**CHEMISTRY**

FORM 3

MID TERM 2 2025

MARKING SCHEME
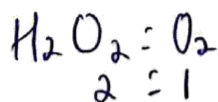
1 a) State the Gay Lussac's Law. (1mk)

The rate of diffusion of a gas is inversely proportional to the square root of its density at constant pressure & temperature.

b) What mass of hydrogen peroxide would be needed to produce 120cm3 of oxygen gas at r.t.p in this experiment? (Molar gas volume at RTP = 24000cm3, H = 1, O = 16) [3 mks]

$$2H_2O_2 \xrightarrow[(aq)]{MnO_2} 2H_2O_{(l)} + O_{2(g)}$$
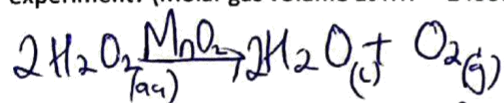
1 mole = 24,000 cm³

120 cm³

$$\frac{120 \times 1}{24\,000} = 0.005 \text{ moles}$$

$H_2O_2 : O_2$

$2 : 1$

0.01 moles : ~~0.05m00~~ 0.005 moles

Mass = moles × RMM

0.01 moles × 34 = 0.34g.

2 a)Use the information in the table below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Atomic number	Melting point (°C)
R	11	97.8
S	12	650.0
T	15	44.0
U	17	-102
V	18	-189
W	19	64.0

a)Give the reasons why the melting point of:

I) S is higher than that of R (2 mks)

S having more Protons than R has a stronger nuclear charge thus has a higher melting point than R.

ii)V is lower than that of U. (2mks)

V is diatomic while U is monoatomic.

b) How does the reactivity of W with chlorine compare with that of R with chlorine? Explain. (2mks)

W is more reactive than R. W having 4 occupied energy level, its outermost electron is loosely held compared to that of R with 3 occupied energy level hence W can easily lose its outermost electron.

c)Write an equation for the reaction between T and excess oxygen. (1mk)

$$4T + 3O_2 \rightarrow 2T_2O_3$$
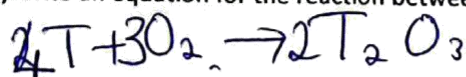
d) i. Define ionization energy. (1 mark)

Is the minimum amount of energy required to lose the outermost electron tih its gaseous state.

(ii) Explain why the 1st ionization energy of Al is higher than that of Na. (2mks)

Al has 13 protons while Na has 11 thus the nuclear force of attraction in Al is much higher than Na. Thus more energy will be required to lose the outermost electron Al than Na

3 The melting point of phosphorous(III)chloride is -91°C while that of sodium chloride is 801°C. In terms of structure and bonding explain the difference in the melting point. (2mk)

Phosphorous (III) chloride exists as a molecule and ha while NaCl has an ionic structure. PCl₃ has covalent bond in the molecule and the molecules are joined by weak van derwaals forces which lower its melting point. NaCl having an ionic structure has ionic bond in its structure which are strong and require more energy to break.

4. A fixed mass of gas occupies 200 cm3 at a temperature of 230c and a pressure of 740 mm Hg. Calculate the volume of the gas at -250c and 790 mm Hg pressure (3mks)

$V_1 = 200 cm^3$ $V_2 =$

$T_1 = 23°C + 273 = 296K$ $T_2 = -25°C + 273 = 248K$

$P_1 = 740 mm Hg$ $P_2 = 790 mm Hg$

$$\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2} \cdot \frac{248 \times 200 \times 740}{296 \times 790} = \frac{V_2 \times 790 \times 248}{248 \times 790}$$

$$V_2 = 156.96 cm^3$$

5) The empirical formula of lead(II) oxide was determined by passing excess dry hydrogen gas over 6.69g of heated lead(II) oxide.

a) What was the purpose of using excess dry hydrogen gas? (1mk)

To ensure that hydrogen had completely reacted with lead (II) oxide.

b) The mass of lead was found to be 6.21g. Determine the empirical formula of the oxide.

(Pb =207.0 0 = 16.0) (3mks)

Element	Mass	RMM	moles
Lead	6.21g	207	0.03
Oxygen	0.48	16	0.03

Pb : O
0.03 : 0.03   = PbO
1 : 1

6)100 cm3 of ozone (O3) diffused through a certain apparatus in 96 seconds. Calculate the time taken by 100 cm3 of carbon (IV) oxide to diffuse through the same apparatus under same conditions. (O = 16.0 C = 12.0) (3 mks)

$O_3 = 100 cm^3$ $CO_2 = 100 cm^3$ $\left(\frac{96}{x}\right)^2 = \left(\sqrt{\frac{48}{44}}\right)^2$

$T = 96 sec$ $T = ?$

$RMM = 48$ $RMM = 44$ $\frac{44 \times 9216}{48 \cdot x^2} = \frac{48 \times x^2}{44 \cdot 48}$

$$\frac{T_A}{T_B} = \sqrt{\frac{RMM_A}{RMM_B}}$$

$x^2 = 91.91 sec$ $T_{CO_2} = 91.91 sec$

7) Explain why molten calcium chloride and magnesium chloride conducts electricity while carbon tetrachloride and silicon tetrachloride do not. (2 mks)

