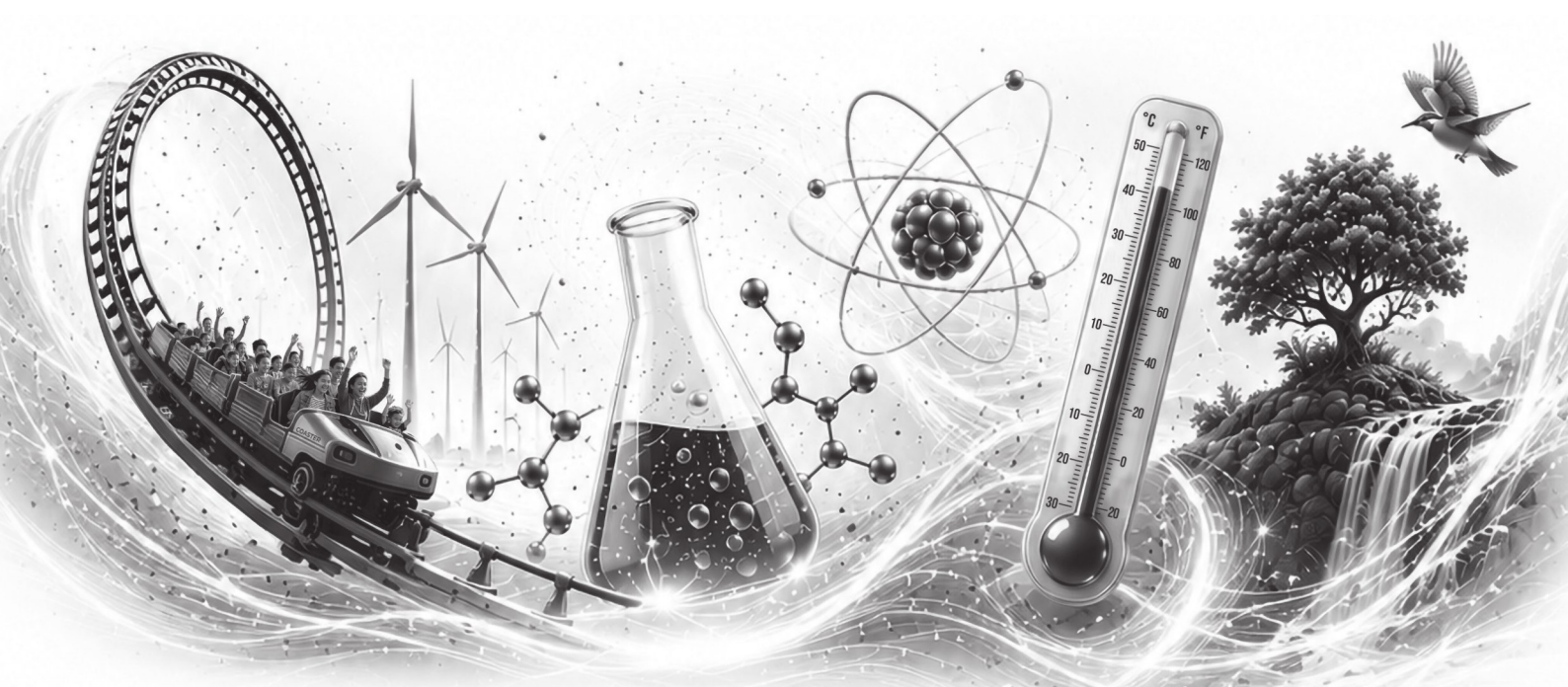


Secondary 1 Science Series

G2 & G3 | MOE Lower Secondary Science Syllabus



A genuine look inside the complete series

Actual notes, diagrams, worksheets, tests and answer explanations

THIS SAMPLE INCLUDES

- 16 Topical Notes pages across all 8 chapters
- 8 Worksheet pages, one from every chapter
- 2 Chapter Test previews
- 4 detailed Answer Key pages
- A full overview of the 24-booklet hardcopy series

The complete Secondary 1 series

8 chapters. 3 separate saddle-stitched booklets per chapter. 24 booklets in total.

01	The Scientific Endeavour	100 pages
02	Exploring Diversity of Matter by Its Physical Properties	92 pages
03	Exploring Diversity of Matter by Its Chemical Composition	92 pages
04	Exploring Diversity of Matter using Separation Techniques	100 pages
05	Ray Model of Light	92 pages
06	Model of Cells: The Basic Unit of Life	88 pages
07	Model of Matter: The Particulate Nature of Matter	88 pages
08	Model of Matter: Atoms and Molecules	84 pages

EVERY CHAPTER: TOPICAL NOTES | WORKSHEET & TEST | ANSWER KEY

Topical Notes

Build a strong foundation of the chapter's key concepts.

Worksheet & Test

Attempt each worksheet and the chapter test under timed conditions.

Answer Key

Full worked explanations, because the reasoning matters more than the final answer.

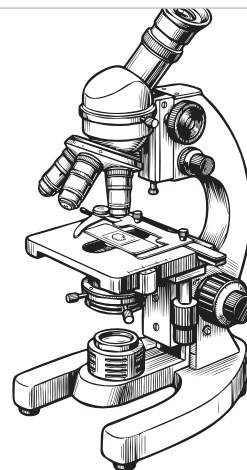
Optional G2 content and enrichment material are clearly identified within the materials.

CHAPTER

1

The Scientific Endeavour

TOPICAL NOTES



This chapter covers what science is, how scientific knowledge is built, how to carry out fair investigations with accurate measurements, and how to work safely and responsibly in the laboratory.

1.1 WHAT IS SCIENCE?

**DEFINITION**

Science: the study of natural phenomena in the world.

- Science begins with **curiosity**: we ask “what”, “why”, “how” and “which” about the things we observe.
- Science is not confined to the laboratory. It is part of everyday life: friction lets us grip a pole on a bus, chemical changes happen as trees make food, and technology powers our phones and transport.
- Research can happen in a laboratory, a controlled environment with the right apparatus, or outside it, collecting real-time data and specimens in natural habitats using data loggers and GPS tags.

Science Is a Human Endeavour

- Scientific knowledge has been built by different civilisations over the centuries. For diabetes, its symptoms were recorded by ancient Egyptian, Indian, Chinese and Arabic civilisations, the Greek physician Aretaeus named it, and later scientists discovered how the pancreas controls blood sugar, leading to modern treatments.
- Knowledge of diabetes (and all science) is still subject to change with new evidence.
- Science is not limited to scientists; everyone can take part in it.

1.2 THE NATURE OF SCIENTIFIC KNOWLEDGE

Science Is Evidence-Based

- Evidence supports or rejects hypotheses and theories. It is obtained by observing natural phenomena or conducting experiments, using our senses or instruments that act as extensions of the senses (such as telescopes, data loggers and balances).

**DEFINITION**

Qualitative data: observations that describe objects or phenomena in words or drawings, without numerical values (e.g. colour, texture, odour, sound).

TOPICAL NOTES

Chapter 1 • The Scientific Endeavour



DEFINITION

Quantitative data: measurements expressed as numerical quantities with units (e.g. 500 g, 2 cm, 50 s).

