0.5 Hz
4. 0.028 m/s

Properties of Waves

1. b
2. Suggested answer:

Transverse waves	Longitudinal waves
microwave radio light	sound earthquake (p-wave) ultrasound earthquake (s-wave)

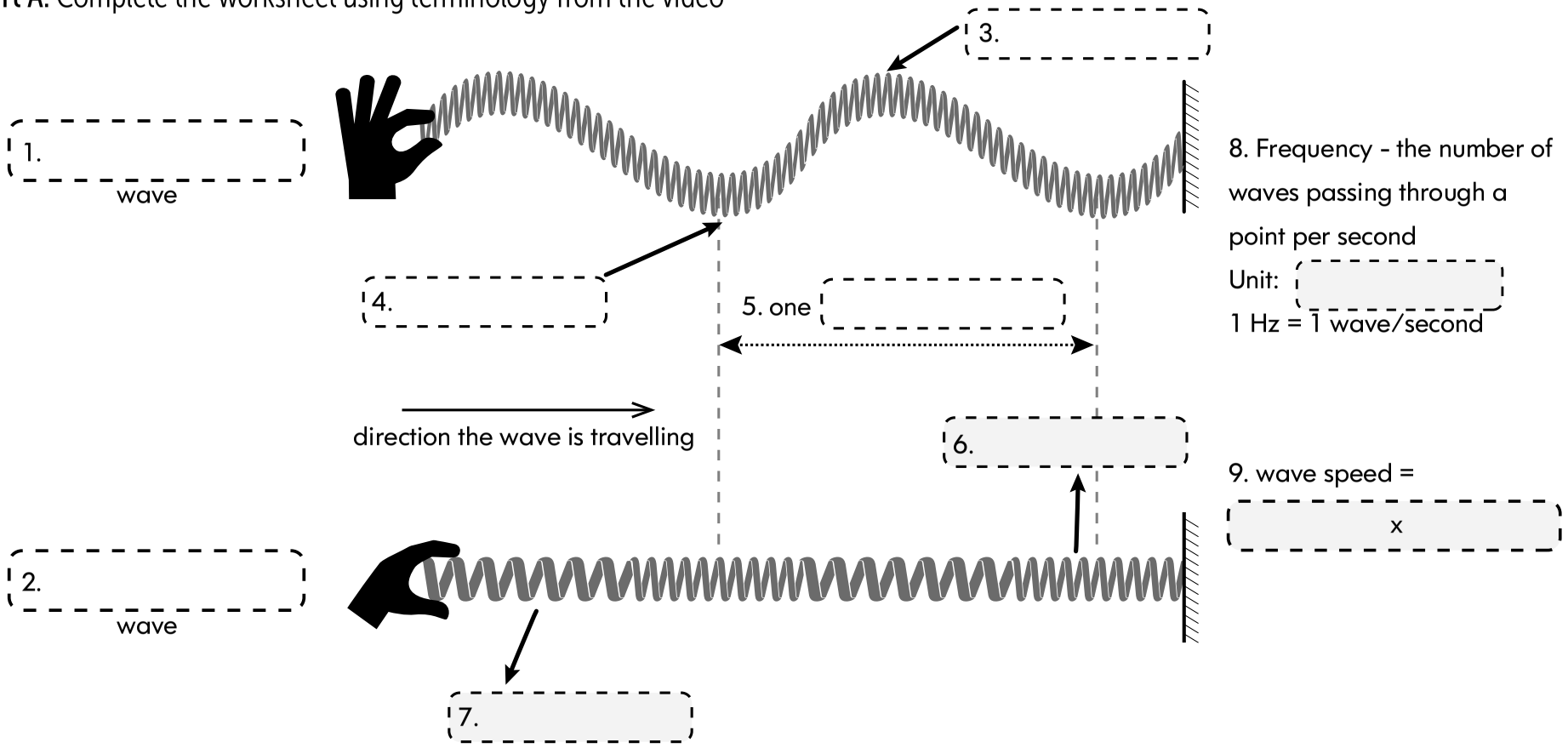
3. Possible answers:

a. The noises heard in the cave are echoes. Echoes are formed when sound waves are reflected from the walls of the caves, back to our ears.

b. Ripples are standing waves as the waves are being continuously reflected superposed. Large ripples indicate that the waves are combining because they are in phase, and therefore forming waves of greater size. Areas with no ripples have waves that are out of phase, cancelling each other out.

PHYSICS

Part A: Complete the worksheet using terminology from the video



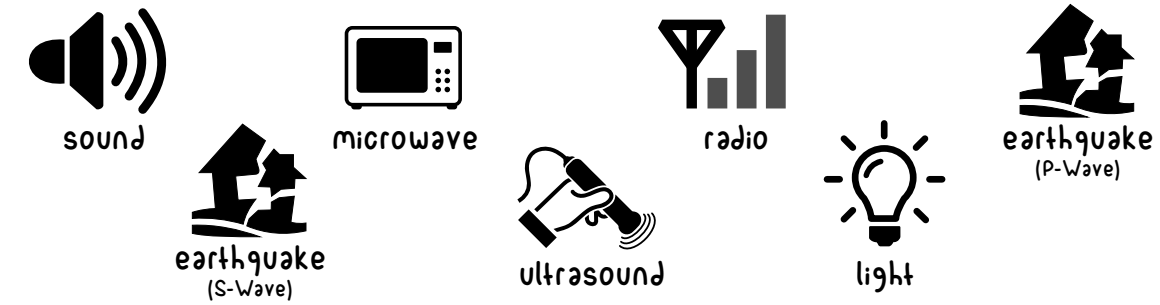
Task 1	Task 2	Task 3	Task 4
Draw arrows to indicate the direction each hand has to move to produce the waves above. **Answer:**	Using a ruler, measure the wavelength of the transverse wave. Express your answer in metres (m). **Answer:**	Two waves are produced every 4 seconds. Calculate the wave's frequency. **Answer:**	What is the wavespeed of the transverse wave? **Answer:**

Part B: Challenge

In your groups, create both transverse and longitudinal waves using the slinky provided. Record a video as you make each wave. Using your laptops, grab a video frame of each wave and label their features. Then, measure the wavelength, wavespeed and frequency of your waves.

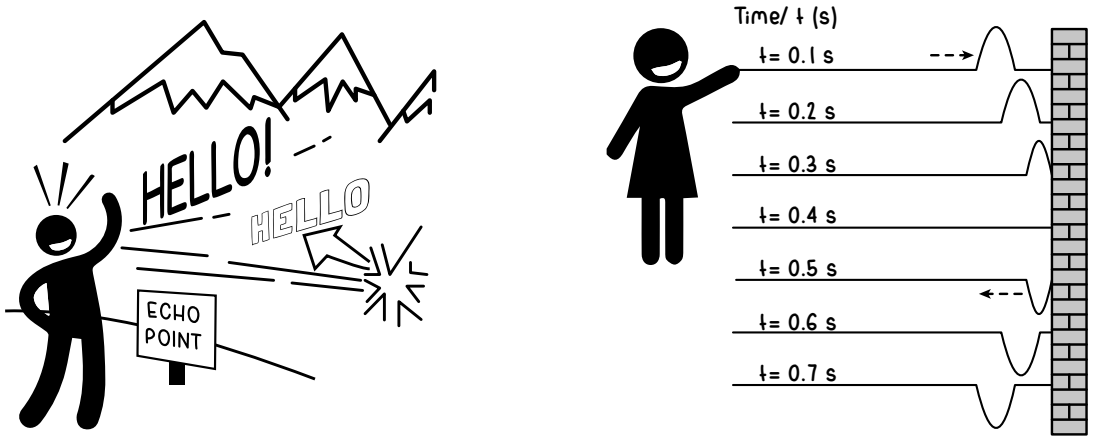
THE ILLUSTRATED GUIDE TO WAVES

WAVES IN OUR DAILY LIVES



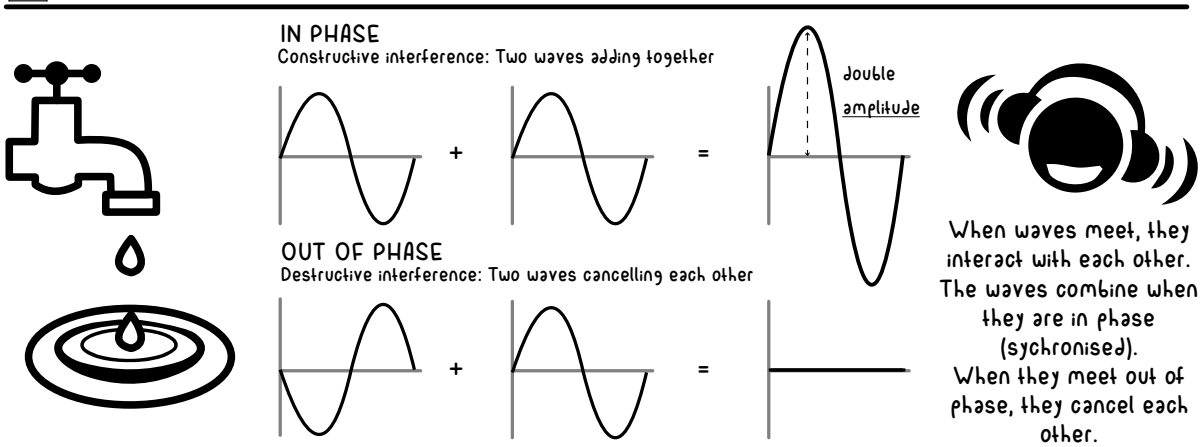
REFLECTION OF WAVES

When waves reach an object, they get reflected and bounce off it. Think of a mirror!



SUPERPOSITION OF WAVES

Waves are overlapping in the same place at the same time



When waves meet, they interact with each other. The waves combine when they are in phase (sychronised). When they meet out of phase, they cancel each other.

PHYSICS

Properties of Waves

Answer the following questions using your own knowledge and the information from the 'Illustrated Guide to Waves' poster. Research terminology if required.

