

233/2
Paper 2

CHEMISTRY
(Theory)

JOINT -MOCK
June 2026 – Time: 2 hours

Admission No. Adm .No.....

School.....Date.....Signature.....

Marking scheme

Instructions to candidates

- Write your Admission Number, Index Number and school in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- Answers all the questions in the spaces provided in the question paper.
- This paper consists of 12 printed pages.
- Mathematics tables and silent electronic calculators maybe used.
- All working must be clearly shown where necessary.
- Candidates should check the question paper to ensure that all pages are printed as indicated

FOR EXAMINER USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	13	
2	11	
3	12	
4	10	
5	11	
6	13	
7	10	
Total	80	

1. a) The grid below represents part of a periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of elements.

					B	Y	
Z			X	L	D	T	M
W	Q						
	R						

- i). Identify the most reactive non-metal. (1 mark)
Y / Fluorine ✓ 01
- ii). Which of the metal is the most reactive? Explain (1 mark)
W / K ✓ larger & outermost electron loosely held ✓ 1
- iii. What name is given to the family of elements to which Y and T belong? (1 mark)
Halogens ✓ 1
- iv. Give reasons for the following (1 mark)
- a) Atomic radius of Q is greater than that of X.
Has fewer protons & weaker effective nuclear charge ✓ 1
- b) Ionic radius of T is bigger than its atomic radius
Reacts by gaining $\frac{1}{2}$ electron leading to increasing electron-electron repulsion ✓ 1
- v. Give an element that does not form compounds under ideal conditions. Explain? (2 marks)
M / stable electron configuration, 1 to 2 ✓ 02
- vi) Give formula of compound formed between R and B. (1 mark)
R₂B / CaO ✓ 1

- b) Study the table below and answer the questions that follow.

Substance	A	B	C	D	E	F
Melting point ($^{\circ}\text{C}$)	801	113 119	39	5	-101	1356
Boiling Point ($^{\circ}\text{C}$)	1410	445	457	54	-36	2860
Electrical conductivity (solid)	Poor	Poor	Good	Poor	Poor	Poor
Electrical conductivity (liquid)	Good	Poor	Good	Poor	Poor	Poor

- i. Identify a substance with
- a) Giant metallic structure (1 mark)
C ✓ 1
- b) i) Has a molecular structure and exists in gaseous state at room temperature and pressure. (1 mark)
E ✓ 1

ii) Suggest a reason why substance B has two melting points. (1 mark)

It is an allotrope ✓

iii. Substance A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current. (2 marks)

In A - In solid state the ions are fixed in one position but in liquid state the ions are mobile ✓

2. a) Determine the oxidation states of the element indicated in brackets.

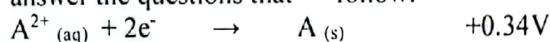
i) MnO_4^- (Mn) (1 mark)

$$\text{Mn} + 4(-2) = -1 \Rightarrow \text{Mn} = +7 \quad \checkmark$$

ii) $\text{K}_2\text{Cr}_2\text{O}_7$ (Cr) (1 mark)

$$2(+1) + 2(\text{Cr}) + 7(-2) = 0 \Rightarrow \text{Cr} = +6 \quad \checkmark$$

b) Below is a list of standard reduction potentials of some elements. Use it to answer the questions that follow.



i) Identify the strongest reducing agent. (1 mark)

$\text{L}(\text{s})$ ✓

ii) Explain why a solution containing A^{2+} ions cannot be stored in a container made of metal N. (1 mark)

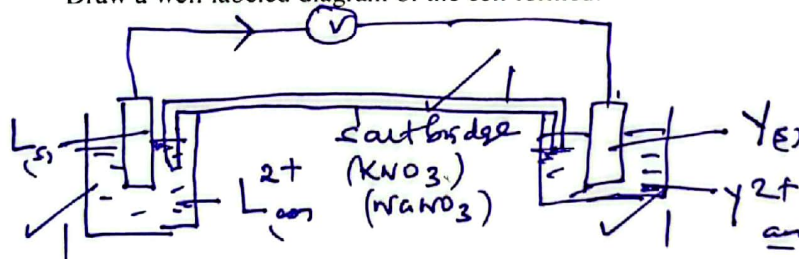
Reaction will take place ✓

$$0.34 + 0.76 = +1.10 \quad \checkmark$$

iii) The half cells of Y and L were combined to form an electrochemical cell

I. Draw a well labeled diagram of the cell formed.

(3 marks)



