

NAME ; STREAM.....

P525/1

CHEMISTRY

Paper 1

2³/₄ hours

DEPARTMENT OF CHEMISTRY
PRE – MOCK EXAMINATIONS
SENIOR SIX CHEMISTRY
PAPER 1

2hours 45 minutes

INSTRUCTIONS

Answer **all** questions in section **A** and **six** questions in section **B**.

Any extra question answered will not be marked.

All questions must be answered in the spaces provided

The Periodic Table with relative atomic masses will be provided

Illustrate your answers with equations where applicable

Molar gas constant $R = 8.314 \text{ Jmol}^{-1}\text{K}^{-1}$

Molar volume of gas at s.t.p is 22.4 litres

For Examiners Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)

(Answer all the questions)

(1) (a) The element Nobelium $^{260}_{103}\text{No}$ undergoes radioactivity to give elements X and Y according to the following equation



Complete the above given equation by **identifying** the missing elements. (2 marks)

(b) A given amount of bismuth-209 decayed by 75% in 40 years. Determine the half life of bismuth.

(3¹/₂ marks)

(2) State what would be observed and write equation for the reaction that occurs when magnesium powder is added to aqueous solution of ;

(a) copper (II) sulphate

Observation

(1 mark)

Equation

(1½ marks)

(b) Aluminium chloride

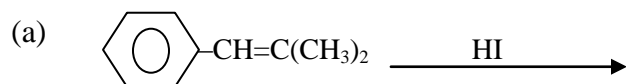
Observation

(1 mark)

Equation

(1½ marks)

(3) Complete the following organic reactions and outline the reaction mechanism.



Mechanism

(4 marks)



Mechanism

(4 marks)

(4) A compound Q contains by mass 34.46% by mass iron and the rest chlorine. Compound Q has vapour density of 81.25.

(a) Determine;

(i) the empirical formula of Q.

(1½ marks)

(ii) the molecular formula of Q

(2 marks)

(b) State what will be observed and write equation for the reaction that takes place when sodium hydroxide solution is added drop wise until in excess to an aqueous solution of compound Q.

Observation

(1 mark)

Equation(s)

(1 mark)

(5) (a) Write equation for the complete combustion of ethanol ($\text{CH}_3\text{CH}_2\text{OH}$)

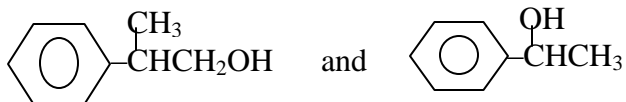
(1 mark)

(b) The enthalpies of combustion of carbon, hydrogen and ethanol are -394, -286 and -1187 KJ mol^{-1} respectively. Calculate the enthalpy of formation of ethanol.

(2¹/₂ marks)

(6) Name the reagent(s) that can be used to distinguish between the following pair of compounds. In each case state the observations made.

(a)



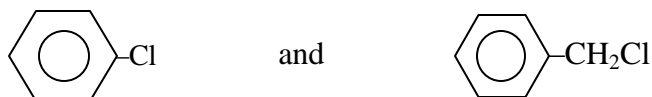
Reagent

(1 mark)

Observation

(2 marks)

(b)



Reagent

(1 mark)

Observation

(2 marks)

(7) Complete the table given below ;

Element	Formula of the chloride	Type of bonding	Type of solid structure
Aluminium			
Silicon			
Sodium			
Magnesium			

(6 marks)

(b) Water was added to each of the chlorides formed by aluminium and sodium respectively.
Write equation for the reaction that took place.

Aluminium chloride

Equation

(1 mark)

Sodium chloride

Equation

(1 mark)

(8) A 0.01M aqueous solution of phenol has a PH of 5.95 at 25⁰C.

(a) Write an equation for dissociation of phenol in water.

(1 mark)

(b) Calculate the acid dissociation constant K_a for phenol

(2¹/₂ marks)

(c) Determine the degree of dissociation for phenol.

(2 marks)

(9) Compare the reaction of beryllium and barium with cold water.

(3 marks)

SECTION B (54 marks)

(Answer **six** questions)

(10) (a) State Raoult's law

(1½ marks)

(b) An **ideal** solution that contains two liquids A and B has a total vapour pressure of $2.9 \times 10^4 \text{ Nm}^{-2}$ at 20°C . The vapour pressures of pure liquids A and B at 20°C are respectively $1.50 \times 10^4 \text{ Nm}^{-2}$ and $3.5 \times 10^4 \text{ Nm}^{-2}$ at 20°C .

(i) Explain what is meant by the term an **ideal** solution.

(1 mark)

(ii) Determine the percentage composition of liquids A and B in the liquid mixture.

(3½ marks)

(c) A mixture of ethanoic acid and water form liquid mixture that deviates negatively from Raoult's law..

