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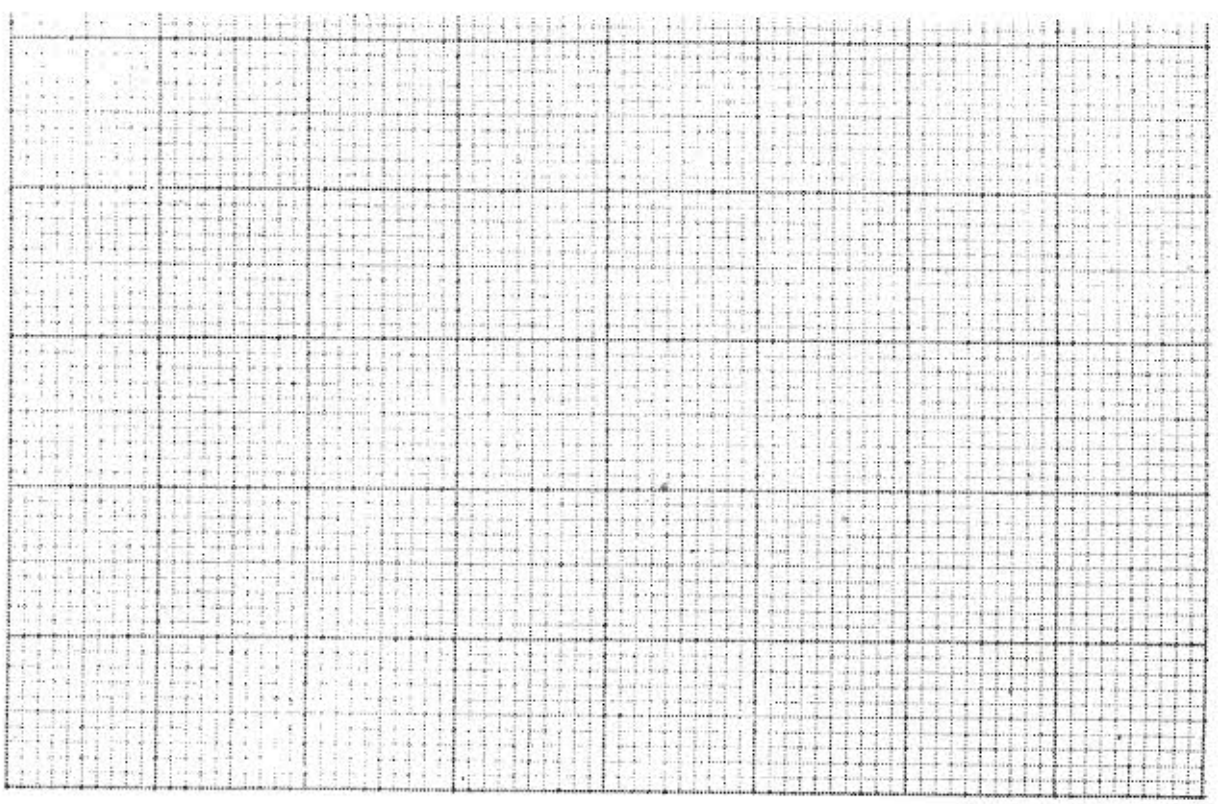
K.C.S.E CHEMISTRY PAPER 233/2 2001

1. In an experiment to study the rate of reaction between duralumin (an alloy of aluminium, magnesium and copper) and hydrochloric acid, 0.5g of the alloy were reacted with excess 4M hydrochloric acid. The data in the data below was recorded. Use it to answer the questions that follow.

Time (minutes)	Total volume of gas (cm^3)
0	0
1	220
2	410
3	540
4	620
5	640
6	640
7	640

a) i) On the grid provided, plot a graph of total volume of gas produced (vertical axis) against time (3 marks)



ii) From the graph, determine the volume of gas produced at the end of 2½ minutes (1 mark)

b) Determine the rate of reaction between the 3rd and 4th minute (1 mark)

_____

_____

c) Give a reason why some solid remained at the end of the experiment (2 marks)

_____

_____

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d) Given that 2.5cm³ of the total volume of the gas was from the reaction between magnesium and aqueous hydrochloric acid, calculate the percentage mass of aluminium present in 0.5g of an alloy

e) State two properties of duralumin that make it more suitable than pure aluminium in aeroplane construction (2 marks)

