Natural Sciences

CLASS TEXT & STUDY GUIDE

Mariechen Vermeulen, Grace Elliott, Liesl Sterrenberg,
Retha Louw, Silvana Scarola & Norman Davies

GRADE

8

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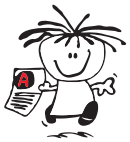
THIS CLASS TEXT & STUDY GUIDE INCLUDES

1. Notes
   - Life and Living
   - Matter and Materials
   - Energy and Change
   - Planet Earth and Beyond
2. Questions per Module
3. Detailed Answers

separate ANSWER BOOKLET

eBook available



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2023 publication | ISBN 978-1-991261-01-4

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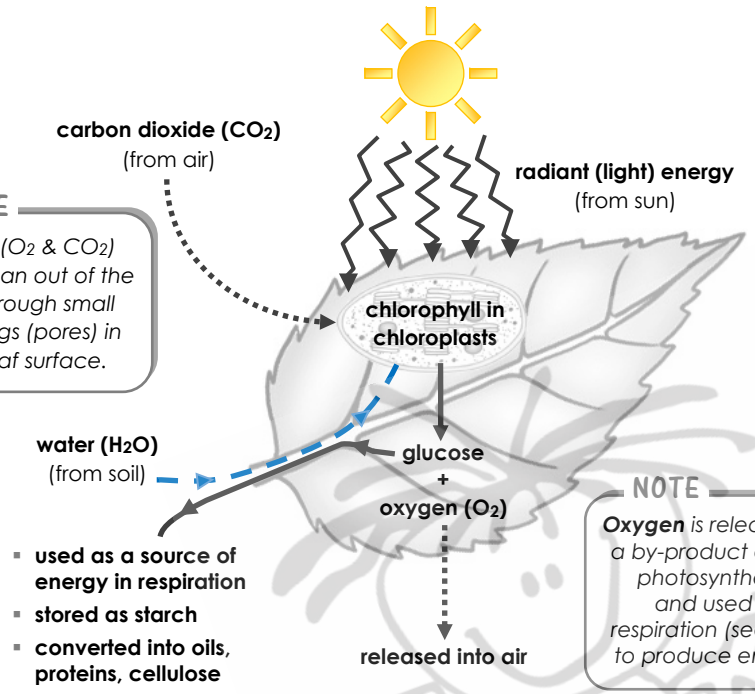
SUMMARY OF PHOTOSYNTHESIS



NOTE

Gases (O_2 & CO_2) move in an out of the leaf through small openings (pores) in the leaf surface.

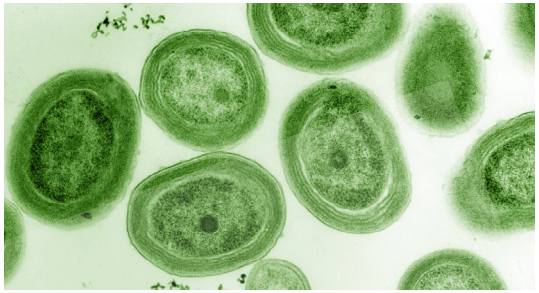
NOTE

***Oxygen** is released as a by-product during photosynthesis, and used in respiration (see p. 8) to produce energy.*

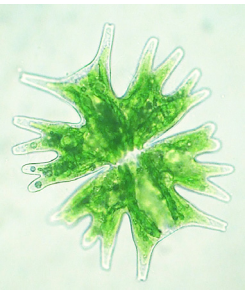
DID YOU KNOW?

Plants are not the only organisms that contain chlorophyll. Algae, certain microorganisms and even some animals can also photosynthesise to produce their own food.

Elysia chlorotica **is a green sea slug that absorbs chloroplasts from its plant food to photosynthesise**



Cyanobacteria **that can photosynthesise**



Green algae under the microscope

NOTE

*When an organism can perform photosynthesis we say it is **photosynthetic**.*

STORAGE AND USE OF GLUCOSE

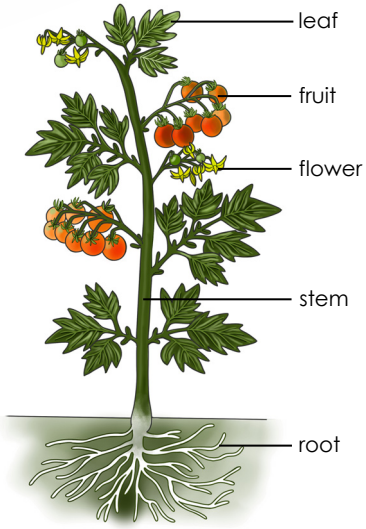
- Glucose is a small, **soluble** molecule that can dissolve in water.
- Dissolved glucose can be easily transported from the leaves to the roots, stems, fruits and flowers.
- If glucose is not used immediately, it must be stored in the **plant organs** (stems, roots, etc.) in an **insoluble** form.

TERMS

soluble: dissolves in water

insoluble: cannot dissolve in water

- **Starch** is a larger, stable, **insoluble** molecule made up of glucose molecules. It is the storage form of glucose in plants.