II. Calculate the e.m.f of the cell formed above.

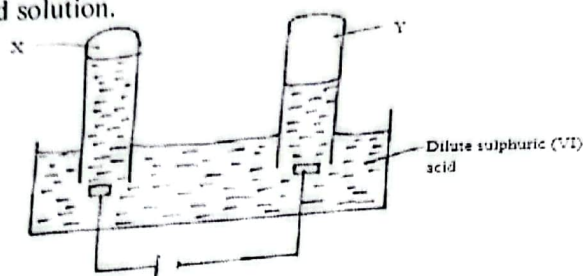
(1 mark)

$$E_{\text{cell}} = E_{\text{red}} - E_{\text{ox}}$$

$$= 0.88 - (-2.16) \quad \checkmark$$

$$= +3.04\text{V} \quad \checkmark$$

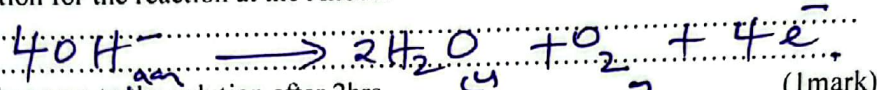
c) The diagram below shows the set up used to investigate electrolysis of dilute sulphuric (VI) acid solution.



i) Identify gases X and Y
 X..... Hydrogen / H_2 $\frac{1}{2}$ (1 mark)

Y..... Oxygen / O_2 $\frac{1}{2}$ (1 mark)

ii) Write an equation for the reaction at the Anode.



iii) Explain what happens to the solution after 2hrs.

Concentration will increase if electrolysis involve the removal of water

3. a) Name the compounds below.

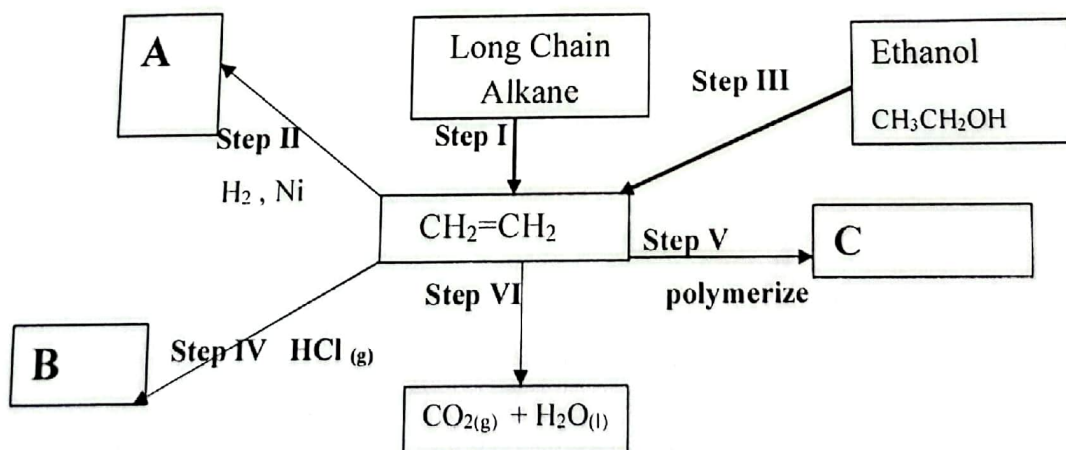
i) C_6H_{10}

Hex-1-yne / Hex-2-yne / hex-3-yne / Hexene (1 mark)

ii) CH_3CHCH_2

prop-1-ene (1 mark)

b) Study the flow chart below and answer the questions that follow:



i) Name the process taking place in Step I

Cracking (1 mark)

- ii) Describe a chemical test that can be used to distinguish between compound A and $\text{CH}_2=\text{CH}_2$ (2 marks)

Ignite the two in separate spatula. A burns with a blue non sooty flame while $\text{CH}_2=\text{CH}_2$ burns with a yellow sooty flame.