1. Pick the correct set of answers to fit in the blanks.

   If the particle displacement of a wave is perpendicular to the direction the wave is moving, the wave is a _____ wave. If the particle displacement of a wave is parallel to the wave is moving, the wave is a _____ wave.

   a) transverse; transverse
   b) transverse; longitudinal
   c) longitudinal; transverse
   d) longitudinal; longitudinal

2. Waves are everywhere in our daily lives. Research to find out if each of the wave examples on the poster is a transverse or longitudinal wave. Record your findings below. Then search for more examples of waves in your daily lives and record them in the table too.

Transverse waves	Longitudinal waves

3. Explain the following scenarios:

   a. You are chatting with a friend as you walk into a cave. As you walk deeper into the cave, your friend begins to say that he's hearing voices and starts to panic. Using your knowledge of the reflection of waves, explain to him what those voices are, and why he is hearing them.

   b. It's raining! When rain falls, waves can form when raindrops hit the surface of a puddle. The waves often interact with each other, forming ripples of different sizes. Using your knowledge of the superposition of waves, explain why ripples of different sizes can be observed.

PHYSICS

Sound Waves

OBJECTIVES

In this lesson, students will learn about sound waves and their properties.

SUBJECT CONTENT - PHYSICS

Waves

Sound waves

- frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound
- sound needs a medium to travel, the speed of sound in air, in water, in solids
- sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal
- auditory range of humans and animals

KEYWORDS

absorption, amplitude, echoes, frequency, hertz, longitudinal wave, loudness, oscilloscope, pitch, reflect, trachea, vibrations, waves

LESSON PLAN

Activity	Resources
Activity 1: Properties of Sound Waves Give out the *Properties of Sound Waves* worksheet to each pair of students. Ask students to complete the worksheet as they watch Chapter 9 of the video. Review the answers with students when they have finished. 15	• Photocopies of the *Properties of Sound Waves* worksheet • ClickView video: *Light and Sound* Chapter 9
Activity 2: Echoes in Our Daily Lives Give out the *Echoes in Our Daily Lives* worksheet to students. Give time to students to complete the questions. Allow students to share their answers with the class when they have finished. 20	• Photocopies of the *Echoes in Our Daily Lives* worksheet • Laptops
Activity 3: Oscilloscopes and Sound Graphs Play Chapter 10 of the video. Give out the *Oscilloscopes and Sound Graphs* worksheet to students. Ask students to complete the worksheet in groups of 3 after they watch the video. Allow students to peer mark when they are finished. 25	• Photocopies of the *Oscilloscopes and Sound Graphs* worksheet • ClickView video: *Light and Sound* Chapter 10

ANSWERS

Properties of Sound Waves

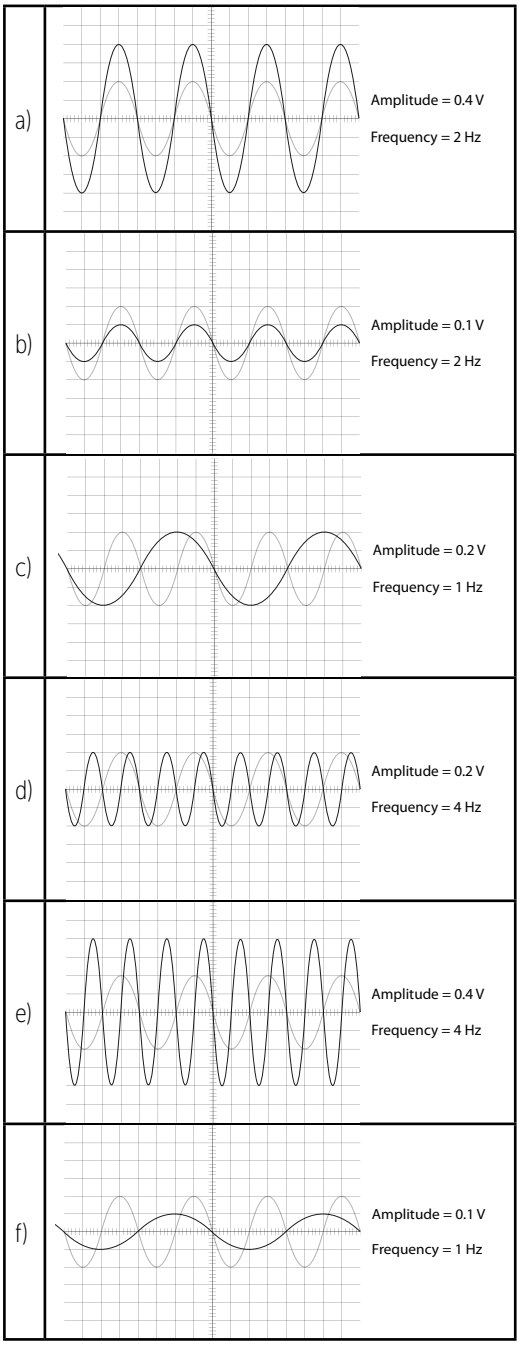
l**o**ngitudinal
v**i**brate
ear**s**, recogni**s**ed, trach**e**a
media
frequen**c**y, **p**itch
ref**l**ected, e**c**h**o**es
Hard, s**o**ft
tight**l**y
oscilloscope

Echoes in Our Daily Lives

1. Speed = (2 x 600)/3.75 = 320 m/s
2. Distance travelled = 1500 x 0.3 = 450 m
   Depth = 450 /2 = 225 m
3. Possible answers:
   Bats use echolation to navigate and to hunt for insects in the dark. Toothed whales use echolation to sense objects when it bounces off the object.

Oscilloscopes and Sound Graphs

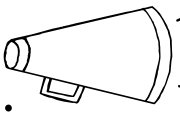
1. 0.2 V
2. 2 waves/sec
3.



PHYSICS

Properties of Sound Waves

Complete this worksheet using information found in the video.



ALL ABOUT SOUND

Sound travels in _____ waves. These waves cause air molecules to _____. We hear because the vibrating air molecules enter our _____ and are _____ by our brain. When we speak, the _____ (wind pipe) vibrates, causing the air passing over our vocal chords to vibrate and create sound.

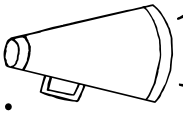
Sounds can move through different _____, such as solids, liquids and gases. Sound does not travel through a medium indefinitely because eventually all of the energy of the vibrating particles is used up. When the _____ changes, the _____ of the sound also changes. A high frequency sound wave produces a high pitch sound. A low frequency results in a low pitch sound.

Sound waves can be _____ and they are known as _____. _____ substances reflect sounds a lot more than _____ substances. Soft substances are ideal sound absorbers, which is why foam is used to soundproof rooms. Sound travels more quickly through liquids than air because particles in a liquid are packed more _____ together.

Rearrange the letters found in the grey boxes above to find out the name of the instrument used to visualise sound waves.

_ _

Complete this worksheet using information found in the video.



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Rearrange the letters found in the grey boxes above to find out the name of the instrument used to visualise sound waves.

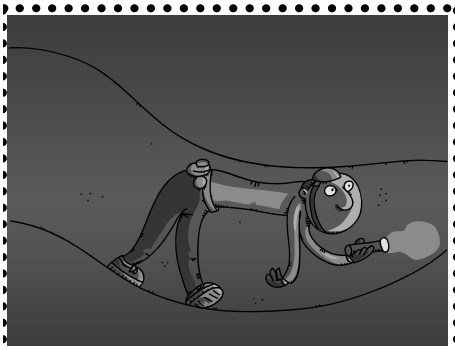
_____

PHYSICS

Echoes in Our Daily Lives

Read the 3 scenarios before answering the questions that follow below.

Scenario #1

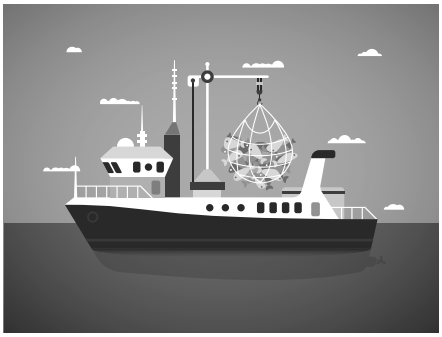


Mike, an avid traveller was walking in a cave 600 m in length. He wanted to know the speed that sound was travelling in that cave so he decided to use his knowledge of echoes. He recorded the time taken for the sound of a clap to be heard again as an echo. The results can be seen in the table below.

Results

Length of cave	600 m
Time to hear clap as an echo	3.75s

Scenario #2

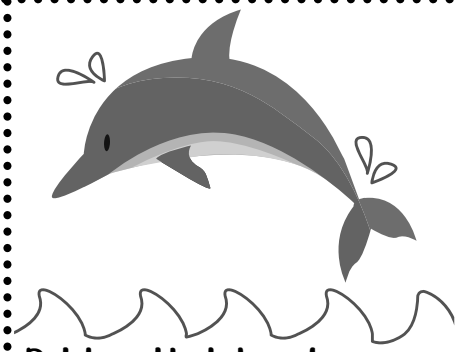


Nathaniel is a fisherman who often depends on echoes to determine the distance of the seabed from his boat. He does this to make sure the boat doesn't get stuck. Sonar systems in boats measure the time taken for echoes to return, the machine calculates distances between objects. The table below shows the time taken for the echo to return.

Results

Speed of sound in the sea	1500 m/s
Time to hear an echo	0.3s

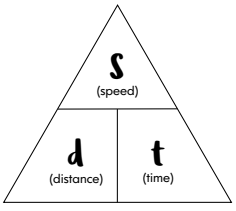
Scenario #3



Dolphins, like bats and some whales, have in-built sonar systems. The characteristic clicks and squeaks that dolphins make are at frequencies too high for human ears to detect. Echolation is used by dolphins when they produce sound waves in order to identify objects and locate food. Dolphins produce sound waves through their nasal passages when the sound waves hit an object they bounce back echo vibrations. Dolphins are able to estimate distance of objects by the time it takes the vibrations to return.