Organs of a flowering plant

LEVELS OF ECOLOGY

Living **organisms** and the interactions between them and their non-living environment are organised into four levels of **ecological interactions**. These levels arranged from small to large are: **populations**, **communities**, **ecosystems** and the **biosphere**.

Organism **Population** **Community** **Ecosystem** **Biosphere**

Organism

An organism is an **individual** (plant or animal) of a particular **species** living in its natural **habitat**.

Meerkat

NOTE

*Habitats can be **terrestrial** (on land) or **aquatic** (in water).*

TERMS

species: organisms that look similar, can interbreed, and produce fertile offspring

Sea anemone

Elephant

Acacia tree

Different organisms in their natural habitats

Population

A population is a **group of individuals** of the **same species** living in the **same area** at the **same time** that can **interbreed** with each other.

Herd of buffalo

Colony of ants

Pine tree plantation

Different populations in their habitats

Community

A community consists of **different populations** that occur in the **same area** at the **same time** and **interact** with each other.

Nina R via Flickr https://www.flickr.com/photos/150102727@N06/5146158824/

A community in Tarangire National Park, Tanzania

A community in a coral reef

SUMMARY OF ENERGY PYRAMID

NOTE

As the amount of available energy per trophic level decreases, so does the number of organisms present on each trophic level.

10 000 energy units from the sun

START HERE

10% 10% 10% 10%

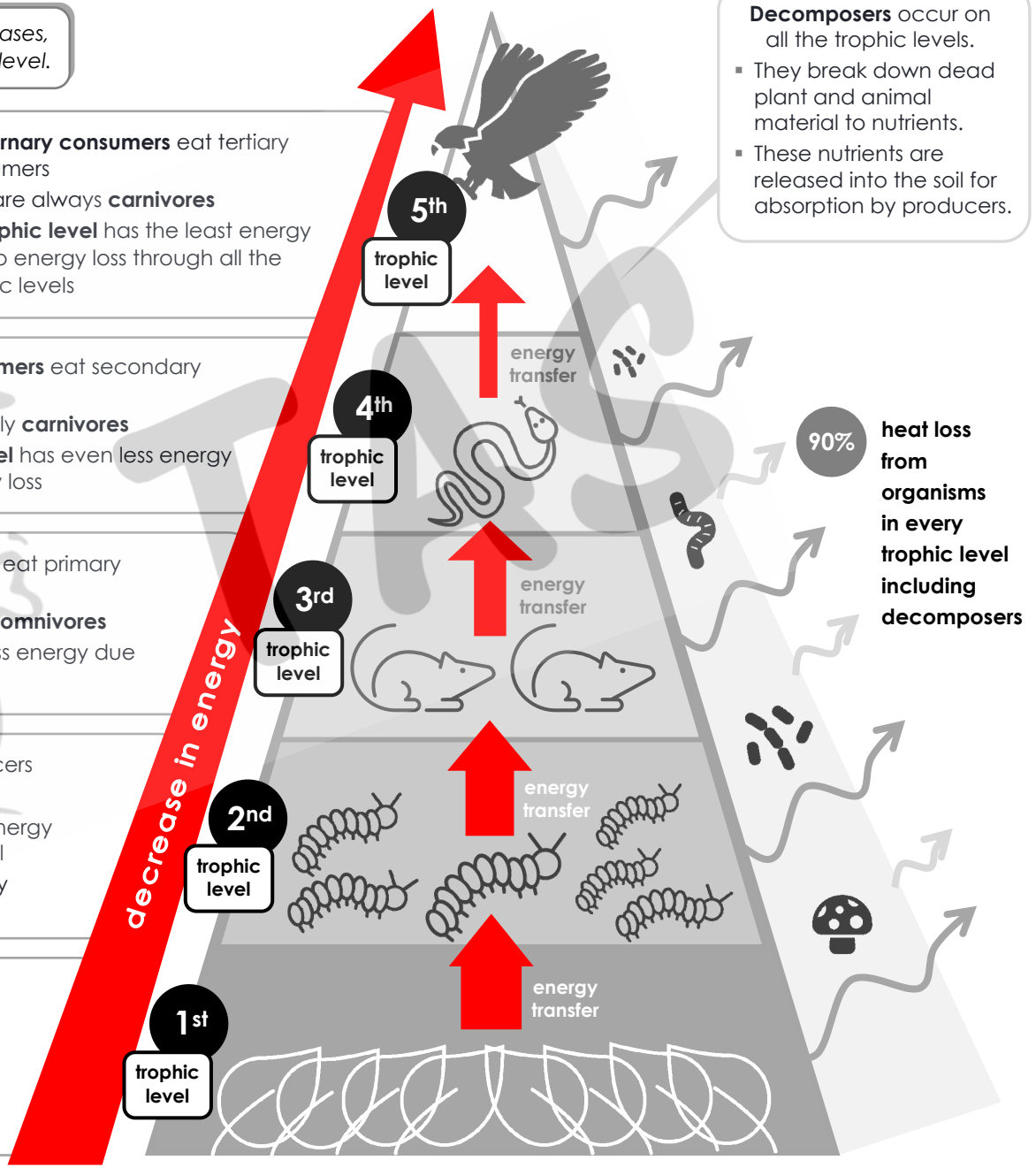
10 000 energy units
- **producers** are **autotrophs** that **photosynthesise**
- they form the base of the food chain
- producers receive the most energy directly from the sun
- **1st trophic level** has the most energy