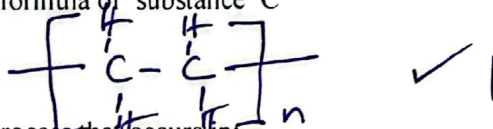
or
Each compound add 2-drops of Bromine water, A O_2 does not decolourise while $\text{CH}_2=\text{CH}_2$ decolourises ✓

- iii) Give the name of the following compounds:

I) A Ethane | C_2H_6 ✓ | (1 mark)

II) B chloroethane | $\text{C}_2\text{H}_5\text{Cl}$ ✓ | (1 mark)

- iv) Give the structural formula of substance C (1 mark)



- v) Name the type of process that occurs in:

I) Step II Hydrogenation ✓ | (1 mark)

II) Step VI combustion ✓ | (1 mark)

- vi) Give the reagents and the conditions necessary for Step III (2 marks)

Reagents: Conc. H_2SO_4 ✓ |

Conditions: temp of 180°C ✓ |

4. a) What is meant by molar heat of combustion? (1 mark)

Enthalpy change when 1 mol of a substance completely burns in oxygen ✓ |

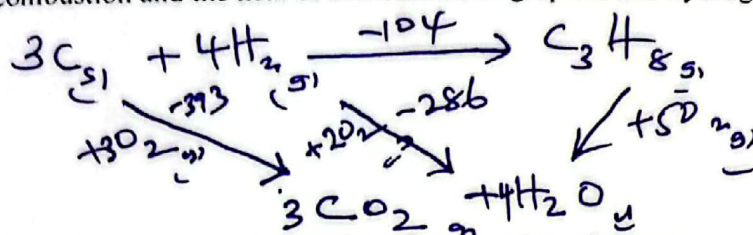
- b) State the Hess's law. (1 mark)

states that the energy used in converting reactants in a chemical reaction to products is the same regardless of route followed ✓ |



ignore symbols but penalise fully if not balanced

- ii) Draw an energy cycle diagram that links the heat of formation of propane with its heat of combustion and the heat of combustion of graphite and hydrogen. (2marks)



- iii) Calculate the standard enthalpy of combustion of propane.

$$\begin{aligned} -104 &= 3(-39.3) + 4(-286) + -x \\ -104 &= -117.9 + -1144 - x \\ -104 &= -2323 - x \quad \checkmark \quad x = -2219.1 \end{aligned}$$

- d) Other than the enthalpy of combustion, state one other factor which should be considered when choosing a fuel. (1 mark)

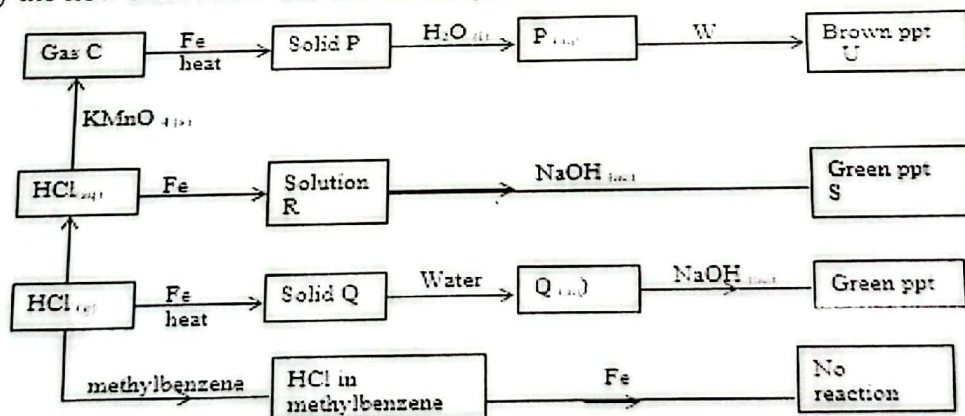
Cost Environmental effect
Availability Any one correct ✓

- e) The molar enthalpies of neutralization of dilute hydrochloric acid and dilute nitric (V) acid are 57.2 kJ mol^{-1} while that of ethanoic acid is $-55.2 \text{ kJ mol}^{-1}$. Explain this observation. (2 marks)

observation. (2marks)

