Western Cape Government

Western Cape Education Department

Directorate: Curriculum FET

PHYSICAL SCIENCES

REVISION BOOKLET
2022 TERM 1

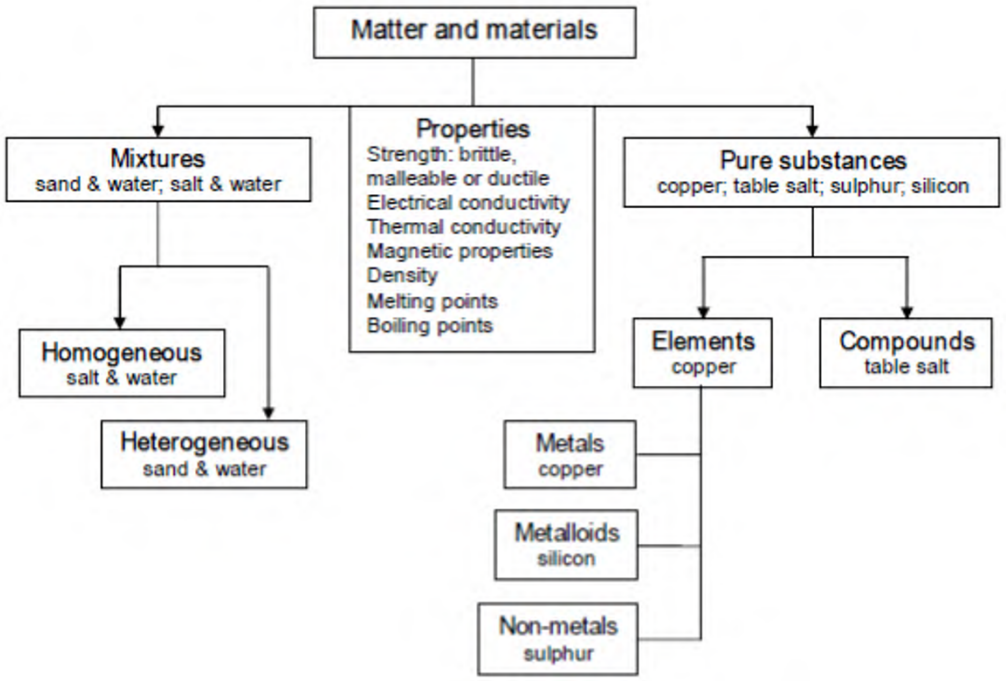
Grade 10

Practical is on Page 9 & 10 of this booklet

This revision program is designed to assist you in revising the critical content and skills covered during the 1st term. The purpose is to prepare you to understand the key concepts and to provide you with an opportunity to establish the required standard and the application of the knowledge necessary to succeed.

The revision program covers the following topics:

Topic 1: Matter and Classification



Terminology	
Pure substance	A substance (element or compound) that contains only one kind of matter.
Boiling point	The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure.
Chromatography	A method of separating and identifying certain substances.
Compound	A pure substance consisting of two or more different elements.
Density	The mass per unit volume of a substance.
Heterogeneous mixture	A mixture in which components can be easily identified. An example is a mixture of sand and water.
Homogeneous mixture	A mixture of which the composition is uniform. An example is a solution of salt and water.
Electrical conductor	A material that allows the flow of charge.
Electrical insulator	A material that does not allow the flow of charge.
Element	A pure chemical substance consisting of one type of atom.
Metalloids/semi-metals	An element with properties intermediate between those of a metal and a non- metal.
Melting point	The temperature at which a solid change to the liquid phase.
Pure substance	A substance that cannot be separated into simpler pieces by physical methods.
Thermal conductor	A material that allows heat to pass through easily.
Thermal insulator	A material that does not allow heat to pass through easily.

Table 1: Chemical and everyday names of well-known compounds

Chemical name	Everyday name	Chemical name	Everyday name
ammonium carbonate	smelling salts	carbon disulphide	carbon bisulphide
ammonium nitrate	fertiliser	hydrogen oxide	water
ammonium sulphate	fertiliser	hydrogen chloride	hydrochloric acid
calcium carbonate	marble	hydrogen sulphate	sulphuric acid
calcium sulphate	plaster of Paris	hydrogen nitrate	nitric acid
magnesium sulphate	Epsom salts	ethanoic acid	acetic acid
sodium chloride	table salt	hydrogen carbonate	carbonic acid
calcium hydroxide	slaked lime	hydrogen sulphite	sulphurous acid
sodium hydrogen carbonate	baking soda	hydrogen nitrite	nitrous acid
sodium hydroxide	caustic soda	copper(II)sulphate	blue vitriol
sodium carbonate	washing soda	calcium oxide	quicklime
potassium hydroxide	caustic potash	carbon dioxide	carbonic acid gas

Table 2: Positive and negative ions

POSITIVE IONS					
+1 symbol	**Name**	**+2 symbol**	**name**	**+3 symbol**	**Name**
H^+	hydrogen	Be^{2+}	beryllium	Al^{3+}	aluminium
Li^+	lithium	Mg^{2+}	magnesium	Fe^{3+}	iron(III)
Na^+	sodium	Ca^{2+}	calcium	Cr^{3+}	chromium(III)
K^+	potassium	Sr^{2+}	strontium	As^{3+}	arsenic(III)
Ag^+	silver	Ba^{2+}	barium	Sb^{3+}	antimony(III)
Hg^+	mercury(I)	Sn^{2+}	tin(II)	Bi^{3+}	bismuth(III)
Cu^+	copper(I)	Pb^{2+}	lead(II)		
NH_4^+	ammonium	Zn^{2+}	sink		
H_3O^+	hydronium (oxonium)	Fe^{2+}	iron(II)		
		Hg^{2+}	mercury(II)		
		Mn^{2+}	manganese		
		Ni^{2+}	nickel		
		Cd^{2+}	cadmium		
		Cr^{2+}	chromium(II)		
		Cu^{2+}	copper(II)		

NEGATIVE IONS					
–1 symbol	**Name**	**–2 symbol**	**Name**	**–3 symbol**	**Name**
F^-	fluoride	O^{2-}	oxide	N^{3-}	nitride
Cl^-	chloride	S^{2-}	sulphide	PO_4^{3-}	phosphate
Br^-	bromide	CO_3^{2-}	carbonate		
I^-	iodide	SO_4^{2-}	sulphate		
OH^-	hydroxide	SO_3^{2-}	sulphite		
NO_3^-	nitrate	CrO_4^{2-}	chromate		
NO_2^-	nitrite	$Cr_2O_7^{2-}$	dichromate		
CN^-	cyanide	$S_2O_3^{2-}$	thiosulphate		
HCO_3^-	hydrogen carbonate	MnO_4^{2-}	manganate		
HSO_4^-	hydrogen sulphate				
ClO_3^-	chlorate				
MnO_4^-	permanganate				
IO_3^-	iodate				
CNS^-	thiocyanate				
CH_3COO^-	ethanoate (acetate)				

QUESTION 1

1.1 The chemical formula for sodium sulphate is ...

A. $NaSO_4$
B. $Na_2(SO_4)_2$
C. Na_2SO_4
D. $Na(SO_4)_2$ (2)

1.2 Write down the names of the following compounds:

1.2.1 $KMnO_4$ 1.2.2 K_2CO_3 1.2.3 KCl
1.2.4 Na_2SO_4 1.2.5 $FeCl_3$ 1.2.6 Na_2S (6)

1.3 Write down the formula of each of the following compounds:

1.3.1 ammonium nitrate
1.3.2 zinc oxide
1.3.3 zinc sulphide
1.3.4 magnesium chloride (4)

1.4 Consider the list of substances. The phase of each substance is written in brackets.

Na(s)	Air(g)	Cu(s)	$O_2(g)$
Sb(s)	Si(s)	$CuSO_4(s)$	S(s)

Choose from this list:

a. An element that is a non-metal. (1)
b. A substance that is a compound. (1)
c. An element that is a good conductor of electricity. (1)
d. Two elements that are semi-metals. (2)
e. An element that is a semi-conductor. (1)
f. Two substances that are metals. (2)
g. A good thermal conductor. (1)
h. A molecule that is an element. (1)

1.5 A learner collects the materials listed in the table below in order to investigate some of their physical properties. Three of the observations made during the investigation are shown (as YES or NO) in the table, whilst others are represented by the letters (a) to (f).

