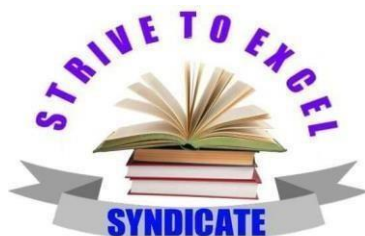


**THE UNITED REPUBLIC OF TANZANIA  
PRESIDENT'S OFFICE, REGIONAL ADMINISTRATION AND  
LOCAL GOVERNMENT**



**FORM SIX SPECIAL SCHOOLS JOINT EXAMINATION**

**CODE: 132/2**

**CHEMISTRY 2**

**Time: 3:00 HRS**

**Thursday 20-February-2025 AM**

**INSTRUCTIONS**

1. This paper consists of **Six (06)** questions
2. Answer only **Five** questions
3. Each question carries **Twenty (20)** Marks.
4. Mathematical tables and non- programmable calculators may be used.
5. Cellular phones are not allowed in the examination room.
6. For calculations you may use the followings constants:
  - Gas constants,  $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$  or  $R = 0.0821 \text{ atm. mol}^{-1} \text{ K}^{-1} \text{ dm}^3$
  - Rydberg's constant,  $R_H = 1.097 \times 10^7 \text{ M}^{-1}$  or  $R_M = 2.18 \times 10^{-18} \text{ J}$
  - Velocity of Light,  $C = 3.0 \times 10^8 \text{ m/s}$
  - Standard temperature = 273k
  - Standard pressure = 760 mmHg
  - Plank's constant,  $h = 6.63 \times 10^{-34} \text{ JS}$
  - Velocity of light ,  $C = 3.0 \times 10^8 \text{ m/s}$
  - Avogadro's constant,  $N = 6.022 \times 10^{23} \text{ mol}^{-1}$
  - Atomic masses: H= 1, C = 12, N = 14, O = 16, Na = 23, S = 32, Cl = 35.5, K = 39, Ag = 108,

1. (a) Account for the following observations on the iodination of propanone in acidified aqueous solution

- (i) When the propanone concentration is doubled, the rate doubles
- (ii) When the iodine concentration is doubled, the rate remains unchanged
- (iii) When the pH of the solution is reduced from 1.0 to 0.7, the rate doubles

**(3 marks)**

- (b) Calculate the ratio of the rate constants at 30 °C and 20 °C for a reaction with activation energy 50 kJ/mol

**(4 marks)**

- (c) The decomposition of dinitrogen pentoxide, N<sub>2</sub>O<sub>5</sub>, was followed at different temperatures and the rate constants for the reaction were found to vary as follows

T (K)	300	310	320	330
K (s <sup>-1</sup> )	3.38 x 10 <sup>-5</sup>	1.35 x 10 <sup>-4</sup>	4.98 x 10 <sup>-4</sup>	1.50 x 10 <sup>-3</sup>

Calculate the activation energy of the reaction

**(4 marks)**

- (d) (i) Not all collisions result into chemical reaction. Explain

- (ii) How activation energy differs from activated complex

**(4 marks)**

- (e) Hydrolysis of ethylethanoate to ethanoic acid and ethanol obeys first order reactions  $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH}$ . At 400K, 50% of ethylethanoate is hydrolysed for 88 minutes. How long will it take for 80% of ethylethanoate to be hydrolysed at the same temperature?

**(5 marks)**

2. (a) Describe what happens when common salt is added to a saturated solution of silver chloride in water

**(3 marks)**

- (b) In an experiment to measure the solubility product of silver chloride the electrolytic conductivity of a saturated aqueous solution was measured and found to be  $1.96 \times 10^{-6} \text{ S cm}^{-1}$  at 25 °C. The water itself has an electrolytic conductivity of  $0.12 \times 10^{-6} \text{ S cm}^{-1}$  at that temperature. Find the value of K<sub>sp</sub> (the limiting molar conductivities of Ag<sup>+</sup> and Cl<sup>-</sup> are  $61.9 \text{ S cm}^2 \text{ mol}^{-1}$  and  $76.4 \text{ S cm}^2 \text{ mol}^{-1}$ )

**(5 marks)**

- (c) Calculate the pH at neutralization point when 70 cm<sup>3</sup> of 0.2M KOH solution is mixed with 80 cm<sup>3</sup> of 0.1M HNO<sub>3</sub>

