

FORM 3

CHEMISTRY

TIME: 1h 30min

Name: _____

Class: _____

Useful Data: Atomic numbers and relative atomic masses are shown in the periodic table printed below.

PERIODIC TABLE

1	2											3	4	5	6	7	0	
																		4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10	
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18	
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	63.5 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36	
85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	99 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54	
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	210 Po 84	210 At 85	222 Rn 86	

Key

$\begin{matrix} a \\ \mathbf{X} \\ b \end{matrix}$	relative atomic mass
	symbol
	atomic number

Marks Grid [For Examiners use only]

Question N ^o .	Section A						Section B			Theory Total
	1	2	3	4	5	6	7	8	9	
Max Mark	10	10	10	10	10	10	20	20	20	
Actual Mark										

Theory Paper: 85%	Practical: 15%	Final Score: 100%

SECTION A – Answer ALL questions. This section carries 60 marks.

1. A sachet of net weight 250g contained two fine powders mixed together. After **excess** water was added, the mixture was allowed to stand in a beaker for several minutes until one of the powders disappeared completely but the other powder settled down and formed a residue at the bottom. The residue was filtered off, washed, dried and weighed.

Mass of mixture: 250g

Mass of dried residue: 110g

- a. Tick the box with the correct answer:

Excess means:

equal to what is required more than is required less than is required [1]

- b. Give one example of a substance that:

(i) disappears when water is added _____

(ii) settles down and forms a residue when water is added _____ [2]

- c. The powder that disappeared is _____ in water while the residue formed at the bottom is _____. [2]

- d. Calculate the mass of the powder that disappeared when excess water was added. _____ [1]

- e. Name one item of lab. equipment necessary for filtering off a residue. _____ [1]

- f. Give one reason why the residue must be (i) washed and (ii) dried before it is weighed.
(i) washed: _____ (ii) dried: _____ [2]

- g. State one method that can be used to recover the powder that disappeared when water was added. _____ [1]

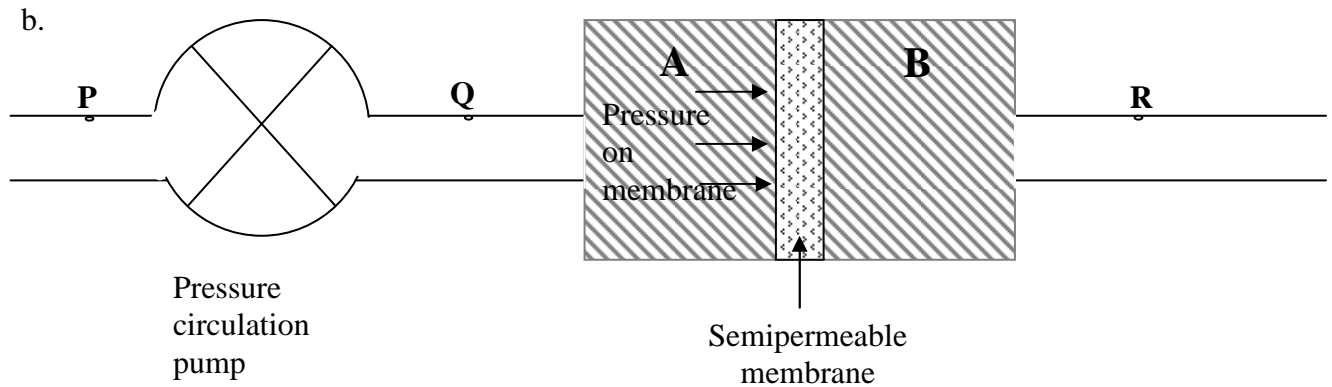
2. a. (i) Melting is a process by which a _____ changes into a _____.
- (ii) Freezing is a process by which a _____ changes into a _____.
- (iii) Give one reason to show that both melting and freezing are physical changes.
_____ [5]
- b. (i) When a fossil fuel burns in air, carbon dioxide and _____ are formed.
- (ii) When the air supply is limited, the incomplete combustion of a fossil fuel results in the formation of toxic _____.
- (iii) Give one reason to show that combustion, whether complete or incomplete, is a chemical change.
_____ [3]
- c. Give the name of the gas that:
- (i) is most abundant in the air. _____
- (ii) causes global warming when present in excess _____ [2]
3. a. The chemical equations below are incomplete. Fill in the spaces with the formulae of the missing substances and balance the equations. **(No need to put state symbols)**
- (i) $2\text{Mg} + \text{O}_2 \longrightarrow$ _____ (ii) $\text{C} + \text{O}_2 \longrightarrow$ _____
- (iii) $\text{Fe} + 2\text{HCl} \longrightarrow$ _____ + H_2 (iv) $\text{CaCO}_3 \longrightarrow$ _____ + CO_2
- (v) $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow$ _____ + H_2 (vi) $\text{NaOH} + \text{HCl} \longrightarrow$ _____ + H_2O [6]
- b. Write down correct and balanced chemical equations for these word equations. **(No need to put state symbols)**
- (i) iron + chlorine \longrightarrow iron (III) chloride

