CHEMISTRY DEPARTMENT 2023
S.6 BRAINSTORMING TEST
TOPIC; PHYSICAL EQUILIBRIA
SUB-TOPIC; MISCIBLE LIQUID MIXTURES

NAME……**INDEX number**……..……

Signature …… **expected score(%)**……

Instructions; *Attempt all questions in this paper*.

1. (a) State Raoult's law of ideal solutions. (01 mark)

……

……

……..

(b) What is meant by?

(i) An ideal solution (01 mark)

……

……

……..

(ii) Partial vapour pressure (01 mark)

……

……

C) State three properties of an ideal solution ($1\frac{1}{2}$ marks)

……

……

……..

d) A mixture of liquids **Y** and **Z** obeys Raoult's law. If the vapour pressure of **Y** and **Z** are 9.50KNm^{-2} and 3.20KNm^{-2} respectively at 20^{0}C,

(i) Calculate the composition of the vapour containing 0.6 moles of Y and 0.2 moles of Z all at 20^0 C. (04 marks)

(ii) State which of the two liquids is more volatile. Give a reason for your answer. (01 mark)

……

……

b) The boiling points of liquids **Y** and **Z** are 368^0C and 395^0C respectively

(i) Sketch a labeled boiling point – composition diagram of the mixture of the liquids. (03 marks)

(ii) Using the diagram, describe how pure liquid **Z** can be obtained from a mixture containing 50% **Z**. (03 marks)

……

……

……

……

……

……

c) Explain why some liquids show negative deviation from Raoult's law. ($1\frac{1}{2}$mks)

……

……

……

……

d) If the mixture of liquids **Y** and **Z** in (b) was to deviate negatively from Raoult's law, sketch a labelled boiling point – composition diagram for the mixture. (03 marks)

e) Explain what is meant by fractional distillation (01 mark)

……

……

……

……

2. (a) (i) what is meant by a constant boiling point mixture (01 mark)

……

……

(ii) Give two types of constant boiling mixtures. (01 mark)

……

……

(iii) Outline one difference between the two types of constant boiling mixtures stated above. (01 mark)

……

……

(iv) State two similarities of Azeotropic mixtures and pure substances or compounds (01 mark)

……

……

(v) State two reasons why azeotropes are considered to be mixtures and not compounds. (02 marks)

……

……

……

(vi) State any three methods of separating components of an azeotropic mixture. (1½ marks)

……

……

(vii) Give a reason why a constant boiling point mixture can not be separated by fractional distillation. (01 mark)

……

……

……

b) The total vapour pressure of a mixture of propanone and trichloromethane, and the mole fraction of trichloromethane at a constant temperature are given in the table below;

Mole fraction of trichloromethane	0.0	0.2	0.4	0.6	0.8	1.0
Vapour pressure of the mixture (mmHg)	347	305	267	244	256	293

(i) Plot a graph of total vapour pressure of the mixture against the mole fraction of trichloromethane. (03 marks)

(ii) Using the graph, deduce how the mixture deviates from Raoult's law.

……

Give a reason for your answer. (01 mark)

……

……

(iii) Explain the cause for the deviation you have stated in b(ii) above.(3mks)

……

……

……

……

(iv) Determine the composition of the azeotrope. (01 mark)

……

(c) Methanoic acid with boiling point 80^0C, and water with boiling point 100^0C, are miscible in all proportions. They form a maximum boiling point mixture containing 77% methanoic acid which boils at 108^0C.

(i) Sketch a labelled boiling point – composition diagram for the mixture of methanoic acid and water. (03 marks)

(ii) Explain the factors that lead to methanoic acid and water forming a maximum boiling point mixture. (03 marks)

……

……

……

……

……

……

(iii) Describe briefly what happens when a mixture containing 40% methanoic acid is distilled. (04 marks)

……

……

……

……

……

……

……

……

……

b) At standard atmospheric pressure, hydrochloric acid and water form a constant boiling point mixture having a boiling point of 110^0 C and composition 20% by mass of hydrochloric acid. The constant boiling point mixture has a density of **1.18gcm^{-3}**. Calculate the volume of the acid needed to prepare **1 litre** of **2M** hydrochloric acid solution. (03marks)

……

……

……

……

……

……

……

……

END.