1 000 energy units
- **primary consumers** eat producers
- they are all **herbivores**
- they receive only 10% of the energy available in the 1st trophic level
- **2nd trophic level** has less energy than the 1st level

100 energy units
- **secondary consumers** eat primary consumers
- they are **carnivores** or **omnivores**
- **3rd trophic level** has less energy due to energy loss

10 energy units
- **tertiary consumers** eat secondary consumers
- they are usually **carnivores**
- **4th trophic level** has even less energy due to energy loss

1 energy unit
- **quaternary consumers** eat tertiary consumers
- they are always **carnivores**
- **5th trophic level** has the least energy due to energy loss through all the trophic levels



Decomposers occur on all the trophic levels.
- They break down dead plant and animal material to nutrients.
- These nutrients are released into the soil for absorption by producers.

17.1 Why would a predator need camouflage?

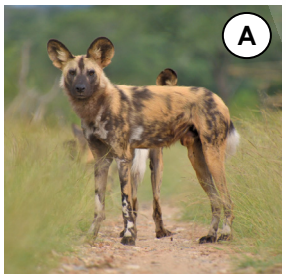
17.2 List all the structural adaptations provided in the diagram that enable the cheetah to reach high speeds.

17.3 Sharks are also excellent predators of the ocean ecosystem. Provide at least THREE similarities between cheetahs and sharks.

17.4 Sharks are nocturnal predators. How does the colouring of a shark support this behavioural adaptation?

Question 18

The images **A** to **F** below show different types of adaptations (structural/ functional/behavioural) in organisms.

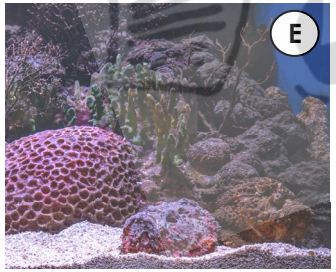


African wild dogs hunt in packs

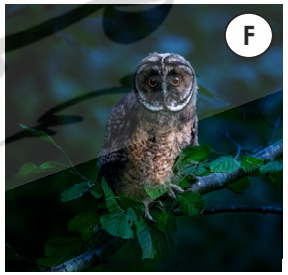
An octopus can change its colour and texture

A bright blue dart frog

The owl butterfly's markings look like eyes



Two predatory stone fish (bottom right corner)



Owls hunt at night

18.1 Image **A**:

18.1.1 What type of carnivore is an African wild dog?

18.1.2 What is the benefit of African wild dogs hunting in packs?

18.1.3 What type of adaptation is illustrated by this hunting strategy?

18.2 Image **B**:

18.2.1 What type of adaptation is represented here?

18.2.2 Another example of this type of adaptation is warning colouring. Give the LETTER (**A** to **F**) of an organism that displays this feature.

18.2.3 What functional adaptation does the warning colouring of an animal indicate?

18.3 Image **D**:

18.3.1 What special type of structural adaptation is exhibited here?

18.3.2 Explain the benefit of this adaptation for the owl butterfly.

18.4 Image **E**:

18.4.1 Why do you think these fish are called stone fish?

18.4.2 What special type of structural adaptation is exhibited here?

18.4.3 Stone fish are predators. Explain how they would benefit from the adaptation mentioned in QUESTION 18.4.2.

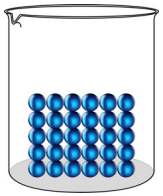
18.5 Image **F**:

18.5.1 What special type of behavioural adaptation is exhibited here?

18.5.2 Provide TWO reasons why this type of adaptation is beneficial to animals.

THE STATES OF MATTER

Solids



Solids have a **fixed shape** and are **not compressible**, i.e. they cannot be packed more tightly due to the very small spaces between their particles.

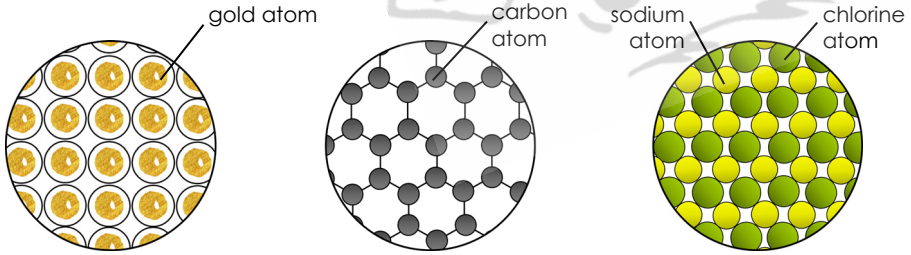
> **NOTE**
> *A **compressible material**, e.g. a gas (see p. 88), can be compacted or packed into a smaller space/volume, but a solid is not compressible.*

Particles in a solid:

1. are **closely packed** and arranged in a **regular**, repeating **pattern**
2. have **very small spaces** between them
3. do not move freely – only **vibrate** in fixed positions
4. are held together with **strong forces of attraction**
5. have very **little kinetic energy** (energy of motion)