Questions:

$$\text{Speed of sound} = \frac{\text{distance travelled}}{\text{time taken to hear an echo}}$$



1. Calculate the speed sound is travelling in the cave in Scenario #1. (Use the equation given)

2. Calculate the distance of the seabed from Nathaniel's boat in Scenario #2. (Use the equation given)

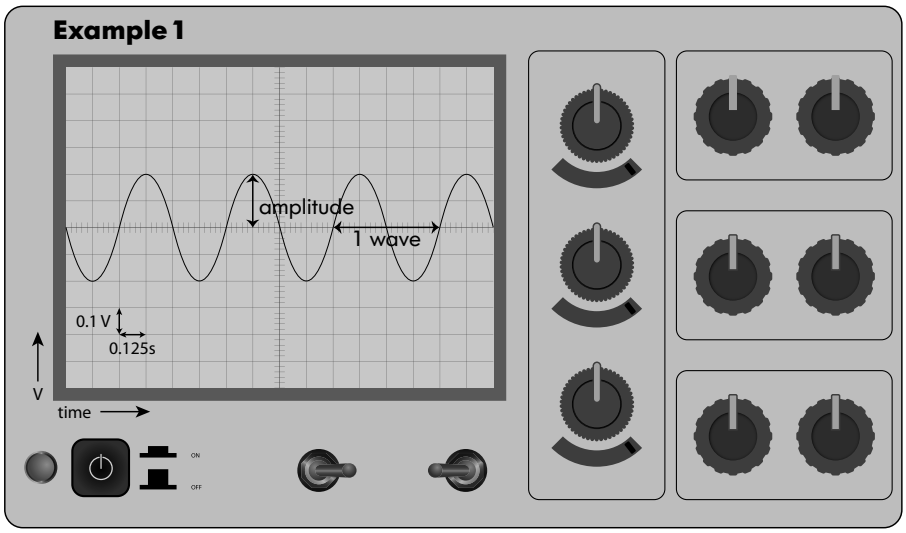
3. Research online to find what and how other animals use echolation in their lives.

PHYSICS

Oscilloscopes and Sound Graphs

After watching the video, use the information below to answer the following questions.

An oscilloscope



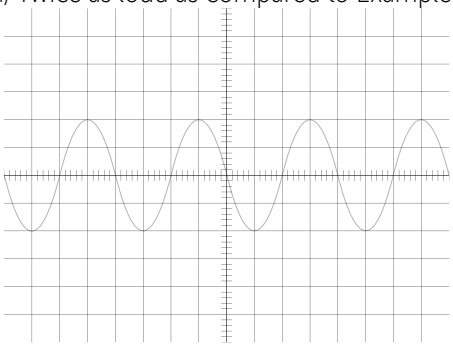
How a sound wave translates onto the graph:

The loudness is shown by the amplitude.
This voltage (V) is used to show loudness.
A louder sound produces a graph with bigger amplitude (higher voltage).

The pitch is represented by the frequency.
Frequency is the number of waves produced in 1 second. It has a unit of hertz (1 Hz = 1 wave/sec)
A sound with a higher pitch produces more waves per second.

1. What is the amplitude of the sound wave shown in Example 1? _____ V
2. How many waves were produced in 1 second? _____ Hz (frequency)
3. In your groups, use the clues to draw sound graphs for the following scenarios.

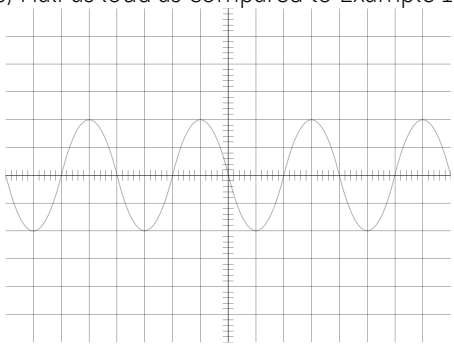
a) Twice as loud as compared to Example 1



Amplitude =

Frequency =

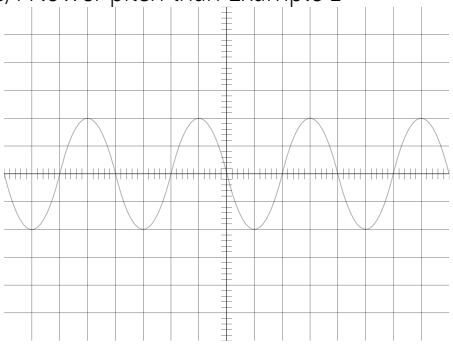
b) Half as loud as compared to Example 1



Amplitude =

Frequency =

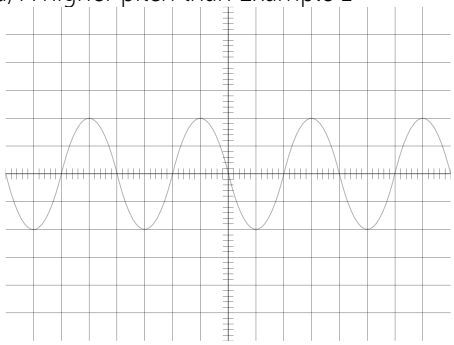
c) A lower pitch than Example 1



Amplitude =

Frequency =

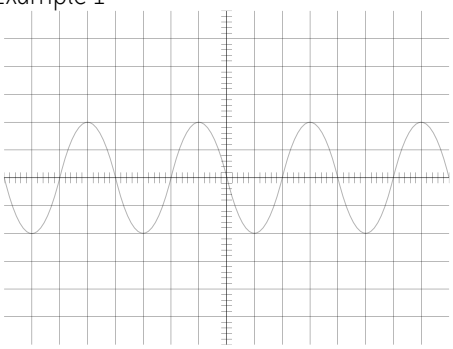
d) A higher pitch than Example 1



Amplitude =

Frequency =

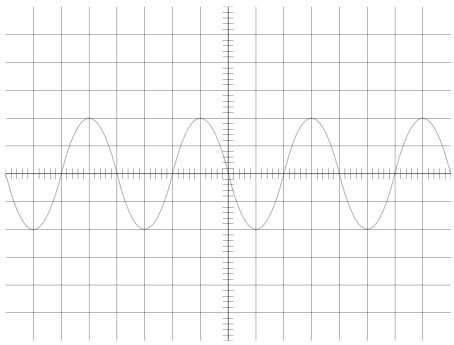
e) Twice as loud, and a higher pitch compared to Example 1



Amplitude =

Frequency =

f) Half as loud, and a lower pitch compared to Example 1



Amplitude =

Frequency =

PHYSICS

Light Waves

LAB LESSON

OBJECTIVES

Students will learn about light waves and their properties.

SUBJECT CONTENT - PHYSICS

Waves

Light waves

- the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface
- use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye

KEYWORDS

absorption, concave, convex, density, image, incident ray, law of reflection, normal, optical density, real, refraction, ray diagram, reflected ray, transmission, translucent, transparent, transverse waves, upright, virtual, waves

LESSON PLAN

Activity	Resources
Activity 1: Properties of Light Waves Give out the *Properties of Light Waves* worksheet to each pair of students. Ask students to complete Part A of the worksheet as they watch Chapter 5 of the video. Give students time to complete Part B of the worksheet. Review the answers with students when they have finished. 20	• Photocopies of the *Properties of Light Waves* worksheet • ClickView video: *Light and Sound* Chapter 5
Activity 2: The Law of Reflection Give out the *The Law of Reflection* worksheet to students. Give time to students to complete the questions. Allow students to share their answers with the class when they have finished. 20	• Photocopies of the *The Law of Reflection* worksheet • For each student: A protractor
Activity 3: Flat Surfaces: Plane Mirrors Divide students into pairs and give out the *Flat Surfaces: Plane Mirrors* worksheet to students. Ask students to complete the experiment and to attempt the challenge. Review the answers with students when they have finished. 25	• Photocopies of the *Flat Surfaces: Plane Mirrors* worksheet • For each pair: a plane mirror
Activity 4: Convex and Concave Mirrors Give out the *Convex and Concave Mirrors* worksheet to students. Give time to students to complete the questions. Go through the answers with students when they have finished. 20	• Photocopies of the *Convex and Concave Mirrors* worksheet • Protractor, ruler
Activity 5: Refraction Divide students into pairs and give out the *The Law of Refraction* worksheet to students. Ask students to complete the investigation and accompanying questions. Review the answers with students when they have finished. 30	• Photocopies of the *The Law of Refraction* worksheet • For each group of 2: perspex block, A4 paper, pencil, protractor, LED ray box

ANSWERS

Properties of Light Waves

Part A:

1	dark blue	6	black	11	black
2	black	7	yellow	12	yellow
3	light green	8	black	13	dark blue
4	grey	9	light green	14	yellow
5	orange	10	grey	15	dark green

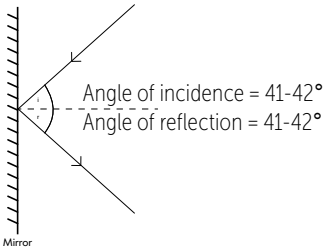
Part B:

Answers can be found here.

It is a firefly.

The Law of Reflection

a)

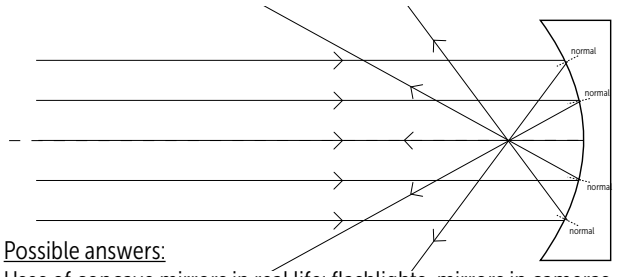


b) Students' answers will vary.

