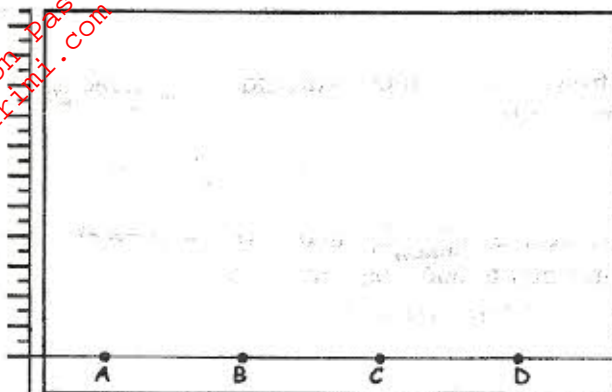# CHEMISTRY PAPER 2 (233/2)

1. (a) The diagram below shows spots of pure substances **A, B** and **C** on a chromatography paper. Spot **D** is that of a mixture.

After development, **A, B** and **C** were found to have moved 8 cm, 3 cm and 6 cm respectively. **D** had separated into two spots which had moved 6 cm and 8 cm.

(i) On the diagram,

    I   Label the baseline (origin)   (1 mark)

    II   Show the positions of all the spots after development.   (3 marks)

(ii) Identify the substances present in the mixture **D**.   (2 marks)

....

....

(b) Describe how solid ammonium chloride can be separated from a solid mixture of ammonium chloride and anhydrous calcium chloride.   (2 marks)

....

....

(c) The table below shows liquids that are miscible and those that are immiscible.

Liquid	L_3	L_4
L_1	Miscible	Miscible
L_2	Miscible	Immiscible

Use the information given to answer the questions that follow.

(i) Name the method that can be used to separate L_1 and L_3 from a mixture of the two.   (1 mark)

....

(ii)   Describe how a mixture of L_2 and L_4 can be separated   (2 marks)

....

....

2.   (a)   Name one raw material from which sodium hydroxide is manufactured.   (1 mark)

....

(b) Sodium hydroxide pellets were accidentally mixed with sodium chloride. 17.6 g of the mixture were dissolved in water to make one litre of solution. 100 cm³ of the solution was neutralised by 40 cm³ of 0.5 M sulphuric acid.

(i)   Write an equation for the reaction that took place.   (1 mark)

....

....

(ii)   Calculate the:

I   number of moles of the substance that reacted with sulphuric acid   (2 marks)

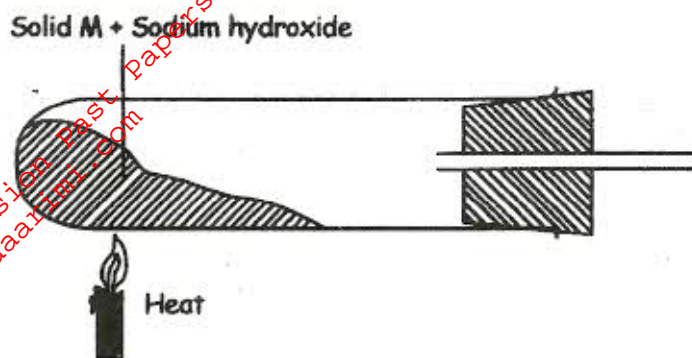..

....

....

II   number of moles of the substance that would react with sulphuric acid in the one litre of solution.   (1 mark)

....

....

III   mass of the unreacted substance in the one litre of solution.   (2 marks)
(H = 1.0 ; Na = 23.0 ; Cl = 35.5 ; O = 16.0)

....

....

....

(c) The diagram below shows an incomplete set-up used to prepare and collect ammonia gas.

Solid M + Sodium hydroxide

Heat

(i) Name solid M. (1 mark)

....

(ii) Complete the diagram to show how a dry sample of ammonia gas can be collected. (3 marks)

(d) In an experiment, excess ammonia gas was passed over heated copper (II) oxide in a combustion tube.

(i) State the observation that was made in the combustion tube at the end of the experiment (1 mark)

....

(ii) What property of ammonia is shown in the above reaction? (1 mark)

....

(iii) Name **one** use of ammonia (1 mark)

....

3. (a) The table below shows the standard reduction potentials for four half-cells. Study it and answer the questions that follow. (Letters are not the actual symbols of the elements).

$$E^\theta \text{ (Volts)}$$

$$F_{2(aq)} + 2e \rightarrow 2F^-_{(aq)} \quad ; +0.54$$

$$G^{2+}_{(aq)} + 2e \rightarrow G_{(s)} \quad ; -0.44$$

$$H^{2+}_{(aq)} + 2e \rightarrow H_{(s)} \quad ; +0.34$$

$$2J^+_{(aq)} + 2e \rightarrow J_{2(g)} \quad ; 0.00$$

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

....