Vibrating particles in a solid

> **NOTE**
> ***Kinetic energy** is the energy of motion (movement), and depends on the speed of motion. The faster an object moves, the more kinetic energy it has. As the particles in **solids** cannot move freely and **only vibrate**, they have **very little kinetic energy**.*



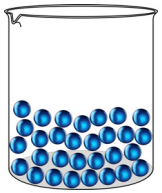
The element gold (Au) has a regular pattern of closely-packed gold atoms

The atoms of some solids, like carbon (C), are arranged into a repeating, crystalline pattern

The compound table salt (NaCℓ) has closely-packed sodium and chloride atoms

Examples of regular patterns in solids

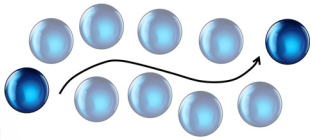
Liquids



Liquids **flow** and are **not compressible**. They **take on the shape** of the container they occupy. Examples include water, liquid mercury and sugar water.

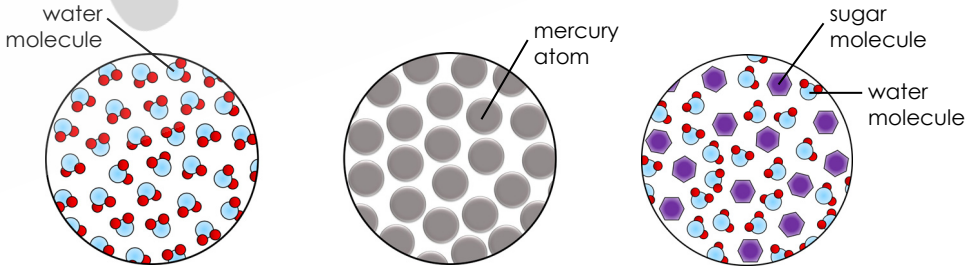
Particles in a liquid:

1. are **randomly** and **loosely arranged**, but still **quite close together**
2. have **small spaces** between them
3. move fast by **flowing** and **sliding past each other**
4. are held together by **weaker forces of attraction**
5. have **more kinetic energy** than solids



Sliding particle in a liquid

> **NOTE**
> *The kinetic energy of the particles in a liquid will depend on the speed at which they move around. When a liquid is **heated**, the particles **move faster** and **gain kinetic energy**.*



The compound water (H_2O) is a liquid

The element mercury (Hg) is a liquid at room temperature

The mixture sugar water is a liquid

Examples of random patterns in liquids

> **NOTE**
> *A liquid takes the shape of any container it occupies, because its particles can slide past each other to fill the spaces left by other particles.*

- Signs that a **chemical change has taken place** include:
  - when a substance **changes colour**
  - when a **gas** is **produced** (this will appear as bubbles in a liquid)
  - when a **new smell** can be **detected**
  - when a **precipitate** has **formed**

TERMS

precipitate: a solid substance that forms in a liquid solution

UNIT 2

REACTANTS & PRODUCTS

- Chemical changes occur during **chemical reactions**.

TERMS

chemical reaction: a process during which chemical substances (reactants) react with each other to produce new chemical substances (products)

A simple chemical reaction

- The ingredients to bake the cakes represent different chemical **substances that react with each another**. These **reactants** are **present at the start** of a chemical reaction.
- The two cakes represent **substances that are produced** due to the reaction between the ingredients. These **products** are **formed at the end** of a chemical reaction.
- **Reactants** therefore combine and change chemically during a chemical reaction to **form** new, different substances called **products**.

TERMS

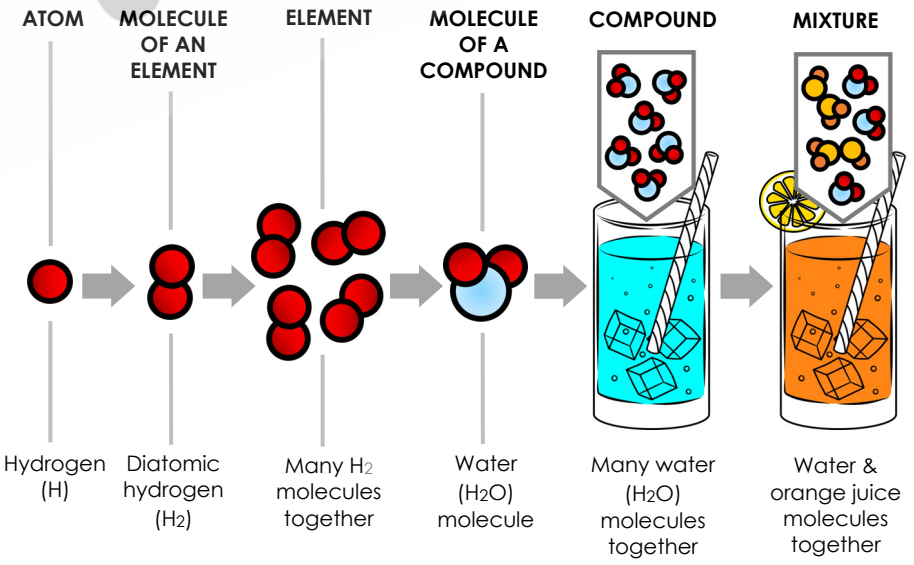
reactants: substances that are present at the start of a chemical reaction