Material	Conduction of electricity	Shiny / Metallic	Ductile
Copper rod	Yes	Yes	(a)
Sodium chloride crystals		(b)	
Magnesium strip	Yes		(c)
Sulphur lump	(d)	(e)	
Carbon powder			(f)

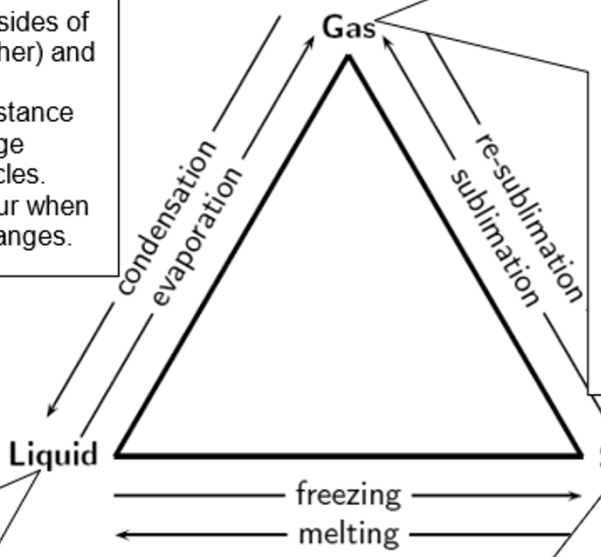
(6)

Topic 2: The Kinetic Theory of Matter

Kinetic Molecular Theory

1. Matter consists of small particles.
2. The particles are in constant motion.
3. There are forces of attraction between the particles.
4. Particles collide (with the sides of the container and each other) and exert pressure.
5. The temperature of a substance is a measure of the average kinetic energy of the particles.
6. A phase change may occur when the energy of particles changes.

Phases of matter
Gases, liquids, solids



Particles in gases:
- Are **very far apart**
- **Move** around **in all directions**
- Have weak **forces of attraction** between them

Gases:
- Have very low density
- Can be compressed
- Can flow
- Have the shape of their container
- have the size of their container

Particles in liquids:
- Are **close together,** but not as close as they are in solids.
- Can **move around** in any direction and are **not fixed in position**.
- Have **quite strong forces of attraction** between them but not as strong as in solids.

Liquids:
- Have a medium density
- Cannot be compressed
- Can flow
- Have the shape of their container
- Have a fixed size

Particles in solids:
- Vibrate about **fixed positions**.
- Have **strong forces** of attraction between them.
- Are **closely packed**.

Solids:
- Have a high density
- Cannot be compressed
- Do not flow
- Have a fixed shape
- Have a fixed size

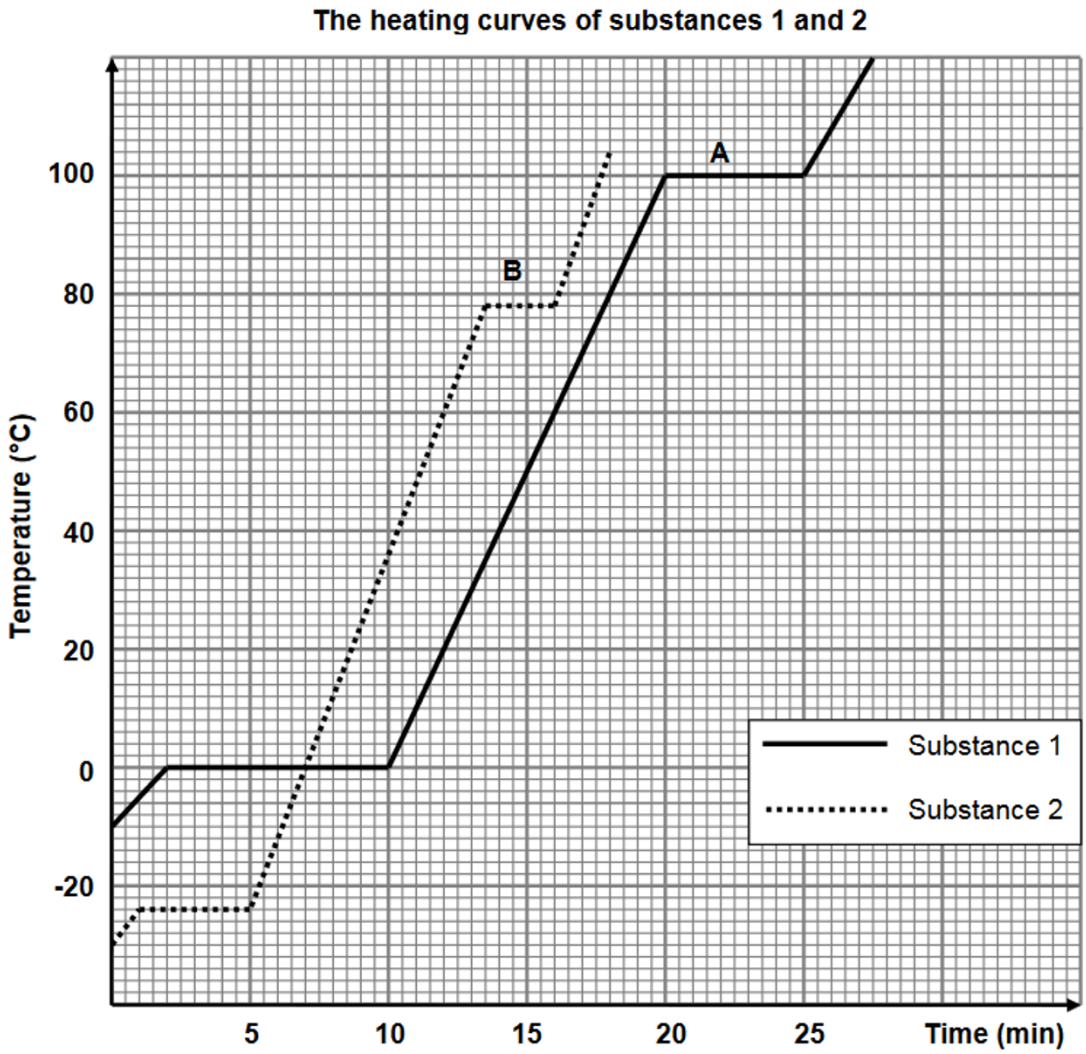
Terminology	
Boiling point	The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure. (Typically boiling points are measured at sea level. At higher altitudes, where atmospheric pressure is lower, boiling points are lower. The boiling point of water at sea level is 100 °C, while at the top of Mount Everest it is 71 °C.
Brownian motion	The random movement of microscopic particles suspended in a liquid or gas, caused by collisions between these particles and the molecules of the liquid or gas. (This movement is named for its identifier, Scottish botanist Robert Brown (1773-1858)).
Condensation	The process during which a gas or vapour changes to a liquid, either by cooling or by being subjected to increased pressure.
Deposition (Re-sublimation)	Deposition is a process in which a gas transforms into a solid. The reverse of deposition is sublimation.
Diffusion	The movement of atoms or molecules from an area of higher concentration to an area of lower concentration.
Evaporation	The change of a liquid into a vapour at a temperature below the boiling point. (Note: Evaporation takes place at the surface of a liquid, where molecules with the highest kinetic energy are able to escape. When this happens, the average kinetic energy of the liquid is lowered, and its temperature decreases.)
Freezing	The process during which a liquid changes to a solid by the removal of heat.
Freezing point	The temperature at which a liquid (releasing sufficient heat), becomes a solid.
Melting	The process during which a solid changes to a liquid by the application of heat.
Melting point	The temperature at which a solid, given sufficient heat, becomes a liquid. (For a given substance, the melting point of its solid form is the same as the freezing point of its liquid form and depends on such factors as the purity of the substance and the surrounding pressure.)
Sublimation	The process during which a solid changes directly into a gas without passing through an intermediate liquid phase.

