4.5.2 Chemistry Paper 2 (233/2)

1. (a) Alkanes are said to be saturated hydrocarbons.

(i) What is meant by saturated hydrocarbons. (1 mark)

(ii) Draw the structure of the third member of the alkane homologous series and name it. (2 marks)

(b) When the alkane, hexane, is heated to high temperature, one of the products is ethene.

(i) Write the equation for the reaction. (1 mark)

(ii) Name the process described in (b). (1 mark)

(c) Study the flow chart in **Figure 1** and answer the questions that follow.

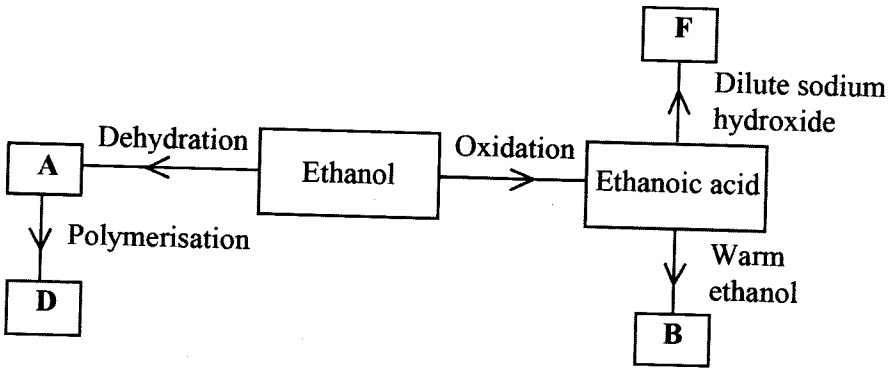

Figure 1

(i) Identify **A**. (1 mark)

(ii) State **one** physical property of **B**. (1 mark)

(iii) Draw the structure of **D**. (1 mark)

(iv) Give a reason why **D** pollutes the environment. (1 mark)

(v) Write an equation for the formation of **F**. (1 mark)

(d) Describe an experiment which can be used to distinguish butene from butanol. (2 marks)

2. (a) Zinc occurs mainly as zinc blende. Name **one** other ore from which zinc can be extracted. (1 mark)

(b) The flow chart in **Figure 2** shows the various stages in the extraction of zinc metal. Study it and answer the questions that follow.

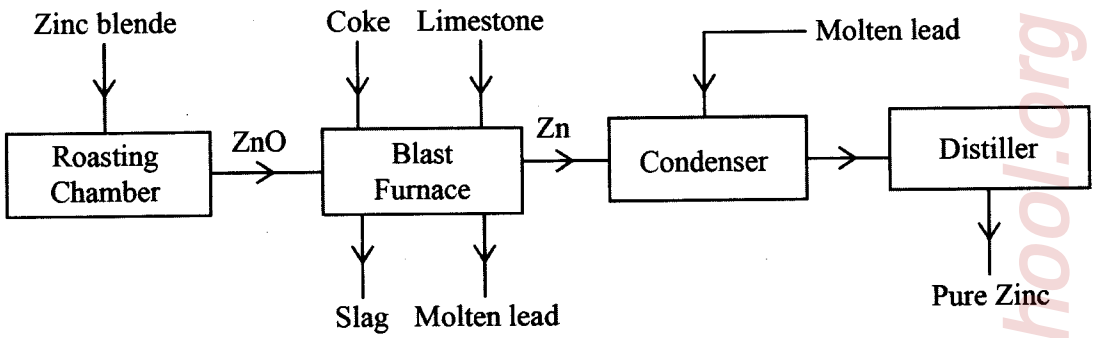

Figure 2

(i) Write an equation for the reaction which occurs in the roasting chamber. (1 mark)

(ii) Describe the process that takes place in the blast furnace. (3 marks)

(iii) Explain why molten lead is added to the condenser. (1 mark)

(iv) State **two** uses of zinc. (1 mark)

(v) Give **one** reason why the extraction of zinc causes pollution to the environment. (1 mark)

(c) Explain the observations made when zinc metal is added to hot sodium hydroxide. (2 marks)

3. **Figure 3** is a flow chart that shows the process that occurs in the manufacture of nitric(V) acid.

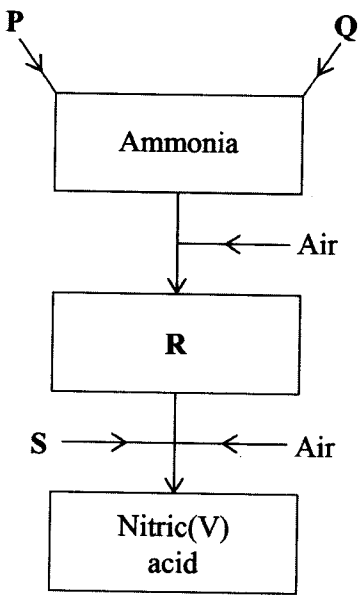

Figure 3

(a) Name substance **P**, **Q**, **R** and **S**.

P ..... (1 mark)

Q ..... (1 mark)

R ..... (1 mark)

S ..... (1 mark)

(b) To obtain substance **R**, ammonia is heated at 900 °C in the presence of air and a catalyst. The product is then cooled in air.

(i) Name the catalyst for the reaction. (1 mark)

(ii) Write the equations for the two reactions described in (b). (2 marks)

(iii) Other than nitric(V) acid, name another product that is formed. (1 mark)

(c) When ammonia is reacted with nitric(V) acid, it produces a nitrogenous fertiliser.