Flat Surfaces: Plane Mirrors

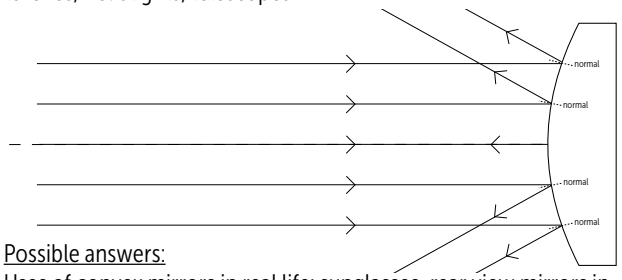
1	upright
2	yes
3	same size
4	virtual
5	same as distance of object to mirror

Concave and Convex Mirrors



Possible answers:

Uses of concave mirrors in real life: flashlights, mirrors in cameras, torches, headlights, telescopes



Possible answers:

Uses of convex mirrors in real life: sunglasses, rear view mirrors in cars, mirrors at corners of intersections and in shops

Refraction

1. Students' answers may vary.
2. Students' answers may vary.
3. Light travels **slower** through perspex than in air. This means that perspex has a **higher** density than air. When light travels through from a less dense to a denser medium, the refracted ray bends **towards** the normal, causing the refracted angle to become **smaller** than the angle of incidence.

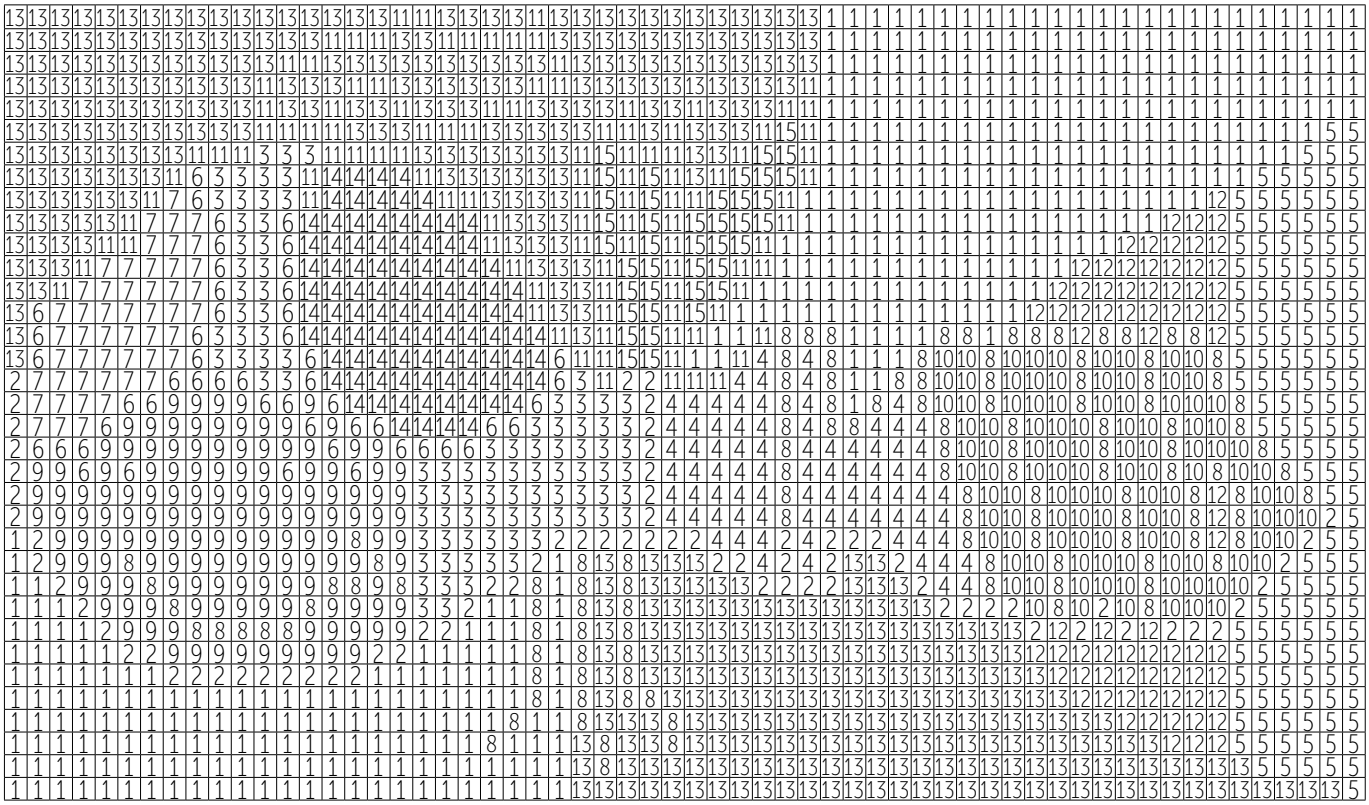
PHYSICS

Properties of Light Waves

Part A: As you watch the video, choose the correct answer for each **statement.**

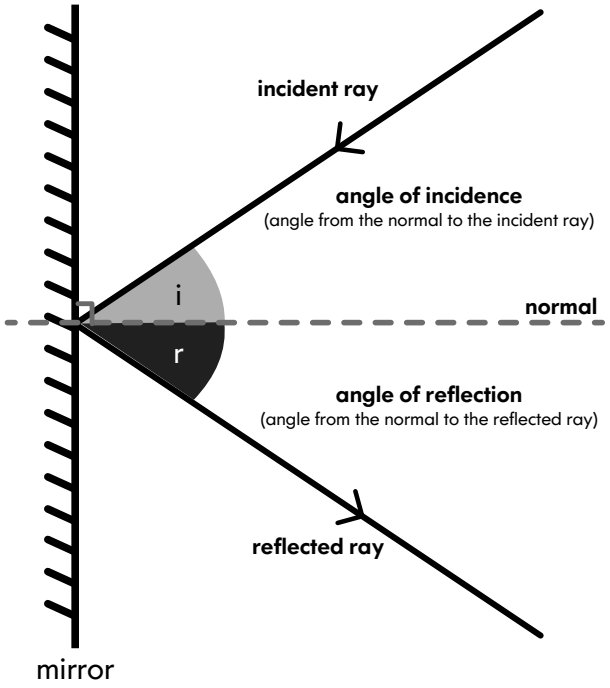
	Statement	True	False
1	Light can be explained by both wave theory and particle theory.	dark blue	yellow
2	Light rays travel in curly lines.	white	black
3	Light can pass through an opaque object.	dark green	light green
4	Light can pass through transparent and translucent materials.	grey	black
5	Light cannot be reflected.	red	orange
6	The Law of Reflection states that the angle of incidence is equals to the angle of reflection.	black	grey
7	A plane mirror absorbs light rather than reflecting it.	orange	yellow
8	There are many different types of mirrors.	black	dark blue
9	A concave mirror is outwardly curved.	yellow	light green
10	A convex mirror is outwardly curved.	grey	red
11	A convex mirror gives a wide angle reflection, the rays are spread out when they are reflected.	black	grey
12	Convex mirrors are also called diverging mirrors.	yellow	red
13	Concave mirrors reflect a ray inwards.	dark blue	light blue
14	Concave mirrors are known as diverging mirrors.	orange	yellow
15	On a non-reflective surface, light is scattered and not reflected.	dark green	dark blue

Part B: Use the answers from Part A to help you. Colour the grid below with the correct colours. For example, if statement 1 is true, colour all the boxes containing the number '1' dark blue. If it was false, colour the boxes yellow. The picture below reveals an abstract picture of something found in our world that has the ability to produce light without giving off heat. Find out what it is!



PHYSICS

The Law of Reflection



Light rays are reflected when they reach a smooth surface.

The light ray going towards the mirror is known as the **INCIDENT RAY**. The light ray leaving the mirror is known as the **REFLECTED RAY**.

The **NORMAL** is an imaginary line drawn perpendicular to the point where the incident ray meets the surface of the mirror.

Law of Reflection

The incident ray, reflected ray and the normal all lie in the same plane (same side of the mirror).

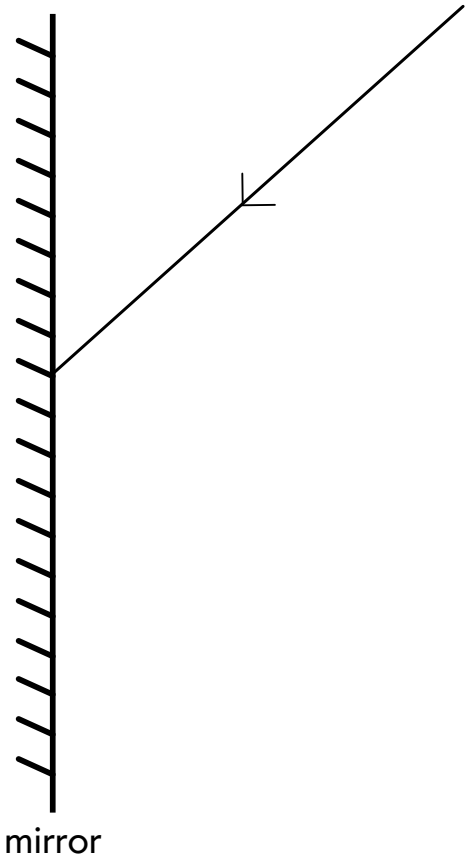
angle of incidence = angle of reflection

Steps to draw a reflected ray

1. Draw the normal at the point where the incident ray meets the mirror.
2. Use a protractor to measure the angle of incidence (i).
3. Mark out the reflected ray using the angle of incidence as a guide.
   (Hint: Refer to the law of reflection for the angle of reflection.)
4. Draw the reflected ray with an arrow to show direction.

Complete the following diagrams with the help of the information found above.
For Question (b), draw your own incident ray to begin the diagram.