QUESTION 2

2.1 According to the kinetic molecular theory the particles of a solid …

A. vibrate in their fixed positions and have a fixed shape.
B. are free to move and are compressible.
C. are free to move and have a fixed shape.
D. vibrate in their fixed positions and are compressible. (2)

2.2 Learners are investigating the effect of increasing temperature on two different substances (1 and 2) over a period of time.
Study the temperature versus time graphs below and answer the questions that follow.



Write down the

2.2.1 Dependent variable (1)

2.2.2 Independent variable (1)

2.3 Write down an investigative question for this investigation. (2)

2.4 In which phase is substance 1 at -10 °C? (1)

2.5 At what temperature does substance 2 melt? (1)

2.6 Define the term boiling point. (2)

2.7 State the phase change that takes place at B. (1)

Temperature remains constant at **B**

2.8 Explain this phenomenon in terms of the spaces and the forces between the particles. (4)

2.9 Which substance on the graph has the weakest intermolecular force between the molecules in the liquid phase? Give a reason for the answer. (2)

2.10 Name the apparatus used to measure the average kinetic energy of the particles. (1)

2.11 How does the average kinetic energy of substance 1 compare to the average kinetic energy of substance 2 at 90 °C?

Write down LESS THAN, EQUAL TO or GREATER THAN and give a reason for the answer. (2)

Topic 3: The Atom

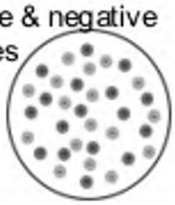
The atom
Basic building block of all matter

Models | Structure | Isotopes | Electron configuration

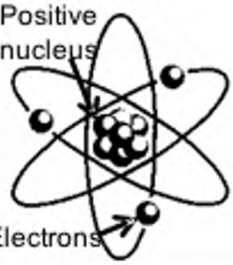
Democritus
Smallest particles in matter - atoms

Dalton
Atoms are solid spheres

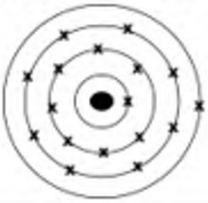
Thomson
Equal number of positive & negative particles



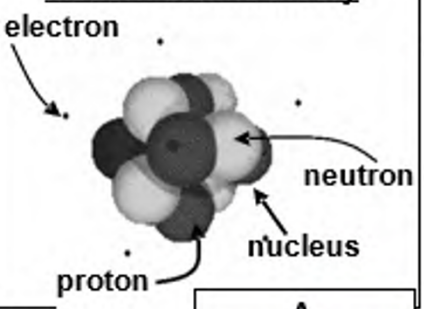
Rutherford
Positive nucleus



Bohr
Electrons in orbits



Modern atomic theory



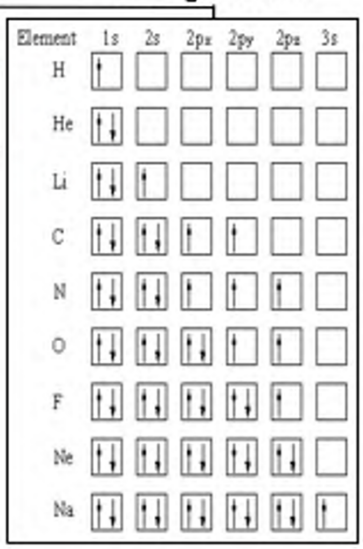
$^{12}_{6}C$ & $^{14}_{6}C$

$^{39}_{19}K$

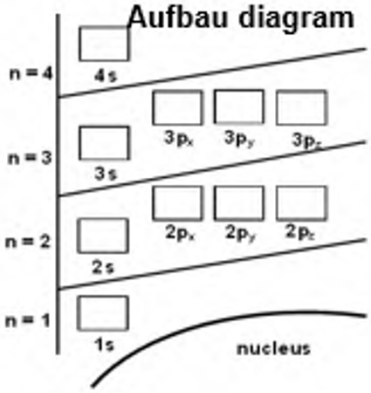
A = Z + N

A
Mass number

Z
Atomic number



Aufbau diagram



Particle	Mass (kg)	Atomic mass (u)	Charge (C)	Relative charge
proton	$1{,}67 \times 10^{-27}$	1	$1{,}6 \times 10^{-19}$	+1
neutron	$1{,}67 \times 10^{-27}$	1	0	0
electron	$9{,}1 \times 10^{-31}$	$\frac{1}{2000}$	$-1{,}6 \times 10^{-19}$	–1

Terminology	
Atomic number (Z)	The number of protons in the nucleus of an atom.
Atomic orbital	The most probable region around the nucleus where electrons will be found.
Electrons	Negative particles occupying space around nucleus.
Excited state	When an electron gains energy and moves into higher energy level.
Ground state	The lowest energy state of an electron.
Hund's rule	No pairing in *p* orbitals before there is not at least one electron in each p orbital.
Ionisation energy	The energy needed to remove an electron(s) from an atom in the gaseous phase.
Isotope	Atoms of the same element with the same atomic number, but different mass numbers due to a difference in the number of neutrons.
Mass number (A)	The sum of protons and neutrons in the nucleus.
Neutrons	Neutral particles in the atomic nucleus.
Nucleons	The particles in the nucleus of an atom i.e. protons and neutrons.
Pauli's exclusion principle	Maximum two electrons per orbital provided that they spin in opposite directions.
Protons	Positive particles in the atomic nucleus.
Quantised energy level	An energy level that can only have specific amounts of energy.
Relative atomic mass	The mass of an atom of an element on a scale where carbon-12 has a mass of 12.
Valence electrons	Outer electrons; electrons in the highest filled energy level of an atom.

QUESTION 3

3.1 Name the particles found in the atom which :

a. Carry no electrical charge (1)
b. Has the smallest mass of all (1)
c. Carry one positive electrical charge (1)
d. Carry one negative electrical charge (1)
e. Occur in the nucleus of the atom (1)

3.2 Complete the table below. Write only the answer next to the question number (3.2.1–3.2.7)

Element	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
Al	**13**	**27**	3.2.1	3.2.2	3.2.3
K^+	**19**	3.2.4	3.2.5	3.2.6	3.2.7

3.3 A certain element, X, has two isotopes in nature. One isotope has an atomic mass of 106,9 amu. The percentage appearance of this isotope is 50%. The atomic mass of the other isotope is 109,1.