(i) Explain why fertilisers play a major role in food production. (2 marks)

(ii) State **two** problems associated with the use of nitrogenous fertilisers. (2 marks)

4. (a) Explain the following observations:

(i) The colour of aqueous copper(II) sulphate fades when a piece of magnesium metal is dropped into the solution. (2 marks)

(ii) A piece of iron bar is coated with a brown substance when left in the open on a rainy day. (2 marks)

(b) A sample of water is suspected to contain aluminium ions (Al^{3+}) . Describe a laboratory experiment that can be carried out to show that Al^{3+} ions are present in the water sample. (3 marks)

(c) In an experiment to determine the number of moles of water of crystallisation of a hydrated compound, $Na_2SO_4 \bullet X\ H_2O$, 5 g of the compound were heated strongly to a constant mass.

(i) Explain how a constant mass was obtained. (2 marks)

(ii) During the experiment, the mass of the residue was found to be 2.205 g. Determine the number of moles of water of crystallisation in the compound. (Na = 23.0 ; O = 16.0 ; S = 32.0 ; H = 1.0) (3 marks)

5. (a) What is meant by molar heat of neutralisation? (1 mark)

(b) In an experiment to determine the molar heat of neutralisation, 50 cm^3 of 1M hydrochloric acid was neutralised by adding 10 cm^3 portions of dilute sodium hydroxide. During the experiment, the data in **Table 1** was obtained.

Table 1

Volume of Sodium hydroxide (cm^3)	0	10	20	30	40	50	60
Temperature of mixture (°C)	25.0	27.0	29.0	31.0	31.0	30.0	29.0

(i) Write the equation for the reaction in this experiment. (1 mark)

.....

(ii) On the grid provided, plot a graph of temperature (Y-axis) against volume of sodium hydroxide (X-axis) added. (3 marks)

(iii) Determine from the graph the:

I. volume of sodium hydroxide which completely neutralises 50 cm^3 of 1M hydrochloric acid. (1 mark)

II. change in temperature, ΔT, when complete neutralisation occurred. (1 mark)

(iv) Calculate:

I. the heat change, ΔH when complete neutralisation occurred.
(Specific heat capacity = 4.2 $Jg^{-1} K^{-1}$, density of solution 1.0 gcm^{-3}) (2 marks)

II. molar heat of neutralisation of hydrochloric acid with sodium hydroxide. (1 mark)

(v) How would the value of molar heat differ if 50 cm^3 of 1M ethanoic acid was used instead of 1M hydrochloric acid? Give a reason. (2 marks)

6. (a) What is meant by standard electrode potential of an element? (1 mark)

(b) Use the standard electrode potentials given below to answer the questions that follow.

Reactions	E^{θ} **(V)**
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$	+1.49
$M^{3+}(aq) + e^- \rightarrow M^{2+}(aq)$	+0.77
$N^{2+}(aq) + 2e^- \rightarrow N(s)$	+0.34
$P^{2+}(aq) + 2e^- \rightarrow P(s)$	−0.23
$Q_2(g) + 2e^- \rightarrow 2Q^-(g)$	+2.87
$R_2(g) + 2e^- \rightarrow 2R^-(g)$	+1.36

(i) State whether acidified MnO_4^- can oxidise M^{2+}. Give a reason. (2 marks)

(ii) Select two half-cells which when combined will give the highest e.m.f. (1 mark)

(iii) Write the cell representation for the cell formed in b (ii). (1 mark)

(iv) Calculate the E^{θ} value for the cell formed in b (iii). (2 marks)

(c) A mass of 1.24 g of a divalent metal was deposited when a current of 6A was passed through a solution of the metal sulphate for 12 minutes. Determine the relative atomic mass of the metal. (1 Faraday = 96,500 C mol^{-1}) (3 marks)

(d) State **two** applications of electrolysis. (1 mark)

7. (a) What is meant by rate of reaction. (1 mark)

(b) In the space provided, sketch the diagram of a set-up that can be used to determine the rate of reaction between manganese(IV) oxide and hydrogen peroxide. (3 marks)

(c) A student placed a small amount of liquid bromine at the bottom of a sealed gas jar of air as shown in **Figure 4**.

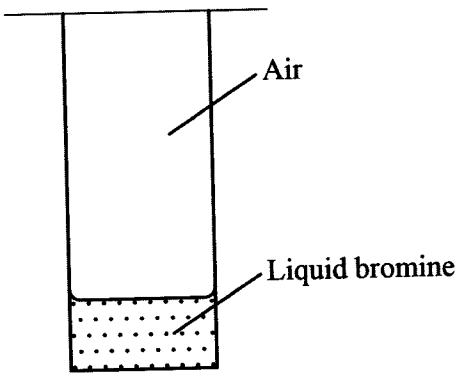

Figure 4

(i) Describe what will be observed: (1 mark)

I. after two minutes .....

II. after 30 minutes .....

(ii) Use the Kinetic theory to explain the observations: (2 marks)

I. after 2 minutes .....

II. after 30 minutes .....

(d) Some plants have seeds that contain vegetable oil.

(i) Describe how the oil can be obtained from the seeds. (3 marks)

(ii) Explain how it could be confirmed that the liquid obtained from the seeds is oil. (1 mark)