

ARCHBISHOP KIWANUKA SS
END OF TERM TWO CHEMISTRY PAPER 2
TIME 2 ½ HOURS

Answer **five** questions including **three** questions from section A and any two from section B

SECTION A

1. (a) (i) What is meant by **steam distillation**? (02 mark)
 (ii) Explain the principle on which steam distillation is based (5 marks)
 (b) steam distillation of chlorobenzene ($\text{C}_6\text{H}_5\text{Cl}$) took place at 94°C and 760mmHg pressure. The vapour pressure of water at 94°C is 654mmHg. Calculate the percentage of chlorobenzene in the distillate (03 marks)
 (c) the following is the data obtained for steam distillation of chlorobenzene at 760mmHg pressure.

Temperature ($^\circ\text{C}$)	90	92	94	96	98	100
Vapour pressure of water (mmHg)	526	567	611	658	707	760
Vapour pressure of chlorobenzene (mmHg)	96	106	114	123	132	141

- (i) On the same axes, plot graphs of vapor pressure of the mixture and each of the components against temperature. (05marks)
 (ii) Determine the boiling point of the mixture. (01 mark)
 (iii) Calculate the percentage by mass of chlorobenzene in the distillate (02 marks)
 (d) State how a sample of chlorobenzene can be obtained from the distillate. (02marks)
2. Discuss the following reactions of benzene. Illustrate your answers with equations and appropriate mechanisms
- a) Nitration (05 marks)
 b) Halogenation (05 marks)
 c) Acylation (05 marks)
 d) Alkylation (05 marks)
3. (a) Define the following terms;
- (i) osmosis (01 mark)
 (ii) osmotic pressure (01 mark)
- b) Describe a method you can use to determine the osmotic pressure of a glucose solution. (07 marks)

ii) The osmotic pressure of a solution containing 1.24% of a polymer is 3.1×10^{-3} atmosphere, at 25°C . Determine the relative molecular mass of the polymer, ($R=0.0821$) (03 marks)

(c) The freezing point of benzene is 5.53°C the freezing point of various concentrations of phosphorus in benzene at 1 atmosphere are given below;

Concentration / gdm^{-3}	0	10	15	20	25	30	40
Freezing point / $^\circ\text{C}$	5.53	5.12	4.91	4.70	4.50	4.29	3.88

i) Plot a graph of freezing point depression against concentration.

(04 marks)

ii) Use your graph to determine the molecular formula of phosphorus in benzene. Given the K_f of benzene is $1.55\text{Kmol}^{-1}\text{Kg}^{-1}$ (04 marks)

SECTION B

4. The elements beryllium, magnesium, calcium, strontium and barium belong to group (II) of the periodic table.

(a) Write equations and state conditions under which the elements react with:

(i) Air (04 marks)

(ii) Water (04 marks)

(iii) Dilute sulphuric acid (04 marks)

(b) The atomic radii and melting points of group (II) elements in the periodic table are given below.

Element	Atomic radius (nm)	Melting point ($^\circ\text{C}$)
Beryllium	0.112	1283
Magnesium	0.160	650
Calcium	0.197	848
Strontium	0.215	770
Barium	0.222	710

Explain the trend in:

(i) Atomic radii (03 marks)

(ii) Melting point group (II) elements. (03 marks)

(c) Although beryllium is a group (II) in the periodic table, in some properties it resembles aluminum which is a group(III). State the reasons why beryllium differs in some of its properties from the rest of the group (II) members. (02 marks)

5. Write equations to show how the following compounds can be synthesized.



(b) CH_3CHO from $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (03 marks)



(c) $(\text{CH}_3)_2\text{CH}-\text{SO}_3^-\text{Na}^+$ from Benzene (04 marks)

(d). 2,2 dibromo propane from propan-1-ol (04 marks)

(e)  $\text{CH}=\text{CH}_2$ from  (03 marks)

(f) name the reagent that can be used to distinguish the following compounds

$\text{CH}_3\text{C}\equiv\text{CH}$ and $\text{CH}_3\text{C}\equiv\text{CCH}_3$ (02 marks)

END