3.3.1 Define the term isotope. (2)
3.3.2 Calculate the relative atomic mass of element X. (5)
3.3.3. Identify element X in QUESTION 3.3.2. (2)

3.4 Study the unknown elements A to E below.

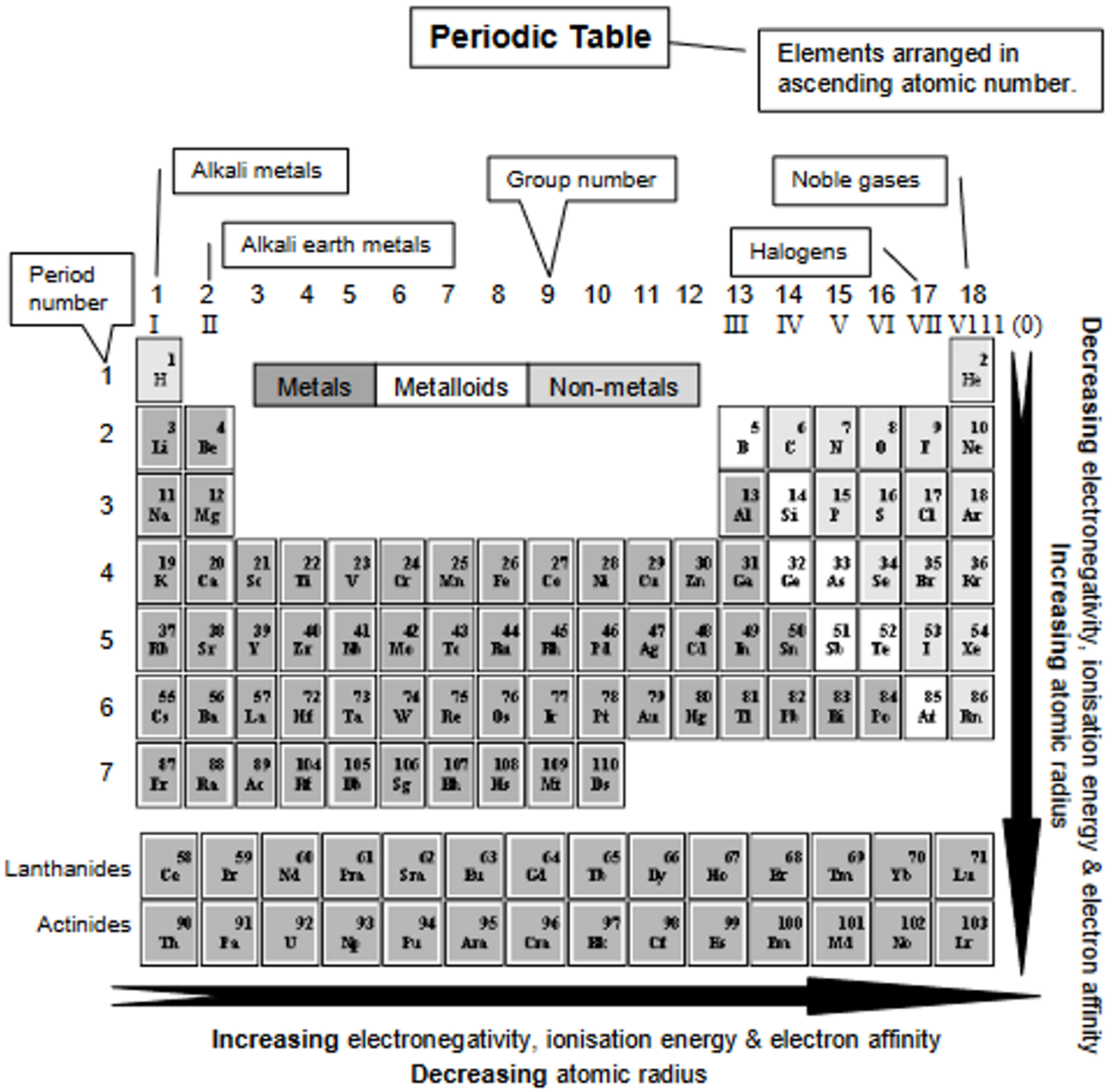
A	B	C	D	E
$^{19}_{9}X$	$^{19}_{10}X$	$^{20}_{9}X$	$^{21}_{11}X$	$^{19}_{8}X$

3.4.1 Which of the elements above are isotopes of each other? (1)
3.4.2 Write down the name of this isotope. (1)

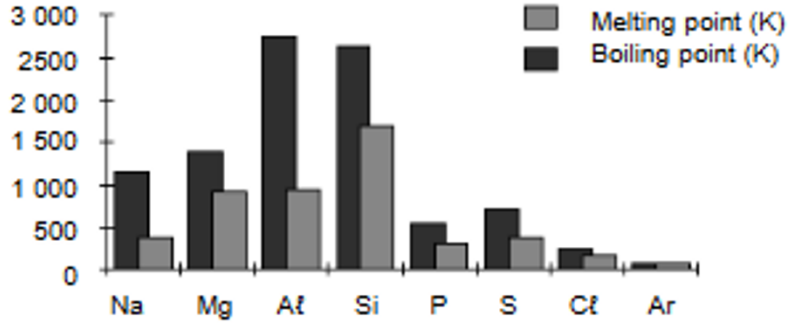
3.5 Calculate the relative atomic mass of copper by using the following Isotopes of copper:

Copper isotopes: ^{63}Cu - 69% and ^{65}Cu - 31% (4)

Topic 4: The Periodic Table



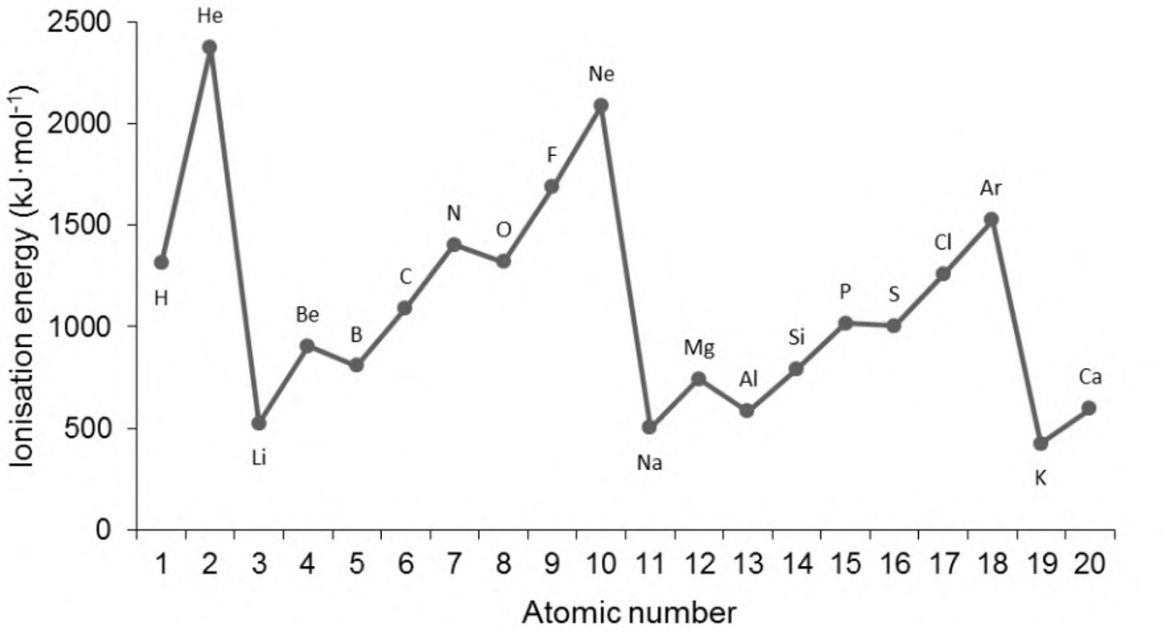
Melting point & boiling points of elements in period 3



