SCIENCE KEY STAGE 3 PART 1

Lesson Plans for the ClickView Curriculum Library

ALIGNED TO THE **NATIONAL CURRICULUM IN ENGLAND**

ClickView

Science Key Stage 3 Part 1
Lesson Plans for the ClickView Curriculum Library

Author: Ailing Tay
Editor: Lauren O'Brien

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Printed in the United Kingdom.
First Printing, 2016
ISBN 0-9945664-2-3

Published by:
ClickView Limited
Fifth Floor
4 Bath Place, London
EC2A 3DR

Company Number: 05919237

Presentations for the lesson plans can be downloaded from:
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ClickView Curriculum Library

ALIGNED TO THE **NATIONAL CURRICULUM IN ENGLAND**

Greetings Science Teachers!

ClickView has always prided itself on providing and producing quality video content to support teachers in their teaching and lesson plans. We also understand how overwhelming and time consuming teaching can be. More often than not, there just aren't enough hours in the day left to prepare for lessons.

We really want to help, which is why it gives us great pleasure to bring you this book! This book is the first of a series of 3 books and it contains 19 plans for key stage 3 students ready to be used in the classroom. The special thing about these lesson plans is that they each contain a related ClickView video with exciting and innovative resources to accompany them.

More engaged students in class?
Checked!

And the best part? These lesson plans are written for the National Curriculum in England so you know that the content is relevant and accessible. Most of the lesson plans come with presentations that can be downloaded from the ClickView website.

For greater time efficiency, students can watch the videos beforehand at home, leaving more time in class for the accompanying activities.

Flipped classroom learning?
Checked!

At ClickView, we work with you to make your teaching experience more fulfilling and rewarding. We hope you will enjoy using these new resources.

Have fun with Science!

Presentations for the lesson plans can be downloaded from:
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Key to Icons in Book


ClickView Video


Presentation

SCIENCE KEY STAGE 3 **PART 1**
ALIGNED TO THE **NATIONAL CURRICULUM IN ENGLAND**

CONTENTS

BIOLOGY

CHEMISTRY

PHYSICS

An Introduction to Cells

OBJECTIVES

In this lesson, students will develop an understanding of the cell theory, recognise that there are different types of cells, and acknowledge the differences that exist between plant cells and animal cells.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Cells and organisation

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
- the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts
- the similarities and differences between plant and animal cells

KEYWORDS

cells, nucleus, cell membrane, cytoplasm, mitochondria, specialised, cell wall, vacuole, chloroplast

LESSON PLAN

Activities	Resources
Activity 1: What Are These Structures? Open the presentation to the first slide and put a simple LEGO® model on each desk. Use the following questions as discussion points: • What are the structures? *(LEGO® models)* • What are they made up of? *(Individual LEGO® pieces)* Link the LEGO® models to living things. For example: *In the same way that the LEGO® models are made up of individual LEGO® pieces, all living organisms are made up of individual components called cells.* 5	• Presentation: An Introduction to Cells • LEGO® models
Activity 2: An Introduction to Cells Give out the *Learning about Cells* worksheet and play the video. As students watch the video, ask them to complete Part A of the worksheet. Use slides 3 and 4 of the presentation to review the answers. Open the presentation to slide 5 and proceed to Part B of the worksheet. Guide students to complete this section. Review the topic using slide 6 of the presentation. 20	• Photocopies of the *Learning about Cells* worksheet • ClickView video *Introduction to Cells* **https://clickv.ie/w/ks3/1** • Presentation: An Introduction to Cells
Activity 3: Exploring Cell City Give out the *Exploring Cell City worksheet*. Using slides 7-9, ask students to complete questions 1 and 2 on the worksheet. Allow time for students to complete question 3. It is a summary of concepts taught. 15	• Photocopies of the *Exploring Cell City* worksheet • Presentation: An Introduction to Cells
Activity 4: Can You Haiku the Organelles? Give out the *Can You Haiku the Organelles?* worksheet. Haiku is a very short form of Japanese poetry consisting of three lines, with the first and last lines having 5 syllables, and the middle line having 7 syllables. Students are to choose 5 organelles and create a haiku poem for each of them, describing their characteristics. Allow students to share their poems with the class. 20	• Photocopies of the *Can you Haiku the Organelles?* worksheet

ANSWERS

Learning about Cells

Part A:

1. plants, animals, human beings, building blocks, chemicals, molecules, shape, size
2. spindle shaped, rod shaped, oval, spherical, star shaped, rectangular, irregularly shaped, polygonal
3. function

Part B:

1. Possible answers:

Item	Function
Pen	Writes on a surface
Ruler	Measures length
Eraser	Erases marks made by pencil
Calculator	Computes sums

   a) Yes
   b) No
2. functions

Exploring Cell City

1. Organelles are organised or specialised structures within a living cell, each with a unique function.

Part of City	Organelle	Function	A	P
City hall	Nucleus	Controls the activities of the cell	✓	✓
Transport system	Endoplasmic reticulum	Provides a network to move substances to the cell membrane and back	✓	✓
Environment	Cytoplasm	Inner area of the cell	✓	✓
Factory	Ribosome	Creates new proteins required by the cell	✓	✓
City police	Cell membrane	Allows some particles to move in and out of the cell	✓	✓
Power station	Mitochondria	Produces energy for use by the cell from glucose	✓	✓
Post office	Golgi complex	Packs and transports proteins to various parts of the cell	✓	✓
Recycling facility	Lysosome	Breaks down worn out cell components and reuses parts	✓	
Water plant	Vacuole	Stores water for the plant to use		✓
City wall	Cell wall	Structural support for cell		✓
Solar power plant	Chloroplast	Site where photosynthesis takes place		✓

Refer to grey columns above for answers to the Venn Diagram.

Learning about Cells

Part A: Complete this section of the worksheet as you watch the video.

1. Fill in the missing words from the video.

   All living organisms, like _____, _____ and _____ _____ are made up of cells.
   Cells are the _____ _____ of all organisms. They are small compartments that contain all the _____ and _____ necessary to keep an organism alive.
   Cells vary in _____ and _____.

2. Circle the different shapes of the cells that were shown in the video.

triangular	spindle shaped	rod shaped	oval	heart
spherical	star shaped	rectangular	irregularly shaped	polygonal

3. The shape of the cell depends on the _____ of the cell.

Part B: Listen to instructions and complete the following task.

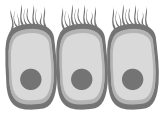
1. Write a function for each item.

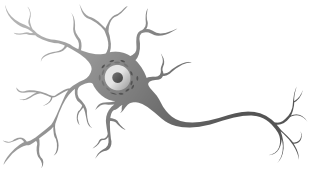
Item	Function
Pen	
Ruler	
Eraser	
Calculator	

   a) Does each item have its own function?
   Yes/No
   b) Is the function of each item interchangeable with the other items?
   Yes/No

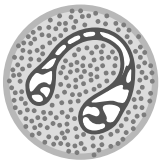
2. **Just as each stationery item has its own purpose, different types of cells have different _____. These different types of cells are specialised.**

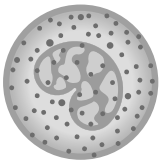
The cells below are each found in different parts in your body. Do you know where they are found?


epithelial cell

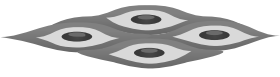

nerve cell

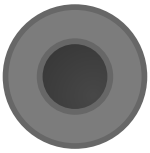

neutrophil

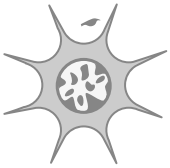

eosinophil

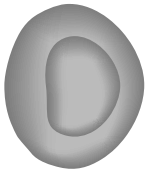

basophil


sperm cell


smooth muscle cell


red blood cell


bone cell


monocyte

Exploring Cell City

Complete the worksheet using the information from the presentation.

1. What are organelles?

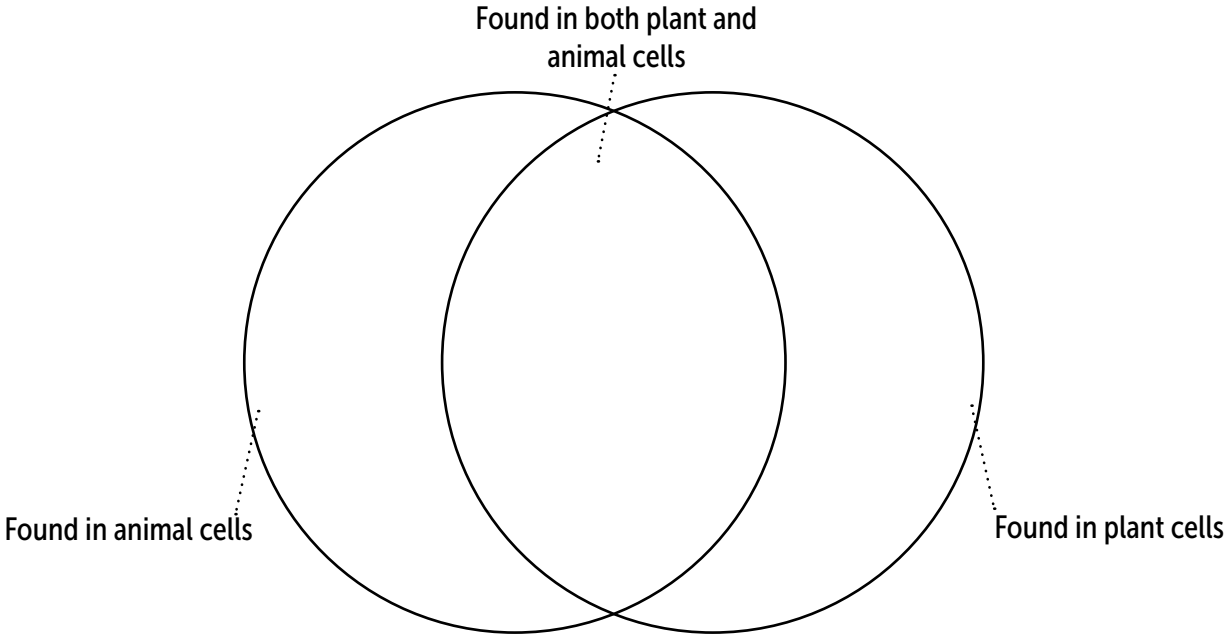
_____

_____

2. Fill in the table with relevant information from the slides.

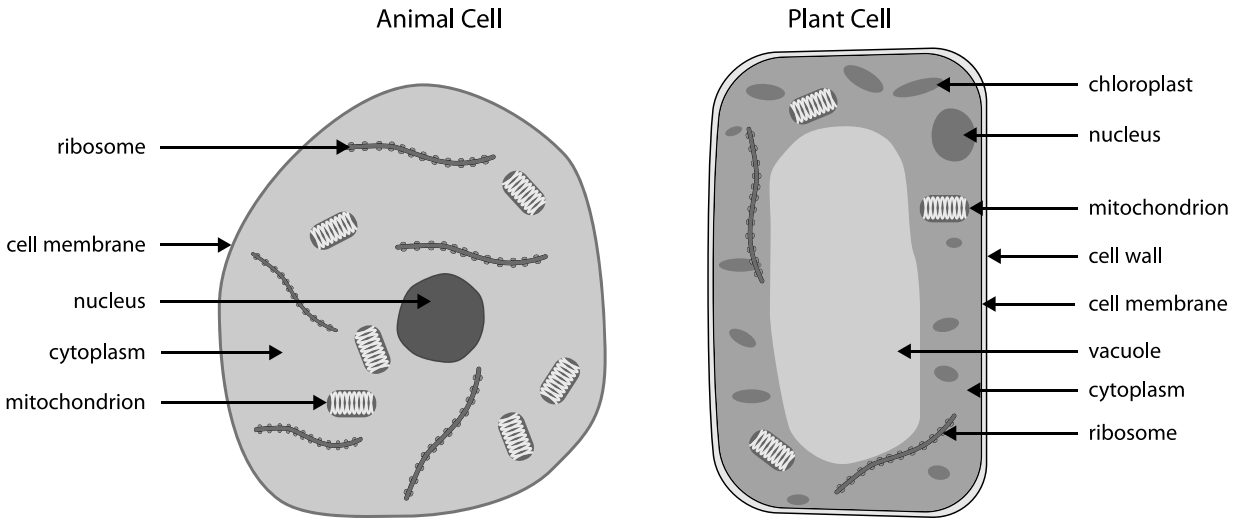
Part of city	Corresponding cell organelle	Function	Where is it found?	
			Animal	Plant
City hall				
Transport system				
Environment				
Factory				
City police				
Power station				
Post office				
Recycling facility				
Water plant				
City wall				
Solar power plant				

3. Classify the organelles using the Venn diagram below.



Can You Haiku the Organelles?

Haiku is a very short form of Japanese poetry. A traditional haiku poem consists of three lines, with the first and last line having 5 syllables, and the middle line having 7 syllables. Choose 5 organelles and create a haiku poem for each of them, describing their characteristics and functions. Don't forget to follow the 5-7-5 rule!



For example:

NUCLEUS

Membrane-bound structure,

found in plants and animals,

controlling the cell.

An Introduction to Microscopes

LAB LESSON

OBJECTIVES

In this lesson, students will gain skills and knowledge regarding the use of a microscope.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Cells and organisation

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope

KEYWORDS

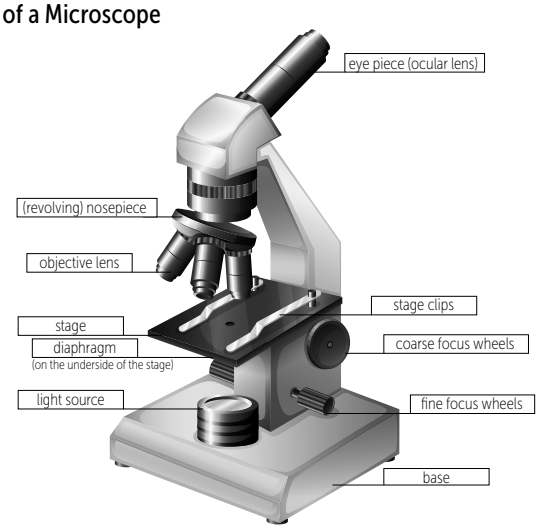
organism, cell, microscope, observation, eyepiece, base, fine focus, coarse focus, stage, stage clips, diaphragm, objective lens, light source, nosepiece, slide, specimen

LESSON PLAN

Activities	Resources
Activity 1: What Do We Use to See? Use the following questions as discussion points: • What tool do you use to enlarge printed text that is too small for your eyes? *(Magnifying glass)* • What do people use to view things that are microscopic? *(Light microscope)* 5	
Activity 2: Parts and Functions of a Microscope Give out the *Parts of a Microscope* worksheet and play the video. As students watch the video, ask them to complete the worksheet. Give out the *Functions of a Microscope* worksheet and play the same video. As students watch the video, ask them to complete the worksheet. Use the presentation to review answers to the worksheets. 15	• Photocopies of the *Parts of a Microscope* and *Functions of a Microscope* worksheets • ClickView video *Using a Microscope - Lab Skills* **https://clickv.ie/w/ks3/2** • Presentation: An Introduction to Microscopes
Activity 3: Let's Use the Microscope Give out the *Let's Use the Microscope* worksheet. Play the same video from before, asking students this time to take note of the steps involved in using the microscope. Allow time for students to complete Part A of the worksheet individually. Divide students into groups of 3 and hand out the listed materials. Ask students to follow the instructions on Part B of the worksheet and see if they can find any form of life in the pond water. 40	• Photocopies of the *Let's Use the Microscope* worksheet • ClickView video *Using a Microscope - Lab Skills* • For each group of 3: Glass microscope slides, plastic dropper, pond water, plastic coverslip, paper towels, microscope

ANSWERS

Parts of a Microscope



Functions of a Microscope

Objective lens	Holds microscopic slide in place on the stage
Eyepiece lens (ocular lens)	A supportive structure that prevents the microscope from tipping over
Focusing wheels (fine and coarse focus wheels)	Shines light up through the slide and is directed to the mirror
Stage	Collects light coming through the object and magnifies it
Stage clips	Controls the amount of light that comes through the aperture
Base	Contains the lens that allows you to view the specimen
Diaphragm	Holds objective lens in place
Light source	Moves the stage or upper part of the microscope up and down to focus on the specimen. There is a coarse focus wheel (used first) and a fine focus wheel (for fine-tuning the focus)
Nosepiece	Holds and supports microscope slides

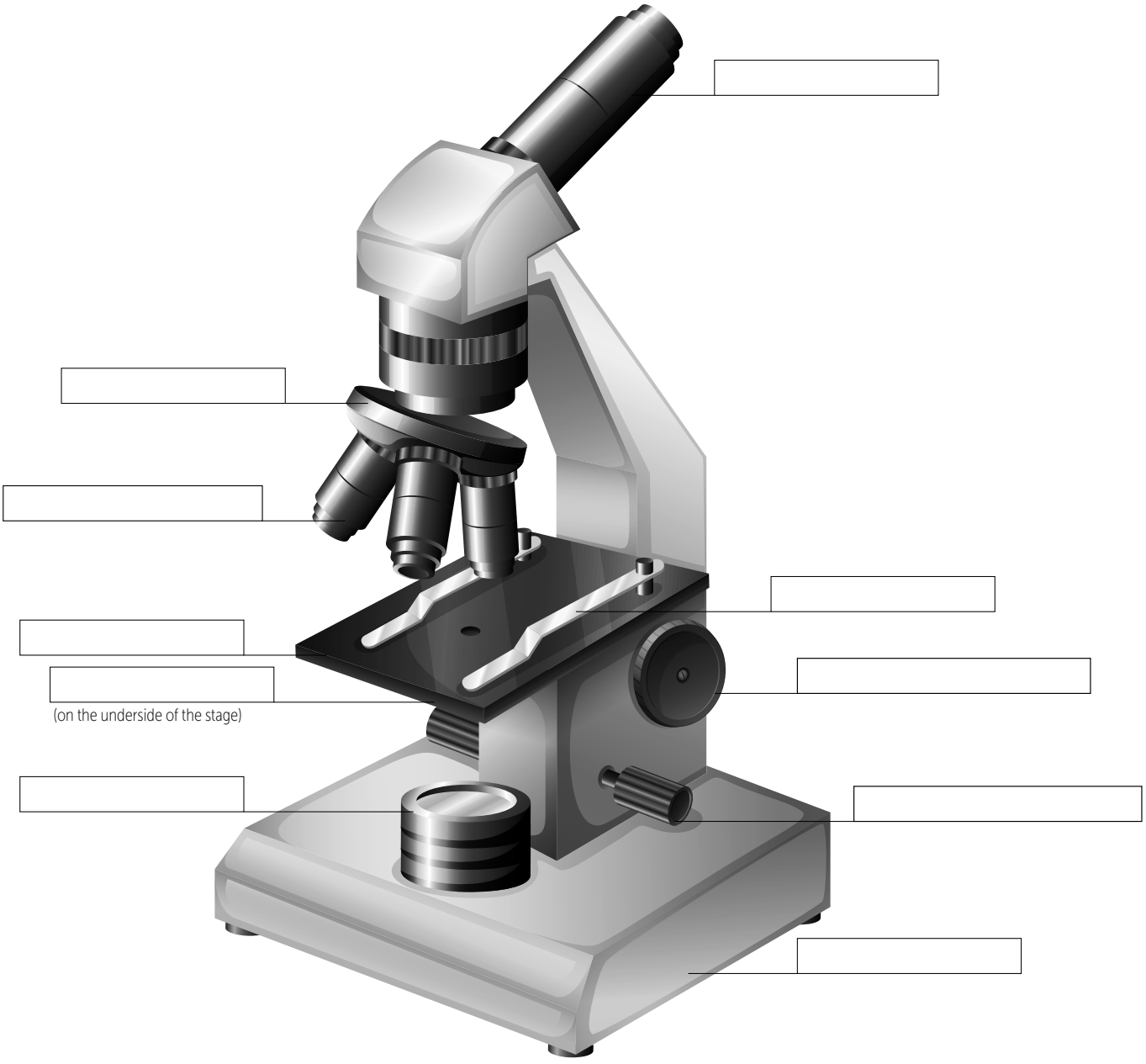
Let's Use the Microscope

1	Carry the microscope with two hands with one hand on the base.
2	Always begin focusing with the lowest power objective lens (e.g. 4x) and the stage in the lowest position so that the slide never touches the objective lens (this avoids cracking of the glass slides and coverslips, and damaging the lens).
3	Use the coarse focus wheel to move the stage up and focus the specimen.
4	Use the fine focus wheel to adjust visibility of the specimen, or change to a higher objective lens.
5	View the specimen under the microscope.
6	Lower the stage and then remove the slide when finished.
7	Return the lowest power objective lens into position over the stage, and be sure the stage is at its lowest function when you have finished using the microscope.
8	Turn off the light and wrap the cord correctly before putting it away.

Parts of a Microscope

Label the parts of the microscope with the words in the box below using information from the video and the presentation.

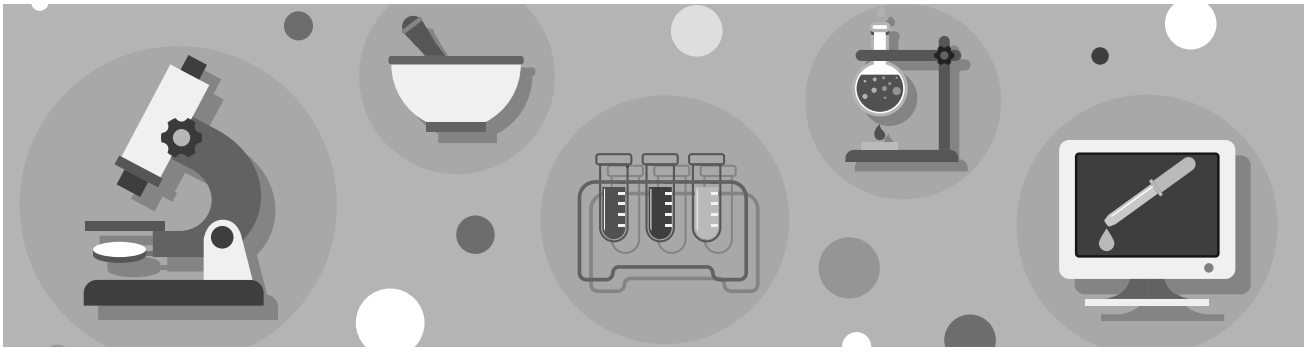
base	fine focus wheel	stage	stage clips	eyepiece (ocular lens)
diaphragm	objective lens	coarse focus wheel	light source	(revolving) nosepiece



Functions of a Microscope

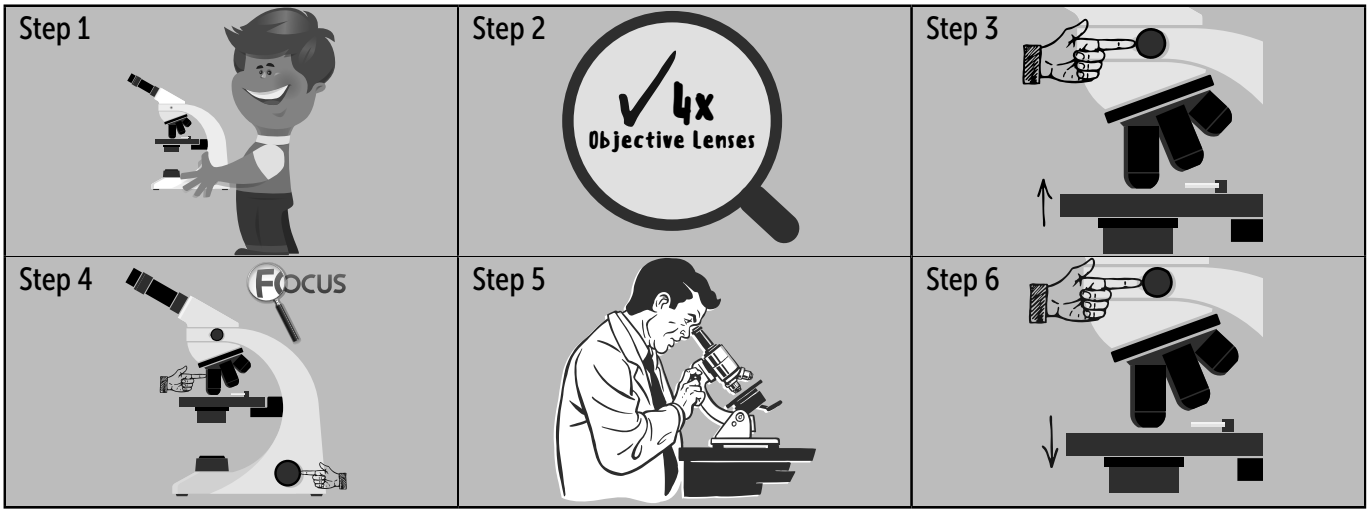
Draw a line to match the features of a microscope to their function. Use the information in the video and the presentation to assist you.

Objective lens	Holds microscopic slide in place on the stage
Eyepiece (ocular lens)	A supportive structure that prevents the microscope from tipping over
Focusing wheels (fine and coarse focus wheels)	Sends light up to the slide and is directed to the mirror
Stage	Collects light coming through the object and magnifies it
Stage clips	Controls the amount of light that comes through the aperture
Base	Contains the lens that allows you to view the specimen
Diaphragm	Holds objective lens in place
Light source	Moves the stage or upper part of the microscope up and down to focus on the specimen. There is a coarse focus wheel (used first) and a fine focus wheel (for fine-tuning the focus)
(Revolving) nosepiece	Holds and supports microscope slides



Let's Use the Microscope

Part A: Using the pictures as clues, create an instructional manual on how to use a microscope. Some of the steps have been provided to assist you.



Step 1	
Step 2	
Step 3	Use the coarse focus wheel to move the stage up and focus the specimen.
Step 4	
Step 5	View the specimen under the microscope.
Step 6	
Step 7	Return the lowest power objective lens into position over the stage, and be sure the stage is at its lowest function when you have finished using the microscope.
Step 8	Turn off the light and wrap the cord correctly before putting it away.

Part B: Prepare a slide and observe it under the microscope. Answer the question in the box below.

Materials:

- microscope
- glass microscope slide
- plastic dropper
- pond water
- plastic coverslip
- paper towels

Instructions:

1. Place a drop of pond water onto the microscope slide using a pipette or dropper.
   TIP: Too small a drop may result in the specimen in the water being crushed. Use the paper towel to remove excess water from the slide if necessary.
2. Place a coverslip on top of the specimen and observe it under the microscope.

What did you see under the microscope?

Unicellular Organisms

OBJECTIVES

In this lesson, students will learn about unicellular organisms and how they differ from multicellular organisms. They will understand the features of unicellular organisms, and research how these organisms are able to survive with only one cell.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Cells and organisation

- the structural adaptations of some unicellular organisms

KEYWORDS

unicellular, paramecium, amoeba, euglena, *E.coli* bacteria, cilium, flagellum, pseudopod, movement

LESSON PLAN

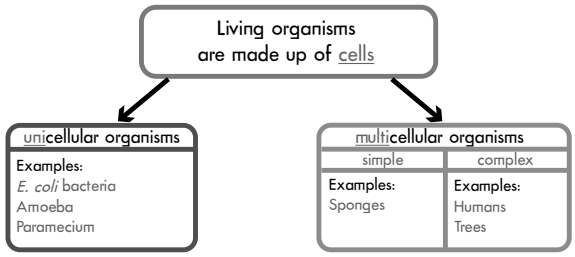
Activities	Resources
Activity 1: How Many Cells Do We Have? Start the lesson by asking students the following questions: • How many cells is the human body comprised of? • Would we be able to survive if we were only made up of one cell? Link discussion to the idea that some organisms in our universe are unicellular and are able to survive with just one cell. 5	
Activity 2: Types of Organisms Give out the *Different Types of Organisms* worksheet and play the video. As students watch the video, ask them to complete Part A of the worksheet. Review answers as a class. 15	• Photocopies of the *Different Types of Organisms* worksheet • ClickView video *Multicellular Organisms and their Nervous Systems* Chapter 1: **https://clickv.ie/w/ks3/3a**
Activity 3: Getting to Know a Unicellular Organism! Divide students into groups of 3 and ask them to research a unicellular organism. Play the video to give students some examples of organisms they could research (Hydra or Amoeba). They may wish to use the template found on Part B of the worksheet as a guide to create an informative poster or PowerPoint presentation to document their findings. When students are finished, allow them to present their research to the class. 40	• *Different Types of Organisms* worksheet • ClickView video *Nutrition in Microscopic Animals - Amoeba, Hydra and Paramecium* **https://clickv.ie/w/ks3/3b** • Laptops

ANSWERS

Different Types of Organisms

Part A:

1.