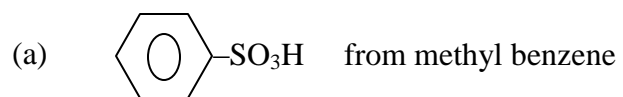
(i) State any two characteristic properties for this liquid mixture.

(1 mark)

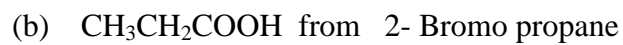
(ii) Explain why the above liquid mixture exhibits the mentioned property

(2 marks)

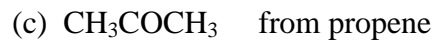
(11) Write equations to show how the following synthesis can be carried out. In each state the reagents and conditions necessary.



(3 marks)



(4 marks)



(2 marks)

(12) (a) Name the shape and draw the structure for each of the species given in the table below. In each case state whether the pH of aqueous solution containing each of the above given species will be equal to, less or greater than 7.

Species	Structure	Shape	pH of the aqueous solution
NH_4^+			
NH_3			
NH_2^-			

(6 marks)

(b) State and explain the trend in variation of the bond angles of the above given species.

(3 marks)

(13) 2-Bromo-2-Methyl propane reacts with aqueous sodium hydroxide to form 2-methylpropan-2-ol.

(a) Write the rate equation for the reaction.

(1 mark)

(b) Draw the energy diagram for the reaction.

(3¹/₂ marks)

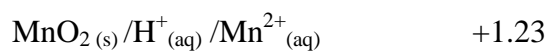
(c) Write a mechanism for the reaction.

(2¹/₂ marks)

(d) Write equations to show how 2-Methylpropan-2-ol can be converted to 2-Bromo-2-Methylpropane.

(2 marks)

(14) The following half cell reactions are given;



(a) Write equations for the half reactions that takes place at the cathode and anode. In each case state the observations made.

(i) At the cathode

Equation

(1 mark)

Observation

(1 mark)

(ii) At the anode.

Equation

(1 mark)

Observation

(1 mark)

(b) Write the cell convention for the cell made by combining the above given two half cells.

(2 marks)

(c) Calculate the e.m.f for the cell in (b) above.

(1½ marks)

(d) State whether the reaction is possible or not. Give reason(s) for your answer.

(1½ marks)

(15) Calcium fluoride is a sparingly soluble in water.

The solubility product (K_{SP}) of calcium fluoride is $4.0 \times 10^{-11} \text{ mol}^3 \text{ dm}^{-9}$ at 25°C .

(a) Write the expression for the solubility product K_{SP} of calcium fluoride.

(1½ marks)

(b) Calculate the solubility of calcium fluoride in;

(i) Water

(2 marks)

(ii) 0.01M solution of sodium fluoride.

(2¹/₂ marks)

(c) Comment on your answer in (b) i and ii above.

(2 marks)

(d) State any **two** applications of solubility product.

(1 mark)

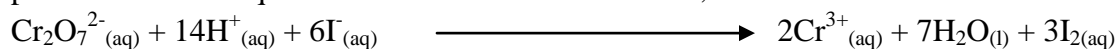
(16) (a) (i) Explain what is meant by the term primary standard.

(1 mark)

(ii) Give reasons why potassium dichromate is usually preferred to potassium permanganate in volumetric titration.

(2 marks)

(b) 0.55g of a metal dichromate with the formula ($M_2Cr_2O_7$) was dissolved in water and the solution made up to 250cm^3 with distilled water. 25cm^3 of the solution was removed acidified with 1M sulphuric acid then followed by excess of potassium iodide solution. The liberated iodine required 12.60 cm^3 of a solution containing 24.78g of sodium thiosulphate pentahydrate per litre. One the equation for the reaction involved is;



(i) Calculate the number of moles of the metal dichromate that reacted.

(3¹/₂ marks)

(ii) Determine the relative atomic mass M in the formula of the metal dichromate

(2¹/₂ marks)

(17) (a) During extraction of aluminium the ore is first roasted in air ,crushed and then heated strongly with sodium hydroxide solution.

(i) Write the formula and the name of the ore from which aluminium metal is extracted.

Formula (1/2 mark)

Name..... (1/2 mark)

(ii) State the purpose of sodium hydroxide solution in the reaction above.

(Use equation(s) where necessary to illustrate your answer)

(4 marks)

(b) Write equation(s) to show how the pure ore is obtained from the solution formed after heating the impure ore with sodium hydroxide.

(2 marks)

(c) (i) Name the process by which pure aluminium metal is obtained the ore in (b) above.

($\frac{1}{2}$ mark)

(ii) Name the compound added to the ore before the process mentioned in (c) i is carried out. State the use of the compound.

($1\frac{1}{2}$ marks

END