	Qualitative Data	Quantitative Data
How collected	Involves senses	Involves senses and measurements taken using instruments
Form	Usually descriptive (e.g. heavy, long, fast, green, smooth)	Numerical (e.g. 500 g, 2 cm, 50 s)
Examples	Colour of a solution changes; object feels smooth; smells musty	Mass = 15 g; height increased by 3 cm; heart rate = 75 bpm



TAKE NOTE

The test is simple: a **number with a unit (or a count)** is quantitative; a description in words is qualitative. “Describing the weight” as heavy/light is qualitative, but “the exact length in cm” is quantitative. Investigations about “reasons”, “types” or “benefits people feel” collect qualitative data; “average mass”, “frequency” or “duration” collect quantitative data.

Construction of Scientific Knowledge

- Scientific knowledge is built from the systematic collection and analysis of evidence and rigorous reasoning, together with imagination and creativity. Patterns and trends in the data lead to inferences and conclusions.
- For example, consider Earth’s position in the solar system:
- Ptolemy** used many observations of the sky to build a model with Earth at the centre, which was accepted for over a thousand years.
- Copernicus** analysed years of data and proposed that the Sun is at the centre, but could not convince most scientists.
- Galileo** built an improved telescope, which gave observable evidence that the Sun is at the centre of the solar system.
- The same evidence can support multiple interpretations: all three studied the same planetary system but explained it differently.
- The scientific community analyses evidence thoroughly before accepting an interpretation; knowledge changes only when the community agrees on new evidence, not by majority opinion or one famous scientist.
- Hence scientific knowledge is reliable and durable, but subject to change with new evidence.



TAKE NOTE

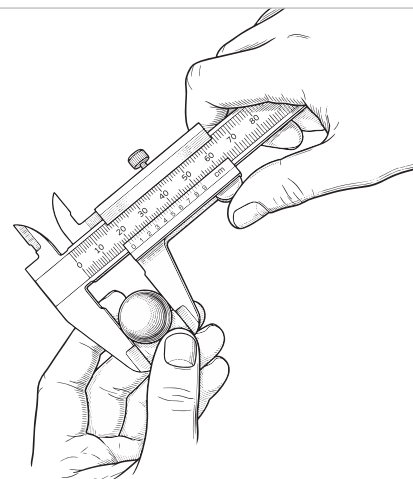
Scientific knowledge is NOT “always correct regardless of time”, and scientists do NOT gather information from “people they believe in”. Knowledge comes from observing and experimenting, and advancements in technology (e.g. the telescope) often provide the new evidence that changes it.

CHAPTER

2

Exploring Diversity of Matter by Its Physical Properties

TOPICAL NOTES



Every material (metal, plastic, glass, ceramic, fibre) has its own **physical properties**. In this chapter, you will describe and measure them, calculate density, predict floating and sinking, and choose the right material for a job and for sustainable living.

2.1

CLASSIFYING MATERIALS

Classifying objects by their common characteristics lets us study them systematically and spot patterns.

- To classify, first identify the similarities and differences, then group similar objects together, and finally name each group.
- The same objects can be classified in many ways (by colour, material, or use), so there is no single “correct” way.
- One useful way is to classify by material, which gives five classes: **ceramic, metal, glass, fibres, plastic**.

Material	Key physical properties
Ceramic	• Made from clay • Hard • Poor conductor of electricity • High melting point • Does not corrode • Can be moulded into shapes • Fragile (brittle)
Metal	• Shiny • Good conductor of electricity and heat • Can be moulded into shapes (malleable) • Can be bent/drawn into wires without breaking (ductile) • Generally high density and high melting point
Glass	• Transparent • Poor conductor of electricity and heat • High melting point • Can be moulded into shapes • Fragile (brittle)

Material	Key physical properties
Fibres	• Can be spun into threads and woven into fabrics • Able to absorb dyes • Flexible • Strong • Poor conductor of electricity and heat
Plastic	• Lightweight (low density) • Does not corrode • Can be moulded into shapes • Generally low melting point (compared with metals, glass and ceramics) • Poor conductor of electricity and heat • Strong and durable

TOPICAL NOTES

Chapter 2 • Exploring Diversity of Matter by Its Physical Properties



TAKE NOTE

“Brittle/fragile” means the material shatters or breaks when dropped or bent; glass and ceramics are hard but brittle. Fibres are NOT fragile; they are strong and flexible. A container that shatters when knocked off a table is most likely glass.

- **Malleable** means it can be hammered or moulded into shape without breaking, while **ductile** means it can be drawn into thin wires. Metals are both.
- Metals are usually solids at room temperature. The exception is mercury, a shiny liquid metal that still conducts electricity and heat.

2.2

COMMON PHYSICAL PROPERTIES OF MATTER



DEFINITION

Physical properties: qualities of a material that can be observed and measured without changing its composition.

Examples: colour, transparency, texture, electrical conductivity, thermal conductivity, melting point, boiling point, strength, hardness, flexibility, density.

Electrical Conductivity



DEFINITION

Electrical conductivity: the measure of how easily an electric current flows through a material.

- Metals such as copper, iron, and mercury are **conductors** with high conductivity. A lamp lights when a conductor completes the circuit.
- Rubber and plastic are **insulators** with low conductivity. Insulators cover wires to protect us from electric shocks.

Thermal Conductivity



DEFINITION

Thermal conductivity: the measure of how easily heat flows through a material.

Metals are good heat conductors, so a metal pan base transfers heat quickly to cook the food.

- Plastic, wood, glass, and ceramics are poor heat conductors, which makes them good insulators. A plastic pan handle stays cool, and a cooler box keeps its contents cold by keeping heat out.
- A good insulator keeps hot things hot AND cold things cold, because it slows heat flow either way.

Melting Point and Boiling Point



DEFINITION

Melting point: the temperature at which a substance changes from the solid state to the liquid state.



DEFINITION

Boiling point: the temperature at which a substance changes from the liquid state to the gaseous state.

CHAPTER

3

Exploring Diversity of Matter by Its Chemical Composition

TOPICAL NOTES



In Chapter 2 we classified matter by its physical properties; here we classify it by its **chemical composition** as **elements, compounds and mixtures**, and also look at solutions, suspensions and dissolving. Knowing what a substance is made of helps us to use it safely and wisely.

3.1 CHEMICAL COMPOSITION IN OUR DAILY LIVES

Knowing the **chemical composition** of everyday items, such as food and waste, guides how we use and dispose of them.

- **Beneficial use:** melamine is light, strong, and mouldable, so it is used for plastic containers, bowls, and spoons.
- **Harmful use:** in 2008, melamine was illegally added to milk powder (mimics milk proteins); it passed protein tests but caused kidney damage and infant deaths.
- Waste can be recycled properly only if it is sorted by composition, with paper, glass, plastics and metals separated.
- **E-waste** such as old phones, batteries, and computers holds metals and hazardous substances, so it belongs in dedicated e-waste bins rather than the rubbish.

 TAKE NOTE

Only clean, uncontaminated items should go into recycling bins. An oily plastic container cannot be recycled; the food residue can spoil the whole batch of recyclables. Practise the 3Rs: Reduce (use fewer disposables), Reuse (e.g. turn old clothes into handicraft), Recycle (clean paper, glass, metal, plastic).

Hazard Symbols and Safe Handling of Chemicals

Exams often show **GHS hazard symbols** and ask their meaning or precaution. For the full GHS hazard-symbol set, see Chapter 1.

3.2 ELEMENTS AND THE PERIODIC TABLE

 DEFINITION

Element: an element is a basic building block of living and non-living matter that cannot be broken down into simpler substances.

- There are 118 known elements, listed in the **Periodic Table**.
- All matter is built from one or more elements.