2.

Statement	Unicellular organisms	Multicellular organisms
These organisms have specialised cells with specialised functions.		✓
These organisms are more likely to reproduce asexually.	✓	
Everything that the organism needs to survive is found in one cell.	✓	
These organisms are usually large in size.		✓

Part B:

Example of an organism:

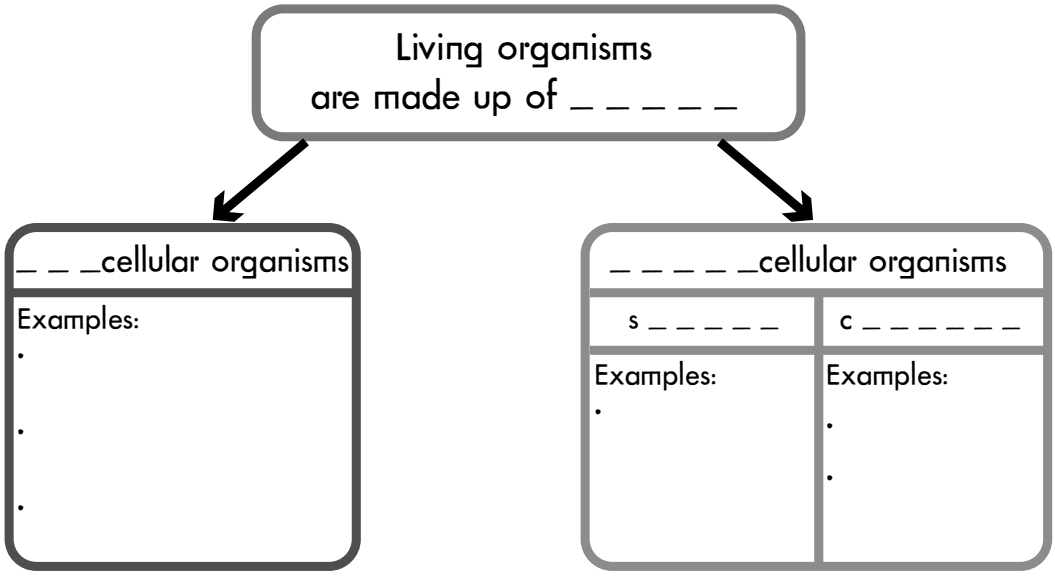
Amoeba			
What am I?	A unicellular organism found in every major lineage of eukaryotic organisms	**Movement**	Moves using pseudopods, which are bulges of cytoplasm due to coordinated action of actin microfilaments pushing out plasma membrane surrounding the cell
Where am I found?	Found in freshwater ponds and on the surface of leaves and plants	**Reproduction**	Asexual reproduction when conditions are right. No reproduction during high stress levels
What do I feed on?	Feeds on bacteria, other protists and sometimes dead organic material through phagocytosis	**Feeding**	Engulfs food with the pseudopods and forms food vacuoles. Food is digested by enzymes
What is found inside me?	No cell wall and contains a single nucleus	**Interesting fact**	Contains a contractile vacuole that expels excess water from the cell to maintain pressure

Other possible organisms: Euglena, *E.coli* bacteria

Different Types of Organisms

Part A: Types of Organisms

1. Complete the diagram as you watch the video.



2. Tick the correct box for each statement.

Statement	Unicellular organisms	Multicellular organisms
These organisms have specialised cells with specialised functions.		
These organisms are more likely to reproduce asexually.		
Everything the organism needs to survive is found in one cell.		
These organisms are usually large in size.		

Part B: Get to Know a Unicellular Organism!

There are many unicellular organisms out there in the universe. Choose one unicellular organism from the video or online and research its main features as well as its adaptations for survival. Refer to the sample poster below for inspiration. You may wish to present your findings on PowerPoint. You cannot choose paramecium for this task.

PARAMECIUM: a unicellular organism

What am I?

I am a unicellular organism of the phylum Ciliophora. I am a heterotroph, which means I cannot make my own food.

Where am I found?

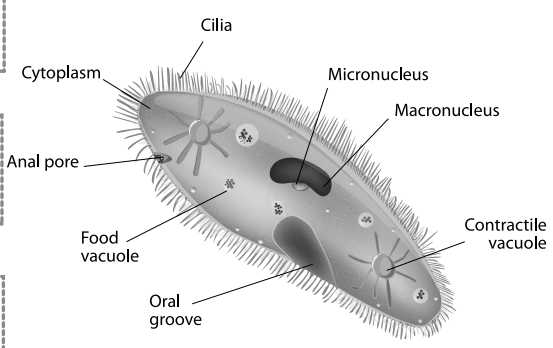
I am found in freshwater ponds.

What do I feed on?

I feed on algae and bacteria through a process known as phagocytosis.

What is found inside me?

I have more than one nucleus.
I have an oral groove for feeding and an anal pore for excretion.



Movement

I am covered with tiny hair-like structures called cilia and they help me push through water, enabling me to swim.

Reproduction

I can reproduce both sexually and asexually depending on stress levels.

Feeding

I use my cilia to sweep my food into my oral groove. When enough food has accumulated, a food vacuole forms and it is digested in my cytoplasm.

Interesting Fact

I have a contractile vacuole that helps maintain water pressure inside me by releasing water into the environment when required.

Organs and Organ Systems

OBJECTIVES

In this lesson, students will learn about the different organ systems in the human body. They will learn that cells, tissues and organs make up an organ system.

SUBJECT CONTENT - BIOLOGY

Structure and function of living organisms:

Cells and organisation

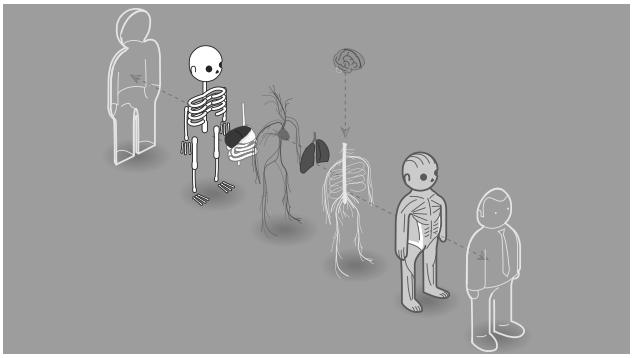
- the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms

KEYWORDS

multicellular organisms, cell, tissue, organ, organ system, muscle, brain, heart, liver, lungs, stomach, kidneys, intestine, circulatory system, respiratory system, digestive system, nervous system, excretory system, muscular system, skeletal system

LESSON PLAN

Activities	Resources
Activity 1: From Cell to Organism Give out the *From Cell to Organism* worksheet. Play Chapter 2 of the video and ask students to complete the worksheet while watching. Pause when required for students to catch up. 15	• Photocopies of the *From Cell to Organism* worksheet • ClickView video *Multicellular Organisms and their Nervous Systems* Chapter 2: **https://clickv.ie/w/ks3/4**
Activity 2: How Many Organs Do You Know? Give out the *How Many Organs Do You Know?* worksheet and divide students into groups of 3. Allow time for the groups to complete the worksheet. Use the presentation to review the answers. 20	• Photocopies of the *How Many Organs Do You Know?* worksheet • Coloured pencils • Presentation: Organs and Organ Systems
Activity 3: We Are the Organ Workers! Give out the *We Are the Organ Workers!* worksheet and ask students to complete it individually. Assign each student a different organ and allow them time to research using the Internet or their textbook. When students are finished, group them according to the organ system they belong to and allow them to share their answers. >35	• Photocopies of the *We Are the Organ Workers!* worksheet • Laptops/ textbooks



ANSWERS

From Cell to Organism

Cell	Tissue	Organ	Organ system
Different cells perform different functions Examples: • Neurons transmit electrical signals • Skin cells protect the body and serve as a barrier against the environment • RBCs deliver oxygen to the body • Muscle cells for contraction	**A collection of cells** Different types of cells put together in a coordinated matrix that work together in a cooperative manner Plant tissues: • vascular • epidermis • ground Animal tissues: • muscle • connective • nervous • epithelial	**A collection of tissues** A group of tissues working together to perform a specific function or a group of functions Plant organs: • leaves • roots • flowers Animal organs: • lungs • eyes • kidneys • sex organs	**A collection of organs that allow different processes to occur in the body**

How Many Organs Do You Know?

Possible answers:

Circulatory system	Digestive system	Respiratory system
• heart • arteries • veins	• mouth • esophagus • stomach • small intestine • large intestine • rectum • anus • liver • pancreas • gallbladder	• lungs • nose • trachea • diaphragm
Excretory system		
• kidneys • ureters • bladder • urethra • lungs		
Muscular system	**Skeletal system**	**Nervous system**
• smooth muscular tissue • skeletal muscles • cardiac muscle	• bones • ligaments and joints • cartilage • tendons	• brain • spinal cord • nerves • sensory organs

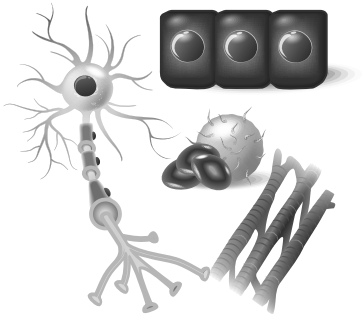
We Are the Organ Workers!

Students' answers may vary.

From Cell to Organism

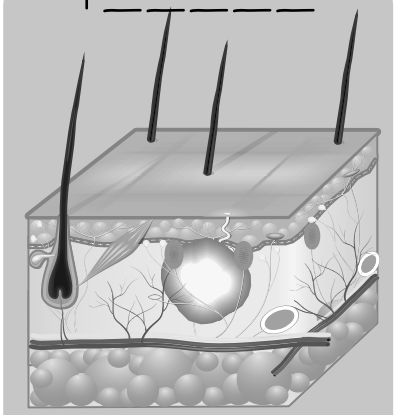
Complete the worksheet using the relevant information from the video.

C___ → T_____ → O_____ → ORGAN S_____ → ORGANISM



Different cell types perform different _____.

List two different types of cells and explain their functions:



A collection of _____

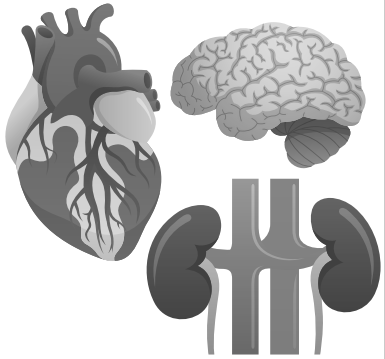
Different types of cells put together in a _____ matrix that work together in a _____ manner

Examples of **plant** tissues:

-
-
-

Examples of **animal** tissues:

-
-



A collection of _____.

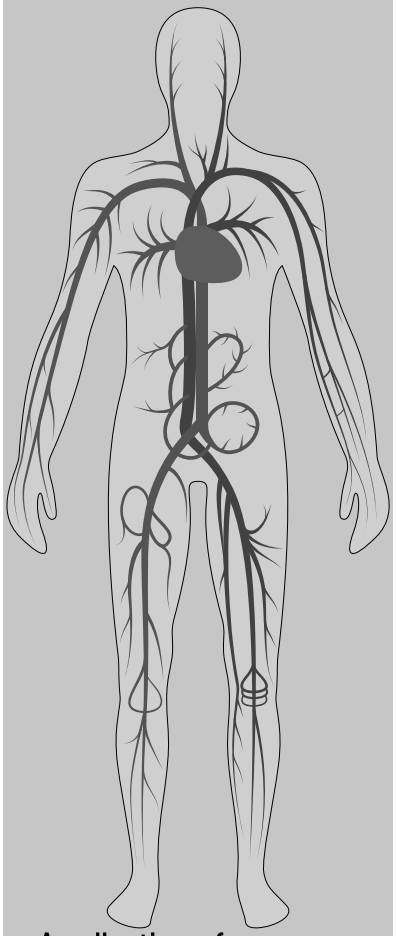
A group of tissues working together to perform a _____ function or a group of functions

Examples of **plant** organs:

-
-
-

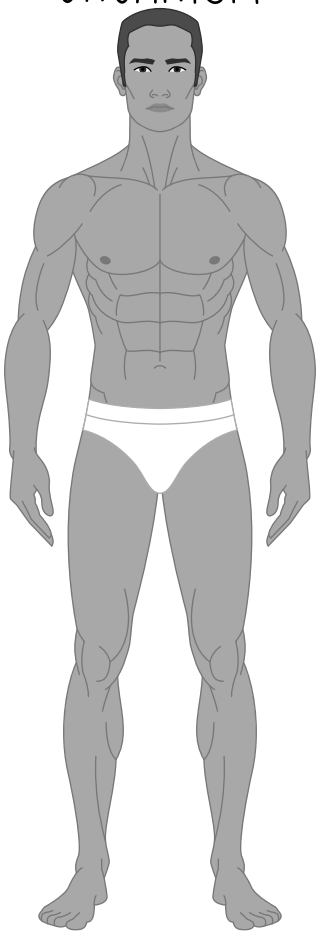
Examples of **animal** organs:

-
-
-
-



A collection of _____ that allow different _____ to occur in the body

(Circulatory system, respiratory system, etc.)

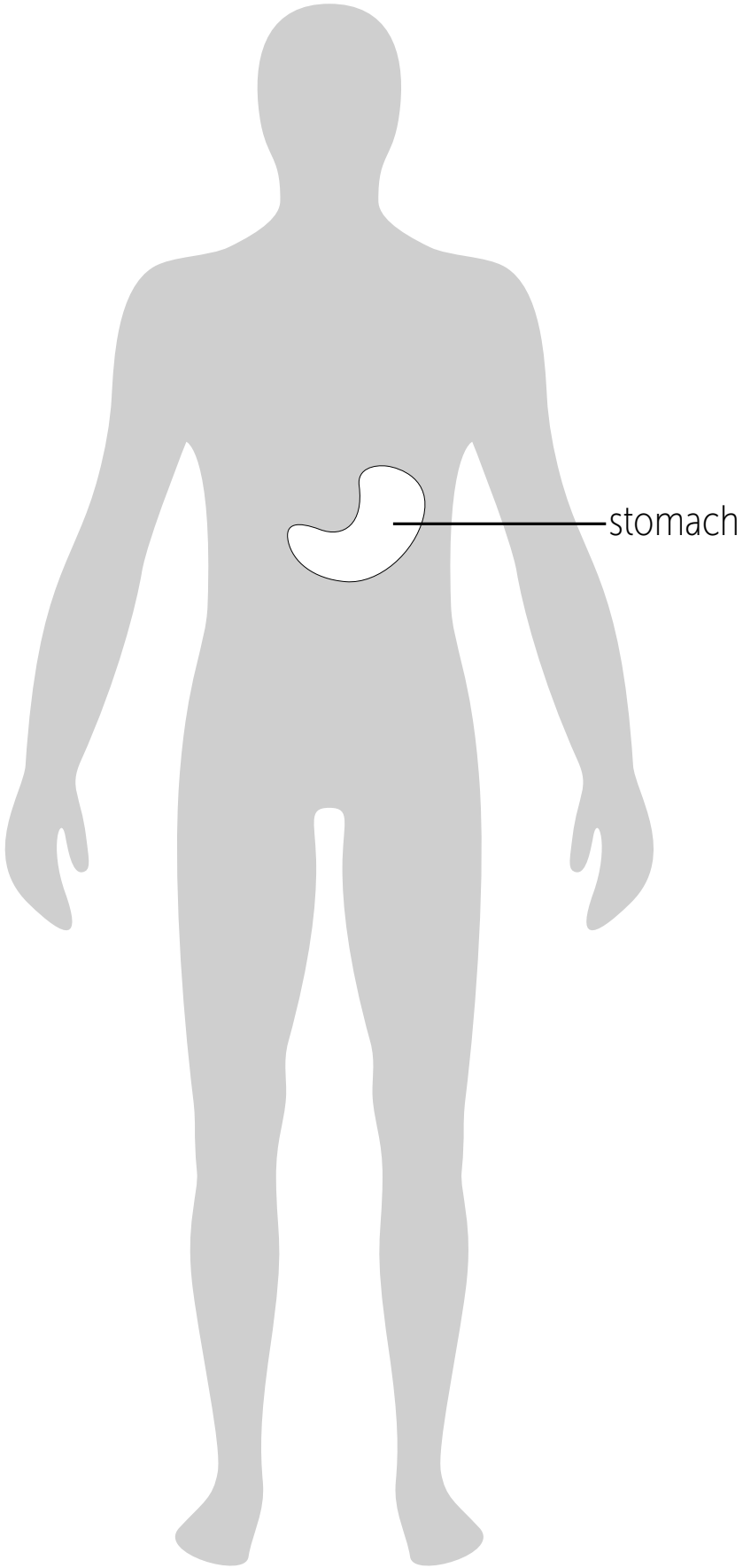


How Many Organs Do You Know?

How many human organs do you know? Label the scientific diagram below to show the organs and their locations inside the body outlined below. An example has been done for you.

Scientific diagrams are:

- 2D
- clear
- not shaded
- labelled correctly



We Are the Organ Workers!

Imagine the human body is a factory. A new manager has just been appointed to oversee the functions of the factory. As an organ worker at the factory, you are asked to provide a description of your role to the manager. Complete the job description form found below based on the organ assigned to you.

JOB DESCRIPTION FORM

1. PERSONAL DATA

Please provide a picture of yourself.

WHAT IS YOUR NAME? *(Name of organ)*

_____

WHICH PART OF THE FACTORY ARE YOU LOCATED IN?
CHOOSE FROM THE FOLLOWING:

- ☐ Skeletal system
- ☐ Muscular system
- ☐ Reproductive system
- ☐ Excretory system
- ☐ Nervous system
- ☐ Respiratory system
- ☐ Circulatory system

WHAT KIND OF EMPLOYMENT DO YOU HAVE WITHIN THE FACTORY?

- ☐ Full-time employment
- ☐ Part-time employment
- ☐ Casual employment

2. JOB DETAILS

WHAT RESPONSIBILITIES ARE ASSOCIATED WITH YOUR JOB?

_____

_____

_____

_____

_____

WITH WHOM IN THE FACTORY DO YOU WORK CLOSELY WITH? NAME THE OTHER WORKERS.

_____

_____

CAN THE FACTORY FUNCTION WITHOUT YOU? WHY OR WHY NOT?

_____

_____

_____

DO YOU REQUIRE INPUT FROM EXTERNAL FACTORS? IF YES, WHAT ARE THEY?

_____

_____

THANK YOU FOR YOUR COOPERATION.

Food Chains

OBJECTIVES

In this lesson, students will develop an understanding of how animals and plants obtain energy in a food chain.

SUBJECT CONTENT - BIOLOGY

Interactions and interdependencies:

Relationships in an ecosystem

- the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops

KEYWORDS

food chain, predator, prey, energy

LESSON PLAN

Activities	Resources
Activity 1: What Is Going on Here? Open the presentation to the first slide and discuss the diagram of a food chain. Students should be able to acknowledge that the arrows represent the transfer of energy from producer to various consumers. Ask students what other examples of food chains they can think of. It's important that they understand the concept of scientists using food chains to demonstrate feeding relationships between organisms in an environment. 5	• Presentation: Food Chains
Activity 2: Learning about Food Chains Give out the *Learning about Food Chains* worksheet then play Chapter 3 followed by Chapter 2 of the video to students. Students are to complete Part A of the worksheet with as much information as they can while watching the video. Using slides 2-8 of the presentation, reiterate the key concepts presented in the video and ask students to complete their worksheet with the additional information given on the slides. Give students time to complete Part B-D of the worksheet after completing Part A. 30	• Presentation: Food Chains • ClickView video *Food Chains and Food Webs* Chapter 3: **https://clickv.ie/w/ks3/5a** Chapter 2: **https://clickv.ie/w/ks3/5b** • Photocopies of the *Learning about Food Chains* worksheet
Activity 3: Find Those Food Chains Open the presentation to the last slide that shows images of a variety of animals. Give out blank paper to students and ask them to work in groups to complete the following tasks: • Draw simple arrow diagrams to represent as many food chains as they can find • Illustrate the longest food chain they discover Have students present their answers to the class. 25	• Blank paper/ notebook • Presentation: Food Chains

ANSWERS

Learning about Food Chains

Part A:

Suggested answers:

Producers

- Able to produce their own food using the sun's energy through a process called photosynthesis
- 95% of their mass comes from carbon dioxide and water that they absorb from their environment
- Food chains always begin with a producer

Herbivores

- Cannot make their own food
- Eat producers for energy

Carnivores

- Eaten by top predators
- Eat herbivores

Top predators

- Eat both herbivores and carnivores

Part B:

Possible answers:

Producers: shrubs, grasses, mosses, ferns, trees, kelp, seagrass, seaweed, phytoplankton
Herbivores: birds, rabbits, squirrels, insects
Carnivores: foxes, snakes, seals
Top predators: lions, tigers, hawks, sharks

Part C:

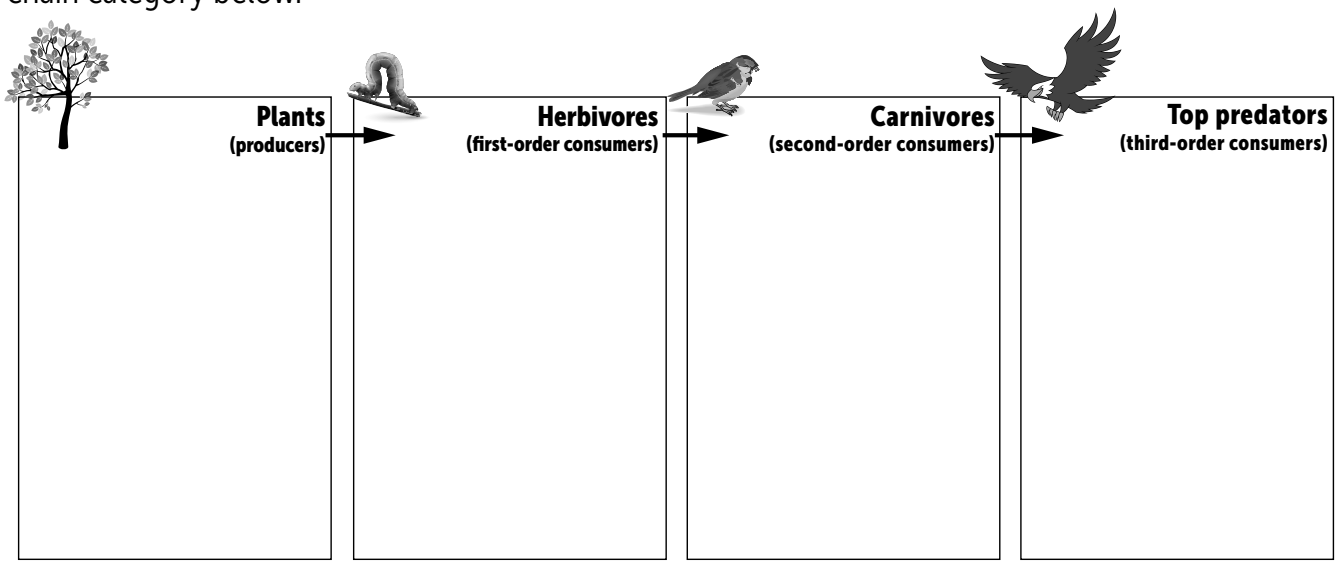
Humans are both herbivores and carnivores as we eat both plants and animals. Humans are known as omnivores.

Part D:

Students' answers may vary.

Learning about Food Chains

Part A: Use information from the video and the presentation to write relevant facts under each food chain category below.



Part B: Use the Internet or a textbook to list examples of plants or animals found in each category of a food chain.

Producers _____

Herbivores
(eat only plants) _____

Carnivores
(prey and predator) _____

Top predators
(have no predator) _____

Part C: Are humans herbivores, carnivores or top predators? Explain your answer.

_____

_____

_____

Part D: Draw a food chain that incorporates a human as a herbivore or carnivore.

Food Webs

OBJECTIVES

In this lesson, students will develop an understanding of food webs. Students will investigate the concept of food webs and develop a food web for a particular habitat.

SUBJECT CONTENT - BIOLOGY

Interactions and interdependencies:

Relationships in an ecosystem

- the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops

KEYWORDS

food chain, food web, predator, prey, energy, decomposer, scavenger

LESSON PLAN

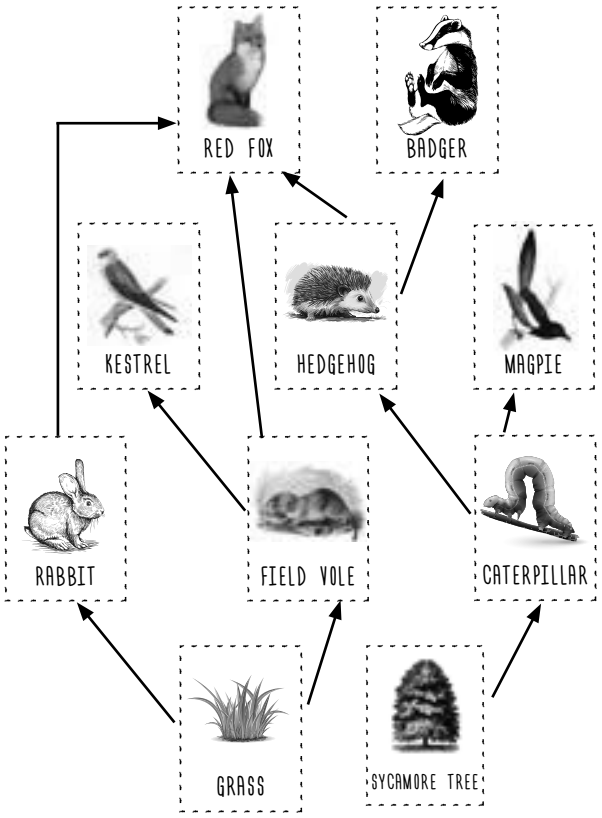
Activities	Resources
Activity 1: Food Chains and Food Webs Open the presentation to the first slide. Use the two food chains to introduce the idea of food webs and show how organisms in a similar habitat are interconnected. 5	• Presentation: Food Webs
Activity 2: Introducing the Food Web Give out one *Introducing the Food Web* worksheet to each pair of students and play Chapter 4 of the video. They are to complete the worksheet whilst watching the video. You may need to play the video more than once for students to obtain all of the required information. Use slides 2 and 3 as a summary of the key concepts raised in the video. 15	• Photocopies of the *Introducing the Food Web* worksheet • ClickView video *Food Chains and Food Webs* Chapter 4: **https://clickv.ie/w/ks3/6a** • Presentation: Food Webs
Activity 3: Cracking the Food Web Give out the *Cracking the Food Web 1 and 2* worksheets and ask students to work in pairs to finish the cut-and-paste activity. They are required to create a food web using information found in the passage 'Life in the Grasslands' on Cracking the Food Web 1. Encourage students to explain how they arrived at their answers. 35	• Photocopies of the *Cracking the Food Web 1 and 2* worksheets • For each pair: scissors, glue and paper
Activity 4: What Happens When an Organism Dies? Before you play Chapter 5 of the video, open the presentation to slide 5 and pose the following questions: • Does the red fox have any natural predators? (Not many) • Does the red fox eventually die? (Yes) • How? (Old age, sickness, disease etc.) • What happens after an animal dies? (Play Chapter 5 of the video. The video discusses decomposers and scavengers and explains the very intricate cycle of an ecosystem. Summarise the key points raised in the video using the last slide of the presentation.) 15	• Presentation: Food Webs • ClickView video *Food Chains and Food Webs* Chapter 5: **https://clickv.ie/w/ks3/6b**

ANSWERS

Introducing the Food Web

	Statement	T	F
1	Most animals get their energy from more than one food source.	✓	
2	Most animals are only part of one food chain.		✓
3	A first-order consumer (herbivore) eats only plants.	✓	
4	A food web shows how all animals eat only one type of food.		✓
5	Second-order consumers (carnivores) eat only primary consumers.		✓
6	A predator in a food web can never become prey.		✓
7	A more complicated food web shows a more stable and secure ecosystem.	✓	

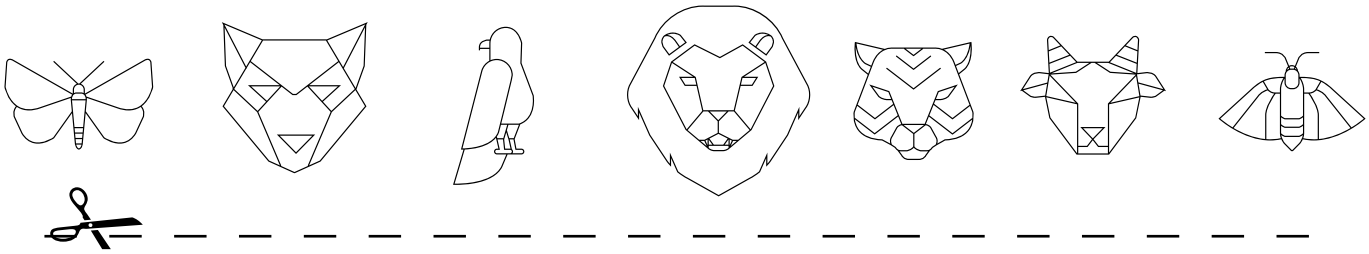
Cracking the Food Web



Introducing the Food Web

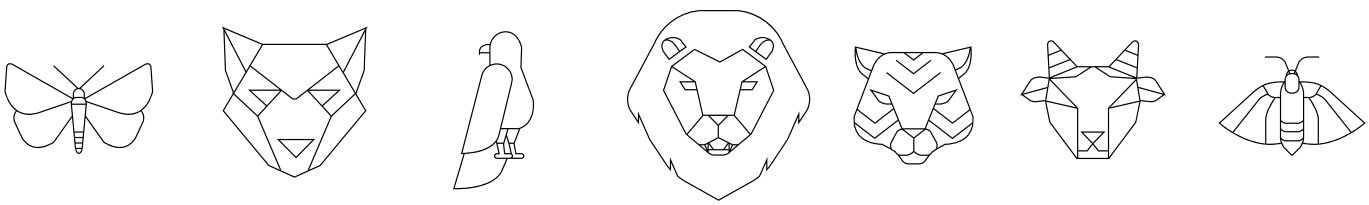
As you watch the video, tick the correct box for each of the following statements.