2. a) In which homologous series do the following compounds belong? (2 marks)

i) CH_3CCH

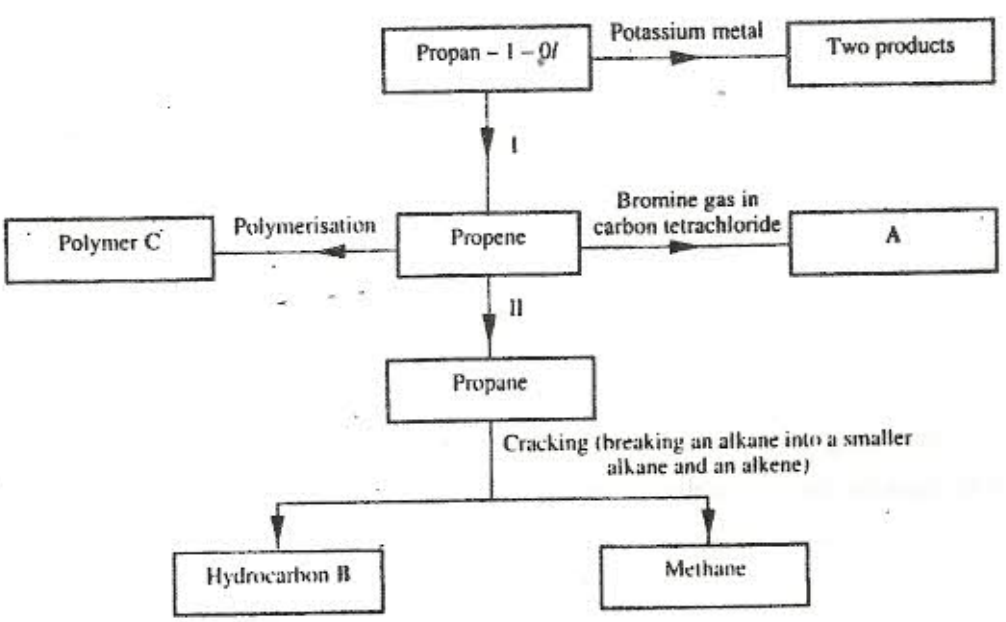
ii) CH_3CH_2COOH

b) Raw rubber is heated with sulphur in the manufacture of natural rubber.

i) What name is given to the process? (1 mark)

ii) Why is the process necessary? (1 mark)

c) Study the scheme given below and answer the questions that follow



i) Write an equation for the reaction between propan-1-0/ and potassium metal (1 mark)

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ii) Name processes I and II

I _____

II _____

iii) Identify the products A and B

A _____

B _____

iv) Name **one** catalyst used in process II

_____

v) Draw the structural formula of the repeating unit in the polymer C (1 mark)

d) State two industrial uses of methane (2 marks)

_____

_____

3. a) Study the standard electrode potentials for the half-cells given below and answer the questions that follow. (The letters do not represent the actual symbols of the elements)

	E^{θ}(volts)
$N^{+}_{(aq)} + e^{-} \rightleftharpoons N_{(s)}$	–2.92
$J^{+}_{(aq)} + e^{-} \rightleftharpoons J_{(s)}$	+0.52
$K^{+}_{(aq)} + e^{-} \rightleftharpoons \frac{1}{2}K_{2(g)}$	0.00
$\frac{1}{2}G_{2(aq)} + e^{-} \rightleftharpoons G^{-}_{(aq)}$	+1.36
$M^{2+}_{(aq)} + 2e^{-} \rightleftharpoons M_{(aq)}$	–0.44

i) Identify the strongest oxidising agent. Give a reason for your answer (2 marks)

_____

_____

ii) Which two half-cells would produce the highest potential difference when combined? (1 mark)

_____

_____

iii) Explain whether the reaction represented below can take place (3 marks)