$\text{HCl} / \text{HNO}_3$ is a strong acid dissolves completely producing large amount of H^+ while ethanol is a weak acid dissolves partially to produce fewer H^+

5. Study the flow chart below and answer the questions that follow



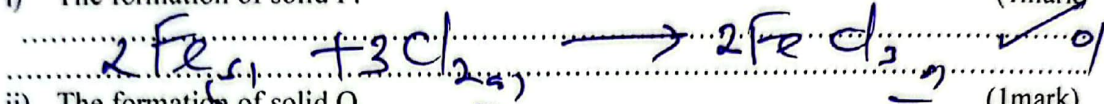
- a) Identify Cl_2 | chlorine gas ✓ (1 mark)
- i) Gas C..... Iron (II) chloride FeCl_2 ✓ (1 mark)
- ii) Solid Q..... FeCl_3 | Iron (III) chloride ✓ (1 mark)

- b) Explain the difference between hydrogen chloride gas in water and hydrogen chloride gas in methylbenzene as shown in the flow chart. (2 marks)
 methylbenzene is non polar cannot dissolve the molecules of HCl hence no H⁺ produced, while H₂O is polar it dissolves the molecules of H₂O HCl to produce H⁺

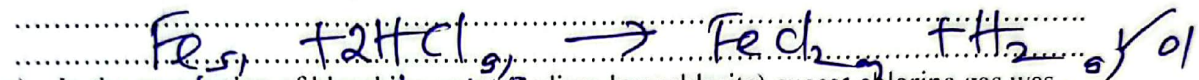
c) Name reagent W. (1 mark)
 sodium hydroxide / ammonia ✓

d) Write the equation for:

i) The formation of solid P. (1 mark)

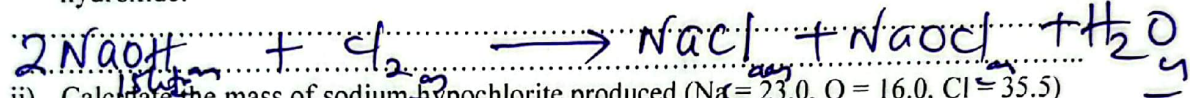


ii) The formation of solid Q. (1 mark)



e) In the preparation of bleaching agent (sodium hypochlorite) excess chlorine gas was bubbled into 15 litres of cold 2M sodium hydroxide.

i) Write the equation for the reaction between chlorine gas and cold dilute sodium hydroxide. (1 mark)



ii) Calculate the mass of sodium hypochlorite produced (Na = 23.0, O = 16.0, Cl = 35.5) (2 marks)