	Statement	True	False
1	Most animals get their energy from more than one food source.		
2	Most animals are only part of one food chain.		
3	A first-order consumer (herbivore) eats only plants.		
4	A food web shows how all animals eat only one type of food.		
5	Second-order consumers (carnivores) eat only primary consumers.		
6	A predator in a food web can never become prey.		
7	A more complicated food web shows a more stable and secure ecosystem.		



As you watch the video, tick the correct box for each of the following statements.

	Statement	True	False
1	Most animals get their energy from more than one food source.		
2	Most animals are only part of one food chain.		
3	A first-order consumer (herbivore) eats only plants.		
4	A food web shows how all animals eat only one type of food.		
5	Second-order consumers (carnivores) eat only primary consumers.		
6	A predator in a food web can never become prey.		
7	A more complicated food web shows a more stable and secure ecosystem.		



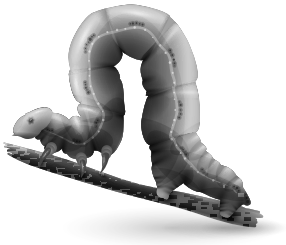
LIFE IN THE GRASSLANDS

Welcome to the grasslands, where different animals live together and roam around freely. A **sycamore tree** stands tall and proud. A **caterpillar** quietly nibbles on one of its leaves. A **magpie** hovers overhead and spots the **caterpillar**. As he prepares to swoop onto his fat and juicy snack, a **hedgehog** appears out of nowhere and consumes the **caterpillar**. Meanwhile, a **rabbit** hops to the grasslands nearby, joining a **field vole** to munch on some juicy **grass**. Over at the far end of a bush, a hungry **red fox** has crept up and stays hidden behind it. He watches the **hedgehog** and **field vole** from afar, salivating. But in the next second, a **badger** makes a dash for the distracted **hedgehog** and uncurls its tight defensive ball of spines with his powerful front claws. As the **red fox** turns its attention to his other prey, a skillful **kestrel** flies in and grabs for the **field vole**. Just as the **red fox** thought he was going to go home hungry, he spots the timid, little **rabbit**, still chewing on the **grass** and thinks to himself, "I'm quite lucky after all!"

Cracking the Food Web 2

Cut out the cards below and create a food web showing the possible feeding relationships between animals using the 'Life in the Grasslands' passage.

BADGER



CATERPILLAR

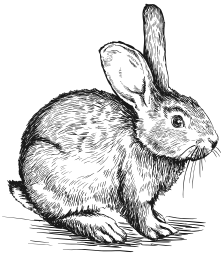
FIELD VOLE

GRASS

HEDGEHOG

KESTREL

MAGPIE



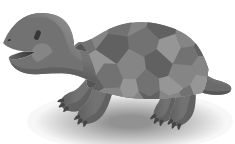
RABBIT

RED FOX

SYCAMORE TREE

DID YOU KNOW?

There are more herbivores than carnivores in the world.
What do you think is the reason for that?



States of Matter

LAB LESSON

OBJECTIVES

In this lesson, students will learn about the different states of matter at the molecular level. They will learn about particle theory and the different processes each state undergoes.

SUBJECT CONTENT - CHEMISTRY

The particulate nature of matter

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure
- changes of state in terms of the particle model

KEYWORDS

particle, property, solid, liquid, gas, states of matter, melting, freezing, evaporation, condensation, sublimation, energy, plasma

LESSON PLAN

Activities	Resources
Activity 1: What Is Happening on the outside of the Glass? As a demonstration, put some ice cubes into a drinking glass. Give out the Understanding the States of Matter worksheet and ask students to complete Part A. They are required to explain what they can observe when the glass is left to stand for 3 minutes. Proceed to ask students the following question to assess prior knowledge: • How many states does water exist in? *(3 states – solid, liquid, gas)* 15	• Drinking glass, ice cubes • Photocopies of the *Understanding the States of Matter* worksheet
Activity 2: Understanding the States of Matter Allow time for students to attempt Part B of the worksheet. Play the first video and ask students to fill in any missing answers that they did not manage to acquire. Give out the *Particles in the States of Matter* worksheet. Ask students to fill the worksheet in with as much information as they can from Chapter 3 of the second video. Then, ask them to complete the rest of the worksheet with the help of the presentation. 30	• Photocopies of the *Understanding the States of Matter* and *Particles in the States of Matter* worksheets • ClickView video *Changes in States of Matter* **https://clickv.ie/w/ks3/7a** • ClickView video *Changing States of Matter* Chapter 3: **https://clickv.ie/w/ks3/7b** • Presentation: States of Matter
Activity 3: We Are Molecules! Use this activity to explain what is happening to the state transitions at the molecular level. Refer to the *We Are Molecules! 1 and 2* activity guides for instructions. 20	• Photocopy of the *We Are Molecules! 1 and 2* activity guides
Activity 4: What's Hidden in the QR Code? Give out the *What's Hidden in the QR Code?* worksheet and allow time for students to complete the T/F section. Check their answers before students start shading the QR code and have them compete to finish shading first. This activity tests their understanding of the concepts taught and introduces them to the fourth state of matter - plasma. 20	• Photocopies of the *What's Hidden in the QR Code?* worksheet • A device that can scan QR codes

ANSWERS

Understanding the States of Matter

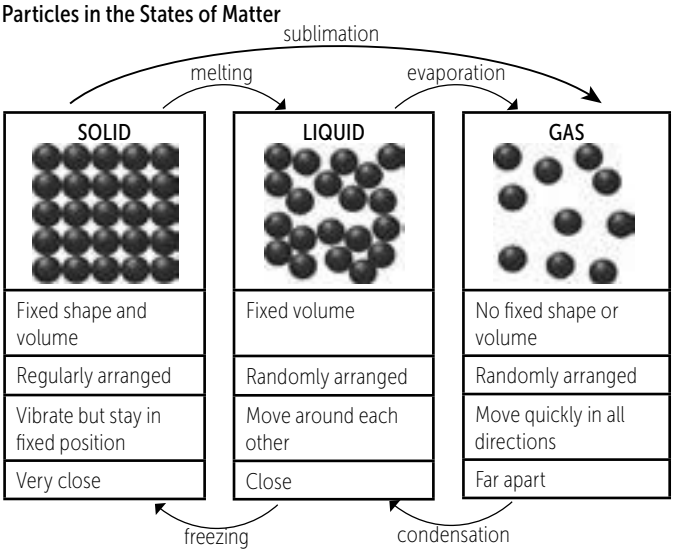
Part A:

Students' answers may vary.

Part B:

states, solid, liquid, gas
freezing, melting
gaseous, evaporation, condensation
interchangeable

Particles in the States of Matter



When water changes from solid ⟶ liquid or from liquid ⟶ gas, energy is required.

What's Hidden in the QR Code?

Statement No.	T/F
1	F
2	T
3	F
4	T
5	T
6	F
7	F
8	T
9	T
10	T
11	F
12	T
13	F

Lightning is one of Earth's famous naturally occurring plasmas. Plasma differs from the other three states because the particles are not neutral.

CHEMISTRY

Understanding the States of Matter

Part A: As you watch the demonstration, write down your observations and reasoning.

WHAT IS HAPPENING ON THE OUTSIDE OF THE GLASS?

Part B: Complete the following sentences by unscrambling the letters.

Solids, liquids and gases are the three _____ of matter, and these states are interchangeable. A _____ like ice
E T T S A S I D O L S

can be changed into water, which is a _____, and it can further be changed into a _____ such as steam.
L I D Q I U A S G

When we cool water in an ice tray, the water which was in the liquid state changes into ice, which is a solid state of matter.

This process is called _____. When we put ice cubes into a kettle and leave it on the table at room
F G I E N R E Z

temperature, the ice cubes change into water. This process is called _____.
M L T E I G N

When we heat water, it changes to water vapour. Water vapour is the _____ state of water. When water
S O U A S E G

changes from the liquid state to the gaseous state, the process is called _____.
E O R A T I V P O A N

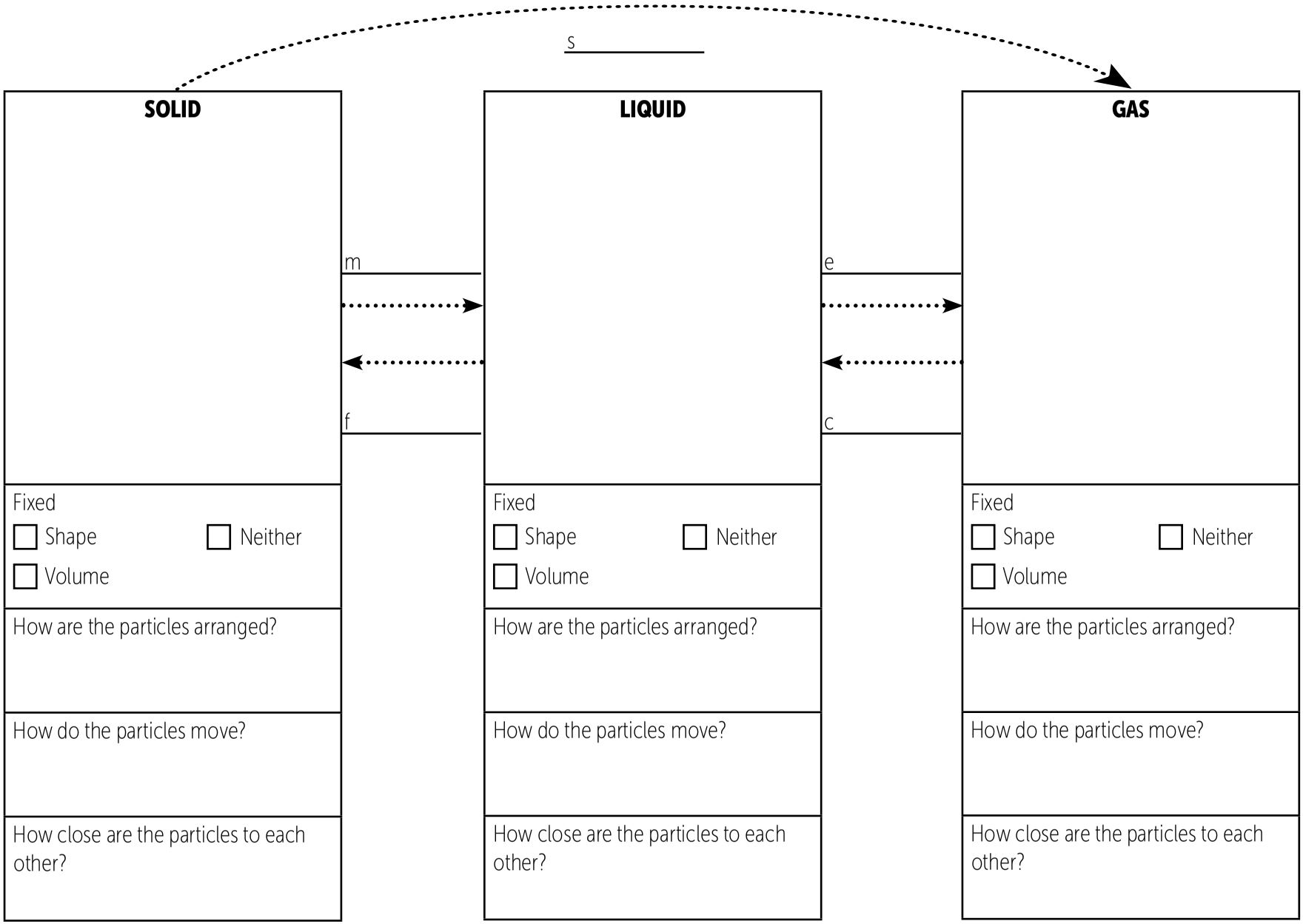
When water vapour comes in contact with a cold surface such as that of a metal plate, it changes to the liquid state. This

conversion is called _____.
C S D N O T N E O A N I

Thus, we see that all the states of matter are _____.
I B E A E N N T G H A R L E C

Particles in the States of Matter

Complete the diagram below about the properties of particles in each state with the help of the video and presentation.

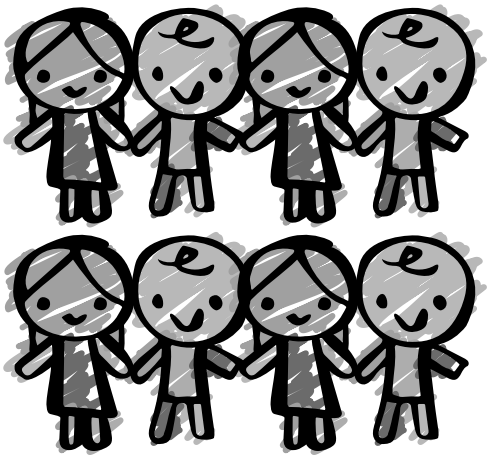


When water changes from solid → liquid, or from liquid → gas, _____ is required.

We Are Molecules! 1

In this activity, students learn to see the states of matter from the molecular level as they pretend to be the molecules of a solid, liquid and gas. This analogy enables them to understand the phase transition concepts in a manner they can better relate to.

SOLID



Theory:

Molecules in a solid phase are tightly packed together, which creates a rigid structure.

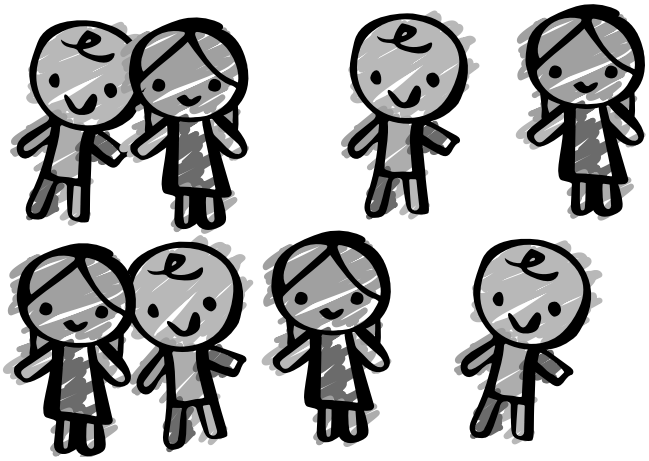
Analogy activity:

Ask students to stand close together, linking arms together.

Questions to ask students:

- Are you able to squeeze closer together?
  (No, they are already closely packed together and cannot be compressed further.)
- Are you able to move around freely?
  (No, they are not able to move around freely, just like the composition of a solid.)

LIQUID



Theory:

Molecules are not as tightly compressed within a liquid as they are in a solid.

A liquid's molecules have freedom to move around and occupy the space they are contained in. They don't hold their shape but they do have a fixed volume.

Analogy activity:

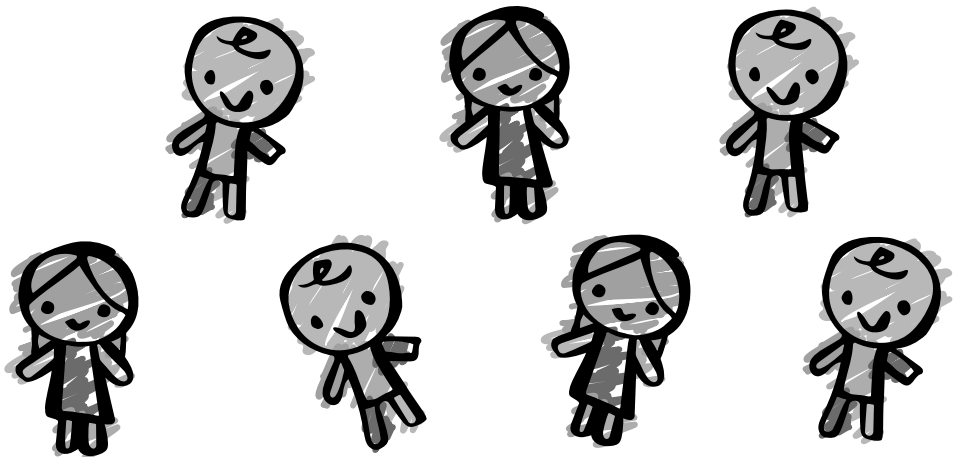
Ask the students to stand in close contact with each other (but still able to move around).

Questions to ask students:

- Are you able to squeeze closer together?
  (No, they are already closely packed together and cannot be compressed further.)
- Are you able to move around freely?
  (Yes, they are able to move around freely. This represents a liquid being able to take up the shape of a container.)

We Are Molecules! 2

GAS



Theory:

Matter in the gas phase doesn't hold its shape and does not have a fixed volume.
Gas particles move quickly in all directions. Gases can be compressed, and completely fill their container.

Analogy activity:

Ask the students to run anywhere in the classroom

Questions to ask students:

- Are you able to squeeze closer together?
  (Yes, they are not closely packed together and can be compressed further.)
- Are you able to move around freely?
  (Yes, they are able to move around freely. This represents gas molecules being able to be compressed further according to the size of the container.)

State Transitions

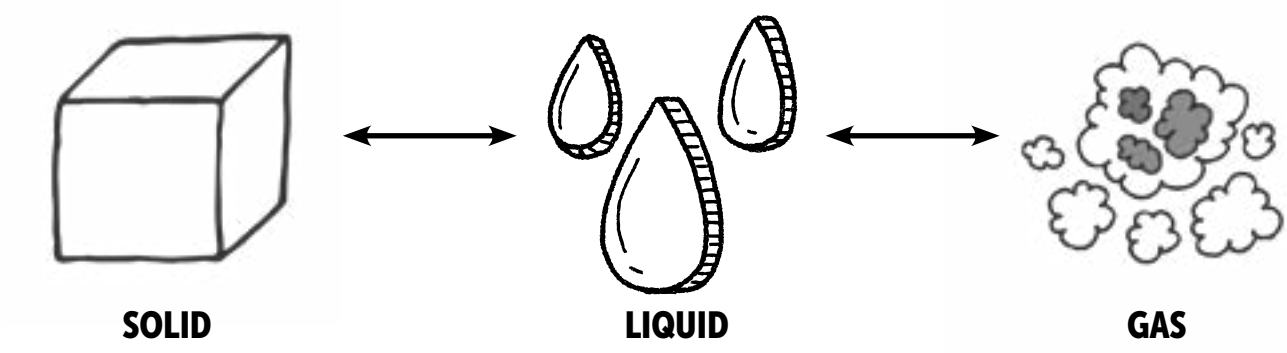
Even though a solid's molecules remain tightly connected to each other, they still vibrate. The "molecules" in the solid phase would be shaking back and forth while still holding hands as they do not have enough kinetic energy to break the bonds between the molecules.

When energy is supplied to the molecules and their vibrations speed up, eventually they will no longer be able to hold hands and will start to move around the classroom (liquid molecules). This can happen when temperature is increased.

If you speed up the vibrations of the liquid molecules even further, they will lose contact with each other and start running around the classroom (gaseous molecules). Gas molecules have the most kinetic energy.

Further Discussion Questions

- What is one advantage of such an analogy activity to understand concepts?
  (It allows us to compare one object or situation to another, allows us to understand a concept through familiar actions.)
- What is one disadvantage of such an analogy activity to understand concepts?
  (There is no perfect fit between the analogy and the concept and the analogue may sometimes not be able to illustrate a particular concept accurately.)



What's Hidden in the QR Code?

Determine whether each of the statements is true or false.

No.	Statements	True/False
1	Water is not the only substance on earth to exist naturally in the solid, liquid and gaseous states.	
2	The states of matter are interchangeable.	
3	Solids have a fixed shape but no fixed volume.	
4	Liquids take the shape of their container.	
5	Freezing is the process of changing a substance from liquid to solid.	
6	Condensation is the process of changing water from gas to solid.	
7	Steam is hot air.	
8	When an ice cube melts, there is no loss in mass.	
9	Energy is required to change matter from liquid to gas.	
10	Melting is the opposite process of freezing.	
11	Gases have the lowest amount of kinetic energy.	
12	The speed at which particles move depends on the amount of energy present in the matter.	
13	Sublimation occurs when a solid changes into a liquid and then to a gas.	

Check your answers are correct with the teacher, then shade the boxes in the QR code that contain the corresponding number for statements that are **true**. This activity will work best using a black pen.

Scan the completed code with a QR code scanner to find the words to complete the sentences.

_____ is one of Earth's famous naturally occurring plasmas. Plasma differs from the other three states because the particles are not _____.

Physical and Chemical Changes

LAB LESSON

OBJECTIVES

In this lesson, students will gain an understanding of the differences between physical and chemical changes.

SUBJECT CONTENT - CHEMISTRY

The particulate nature of matter

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure

Pure and impure substances

- mixtures, including dissolving

Chemical reactions

- chemical reactions as the rearrangement of atoms

KEYWORDS

physical changes, chemical changes, mixture, property, states of matter, reversible, irreversible, solid, liquid, gas

LESSON PLAN

Activities	Resources
Activity 1: All about Physical and Chemical Changes Give out the *All about Chemical and Physical Changes* worksheet to each pair of students. Play the video and ask students to complete the worksheet as they watch it. Review the answers when students have completed the task. 15	• Photocopies of the *All about Chemical and Physical Changes* worksheet • ClickView video *Differences Between Physical and Chemical Changes* **https://clickv.ie/w/ks3/8**
Activity 2: Is It Physical or Chemical? Give out the *Is It Physical or Chemical?* worksheet to students before dividing them into groups of 3. Read through the instructions as a class before students undertake the experiments. Ensure Bunsen burner safety guidelines are followed throughout the lesson. Allow students to share their observations and responses when they have finished. 40	• Photocopies of the *Is It Physical or Chemical?* worksheet • For each group of 3: marshmallows, skewers, Bunsen burner, ice cubes, evaporating dishes, tripod stand, wire gauze, 2 x beakers, tap water, salt, glass rod, Alka-Seltzer®, aluminium foil, chocolate buttons, ice-cream stick
Activity 3: Chemistry in Our Daily Lives Give out the *Chemistry in Our Daily Lives* worksheet to students. The worksheet is a review to test their understanding of physical and chemical changes. 5	• Photocopies of the *Chemistry in Our Daily Lives* worksheet

ANSWERS

All about Chemical and Physical Changes

1.	C	9.	C
2.	P	10.	C
3.	C	11.	C
4.	C	12.	P
5.	P	13.	C
6.	C	14.	P
7.	P	15.	P
8.	P	16.	C

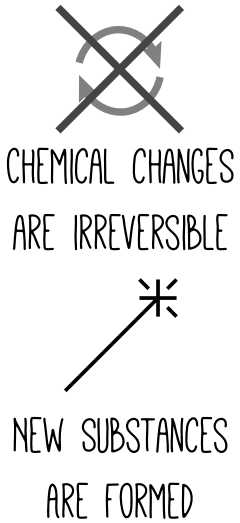
Is It Physical or Chemical?

Possible answers:

Task	Observations	Physical or chemical change?
a	The marshmallow changed in size.	Physical
b	The marshmallow turned brown when heated.	Chemical
c	The marshmallow remained brown.	Physical
d	The ice cube changed from a solid to a liquid to a gas.	Physical
e	The salt dissolved in the water.	Physical
f	Bubbles formed around the tablet as it dissolved.	Chemical
g	The chocolate changed from solid to liquid.	Physical
h	The chocolate turned hard and looked dull.	Chemical

Chemical Changes in Our Daily Lives

START
↓
Electrolysis of water
↓
Fizzing of baking soda in vinegar
↓
Burning firewood
↓
Digesting food
↓
Lighting firecrackers
↓
Rusting iron
↓
Baking cupcakes
↓
FINISH

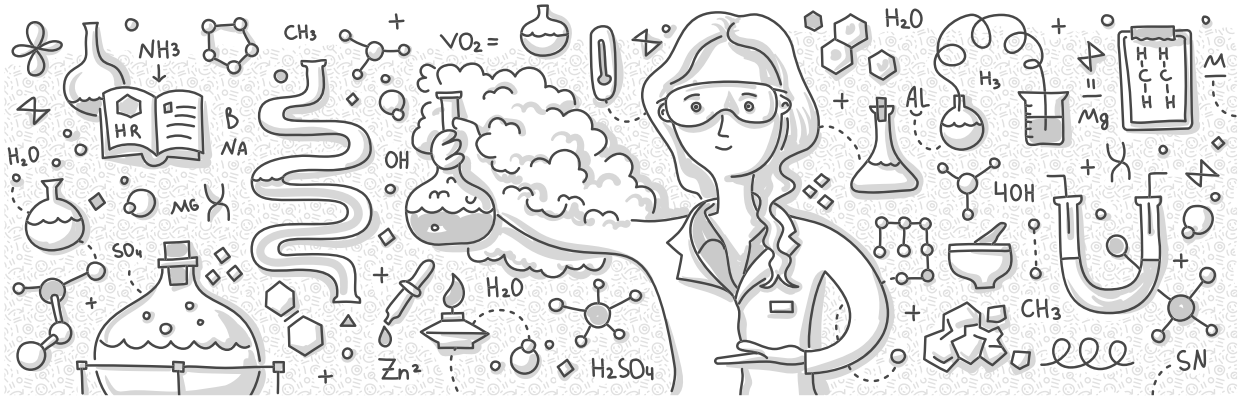


CHEMISTRY

All about Physical and Chemical Changes

As you watch the video, write 'P' in the box if the information provided relates to a physical change, and 'C' if the statement is related to a chemical change.

	Information	P/C		Information	P/C
1.	Changes at the molecular level		9.	Reactants used up	
2.	Change in the physical properties		10.	Iron rusting	
3.	Heat generated		11.	A change in molecular structure	
4.	Usually irreversible		12.	A change in shape	
5.	A change in state		13.	Burning paper	
6.	New substances formed		14.	Melting ice	
7.	Cutting paper		15.	A change in size	
8.	May be reversible		16.	Eggs spoiling	



As you watch the video, write 'P' in the box if the information provided relates to a physical change, and 'C' if the statement is related to a chemical change.

