

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION
EXAMINATION

132/2

CHEMISTRY 2
(For Both School and Private Candidates)

Duration: 3 Hours

Year: 2025

Instructions

1. This paper consists of a total of **six (6)** questions.
2. Answer a total of **five (5)** questions.
3. Each question carries **twenty (20)** marks.
4. Mathematical tables and non-programmable calculators may be used.
5. Communication devices and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. For calculations you may use the following constants:

Gas constant, $R = 8.3145 \text{ J mol}^{-1} \text{ K}^{-1}$ or $0.082 \text{ atm mol}^{-1} \text{ K}^{-1} \text{ dm}^3$

Standard pressure = $760 \text{ mm Hg} = 1 \text{ atm} = 1.0 \times 10^5 \text{ N m}^{-2}$

$1F = 96,500 \text{ C}$

Atomic masses: $\text{H} = 1, \text{O} = 16, \text{Al} = 27, \text{Ca} = 40, \text{S} = 32, \text{Cu} = 63.5$



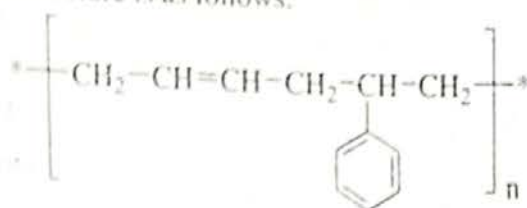
Answer a total of **five (5)** questions.

1. (a) The following results were obtained in a reaction between X and Y at 293 K:

Experiment No.	[X] ₀ (mol dm ⁻³)	[Y] ₀ (mol dm ⁻³)	Initial rate (mol dm ⁻³ s ⁻¹)
1	2.1×10^{-6}	2.1×10^{-6}	1.6×10^{-5}
2	2.1×10^{-6}	4.2×10^{-6}	3.2×10^{-5}
3	2.1×10^{-6}	6.3×10^{-6}	4.8×10^{-5}
4	4.2×10^{-6}	6.3×10^{-6}	9.6×10^{-5}
5	6.3×10^{-6}	6.3×10^{-6}	14.4×10^{-5}

- (i) From the initial concentrations and rates given in the table, find the rate law for the reaction.
- (ii) Calculate the rate constant with its units (Use data from experiment 1).
- (iii) Find the initial rate of the reaction when the initial concentrations are $[X] = 9.0 \times 10^{-6} \text{ mol dm}^{-3}$ and $[Y] = 1.0 \times 10^{-6} \text{ mol dm}^{-3}$. **(12 marks)**
- (b) A metallic object to be coated with copper, is placed in CuSO₄ electrolyte.
- (i) To which electrode should the object be connected where direct current power supply flows?
- (ii) What mass of copper will be deposited if a current of 0.22 A flows through the cell for 1.5 hours? **(8 marks)**
2. (a) Iron is used as a catalyst in Haber process for the manufacture of ammonia from combination of nitrogen and hydrogen gas. Briefly, explain four properties that enables the iron metal to act as a catalyst. **(4 marks)**
- (b) With reference to nylon-6,6, explain in detail how polyamides polymer are synthesized. **(6 marks)**

- (c) Write the chemical equation for the preparation of styrene-butadiene rubber, whose structure is as follows:



(4 marks)

- (d) Using polymerization of vinyl chloride as an example when forming poly (vinyl chloride), show the chain at;

- initiation step.
- propagation step.
- termination step.

(6 marks)

3. (a) Name two factors which are to be considered when choosing an appropriate method for metal extraction. (2 marks)

- (b) Give a brief account for the extraction of aluminium, emphasizing the chemical principles involved. (Technical details are not required). (14 marks)

- (c) Consider the following table which shows the variation in electronegativity across period II of the periodic table.

Element	Li	Be	B	C	N	O	F
Electronegativity	0.97	1.50	2.00	2.50	3.10	3.50	4.10

Briefly, comment on the variation of electronegativity values shown in the table.

(4 marks)

4. (a) (i) What is meant by a common ion effect?
 (ii) Distinguish solubility and solubility product of a sparingly soluble salt.
 (iii) How can you affect the solubility of a salt? Give four ways. (8 marks)

- (b) Calculate the solubility of AgCl in:

(i) Pure water

(ii) 0.1 M NaCl

[Given that $K_{sp}(\text{AgCl}) = 2 \times 10^{-10} \text{ mol}^2 \text{ dm}^{-6}$].

(5 marks)

- (c) (i) Why precipitate forms when a solution of Na_2SO_4 and $\text{Ca}(\text{NO}_3)_2$ are Mixed? Explain briefly.