$2N^{+}_{(aq)} + M_{(s)} \rightarrow 2N_{(s)} + M^{2+}_{(aq)}$

_____

_____

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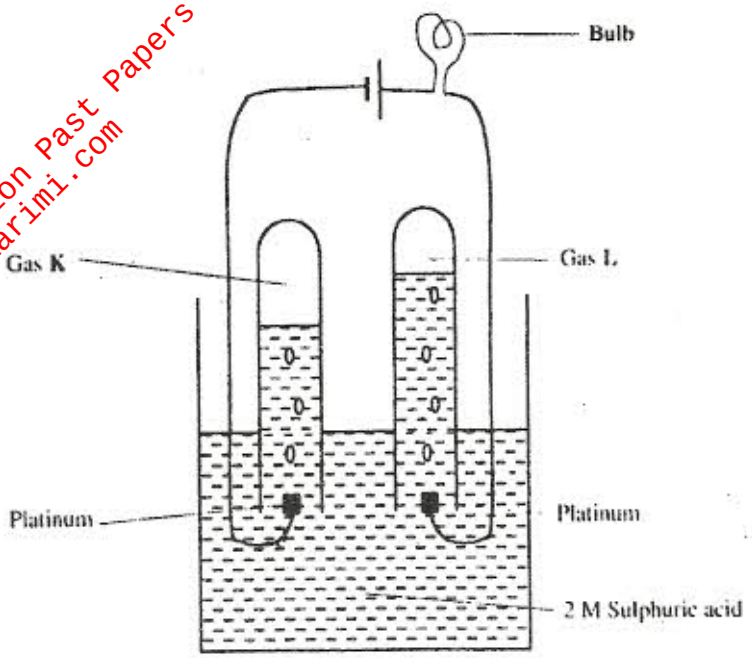
b) $100cm^3$ of 2M sulphuric acid was electrolysed using the set up represented by the diagram below



i) Write an equation for the reaction that produces gas L (1 mark)

ii) Describe how gas K can be identified (2 marks)

iii) Explain the difference in:
I the volumes of the gases produced at the electrodes (3 marks)

II brightness of the bulb if $100cm^3$ of 2M ethanoic acid was used in place of sulphuric acid (2 marks)

4. a) Fractional distillation of liquid air usually produces nitrogen and oxygen as the major products.
i) Name **one** substance that is used to remove carbon dioxide from the air before it is changed into liquid (1 mark)

ii) Describe how nitrogen gas is obtained from the liquid air
(Boiling points Nitrogen = –196°C, Oxygen = –183°C) (2 marks)

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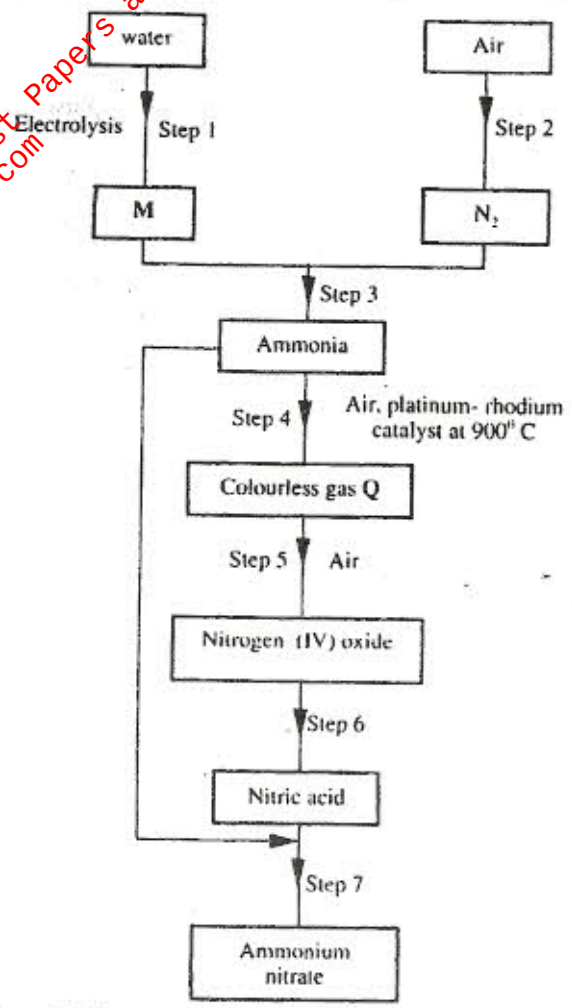
b) Study the flow chart below and answer the questions that follow



i) Name element M (1 mark)

ii) Why is it necessary to use excess air in step 4? (1 mark)

iii) Identify gas Q (1 mark)

iv) Write an equation for the reaction in step 7 (1 mark)

v) Give one use of ammonium nitrate (1 mark)

c) State and explain in the observations that would be made if a sample of sulphur is heated with concentrated nitric acid (3 marks)