TOPICAL NOTES

Chapter 3 • Exploring Diversity of Matter by Its Chemical Composition

- Elements are **pure substances**, so they have fixed melting and boiling points.
- Some elements aren't natural; a few (e.g. technetium) were first made in labs.

Chemical Symbols

- A **chemical symbol** is one capital letter, or two letters with only the first one capitalised.

Element	Symbol	Element	Symbol
Hydrogen	H	Sodium	Na
Carbon	C	Magnesium	Mg
Nitrogen	N	Chlorine	Cl
Oxygen	O	Potassium	K
Sulfur	S	Iron	Fe
Silver	Ag	Copper	Cu



TAKE NOTE

The symbol of potassium is K, not P; P is phosphorus. Watch out for symbols that come from Latin names: Na (sodium), K (potassium), Fe (iron), Cu (copper), Ag (silver).

Atoms and Molecules

- An atom is the smallest particle of an element.
- A molecule is two or more atoms chemically joined together.
- An **element molecule** contains one element only, e.g. oxygen O₂, nitrogen N₂, sulfur S₈.
- A **compound molecule** contains different elements, e.g. H₂O, CO₂.
- A single unjoined atom (e.g. argon, Ar) is not a molecule.
- Elements can exist as single atoms (such as helium and copper) or as molecules (such as oxygen), not only as single atoms.

The Periodic Table

- A **group** is a vertical column; elements in the same group share chemical properties (for example, chlorine and iodine in Group 17).
- A **period** is a horizontal row; from left to right across a period, elements trend metallic → non-metallic.
- **Metals** are on the left and in the centre; **non-metals** are on the right (plus hydrogen).
- **Metalloids**, such as silicon and boron, lie on the zigzag boundary and are part-metal, part-non-metal.
- Commonly tested: chlorine is in Group 17 and Period 3; boron is in Group 13 and Period 2.

CHAPTER

4

Exploring Diversity of Matter using Separation Techniques

TOPICAL NOTES



Mixtures are everywhere: seawater, ink, scrap metal. This chapter: separating a mixture's constituents by differences in physical properties, and how Singapore uses these techniques for a sustainable supply of **potable** (drinkable) water.

4.1

WHY WE SEPARATE MIXTURES AND HOW TO CHOOSE A TECHNIQUE

Separating mixtures lets us **reduce, reuse, recycle** resources. Examples: potable water, food safety, waste management.

Because the constituents are not chemically combined, they keep their own physical properties. Separation exploits a difference in a physical property between them.

- Choose the technique from the constituents' properties (whether they are magnetic, and their particle size, solubility and boiling point) and from which substance you want to collect.
- The amount of each constituent does NOT determine the technique.
- Other factors to consider are cost, reliability and environmental impact.

★ Optional for G2

- For example, reverse osmosis gives potable water but is costly, so Singapore can't rely on it alone.

Separation technique	Physical property used	Type of mixture separated	Example
Magnetic attraction	Magnetism	Magnetic + non-magnetic substances	Iron filings from sulfur
Sieving / filtration	Particle size	Insoluble solid + liquid (or solids of different sizes)	Sand from water
Evaporation to dryness	Solvent boils away at a lower temperature than the solute	Dissolved (soluble) solid + liquid, to obtain the solid	Salt from salt solution
Distillation	Difference in boiling points	Solvent + dissolved solid, or two miscible liquids, to obtain the pure liquid	Pure water from seawater
Paper chromatography	Different solubilities in a solvent	Small amounts of substances dissolved to different extents	Dyes in ink

✎ TAKE NOTE

Separation techniques are physical methods; they only work on mixtures. A compound such as water cannot be separated into hydrogen and oxygen by any of these techniques, because its elements are chemically combined.

TOPICAL NOTES

Chapter 4 • Exploring Diversity of Matter using Separation Techniques

4.2 MAGNETIC ATTRACTION



DEFINITION

Magnetic attraction: the process of attracting magnetic substances using a magnet.

- Magnetic materials include iron, steel, nickel and cobalt (steel contains iron).
- Non-magnetic materials include plastic, paper, glass, rubber, sulfur and sand, and the metals aluminium, copper, zinc, gold, silver and brass.
- Hold a magnet over a mixture of iron filings and sulfur: only the iron filings are attracted, and the sulfur is left behind.
- Fastest way to remove iron filings from a liquid (e.g. oil): move a magnet through it.

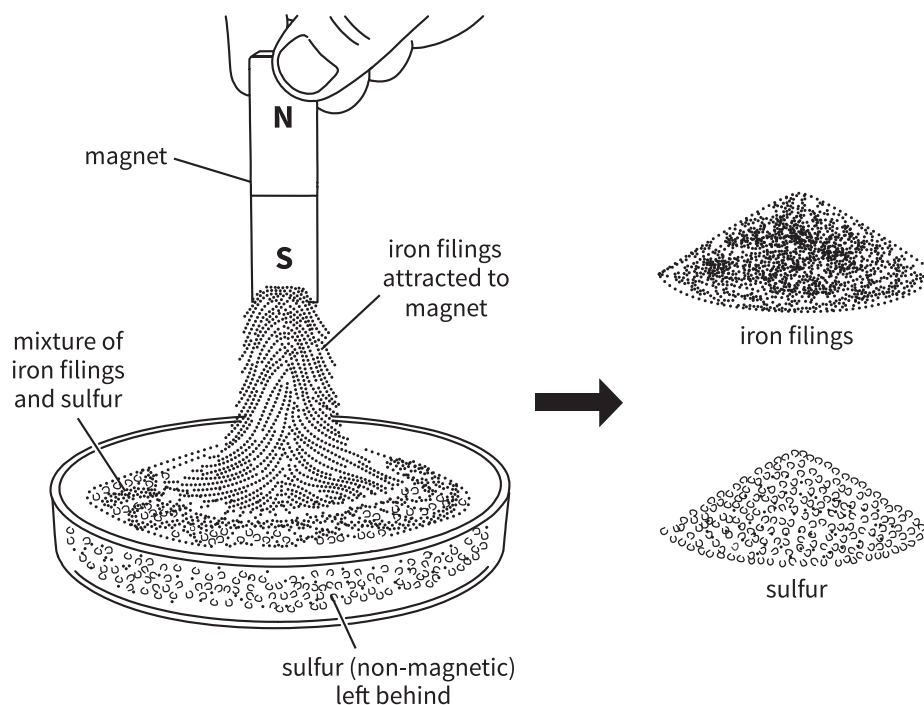


Figure 4.1: Separating iron filings from sulfur using magnetic attraction.

Application: Recycling Scrap Metal

- Scrap metal is a mixture of metals, such as aluminium, copper and iron.
- Strong magnet (e.g. scrapyard crane) removes magnetic items (iron bars, chains, steel bolts); non-magnetic (glass mirrors, rubber tyres, plastic parts) stay behind.
- The recovered iron is reused or recycled, which means less waste.



TAKE NOTE

Magnetic attraction only works if exactly ONE constituent is magnetic. A mixture of iron and steel, iron and nickel, iron and cobalt, or cobalt and steel CANNOT be separated this way; the magnet attracts both constituents. Likewise, it fails if neither constituent is magnetic (e.g. copper and aluminium). Exam questions love this trap.

CHAPTER

5

Ray Model
of Light

TOPICAL NOTES



Light is explained with a simple model: the **ray**. This chapter covers how light travels, reflects (from mirrors and rough surfaces) and refracts between media, and how light and **EM radiation** affect our lives.