(ii) Write the equation for the reaction which takes place when solid **G** is added to a
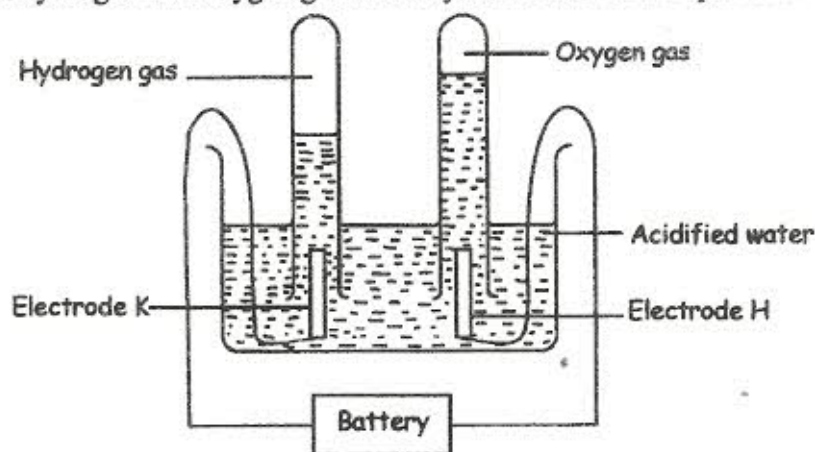solution containing H²⁺ ions.   (1 mark)

....

....

(iii) Calculate the E^θ value for the reaction in (ii) above   (1 mark)

....

....

(b) The diagram below shows the apparatus that can be used to electrolyse acidified water to
obtain hydrogen and oxygen gases. Study it and answer the questions that follow.

(i) Identify the electrode at which oxidation takes place.   (1 mark)

....

(ii) Give a reason why it is necessary to acidify the water.   (1 mark)

....

(iii) Explain why hydrochloric acid is not used to acidify the water.   (2 marks)

....

....

(c) During electrolysis of aqueous copper (II) sulphate, 144750 coulombs of electricity were used. Calculate the mass of copper metal that was obtained.
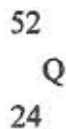(Cu = 64; 1 Faraday = 96500 coulombs) (3 marks)

....

....

....

4. (a) An atom Q can be represented as

$$^{52}_{24}Q$$

What does the number 52 represent? (1 mark)

....

(b) Study the information in the table below and answer the questions that follow.
(Letters are not the actual symbols of the elements).

Element	Electronic arrangement of stable ion	Atomic radius (nm)	Ionic radius (nm)
N	2.8.8	0.197	0.099
P	2.8.8	0.099	0.181
R	2.8	0.160	0.065
S	2.8	0.186	0.095
T	2	0.152	0.068
U	2.8	0.072	0.136

(i) Write the formula of the compound formed when N reacts with P. (Atomic numbers are N = 20; P = 17.) (1 mark)

....

(ii) Identify the elements which belong to the third period of the periodic table.
Explain (2 marks)

....

....

(iii) Which of the elements identified in b (ii) above comes first in the third period? Explain (2 marks)

....

....

(iv) Select two elements which are non-metals (1 mark)

....

(c) The table below gives some properties of substances I, II, III and IV. Study it and answer the questions that follow.

Substance	Electrical Conductivity		M.P (°C)	B.P (°C)
	Solid	Molten		
I	Does not conduct	Conducts	801	1420
II	Conducts	Conducts	650	1107
III	Does not conduct	Does not conduct	1700	2200
IV	Does not conduct	Does not conduct	113	440

(i) What type of bonding exists in substances I and II? (2 marks)

I ....

II ....

(ii) Which substance is likely to be sulphur? Explain (2 marks)

....

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....

5. In an experiment, a piece of magnesium ribbon was cleaned with steel wool. 2.4 g of the clean magnesium ribbon was placed in a crucible and completely burnt in oxygen. After cooling, the product weighed 4.0 g.

(a) Explain why it was necessary to clean the magnesium ribbon. (1 mark)

....

....

(b) What observation was made in the crucible after burning? (1 mark)

....

(c) Why was there an increase in mass? (1 mark)

....

....

(d) Write the equation for the reaction which took place in the crucible. (1 mark)

....

....

(e) The product in the crucible was shaken with water and filtered. Explain the observation which was made when blue and red litmus papers were dropped into the filtrate

.... (3 marks)

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(f) Calculate the volume of oxygen gas used during the burning. ($0 = 16.0$; Molar volume of a gas is 24,000 cm³ at room temperature). (3 marks)

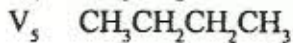...