- (ii) zinc + copper chloride \longrightarrow zinc chloride + copper
_____ [4]

4. Desalination is the process used to reduce or eliminate the concentration of soluble salts in seawater. It is commonly used in countries like Malta where seawater is readily available but rainwater is scarce.

a. Besides reverse osmosis, name one other method that can be used to change seawater into drinking water _____.

[1]



The diagram shows a simplified version of a reverse osmosis plant. Impure water is fed into compartment A. A pressure circulation pump creates a large pressure to force the liquid through a semipermeable membrane, retaining the **solute** on one side and allowing the pure **solvent** to pass to the other side.

(i) Name the **solute** that is mostly abundant in seawater _____

(ii) Which of the following is mostly present in compartment B?

seawater drinking water rainwater

(iii) Which of the following describes **best** the semipermeable membrane?

- it must be made from a strong material to withstand pressure
- it must contain microscopic holes to allow sodium ions to pass through
- it must be made from a natural material that reacts with the dissolved salts.

[3]

c. Most reverse osmosis plants have a filtration apparatus attached to the system. Is this attached at P, Q or R?

(i) _____.

(ii) Suggest a reason for your answer _____

[2]

d. Over the years, many different names have been used to describe reverse osmosis.

Which one do you think is **most** suitable?

membrane filtration water purification salt removal

[1]

e. Besides used to purify seawater, reverse osmosis has other industrial uses. Name one such use for reverse osmosis _____

[1]

f. Name one advantage and one disadvantage the method you named in question a. has over reverse osmosis.

Advantage: _____ Disadvantage: _____

[2]

5. a. State what you would **observe** when:

(i) a small piece of sodium is placed in cold water

(ii) pieces of zinc are placed in dilute hydrochloric acid

[2]

b. In each of these reactions, a gas is liberated. Write down:

(i) the name of this gas _____

(ii) a simple test that confirms its presence _____

(iii) one property that this gas possesses _____

[3]

c. The solution that results from the reaction in question a.(i) is strongly **alkaline**.

(i) Which test would you carry out to show this?

(ii) What would you **observe** while carrying out this test?

[2]

d. When dried, the salt produced during the reaction in question a.(ii) consists of deliquescent white crystals. Write down:

(i) the name and formula of this salt

Name: _____ Formula: _____

(ii) the name of **another** salt that is also deliquescent _____

[3]

6. The table below gives information about an element symbol A. (A is **not** the true symbol of the element)

1.	Element A is diatomic.
2.	Element A is a gaseous non-metal at room temperature and normal atmospheric pressure.
3.	Element A has numerous isotopes.
4.	One isotope of element A has a relative atomic mass (R.A.M.) of 15; another isotope of A has a relative atomic mass of 14.
5.	An atom of element A contains 7 electrons.
6.	The average relative atomic mass of element A is 14.0067.

- a. Using A to represent the element, write down the symbol that represents **one molecule** of element A. _____ [1]

- b. If room temperature is 20°C, which one of the following is the temperature at which element A condenses?