(a)



Angle of incidence = _____°

Angle of reflection = _____°

(b)

Angle of incidence = _____°

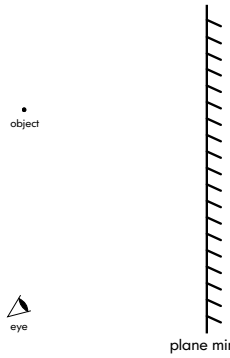
Angle of reflection = _____°

PHYSICS

Flat Surfaces: Plane Mirrors

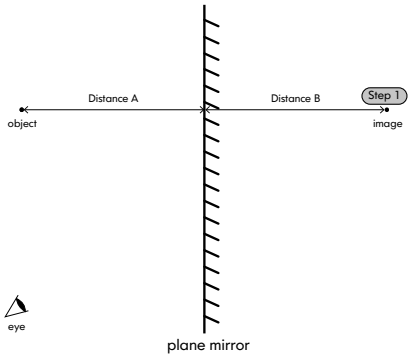
Drawing ray diagrams for plane mirrors

Step 1: Place object in front of a plane mirror.



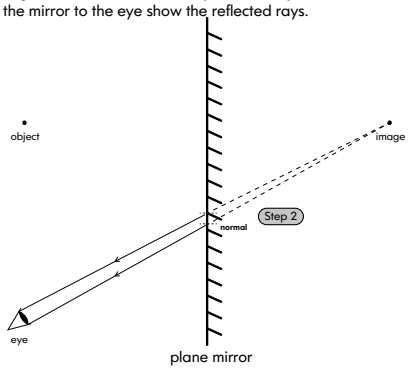
Step 2: Measure the distance between the object and the mirror. The distance between the object and the mirror should be the same as the distance between the image formed and the mirror.

Draw the image of the object on the other side of the mirror.



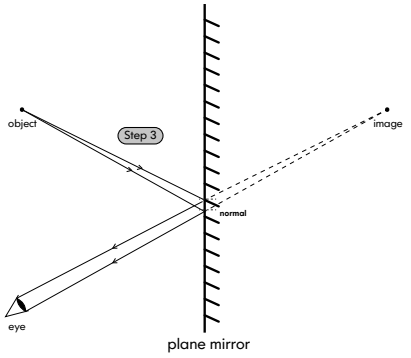
Step 3: Draw **2** light rays from the image to the corners of the eye (together with the 2 normals).

Because it is a virtual image, any rays on the side of the mirror where the image is located need to be represented by dotted lines. Solid lines from the mirror to the eye show the reflected rays.



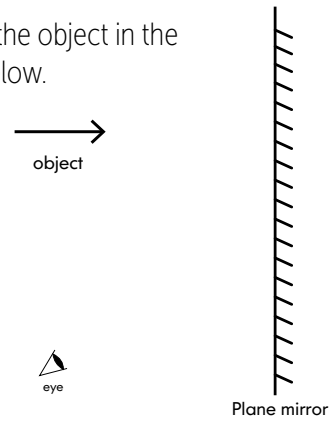
Step 4: Draw **2** light rays from the object to the mirror, meeting the reflected rays.

These light rays represent the incident rays.



It's a Challenge!

Can you draw the image formed by the object in the mirror? Complete the ray diagram below.



Follow the instructions and highlight the correct box for each property you observe. Research online if you do not understand any of the terms used.

Materials:

- mirror

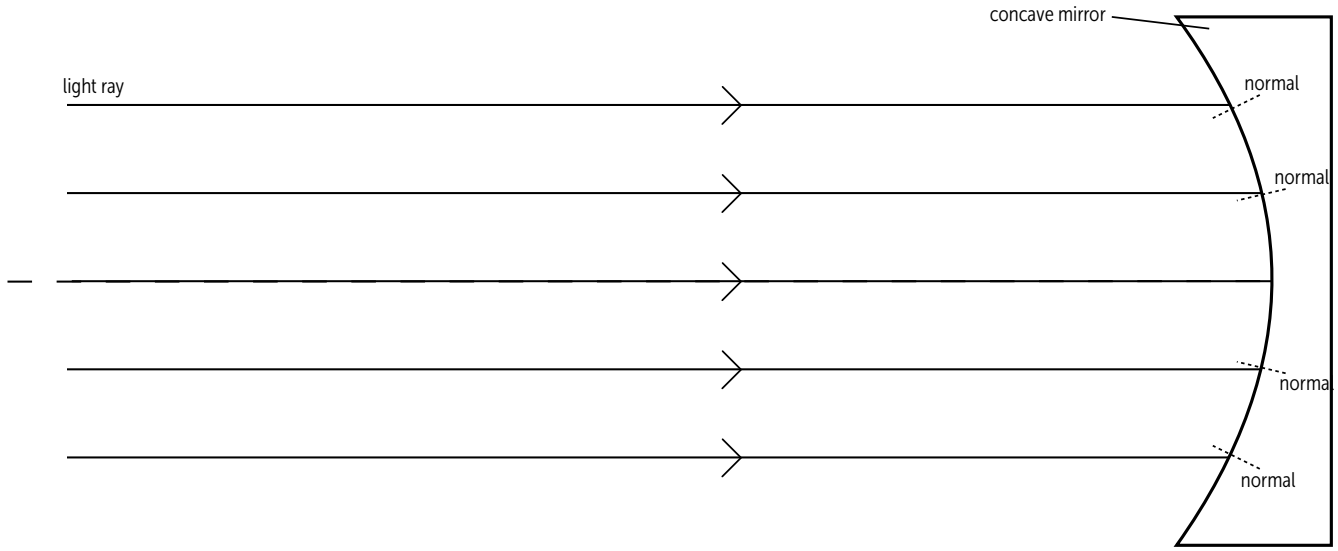
Instructions: Look in the mirror and observe the image formed. What kind of characteristics does the image have?

	Property	Choose the correct answer.	
1	Vertical image orientation	upright	upside down
2	Laterally inverted (Does 'a' appear as 'ɒ'?)	yes	no
3	Size of image formed	significantly reduced	same size
4	Type of image formed	real	virtual
5	Distance of image to mirror	same as distance of object to mirror	different from distance of object to mirror

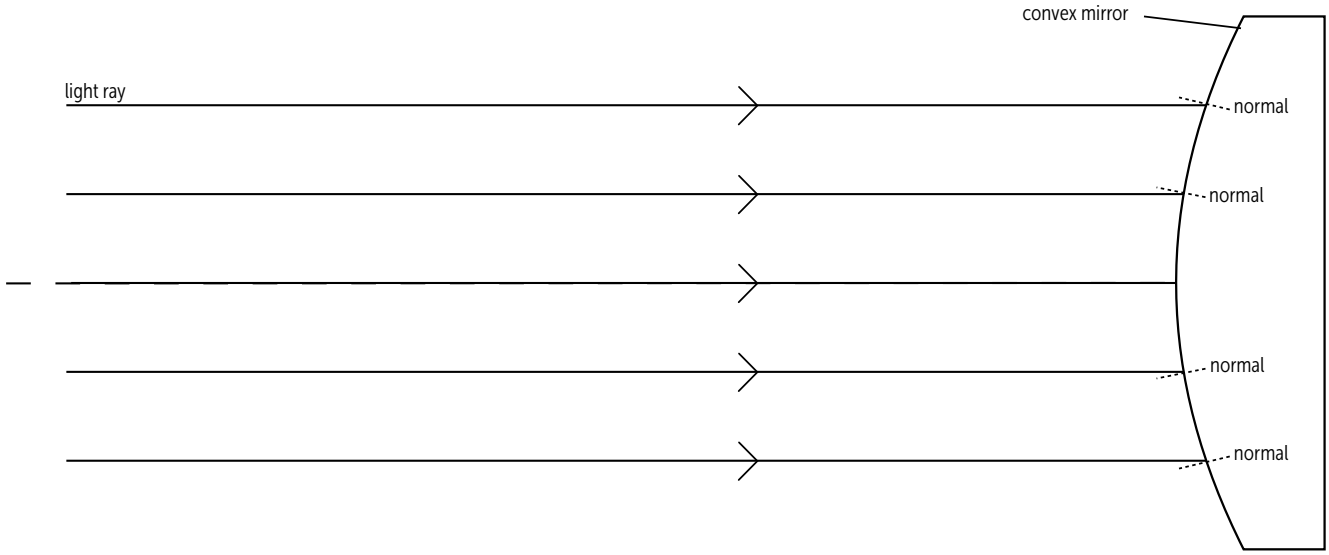
Convex and Concave Mirrors

Convex and concave mirrors produce different types of images due to their different surfaces. Use your knowledge of mirror reflections and the law of reflection to complete the ray diagrams below.

(Hint: The normal divides the angle equally between the incident ray and the reflected ray.)



Uses of concave mirrors in real life:	



Uses of convex mirrors in real life:	

PHYSICS

Refraction

Carry out the refraction experiment in pairs after reading the following passage. Then answer the questions using information from the passage.

Look at this glass of water. What do you notice about the straw submerged in the liquid? That's right, it looks bent!

It looks like magic, doesn't it?

What you are looking at is an example of refraction. Light travels at different speeds, in different mediums. The denser the medium, the slower light travels through it. Refraction is the bending of a wave when it enters a different medium due to a change in speed. In this example, the mediums are air and water.

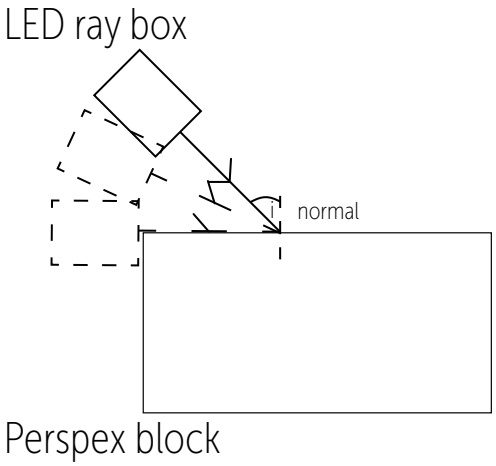
Refraction is everywhere in our daily lives.

Experiment

Let's find out how refraction occurs!