mole of NaOH

$$2 \rightarrow 1.520$$

$$= 30 \text{ moles} \quad \checkmark$$

molar ratio

$$2:1$$

mole of NaOCl

$$= 30/2 = 15 \text{ moles}$$

$$\text{NaOCl} = 74.5 \text{ g}$$

$$15 \times 74.5$$

$$= 1117.5 \text{ g}$$

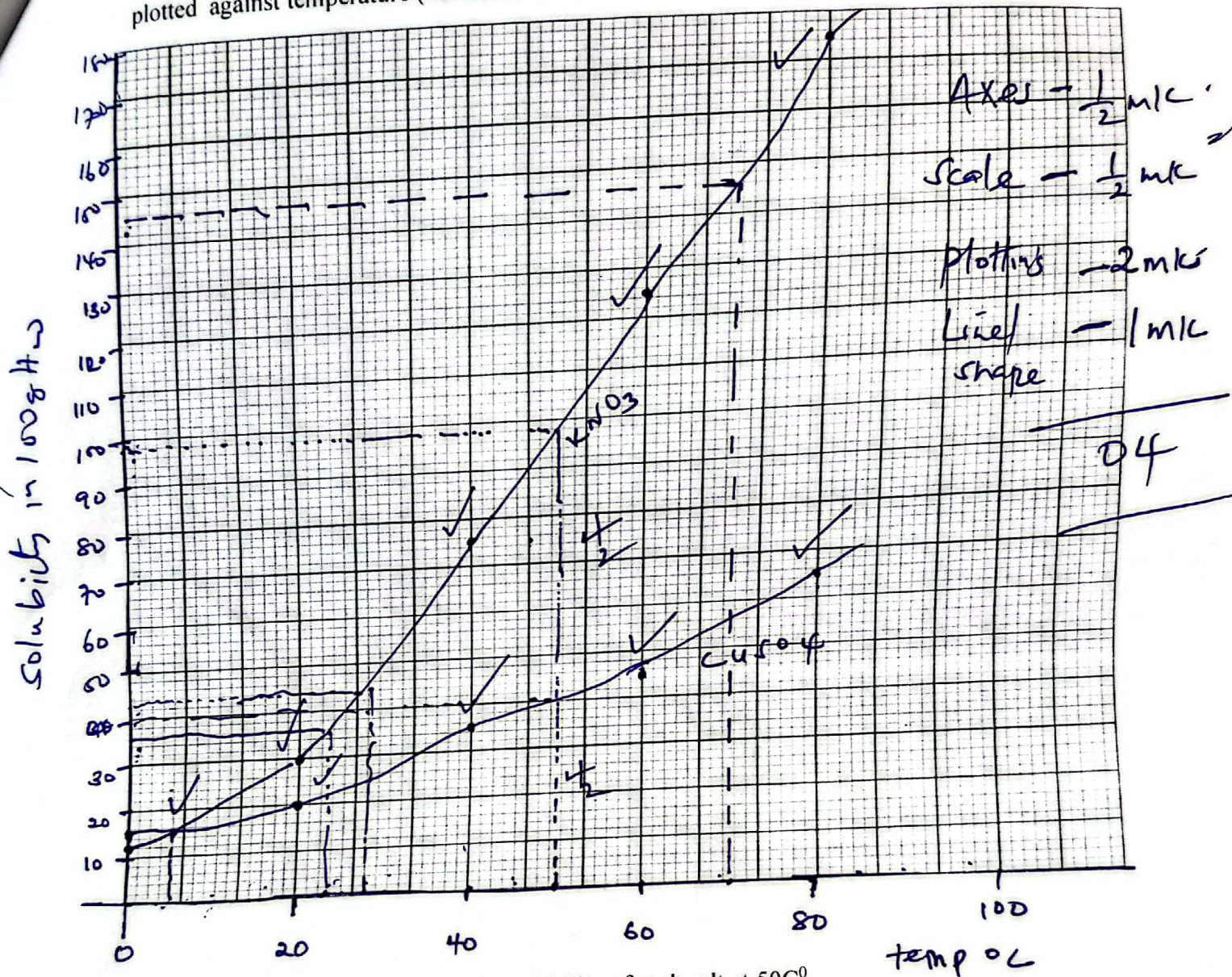
$$= 1.1175 \text{ kg}$$

$$\checkmark$$

6. Solubility of potassium nitrate and copper (II) sulphate were determined at different temperatures. The following data was obtained.

Temperature (°C)		0	20	40	60	80	100
Solubility g / 100g of water	KNO ₃	12	30	75	125	185	250
						175	

b) i). On the grid below, plot solubility curves for both salts: where solubility (vertical axis) is plotted against temperature (horizontal axis) (4 marks)



ii) Determine from the graph the solubility of each salt at 50°C (1 mark)

I) KNO₃

98 g/100g H₂O ± 2

✓ 01

II) CuSO₄

40 g/100g H₂O

(1 mark)

01

iii) At what temperature was the solubility of both salts equal? (1 mark)

53 5°C ± 2

✓ 01

iv) If a hot solution containing 80g of KNO_3 in 100g of water was cooled from 70°C to 25°C ; what mass of crystals would be formed? (2 marks)

$$\begin{array}{r} \text{At } 70^\circ\text{C} = 146 \\ 25^\circ\text{C} = 36 \\ \hline 110\text{g} \end{array}$$

c) i) What is meant by the permanent hardness of water? (1 mark)