	Statements	P/C		Statements	P/C
1.	Changes at the molecular level		9.	Reactants used up	
2.	Change in the physical properties		10.	Iron rusting	
3.	Heat generated		11.	A change in molecular structure	
4.	Usually irreversible		12.	A change in shape	
5.	A change in state		13.	Burning paper	
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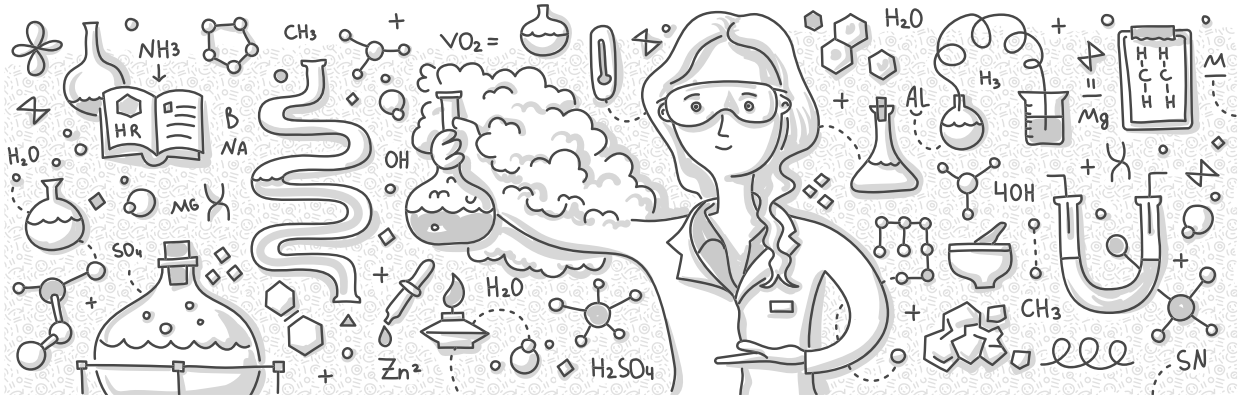
7.	Cutting paper		15.	A change in size	
8.	May be reversible		16.	Eggs spoiling	

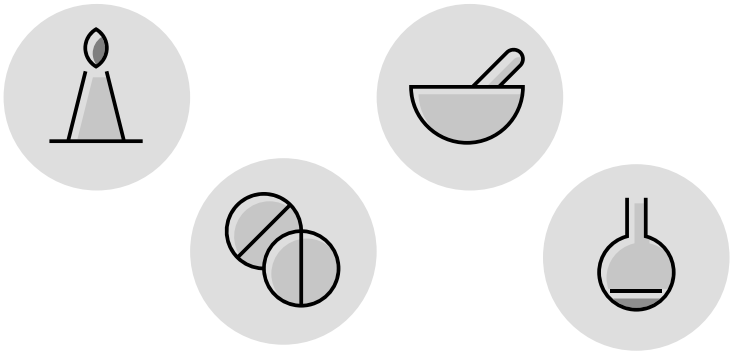


CHEMISTRY

Is It Physical or Chemical?

Materials:

- marshmallows
- skewer
- Bunsen burner
- an ice cube
- evaporating dish
- tripod stand
- wire gauze
- 2 x beakers
- tap water
- salt
- glass rod
- Alka-Seltzer®
- aluminium foil
- chocolate buttons
- ice-cream stick



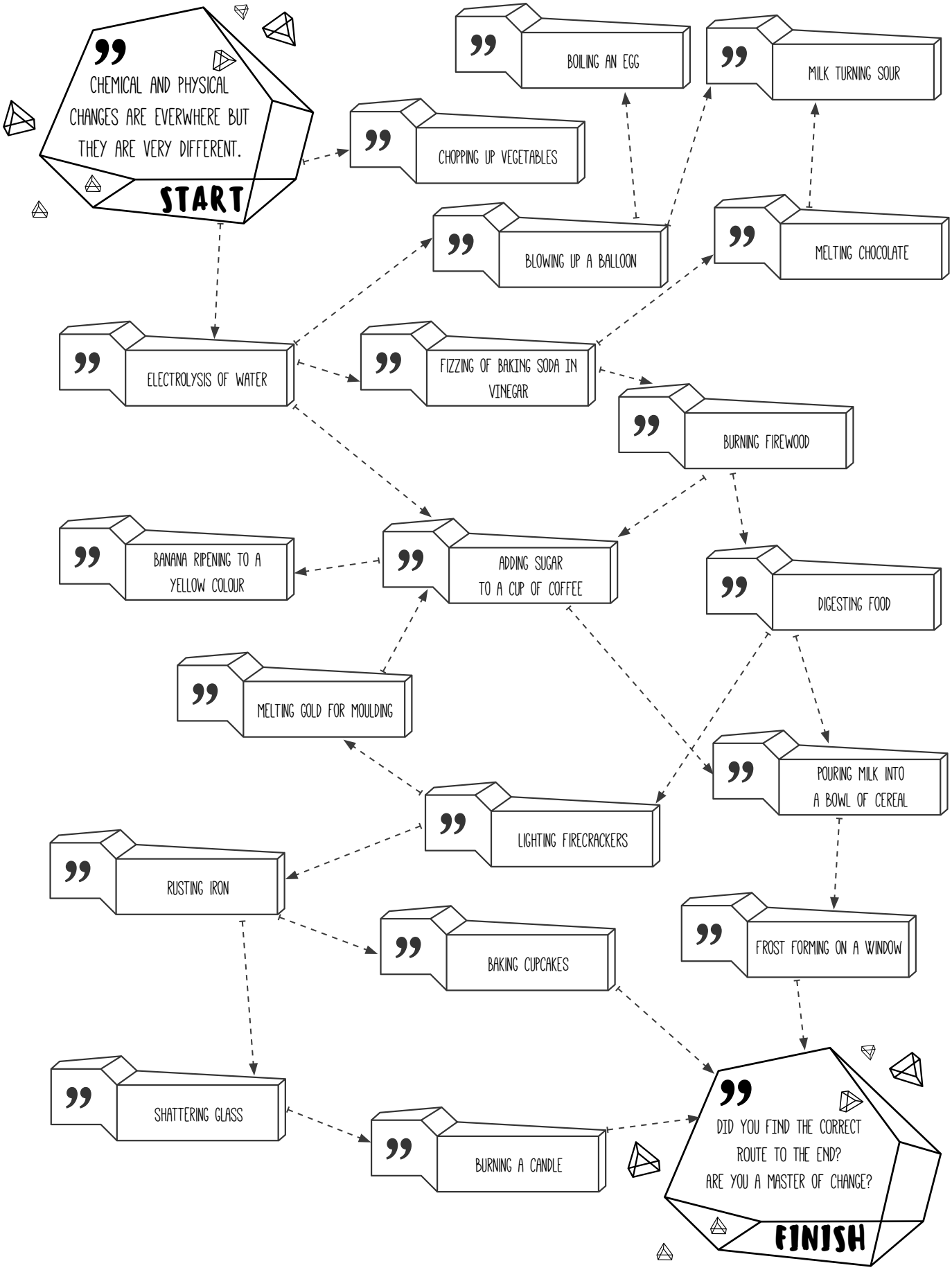
Instructions:

Carry out the following tasks and record your observations. Determine whether each task resulted in a physical or chemical change.

Materials	Task	Steps	Observation (Any changes?)	Physical or chemical change
• marshmallows • skewer • Bunsen burner	a	1. Tear a marshmallow in half.		
	b	1. Pierce the marshmallow with the skewer. 2. Heat the marshmallow over the Bunsen burner fire for 30 seconds.		
	c	1. Cool the marshamllow from the previous task.		
• an ice cube • evaporating dish • tripod stand • wire gauze • Bunsen burner	d	1. Put an ice cube in the evaporating dish. 2. Place a tripod stand with a wire gauze over the Bunsen burner. 3. Place the evaporating dish on the tripod stand. 4. Heat the ice cube until it eventually evaporates.		
• 2 x beakers • tap water • salt • glass rod • Alka-Seltzer®	e	1. Add 100 mL of water to an empty beaker. 2. Add 1 tbs. of salt to the beaker. 3. Stir the mixture with the glass rod.		
	f	1. Add 100 mL of water to an empty beaker. 2. Add one Alka-Seltzer® tablet to the beaker.		
• Bunsen burner • aluminium foil • tripod stand • wire gauze • chocolate buttons • ice-cream stick	g	1. Make a boat using the aluminium foil. 2. Place a tripod stand with a wire gauze over the Bunsen burner. 3. Put a chocolate button in the boat and put the boat on the tripod stand. 4. Melt the chocolate over the Bunsen burner. 5. Stir the melted chocolate with the ice-cream stick.		
	h	1. Heat the same sample of chocolate further until it is crusty (2-3 minutes).		

Chemistry Changes in Our Daily Lives

The maze provides examples of both physical changes and chemical changes. Can you find the correct route from start to finish? Note: The route can only be made of chemical changes.



Acids and Alkalis

LAB LESSON

OBJECTIVES

In this lesson, students will learn about acids and alkalis. They will learn how to identify whether a substance is acidic or alkaline through the use of indicators.

SUBJECT CONTENT - CHEMISTRY

Chemical reactions

- defining acids and alkalis in terms of neutralisation reactions

KEYWORDS

acid, alkali, pH scale, indicator, neutral, corrosive, strong, weak

LESSON PLAN

Activities	Resources
Test the pH of the samples used in Activity 3 to get a rough idea of the colour students would obtain in the experiment. Label the sample each test tube accordingly with its respective letter.	• (A) Egg white, (B) dilute sodium hydroxide, (C) baking soda, (D) dilute hydrochloric acid, (E) lemon juice, (F) milk, (G) soap, (H) vinegar, (I) fizzy drink, (J) powdered antacid
Activity 1: Properties of Acids and Alkalis Give out the *Properties of Acids and Alkalis* worksheet to students and ask them to complete Part A and B of the worksheet while watching Chapters 2 and 3 of the video. Review the answers when they have completed the task. 15	• Photocopies of the *Properties of Acids and Alkalis* worksheet • ClickView video *Acids and Bases in the Home* Chapter 2: **https://clickv.ie/w/ks3/9a** Chapter 3: **https://clickv.ie/w/ks3/9b**
Activity 2: pH Scale and Indicators Give out the *pH Scale and Indicators* worksheet to students. Play Chapter 5 of the video and ask students to complete Part A. Allow time for students to research on the Internet to complete Part B of the worksheet. Allow students to share their answers and review them when they have completed. 15	• Photocopies of the *pH Scale and Indicators* worksheet • ClickView video *Acids and Bases in the Home* Chapter 4: **https://clickv.ie/w/ks3/9c** • Laptops/tablets
Activity 3: Let the Colour Do the Talking! Give out the *Let the Colour Do the Talking!* worksheet and distribute the materials required for the activity. Divide students into groups of 3 and go through the instructions with the students. Allow time for students to complete the task and allow them to share their answers once they have finished. >30	• Photocopies of the *Let the Colour Do the Talking!* worksheet • For each group of 3: samples in 10 test tubes (labelled A-J), dropper, distilled water, litmus paper, universal indicator

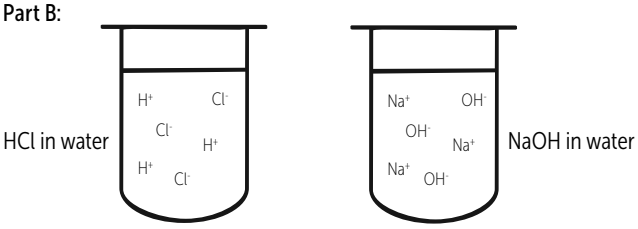
ANSWERS

Properties of Acids and Alkalis

Part A:

Acids	Alkalis
• corrosive • sour • loses H^+ ion in water	• slippery to touch • bitter • loses OH^- ion in water

Part B:



pH Scale and Indicators

Part A:

1. The pH scale measures the strength of the acid/base (alkali) .
2.

pH	What is it?
<7	Acid
7	Neutral
>7	Alkali

3.

Strong acid	pH 0-3
Weak acid	pH 4-6
Strong alkali	pH 11-14
Weak alkali	pH 8-10

Part B:

1. Indicators change colour under different pH levels, which allows us to know how acidic or alkaline a certain substance is.

2 & 3. Refer to the following diagram **(https://clickv.ie/w/ks3/aa)**

4. Students' answers may vary.
An example of an indicator: Congo Red

pH	Colour
<7	Yellow
7	Yellow
>7	Blue

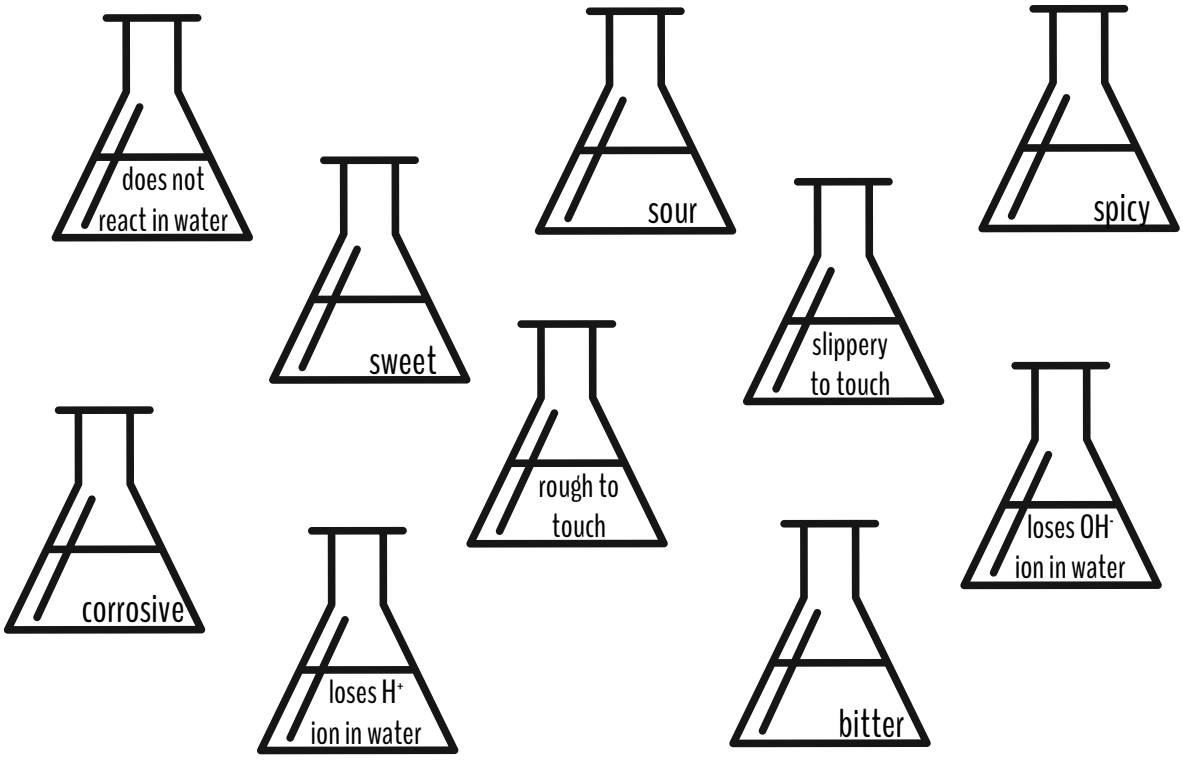
Let the Colour Do the Talking!

	Name	Litmus paper	Universal indicator	Acid or alkali?	Theoretical pH
A	egg white	blue	to be compared with a pH chart	alkali	8.9-9.4
B	dilute sodium hydroxide	blue		alkali	14
C	baking soda	blue		alkali	9
D	dilute hydrochloric acid	red		acid	1
E	lemon juice	red		acid	2
F	milk	red		acid	6.5-6.7
G	soap	blue		alkali	varies
H	vinegar	red		acid	2.6
I	fizzy drink	red		acid	3.3
J	powdered antacid	blue		alkali	varies

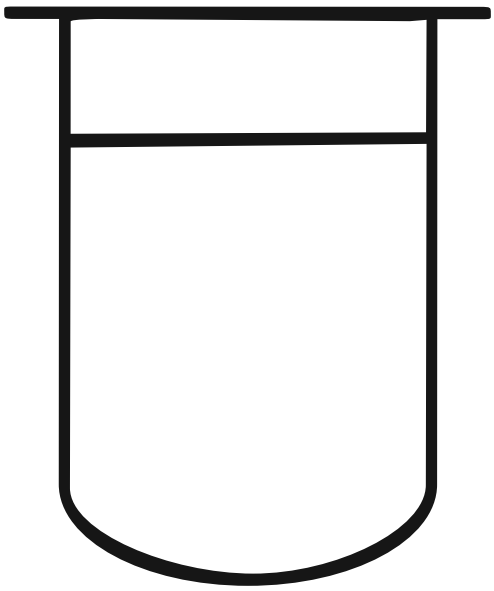
CHEMISTRY

Properties of Acids and Alkalis

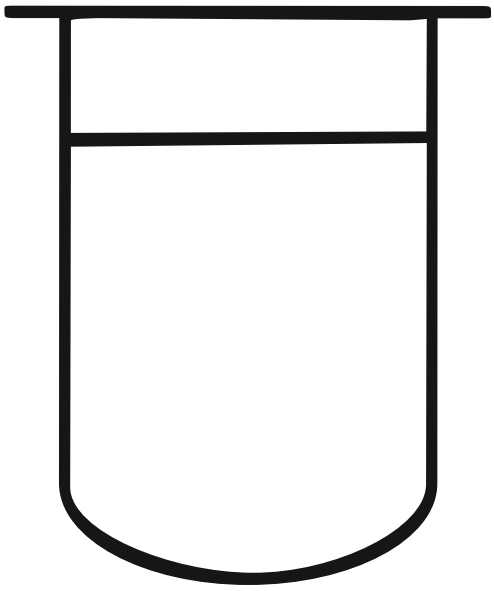
Part A: The flasks below show some properties of acids and alkalis. As you watch the video, circle the flasks that show properties of an acid with a red pen. Circle any flasks that show the properties of an alkali with a blue pen.



Part B: Draw what happens when an acid (HCl) and an alkali (NaOH) dissolve in water in each beaker using information from the video.



HCl in water



NaOH in water

CHEMISTRY

pH Scale and Indicators

Fill in the worksheet with information from the video.

Part A: pH Scale

1. What do we use the pH scale for?

   _____

2. Complete the following table with the words 'acid', 'neutral' or 'alkali'. Only use each word once.

pH	What is it?
<7	
7	
>7	

3. Suggest a pH for the following substances.

Strong acid	
Weak acid	
Strong alkali	
Weak alkali	

Part B: pH Indicators

1. Why are indicators useful?

   _____

   _____

2. Colour the boxes with the relevant colour when a litmus paper is used against the following substances.

Substance	Colour
Acid	
Alkali	

3. Universal indicators are useful because they can turn into many colours. Use colour pencils to show the colours the indicator will turn into at each pH.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
							Neutral							

4. Research online for another common indicator used in science labs and write down the colour changes in different pHs. Refer to the example on the left.

Name of indicator: Turmeric

pH	Colour
<7	*yellow*
7	*yellow*
>7	*red*

Name of indicator: _____

pH	Colour
<7	
7	
>7	

CHEMISTRY

Let the Colour Do the Talking!

Imagine yourself as a laboratory assistant. You know how important it is that substances are labelled correctly in the science lab. One day, you find some of the sample labels incomplete! You are given the mixed up samples and some information about each one. Identify each sample based on its pH and appearance, then complete the table using the materials given. If a sample is in a powdered form, dissolve it in distilled water before testing it.

Materials:

- samples in 10 test tubes (labelled A-J)
- dropper
- distilled water
- litmus paper
- universal indicator

Instructions

1. Using the dropper, put some of sample A on the red and blue litmus paper. Record your observations.
2. Add a few drops of the universal indicator into the test tube A. Record the colour change.
3. Wash the dropper with distilled water.
4. Repeat steps 1-3 with the rest of the samples.

Label on sample	Name	Colour change (litmus paper)	Colour change (universal indicator)	Acid or alkali?
A		blue		
B	dilute sodium hydroxide			
C	baking soda			
D	dilute hydrochloric acid			
E				acid
F		red		
G	soap	blue		
H	vinegar			
I				acid
J	powdered antacid			

Based on your experiment and observations, fill up the names of the unknown samples from the following substances: **fizzy drink, lemon juice, milk, and egg white.**

Neutralisation

OBJECTIVES

In this lesson, students will learn about neutralisation reactions between acid and alkalis. They will also learn how to write word equations for chemical reactions.

SUBJECT CONTENT - CHEMISTRY

Chemical reactions

- defining acids and alkalis in terms of neutralisation reactions
- representing chemical reactions using formulae and using equations
- reactions of acids with alkalis to produce a salt plus water

KEYWORDS

acid, alkali, neutralisation, neutral, salt, water, chemical reaction, word equation, reactants, products

LESSON PLAN

Activities	Resources
Activity 1: What Is Neutralisation? Give out the *What Is Neutralisation?* worksheet to students. Ask students to complete the worksheet as they watch Chapter 6 of the video. Review answers and concepts with the first three slides of the presentation. 15	• Photocopies of the *What Is Neutralisation?* worksheet • ClickView video *Acids and Bases in the Home* Chapter 6: **https://clickv.ie/w/ks3/10** • Presentation: Neutralisation
Activity 2: Neutralise It! Divide students into groups of 3. Give out the *Neutralise It!* worksheet to each group. Open the presentation to slide 4. Ask students to read the instructions and then cut out the individual boxes on the worksheet. Each box contains either an acid or an alkali. In this game, students first place the boxes with the words facing down on the table. They are given 5 minutes time where one student in each group flips over two pieces of paper in turn. If the flipped pieces of paper contain an alkali and acid, the group has to write out the word equation for that neutralisation reaction on a blank piece of paper. Put the chosen pieces of paper aside after they finish writing the equations. If two acids/alkalis are flipped open, the student flips them back and the next student in the group gets to choose two other pieces of paper. The first group to go through all the pieces of paper with all the correct word equations wins the game. 25	• Photocopies of the *Neutralise It!* worksheet • For each group of 3: scissors, blank paper • Presentation: Neutralisation
Activity 3: Neutralisation in Your Daily Life Give out the *Neutralisation in Your Daily Life* worksheet to students and ask them to research neutralisation reactions in their daily life on the Internet. Allow students to share their answers with the class. Review the answers with slides 5-12 of the presentation. 20	• Photocopies of the *Neutralisation in Your Daily Life* worksheet • Laptops/tablets • Presentation: Neutralisation

ANSWERS

What Is Neutralisation?

Part A:

alkali + acid ⟶ salt + water

Word equation:

sodium hydroxide + hydrochloric acid ⟶ sodium chloride + water

Alkali in water: OH- ion

Acid in water: H+ ion

Part B:

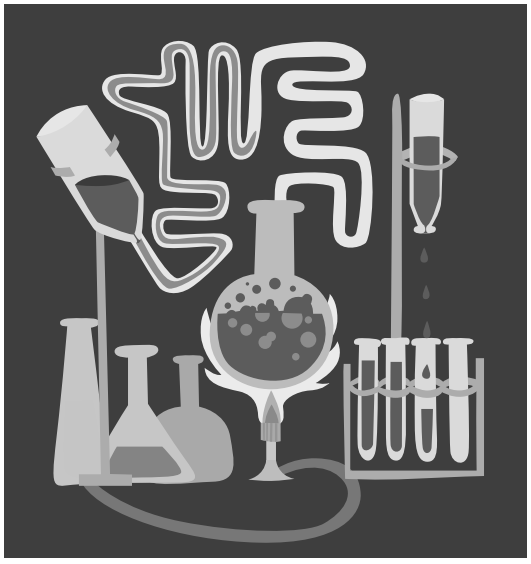
1. Neutralisation is a chemical reaction. New substances are produced (salt and water).
2. neutral
3. a metal and a non-metal
4. The reactants are sodium hydroxide and hydrochloric acid.
5. The products are sodium chloride and water.
6. It would be green in colour.

Can You Remember Neutralisation?

Students' answers may vary.

Neutralisation in Your Daily Life

Example	Acid	Alkali
#1	Bee sting (Methanoic acid in venom)	Soap
#2	Hair conditioner	Hair shampoo
#3	Stomach acid	Antacid pill
#4	Acid from food and drink	Fluoride toothpaste
#5	Acidic soil	Lime fertiliser
#6	Rust remover (phosphoric acid)	Rust



What Is Neutralisation?

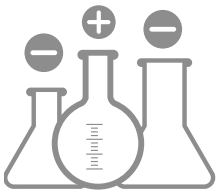
Part A: Complete this section of the worksheet with information from the video.

NEUTRALISATION

alkali + acid ⟶ s_____ + w_____

WORD EQUATION

sodium hydroxide (A)	+ hydro**chloric** acid (B)	⟶	s_____ c_____	+ w_____



ALKALI IN WATER

Circle the correct ion produced.

sodium hydroxide ⟶ sodium ion + H⁺ ion/ OH⁻ ion

ACID IN WATER

hydrochloric acid ⟶ chloride ion + H⁺ ion/ OH⁻ ion

combine to form H_2O.

Part B: Complete the following section after watching the video.

NAMING SALTS

The name of a salt contains 2 parts: A & B

Part A is derived from: the metal in the **alkali** (before the hydroxide/oxide) — A B — Part B is derived from: the **acid**
-chloric to chloride
-sulphuric to sulfate
-nitric to nitrate

1. Is neutralisation a chemical or physical reaction? Why?

_____

_____

2. What kind of products are formed in a neutralisation reaction? Tick the correct option.

☐ acidic ☐ alkaline ☐ neutral

3. What is a salt made out of?

☐ two metals ☐ a metal and a non-metal ☐ two non-metals

4. What are the **reactants** for the reaction in the box above? (Reactants are always on the left of an equation.)

_____

5. What are the **products** for the reaction in the box above? (Products are always on the right of an equation.)

_____

6. What colour would the universal indicator be in a neutral reaction?

_____

CHEMISTRY

Neutralise It!

How much do you know about neutralisation? Follow the instructions and play this game to find out!

Pre-game Instructions:

1. Cut along the dotted lines to produce 16 individual pieces of paper squares.
2. Place these squares on the table with the words facing down.
3. Randomly mix and shuffle the boxes.
4. Wait for your teacher's instructions to start.

You will be given 5 minutes. In your groups, choose and flip two squares. If they contain an acid and an alkali, write out the word equation for the neutralisation reaction (producing a salt and water) on a blank piece of paper and put those squares aside. If they contain two acids or two alkalis, flip them back and choose two new squares. The first group to complete all 8 word equations correctly wins the game!

NAMING SALTS

The name of a salt contains 2 parts: A & B

Part A is derived from: the metal in the **alkali** (before the hydroxide/oxide)

A B

Part B is derived from: the **acid**
-chloric to chloride
-sulphuric to sulfate
-nitric to nitrate

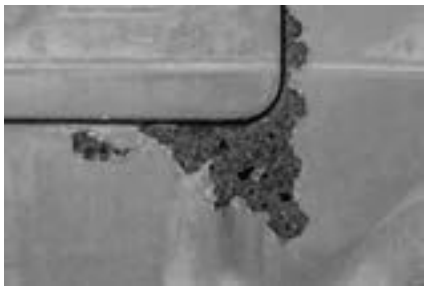
Cut along the dotted lines.

Lithium hydroxide	Sodium hydroxide	Calcium hydroxide	Potassium hydroxide
Magnesium hydroxide	Lead oxide	Iron oxide	Zinc oxide
Hydrochloric acid	Sulphuric acid	Acetic acid	Nitric acid
Hydrochloric acid	Sulphuric acid	Acetic acid	Nitric acid

CHEMISTRY

Neutralisation in Your Daily Life

Do you know that neutralisation reactions are all around us? The situations described below are all examples of neutralisation reactions in your daily life. Research online to determine what the acid/ alkali is in each example.

#1: Treating a bee sting with soap	#2 Using hair conditioner after shampoo	#3 Treating indigestion with antacid
		
Acid:	Acid:	Acid:
Alkali:	Alkali:	Alkali:
#4 Using fluoride toothpaste to prevent cavities	**#5 Using lime fertilisers in soil**	**#6 Cleaning metals with rust removers**
		
Acid:	Acid:	Acid:
Alkali:	Alkali:	Alkali:

Can you think of any other examples around you?

An Introduction to the Periodic Table

OBJECTIVES

In this lesson, students will develop an understanding on the elements of the periodic table by learning about how it was created, and its main features. They will learn how to read the various symbols that represent the different elements.