Important terms/Definitions:	
Atomic number	Number of protons in the nucleus of an atom.
Atomic radius	Radius of an atom. (The distance from the atomic nucleus to the outermost stable electron in an atom.)
Boiling point	The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure.
Density	The mass per unit volume of a substance.
Electron affinity	The energy released when an electron is attached to an atom or molecule to form a negative ion.
Electronegativity	The tendency of an atom in a molecule to attract bonding electrons closer to itself.
First ionisation energy	Energy needed to remove the first electron from an atom in the gaseous phase.
Group	Vertical columns in the periodic table. Some groups have names.
Ion	A charged particle made from an atom by the loss or gain of electrons.
Ionisation energy	Energy needed to remove an electron(s) from an atom in the gaseous phase.
Melting point	The temperature at which a solid, given sufficient heat, becomes a liquid.
Period	Horizontal rows in the periodic table.
Periodicity	The repetition of similar properties in chemical elements, as indicated by their positioning in the periodic table. (With increasing atomic number, the electron configuration of the atoms displays a periodic variation.)

QUESTION 4

Consider the graph of the first ionisation energy and answer the questions that follow.



4.1 Define the term ionisation energy. (2)

4.2 State the general trend in ionisation energy from left to right across a period on the periodic table. (2)

4.3 There is a drop in ionisation energy from beryllium to boron.

4.3.1 Write down the sp-notation for beryllium AND boron. (4)

4.3.2 Explain this drop in ionisation energy. (3)

4.4 Is the following statement TRUE or FALSE? If false, rewrite the statement correctly.

The ionisation energy of noble gases is high because of the half-filled s- and p-orbitals. (2)

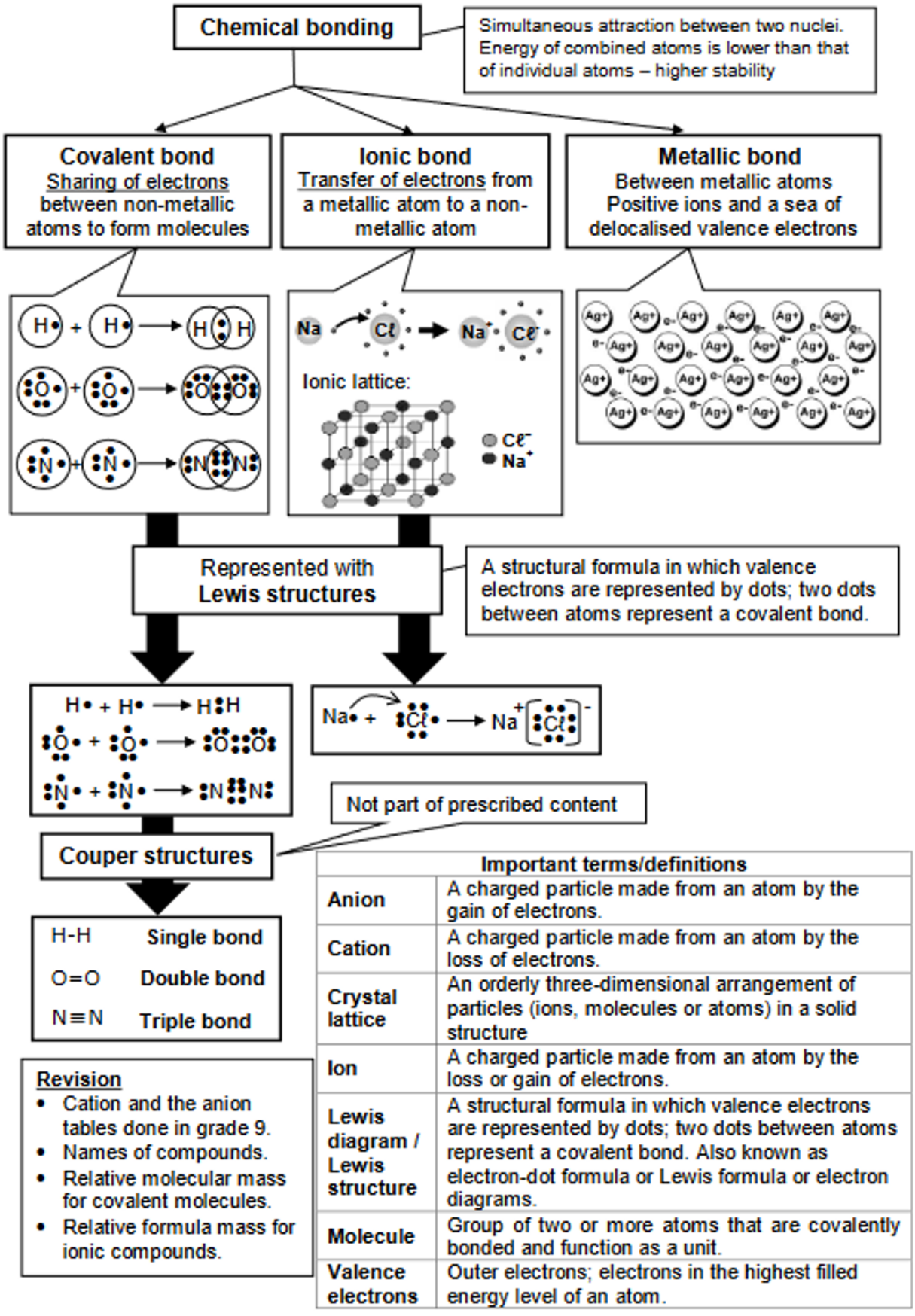
4.5 Study the ionisation energy of the group (I) elements in the graph above and answer the questions that follow.

4.5.1 Give the general name of the group (I) elements. (1)

4.5.2 State the trend in the reactivity of elements in group (I). (2)

4.5.3 Explain the reason for the trend in QUESTION 4.5.2 by using the graph of ionisation energy. (2)

Topic 5: Chemical Bonding



Revision

- Cation and the anion tables done in grade 9.
- Names of compounds.
- Relative molecular mass for covalent molecules.
- Relative formula mass for ionic compounds.

Important terms/definitions	
Anion	A charged particle made from an atom by the gain of electrons.
Cation	A charged particle made from an atom by the loss of electrons.
Crystal lattice	An orderly three-dimensional arrangement of particles (ions, molecules or atoms) in a solid structure
Ion	A charged particle made from an atom by the loss or gain of electrons.
Lewis diagram / Lewis structure	A structural formula in which valence electrons are represented by dots; two dots between atoms represent a covalent bond. Also known as electron-dot formula or Lewis formula or electron diagrams.
Molecule	Group of two or more atoms that are covalently bonded and function as a unit.
Valence electrons	Outer electrons; electrons in the highest filled energy level of an atom.

QUESTION 5

Ammonia (NH_3) is manufactured using an industrial process, known as the Haber process. It is used in the production of inorganic fertilisers, such as ammonium sulphate.