Materials:

- perspex block
- A4 paper
- pencil
- protractor
- LED ray box



Instructions:

1. In pairs, place the perspex block on the A4 paper and outline the shape of the block with a pencil.
2. Shine the LED ray box on the block as shown at least 5 different angles of incidence from 0° to 90°.
3. Observe the light ray as it passes through the perspex block.
4. Trace the path of the light ray on the paper (with arrows).

Questions:

1. The ray passing through the perspex block is known as the refracted ray. For an angle of incidence of 30°, what is the angle between the refracted ray and the normal? _____°
2. Which is the bigger angle: the angle of incidence or the angle of refraction? _____
3. Refer to the information in the table below and circle the correct answers in the statement found in the box.

Medium	Refractive index
air	1.000
perspex block	1.495

The greater the refractive index, the greater the optical density.

Light travels **faster/slower** through perspex than in air. This means that perspex has a **higher/lower** optical density than air. When light travels through from a less dense to a denser medium, the refracted ray bends **away/towards** the normal, causing the refracted angle to become **smaller/bigger** than the angle of incidence.

Renewable & Non-Renewable Energy

OBJECTIVES

In this lesson, students will develop an understanding of renewable and non-renewable energy sources. They will conduct their own research and present their findings to the class.

SUBJECT CONTENT - PHYSICS

Energy:

Calculation of fuel uses and costs in the domestic context

- fuels and energy resources

KEYWORDS

biofuels, coal, energy, geothermal, hydroelectric power, natural gas, non-renewable, nuclear, oil, renewable, solar, wind

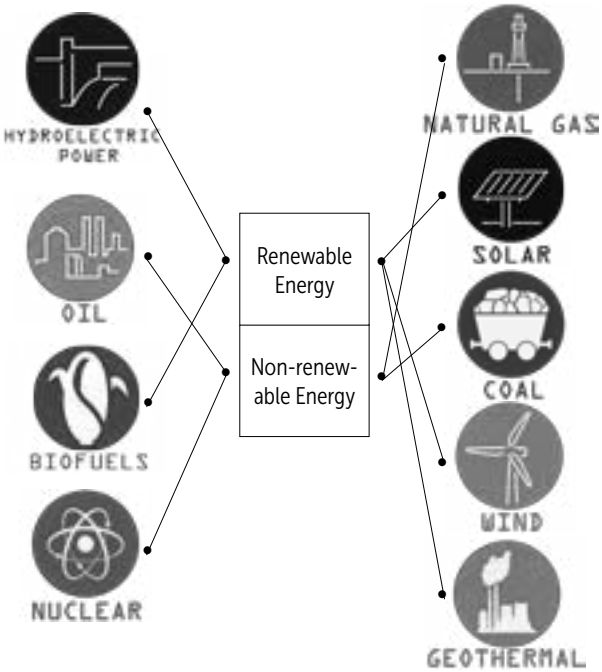
LESSON PLAN

Activities	Resources
Activity 1: It's All about Energy! Play Chapters 2 and 3 of the video to introduce the topic. Open the presentation to the first slide and lead a brainstorming session using the following questions: • Have you used electricity today? • When did you use it? • Where does electricity come from? • What can you do to reduce the use of non-renewable energy sources? 15	• ClickView video: *Renewable Fuels* Chapter 2 Chapter 3 • Presentation: Renewable and Non-Renewable Energy
Activity 2: Am I Renewable? Use slides 3 and 4 of the presentation to provide a definition of Renewable and Non-Renewable Energy. Give out the *All about Energy!* worksheet and ask students to complete Part A while watching Chapter 4 of the video. 10	• Presentation: Renewable and Non-Renewable Energy • Photocopies of the *All about Energy!* worksheet • ClickView video: *Renewable Fuels* Chapter 4
Activity 3: Tell Me about Energy! This is a research activity where students are required to work in pairs. They must choose one form of renewable energy and one form of non-renewable energy to research. Ask students to research their chosen energy sources on the Internet and use the table on *All about Energy!* Part B to document their findings. Once their findings have been accumulated, they are to create a poster using PowerPoint or similar. Students are to present their posters to the class when they are done. 35	• Photocopies of the *All about Energy!* worksheet • Presentation: Renewable and Non-Renewable Energy • Access to the Internet • Laptops (if students do not have their own, conduct this lesson in a computer lab)

ANSWERS

All about Energy!

Part A:



Features of renewable energy:	Features of non-renewable energy:
• can be replenished naturally • is usually replenished over a short period of time	• is available in limited quantities • takes a long time, usually millions of years, to be replenished

Part B:

Students' answers may vary.

PHYSICS

All about Energy!

Part A: Draw a line to match each type of energy to the correct box. Then, use the presentation to help you list two features of each energy category.

Renewable Energy
Features:
- _____
  _____
- _____
  _____

Non-Renewable Energy
Features:
- _____
  _____
- _____
  _____

Part B: Choose one renewable and one non-renewable energy source to research. Fill in the table below with your notes before transforming your findings into a presentation.

Type of renewable energy:		**Type of non-renewable energy:**	
Where does it come from?		Where does it come from?	
How is it transformed into energy?		How is it transformed into energy?	
Its advantages:	Its disadvantages:	Its advantages:	Its disadvantages:

The Two Main Types of Energy

LAB LESSON

OBJECTIVES

In this lesson, students will develop an understanding of potential and kinetic energy. They will investigate these two main types of energy and gain an understanding of energy being the capacity for doing work.

SUBJECT CONTENT - PHYSICS

Energy:

Changes in systems

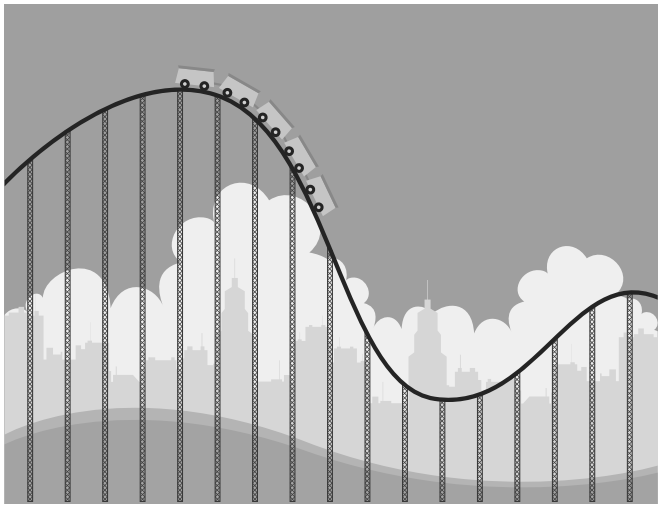
- energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change
- comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions

KEYWORDS

energy, kinetic energy, potential energy, Sun

LESSON PLAN

Activities	Resources
Activity 1: What Is Energy? Give out the *What Is Energy?* worksheet. Play Chapters 1-3 of the video and ask students to complete the worksheet. You may need to pause between chapters for students to catch up. Review answers when students are done. 15	• Photocopies of the *What Is Energy?* worksheet • ClickView video: *Forms of Energy* Chapter 1 Chapter 2 Chapter 3
Activity 2: Observing the Effects of Energy Give out the *Observing the Effects of Energy* worksheet. Divide students into groups of 3-4, and ask them to complete the tasks given. Walk around to guide students when necessary. Review answers when students are done. 30	• Photocopies of the *Observing the Effects of Energy* worksheet • For each group of 3-4: tennis ball, metre ruler, masking tape
Activity 3: Is It Potential or Kinetic Energy? Give out the *Is It Potential or Kinetic Energy?* worksheet. Allow time for students to answer the questions independently. When students are finished, open the presentation and review the answers. Allow students to peer mark their work. 15	• Photocopies of the *Is It Potential or Kinetic Energy?* worksheet • Presentation: The Two Types of Energy



ANSWERS

What Is Energy?

1. Possible answers:
   - Energy is the ability to do work.
   - Energy is the reason we and everything exist.
   - Energy drives every change or movement on Earth.
   - Energy is derived from the Sun.
   - Energy is everywhere.
   - Animals access the Sun's energy by using the stored energy either contained in plants or other animals.
2. Kinetic energy is energy moving objects have.
3. transferred
4. Heavier objects have more kinetic energy.
5. Potential energy is stored energy.
6. Higher objects have more potential energy.

Observing the Effects of Energy

Hypothesis and Questions: Students' answers may vary.

Conclusion:

Potential energy: The higher the height at which the ball was released, the greater potential energy the ball possessed, and the higher the ball could bounce.

Kinetic energy: The higher the height at which the ball was released, the greater kinetic energy the ball gained, and the further it travelled.

Is It Potential or Kinetic Energy?

	Example	P.E.	K.E.
1	A moving tractor		✓
2	A bullet loaded in a gun	✓	
3	A torch battery	✓	
4	An opening door		✓
5	A bird in a nest high up in a tree	✓	
6	A stationary roller-coaster on the top of a slope	✓	
7	A stretched rubber band	✓	
8	A basketball thrown through a hoop	✓	✓
9	A fan with blades moving or rotating		✓
10	A bird flying into the sky	✓	✓

What Is Energy?

Complete the following worksheet as you watch Chapters 1-3 of the video.

What Is Energy?

1. List three facts about energy mentioned in Chapter 1 of the video.

   1st fact (a definition): _____

   2nd fact: _____

   3rd fact: _____

Kinetic Energy

2. What is kinetic energy?

   _____

3. Complete the following sentence:

   Energy is constantly changing form and is easily t _ _ _ _ _ _ _ _ _ _ from one form to another. This is known as the **LAW OF CONSERVATION OF ENERGY**.

4. Do you think heavier objects have more or less kinetic energy than lighter objects moving at the same speed?

   _____

Potential Energy

5. What is potential energy?

   _____

6. Do you think objects at a higher height have more or less potential energy than objects at a lower height?

   _____

Observing the Effects of Energy

With the given materials, follow the instructions and try to solve the problem posed in each scenario.