Carbon tet and silicon tetrachloride exists as molecular structures and have not delocalised electrons while Molten calcium and magnesium chloride have mobile delocalised electrons responsible for conductivity

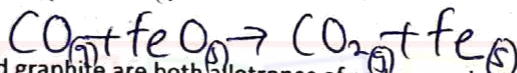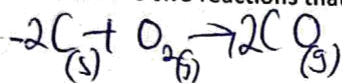8) a) The set up below was used on a sample of an iron iii oxide. Study it and answer the questions that follow.
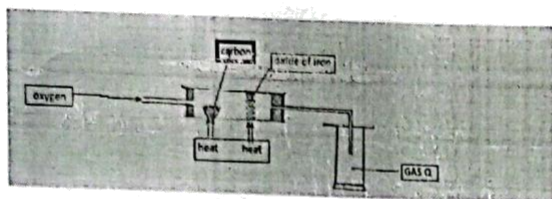
i) Identify the gas Q collected (½ mk)

Carbon (14) oxide.

ii) What observation is made on the excess iron (III) oxide? (1 mk)

Brown iron (III) oxide turns to brown.

iii) Write equations for the two reactions that take place in the combustion tube (2mk)

$$2C_{(s)} + O_{2(g)} \rightarrow 2CO_{(g)}$$

$$CO_{(g)} + fe O_{(s)} \rightarrow CO_{2(g)} + fe_{(s)}$$

b) Diamond and graphite are both allotropes of carbon explain using structure and bonding why diamond is hard while graphite is soft. (2mk)

Diamond is hard due to uniformity of covalent bonds between the atoms throughout the structure while Graphite is made up of hexagonal layers which are held by weak van der waals forces, making it soft

c) The diagram below was used by a form I student to prepare a certain gas. Study it and answer the questions that follow.
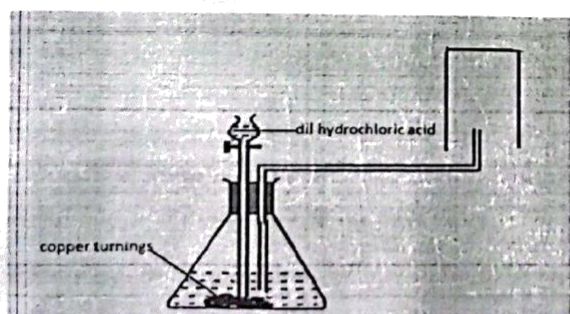
i) Identify two mistakes in the set up above. (2mk)

1. The delivery tube should not be dipped in the solution.

2. The dropping funnel should not be immersed in the soln.

ii) Identify one of its physical properties apart from its solubility in water and one of its uses (2 mk)

Property

Is acidic and changes ~~blue~~ moist blue litmus paper red.
Is less denser than air.

Use –

Mixed with oxygen and used in welding.

d) A student was supplied with a colourless liquid suspected to be water describe one chemical test that could have been used to show that the liquid was water (1½ mk)

Add the liquid to anhydrous copper (II) sulphate it turns from white powder to blue crystals.

Anhydrous Cobalt (II) chloride ~~thi~~ turns from blue to pink.

9) A student accidentally added potassium chloride into a mixture of zinc oxide and iron (III) chloride. Describe how you can help him obtain pure potassium chloride from the mixture. (3mks).

Heat the mixture to sublime iron (III) chloride.
Add water to a mixture of potassium chloride and zinc oxide.
KCl dissolves while ZnO doesnot. filter the solution and obtain the potassium chloride soln as the filtrate and ZnO as the residue. Heat to evaporation and obtain the potassium chloride crystals.

10) Using dots (.) and crosses (X) to represent electrons show bounding in phosphonium ion (PH4+) (2mks)

$P = 2 \cdot 8 \cdot 5$
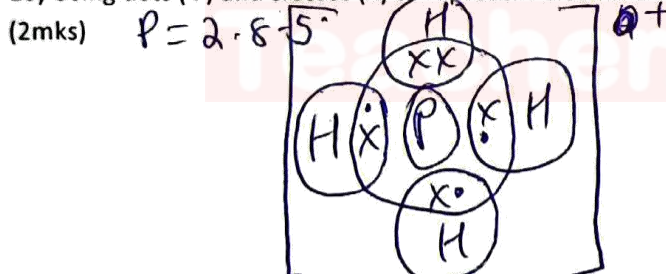
11) In the manufacture of sodium carbonate by solvay process, ammoniated brine trickles down the carbonator while carbon (IV) oxide rise up.

(a) What is ammoniated brine.(1 mark)

A mixture of Ammonia and At Sodium Chloride/Brine.

(b) What is the main source of carbon (IV) oxide in the above process.(1 mark)

kiln
— Decomposition of Calcium carbonate.
— Burning Coke in oxygen.

c) State two recyclable wastes in the solvey process (2 mks)

Ammonia.
+ Water.
Calcium chloride.

CamScanner

12) Air is a mixture of different components. Identify;

i)A compound that turn lime water to a white precipitate[1 mk]

Carbon (IV) oxide.

ii)A compound that changes cobalt(ii)chloride from blue to pink [1 mk]

Water.

iii) A diatomic gas that has triple bond[1 mk]

Nitrogen.