# THE PRIME MINISTER'S OFFICE

## REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

## KILIMANJARO REGIONAL COMMISSIONER'S OFFICE

## FORM SIX MOCK EXAMINATION

## CHEMISTRY 2

**032/2**

**TIME: 3:00 Hours** **Friday 06th November 2026 Pm**

**INSTRUCTIONS**

1. This paper consists of **six (6)** questions.
2. Answer **five (5)** questions.
3. Each question carries twenty **(20).**
4. Mathematical table and non-programmable calculator may be used.
5. Write your **Examination Number** on every page of your answer sheet.
6. Where necessary you may use the following constants
   - Gas constant R = 8.31Jmol$^{-1}$k$^{-1}$ or 0.0821atm mol$^{-1}$k$^{-1}$.
   - GMV = 22.4dm$^{3}$
   - Standard temperature 273K
   - Stand pressure = 760mmHg
   - Mass of electron = 9.11 x 10$^{-31}$kg
   - Faraday constant 1F = 96500C
   - Atomic masses: Pb = 207, C = 12, Cl = 35.5, O = 16, Ag = 108, Fe = 56, Cu = 63.5, Na = 23, N = 14.

1. a) Give the deviation from Raoult's law exhibited by the following pair and draw the vapour pressure mole fraction phase diagram for
   i. Water and ethanol
   ii. Chloroform and diethyl ether
   iii. Acetone and aniline **(6marks)**

   b) Give short account for the following
   i. Component of a binary mixture of two liquids A and B were being separated by distillation. After sometime separation of components stopped and composition of vapour phase become the same as that of liquid phase. Both the components started coming in distillate. Explain why this happened.
   ii. Multi – step extraction using the same amount of solvent are more economical than a single step extraction. **(4marks)**

   c) Liquid A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary solution of liquid A and B has vapour pressure 45 Torr. At the same temperature a new solution of A and B having mole faction of $X_A$ and $X_B$ respectively has vapour pressure of 22.5 Torr. What is the value of $X_A/X_B$ in the new solution? (Given that the vapour pressure of pure liquid A is 20Torr at temperature T). **(5marks)**

   d) Phenol dissolves with its normal molecular weight in both water and ethyl alcohol. An aqueous solution ($H_2O$) containing 0.22g phenol per $dm^3$ and ethyl alcohol 3.52g phenol per $dm^3$.
   i. Find partition coefficient
   ii. What mass of phenol will be extracted from $50cm^3$ of an aqueous solution containing 50g phenol per $dm^3$ by shaking with two successive quantities of $100cm^3$ ethyl alcohol. **(05marks)**

2. a) Define the following terms: -
   i. Elementary step
   ii. Unimolecular reaction
   iii. Reaction mechanism
   iv. Rate constant **(04marks)**

   b) i. Express the relationship between the rate of production of HCl and the rate of disappearance of $H_2$ in the following reactions.

   $$H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$$

   ii. The half-life for first order decomposition of nitroamide $NH_2NO_{2(aq)} \rightarrow N_2O_{(g)} + H_2O_{(l)}$ is 124min at 288K, if $165cm^3$ of $0.2moldm^{-3}$ $NH_2NO_2$ solution is allowed to decompose, how long must the reaction proceed to yield $50.0cm^3$ of $N_2O$ collected over water at 288K and a barometric pressure of 750mmHg? (The vapour pressure of water is 12.9mmHg). **(9marks)**

c) i. How would you determine the standard electrode potential of the System $Mg^{2+}/Mg^{2}$. (Diagram is not needed).

ii. Can you store copper sulphate solution in a zinc pot? Justify your answer. **(4marks)**

d) If a current 0.5 ampere flows through a metabolic wire for 2 hours, then how many electrons would flow through the wire? **(3markss**

3. a) As a chemist account for the following statements as analyzed by the form VI student at Mpwapwa Secondary School.

i. Determination of the concentration of hydrogen ion plays important role in solution analysis field center.