SUBJECT CONTENT - CHEMISTRY

The Periodic Table

- the varying physical and chemical properties of different elements
- the Periodic Table: periods and groups; metals and non-metals

KEYWORDS

period, group, metal, non-metal, history, physical property, chemical property, symbol, formula, electron, atomic mass, atomic number, element

LESSON PLAN

Activities	Resources
Activity 1: Why Do We Use This? Open the presentation to the first two slides. These two slides show examples of short forms/ abbreviations commonly used in text messages. Use the following questions to lead into a discussion with students: • Why do people use short forms and abbreviations? *(It saves time and they are widely recognised.)* • What are some of the disadvantages of using short forms/abbreviations? *(If you do not know about them, you will not recognise/understand what is being communicated.)* Similarly, students should understand that the periodic table is a table of organised chemical elements represented by symbols. It is recognised by scientists everywhere (a common language). 15	• Presentation: The Periodic Table
Activity 2: Learning about the Periodic Table Give out the *Learning about the Periodic Table* worksheet and play Chapter 1 and 2 of the video. Ask students to complete the worksheet as they watch the videos. Using slides 3 and 4 of the presentation, review the answers and highlight the key features of the periodic table, including: • Metals and non-metals (and the in-betweens) • Groups and periods 15	• Photocopies of the *Learning about the Periodic Table* worksheet • ClickView video *The Periodic Table* Chapter 1: **https://clickv.ie/w/ks3/11a** Chapter 2: **https://clickv.ie/w/ks3/11b** • Presentation: The Periodic Table
Activity 3: Elements in the Periodic Table Give out the *Elements in the Periodic Table* worksheet. Using slides 5 and 6, ask students to fill in Part A of the worksheet. Allow time for students to complete Part B and C of the worksheet using the periodic table in the presentation. Review the answers when students have finished. 20	• Photocopies of the *Elements in the Periodic Table* worksheet • Presentation: The Periodic Table
Activity 4: Decipher the Message! Give out the *Decipher the Message!* worksheet and allow time for students to complete the activity. This activity allows them to get familiar with the symbols of the periodic table. 10	• Photocopies of the *Decipher the Message!* worksheet

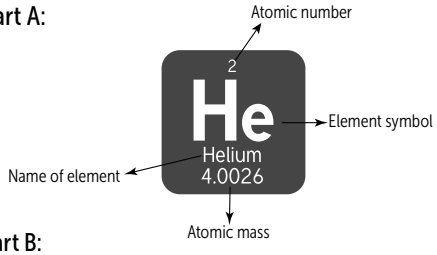
ANSWERS

Learning about the Periodic Table

1. Arsenic (in the mid-13th century)
2. atomic mass
3. periods
4. groups
5. Potassium (K)
6. The elements found in the same group have similar properties (recurring/periodic).
7. They are found in group 1.
   They only have 1 electron in their outer shells.
   They are metals.

Elements in the Periodic Table

Part A:



Part B:

Period	Group	Element name	Element symbol	Number of Electrons
1	1	Hydrogen	H	1
2	15	Nitrogen	N	7
4	7	Manganese	Mn	25
2	2	Beryllium	Be	4
6	11	Gold	Au	79
4	8	Iron	Fe	26
3	13	Aluminium	Al	13
1	18	Helium	He	2
3	2	Magnesium	Mg	12
5	11	Silver	Ag	47
4	4	Titanium	Ti	22

Part C:

1. Cl
2. S
3. Si
4. B
5. F

Decipher the Message

1. Oxygen Potassium ⟶ OK
2. Copper Tellurium ⟶ CuTe
3. Oxygen Magnseum ⟶ OMg
4. Nobellium! That's too Colbalt Radon Yttrium ⟶ No! That's too CoRnY!

CHEMISTRY

Learning about the Periodic Table

Answer the following questions as you watch the video.

1. Which element was scientifically discovered first?

   _____

2. Mendeleev arranged the known elements in order of _____.

3. Horizontal rows are known as _____. (Circle an example on the periodic table.)

4. Vertical columns are known as _____. (Circle an example on the periodic table.)

5. Which element appears below sodium on the periodic table? (Write the symbol on the periodic table below.)

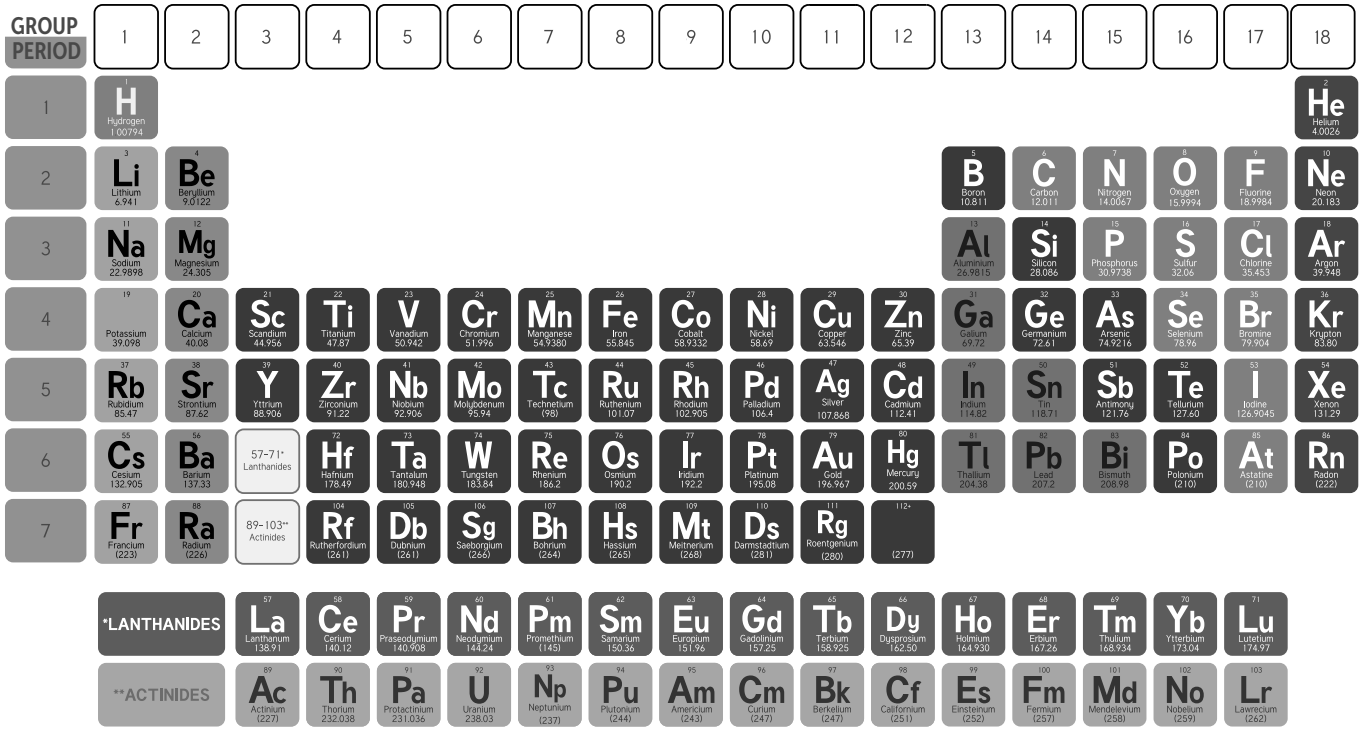
6. Why is the periodic table called the periodic table? (Hint: What does the word 'periodic' mean?)

   _____

   _____

7. What 3 things do sodium, potassium and rubidium have in common?

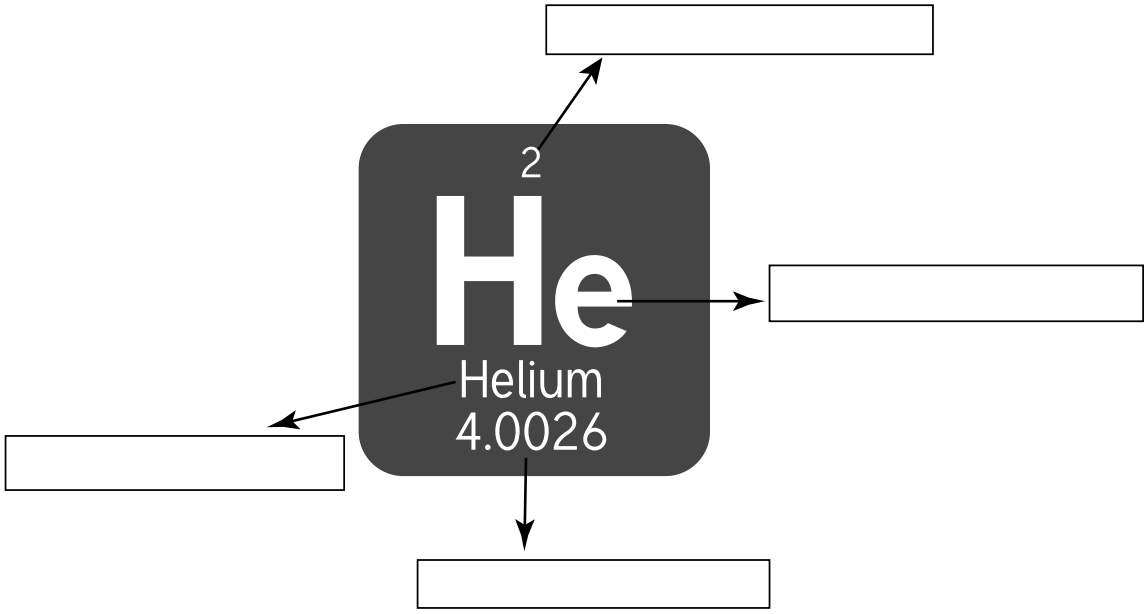
   - _____
   - _____
   - _____



Elements in the Periodic Table

Part A: In the periodic table, four important details about each of the elements are provided. Write down what these four components are in the boxes below.

The atomic number shows the number of protons in an element.
In any element, number of electrons = number of protons.



Part B: Fill in the table below using the information found in the periodic table.

Period	Group	Element name	Element symbol	Number of electrons
1	1			
2	15			
4	7			
2	2			
6	11			
4	8			
3	13			
1	18			
3	2			
5	11			
4	4			

Part C: Choose the odd one out from the following elements in each row.

1.	He	Ne	Cl	Rn
2.	Li	N	O	S
3.	Ru	Fe	Co	Si
4.	Na	K	B	Fr
5.	Be	Mg	K	F

Decipher the Message!

You can say a lot with the periodic table! Decipher each of the messages by writing the symbol of each given element in the boxes to understand the meaning of each message.

1.

Answer: ☐☐

2.

Are you made of COPPER and TELLURIUM? Because you are very

☐☐

3.

I heard that OXYGEN and MAGNESIUM were going out and I was, like, thinking...

☐☐

4.

Answer: ☐! That's too ☐☐☐!

Write your own periodic table message!

CHEMISTRY

Atoms, Elements and Compounds

LAB LESSON

OBJECTIVES

In this lesson, students will learn about the particles in elements and compounds. They will understand how elements can combine together to form simple compounds that can be represented by symbols and formulae.

SUBJECT CONTENT - CHEMISTRY

Atoms, elements and compounds

- chemical symbols and formulae for elements and compounds

The Periodic Table

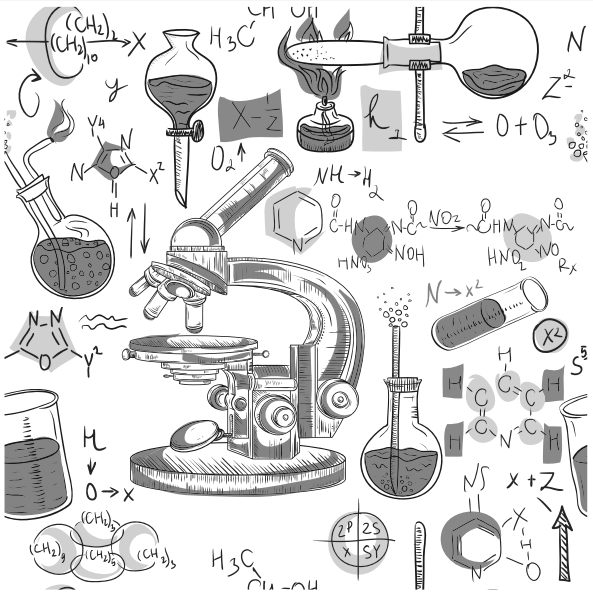
- the varying physical and chemical properties of different elements
- the Periodic Table: periods and groups; metals and non-metals

KEYWORDS

atom, element, compound, electron, symbol, formula, ion, particle, matter

LESSON PLAN

Activities	Resources
Activity 1: The Element-ary Story Give out the *The Element-ary Story* worksheet to students and play the video. Ask students to complete Part A while watching the video, pausing and prompting when needed. After watching the video, allow time for students to complete Part B of the worksheet. Review the answers when students have completed the task. 30	• Photocopies of the *The Element-ary Story* worksheet • ClickView video *Physical and Chemical Changes* **https://clickv.ie/w/ks3/12**
Activity 2: Modelling the Particles Give out the *Modelling the Particles* worksheet. Divide students into groups of 3 and distribute the materials to them. Allow time for students to complete the experiment. Ask students to share their answers when they have completed the task. 25	• Photocopies of the *Modelling the Particles* worksheet • For each group of 3: green, red and blue modelling clay, blank A4 paper, camera or smart phone
Activity 3: Chemistry in Our Daily Lives Give out the *Chemistry in Our Daily Lives* worksheet. Ask students to complete the activity. Ask students to exchange their answers and peer mark. 5	• Photocopies of the *Chemistry in Our Daily Lives* worksheet • Photocopies of the Periodic Table



ANSWERS

The Element-ary Story

Part A:

Suggested answers:

1. Elements are arranged according to the number of electrons in the outer shell.
2. Atoms of non-metals form molecules when they combine with each other. (Noble gases do not form molecules.)
3. Hydrogen bonds with oxygen to form water.
4. A sodium atom reacts with a chlorine atom to form common salt. (sodium chloride - a negative and positive ion)
5. A physical reaction takes place when sodium chloride is melted.
6. Electrolysis is used to separate molecules back into their constituent atoms.
7. Carbon is able to react with many different atoms.
8. Brass is an alloy, consisting of a mixture of zinc and copper atoms. It does not result in a chemical change.

Part B:

1. Yes, they can react with non-metals to form salts. An example is sodium chloride.
2.

Formation of water	Formation of sodium chloride
non-metals	a metal and a non-metal
neutral molecules	a positive and a negative ion
electrons are shared	electrons are transferred

3. When an atom does not combine with another atom, it is a physical change. Examples include when copper is stretched, bent, heated or melted, boiled, cut into pieces or in the formation of alloys.
4. It is a physical change as there is no reaction between the elements.
5. Possible answer:
   It is a physical change as there is no change to the molecules and just a change in state.

Modelling the Particles

1. 4
2. a) A mixture is a combination of more than one type of pure substance that is not chemically combined.
   b) example (f)
3. It is a chemical change because a chemical bond is formed between the atoms. A physical change is any change that does not break the substance's chemical composition to form a new substance.
4. Water does not look like the elements it's made from, which are both gases. It undergoes a chemical change.
5. B, A, E, C, D

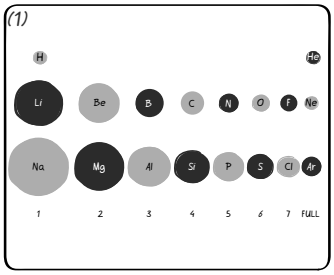
Chemistry in Our Daily Lives

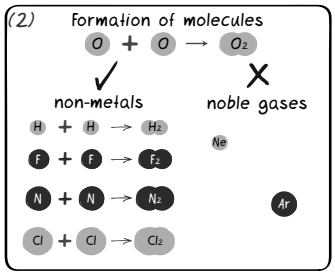
water → H_2O
sodium fluoride → NaF
hydrogen peroxide → H_2O_2
helium → He
silicon dioxide → SiO_2
calcium carbonate → $CaCO_3$
alcohol → C_2H_6O
common salt (sodium chloride) → NaCl
sugar (sucrose) → $C_{12}H_{22}O_{11}$

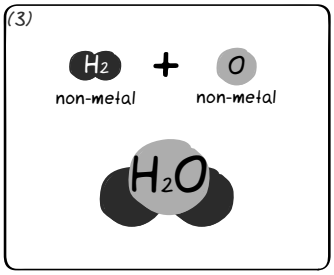
CHEMISTRY

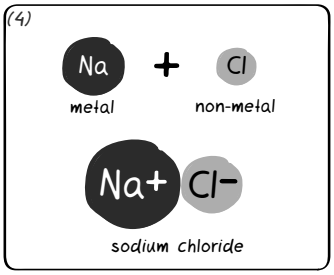
The Element-ary Story

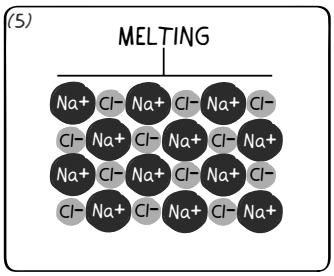
Part A: Each picture corresponds to a specific section of the video. Summarise the illustration in each box in one sentence.

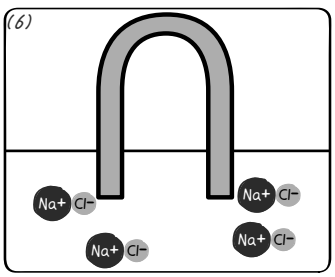


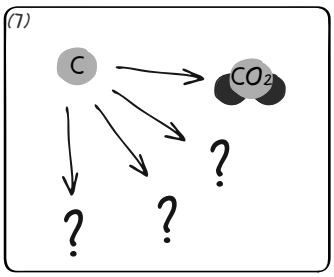


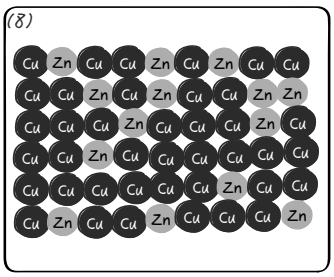












Part B: Answer the following questions after watching the video.

1. Are metals able to react with other atoms? If yes, give an example.

2. What are the key differences between the formation of water and sodium chloride? Complete the table below.

	Formation of water	Formation of sodium chloride
Types of atoms involved in the reaction (metals or non-metals)		
Types of products formed (neutral molecules or positive/negative ions)		
How do the electrons between different atoms interact?		

3. What is a physical change? What examples of physical changes were given in the video?

4. Is the formation of steel a physical or chemical change? Why?

5. Do you think the melting of ice is a physical change or a chemical change? Why?

Modelling the Particles

Materials:

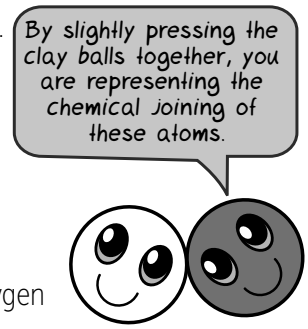
- green, red and blue modelling clay
- a blank piece of A4 paper
- camera or smart phone

Instructions:

1. Use the modelling clay to make 20 red balls, 15 blue balls and 15 green balls of equal size. Each colour represents a different element:

Red	Green	Blue
Hydrogen	Carbon	Oxygen

2. For each example, assemble the molecules on a blank piece of paper and take a picture. Then, disassemble and continue with the next example.
   (a) 4 molecules of hydrogen gas (2 hydrogen atoms)
   (b) 4 molecules of water (1 oxygen and 2 hydrogen atoms)
   (c) 3 molecules of carbon dioxide gas (1 carbon and 2 oxygen atoms)
   (d) 5 molecules of oxygen gas (2 oxygen atoms)
   (e) 2 molecules of methane (1 carbon and 4 hydrogen atoms)
   (f) 1 molecule of sugar (6 carbon, 12 hydrogen and 6 oxygen atoms), 2 molecules of oxygen gas and 2 molecules of hydrogen gas



Questions:

1. Compounds are molecules made up of two or more different kinds of atoms that are chemically joined. How many unique compounds are there in the examples? _____
2. In our activity, one of the examples is a mixture.
   (a) What is a mixture?

   _____

   _____

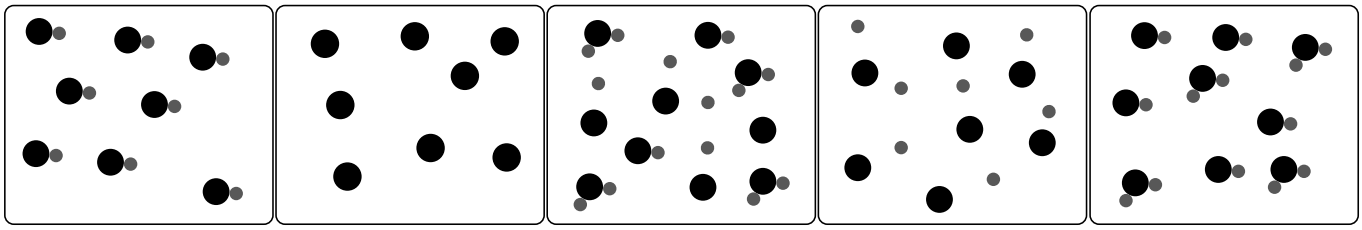
   (b) Which example is the mixture? _____
3. Do molecules undergo a physical or chemical change when they are formed? Explain your answer.

   _____

   _____
4. Think about the appearance of the compound water in example (b). How do we know that water is not simply a mixture of hydrogen and oxygen?

   _____

   _____
5. Correctly label each small box with the letter that describes it below:
   (A) Elements
   (B) Compounds
   (C) Mixture of elements
   (D) Mixture of compounds
   (E) Mixture of elements and compounds



CHEMISTRY

Chemistry in Our Daily Lives

Write the chemical formulae of the substances in bold as you read the text.

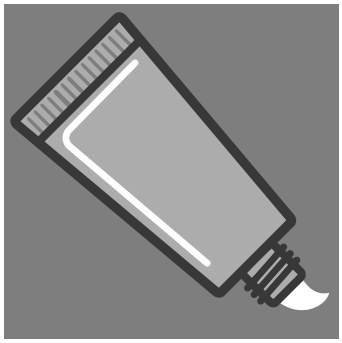
How to construct a chemical formula:

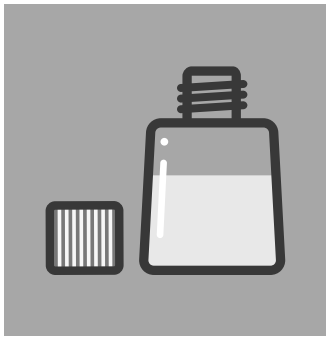
Step 1: Identify the elements in the compound.
Step 2: Identify the number of each element in the compound.
Step 3: Write the symbols for each element (with the help of the periodic table), followed by its number in subscript. If there is only one of each atom, you can omit the number. Refer to the right for an example.

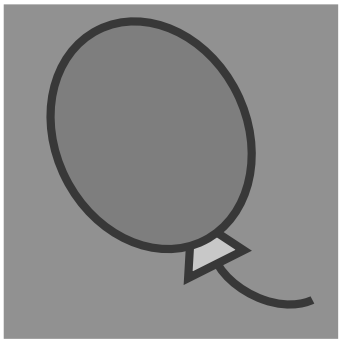
Methane is made up of:
1 carbon atom
4 hydrogen atoms

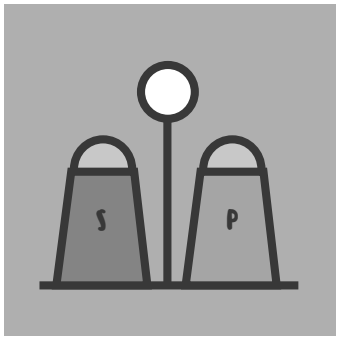
CH_4

	Formula
Chemistry is involved everywhere. Everything you see and hear, the things you eat, even the air you breathe, can be represented by the symbols in the periodic table. These chemical formulae can sometimes be derived from their names. Let's figure them out! Let's take a look at the amazing human body. The human body is made up of approximately 60% water. Do you know what the chemical formula of **water** is? When we wake up and brush our teeth, the toothpaste we use contains **sodium fluoride**. Its job is to prevent cavities and strengthen enamel. This compound contains 1 sodium atom and 1 fluorine atom. The mouthwash we use contains **hydrogen peroxide**, which is made up of 2 hydrogen atoms and 2 oxygen atoms. This compound helps to kill bacteria and other germs that contribute to tooth decay. What about things we see in our daily lives? Think of the balloon flying in the sky, it is filled with **helium**. The chemical formula of helium consists of just 1 helium atom. When you visit the beach, what are you always surrounded by? Sand! The sand on the beach is mostly made up of **silicon dioxide**, made up of 1 silicon atom and 2 oxygen atoms. This same silicon dioxide (silica) is the main ingredient in glass! Chalkboard chalk is otherwise known as **calcium carbonate**. It is made up of 1 calcium atom, 1 carbon atom and 3 oxygen atoms. When someone grazes their skin, alcohol wipes are usually used to sterilise the wound. The **alcohol** is made up of 2 carbon atoms, 6 hydrogen atoms and 1 oxygen atom. Alcohol provides the skin with a "cool" feeling because it absorbs heat when it evaporates. How *cool* is that!? What chemistry is in the food we eat? Take the common table salt as an example. **Common salt** (sodium chloride) is made up of a single sodium atom and a single chlorine atom. Next time you eat, you could say: "Add a little more sodium chloride to your food." Whether we realise or not, we consume **sugar** (sucrose) on a daily basis. Sugar (sucrose) has a chemical formula consisting of 12 carbon atoms, 22 hydrogen atoms and 11 oxygen atoms. That is a huge compound! Can you imagine how complicated life would be if we called things by their scientific names rather than their common names?	









Types of Forces

LAB LESSON

OBJECTIVES

In this lesson, students will explore the concept of forces and learn about the different types of forces and their effects.

SUBJECT CONTENT - PHYSICS

Motion and forces:

Forces

- forces as pushes or pulls, arising from the interaction between two objects

KEYWORDS

forces, push, pull, contact force, non-contact force, effects of force

LESSON PLAN

Activities	Resources
Activity 1: What Are Harry and Ronald Doing? Open the presentation to the first slide and discuss the following questions with students: • What is Harry doing? *(pulling)* • What is Ronald doing? *(pushing)* • What are they trying to do? *(trying to move the rock using force)* By the end of the discussion, students should understand that a force is a push or a pull that results in objects changing motion and interacting with other objects. 5	• Presentation: Types of Forces
Activity 2: Introduction to the Types of Forces Give out the *Types of Forces* worksheet and play Chapter 1 of the video. Ask students to complete Part A of the worksheet while watching the video. Part B is to be completed using the Internet or a textbook. Let students exchange their worksheets and mark them as a class. 20	• ClickView video *Push and Pull Forces* Chapter 1: **https://clickv.ie/w/ks3/13** • Photocopies of the *Types of Forces* worksheet • Textbooks/ laptops
Activity 3: Effects of Forces Open the presentation and use slides 2-4 as a review of Activity 2. Use the remaining slides to explain the different effects a force can have on an object. Give out the *Effects of Forces* worksheet and ask students to work in groups of 3-4 to demonstrate the effect forces can have on objects using the equipment that they are given. Guide students who might have difficulty achieving results. Have students share their answers. Note: The answers to this activity are not limited to the actions shown in the answers. There are many possible results. 25	• Presentation: Types of Forces • Photocopies of the *Effects of Forces* worksheet • For each group of 3-4: empty plastic waterbottle with no lid, metre ruler, 10p coin, pencil, table tennis ball, 20 cm string
Activity 4: Can You Force Yourself to the Castle? Give out the *Can You Force Yourself to the Castle?* worksheet. Have students complete the worksheet in class (if time permits) or as homework. 10	• Photocopies of the *Can You Force Yourself to the Castle?* worksheet

ANSWERS

Types of Forces

Part A:

1. A force is a push or a pull.
2. Gravitational force, force by wind, force by muscles, magnetic force

Part B:

3.

Contact forces	Non-contact forces
• Frictional force • Elastic force • Normal force • Tension force • Air resistance force • Applied force • Spring force	• Gravitational force • Magnetic force • Electrical force

4. 1, 4, 2, 3

Effects of Forces

Possible answers:

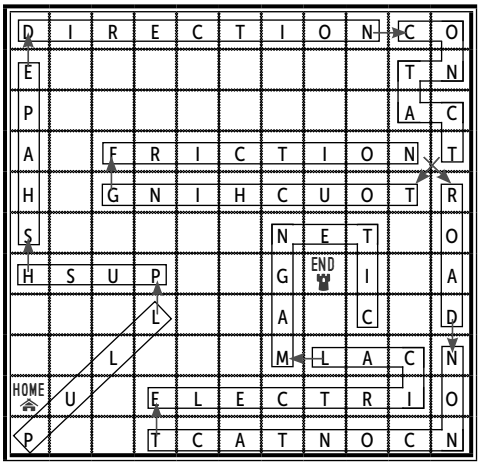
Objects used	Action	What did the force cause the object to do?
• table tennis ball • metre ruler	Lean the ruler against a chair or wall to form a slope. Release the ball so it rolls down the ruler and onto the floor.	• begin to move • speed up • change its direction of motion
• 10p coin	Spin the coin until it stops.	• begin to move • speed up • slow down • stop moving
• empty plastic water bottle	Crush the water bottle with your foot.	• change its shape
• string • pencil	Tie the string to the pencil and swing it in circles in front of you.	• begin to move • speed up • change its direction of motion

Can You Force Yourself to the Castle?