hardness which cannot be removed by boiling ✓

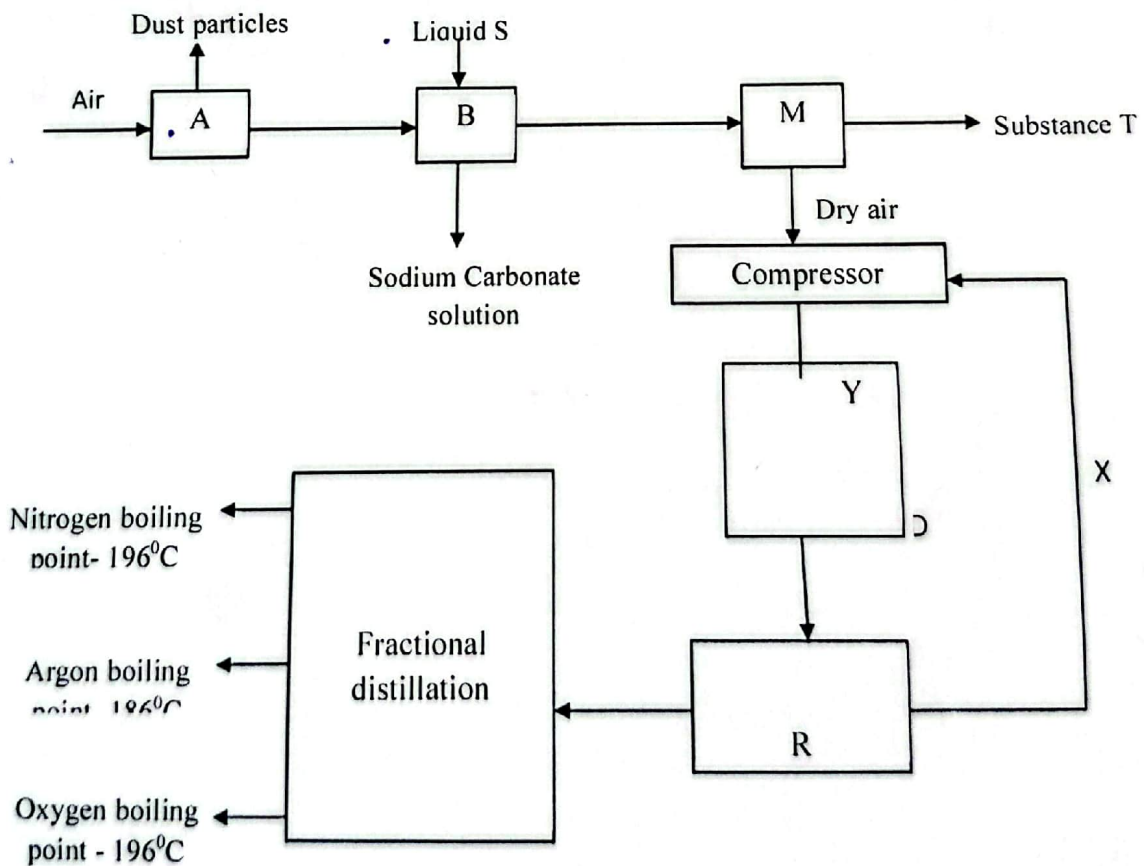
i) State one chemical substance that can be used to remove permanent hardness (1 mark)

Sodium carbonate ✓

ii) State one advantage of hard water. (1 mark)

- stain white clothes ✓ Any 1 correct
- does not form lather easily with soap

7. Fractional distillation of air is used in the industrial manufacture of oxygen. The diagram below shows the process.



a) What processes are taking place in chamber A and M (2 marks)

A.....Filtration.....✓ 1/2

M.....Freezing.....✓ 1/2

b) Name;

(i) Liquid S (1 mark)

.....Sodium hydroxide.....✓ 1

(ii) Substance T (1 mark)

.....water / ice.....✓ 1

c) Give two industrial uses of oxygen gas? (2 marks)

.....Welding.....✓

.....Hospital with patients having difficulty in breathing.....✓

.....mountain climbers.....✓

Any 2 - correct ✓ 02

d) In the laboratory preparation of oxygen, manganese (iv) oxide and hydrogen peroxide are used. Write an equation to show how oxygen gas is formed. (1 mark)

..... $2H_2O_2 \xrightarrow{MnO_2} O_2 + 2H_2O$✓ 01

e) An investigation was carried out using the set-up below. Study it and answer the questions that follow.