ii. The dissociation constant for acid is important in determining the extent to which the acid tends to ionize in aqueous solution to give hydrogen ion ($H^+$). **(4marks)**

b) A 500 $cm^3$ of 0.1M aqueous solution of $CH_3COOH$ (acetic acid were mixed with 500$cm^3$ of 0.1MHCl solution. If 3.0g of NaOH are added to the mixture calculate the pH of the mixture before and after addition of NaOH, assuming that no change in volume occurs on mixing. **(9marks)**

c) i. Although Lead (II) chloride is sparingly soluble in pure water it is soluble in concentrated hydrochloric acid. Explain briefly.

ii. Calculate the volume of water required to dissolve 0.1g Lead (II) chloride to get a saturated solution. (Ksp of $PbCl_2 = 3.2 \times 10^{-8}$, atomic mass of Pb = 207). **(7marks)**

4. a) Differentiate the following

i. Thermoplastic polymers and thermosetting polymers

ii. Branched chain polymers and network polymers **(3marks)**

b) Write the monomers used in synthesis of the following polymers

i. Polyvinylchloride (PVC)

ii. Teflon

iii. Bakelite

iv. Dacron **(4 marks)**

c) i. Why cationic polymerization is more favored than anionic polymerization when vinylic monomers contain an electron donating group?

ii. Why styrene undergoes anionic polymerization easy? Briefly explain.

iii. Differentiate addition from condensation polymers basing on the mode of polymerization. Give an example in each type. **(6 marks)**

d) An organic compound A with a molecular formula $C_3H_6O$ form orange red precipitate B with 2,4-DNP reagent and gives yellow precipitate C on heating with iodine in the presence of NaOH. It neither reduces Tollen's or Fehling's reagent nor does not not decolorize bromine water or Baeyer's reagent. On drastic oxidation with chromic acid, carboxylic D is formed having a molecular $C_3H_6O_2$. Identify the compound A-D, explaining the reactions involved. **(07 marks)**

5 a) With one example define the following terms
i Bidentate ligands
ii Coordination number
iii Ambidentate ligands
iv Polydentate ligand **(6marks)**

b) Briefly explain the following
i A concentrated aqueous Copper (II) chloride solution is bright green in colour but changes to light blue when diluted with water
ii $CuSO_4.5H_2O$ is blue in colour while $CuSO_4$ is white.
iii Transition elements have higher enthalpies of atomization. **(6marks)**

c) A cobalt complex having molecular formula of $Co(NO_2)_2Cl_4NH_3$ give an electrical conductance equivalent to two ions per formula unit. Excess $AgNO_3$ solution precipitate one mole of AgCl per formula unit.
i Write the complex formula
ii Give the IUPAC name **(4marks)**

(d) Knowledge of buffer solution finds extensive application in a variety of fields. As a chemist, describe four major applications of it in our day-to-day activities. **(04 Marks)**

6 a) An organic compound A was treated with nitrous acid and yield compound B and nitrogen gas was evolved. Compound B has a composition of 60%C, 13.3%H and 26.67%O. Compound B has vapour density of 30. When compound B was oxidized using $H_2CrO_4$ it yields compound C. Compound C Forms Oxime with hydroxylamine. Compound C also reacts Fehling's solution to form brick red precipitate.
i. Workout to suggest the structure of compound A, B and C **(03Marks)**
ii. Give proper chemical equation for reactions mentioned **(03marks)**

b) Give supportive explanation to the following statement: -
i. Alkylamine is more basic than ammonia
ii. It is difficult to prepare pure amine by ammonolysis of a alkyl halide
iii. Primary amine have higher boiling point than tertiary amine.
iv. How can an acid be converted into an ester without using any alcohol? **(6marks)**

c) An unknown ester, E was found to have molecular formula $C_3H_{10}O_2$, when E was hydrolyzed with water in the presence of mineral acid, it produced Carboxylic acid, A and alcohol B. The treatment of B with $SOCl_2$ gave an alkyl Chloride C. When C is treated with KCN a product D was formed which on Hydrolysis with water produced carboxylic acid A.
i. Use this information to deduce the structure and name of the original ester.
ii. Identify A through D and write the chemical equations for the reactions involved. **(8marks)**