A force is a pull or a push that acts on an object to change its shape, speed or direction. The two main types of forces are contact and non-contact forces.

Contact forces require one object touching another in order to have an effect. Friction is an example of a contact force. It can occur between tyres and the surface of a road.

The three types of non-contact forces are electrical, gravitational and magnetic force.



PHYSICS

Types of Forces

Part A: Use the information presented in the video to answer the following questions.

1. What is a force?

   _____

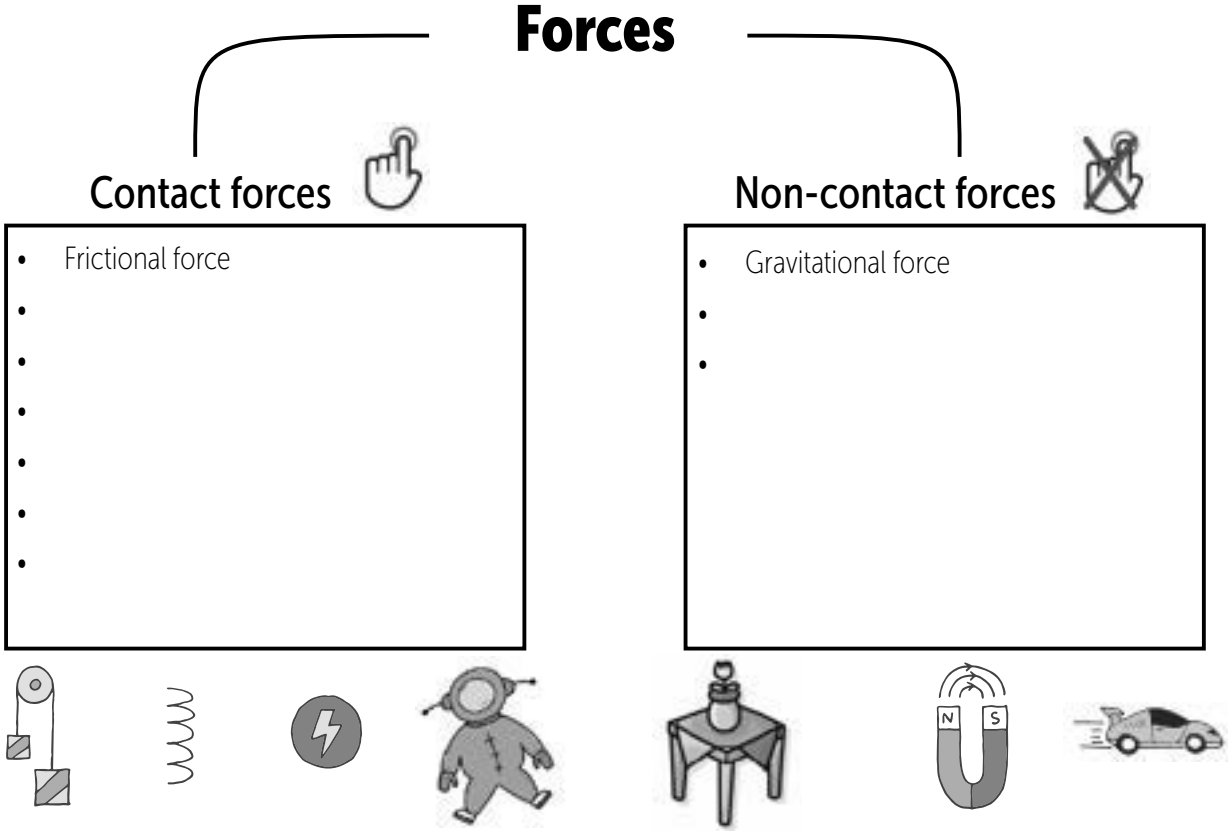
2. List the forces described in Chapter 1 of the video.

   _____

   _____

Part B: Complete the following questions after you have watched the video.

3. Use the Internet or a textbook to research contact and non-contact forces. List the types of forces that fall under each category below. The first one has been done for you.



4. Rank the following according to the amount of force required to complete the action. Rank 1-4, from least to most.

   (a) Typing one letter on a computer keyboard ☐

   (b) An aeroplane taking off ☐

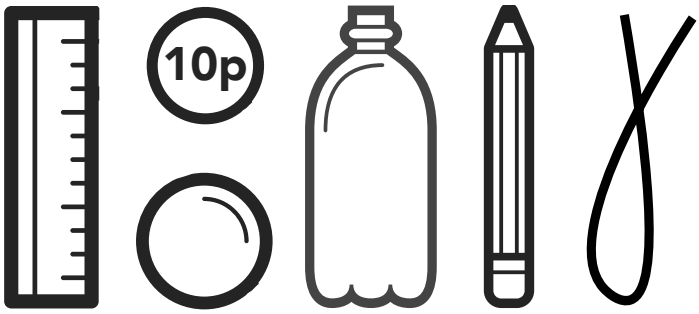
   (c) Kicking a soccer ball ☐

   (d) Pushing a car along a road ☐

Effects of Forces

Materials:

- empty plastic water bottle (with no lid)
- metre ruler
- 10p coin
- pencil
- table tennis ball
- 20 cm of string



Instructions:

In groups, use the materials listed to demonstrate ways you can show each of the effects of forces listed below. Use each object only once, but you may use more than one object per demonstration.

A force may cause an object to:

- begin to move
- speed up
- slow down
- stop moving
- change its direction of motion
- change its shape

Objects used	Action	What did the force cause the object to do?
• *metre ruler* • *table tennis ball*	*Lean the ruler against a chair or wall to form a slope. Release the ball so it rolls down the ruler and onto the floor.*	• *begin to move* • *speed up* • *change its direction of motion*

PHYSICS

Can You Force Yourself to the Castle?

Starting from home, weave your way to the castle through the maze of letters. Find all the missing words in the order in which they appear in the passage.

Some extra information to guide you:

- A new word will start in any box around the last letter of the previous word.
- Letters can be used more than once.
- This is a maze not a wordsearch, so the sequence of letters in words can move in any direction.

A force is a _____ or a _____ that acts on an object to change its _____, speed or _____. The two main types of forces are _____ and non-contact forces.

Contact forces require one object _____ another in order to have an effect. _____ is an example of a contact force. It can occur between tyres and the surface of a _____.

The three types of _____-_____ forces are _____, gravitational and _____ force.

D	I	R	E	C	T	I	O	N	C	O
E	Z	W	B	A	T	E	E	H	T	N
P	T	R	U	N	V	J	V	I	A	C
A	E	F	R	I	C	T	I	O	N	T
H	S	G	N	I	H	C	U	O	T	R
S	H	U	T	T	E	N	E	T	F	O
H	S	U	P	E	C	G	END	I	O	A
M	Y	S	L	S	Y	A	Z	C	R	D
A	B	L	T	E	R	M	L	A	C	N
HOME	U	C	E	L	E	C	T	R	I	O
P	R	O	T	C	A	T	N	O	C	N

Identifying Forces

OBJECTIVES

Students will understand that every force has at least two objects or participants. Students will also learn how to represent forces using force diagrams.

SUBJECT CONTENT - PHYSICS

Motion and forces:

Forces

- forces as pushes or pulls, arising from the interaction between two objects
- using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces
- non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity

KEYWORDS

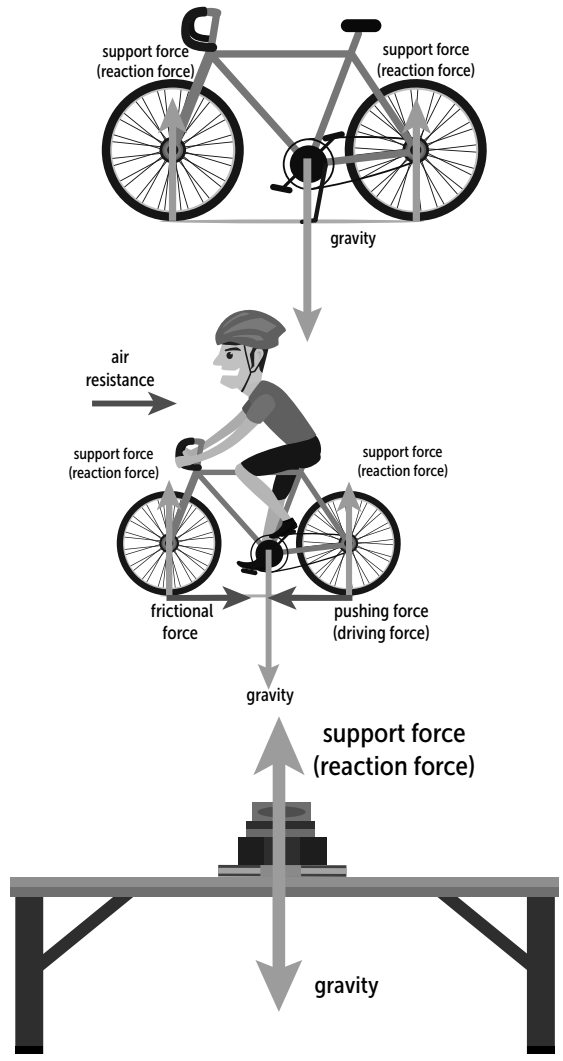
forces, push, pull, reaction force, frictional force, air resistance, gravity, non-contact force

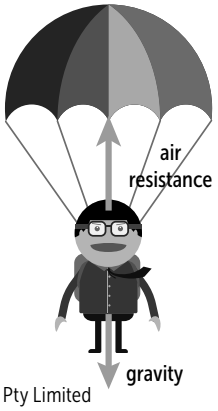
LESSON PLAN

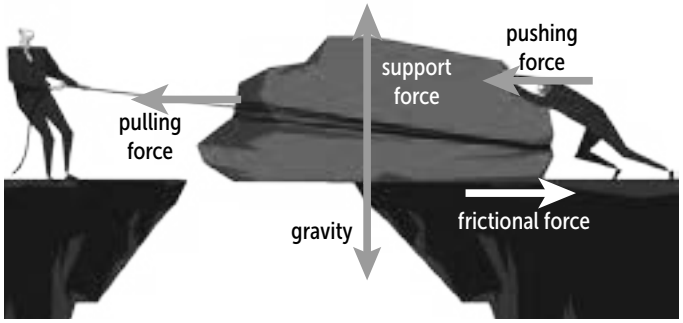
Activity	Resources
Activity 1: Identifying Forces in Our Daily Lives Introduce the topic with lots of examples of forces. Elaborate on the effect a push/pull can have on an object. Have students think of some actions in their daily lives that show the effects of forces. Conduct a discussion with the class using the example of opening/closing a door. 10	
Activity 2: Identifying Participants of a Force Open the presentation to slide 2 and use the example of opening the door to demonstrate that there are always two objects, or participants, when a force is applied. The source, or agent, is the person or object that is applying a push/pull on another object. The receiver is the object being pushed or pulled. Open the presentation to the next slide and give out the *Identifying Participants of a Force* worksheet. Ask students to list their three daily actions on the worksheet and identify the corresponding agents and receivers of each force. 15	• Presentation: Identifying Forces • Photocopies of the *Identifying Participants of a Force* worksheet
Activity 3: Identifying Forces (Direction) Let students know that although forces are in action all around us, we can't really see the direction they work in, so scientists use arrows on diagrams to represent forces around us (force diagrams). Use slide 4 of the presentation to discuss the components of a force diagram. Give out the *Identifying Forces (Direction) 1* worksheet. Play Chapter 2 of the video and have students complete the worksheet as they watch. The answers to the worksheet are on slides 6 and 7 of the presentation. Give out the *Identifying Forces (Direction) 2* worksheet and allow students to work in pairs to label the force diagrams for each example. Use the presentation to discuss the answers. 35	• Photocopies of the *Identifying Forces (Direction) 1 and 2* worksheets • ClickView video *Push and Pull Forces* Chapter 2: **https://clickv.ie/w/ks3/14** • Presentation: Identifying Forces

ANSWERS

Identifying Forces (Direction)



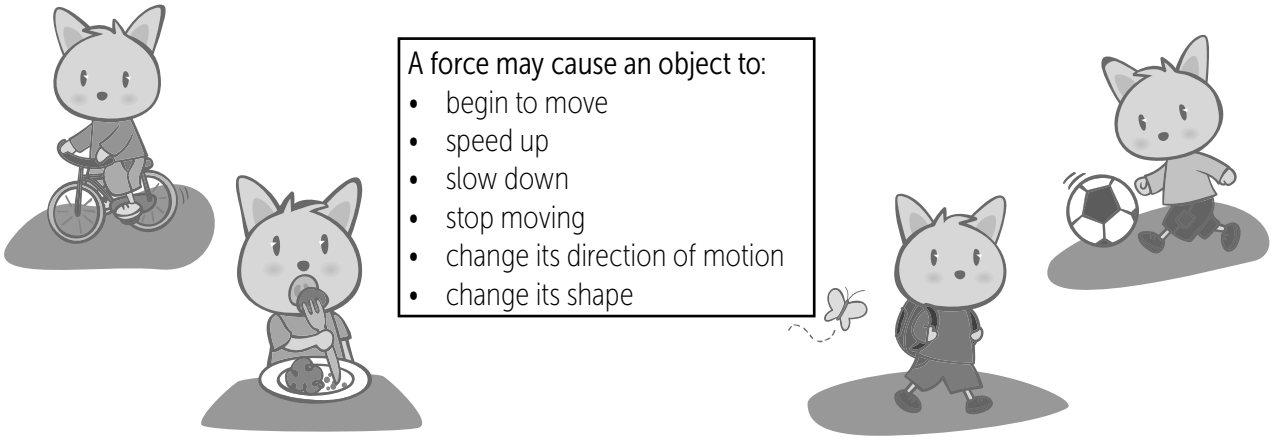




PHYSICS

Identifying Participants of a Force

List 3 actions that apply force in your daily life and identify the effect of each force.



A force may cause an object to:

- begin to move
- speed up
- slow down
- stop moving
- change its direction of motion
- change its shape

Action	Effect of the force	Agent (the person or object doing the pushing/ pulling)	Receiver (the thing that gets pushed/pulled)
Pushing a trolley in the supermarket	*The trolley begins to move*	*The person*	*The trolley*

PHYSICS

Identifying Forces (Direction) 2

As you watch the video, label the diagrams below showing showing the forces present and the direction in which they are applied.

You can use the following labels more than once:

- Gravity (weight)
- Support force (reaction force)
- Air resistance
- Pulling force
- Pushing force (driving force, force by muscles, etc.)
- Frictional force

Stationary **bicycle**

Moving **bicycle**

PHYSICS

Identifying Forces (Direction) 2

Identify the forces in the situations below.

Instructions:

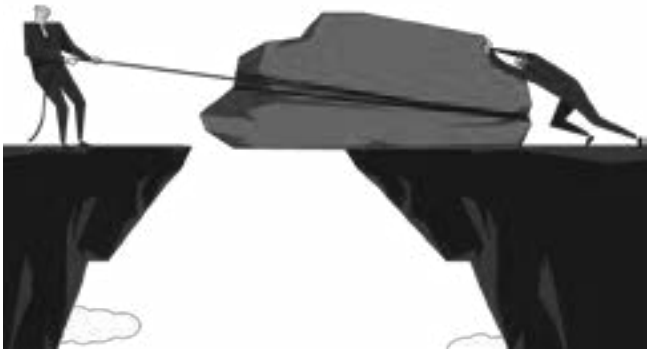
Step 1: Identify the types of forces acting on the object (shown in bold).
Step 2: Draw arrows to indicate the direction of the forces involved.
Step 3: Label the forces involved.

A pile of books on a table

A parachuting man falling to Earth

A boy kicking **a ball**

Two men moving **a rock**



Balanced and Unbalanced Forces

OBJECTIVES

In this lesson, students will learn about the differences between balanced and unbalanced forces. They will learn about situations that are in equilibrium.

SUBJECT CONTENT - PHYSICS

Motion and forces:

Forces

- forces as pushes or pulls, arising from the interaction between two objects
- using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces

KEYWORDS

force, balanced, unbalanced, equilibrium, stationary

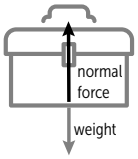
LESSON PLAN ACTIVITIES

Activity	Resources
Activity 1: Balanced Forces Give out the *Balanced Forces* worksheet to students. Ask students to complete Part A of the worksheet as they watch Chapter 1 of the video. Allow time for students to complete the section. Play Chapter 3 of the video and ask students to complete Part B of the worksheet. Review the answers when students have completed. 25	• Photocopies of the *Balanced Forces* worksheet • ClickView video *Newton's Laws of Motion* Chapter 1: **https://clickv.ie/w/ks3/15a** Chapter 3: **https://clickv.ie/w/ks3/15b**
Activity 2: Unbalanced Forces Give out the *Unbalanced Forces* worksheet to students. Ask students to complete Part A of the worksheet as they watch Chapter 5 of the video. Review the answers for the section. Allow time for students to complete Part B and C. Ask students to share and explain their answers so as to assess their understanding of concepts. 20	• Photocopies of the *Unbalanced Forces* worksheet • ClickView video *Newton's Laws of Motion* Chapter 5: **https://clickv.ie/w/ks3/15c**
Activity 3: Stand-off Those Forces! Give out the worksheet to each pair of students. Read through the instructions with students to explain the activity. After the activity, allow time for students to attempt the question. Ask for volunteers to explain their answers. 15	• Photocopies of the *Stand-off Those Forces!* worksheet

ANSWERS

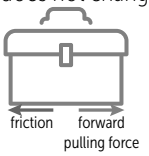
Balanced Forces

Part A:

1. 2
2. 

3. W = N
4. 0

Part B:

1. has no change in speed; does not change direction
2. 

3. frictional force
4. 0

Unbalanced Forces

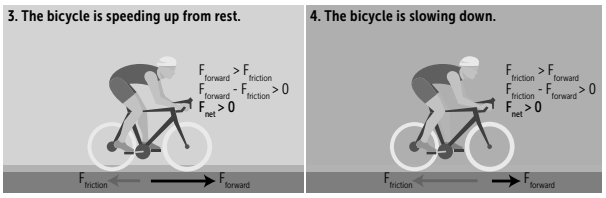
Part A:

1. increase; decrease; change
2. proportional; doubled; halved

Part B:

	Throw 1	Throw 2	Throw 3	Throw 4
Force (N)	14	28	7	42
Acceleration (m/s^2)	2	4	1	6

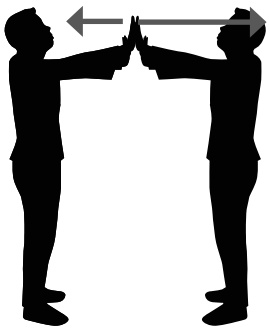
Part C:



Scenarios 3 and 4 show <u>unbalanced</u> forces because they result in a change in speed.

Stand-off Those Forces!

1. Students' answers may vary.
<u>Possible answer:</u>
When student A pushed my hands with a greater force than I did, there was a net force acting on me, causing me to lose balance.



PHYSICS

Balanced Forces

As you watch the video, answer Part A and Part B of the worksheet.

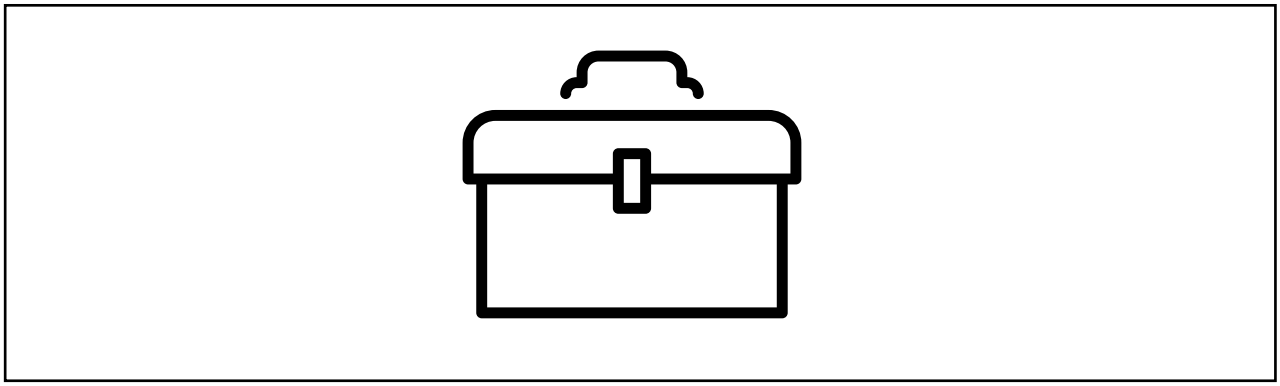
Newton's First Law
(when balanced forces act on an object)

An object **at rest** (i) remains **at rest**, and an object **in motion** (ii) tends to **stay in motion**, unless an outside force acts on it.

$\mathbf{F_{net} = 0}$

Part A: Balanced Forces on Stationary Objects

1. An object at rest has at least _____ forces acting on it.
2. Draw the forces acting on the case as shown in the video.



3. Tick the equation that best represents the box at rest.

☐ W < N ☐ W > N ☐ W = N

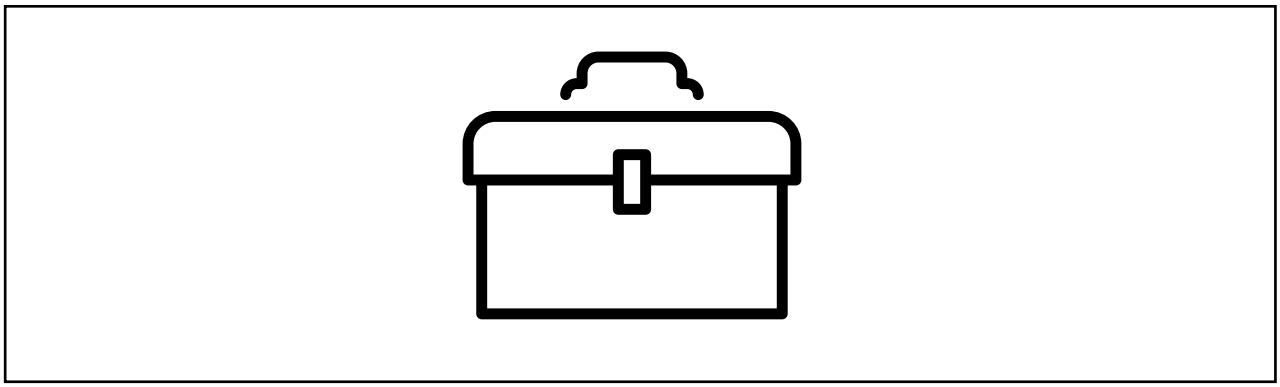
4. What is the net force (resultant force) acting on the box at rest? _____

Part B: Balanced Forces on Moving Objects

1. Choose all that apply.
   A moving object with balanced forces:

☐ has no change in speed ☐ has a change in speed ☐ changes direction ☐ does not change direction

2. Draw the forces acting on the moving case as shown in the video.



3. When a box moves at constant velocity, the pulling force exerted by the girl is balanced by the _____ _____ acting on the object.
4. What is the net force (resultant force) acting on a swimmer who is swimming at constant speed? _____

When forces are balanced, the object is in <u>equilibrium</u>.

Unbalanced Forces

Part A: As you watch the video, complete this section of the worksheet.

Newton's Second Law
(when an unbalanced force acts on an object)

Under a net force, an object accelerates.
The **greater** the net force (resultant force), the **greater** the acceleration.

$F_{net} \neq 0$

Questions:

1. When an object accelerates, it can undergo:
   - an _____ in speed,
   - a _____ in speed, and/or
   - a _____ in direction.
2. According to Newton, the acceleration of an object is _____ to the unbalanced net force that is acting on it.
   If a force is doubled, its acceleration is _____.
   If a force is halved, its acceleration is _____.

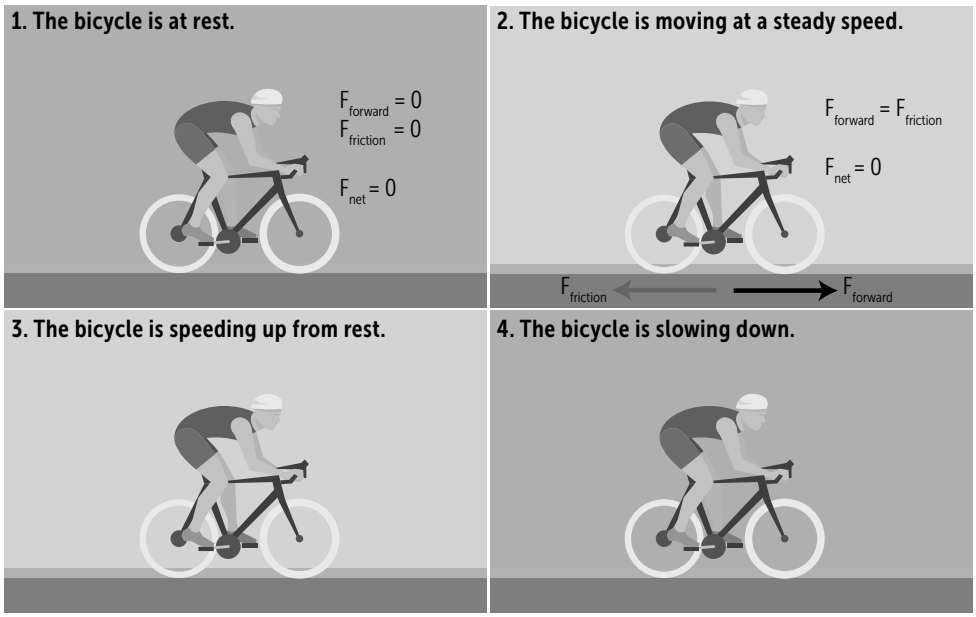
Part B: Complete the table below.

Alan is a basketball player. He has learned about Newton's laws in school and understands that when he throws a ball, the acceleration of the ball is dependent on the force he has applied. Complete the table with the correct values.

	Throw 1	Throw 2	Throw 3	Throw 4
Force (N)	14	28	7	
Acceleration (m/s^2)	2			6

Part C: The picture on the right shows a cyclist in four different scenarios. Scenarios 1 and 2 show balanced forces.

Add arrows on scenarios 3 and 4 to show the forces acting on the cyclist.



Scenarios 3 and 4 show _____ forces because they result in a change in speed.

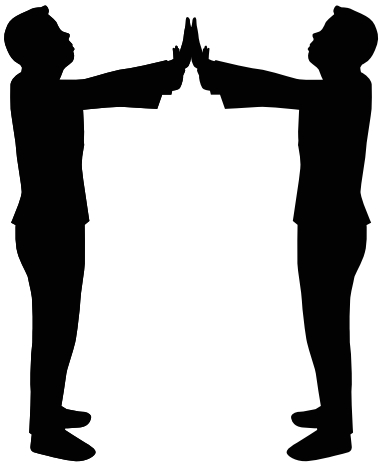
PHYSICS

Stand-off Those Forces!

Follow the instructions and answer the question that follows.

Instructions:

1. With your partner, put your feet together and stand facing each other with your arms out in front of you.
2. You will be given 1 minute to play the game.
3. When instructed by your teacher, start pushing your partner on the hands or dodge their hands without moving your feet.
4. The objective of the game is to make your partner lose their balance and not move your feet out of position.
5. The person who wins 2 out of 3 games is the final winner.



Name of your partner: _____

	Round 1	Round 2	Round 3
Winner			

Question:

1. Using the ideas of forces, explain how your partner/you won one of the rounds (Did they dodge? Did you push hard? etc.). Draw arrows on the picture above to explain the situation.

_____

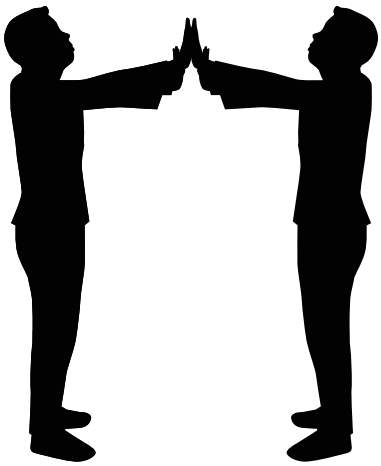
_____

_____

Follow the instructions and answer the question that follows.