5.1 LIGHT AND THE RAY MODEL

Light is a form of energy that is emitted by light sources and detected by our eyes.

- Light travels in straight lines.
- Light also travels through a **vacuum** (empty space), which is how sunlight reaches Earth. In a vacuum, its speed is $3 \times 10^8 \text{ m/s}$ (300 million m/s).
- Light travels much faster than sound, so lightning is seen before thunder is heard.



DEFINITION

Ray of light: a single straight line, with an arrow, that represents the path taken by light and the direction in which it travels.



DEFINITION

Beam of light: a bundle (group) of light rays.

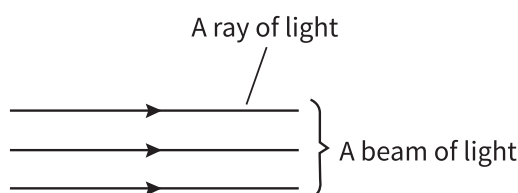


Figure 5.1: A group of light rays forming a beam of light.

- A beam can be **parallel** (rays stay equidistant), **convergent** (rays meet at a point) or **divergent** (rays spread from a point).
- A **ray diagram** is a scientific model used to explain and predict how light behaves.

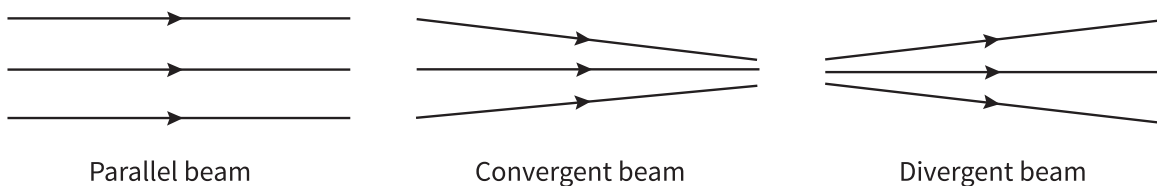


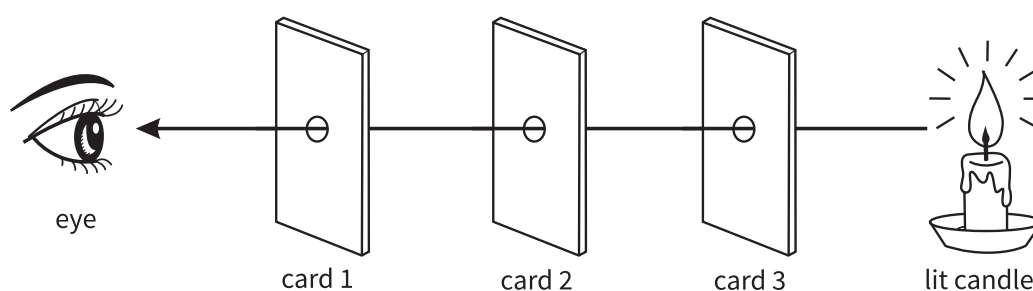
Figure 5.2: Beams of light which can be parallel, convergent or divergent.

TOPICAL NOTES

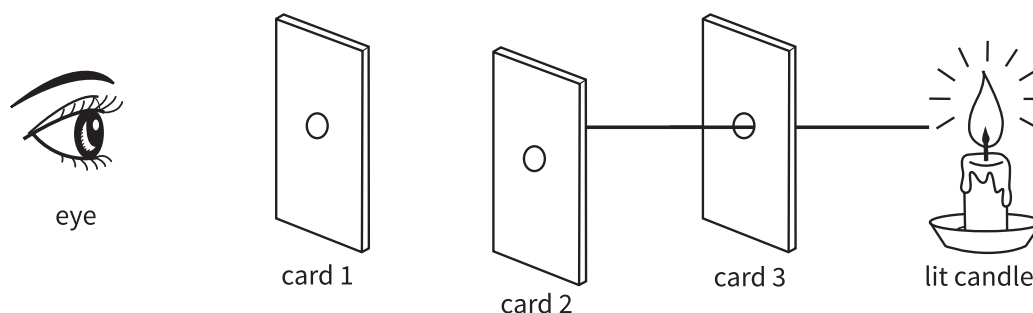
Chapter 5 • Ray Model of Light

Evidence That Light Travels in Straight Lines

- **Card experiment:** the candle can be seen through three holed cards only when all the holes and the eye are in one straight line; if you shift a card, the flame is hidden.
- **Shadows:** light cannot bend round an opaque object, so a dark shadow forms behind it.
- **Eclipses:** in a solar eclipse, the Moon blocks sunlight from part of Earth, which is only possible because light travels in straight lines.



Holes aligned: light passes through, so the eye sees the flame.



Middle card shifted: light is blocked, so the eye cannot see the flame.

Figure 5.3: The flame is seen only when all the holes are in a straight line; light travels in straight lines.

 TAKE NOTE

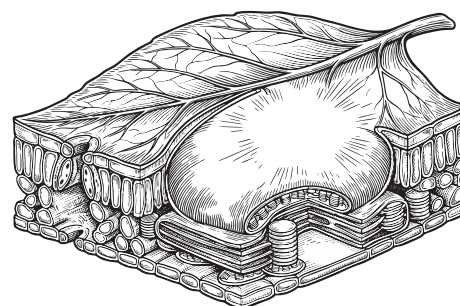
Rainbows and objects appearing shallower in water are NOT evidence that light travels in straight lines; they are caused by refraction, where light bends at a boundary. Also, do not say “light cannot travel through a vacuum”; it can, which is why we can see the sun and stars.

CHAPTER

6

Model of Cells – The Basic Unit of Life

TOPICAL NOTES



All living things are made of **cells**, the smallest units that carry out life processes. This chapter looks at how microscopes reveal cells; the structures inside typical plant and animal cells and their functions; how to tell plant from animal cells; and how cells are organised into tissues, organs, systems and organisms.

6.1 CELLS AND LIVING ORGANISMS

Cells are the basic building blocks of life. Every organism is made of one or more cells, which carry out the activities that keep it alive.

- Cells take in nutrients from food and convert them into energy.
- Cells carry out specialised functions and can reproduce (make more cells).
- Cells are very small, usually 1–100 micrometres (μm) across, so most are only visible under a microscope.

**DEFINITION**

Cell: the basic (smallest) unit of life that makes up all living things.

Unicellular and Multicellular Organisms

Organisms are grouped by how many cells they have.

Type	Meaning	Examples
Unicellular	Made of only one cell	Bacteria, Amoeba, Paramecium, diatoms, yeast, some plankton
Multicellular	Made of many cells	Animals, plants, fungi (e.g. mushroom, worm, cat, fern, hibiscus)

**TAKE NOTE**

The size of an organism does NOT tell you if it is unicellular or multicellular. A tiny organism may still be multicellular, and some single cells are quite large. Judge by the NUMBER of cells, not the size.

**TAKE NOTE**

A common exam trap: a unicellular organism (like an Amoeba) still needs a nucleus to control its activities and to reproduce. “Unicellular” does not mean “no nucleus”.

TOPICAL NOTES

Chapter 6 • Model of Cells – The Basic Unit of Life

6.2 ADVANCES IN TECHNOLOGY AND THE STUDY OF CELLS

Cells were unknown until the microscope was invented. As microscopes improved, scientists saw cells and their structures in greater detail, and knowledge of cells grew, showing how advances in technology drive the building of scientific knowledge.

