P525/2
CHEMISTRY PAPER 2
SENIOR SIX
TIME: 2½ HOURS

INSTRUCTIONS:

- *Attempt any <u>five</u> Questions.*
- *Start each question on a fresh page.*

Question 1

(a). A compound **Q** contains 64.9% carbon, 13.5% hydrogen the rest being oxygen. 1.85g of **Q** in the vapour form occupied 969.8cm^3 at 200°C and 1 atmosphere.

(i). Calculate for the empirical formular of **Q**   (3 marks)

(ii). Determine the molecular formular of **Q** (Take R = 8.314 JK^{-1}mol^{-1})   (3 marks)

(b). **Q** reacts with sodium with effervescence but has no effect on sodium carbonate. Write the names and structural formulae of all possible isomers of **Q**   (4 marks)

(c). When treated with anhydrous zinc chloride and concentrated hydrochloric acid, **Q** formed a cloudy solution in about 8 minutes. Write the structural formular of **Q**   (1 mark)

(d). **Q** reacts with acidified chromium trioxide to give compound **A**. Write the equation of reaction;

(i). Leading to formation of **A**   (1 mark)

(ii). Between **A** and acidified 2,4-dinitrophenylhydrazine and outline the mechanism   (5 marks)

(e). Write equation to show how **Q** can be prepared from an alkene and outline the mechanism   (3 marks)

Question 2

(a). Explain what is meant by the following terms;

(i). Solubility product   (3 marks)

(ii). Common ion effect   (3 marks)

(b). (i). Describe briefly how the solubility product of magnesium hydroxide can be determined by a titrimetric technique   (6 marks)

(ii). State how the solubility product value can be used to predict precipitation or dissolution   (3 marks)

(c). The solubility product of calcium sulphate at 25°C is 2.4 × 10^{-5} mol^{2}dm^{-6}. Calculate for the solubility of calcium sulphate in moldm^{-3} in;

(i). Water   (2 marks)

(ii). 0.5M sodium sulphate solution   (2 marks)

(d). State **two** conditions for validity of solubility product   (1 mark)

Question 3

(a). Write the name and formular of the chief ore from which copper is extracted (1 mark)

(b). Describe how the copper ore is concentrated (3 marks)

(c) (i). Write equations for the reactions that take place during roasting and reduction of the ore (3 marks)

(ii). During extraction, the copper ore is smelted. Why? (1 mark)

(d). Explain what takes place during the refinery process of copper (3 marks)

(e). Explain the reaction of copper(II) sulphate with a solution of;

(i). Potassium iodide (3 marks)

(ii). Ammonia (4 marks)

(iii). Sodium carbonate (2 marks)

Question 4

(a). (i). Sate the term that refers to the formation of soap and write equation for the reaction that leads to the formation of soap (2 marks)

(ii). Name a locally available raw material from which soap can be prepared (1 mark)

(b). (i). Describe how a sample of solid soap can be prepared in the laboratory starting from the named raw material in a(ii) above (5 marks)

(ii). Outline how a sample of soapless detergent can be prepared (*Include equations in your answer*) (4 marks)

(iii). Explain the cleansing action of soap (4 marks)

(c). Explain;

(i). **One** disadvantage of using soap for washing as opposed to the use of soapless detergents (2 marks)

(ii).**One** disadvantage of using soapless detergents (2 marks)

Question 5

(a). Define '**standard enthalpy of formation**' (1 mark)

(b). Use the following thermochemical data to answer the questions that follow

Enthalpy change	Energy value ($kJmol^{-1}$)
Heat of formation of aluminium oxide	-1675.7
Heat of atomization of aluminium	+324.3
1st ionisation energy of aluminium	+578.0
2nd ionisation energy of aluminium	+1817.0
3rd ionisation energy of aluminium	+2745.0
Heat of atomization of oxygen	+249.2
1st electron affinity of oxygen	-141.4
2nd electron affinity of oxygen	+790.8

(i). Draw an energy level diagram and use it to calculate for the lattice energy of aluminium oxide

(4½ marks)

(ii). If the aluminium in the oxide has +2 charge instead of +3, would the oxide be stable or not? Explain.

(2½ marks)

(iii). From the data above, the 1st electron affinity of oxygen is exothermic while the 2nd electron affinity of oxygen is endothermic. Explain this scenario   (3 marks)

(c). (i). Define '**standard enthalpy of solution'**   (1 mark)
(ii). Describe an experiment to determine the enthalpy of solution of sodium chloride   (6 marks)
(iii). Explain why the standard enthalpy of hydration of gaseous cations is always exothermic   (2 marks)

END
Department of Chemistry at SMACOL