- (ii) Exactly 50 cm^3 of a 0.0152 M Na_2SO_4 is added to 50 cm^3 of 0.0125 M $\text{Ca}(\text{NO}_3)_2$. Predict whether the precipitate of CaSO_4 will be formed or not. Given that the solubility product $[K_{sp}(\text{CaSO}_4) = 9.1 \times 10^{-6} \text{ mol}^2 \text{ dm}^{-6}]$.

(7 marks)

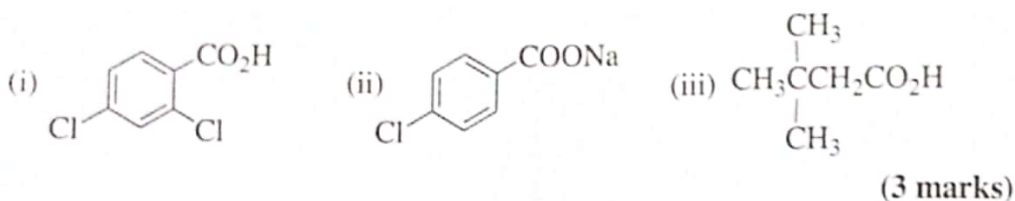
5. (a) When 500 cm^3 of an aqueous solution containing 4 g of solute **G** per litre, was shaken with 100 cm^3 of pentan-1-ol, 1.5 g of the solute **G** was extracted. Assuming molecular state of the solute remain the same in both solvents, calculate:

- The partition coefficient of the solute **G** between pentan-1-ol and water.
- The mass of the solute **G** which will remain in the aqueous solution after a further shaking with 100 cm^3 of pentan-1-ol. **(10 marks)**

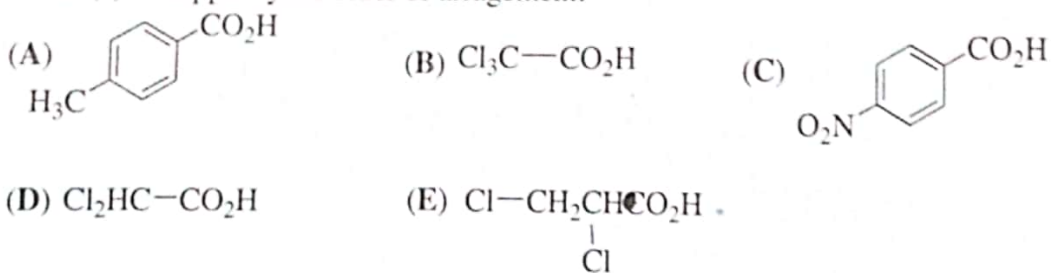
- (b) An aromatic compound **Z** was steam distilled at 98°C and 1 atmosphere pressure. The distillate was found to contain 26 g of water and 7.5 g of the compound **Z**. If the saturated vapour pressure of water at 88°C is 720 mmHg, calculate the molar mass of **Z**. **(5 marks)**

- (c) The vapour pressures of ethanol and phenol at 20°C are 53.6 mm Hg and 85.2 mm Hg, respectively. The mole fraction of ethanol in a mixture of phenol and ethanol at 20°C is 0.45. Calculate the total vapour pressure of the mixture and the mole fraction of phenol in the vapour phase. **(5 marks)**

6. (a) Write IUPAC names of each of the following organic compounds:

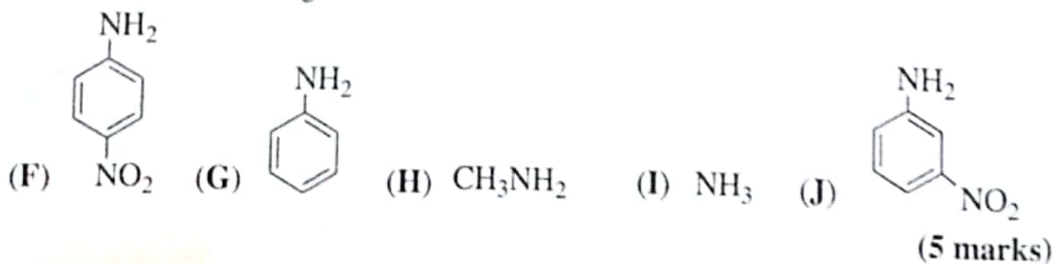


- (b) Arrange the following organic acids (**A-E**) in order of increasing acidity. Give reason(s) to support your order of arrangement.



(5 marks)

- (c) Giving reason(s), arrange the following organic compounds (**F-J**) in decreasing order of basic strengths.



- (d) Write equations for the laboratory synthesis of the following compounds. Use any suitable organic or inorganic reagent.
- (i) Propanoic acid from butanone.
 - (ii) Propanoic acid from 1-chloropropane.
 - (iii) Propanoic acid from 1-propanol.
 - (iv) Propanoic acid from propanal.

(7 marks)