products: substances present at the end of a chemical reaction

REMEMBER

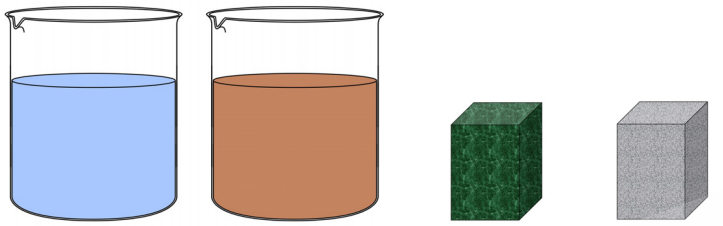
Use the diagram below and recap the important terms from TOPIC 1:

- *atom*
- *diatomic molecule*
- *element*
- *compound*
- *mixture*



Question 16

Peter has two liquids (**1** and **2**) as well as two solids (**1** and **2**) in his possession. The density of each liquid and solid is shown below.



Liquid 1 **0,7 g/cm³** | **Liquid 2** **1,1 g/cm³** | **Solid 1** **0,5 g/cm³** | **Solid 2** **0,5 g/cm³**

For each of the following statements, indicate whether it is *true* or *false*. In each case give a reason for your answer.

16.1 Solid **1** will float on both Liquid **1** and Liquid **2**.

16.2 Liquid **1** will float on Liquid **2** if they are not mixed.

16.3 Solid **2** will float on Liquid **2**, but sink in Liquid **1**.

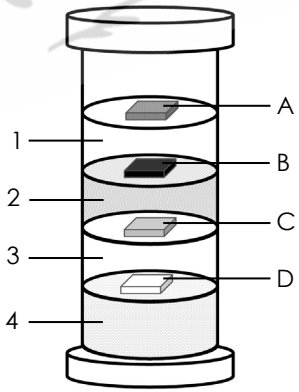
16.4 Solid **1** will float deeper in Liquid **1** than in Liquid **2**.

Question 17

The apparatus below shows four liquids (**1** – **4**) in a cylinder. Four solids (**A** to **D**) can be seen floating on the liquids.

The table below shows the relative densities of the liquids (**1** to **4**) and solids (**A** to **D**) in the cylinder alongside.

Liquid density (g/cm³)		Solid density(g/cm³)	
mercury	13,6	ice	0,91
alcohol	0,79	silver	10,5
glycerine	1,26	wood (ebony)	1,2
water	1,0	polystyrene	0,64

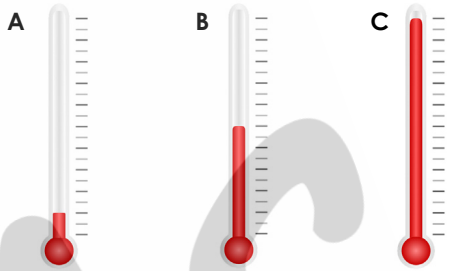


17.1 Identify the liquids **1** to **4**.

17.2 Identify the solids **A** to **D**.

Question 18

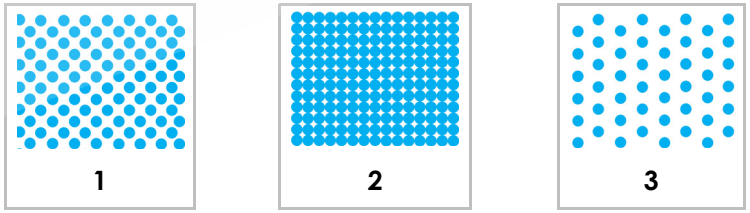
Pictures **A**, **B** and **C** show three thermometers.



18.1 What toxic element is used in some thermometers? Provide its NAME and chemical SYMBOL.

18.2 Which phenomenon in matter is used in a thermometer?

18.3 The three representations below show the liquid particles in the three thermometers provided. Which number (**1** to **3**) best represents the liquid particles inside each of the thermometers (**A** to **C**)?



18.4 For each of the following statements, indicate whether it is *true* or *false*:

18.4.1 When a material contracts, its mass decreases.

18.4.2 The volume of a material increases when it is heated.

18.4.3 When a material expands, its particles get bigger.

18.4.4 When a material contracts, its particles move closer to one another.

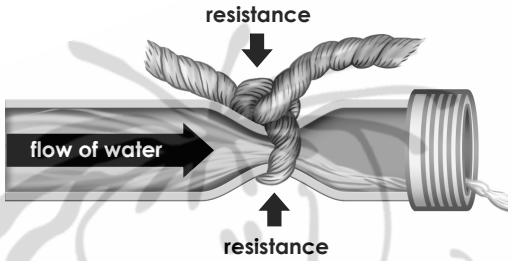
18.4.5 The density decreases when a material expands.

- Resistors connected in an electric circuit influence the **amount of electric current** (i.e. its **strength**) in a circuit.
  - The **higher** the **resistance** in a circuit, the **weaker** the **current** that flows through the circuit.
  - The **lower** the **resistance** in a circuit, the **stronger** the **current** that flows through the circuit.