Materials:

- masking tape
- metre ruler
- marker pen
- tennis ball

	Scenario 1	Scenario 2
Problem	How can the potential energy of a ball about to be dropped be increased?	How can you increase the kinetic energy of a rolling ball?
Hypothesis	If _____ _____ _____, then the potential energy of a dropped ball can be increased.	If _____ _____ _____, then the kinetic energy of a rolling ball can be increased.
Instructions	1. Measure 1 m vertically from the floor, then lightly stick the masking tape on the wall to represent the measurement. 2. Use the metre ruler to draw lines across the tape at 50 cm, 75 cm, and 100 cm. 3. Hold the ball at the 50 cm mark and drop it. 4. Observe the ball's first bounce. 5. Mark the height of the first bounce on the tape. 6. Measure the height of the first bounce and record it in the data table below. 7. Repeat steps 3-6 for each height for a total of 3 trials per height.	1. Lean the metre ruler against a table so that the ruler is angled approximately 45° from the floor. 2. Release the ball at the 50 cm mark and allow it to roll down the slope. 3. Measure the distance from the ruler to the point where the ball stops rolling. 4. Record your results. 5. Repeat steps 2-4 for a total of 3 trials. 6. Repeat steps 2-5, dropping the ball at 75 cm and 100 cm.

Results	Trial 1	Trial 2	Trial 3	Average	Trial 1	Trial 2	Trial 3	Average
50 cm								
75 cm								
100 cm								

Questions	
	7. From which height did the ball have the most kinetic energy in Scenario 1? Explain.
	8. How did the ball's energy change from potential to kinetic energy in Scenario 2?

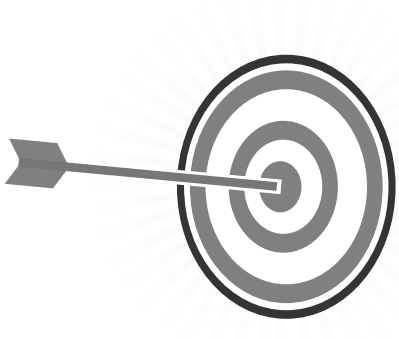
What can you conclude about potential/kinetic energy for each scenario?	

PHYSICS

Is It Potential or Kinetic Energy?

Identify the type(s) of energy possessed in the following examples.

No.	Example	Potential energy	Kinetic energy	Reason
1	A moving tractor			
2	A bullet loaded in a gun			
3	A torch battery			
4	An opening door			
5	A bird in a nest high up in a tree			
6	A stationary roller-coaster at the top of a slope			
7	A stretched rubber band			
8	A basketball thrown through a hoop			
9	A fan with blades moving or rotating			
10	A bird flying into the sky			



Types of Potential and Kinetic Energy

LAB LESSON

In this lesson, students will develop an understanding of the different types of potential and kinetic energy. They will also investigate the effects different types of energy can bring about.

SUBJECT CONTENT - PHYSICS

Energy:

Energy changes and transfers

- other processes that involve energy transfer: changing motion, dropping an object,completing an electrical circuit, stretching a spring, metabolism of food, burning fuels

Changes in systems

- comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions

KEYWORDS

chemical potential energy, elastic energy, electrical energy, gravitational potential energy, mechanical energy, radiant energy, sound energy, thermal energy

LESSON PLAN

Activities	Resources
Before the lesson, set up the materials required for the tasks in Activity 2. Depending on class size, you may need to set up more than one station for each task. Provide enough sets of equipment to accommodate groups of 3-4 (for tasks #1-#4) on the Recording the Effects of Energy worksheet.	• Teacher's demonstration #1: tuning fork, alarm bell, vacuum pump, bell jar • Teacher's demonstration #2: cold water in a glass, microwave oven • #1: Rubber band, measuring tape • #2: Empty beaker, 50°C water • #3: Small light globe (1.5V), dry cell, copper wires with crocodile clips • #4: Tennis ball, metre ruler
Activity 1: The Different Types of Energy Give out the *The Different Types of Energy* worksheet. Play Chapters 4 and 5 of the video and ask students to complete the worksheet. There are some types of energy in the worksheet that are not shown in the video. Use the presentation to review answers (with the sound turned on). 20	• Photocopies of the *The Different Types of Energy* worksheet • ClickView video: *Forms of Energy* Chapter 4 Chapter 5 • Presentation: Types of Potential and Kinetic Energy
Activity 2: Observing and Recording the Effects of Energy Give out the *Observing the Effects of Energy* and *Recording the Effects of Energy* worksheet. Before the students conduct their own experiments, carry out the two teacher demonstrations and have students complete the related questions. Divide students into groups of 3-4 and ask them to complete the tasks given. Groups are to rotate between stations when instructed. Allow about 10 minutes for each station. Review answers when students are finished. >40	• Photocopies of the *Observing the Effects of Energy* and *Recording the Effects of Energy* worksheets • Equipment set up beforehand

ANSWERS

The Different Types of Energy

	Form of energy
1	Chemical potential energy
2	Radiant energy
3	Mechanical/kinetic energy
4	Elastic energy
5	Gravitational potential energy
6	Electrical energy
7	Sound energy
8	Thermal energy

Recording the Effects of Energy

Results: Students' answers may vary.

Questions:

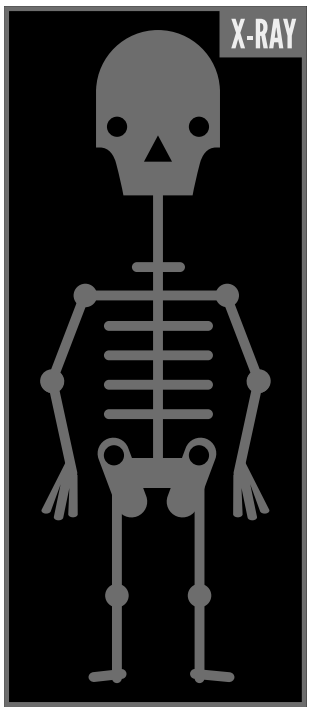
1. Sound is the energy caused by vibrations of air particles. When the tuning fork was struck, it vibrated, and it forced the air particles all around it to vibrate. As the air moved, it carried energy out from the tuning fork in all directions, eventually reaching the air inside the ears.
2. No. As the air was pumped out of the bell jar, it created a vacuum in the jar. A vacuum is a space where matter is absent and hence there is no air to carry the sound.
3. It became hot. Microwave ovens use radio waves to agitate water molecules in food, causing them to move. As the water molecules get agitated, they vibrate and generate heat.
4. It travelled a further distance. There is more elastic potential energy stored in the rubber band when it is stretched completely.
5. The beaker felt warm. Heat energy is transferred from a hotter region to a cooler region. As the beaker is at room temperature, the thermal energy from the water was transferred to the beaker, eventually resulting in a common temperature.
6. The food colouring in the beaker containing 70°C water spread at a quicker rate as compared to the food colouring in room temperature water. The molecules in the hot water move faster, spreading the food colouring more rapidly than the cold water molecules.
7. No, the dry cell has stored chemical energy that is released when connected in a circuit. Electricity is generated from the movement of electrons flowing through the copper wire, reaching the globe and making it light up.
8. It bounced higher at 100 cm as there was a greater gravitational potential energy when it was released from 100 cm.
9. At a faster starting speed, it had more kinetic energy to roll further.

The Different Types of Energy

Using the video and presentation, write down the names of the different types of potential and kinetic energy. Use the images to help you if you are unsure. The first one has been done for you.

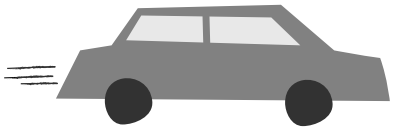
1	Chemical potential energy

Energy that is **stored** in a medium and released later into different forms. For example, found in food, batteries



2	

Energy that involves the **movement** or travelling of electromagnetic waves/ particles. For example, light, x-rays and UV rays

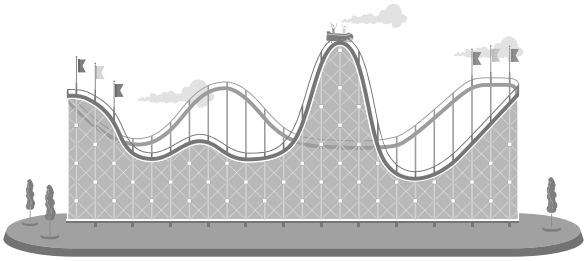


3	

Energy of a **moving** object

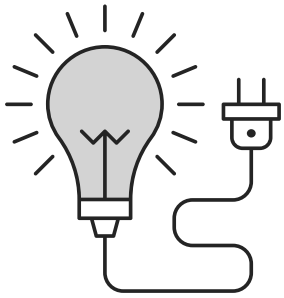
4	

Energy that is **stored** in elastic materials as a result of being stretched or compressed



5	

Energy **stored** in an object as a result of its position in a gravitational field

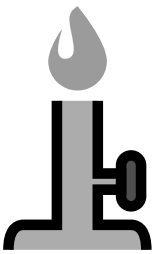


6	

Energy that involves the **movement** of atomic particles called electrons

7	

Energy produced by the **vibrations** of air particles, which creates sound waves



8	

Energy derived from heat, from the **movement** of tiny particles such as atoms

PHYSICS

Observing the Effects of Energy

In this activity, there are six different tasks (two demonstrations and four experiments). Carry out the tasks and answer the questions on the 'Recording the Effects of Energy' worksheet.