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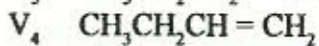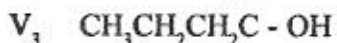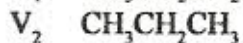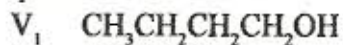...

6. (a) The list below gives the formulae of some organic compounds. Use it to answer the questions that follow.

V_1 $CH_3CH_2CH_2CH_2OH$

V_2 $CH_3CH_2CH_3$

V_3 $CH_3CH_2CH_2\overset{\overset{\displaystyle O}{\|}}{C} - OH$

V_4 $CH_3CH_2CH = CH_2$

V_5 $CH_3CH_2CH_2CH_3$

(i) Select two compounds which,

    I   are **not** hydrocarbons   (1 mark)

....

....

    II   belong to the same homologous series.   (1 mark)

....

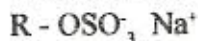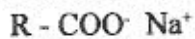...

(ii) Identify the compound that is likely to undergo polymerisation. Give a reason for your answer.   (2 marks)

....

(b) The structures below represent two cleansing agents.

R - COO⁻ Na⁺

R - OSO⁻₃ Na⁺

In the table below, give one advantage and one disadvantage of using each one of them.

	Advantage	Disadvantage
R - COO⁻ Na⁺		
R - OSO⁻₃ Na⁺		

(c) Under certain conditions, ethanoic acid ($C_2H_4O_2$) and ethanol (C_2H_5OH) react to form a sweet smelling compound.

(i) What is the general name of the compounds to which the sweet smelling compound belongs?   (1 mark)

....

(ii) Write the formula of the sweet smelling compound.   (1 mark)

....

(iii) Give one use of ethanoic acid other than the formation of the sweet smelling compounds.   (1 mark)

....

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(iv) Write the equation for the reaction between dilute ethanoic acid and solid potassium carbonate (1 mark)

....

....

(d) Fibres are either synthetic or natural. Give one;

(i) example of a natural fibre (1 mark)

....

(ii) advantage synthetic fibres have over natural fibres (1 mark)

....

7. (a) Below is a simplified diagram of the Downs Cell used for the manufacture of sodium. Study it and answer the questions that follow.
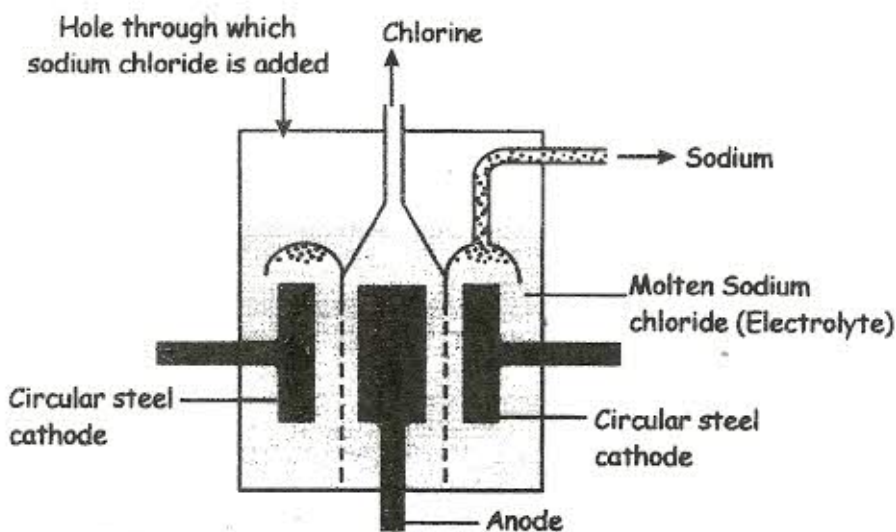
(i) What material is the anode made of? Give a reason. (2 marks)

....

....

(ii) What precaution is taken to prevent chlorine and sodium from re-combining? (1 mark)

....

(iii) Write an ionic equation for the reaction in which chlorine gas is formed.

(1 mark)

....

(b) In the Downs process (used for manufacture of sodium), a certain salt is added to lower the melting point of sodium chloride from about 800^0C to about 600^0C.

(i) Name the salt that is added. (1 mark)

....

(ii) State why it is necessary to lower the temperature. (1 mark)

....

(c) Explain why aqueous sodium chloride is **not** suitable as an electrolyte for the manufacture of sodium in the Downs process. (2 marks)

....

....

....

(d) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides. (2 marks)

....

....

(e) State two uses of sodium metal (2 marks)

....

....

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