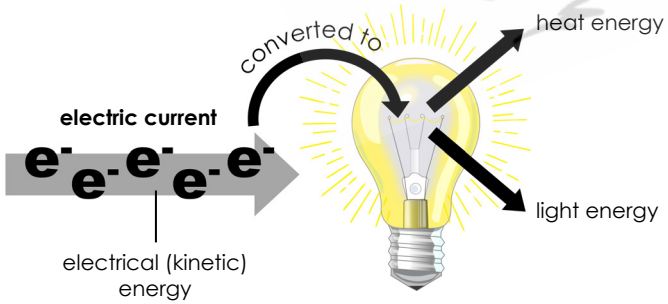
resistor: a poor conductor that resists/opposes the flow of an electric current

NOTE

When you squeeze a hose pipe, there is a weaker stream of water flowing out. In the same way resistors decrease the flow of an electric current.

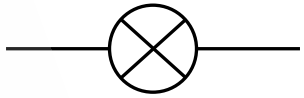


- Some **resistors** (light bulb filaments, heating wires, elements in kettles/heaters/geysers/stoves etc.) **can heat up** to provide useful output energy.
  - The electrical energy is **converted into** other types of energy in the process, e.g. **heat** or **light** energy.



Energy conversion in a light bulb

LIGHT BULBS

SYMBOL


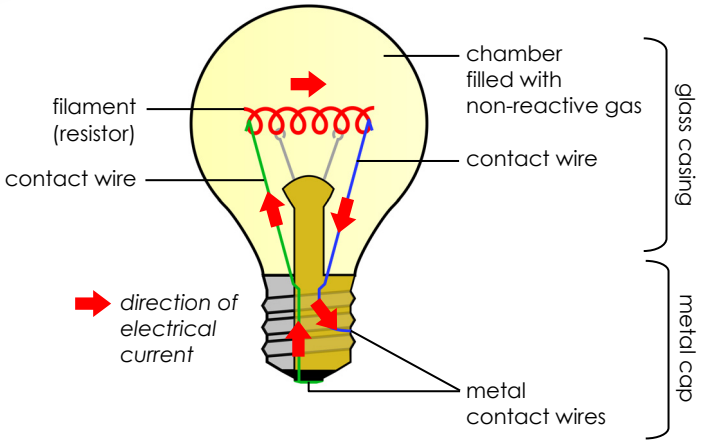
Light bulbs contain a resistance wire called a **filament**.

- The filament acts as a **resistor** and **converts electrical energy** to **heat and light energy**.
- Light bulbs are used in circuits to **determine** if **current** is **flowing**.
  - If the light bulb is **not glowing**, it indicates that **no current is flowing** through the circuit due to an **open circuit** or **wrong connections**.
  - If the light bulb is **glowing**, it indicates that the **circuit is closed** and **current is flowing** through the circuit to the light bulb.

Structure of a light bulb

- A standard, **incandescent** light bulb consists of:
  - a **glass casing** filled with a non-reactive gas
  - a **metal cap** that encloses the base of the light bulb

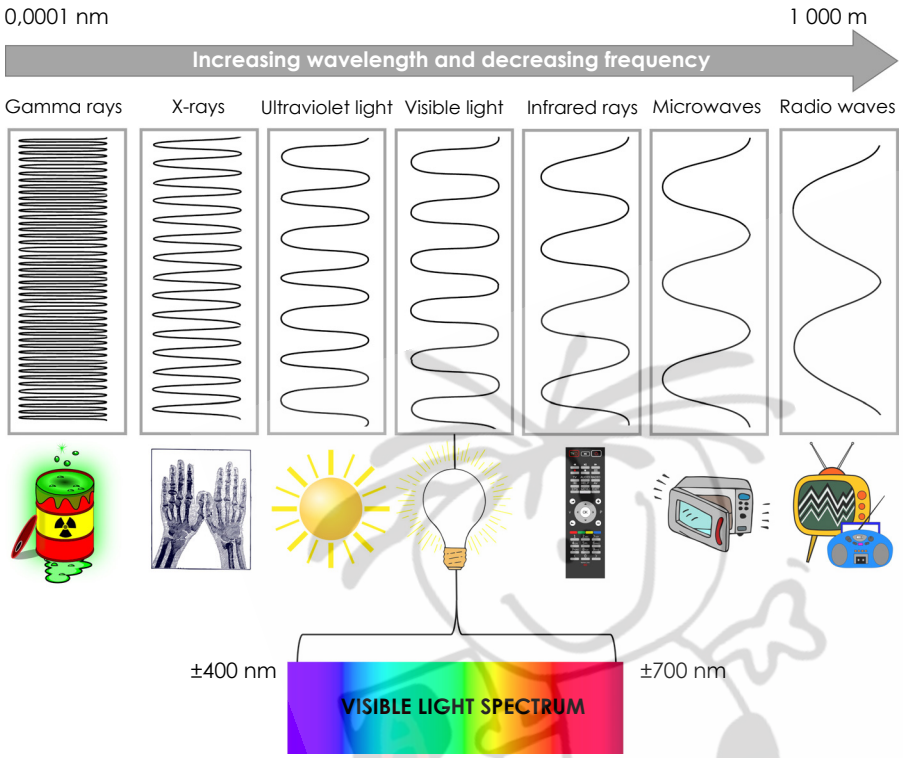
incandescent: to emit light as a result of heating