Instructions:

1. With your partner, put your feet together and stand facing each other with your arms out in front of you.
2. You will be given 1 minute to play the game.
3. When instructed by your teacher, start pushing your partner on the hands or dodge their hands without moving your feet.
4. The objective of the game is to make your partner lose their balance and not move your feet out of position.
5. The person who wins 2 out of 3 games is the final winner.



Name of your partner: _____

	Round 1	Round 2	Round 3
Winner			

Question:

1. Using the ideas of forces, explain how your partner/you won one of the rounds (Did they dodge? Did you push hard? etc.). Draw arrows on the picture above to explain the situation.

_____

_____

_____

The Solar System

OBJECTIVES

In this lesson, students will develop understanding of the solar system. They will learn about each planet in detail and the order that they are located within the solar system.

SUBJECT CONTENT - PHYSICS

Space physics

- our Sun as a star, other stars in our galaxy, other galaxies
- the seasons and the Earth's tilt, day length at different times of year, in different hemispheres

KEYWORDS

planets, Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, orbit

LESSON PLAN

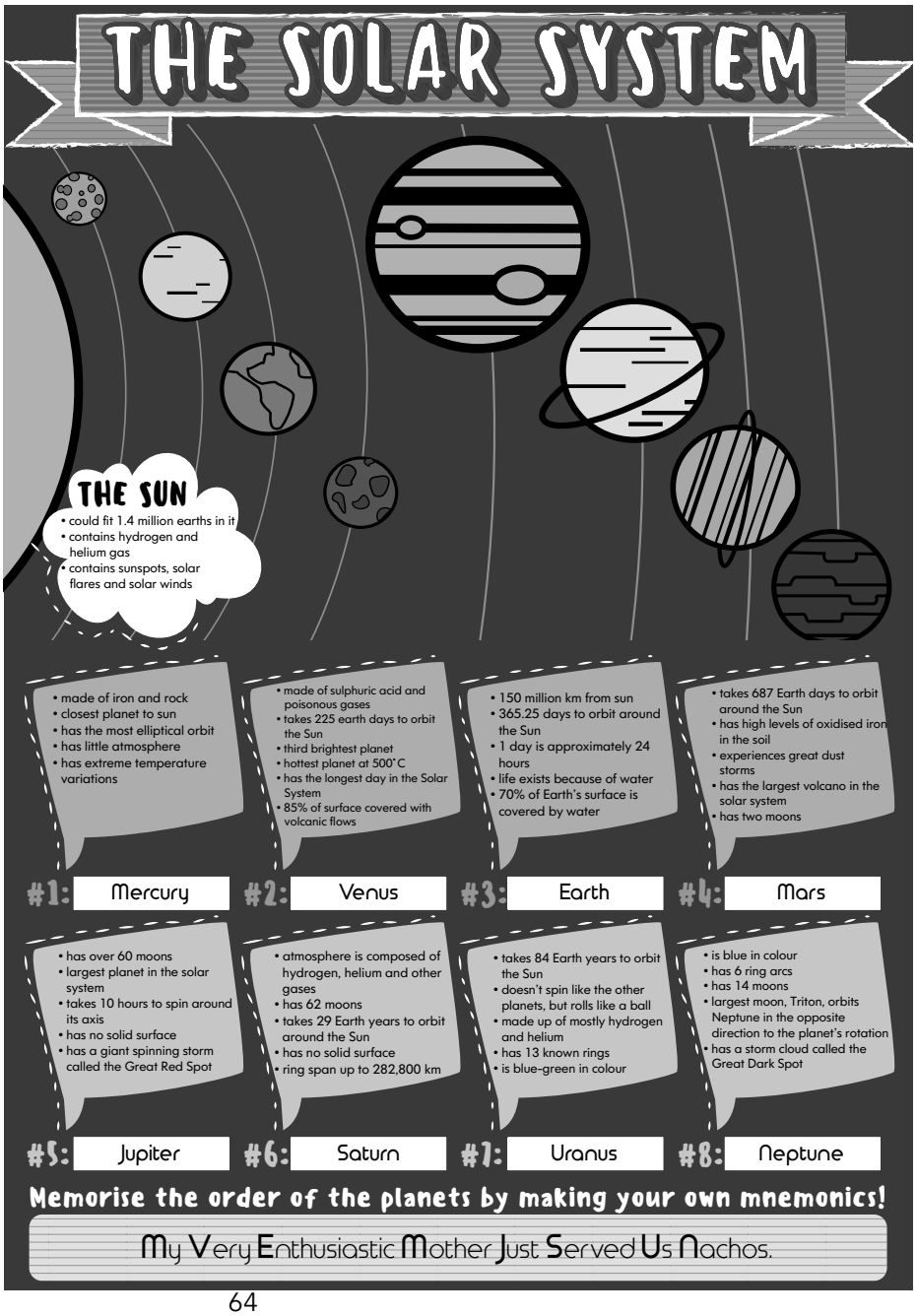
Activities	Resources
Activity 1: Learning about the Solar System Divide students into pairs. Play the video chapter by chapter. As students watch the chapters, they are to take down notes of at least three facts about each planet and the order that they are in. Pause the video if required. Give out the *Learning about the Solar System* worksheet and a copy of the poster template in A3 size to each pair. Ask students to cut out the planets and their names and complete the poster with the information they have taken down previously. Poster template and answers (PDF) can be found here: **https://clickv.ie/w/ks3/tss** (print in A3 size) 60	• ClickView video *Exploring the Solar System* **https://clickv.ie/w/ks3/16** • Photocopies of the *Learning about the Solar System* worksheet

ANSWERS

Learning about the Solar System

Students' answer may vary.

Possible answers:

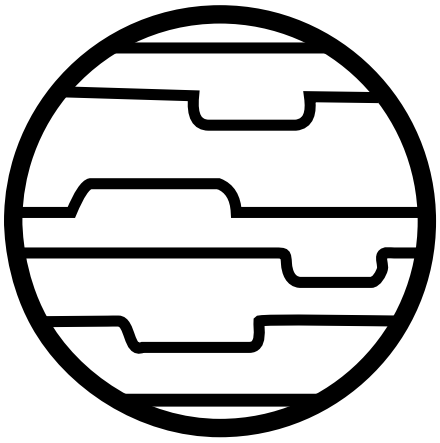


PHYSICS

Learning about the Solar System

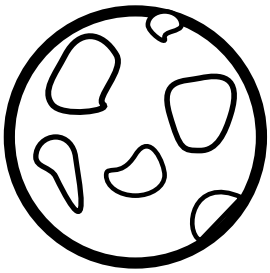
Instructions:

1. Cut out the planets and the boxes containing their names.
2. With the help of the video, paste the planets in the order that they appear in on the poster and colour them.
3. Fill in at least 3 facts about each planet in their respective boxes.

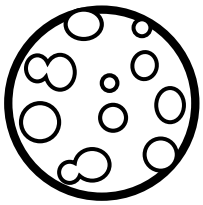


Neptune

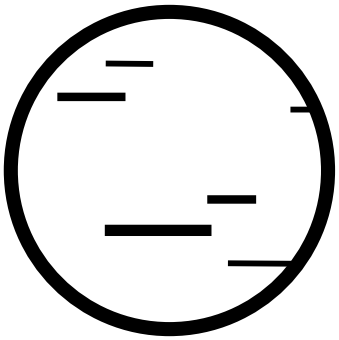
Earth



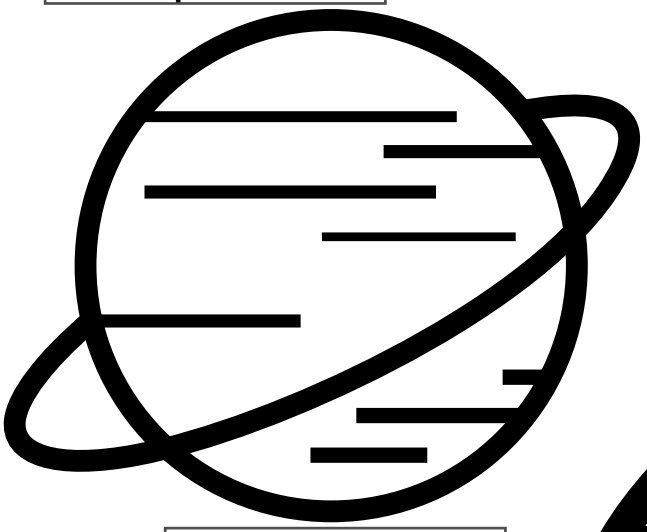
Mars



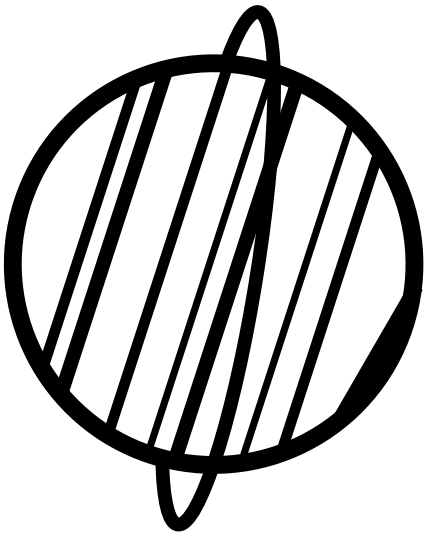
Mercury



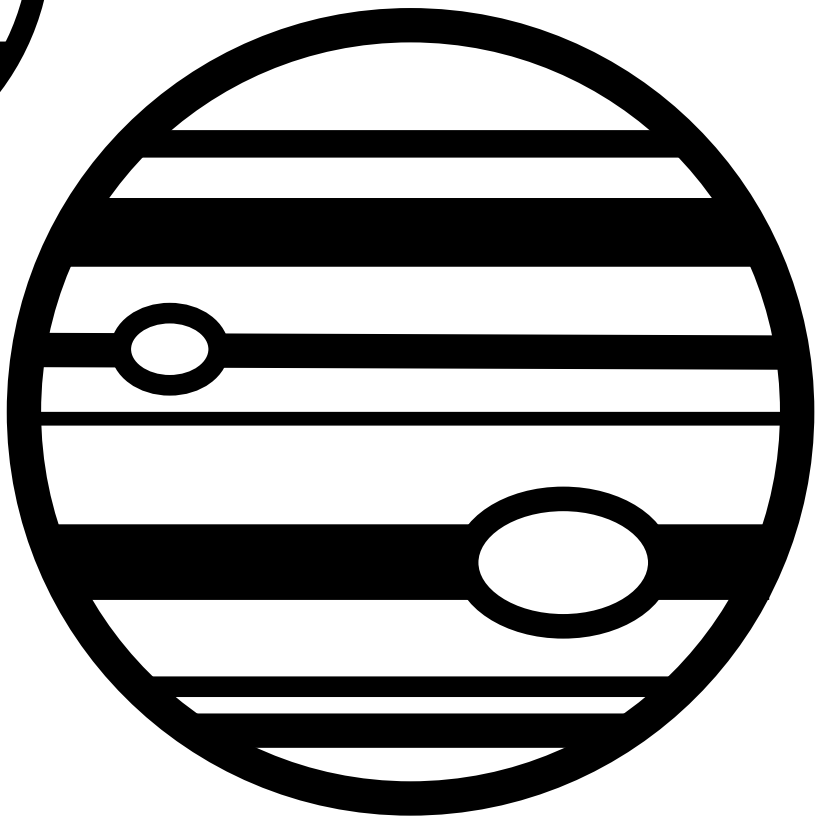
Venus



Saturn



Uranus



Jupiter

The Moon (Part A): Moon Phases

LAB LESSON

OBJECTIVES

In this lesson, students will develop an understanding of the phases of the Moon. They will be constructing their own moon wheel using the information presented in the video, which will help them visualise why this phenomenon occurs.

SUBJECT CONTENT - PHYSICS

Space physics

- our Sun as a star, other stars in our galaxy, other galaxies

KEYWORDS

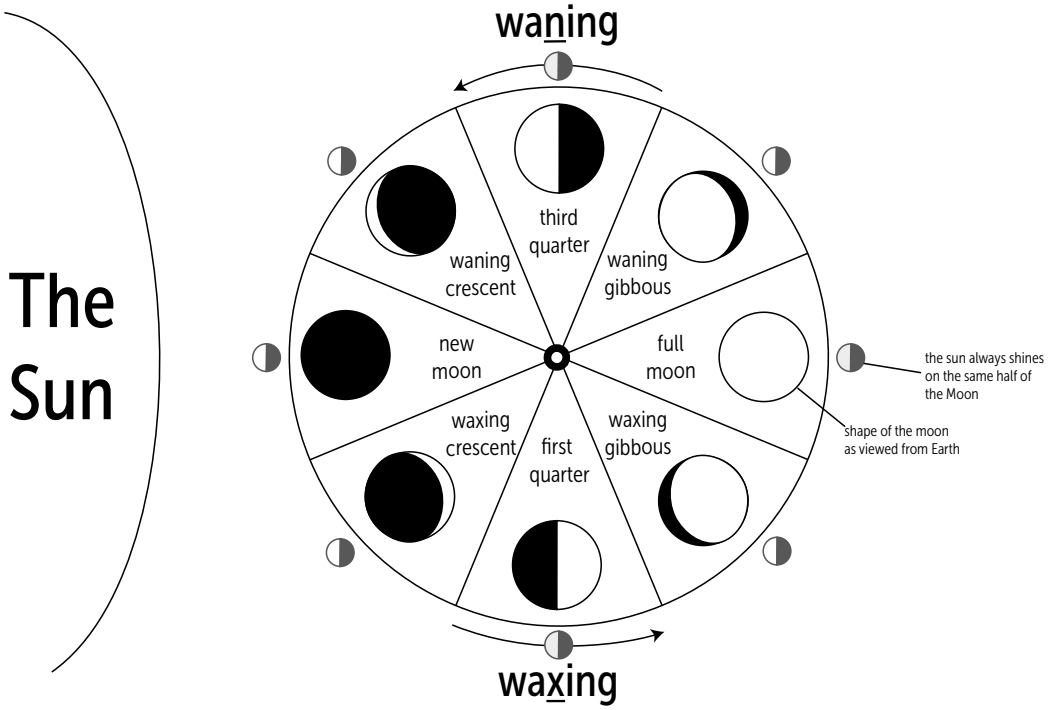
Sun, Moon, Earth, satellite, natural satellite, reflect, phases of the moon

LESSON PLAN

Activities	Resources
Activity 1: Lightning Writing Lightning writing is a strategy used to encourage students to write as much as they can about a topic in a set period of time. Have students respond to the questions on the first slide of the presentation using lightning writing. Discuss answers as a class using slides 2-5 of the presentation. 10	• Presentation: Moon Phases
Activity 2: It's Just a Phase Give out the *It's Just a Phase 1 and 2* worksheets to students. Play the video and allow students time to complete the shading and labelling of the Moon Wheel (page 69). Students should only start to fill in their worksheet from 1:45 of the video. Pause the video if required to allow for catch up. Then, cut out the wheel on the It's Just a Phase 1 worksheet and secure it with split pins. 25	• Presentation: Moon Phases • ClickView video *The Phases of the Moon* **https://clickv.ie/w/ks3/17a** • Photocopies of the *It's Just a Phase 1 and 2* worksheets (on separate pages) • Split pins and scissors
Activity 3: Modelling the Moon's Phases Carry out the activity with the following instructions: 1. Pierce the polystyrene ball with the pencil so it appears lollipop shaped. This is Earth's Moon. 2. Turn the light source on and place it in the middle of the room. This is the Sun. 3. Turn off the lights in the classroom. 4. Select a volunteer to stand approximately 2 m from the light source and hold the Moon with their arm extended, such that they can still see the light. The student's view of the Moon represents that as seen from Earth. This student will start the activity facing the light source. The Moon should be in its new moon phase. 5. Discuss observations as a class. 6. Have the student holding the Moon move slowly in a counter clockwise direction until the next moon phase is identifiable. Continue this until all the moon phases have been achieved. Students should be checking each phase with their moon wheels. 7. Once back at the new moon starting position, have another student repeat the activity, but this time holding a camera or smart phone in front of them to film the moon phases. 25	• Polystyrene ball (approx. 8 cm in diameter), pencil, light source with a bright, clear bulb (lamp or overhead projector), camera or smart phone

ANSWERS

It's Just a Phase



PHYSICS

The Moon (Part B): Eclipses

LAB LESSON

OBJECTIVES

In this lesson, students will develop an understanding of solar and lunar eclipses. With the help of the video, they will investigate the differences between the eclipses and learn about the frequency of their occurences.

SUBJECT CONTENT - PHYSICS

Space physics

- our Sun as a star, other stars in our galaxy, other galaxies

KEYWORDS

Sun, Moon, Earth, umbra, total solar eclipse, penumbra, partial solar eclipse, lunar eclipse

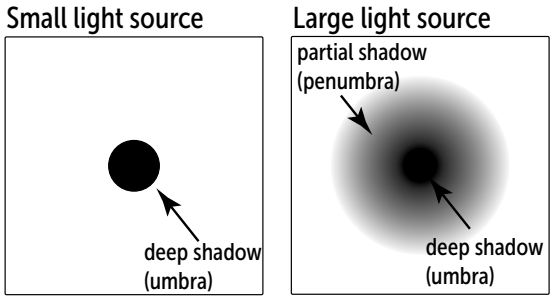
LESSON PLAN

Activities	Resources
Activity 1: The Legend of Skoll and Hati Open the presentation to the first slide and start the lesson with the mythical story of Skoll and Hati. Allow students to read the story on the slides. Lead a class discussion about why people from the past created myths to explain daily occurences (i.e. a lack of scientific knowledge and technological means to discover the truth). 10	• Presentation: Eclipses (first 9 slides)
Activity 2: The Two Types of Shadows Give out the *The Two Types of Shadows* worksheet to students. Using slides 11 - 14 of the presentation, discuss the difference between umbra and penumbra shadows and how they relate to the topic. For example: The **umbra** is the region of deep total shadow. When an umbra eclipse occurs, no sunlight is visible. The **penumbra** is the region of outer, partial shadow. When a penumbra eclipse occurs, some sunlight is visible. Follow the instructions below to demonstrate umbra and penumbra eclipses to the class. 1. Turn off the lights in the classroom. 2. Shine the torch against a blank wall. 3. Pierce the polystyrene ball with the skewer to create a lollipop-shaped figure. 4. Hold the figure about 1 m in front of the torch and approximately 1 m from the blank wall. This should create a penumbra shadow. 5. Create an umbra shadow, by holding the paper in front of the torch and shine the torch through the small opening. 30	• Presentation: Eclipses • Photocopies of the *The Two Types of Shadows* worksheet • Dark classroom • Blank wall, torch, polystyrene ball (approx. 10 cm in diameter), skewer, a piece of paper with a small opening cut out of the centre (the peephole)
Activity 3: All about Eclipses Give out the *All about Eclipses* worksheet. Play each video and ask students to work on the relevant sections on the worksheet. Pause the videos if required. Use slides 11 and 12 of the presentation to review answers. 35	• Photocopies of the *All about Eclipses* worksheet • ClickView video *Solar Eclipses* **https://clickv.ie/w/ks3/17b** *Lunar Eclipses* **https://clickv.ie/w/ks3/17c** • Presentation: Eclipses

ANSWERS

The Two Types of Shadows

1. Shadows are the result of light not being able to pass through objects.
2. The umbra is a region where no light can reach to while the penumbra is a region where some light can reach.
3. Suggested answer:



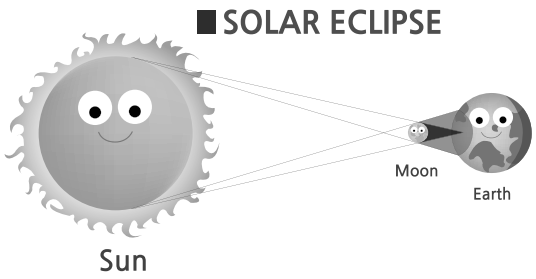
All about Eclipses

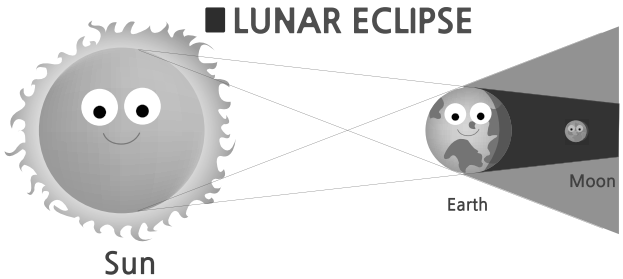
Solar Eclipses

total solar eclipse, darkness, rare, new moon, smaller, close proximity, umbra

Lunar Eclipses

Earth's shadow, far side of Earth, full moon, common





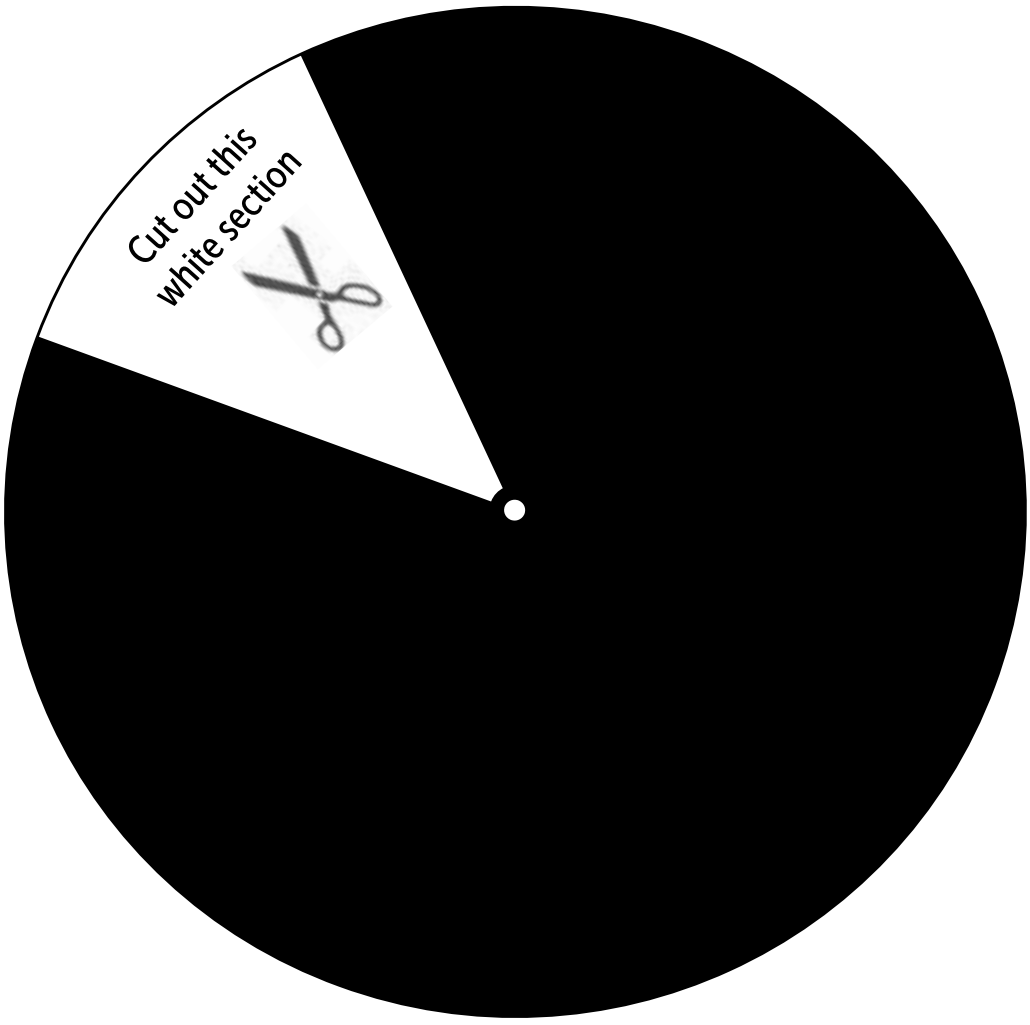
PHYSICS

It's Just a Phase 1

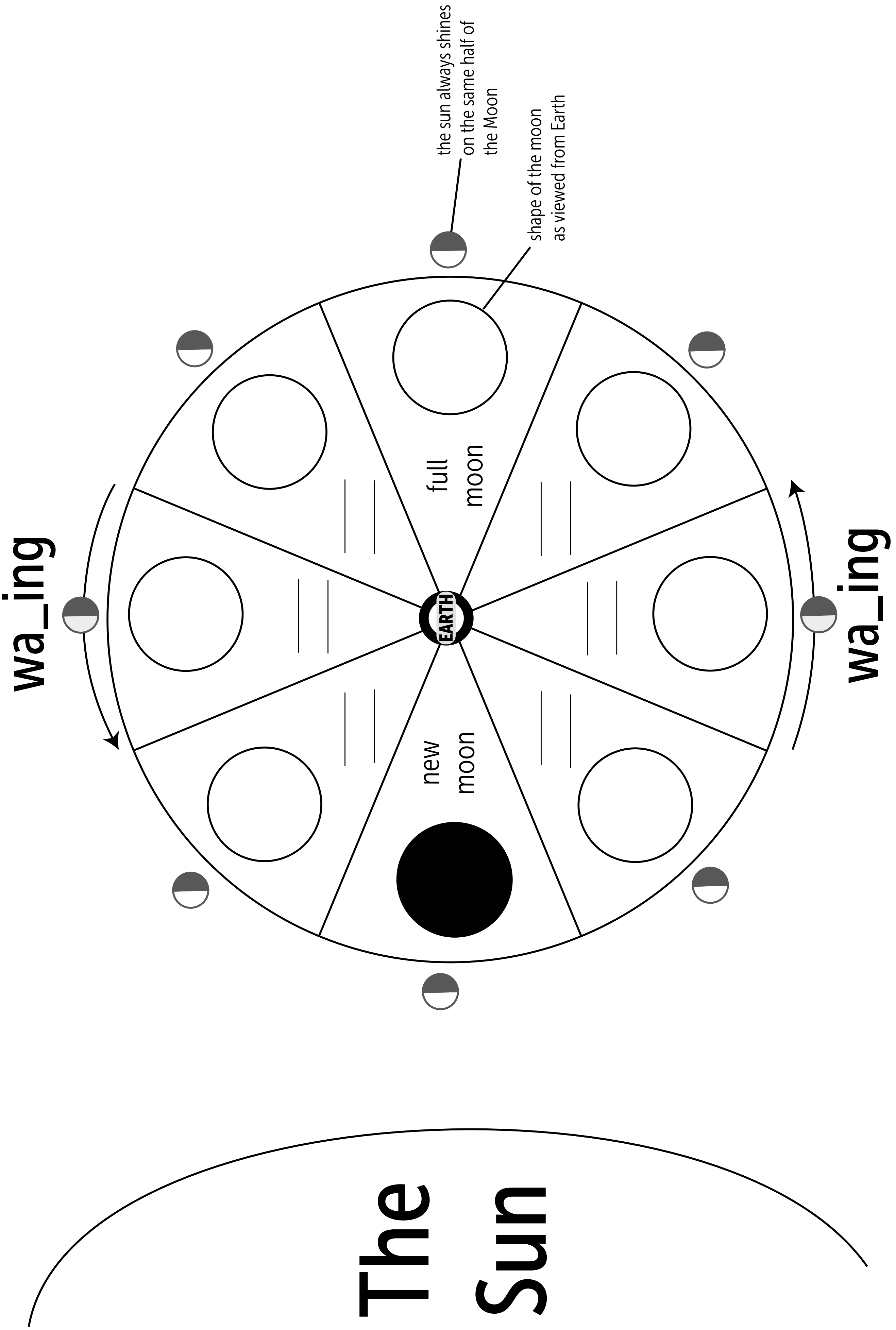
Instructions:

You will need the 'It's Just a Phase 2' worksheet to complete this task.

1. Cut out the black circle on this page. Be sure to also cut out the white wedge.
2. Complete the missing letters on the It's Just a Phase 2 worksheet.
3. As you watch the video, shade the moon for each of the moon phases as how it would appear when viewed from Earth.
4. Using a split pin, connect your black circle to the centre of the moon wheel.

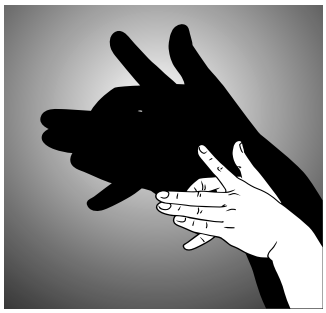


It’s Just a Phase 2



The Two Types of Shadows

Answer the following questions with help from the presentation.