5.1 Write down the chemical formula for ammonium sulphate. (1)

5.2 Name the type of bond between the atoms in the ammonia molecule. Give a reason for the answer. (2)

5.3 Draw the Aufbau diagram (orbital box diagram) for nitrogen. (2)

5.4 How many valence electrons does nitrogen have? (1)

5.5 Draw the Lewis dot diagram for the ammonia molecule. (2)

Consider the following substances

$$C_{90};\quad NaC\ell;\quad CO_2;\quad Fe;\quad H_2O$$

5.6 Write down a substance from the list above that is the following:

5.6.1 A molecular structure (1)
5.6.2 A metallic structure (1)
5.6.3 A covalent network structure (1)
5.6.4 An ionic network structure (1)

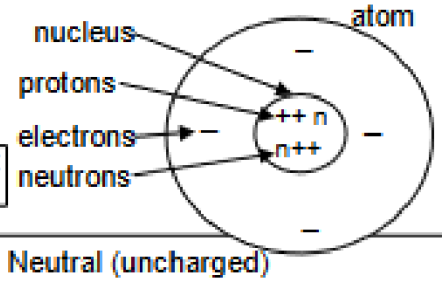
5.7 Draw the Lewis dot diagram for the CO_2 molecule. (2)

5.8 Identify the type of chemical bond in H_2O. (1)

5.9 Draw the Lewis dot diagrams to show the formation of $NaC\ell$. (3)

Topic 6: Electrostatics

ELECTROSTATICS — Study of charges at rest

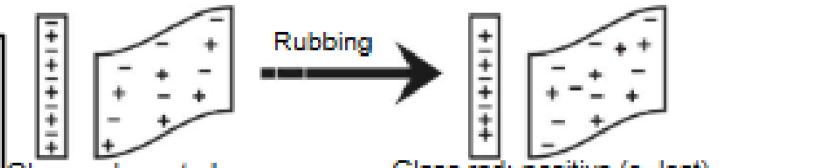


Two kinds of charge
Positive: electron deficient
Negative: excess of electrons

All matter consist of atoms

Neutral (uncharged)
Number of protons = number of electrons

Charging objects
By contact: Electrons transferred from one object to another.



Glass rod: neutral
Woollen cloth: neutral

Glass rod: positive (e- lost)
Woollen cloth: negative (e⁻ gained)

When the glass rod is rubbed (comes in contact) with the woollen cloth, electrons are transferred from the rod to the cloth. The rod has an electron deficit and is positive. The cloth has an excess of electrons and is negative.

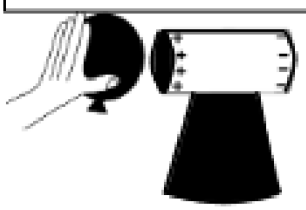
Electrostatic forces
Like charges: Repel
Unlike charges: Attract

Tribo-electric series Materials
Dry skin of humans
Leather
Rabbit fur
Glass
Human hair
Nylon
Wool
Lead
Cat hair
Silk
Aluminium
Paper
Cotton (neutral)
Steel (neutral)
Wood (practically neutral)
Amber
Rubber
Nickel, Copper
Brass, Silver
Gold, Platinum
Polyester
Foam plastic
Cling wrap
Polyurethane (type of plastic)
Polyethylene (Scotch tape)
Polypropylene (type of plastic)
Vinyl (PVC) (type of plastic)

Stronger positive

Stronger negative

Polarisation of charge
Negatively charged balloon repels electrons in can towards far end.



Electrostatic forces
Charged object on neutral object by polarisation

Conservation of charge

Charge cannot be created or destroyed. It can only be transferred from one object to another.

Charge quantisation

All charges are multiples of the smallest charge i.e. the charge on one electron: $1,6 \times 10^{-19}$ C

Terminology	
Electrons	Negative particles occupying space around nucleus.
Elementary charge	An indivisible unit of charge i.e.1,6 x 10^{-19} C.
Neutrons	Neutral particles in the atomic nucleus.
Protons	Positive particles in atomic nucleus.
Polarisation (of charge)	The partial or complete polar separation of positive and negative electric charge in a system.
Quantization (of charge)	Division of charge in smaller units
Principle of conservation of charge	Charge cannot be created or destroyed. It can only be transferred from one object to another.
Principle of charge quantization	Every stable and independent object has a charge that is an integer multiple of the elementary charge.
Triboelectric charging (Triboelectric effect)	A type of contact electrification in which certain materials become electrically charged after they come into contact with another different material and are then separated (such as through rubbing). The polarity and strength of the charges produced differ according to the materials.

QUESTION 6

6.1 A rod acquires a negative charge after it has been rubbed with wool.

Which ONE of the following best explains why this happens?

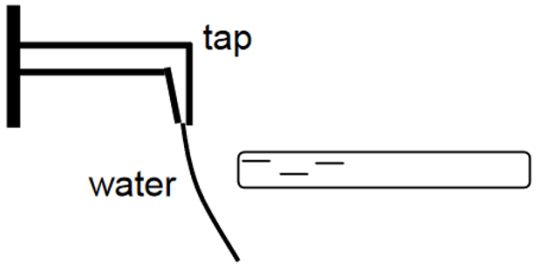
A. Positive charges are transferred from the rod to the wool.
B. Negative charges are transferred from the rod to the wool.
C. Positive charges are transferred from the wool to the rod.
D. Negative charges are transferred from the wool to the rod. (2)

6.2 A rubber balloon obtains a negative charge after it has been rubbed against human hair.

Which ONE of the statements below best explains why this happens?

A. Negative charges are transferred from the rubber balloon to the human hair.
B. Positive charges are transferred from the rubber balloon to the human hair.
C. Positive charges are transferred from the human hair to the rubber balloon.
D. Negative charges are transferred from the human hair to the rubber balloon. (2)

6.3 A learner in a Physical S ciences class rubs his hair with a plastic rod. The rod becomes negatively charged. The learner now opens a tap so that a thin stream of water runs from it. When the rod is brought close to the water without touching it, it is observed that the water bends toward the rod, as shown in the diagram below.



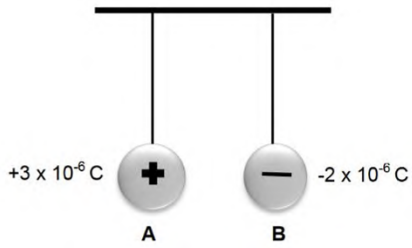
6.3.1 Write down the principle of conservation of charge in words. (2)

6.3.2 Give a reason why the stream of water bends towards the rod. (2)

During the rubbing process 10^{14} electrons are transferred to the rod.

6.3.3 Calculate the net charge now carried by the rod. (4)

6.4 Two small identical spheres, A and B, are suspended on long silk threads, as shown in the sketch below. The spheres carry charges of +3 x 10^{-6} C and -2 x 10-6 C respectively.