- **Robert Hooke** examined cork (tree bark) under an early microscope, saw honeycomb-like box spaces, and named them “cells”, from Latin cella, “small room”.
- **Antonie van Leeuwenhoek**, the “Father of Microscopy”, built over 500 microscopes and was the first to observe tiny living single-celled organisms.

Light Microscope vs Electron Microscope

Feature	Light microscope	Electron microscope
Uses	Visible light and glass lenses	Beams of electrons
Detail/magnification	Lower – shows cells but not fine detail	Much higher – shows fine detail inside cells
What it can see	Larger structures (e.g. nucleus, chloroplasts)	Very small structures, viruses, prions

TAKE NOTE

A light microscope can only clearly show objects roughly 0.1–1 μm and larger. Objects smaller than this (e.g. viruses at about 0.1 μm , prions at about 0.01 μm) can only be seen with an electron microscope. This is a favourite exam question using a table of cell sizes.

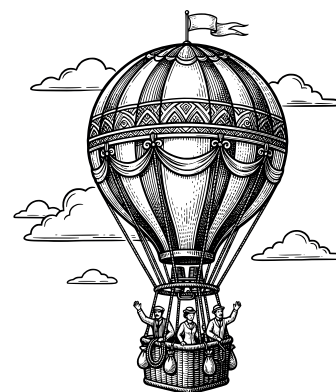
To view tiny living things (e.g. bacteria, the Ebola virus), use a **microscope**, not a magnifying glass, spectacles or telescope.

CHAPTER

7

Model of Matter – The Particulate Nature of Matter

TOPICAL NOTES



Ice, water and steam: same substance, very different behaviour. This chapter uses a model (the particulate nature of matter) to explain solid/liquid/gas properties, what happens on heating and cooling, and everyday phenomena such as diffusion.

7.1

MATTER AND THE PARTICULATE MODEL



DEFINITION

Matter: anything that has mass and occupies (takes up) space.

- Living things (animals, plants, fungi) and non-living things (air, water, rock, soil, dust, dry ice) are all matter.
- Light, heat energy and shadows are not matter, because they have no mass and take up no space. A vacuum is not matter either: it is empty space with no particles.

Matter is too small to be seen directly, so scientists use a model to represent it.



DEFINITION

Particulate nature of matter: a model which states that matter is made up of tiny, discrete particles that are in constant and random motion.

- **Discrete** means separate, individual units with empty space (a vacuum) between them; that space holds no matter.
- All particles of one pure substance are identical. A particle has the **same mass** whether solid, liquid or gas.
- It is also called the **kinetic particle theory**. To “state” it, write: *matter is made up of tiny particles in constant and random motion*.



TAKE NOTE

Like all models, the particulate model has limitations. Particles are drawn as circles for convenience, but the model does NOT claim that all particles are spherical or the same size, and a static diagram cannot show the constant, random motion of the particles. Scientists remain open-minded and refine models as new evidence appears.

TOPICAL NOTES

Chapter 7 • Model of Matter – The Particulate Nature of Matter

7.2 EVIDENCE: BROWNIAN MOTION

In 1827, the botanist **Robert Brown** saw pollen grains in water jiggle randomly under a microscope, and even non-living specks of glass and metal did the same. **Einstein** reasoned, and **Jean Perrin** later verified, that invisible liquid particles were bombarding the visible ones.



DEFINITION

Brownian motion: the constant, random movement of microscopic particles suspended in a liquid or a gas, caused by uneven bombardment (collisions) from the invisible particles of the liquid or gas around them.

- In water, pollen grains are hit unevenly from all directions by fast-moving **water particles**, so each grain follows a random zigzag path.
- In air (a smoke cell), invisible **air particles** bombard the smoke particles randomly, making them jerk about in a haphazard zigzag.
- Dust “dancing” in a light beam happens because ever-moving air particles knock the dust from random directions. This is also why fine dust settles slowly.
- This is **evidence** that matter is made of small discrete particles in constant random motion. The invisible liquid or gas particles cause the movement: the pollen, smoke or dust does not move by itself, and is not alive, magnetic or wind-blown.

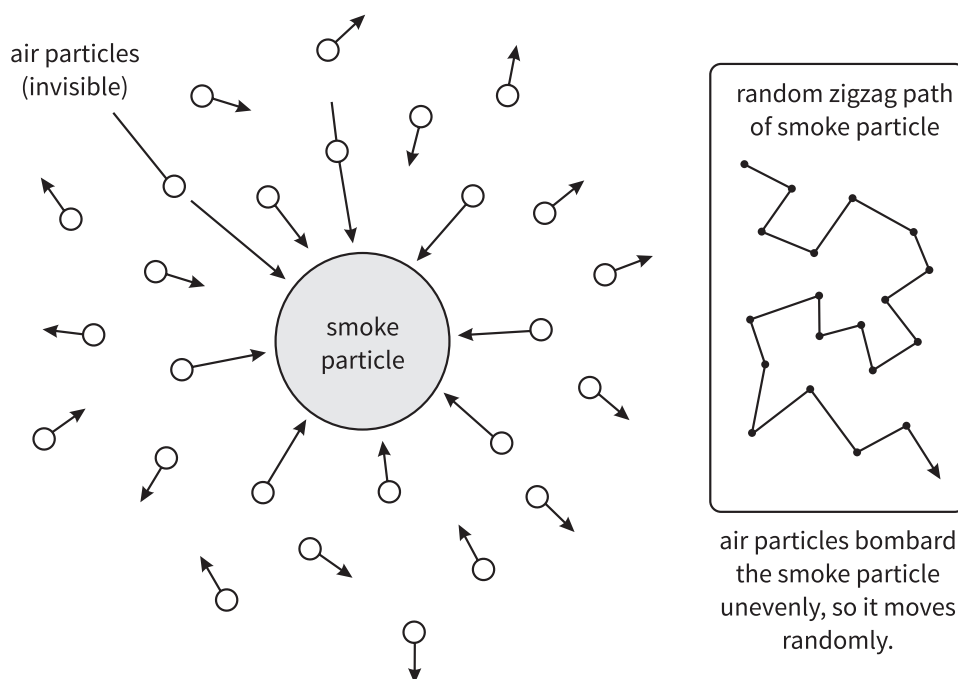


Figure 7.1: Brownian motion. A smoke particle moves randomly because invisible air particles collide with it unevenly.



TAKE NOTE

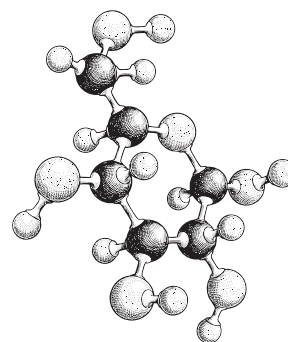
Exam answers on Brownian motion must name (1) the invisible particles doing the colliding (water particles or air particles), (2) that they are in constant, random motion, and (3) that the collisions/bombardment are uneven, pushing the visible particle in random directions. “The pollen grains collide with one another” is a common wrong option.

CHAPTER

8

Model of Matter –
Atoms and Molecules

TOPICAL NOTES



Elements are made of tiny **atoms**, far too small to see. This chapter looks at what is inside an atom, how proton number identifies an element, how atoms form molecules, and how atomic knowledge serves technology.

8.1

ATOMS: THE SIMPLEST UNIT OF AN ELEMENT

So far, 118 elements have been found, either natural or laboratory-made. Each element in the Periodic Table has one type of atom only.



DEFINITION

Element: a substance that is made up of only one type of atom and cannot be broken down into simpler substances by chemical means.