1. Why do we see shadows?

_____

_____

_____

2. What is the difference between the umbra and penumbra regions of a shadow?

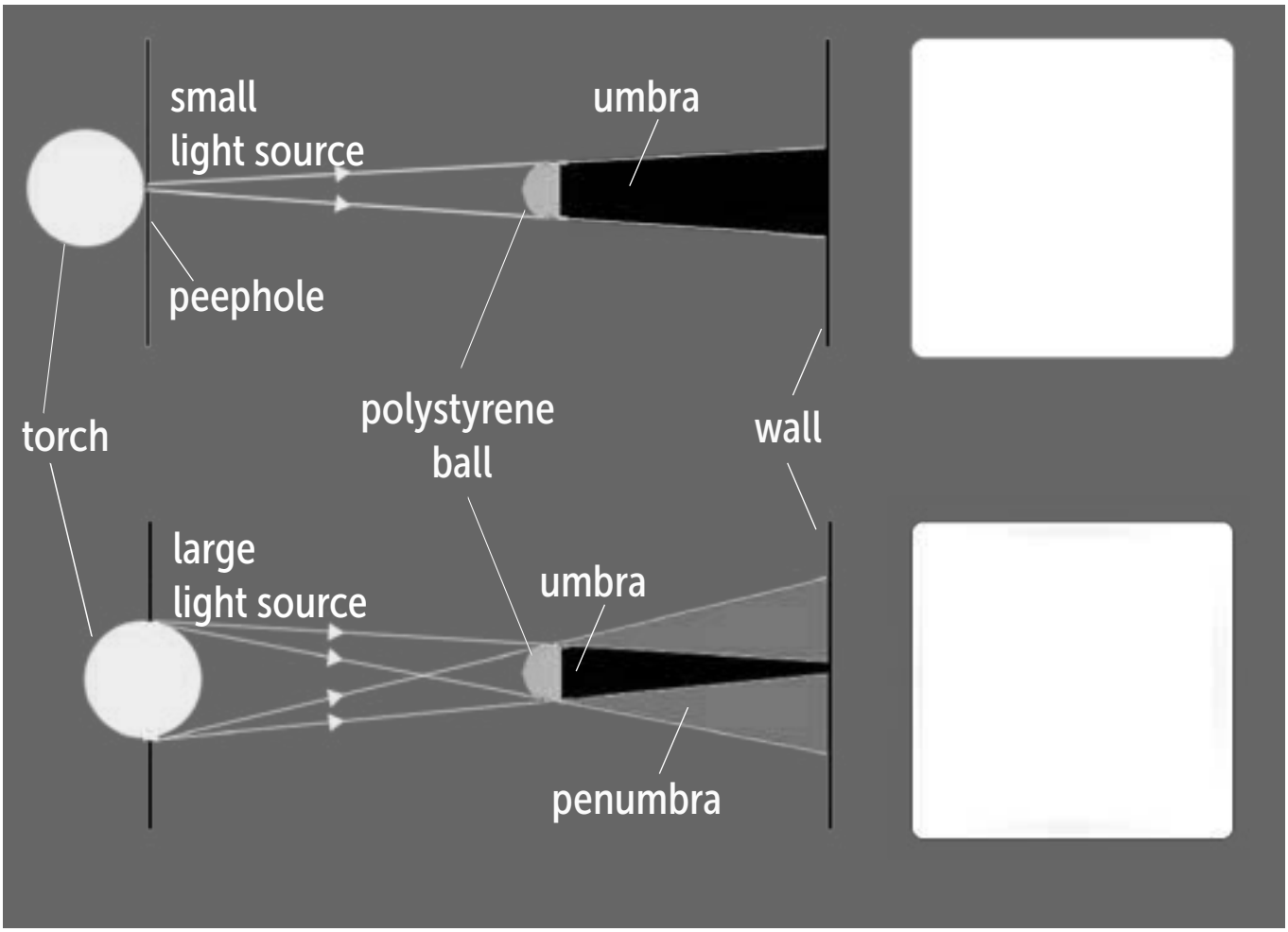
_____

_____

_____

_____

3. As you watch the demonstration, draw and label the diagram below to show what you observe on the wall.



PHYSICS

All about Eclipses

How much do you know about eclipses? Fill in the blank spaces with words or phrases from the box below as you watch the videos about solar and lunar eclipses.

Earth's shadow	smaller	rare	darkness	full moon	new moon
total solar eclipse	close proximity	umbra	common	further	far side of Earth

Solar Eclipses

When the Sun, Moon and Earth are perfectly aligned, the Moon blocks the light of the Sun from reaching Earth. This is called a _____. On Earth we experience temporary _____caused by a big, round shadow (the Moon) blocking our sunlight. Total solar eclipses are _____ and scientists believe that, in the very best conditions, they only last for around seven minutes.

Partial solar eclipses occur when the Moon passes between the Sun and Earth but they are not perfectly aligned, allowing only part of the Sun to be covered. Partial solar eclipses are much more common than total solar eclipses.

A solar eclipse can only occur during a _____, a phase of the lunar cycle where the Moon is positioned between the Earth and the Sun. During a new moon phase, the Moon is barely visible from Earth.

Even though the Moon is approximately 400 times _____ than the Sun, it appears to be the perfect size to cover the Sun due to its _____ to Earth. Whether you see a full or partial eclipse will depend on where you are located in the world. A total eclipse can be observed if your location falls in the _____ of the Moon. A partial eclipse can be observed if your location falls in the penumbra of the Moon.

Lunar Eclipses

While Earth orbits the Sun, the Moon simultaneously orbits around Earth. When Earth passes between the Sun and the Moon, it can block sunlight from being reflected by the Moon. Instead, the Moon is covered by _____. We call this a lunar eclipse. A lunar eclipse can only occur when the Moon is on the _____, away from the Sun.

Lunar eclipses can only occur during a _____. Lunar eclipses are much more _____than solar eclipses. They are also easier for many people to view at the same time. Scientists believe it is possible for a whole hemisphere to see a lunar eclipse occurring. Lunar eclipses can last several hours.

Seasons

LAB LESSON

OBJECTIVES

In this lesson, students will develop an understanding of the seasons and why they occur. They will investigate why the Northern Hemisphere and Southern Hemisphere experience different seasons at different times of the year. Students will use equipment to model the seasonal changes.

SUBJECT CONTENT - PHYSICS

Space physics

- the seasons and the Earth's tilt, day length at different times of year, in different hemispheres

KEYWORDS

axis, day, night, season, year, tilt, northern hemisphere, southern hemisphere, poles, equator, spring, summer, autumn, winter

LESSON PLAN

Activities	Resources
Activity 1: Think-Pair-Share about Seasons Think-Pair-Share is an activity where students think about a question, discuss their thoughts with a partner and then share their responses with the class. Ask students to respond to the following questions using Think-Pair-Share: • What is your favourite season? • What do you do during that season? • What can you observe during that season? 5	
Activity 2: Seasons in the Sun Give out the *Seasons in the Sun* worksheet. Play Chapter 4 of the video while students complete the crossword. 15	• ClickView video *Cycles and Seasons* Chapter 4: **https://clickv.ie/w/ks3/18** • Photocopies of the *Seasons in the Sun* worksheet
Activity 3: Understanding Earth's Tilt Divide students into groups of 3 and prepare a set of materials for each group. Have students build a model to explain Earth's tilt and to understand: • Why Earth experiences seasons • Why the Poles do not get sunlight during winter Warn students to never look directly at the light source as it could cause damage to their eyes. Once the modelling activity has concluded, go through the answers to the worksheets. Use the presentation to explain the various terms presented in the video. 30	• Photocopies of the *Understanding Earth's Tilt 1 and 2* worksheets • For each group of 3: polystyrene ball (approx. 10 cm in diameter), marker pen, skewer, table, light source (lamp), camera or smart phone • Presentation: Seasons
Activity 4: Guess the Seasons Open the presentation to the last slide and conclude the lesson by showing the climate data of three countries and asking students to identify when the countries experience summer and winter. • New Zealand (summer in December, winter in June) • Malaysia (no distinct seasons) • Finland (summer in June, winter in December) 10	• Presentation: Seasons

ANSWERS

Seasons in the Sun

ACROSS	DOWN
2. winter	1. December
4. Poles	3. spring
6. northern	5. solstice
7. 365 Days	9. equinox
8. twice	11. equator
10. night time	13. autumn
12. southern	14. hot
15. tilt	
16. closer	
17. summer	

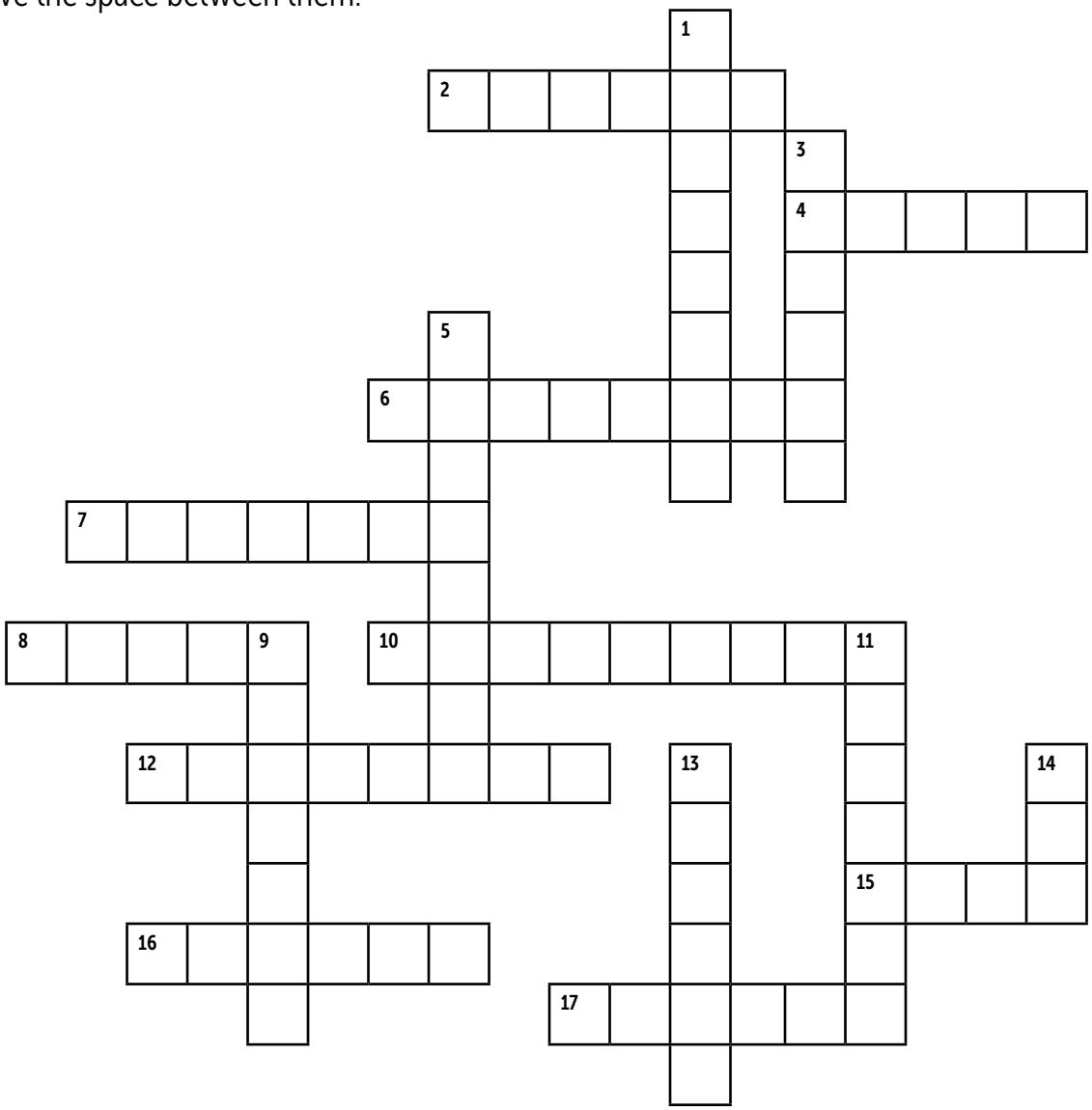
Understanding the Earth's Tilt 2

1. Suggested answer:
   If Earth was not tilted, every location would have equal hours of day and night. There would be no seasons. Regions in the north and south would always be cold as their distances from the sun would not vary throughout the year.
2. The equator receives the same amount of sunlight each day of the year.
3. During summer at the Poles, the sun does not set as the Poles are continuously facing the sun. In winter, the sun does not rise as the Poles do not receive any direct sunlight.

PHYSICS

Seasons in the Sun

Complete the crossword puzzle while watching the video.
Please note: some of the answers include numeric digits. If the answer contains two words, remove the space between them.



ACROSS

2. This season occurs in December for Europe.
4. It is always cold at the _____.
6. The _____ Hemisphere experiences summer in June.
7. Earth takes _____ _____ to make one complete revolution of the Sun.
8. A solstice occurs _____ per year.
10. There is only _____ _____ during winter at the Poles.
12. Summer begins in December for Australia because it is located in the _____ Hemisphere.
15. The seasons are caused by Earth's _____.
16. Summer occurs when the hemisphere is _____ to the Sun.
17. The season that comes before autumn.

DOWN

1. On the 21st of _____, the Southern Hemisphere has its longest day and shortest night.
3. The season that comes before summer.
5. When a hemisphere has its longest day and shortest night, it is known as a _____.
9. When the length of the day and night are equal, it is called an _____.
11. An imaginary line around the middle of Earth that separates the Northern and Southern Hemispheres.
13. The season characterised by falling leaves.
14. It is always _____ at the equator.

Understanding Earth's Tilt 1

Using the materials, follow the instructions to learn about the Earth's Tilt. Then, answer the questions on the 'Understanding Earth's Tilt 2' worksheet.

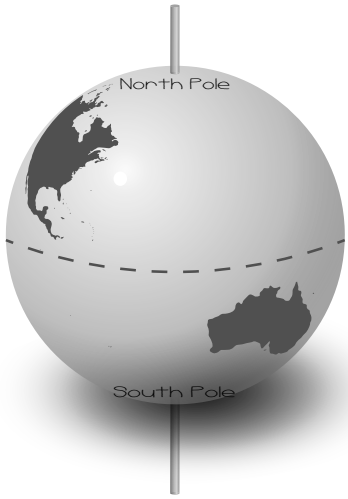
Materials:

- polystyrene ball (approx. 10 cm in diameter)
- marker pen
- skewer
- table
- light source (lamp)

Instructions:

1. The polystyrene ball represents Earth. Use the marker pen to label the North Pole, South Pole, position of the UK, Australia and the equator.

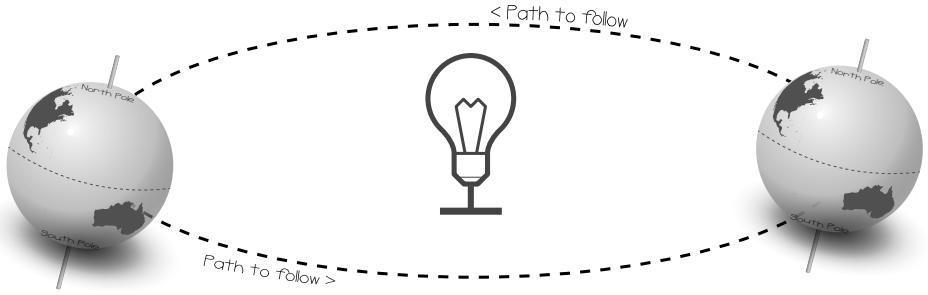
2. Pierce the skewer through the North Pole so it exits at the South Pole. The skewer represents Earth's imaginary axis.



3. Put the light source in the middle of the table. This will represent the Sun.

4. Turn the lights off in the room.

5. Orbit the light source with the polystyrene ball on a slight tilt. Follow the path indicated on the diagram below while maintaining the tilt in the same direction.



6. Take two pictures of:
   a. The UK experiencing summer
   b. Australia experiencing summer

PHYSICS

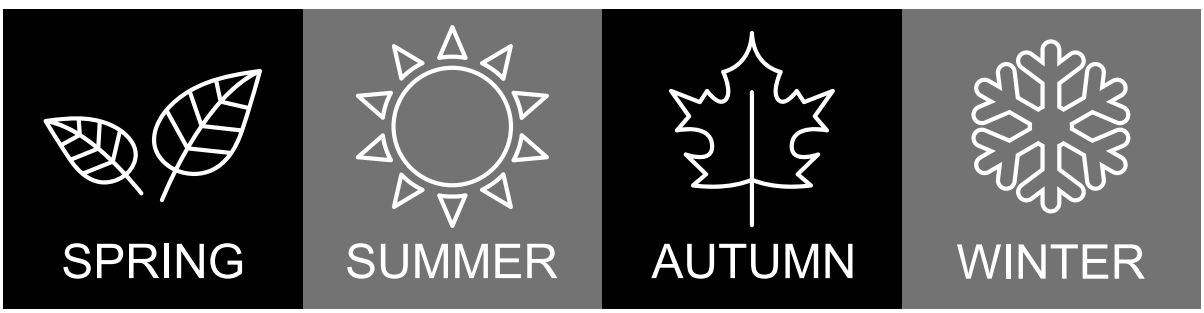
Understanding Earth's Tilt 2

Questions:

1. What do you think would happen if Earth was not tilted? Would there still be seasons?

2. Record what you observed happening at the equator during the investigation.

3. Record and explain what you observed happening at the Poles during summer and winter.



Gravity

LAB LESSON

OBJECTIVES

In this lesson, students will learn about gravitational force and the effect of gravity.

SUBJECT CONTENT - PHYSICS

Motion and forces:

Forces

- forces as pushes or pulls, arising from the interaction between two objects
- non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity

Space physics

- gravity force, weight = mass x gravitational field strength, on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)

KEYWORDS

weight, mass, newton, kilogram, gravitational field, gravitational field strength (g)

LESSON PLAN

Activities	Resources
Activity 1: Learning about Gravity Open the presentation to the first slide and pose the question: • Why can't we fly like Superman? Give out the *Learning about Gravity* worksheet before using slides 1-5 of the presentation to introduce the topic to the class. Students will need the information on the slides to answer most of the worksheet so it is recommended you don't rush. Once you have reached slide 5 of the presentation, play Chapter 4 of the video. There is information in the video that students will need to complete the worksheet. 20	• Presentation: Gravity • Photocopies of the *Learning about Gravity* worksheet • ClickView video *Force and Pressure* Chapter 4: **https://clickv.ie/w/ks3/19**
Activity 2: Gravity Keeps Us in! Give out the *Gravity Keeps Us in!* worksheet and divide the class into groups of 3. Give out the materials needed to undertake the investigation. Please note that question 1 requires a prediction and should be answered before undertaking the task. At the end of the analogy activity, students should understand that a body with greater mass has a stronger gravitational pull. 25	• Photocopies of the *Gravity Keeps Us in!* worksheet • For each group of 3: ping-pong ball, marble, tennis ball, 3 cm diameter thick rubber band
Activity 3: Mass and Weight Give out the *Mass and Weight* worksheet. Open the presentation to the last slide and explain the difference between mass and weight. Have students complete the worksheet individually. Mark answers as a class. 15	• Photocopies of the *Mass and Weight* worksheet • Presentation: Gravity • Calculators

ANSWERS

Learning about Gravity

1. Gravity is a non-contact force of attraction. It is the force that attracts, or pulls, objects towards the centre of Earth. Everything in the universe has gravity.
2. Sir Isaac Newton.
3. distance, mass
4. A spring balance
5. Moon, smaller, pulls, lesser
6. a) 1 kg rock
   b) A small car
   c) They would experience the same amount of force.

Gravity Keeps Us in!

1. Students' answers may vary.
2. 2, 1, 3
3. The Sun
4. I would be able to jump higher on the Moon as the gravitational pull by the Moon is weaker than that by Earth. In the experiment, it was easier to move my fingers away from the marble than the ping-pong ball.
5. Gravity is important as it keeps us grounded by pulling everything on the surface towards the centre of Earth. Without gravity, we would all float away into space.

Mass and Weight

Part A:

The Sun: 20 x 27.9 = 558 N
Earth: 20 x 9.8 = 196 N
The Moon: 20 x 1.6 = 32 N

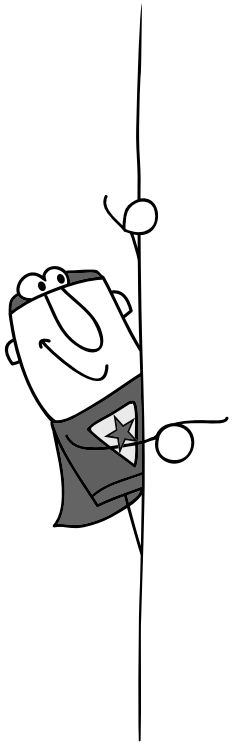
Part B:

Gravity is a force that attracts and pulls objects together. According to legend, Sir Isaac Newton first thought about gravity when an apple fell on his head. There are two factors that affect gravity: mass, distance ~~and speed~~. This means that the samller the mass an object has, the weaker the pulling force it exerts on other objects. Mass is the amount of matter in an object. It does not change regardless of where you are in the universe. Weight on the other hand, can change. A man with a mass of 75 kg has a heavier weight on Earth than he would on the Moon. We can see gravity at work when we compare the force needed to jump up onto a chair and the force needed to jump down from a chair. It is easier to jump down from a chair than it is to jump up.

PHYSICS

Learning about Gravity

Use the information in the presentation and the video to answer the following questions.



1. What is gravity?

   _____

   _____

   _____

2. Who is credited with discovering gravity?

   _____

3. What are the two factors affecting gravitational force between two objects?

   _ _ _ _ _ _ _ _ and _ _ _ _

4. What tool can you use to measure an item's gravitational force?

   _____

5. Fill in the missing words.

The _____ has less mass than Earth and hence a _____ force of gravity. The Moon _____ objects towards itself with a _____ force than Earth.

6. Circle the item that would experience the most gravitational force.

a)

1 kg rock
200 g packet of crisps
They would experience the same amount of force.

b)

A school desk
A small car
They would experience the same amount of force.

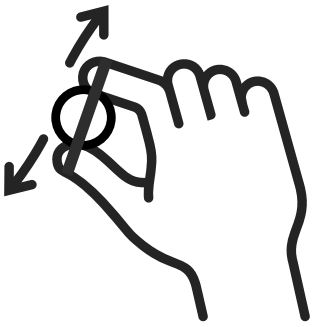
c)

1 kg gold bar
1 kg bag of feathers
They would experience the same amount of force.

PHYSICS

Gravity Keeps Us in!

With the given materials, follow the instructions and answer the questions that follow.



Materials:

- ping-pong ball
- marble
- tennis ball
- 3 cm diameter thick rubber band

Instructions:

1. Put a rubber band around the ping-pong ball.
2. Place your thumb and index finger between the rubber band and the ping-pong ball.
3. Try to move your fingers away from the ball.
4. Repeat steps 1-3 using the marble and the tennis ball (use the same hand for each ball).
5. Answer the questions below.

Object	What it represents
fingers	humans
ping-pong ball	Earth
marble	the Moon
tennis ball	the Sun
rubber band	gravitational force

Let's Predict!

1. Predict what will happen when you try to pull your fingers away from the balls.

_____

_____

Results

2. Rank the balls 1-3, from least to most, in order of the amount of force needed to move your fingers away from them.

Item	ping-pong ball	marble	tennis ball
Ranking			

3. Based on the experiment, where do you think a person would experience the greatest gravitational force?

Earth	the Moon	the Sun

4. Do you think you would be able to jump higher on the Moon or on Earth? Explain your answer.

_____

_____

Conclusion

5. Why do you think gravity is important to us on Earth?

_____

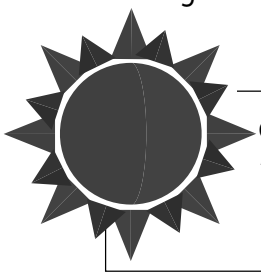
_____

Mass and Weight

Part A: Mass and Weight

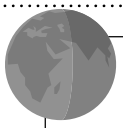
Mass and weight are not the same.

Weight (N) = Mass (kg) x Gravitational field strength, g (N/kg)



On the Sun, g = 27.9 N/kg
A 1 kg object has a weight of 27.9 N.

1 kg X 27.9 = 27.9 N



On Earth, g = 9.8 N/kg
A 1 kg object has a weight of 9.8 N.

1 kg X 9.8 = 9.8 N

On the Sun, g = 1.6 N/kg
A 1 kg object has a weight of 1.6 N.

1 kg X 1.6 = 1.6 N

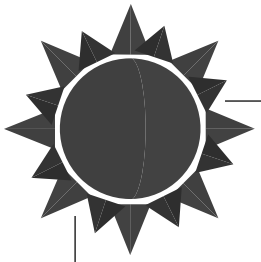
Mass is the measure of the amount of matter in an object. Mass is measured in kilograms (kg).

Weight of an object is defined as the force of gravity on the object. Its unit of measurement is newtons (N).

Because the mass of the planets and stars are all different, the pull of gravity on each body varies. For example; the Moon has less mass than Earth, therefore its gravitational pull is less than that of Earth's.

Your mass does not change but your weight does.

What would be the weight of an object with a mass of 20 kg at each location? Show your working.



Sun

Earth

Moon

Part B: There are six errors in the following passage. Circle the errors then rewrite the entire passage.

Gravity is a force that attracts and pushes objects together. According to legend, Sir Isaac Newton first thought about gravity when an apple fell on his head. There are three factors that affect gravity: mass, distance and speed. This means that the smaller the mass an object has, the stronger the pulling force it exerts on other objects. Mass is the amount of matter in an object. It does not change regardless of where you are in the universe. Weight, on the other hand, can change. A man with a mass of 75 kg has a lighter weight on Earth than he would on the Moon. We can see gravity at work when we compare the force needed to jump up onto a chair and the force needed to jump down from a chair. It is harder to jump down from a chair than it is to jump up.

Curriculum Mapping Grid

Lesson Plan	Subject Content
BIOLOGY	
An Introduction to Cells (p6)	**Structure and function of living organisms:** Cells and organisation • cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope • the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts • the similarities and differences between plant and animal cells
An Introduction to Microscopes (p10)	**Structure and function of living organisms:** Cells and organisation • cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
Unicellular Organisms (p14)	**Structure and function of living organisms:** Cells and organisation • the structural adaptations of some unicellular organisms
Organs and Organ Systems (p16)	**Structure and function of living organisms:** Cells and organisation • the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms
Food Chains (p20)	**Interactions and interdependencies:** Relationships in an ecosystem • the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops
Food Webs (p22)	**Interactions and interdependencies:** Relationships in an ecosystem • the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops
CHEMISTRY	
States of Matter (p26)	The particulate nature of matter • the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure • changes of state in terms of the particle model
Physical and Chemical Changes (p32)	The particulate nature of matter • the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure Pure and impure substances • mixtures, including dissolving Chemical reactions • chemical reactions as the rearrangement of atoms
Acids and Alkalis (p36)	Chemical reactions • defining acids and alkalis in terms of neutralisation reactions

Lesson Plan	Subject Content
Neutralisation (p40)	Chemical reactions • defining acids and alkalis in terms of neutralisation reactions • representing chemical reactions using formulae and using equations • reactions of acids with alkalis to produce a salt plus water
An Introduction to the Periodic Table (p44)	The Periodic Table • the varying physical and chemical properties of different elements • the Periodic Table: periods and groups; metals and non-metals
Atoms, Elements and Compounds (p48)	Atoms, elements and compounds • chemical symbols and formulae for elements and compounds The Periodic Table • the varying physical and chemical properties of different elements • the Periodic Table: periods and groups; metals and non-metals
PHYSICS	
Types of Forces (p52)	**Motion and forces:** Forces • forces as pushes or pulls, arising from the interaction between two objects
Identifying Forces (p56)	**Motion and forces:** Forces • forces as pushes or pulls, arising from the interaction between two objects • using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces • non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity
Balanced and Unbalanced Forces (p60)	**Motion and forces:** Forces • forces as pushes or pulls, arising from the interaction between two objects • using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces
The Solar System (p64)	Space physics • our Sun as a star, other stars in our galaxy, other galaxies • the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
The Moon (Part A and B) (p66)	Space physics • our Sun as a star, other stars in our galaxy, other galaxies
Seasons (p72)	Space physics • the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
Gravity (p76)	**Motion and forces:** Forces • forces as pushes or pulls, arising from the interaction between two objects • non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity Space physics • gravity force, weight = mass x gravitational field strength, on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)

Educational Videos for Secondary Schools

ABOUT CLICKVIEW

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ISBN 978-0-9945664-2-3