6.4.1 Which sphere has an excess of electrons? (1)

6.4.2 The two spheres are allowed to touch. Will the electrons be transferred from A to B or B to A? (1)

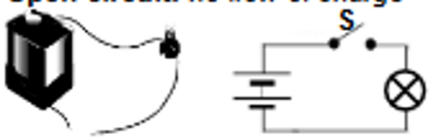
The spheres are now separated

6.4.3 Calculate the new charge on sphere B. (3)

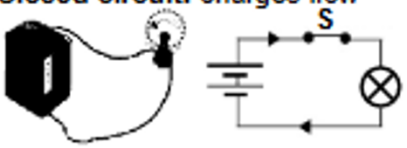
6.4.4 Calculate the number of electrons transferred during contact. (3)

Topic 7: Electric Circuits

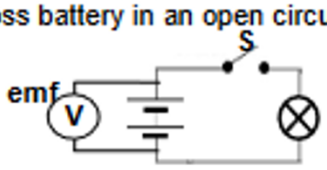
Open circuit: no flow of charge



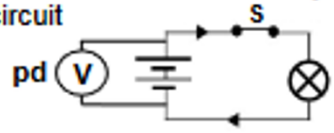
Closed circuit: charges flow



Emf of battery: potential difference across battery in an open circuit



Potential difference of battery: Potential difference across battery in a closed circuit



Potential difference
Unit: volt (V)
Measuring instrument:
voltmeter - connected in parallel

Current:

Rate of flow of charge: $I = \frac{Q}{\Delta t}$

Unit: ampere (A)
Measuring instrument:
ammeter - connected in series
Conventional current:
from positive to negative

Resistance
Opposition to flow of charge
Unit: ohm (Ω)
Resistance is the ratio of potential difference across a resistor to the current through it: $R = \frac{V}{I}$

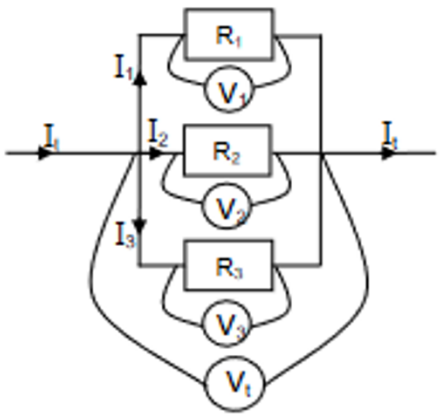
Electric circuits

Parallel circuit

More than one pathway for charges
One or more branches

Resistors in parallel

1. Current dividers
   $I_t = I_1 + I_2 + I_3$
2. $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
3. Potential difference everywhere the same: $V_t = V_1 = V_2 = V_3$

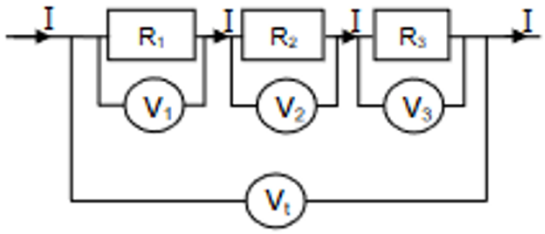


Series circuit

Only one pathway for charges
No branches

Resistors in series

1. Potential dividers
   $V_t = V_1 + V_2 + V_3$
2. $R_{total} = R_1 + R_2 + R_3$
3. Current everywhere the same



Important terms/definitions	
ampere (A)	The unit of measurement of electric current.
coulomb (C)	The unit of measurement of electric charge. Definition: The current is one ampere when a charge of one coulomb passes a given point in a conductor one second.
Electric current	The rate of flow of charge. ($I = \frac{Q}{\Delta t}$)
Emf	The potential difference (voltage) measured across the terminals of a battery when no charge flows through the battery.
ohm (Ω)	Unit of measurement of resistance. Definition: One ohm is one volt per ampere.
Potential difference	The potential difference between the ends of a conductor is equal to the energy transferred (from electrical to other forms of energy) per unit electric charge flowing through it. ($V = \frac{W}{Q}$)
Resistance	Resistance is the ratio of the potential difference across a resistor to the current in the resistor.
volt (V)	The unit of measurement of potential difference.
Voltmeter	The instrument used to measure potential difference. A voltmeter is connected in parallel and has a very high resistance.
Ammeter	The instrument used to measure electric current. An ammeter is connected in series and has a very low resistance.

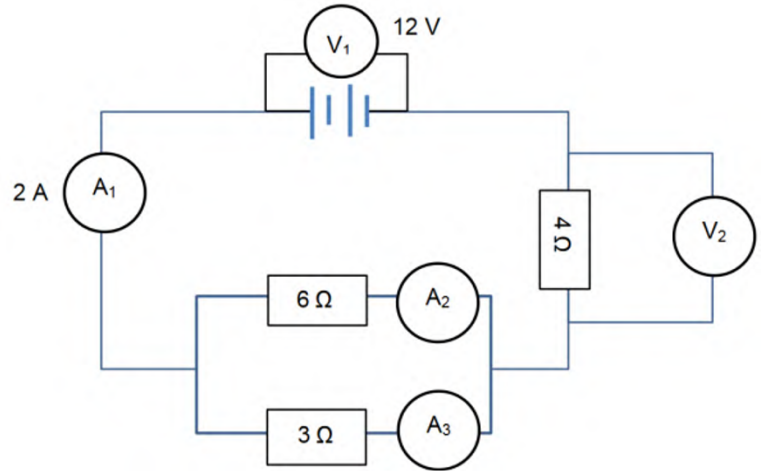
QUESTION 7

7.1 For which ONE of the quantities below is the CORRECT unit of measurement given?

	QUANTITY	UNIT
A	Current	$A \cdot s^{-1}$
B	Energy	kW
C	Potential difference	V
D	Resistance	V·s

(2)

7.2 In the circuit diagram below the reading on voltmeter V_1 is 12 V and the reading on ammeter A_1 is 2 A.



Calculate the:

7.2.1 Total resistance of the circuit (4)

7.2.2 Reading on V_2 (3)

7.2.3 Reading on A_2 (3)

7.2.4 Amount of charge that flows through ammeter A_1 in 120 s (3)

7.3 How will the reading on ammeter A_1 be affected if the 6 Ω resistor is removed from the circuit?
Write down only INCREASE, DECREASE or REMAIN THE SAME. (1)

7.4 Explain the answer to QUESTION 7.3 WITHOUT any calculations. (3)

MARKING GUIDELINES

QUESTION 1

1.1 C ✓✓ (2)

1.2.1 Potassium permanganate✓

1.2.2 Potassium carbonate ✓

1.2.3 Potasium chloride✓

1.2.4 Sodium sulfate✓

1.2.5 Iron(III) chloride

1.2.6 Sodium sulfide✓ (6)

1.3.1 NH_4NO_3✓ (1)

1.3.2 ZnO✓ (1)

1.3.3 ZnS✓ (1)

1.3.4 $MgCl_2$✓ (1)

1.4 a) S(s) / O_2(g) ✓ (1)

b) $CuSO_4$(s) ✓ (1)

c) Cu(s) / Na(s) ✓ (1)

d) Si(s) and Sb(s) ✓✓ (2)

e) Si(s) / Sb(s) ✓ (1)

f) Cu(s) and Na(s) ✓✓ (2)

g) Lug✓ (1)

h) O_2✓ (1)

1.5 a) Yes✓ (1)

b) No✓ (1)

c) Yes✓ (1)

d) No✓ (1)

e) No✓ (1)

f) No✓ (1)

QUESTION 2

2.1 A ✓✓ (2)

2.2.1 Temperature✓ (1)

2.2.2 Time/Phase change ✓ (1)

2.3 What is the relationship between an increase in temperature over a period of time and phase change? ✓✓ (2)

2.4 Solid✓ (1)

2.5 -24 °C ✓ (1)

2.6 Boiling point is the temperature of a liquid at which its vapour pressure is equal to the external (atmospheric) pressure✓✓ (2)

2.7 Liquid changes to gas. ✓ (1)

2.8 The energy is used to break the forces between the particles✓, resulting in a phase change✓, the kinetic energy of the particles remains the same✓, particles move further away from each other (increase in potential energy✓. (4)

2.9 Substance 2✓,
Substance 2 has a lower melting and/or boiling point than substance 1✓ (2)

2.10 Thermometer ✓ (1)

2.11 Equal to ✓Substance 1 and 2 are at the same temperature. Therefore they will have the same average kinetic energy. ✓ (2)

[20]

QUESTION 3

3.1
a. Neutron✓ (1)
b. Electron✓ (1)
c. Proton✓ (1)
d. Electron✓ (1)
e. Neutron✓ (1)