Structure of an incandescent light bulb

THE ELECTROMAGNETIC SPECTRUM

– different types of electromagnetic radiation –



NOTE

nm *is the symbol for* ***nanometre*** *(one billionth of a metre or* 10^{-9} *m)*

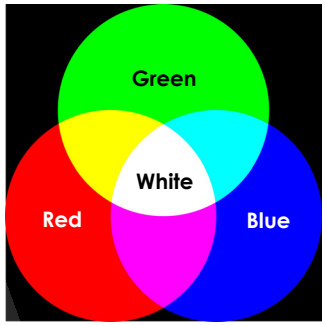
- A small section of the electromagnetic spectrum is composed of wavelengths and frequencies that may be **detected by the human eye**.
- This section is known as the **visible light spectrum** and lies between wavelengths 400 nm and 700 nm.
- **Seven colours** can be distinguished in the visible light spectrum:

violet **indigo** **blue** **green** **yellow** **orange** **red**

- **All the colours** of the visible light spectrum combine to form **white light**.

NOTE

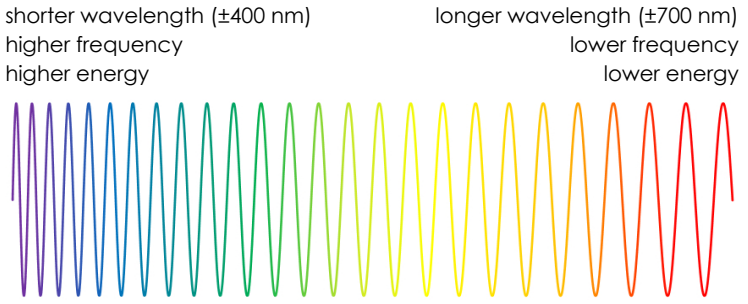
- ***Red***, ***green*** *and* ***blue*** *are the* ***primary colours of light.***
- ***Other colours*** *like pink and brown are* ***mixtures of the seven colours of visible light.***
- ***White*** *is not the absence of colour, but* ***all the colours*** *in the visible light spectrum* ***combined.***



- Each colour of the visible light spectrum has its own **wavelength**, **frequency** and **energy**:
  - **violet** light has the **shortest wavelength**, **highest frequency** and **highest energy**
  - **red** light has the **longest wavelength**, **lowest frequency** and **lowest energy**

NOTE

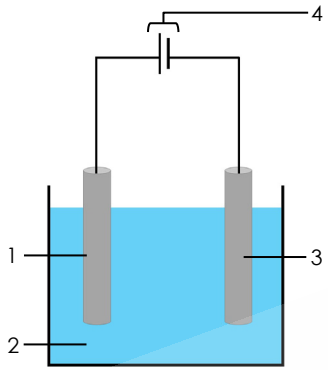
The ***colour*** *of light we see* ***depends on*** *the* ***wavelength and frequency*** *of the light rays that enter the eye.*



The wavelengths, frequencies and energy of the different colours in the visible light spectrum

Question 10

In the accompanying experiment, an electric current is passed through a solution of copper chloride ($CuC\ell_2$). Components **1** and **3** represent electrodes.



Refer to MODULE 2, TOPIC 1 p. 82 to recap electrolysis in detail.

10.1 Which property/effect of an electric current is illustrated by this experiment?

10.2 Identify the term used for the process illustrated above.

10.3 What are the electrodes composed of?

10.4 Which NUMBER represents the:

10.4.1 anode 10.4.2 cathode 10.4.3 electrolyte

10.5 What is the purpose of number **4** in the experiment?

10.6 During the experiment, gas bubbles form at one of the electrodes.

10.6.1 Name the electrode at which gas bubbles will form.

10.6.2 Which gas forms the bubbles at this electrode?

10.6.3 List ONE other observation that will confirm the gas identified in QUESTION 10.6.2.

10.6.4 Briefly explain what is observed at the other electrode.

10.7 Why is it important that the two electrodes do not touch each other while the electric current is flowing?

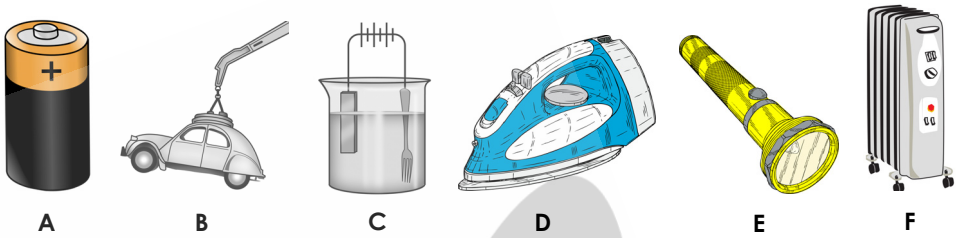
10.8 This process is used during electroplating.

10.8.1 List TWO everyday items that may be electroplated.

10.8.2 Give THREE reasons for the electroplating of items.

Question 11

There are many energy conversions that occur in an electrical system. Identify the energy conversion that occurs within each of the systems (**A** to **F**) shown below.