DEFINITION

Atom: the simplest unit of an element.

- The word “atom” comes from the Greek *atomos*, meaning “cannot be cut” or “indivisible”.
- Carbon contains only carbon atoms, and gold contains only gold atoms.
- Different elements have atoms of different sizes and structures.

Size of an Atom

Atoms are extremely tiny, invisible to the naked eye and even to a light microscope.

- A row of one million carbon atoms is about as wide as a human hair (~0.001–0.006 cm).
- A row of 50 million hydrogen atoms is about as long as a grain of rice (~0.5 cm).
- A row of over 100 million hydrogen atoms is about as long as a fingernail (~1 cm).
- Even a caesium atom, among the largest, is only ~0.0000007 cm wide.
- Special instruments, such as atomic force and scanning tunnelling microscopes, are needed to view this scale.



TAKE NOTE

On a size scale, an atom is about 10^{-10} m wide while a red blood cell is about 10^{-6} m wide. To compare sizes, divide: $10^{-6} \div 10^{-10} = 10^4$, so an atom is about 10 000 times SMALLER than a red blood cell. Exam questions often ask for this kind of comparison from a size scale; always divide the larger size by the smaller size.

TOPICAL NOTES

Chapter 8 • Model of Matter – Atoms and Molecules

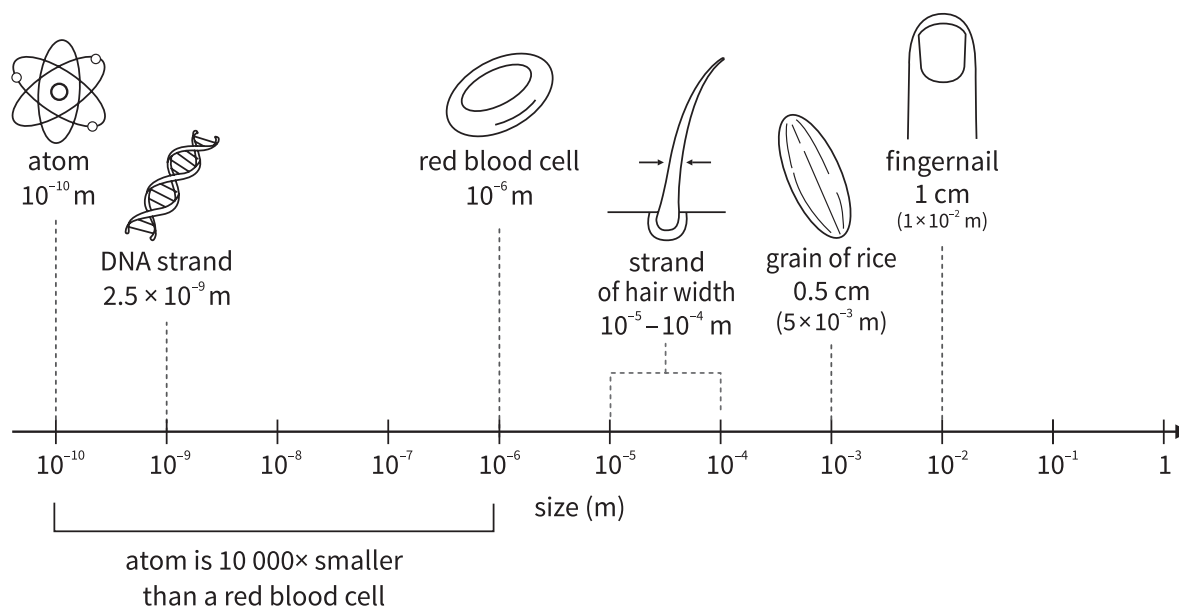


Figure 8.1: Comparing the size of an atom with the sizes of everyday objects.

8.2 STRUCTURE OF AN ATOM

An atom has three sub-atomic particles: **proton**, **neutron**, **electron**.

- Protons and neutrons sit in the **nucleus** at the atom's centre.
- The nucleus is positively charged because it holds the protons, while the neutrons are uncharged.
- Electrons are negative and move around the nucleus at high speed in shells (orbits), never inside it.

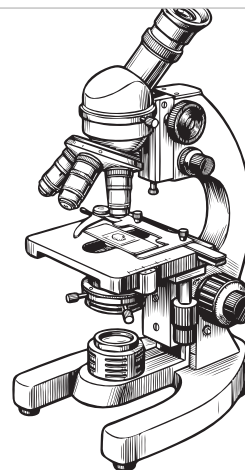
Sub-atomic particle	Relative charge	Relative mass	Position in the atom
Proton	+1	1	Within the nucleus
Neutron	0	1	Within the nucleus
Electron	-1	1/1840 (negligible)	Around the nucleus (in shells)

CHAPTER

1

The Scientific Endeavour

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

1 Which statement gives an example of qualitative data?

- (A) counting the number of apples that turned brown after a day
- (B) measuring the change in height of a plant over a month
- (C) recording the colour change of a solution as it is heated
- (D) timing the duration of an experiment

()

2 Which SI unit is **incorrectly** matched to the physical quantity?

	physical quantity	SI unit
(A)	length	metre (m)
(B)	mass	kilogram (kg)
(C)	temperature	Kelvin (K)
(D)	time	hour (h)

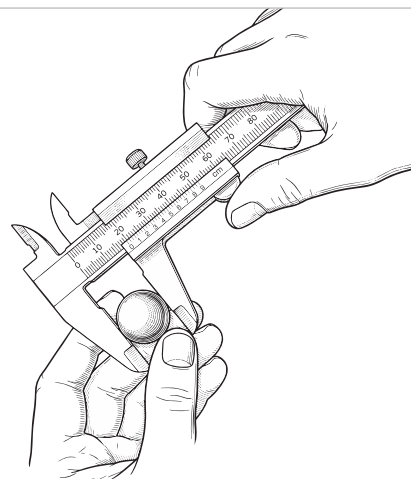
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CHAPTER

2

Exploring Diversity of
Matter by Its Physical
Properties

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

- 1 A common material used for insulating electrical wires is plastic.
Which properties does plastic have that make it suitable for wire insulation?

	electrical conductivity	flexibility
(A)	high	high
(B)	high	low
(C)	low	high
(D)	low	low

()

- 2 Which of the following is the smallest mass?

- (A) 0.5 ton
(B) 5 kg
(C) 500 mg
(D) 5000 g

()

CHAPTER

3

Exploring Diversity of Matter by Its Chemical Composition

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

1 What are the chemical symbols of sodium and chlorine?

	sodium	chlorine	
(A)	na	cl	
(B)	Na	Cl	
(C)	S	C	
(D)	So	Ch	()

2 Three elements, R, S and T combined to form a compound.

Which is correct for the properties of compound RST?

- (A) It is different from the properties of R, S and T.
 - (B) It is similar to the properties of R and S.
 - (C) It is similar to the properties of R and T.
 - (D) It is similar to the properties of S and T.
- ()

CHAPTER

4

Exploring Diversity of Matter using Separation Techniques

WORKSHEET 1

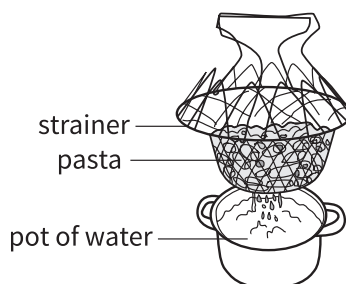


SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

- 1 A hawker is taking pasta out from a pot of water using a strainer.