3.2.1 13✓ (1)

3.2.2 14✓ (1)

3.2.3 13✓ (1)

3.2.4 39✓ (1)

3.2.5 19✓ (1)

3.2.6 20✓ (1)

3.2.7 18✓ (1)

3.3.1 Isotope: atoms of the same element having the same number of protons, but different number of neutrons. OR Same atomic number, but different mass numbers. ✓✓ (2)

3.3.2 $50\% = 106{,}9 \text{ amu}$
$50\% = 109{,}1 \text{ amu}$ ✓

$$A_r = \frac{(50 \times 106{,}9) + (50 \times 108{,}9)}{100} \quad \text{(✓ ✓ ✓)}$$
$$= 108 \text{ ✓}$$

(5)

3.3.3 Ag/Silver✓✓ (2)

3.4.1 $^{19}_{9}X$ and/*en* $^{20}_{9}X$ ✓
OR/*OF*
A and/*en* C✓ (1)

3.4.2 Fluorine ✓ (1)

3.5 $Ar(Cu) = \left(\frac{69}{100}\checkmark \times 63\checkmark\right) + \left(\frac{31}{100}\checkmark \times 65\right)$
$= 63.62\checkmark$ (4)

QUESTION 4

4.1 Energy needed per mole to remove an electron from an atom in a gaseous phase. ✓✓ (2)

4.2 Ionisation energy increases from left to right, across a period. ✓✓ (2)

4.3

4.3.1 Be:$1s^2\ 2s^2$✓✓ (4)
B:$1s^2\ 2s^2\ 2p^1$✓✓

4.3.2 B has a 2p energy level; 2p has a higher energy than 2s. ✓
Therefore less energy is needed to remove the valence electrons from B as from Be✓✓ (3)

4.4 False✓,
The energy is high because of filled s and p-orbitals. ✓ (2)

4.5

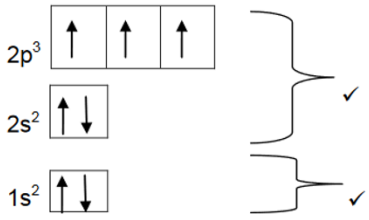
4.5.1 Alkali-metals ✓ (1)
4.5.2 Reactivity increases from top to bottom✓✓ (2)
4.5.3 Ionisation energy decreases, thus less energy to remove an electron. ✓
Therefore reactivity increases✓ (2)

QUESTION 5

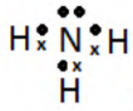
5.1 $(NH_4)_2SO_4$ ✓ (1)

5.2 Covalent bond✓. Electrons are shared✓ between the atoms of hydrogen and nitrogen (2)

5.3 (2)

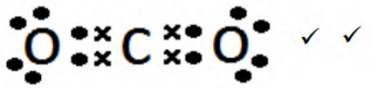


5.4 5 ✓ (1)

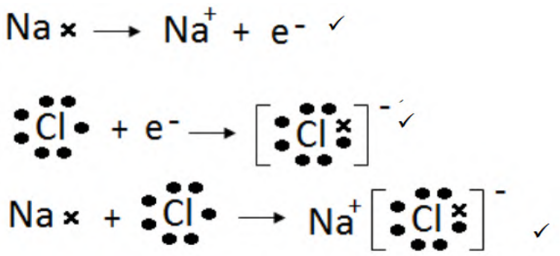
5.5  ✓✓ (2)

5.6 Write down a substance from the list above that is the following:

5.6.1 CO_2✓ **OR/*OF*** H_2O✓ (1)
5.6.2 Fe ✓ (1)
5.6.3 C_{90} ✓ (1)
5.6.4 NaCl✓ (1)

5.7  ✓ ✓ (2)

5.8 Covalent bond✓ (1)

5.9  (3)

QUESTION 6

6.1 D✓✓ (2)

6.2 D✓✓ (2)

6.3.1 In an isolated system the total/net charge remains constant✓✓

ACCEPT

In an isolated system charge is neither created nor destroyed (2)

6.3.2 The water molecule has a positive charge ✓and is attracted toward the rod. ✓

OR

The positive end⎫ of the water molecules are attracted⎫ to the negatively charged rod.

OR

Unlike charges attract. ✓ The positive end of the water molecules are attracted ✓to the negatively charged comb. (2)

6.3.3 $n = \frac{Q}{e}$ ✓**OR/*OF*** $Q = nq_e$

$Q = 10^{14}$ ✓x $(1,6 \times 10^{-19})$ ✓

$= 1,6 \times 10^{-5}C$ (0,000016 C) ✓

(4)

6.4.1 B✓ (1)

6.4.2 B to A ✓ (1)

6.4.3 $Q_{new/nuut} = \frac{Q_1 + Q_2}{2}$ ✓

$= \frac{(+3 \times 10^{-6} + (-2 \times 10^{-6}))}{2}$ ✓

$= 5 \times 10^{-7}C$ ✓ (3)

1.1.1

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$n = \frac{Q}{e}$ ✓ $= \frac{5 \times 10^{-7} - (-2 \times 10^{-6})}{-1,6 \times 10^{-19}}$ ✓ $= 1,56 \times 10^{13}$ electrons ✓ *elektrone*	$n = \frac{Q}{e}$ ✓ $= \frac{5 \times 10^{-7} - (+3 \times 10^{-6})}{-1,6 \times 10^{-19}}$ ✓ $= 1,56 \times 10^{13}$ electrons ✓ *elektrone*

(3)

QUESTION 7

7.1 C ✓✓ (2)

7.2.1

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*

$\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
$= \frac{1}{6} + \frac{1}{3}$ ✓
$\therefore R_{//} = 2\Omega$
 	
$\therefore R_{total/totaal} = 4 + 2$ ✓
$= 6\ \Omega$ ✓
	$R_{//} = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓
	$= \frac{6 \times 3}{6+3}$ ✓
	$= 2\Omega$
	
	$\therefore R_{total/totaal} = 4 + 2$ ✓
	$= 6\ \Omega$ ✓

(4)

7.2.2 $R_{4\Omega} = \frac{V_2}{I_T}$ ✓

$4 = \frac{V_2}{2}$ ✓

$\therefore V_2 = 8\ V$ ✓ (3)

7.2.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$I = \frac{V}{R}$ ✓ $= \frac{12 - 8}{6}$ ✓ = 0,67 A ✓	$R \alpha \frac{1}{I}$ ✓ or in words: resistance is inversely proportional to current and ∴ratio of resistors is 6 : 3 2 : 1 ∴ratio of current is 1 : 2 ✓ $A_2 : A_3$ $\therefore I_{A2} = \frac{2}{3} \times 1$ $\therefore I_{A2}$ = 0,67 A ✓ *$R \alpha \frac{1}{I}$ ✓ in woorde:* *weerstand is omgekeer eweredig aan stroom* *∴verhouding van resistors is 6 : 3* *2 : 1* *∴verhouding van stroom is 1 : 2 ✓* *$A_2 : A_3$* *$\therefore I_{A2} = \frac{2}{3} \times 1$* *$\therefore I_{A2}$ = 0,67 A* ✓

(3)

7.2.4 A_1= 2 A

∴Q = I Δt ✓

= 2 x 120 ✓

= 240 C ✓ (3)

7.3 Decrease ✓ (1)

7.4 • If the 6 Ω resistor is removed, the resistance of the whole circuit increases✓

• Since R α $\frac{1}{I}$, if R increases, and V is constant✓and I of the circuit decreases✓ (3)