TOPIC 3 SERIES & PARALLEL CIRCUITS

Question 1

Give ONE word or term for each of the following statements:

1.1 A circuit in which current can only flow along one pathway.

1.2 A circuit in which current flows along more than one pathway.

1.3 Circuit components that oppose the flow of charge and decrease the strength of a current.

1.4 The metal commonly used in electric cables to ensure fast and easy supply of electricity.

1.5 The metal alloy commonly used in the elements of electrical appliances.

1.6 Devices that convert electrical energy into useful forms of energy.

1.7 Lights that are an energy-efficient alternative to the standard incandescent light bulb.

1.8 The type of effect produced by an electric current and used in the functioning of an electric motor.

THE SMALLER, INNER TERRESTRIAL PLANETS

The **four inner planets** are relatively small and have rocky surfaces. They are called **terrestrial planets**. They all have a metal core, rocky mantle (middle layer) and thin surface crust. The **asteroid belt** separates the four inner planets from the four outer planets.

terrestrial planets: the first four planets made of a metal core, rocky mantle and thin surface crust

TERMS

SUN

1 MERCURY

- average temperature: 167°C
- orbit around the sun: 88 Earth days
- rotates around its axis: 59 Earth days
- no moons
- **closest** planet **to the sun**
- no atmosphere, no water
- very heavy planet – consists mainly of iron

2 VENUS

- average temperature: 464°C (**hottest planet**)
- orbit around the sun: 225 Earth days
- rotates around its axis: 243 Earth days
- only planet to rotate clockwise
- no moons
- CO_2-rich atmosphere
- no water
- many volcanoes on the surface
- known as the **morning star / evening star** due to sulphur clouds reflecting bright light
- named after Roman goddess of love

3 EARTH

- average temperature: 16°C
- orbit around the sun: 365 ¼ days (1 year)
- rotates around its axis: 24 hours (1 day)
- 1 moon
- O_2-rich atmosphere with ozone layer
- 70% covered with water
- **abundant** plant and animal **life**

4 MARS

- average temperature: -65°C
- orbit around the sun: 687 Earth days
- rotates around its axis: 24,6 hours
- 2 moons
- CO_2-rich atmosphere with very little O_2
- frozen water at polar regions
- known as the '**red planet**' due to the red colour from the rich iron-oxide crust
- named after Roman god of war

MOON (p. 224)
a natural satellite that orbits around a planet

ASTEROID BELT (p. 224)

- consists of metal-like rock pieces called **asteroids** orbiting the sun
- located around the four inner planets – between Mars and Jupiter
- remnants of the formation of the solar system
- source of meteoroids

ASTEROID BELT

METEOROID (p. 224)
a rock, smaller than an asteroid, free-floating in space

CALCULATIONS OF DISTANCE IN SPACE

Use the information in the tables provided.

Our solar system has a diameter of about 13 light hours.

How many kilometres is 13 light hours?

Distance in kilometres
= 13 × 1 000 000 000
= 13 000 000 000 (13 billion km)

NOTE
1 hour = 1 billion km

How many light minutes is 13 light hours?

Distance in light minutes
= 13 × 60
= 780 light minutes

REMEMBER
1 light hour = 60 light minutes

How many light seconds is 13 light hours?

Distance in light seconds
= 780 × 60
= 46 800 light seconds

REMEMBER
1 light minute = 60 light seconds

LOOKING BACK IN TIME

ENRICHMENT

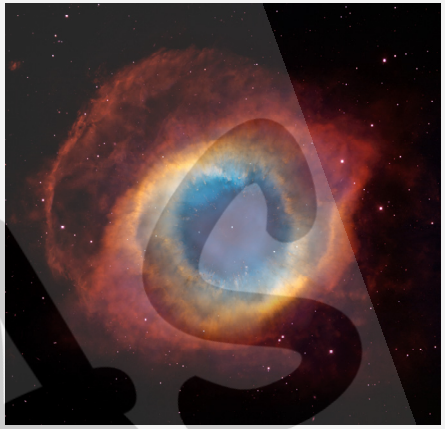
When we measure distance in terms of light, we are really expressing how long it takes light from the object to reach us.

Light takes 8 minutes to reach the earth from the sun. This means that if the sun were 'switched off' like a lamp, darkness would only be experienced 8 minutes later.

Light that is emitted from an object that is one light year away from Earth, takes one calendar year to reach the earth.

When viewing Alpha Centauri in the Southern Cross, we are really seeing the star as it would have appeared 4,2 years ago. It took light 4,2 years (light years) to reach the earth from Alpha Centauri.

When scientists view space and its celestial objects through telescopes, the images they capture are technically in the past – i.e. they are 'looking back in time'. It is like looking at a photograph of an old man when he was a little boy. Photos of space show what celestial objects looked like when light was first emitted from them.



This image shows the Helix Nebula (690 light years away). Light emitted by this giant cloud of dust and gas travelled 690 years before reaching Earth. So, this image shows what it looked like 690 years ago.

The Andromeda galaxy is 2,5 million light years from Earth

The Fairy of Eagle Nebula is 9,5 light years from Earth