Which row correctly depicts the separation technique used and the identity of pasta and water?

	separation technique	pasta	water
(A)	distillation	distillate	residue
(B)	distillation	residue	distillate
(C)	filtration	filtrate	residue
(D)	filtration	residue	filtrate

()

- 2 Which mixture can be separated by magnets?

- (A) aluminium and copper
- (B) iron and carbon
- (C) gold and silver
- (D) plastic and rubber

()

CHAPTER

5

Ray Model
of Light

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

1 Which of the following uses a concave mirror as part of the instrument?

- 1 dentist's mirror
- 2 cosmetics mirror
- 3 microscope

(A) 1, 2

(B) 1, 3

(C) 2, 3

(D) 1, 2, 3

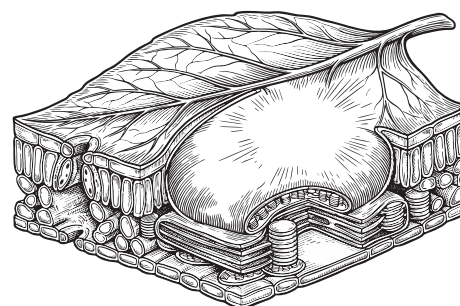
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CHAPTER

6

Model of Cells – The Basic Unit of Life

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

1 Which row lists the structures from the simplest to the most complex?

	simplest	→			most complex
(A)	cells	tissues	organs	systems	
(B)	cells	organs	tissues	systems	
(C)	systems	organs	tissues	cells	
(D)	tissues	cells	systems	organs	()

2 Which option is not an organ?

- (A) blood
- (B) leaf
- (C) root
- (D) stomach

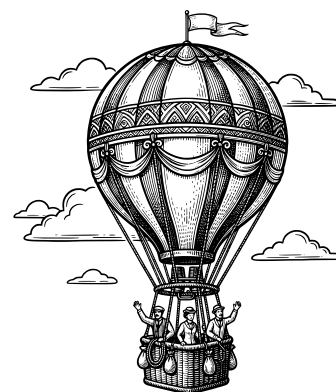
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CHAPTER

7

Model of Matter – The Particulate Nature of Matter

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

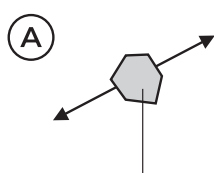
1 Based on the particulate model of matter, which statement about solids is false?

- (A) Particles in solids are arranged in disorderly pattern.
- (B) Particles in solids are held together by strong forces of attraction.
- (C) Solids have a definite shape and a definite volume.
- (D) Solids have a higher density than gases with the same volume.

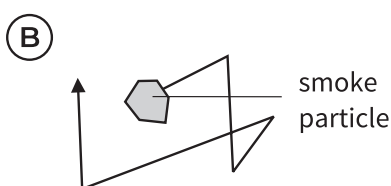
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2 A student observes the Brownian motion of a bright speck of smoke particle through a light microscope.

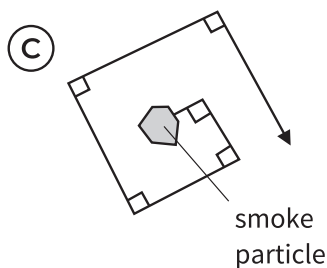
Which diagram best represents the motion of the smoke particle?



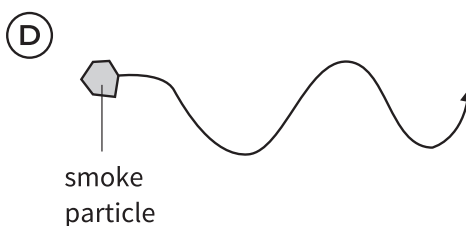
smoke
particle



smoke
particle



smoke
particle

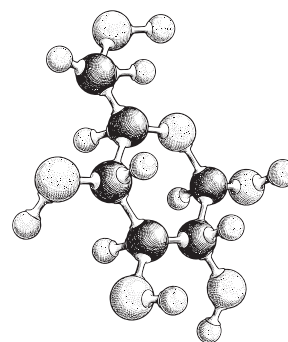


smoke
particle

()

8

WORKSHEET 1



MULTIPLE CHOICE QUESTIONS

1 Which element in the Periodic Table has the greatest number of protons?

A 5x15 grid representing a periodic table. The grid is divided into four main sections by a gap in the top row. The top row has a single square in the 4th column, a 2x2 square in the 15th column, and a 2x2 square in the 15th column. The remaining rows are filled with squares. The labels are placed in the following positions: A is in the top-right corner (row 1, column 15); B is in the top-left corner (row 1, column 1); C is in the middle of the grid (row 3, column 10); D is in the bottom-right corner (row 5, column 15).

()

2

Which of the following makes up the mass of an atom?

- ☐ A number of electrons and protons
☐ B number of neutrons only
☐ C number of neutrons and protons
☐ D number of protons only

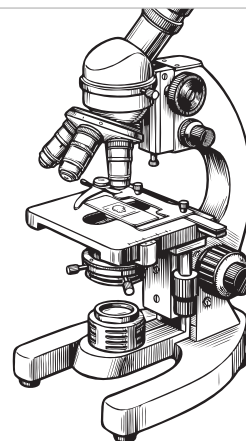
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CHAPTER

1

The Scientific Endeavour

TEST



TEST SUMMARY

Section A

____ / 20

Section B

____ / 32

Total

____ / 52

SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

- 1 Which row **correctly** matches each physical quantity to its SI unit?

	length	mass	time	
(A)	centimetre	gram	minute	
(B)	centimetre	gram	second	
(C)	metre	kilogram	minute	
(D)	metre	kilogram	second	()

- 2 Which of the following is not an important value that makes a good scientist?

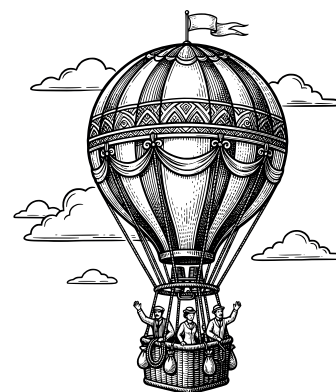
- (A) grit
 (B) perseverance
 (C) resilience
 (D) stubbornness ()

CHAPTER

7

Model of Matter – The Particulate Nature of Matter

TEST



TEST SUMMARY

Section A

____ / 20

Section B

____ / 29

Total

____ / 49

SECTION A

MULTIPLE CHOICE QUESTIONS

There are twenty questions in this section. Answer ALL questions. For each question, there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in the brackets provided.

1

★ Optional for G2

Which changes of state involve the gaining of heat?



- (A) 1 and 2
(B) 1 and 4
(C) 2 and 3
(D) 3 and 4

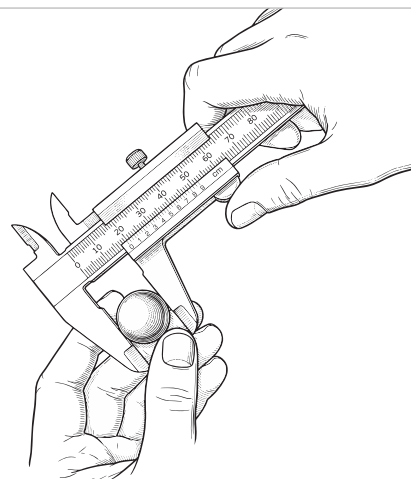
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CHAPTER

2

Exploring Diversity of Matter by Its Physical Properties

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10
C	C	B	A	C	C	D	D	D	B

11	12	13	14	15	16	17	18	19	20
D	C	B	C	C	D	A	A	D	B

SECTION A – Detailed Explanations

1 C The correct answer is C because plastic is an electrical insulator, so it has low electrical conductivity, which prevents electric current from flowing through the covering and causing electric shocks; plastic is also flexible, meaning it can bend easily so the wire can be moved and routed around corners without the insulation cracking.