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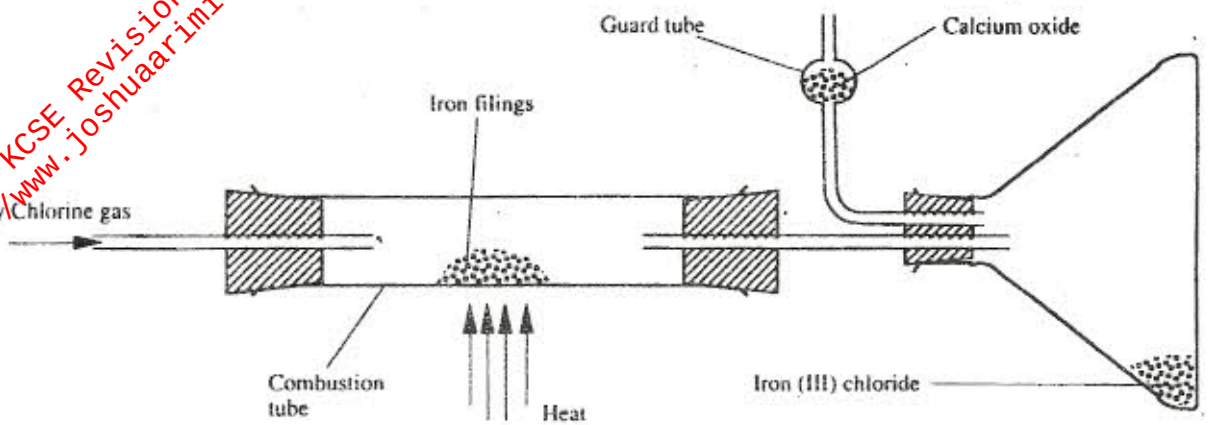
5. a) Give the name of one reagent which when reacted with concentrated hydrochloric acid produces chlorine gas (1 mark)

b) A student set out to prepare iron (III) chloride using the apparatus shown in the diagram below



i) Explain why:
I it is necessary to pass chlorine gas through the apparatus before heating begins (2 marks)

II calcium oxide would be preferred to calcium chloride in the quard tube (2 marks)

ii) What property of iron (III) chloride makes it possible to be collected as shown in the diagram (1 mark)

iii) Write an equation for one chemical reaction that took place in the quard tube (1 mark)

iv) The total mass of iron (III) chloride formed was found to be 0.5g. Calculate the volume of chlorine gas that reacted with iron
(Fe = 56.0, Cl = 35.5 and Molar gas volume at 298K is 24,000cm^3) (4 marks)

c) When hydrogen sulphide gas was passed through a solution of iron (III) chloride the following observations were made:
i) the colour of the solution changed from reddish-brown to green and
ii) a yellow solid was deposited
Explain the observations (2 marks)

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d) State and explain in the observations that would be made if a moist blue litmus paper was placed in a gas jar full of chlorine gas (2 marks)

6. a) Study the information in the table below and answer the questions that follow (The letters do not represent the actual symbols of the elements)

Element	Electronic configuration	Ionisation energy $kJmol^{-1}$
P	2.1	519
Q	2.8.1	494
R	2.8.8.1	418

i) What is the general name given to the group in which elements P, Q and R belong? (1 mark)

ii) What is meant by ionisation energy (1 mark)

iii) Explain why element P has highest ionisation energy (1 mark)

iv) When a piece of element Q is placed on water, it melts and a hissing sound is produced as it moves on the surface of the water. Explain these observations (3 marks)

v) Write an equation for the reaction between element Q and water (1 mark)

b) Distinguish between a strong and a weak base. Give an example of each (2 marks)

c) Neutralisation is one of the methods of preparing salts

i) What is meant by neutralisation? (1 mark)

ii) Describe how you would prepare crystals of sodium nitrate starting with $200cm^3$ of 2M sodium hydroxide (3 marks)

iii) Write an equation for the reaction that takes place when a solid sample of sodium nitrate is heated (1 mark)

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