	Teacher's demonstration #1	Teacher's demonstration #2	#1
Materials:	• tuning fork • alarm bell • bell jar • vacuum pump	• cold water in a glass • microwave oven	• rubber band • blank wall • measuring tape
Method:	(A) 1. Strike the tuning fork. (B) 1. Turn on the alarm bell. 2. Cover the bell with the glass jar. 3. Connect the vacuum pump to the glass jar. 4. Turn on the vacuum pump. 5. Wait 2 minutes.	1. Put a glass of cold water into a microwave oven for 30 seconds.	1. Stretch the rubber band halfway. 2. Release it towards a blank wall making sure there are no objects that might be hit. 3. Record the distance travelled by the rubber band. 4. Repeat steps 1-3 three times. 5. Complete the task again with the rubber band stretched completely.
	#2	#3	#4
Materials:	• 2 empty beakers (approx. 200 mL) • 100 mL 70°C water • 100 mL room temperature water • dropper • red food colouring	• small light globe (1.5V) • copper wires with crocodile clips • dry cell	• metre ruler • tennis ball
Method:	(A) 1. Pour 100 mL of the 70°C water into an empty beaker. 2. Wait 30 seconds, then touch the sides of the beaker. (B) 1. Take the beaker filled with heated water from (A) and also the other beaker filled with 100 mL of room temperature water, add 3 drops of red food colouring into each beaker at the same time. 2. Wait 30 seconds, then observe the spread of the food colouring throughout the water.	1. Using the materials given in this station, make a circuit to light up the light globe.	(A) 1. Lean the metre ruler straight up against a wall. 2. Drop the ball from the 50 cm mark. 3. Record the height the ball reached when it bounced. 4. Repeat steps 1-3 from the 100 cm mark. (B) 1. Roll the ball on a flat ground with minimal force. 2. Measure the distance travelled by the ball and record it. 3. Roll the ball again, this time with more force than before. 4. Record the new distance travelled by the ball.

Recording the Effects of Energy

Record your results in the following table.

#1	Rubber band stretched halfway				Rubber band stretched completely			
	Dist. 1	Dist. 2	Dist. 3	Average	Dist. 1	Dist. 2	Dist. 3	Average
#3	Draw a diagram of your circuit.							
#4	(A) Height the ball bounced				(B) Distance the ball rolled			
	50 cm mark		100 cm mark		1st Roll		2nd Roll	

Answer the following questions.

Tasks	Question	Answer
Teacher's Demonstration #1	1. Why were you able to hear sound?	
	2. In (B), were you able to hear the bell's alarm when the vacuum pump was switched on? Why or why not?	
Teacher's Demonstration #2	3. What happened to the water after 30 seconds in the microwave oven? How was this possible?	
#1	4. Did the rubber band travel further when it was stretched completely? Why was this so?	
#2	5. In (A), What happened to the sides of the beaker after 30 seconds? Why was this so?	
	6. In (B), what did you observe in each beaker after 30 seconds? Why was this so?	
#3	7. Were you able to light up the globe without the dry cell? Why or why not?	
#4	8. In (A), did the ball bounce back higher at 50 cm or 100 cm? Why was this so?	
	9. In (B), did the ball roll further when it started with a smaller or greater force? Why was this so?	

Energy Transformations

OBJECTIVES

In this lesson, students will develop an understanding of the law of conservation of energy and understand how energy is transformed from one form to another. They will also learn how to draw energy flow diagrams.

SUBJECT CONTENT - PHYSICS

Energy:

Energy changes and transfers

- other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels

Changes in systems

- energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change
- comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions

KEYWORDS

conservation, energy transfers, kinetic energy, potential energy, transformation

LESSON PLAN

Activities	Resources
Activity 1: What Happens to Pengy? Give out the *What Happens to Pengy?* worksheet to each pair of students. Open the presentation to the first 2 slides and ask students to complete the worksheet while watching the presentation. Review the answers when students are done. 10	• Photocopies of the *What Happens to Pengy?* worksheet • Presentation: Energy Transformations
Activity 2: Learning about Energy Transformations Give out the *Learning about Energy Transformations* worksheet. Play Chapter 6 of the video and ask students to complete the worksheet as they watch the video. You may need to pause the video at example 1 and example 2 and give students time to finish the question. Review answers with slides 9-11 of the presentation. Give time to students to make their own energy flow diagrams. Allow students to share the energy flow diagrams they have created with the class. 20	• Photocopies of the *Learning about Energy Transformations* worksheet • ClickView video: *Forms of Energy* Chapter 6 • Presentation: Energy Transformations
Activity 3: All about Energy Flow Diagrams Give out the *All about Energy Flow Diagrams* worksheet to each pair of students. Open the presentation to the last slide and have students choose the numbers on the slide to uncover questions related to energy flow diagrams. Ask students to write their answers in the boxes. When students are finished, allow them to exchange their answers and peer mark. 25	• Photocopies of the *All about Energy Flow* Diagrams worksheet • Presentation: Energy Transformations

ANSWERS

What Happens to Pengy?

Possible answers:

At the top of the hill:

Pengy possesses gravitational potential energy as he is at the highest point from the ground.

At the bottom of the hill:

Pengy possesses maximum kinetic energy because he is moving at maximum speed.

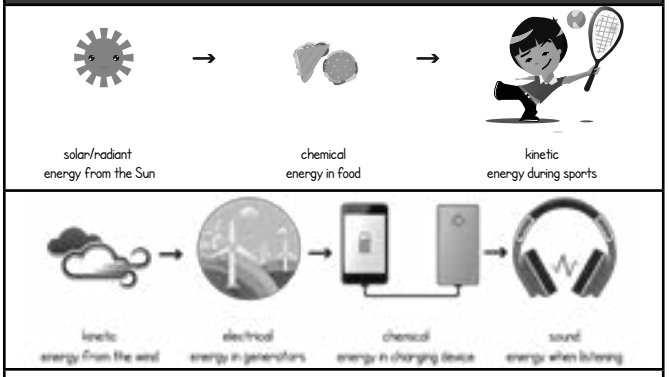
Learning about Energy Transformations

Law of Conservation of Energy:

Energy does not magically appear or disappear.

It is always transferred from one form to another.

An energy flow diagram



Students' answers may vary.

All about Energy Flow Diagrams

Possible answers:

electrical energy → kinetic energy of the blades	• Heater • Hair dryer • Toaster • Hair straightener • Electric stove	chemical energy → kinetic energy → sound + heat energy	chemical energy → heat energy
• Rubbing your hands together	• Computer • Mobile phone • Television	• Compressing a spring	chemical energy → kinetic energy
electrical energy → heat energy	• Car • Fireworks	electrical energy → kinetic energy of the blades	• Solar energy converted into electrical energy converted to treadmill moving

PHYSICS

What Happens to Pengy?

In your own words, describe what kind of energy Pengy possesses at each location.

At the top of the hill 	
At the bottom of the hill 	

In your own words, describe what kind of energy Pengy possesses at each location.

At the top of the hill 	
At the bottom of the hill 	

Learning about Energy Transformations

As you watch the video, complete the questions about energy transformations.

LAW OF CONSERVATION OF ENERGY

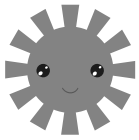
Energy does not magically _____ or _____.

It is always _____ from one form to another.

An energy _____ diagram

It shows how energy is transformed from one form to another.

Example 1:



_ _ _ _ _/_ _ _ _ _ _ _

energy from the Sun

_ _ _ _ _ _ _ _

energy in food

_ _ _ _ _ _ _

energy during sports

Example 2:

Draw your *longest* energy flow diagram here!

PHYSICS

All about Energy Flow Diagrams

Follow the instructions as shown on the presentation about energy flow diagrams.

1	2	3	4
5	6	7	8
9	10	11	12

Follow the instructions as shown on the presentation about energy flow diagrams.

1	2	3	4
5	6	7	8
9	10	11	12

Curriculum Mapping Grid

Lesson Plan	Subject Content		
Diffusion (p6)	**Structure and function of living organisms:** Cells and organisation • the role of diffusion in the movement of materials in and between cells	Pure and impure substances • diffusion in terms of the particle model	**Matter:** Physical changes • diffusion in liquids and gases driven by differences in concentration
BIOLOGY			
The Human Skeletal System (p8)	**Structure and function of living organisms:** The skeletal and muscular systems • the structure and functions of the human skeleton, to include support, protection, movement and making blood cells		
The Human Reproductive System (p12)	**Structure and function of living organisms:** Reproduction • reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta		
The Human Respiratory System (p16)	**Structure and function of living organisms:** Gas exchange systems • the structure and functions of the gas exchange system in humans, including adaptations to function		
The Human Digestive System (p20)	**Structure and function of living organisms:** Nutrition and digestion • the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)		
Imbalances in the Diet (p24)	**Structure and function of living organisms:** Nutrition and digestion • the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases		
Recreational Drugs and their Effects (p26)	**Structure and function of living organisms:** Health • the effects of recreational drugs (including substance misuse) on behaviour, health and life processes		
CHEMISTRY			
The Atom (p28)	Atoms, elements and compounds • a simple (Dalton) atomic model		
Pure Substances and Mixtures (p32)	Pure and impure substances • the concept of a pure substance • mixtures, including dissolving • the identification of pure substances		
Types of Mixtures (p36)	Pure and impure substances • the concept of a pure substance • mixtures, including dissolving		
Solutions (p40)	Pure and impure substances • the concept of a pure substance • mixtures, including dissolving		

Lesson Plan	Subject Content
Chromatography (p44)	Pure and impure substances • simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography • the identification of pure substances
Oxidation Reactions (p48)	Chemical reactions • representing chemical reactions using formulae and using equations • combustion, thermal decomposition, oxidation and displacement reactions
PHYSICS	
The Two Types of Waves (p52)	**Waves** Observed waves • waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition Sound waves • sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal
Sound Waves (p56)	**Waves** Sound waves • frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound • sound needs a medium to travel, the speed of sound in air, in water, in solids • sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal
Light waves (p60)	**Waves** Light waves • the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface • use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye
Renewable and Non-Renewable Energy (p66)	**Energy:** Calculation of fuel uses and costs in the domestic context • fuel and energy resources
The Two Main Types of Energy (p68)	**Energy:** Changes in systems • energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions
Types of Potential and Kinetic Energy (p72)	**Energy:** Energy changes and transfers • other processes that involve energy transfer: changing motion, dropping an object,completing an electrical circuit, stretching a spring, metabolism of food, burning fuels Changes in systems • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions
Energy Transformations (p76)	**Energy:** Energy changes and transfers • other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels Changes in systems • energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions

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