A is incorrect because high electrical conductivity means the material conducts electricity, which would allow current to flow through the covering and cause electric shocks, making it unsafe as an insulator.

B is incorrect because high electrical conductivity means the plastic would conduct electricity rather than insulate, and low flexibility means it would crack or break when the wire is bent.

D is incorrect because although low electrical conductivity is correct, low flexibility means the covering would crack when bent, making it unsuitable for wire insulation.

2 C The correct answer is C because converting all masses to grams gives: $A = 0.5 \text{ ton} = 0.5 \times 1\,000\,000 \text{ g} = 500\,000 \text{ g}$; $B = 5 \text{ kg} = 5 \times 1000 \text{ g} = 5000 \text{ g}$; $C = 500 \text{ mg} = 500 / 1000 \text{ g} = 0.5 \text{ g}$; $D = 5000 \text{ g}$. Comparing all four, 0.5 g is the smallest.

A is incorrect because $0.5 \text{ ton} = 500\,000 \text{ g}$, which is the largest mass.

B is incorrect because $5 \text{ kg} = 5000 \text{ g}$, which is much larger than 0.5 g.

D is incorrect because 5000 g equals 5 kg and is the same size as B, both far larger than 500 mg.

3 B The correct answer is B because the wheels of a racer bicycle should be made from a material of low density so that they are light, allowing the cyclist to move faster and accelerate more easily.

A is incorrect because the boiling point of the material is irrelevant to how the wheel performs while cycling.

C is incorrect because a flexible material would bend out of shape under the rider's weight and would not keep the wheel rigid.

D is incorrect because the thermal conductivity of the material has no effect on the speed or performance of the wheel.

CHAPTER

4

Exploring Diversity of Matter using Separation Techniques

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10
D	B	C	C	C	D	A	D	B	B

11	12	13	14	15	16	17	18	19	20
B	A	D	C	C	B	A	C	D	C

SECTION A – Detailed Explanations

1

D

The correct answer is D because using a strainer to separate pasta from water is filtration, where the strainer acts as the filter; the pasta is too large to pass through the holes and is retained on the strainer, making it the residue, while the water passes through the holes and collects below, making it the filtrate.

A is incorrect because the technique is filtration, not distillation, and pasta cannot be a distillate as it is a solid that does not vapourise and condense.

B is incorrect because the technique is filtration, not distillation, and water passes through the strainer so it is the filtrate, not the distillate.

C is incorrect because although the technique is correctly identified as filtration, pasta is retained by the strainer and does not pass through, so it is the residue, not the filtrate.

2

B

The correct answer is B because iron is a magnetic material, so a magnet will attract the iron and separate it from the carbon, which is non-magnetic.

A is incorrect because aluminium and copper are both non-magnetic metals, so a magnet cannot attract either of them.

C is incorrect because gold and silver are both non-magnetic metals, so a magnet cannot attract either of them.

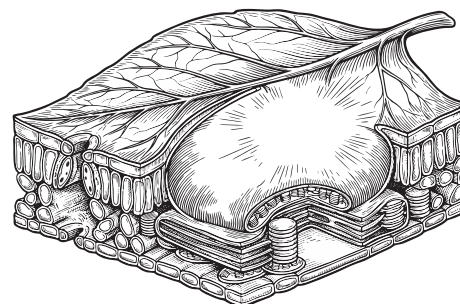
D is incorrect because plastic and rubber are both non-magnetic materials, so a magnet cannot attract either of them.

CHAPTER

6

Model of Cells – The Basic Unit of Life

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10
A	A	D	B	C	A	C	B	C	D

11	12	13	14	15	16	17	18	19	20
B	A	B	C	A	B	B	A	D	D

SECTION A – Detailed Explanations

1

A

The correct answer is A because the correct order of organisation from simplest to most complex is cells → tissues → organs → systems; cells are the basic unit of life, groups of similar cells form tissues, groups of tissues form organs, and groups of organs working together form a system.

B is incorrect because it places organs before tissues, but tissues are simpler than organs.

C is incorrect because it lists systems as the simplest, when systems are actually the most complex level.

D is incorrect because it places tissues as the simplest and cells in the middle, but cells are the simplest unit, not tissues.

2

A

The correct answer is A because blood is a tissue (a group of similar cells working together), not an organ; an organ is made up of different tissues working together to carry out a function.

B is incorrect because a leaf is an organ made up of different tissues such as the epidermis and mesophyll tissue.

C is incorrect because a root is an organ made up of different tissues that work together to absorb water and minerals.

D is incorrect because the stomach is an organ made up of different tissues such as muscle tissue and lining tissue that work together to digest food.

3

D

The correct answer is D because the cell membrane is selectively permeable, meaning it allows only some substances to pass through in both directions – some substances can enter the cell and some substances can leave the cell.

A is incorrect because it only mentions substances entering the cell, leaving out the fact that substances can also leave.

B is incorrect because it only mentions substances leaving the cell, leaving out the fact that substances can also enter.

C is incorrect because the cell membrane does not allow all substances to pass through freely; it controls which substances can enter and leave.

4

B

The correct answer is B because the cell membrane is a partially permeable layer that surrounds the cell and controls what substances can enter and leave the cell.

A is incorrect because photosynthesis takes place in the chloroplast, not the cell membrane.

C is incorrect because energy is released in the mitochondria, not the cell membrane.

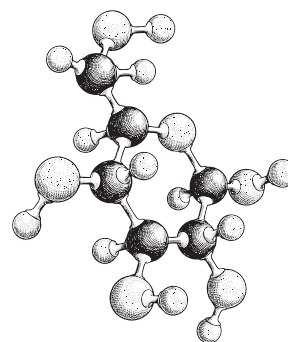
D is incorrect because chemical reactions take place in the cytoplasm, not the cell membrane.

CHAPTER

8

Model of Matter -
Atoms and Molecules

WORKSHEET 1



SECTION A

MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10
D	C	C	B	A	A	D	C	C	B

11	12	13	14	15	16	17	18	19	20
C	C	B	D	B	B	A	B	B	D

SECTION A – Detailed Explanations

1 **D** The correct answer is D because the number of protons increases across each period and down the table, so the element positioned furthest along and lowest in the table has the greatest number of protons, and D is the lowest and furthest-right element shown.

- A** is incorrect because it is in an upper period, so it has fewer protons than D.
B is incorrect because it is near the top left, where the proton number is very small.
C is incorrect because it lies in an earlier period, so it has fewer protons than D.

2 **C** The correct answer is C because the mass of an atom is made up of the number of neutrons and protons combined, as both particles are found in the nucleus and each has a relative mass of 1, while electrons have a negligible mass (nearly zero) and do not contribute to the mass of the atom.

- A** is incorrect because electrons have negligible mass and do not contribute to the mass of the atom, so including them alongside protons gives an incomplete and inaccurate account.
B is incorrect because neutrons alone do not make up the full mass of the atom; protons, which also have a relative mass of 1, must be included as well.
D is incorrect because protons alone do not account for the full mass of the atom; neutrons, which also have a relative mass of 1, must be counted together with protons.

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