20°C 36°C -196°C 100°C [1]

- c. Element A has at least two isotopes. What is an isotope?
_____ [1]

- d. Fill in the table below:

Element A	Isotope with R.A.M. of 14	Isotope with R.A.M. of 15
Number of electrons per atom		
Number of protons per atom		
Number of neutrons per atom		

[3]

- e. (i) Which isotope of element A is more abundant?

R.A.M. 14 R.A.M. 15

- (ii) Give a reason for your answer to (i)
_____ [2]

- f. Element A shows various valencies. Using A to represent the element, write down the formula of:

(i) its oxide when A shows a valency of 2 _____

(ii) the compound it forms with hydrogen when A shows a valency of 3

_____ [2]

SECTION B – Answer TWO questions only on the foolscap provided.

This section carries 40 marks.

7. **Useful information - Relative Atomic Masses: H = 1, C = 12, O = 16, Cu = 64**
Avogadro's Number: 6×10^{23}

- a. A stream of methane gas was passed through a combustion tube that contained 24g of heated copper oxide. All the copper oxide was reduced to copper metal in the process. After cooling, the copper metal was weighed.

Mass of copper oxide: 24g Mass of copper : 19.2g

Calculate:

- the mass of oxygen in 24g of copper oxide
- the number of moles of copper present in 19.2g of the metal
- the number of moles of oxygen present in 24g of copper oxide.
- Use your answers to a. (ii) and a. (iii) to write down the empirical formula of copper oxide.

[7]

- b. The chemical formula of Vitamin C is $C_6H_8O_6$
- Calculate the mass in g of one mole of Vitamin C.
 - Work out the percentage mass of carbon in Vitamin C.
 - If you take a tablet containing 0.100g of Vitamin C, find out how many moles of Vitamin C you are taking.
 - How many molecules of Vitamin C are there in one tablet?
 - Pure fresh orange juice contains 0.2% by mass Vitamin C.
 - How much Vitamin C are you taking when you drink a 250g carton of pure fresh juice?
 - If one tablet contains 0.100g of Vitamin C, how many tablets are equivalent to drinking a 250g carton of pure fresh orange juice?

[13]

8. Explain briefly each of the following statements. Add diagrams to your explanations where appropriate.

- Unlike liquids, gases are **compressible** because the free space between gas particles is much larger than that between liquid particles.
- Perfume from an open perfume bottle travels and fills up the room, pushing away air particles.
- A molecule of chlorine is formed when two chlorine atoms are joined together by a **covalent bond** while a hydrogen chloride molecule is formed when a hydrogen atom is joined by a **covalent bond** to a chlorine atom.
- Lithium fluoride is an ionic compound since a molecule of lithium fluoride is formed when a lithium atom sticks to a fluorine atom by an **ionic bond** so that both atoms acquire a noble gas configuration.

[5]

[4]

[6]

[5]

9. a. In the lab., oxygen is usually prepared by the catalytic decomposition of hydrogen peroxide solution.
- (i) Draw a **fully labelled diagram** to show the apparatus needed for the **preparation** and **collection** of oxygen using this method.
- (ii) Re-write and complete the chemical equation below to show how hydrogen peroxide decomposes into water and oxygen. **Include state symbols.**
- $$2\text{H}_2\text{O}_{2(\text{aq})} \longrightarrow \text{ ______ } + \text{ ______ }$$
- (iii) Write down the name of the catalyst used for this method of preparation.
- (iv) Oxygen prepared in the lab. by this method is usually pure but not fully dry. Suggest one suitable drying agent.

[10]

- b. With the help of a labelled diagram and a brief explanation, show how you can determine the percentage volume of oxygen present in the air. (Your apparatus should include two syringes and an interconnecting combustion tube).

[5]

- c. (i) Ozone is a form of oxygen but its molecules are triatomic. Explain with reference to ozone what triatomic means.
- (ii) Ozone forms a shield in the upper atmosphere that prevents harmful radiation to reach us. Write down the name of :
- one type of radiation that is harmful if it reaches the earth's surface.
 - one substance that is destroying the ozone layer.
 - one effect on humans produced by ozone depletion.
- (iii) State what can be done to stop the ozone layer from getting thinner.

[5]