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 J mol^{-1} K^{-1} or 0.082 atm mol^{-1} K^{-1} dm^3
   Standard pressure = 760 mm Hg = 1 atm = 1.0 × 10^{-5} N m^{-2}
   1F = 96,500 C
   Atomic masses: H = 1, O = 16, Al = 27, Ca = 40, S = 32, Cu = 63.5

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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.	$[X]_o$ (mol dm^{-3})	$[Y]_o$ (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 $[X] = 9.0 \times 10^{-6}$ mol dm^{-3} and $[Y] = 1.0 \times 10^{-6}$ mol dm^{-3}. **(12 marks)**

(b) A metallic object to be coated with copper, is placed in $CuSO_4$ 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)**

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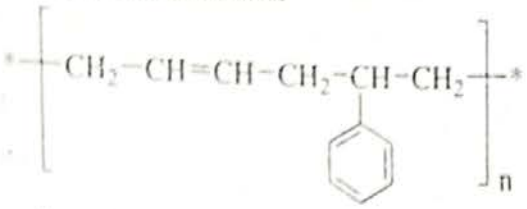
(c) Write the chemical equation for the preparation of styrene-butadiene rubber, whose structure is as follows:



(4 marks)

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

(i) initiation step.

(ii) propagation step.

(iii) 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 $K_{sp}(AgCl) = 2 \times 10^{-10}\ mol^2\ dm^{-6}$]. **(5 marks)**

(c) (i) Why precipitate forms when a solution of Na_2SO_4 and $Ca(NO_3)_2$ 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 $Ca(NO_3)_2$. Predict whether the precipitate of $CaSO_4$ will be formed or not. Given that the solubility product [$K_{sp}(CaSO_4) = 9.1 \times 10^{-6}\ mol^2 dm^{-6}$].

(7 marks)

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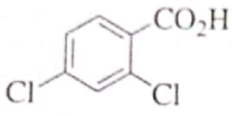
5. (a) When 500 cm^3 of an aqueous solution containing 4 g of solute **G** per litre, was shaken with 100 cm^3 of pentan-1-ol, 1.5 g of the solute **G** was extracted. Assuming molecular state of the solute remain the same in both solvents, calculate:

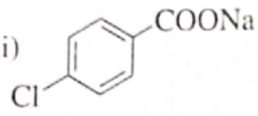
(i) The partition coefficient of the solute **G** between pentan-1-ol and water.
(ii) The mass of the solute **G** which will remain in the aqueous solution after a further shaking with 100 cm^3 of pentan-1-ol. **(10 marks)**

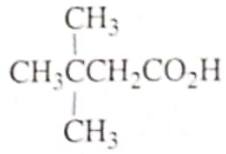
(b) An aromatic compound **Z** was steam distilled at 98 °C and 1 atmosphere pressure. The distillate was found to contain 26 g of water and 7.5 g of the compound **Z**. If the saturated vapour pressure of water at 88 °C is 720 mmHg, calculate the molar mass of **Z**. **(5 marks)**

(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:

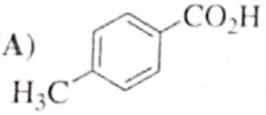
(i) 

(ii) 

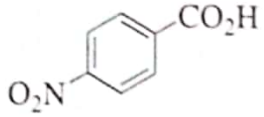
(iii) 

(3 marks)

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

(A) 

(B) Cl_3C-CO_2H

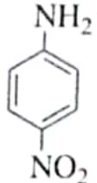
(C) 

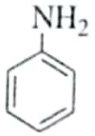
(D) Cl_2HC-CO_2H

(E) $Cl-CH_2CH(Cl)CO_2H$

(5 marks)

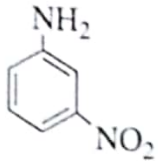
(c) Giving reason(s), arrange the following organic compounds (**F-J**) in decreasing order of basic strengths.

(F) 

(G) 

(H) CH_3NH_2

(I) NH_3

(J) 

(5 marks)

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(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)**

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