**(6 marks)**

- (d) What volume of 1M propanoic acid and 1M of sodium propanoate must be mixed together in order to prepare 100 cm<sup>3</sup> of buffer solution of pH = 4? (Given pK<sub>a</sub> (CH<sub>3</sub>CH<sub>2</sub>COOH) = 4.9)

**(6 marks)**

3. (a) Write a mathematical expression for distribution law

**(2 marks)**

- (b) Compound P has a partition coefficient of 4.00 between ethoxyethane and water. Given that 2.0g of P is obtained in solution, in 50 cm<sup>3</sup> of water, calculate the mass of P that can be extracted from the aqueous solution by;
- (i) 50 cm<sup>3</sup> of ethoxyethane
  - (ii) Two successive extractions of 25 cm<sup>3</sup> of ethoxyethane each **(8 marks)**
  - (c) Comment on the variation of the amount extracted in (b) (i) and (ii) **(2 marks)**
  - (d) When 500 cm<sup>3</sup> of an aqueous solution containing 4g of a solute G per litre was shaken with 100 cm<sup>3</sup> of pentan-1-ol, 1.5g of the solute G was extracted. Assuming a molecular state of the solute remains the same in both solvents, calculate
    - (i) The partition coefficient of the solute G between pentan-1-ol and water
    - (ii) Mass of the solute G which will remain in the aqueous solution after a further shaking with 100 cm<sup>3</sup> of pentan-1-ol **(8 marks)**
4. (a) In every group in the modern periodic table, first element has peculiar characteristics which makes it differ in physical and chemical properties due to small atomic size, higher value of electronegativity, higher value of ionization and inability to expand d-orbital. Justify the statement by using Fluorine of group VIIA. **(04 marks)**
- (b) With reason arrange the following molecules in the order of increasing acidic strength, HBr, HF, HCl, HI. **(02 marks)**
- (c) Explain the following facts
  - (i) Fluorine has unexpectedly lower value of bond dissociation energy.
  - (ii) The aqueous solution of copper (II) chloride turns blue litmus paper red.
  - (iii) Sodium and potassium are elements of groups IA, but have never been used in construction of bridges. **(06 marks)**
- (d) Explain how tin (Sn) can be extracted from cassiterite (SnO<sub>2</sub>) by using below guidelines.
  - (i) Concentration of the ore
  - (ii) Roasting
  - (iii) Smelting
  - (iv) Reduction
  - (v) Purification (electrolytic cell is not required) **(08 marks)**
5. (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, 13.33% H, and 26.67% O. Compound B has a vapour density of 30. When compound B was oxidized using H<sub>2</sub>CrO<sub>4</sub> it yield compound C. Compound C forms oxime with hydroxylamine. Compound C also reacts with Fehling's solution to form brick red precipitate
  - i. Work out to suggest the structure of compound A, B and C **(5 marks)**
  - ii. Give the proper chemical equations for the reactions mentioned **(2 marks)**
- (b) What are the effects of the following on the acidity of carboxylic acids?
- i. Chlorine as a withdrawing atom
  - ii. Large sized alkyl group **(3 marks)**

(c) Show how the following conversions can be achieved

- i. Benzene to 3-nitrobenzoic acid
- ii. Phenol to benzylchloride
- iii. Propanoyl chloride to ethylpropanoate **(6 marks)**

(d) A form six students provided with two containers which contains two compounds. One container contains compound A with a molecular formula  $C_3H_9N$  and another container contains compound B with molecular formula  $C_6H_{15}N$ . Both compounds gives positive results with arylsulphonyl chloride but the product formed when compound A reacts with arylsulphonyl chloride seems to be soluble in alkali solution but the product formed when B react with arylsulphonyl chloride is insoluble in alkali solution.

- (i) Suggest the structural formula of compound A and B
- (ii) Write all chemical reactions to show how those products are formed
- (iii) Explain why the product is soluble in alkali and another is insoluble in alkali? **(4 marks)**

6. (a) (i) Briefly explain how Bakelite is formed from its monomers **(4 marks)**  
(ii) Explain how the natural rubber is modified by the process of vulcanization **(4 marks)**  
(b) Explain how polyvinyl chloride (PVC) is formed from its monomers by cationic polymerization process (show all steps involved in this reaction) **(6 marks)**  
(c) What are the hazards and uses of polymers in the life of human being? **(6 marks)**