

P525/2
CHEMISTRY
Paper 2
July/August 2025
2½ hours



WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

CHEMISTRY

(Principal Subject)

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES;

- Answer five questions including three questions from section A and any two questions from section B.
- Write the answers in the answer booklet/sheets provided.
- Begin each question on a fresh page.
- Mathematical tables and graph papers are provided.
- Non programmable, silent scientific electronic calculators may be used.
- Illustrate your answers with equations where applicable.
- Where necessary use (C = 12, O = 16, H = 1, N = 14, Br = 80, Cl = 35.5, Sr. 87.6 Cr = 52, IF = 96500C)
- 1 mole of a gas at room temperature occupies 24 dm³.

Attempt only three questions from this section.
Any additional question answered will **not** be marked

1. When 2.2g of an organic compound **W** was burnt completely in excess oxygen, 3.3g of carbon dioxide and 0.9g of water were formed. The vapour density of **W** is 44.
- (a) (i) Calculate the empirical formula of **W**. (3½marks)
(ii) Determine the molecular formula of **W**. (02marks)
- (b) **W** burns with a non-sooty flame, liberates carbon dioxide from sodium carbonate and forms silver mirror with ammoniacal silver nitrate solution. Identify **W**. (0½mark)
- (c) State what would be observed and write equation for the reaction when **W** was warmed with Fehling's solution. (1½marks)
- (d) Write the mechanism for the reaction between **W** and
(i) methanol in the presence of few drops of concentrated sulphuric acid and the mixture heated. (04marks)
(ii) potassium cyanide in presence of dilute sulphuric acid at a temperature below 20°C. (2½marks)
(iii) Brady's reagent. (04marks)
- (e) Using equations only show how **W** can be converted to ethanol. (02marks)

2. (a) The *rate law* for the *stoichiometric equation* of reaction between acidified solution of bromate(V) ions and bromide ions

$$\text{BrO}_3^-(\text{aq}) + 6\text{H}^+(\text{aq}) + 5\text{Br}^-(\text{aq}) \longrightarrow \text{Br}^-(\text{aq}) + 3\text{Br}_2(\text{aq}) + 3\text{H}_2\text{O}(\text{l})$$

$$\text{Rate} = k[\text{BrO}_3^-][\text{H}^+]^2[\text{Br}^-]$$
 (i) What is meant by the terms in the italics? (02marks)
 (ii) State how the rate of reaction will be affected if the concentration of all the reacting species was doubled. (02marks)
 (iii) Determine the rate constant for the reaction and state its units. Given the initial concentrations of $[\text{Br}^-] = 0.025\text{mol dm}^{-3}$, $[\text{BrO}_3^-] = 0.015\text{mol dm}^{-3}$, $[\text{H}^+] = 0.02\text{mol dm}^{-3}$ and initial rate = $1.5 \times 10^{-5}\text{mol dm}^{-3}\text{s}^{-1}$. (2½marks)
- (b) The iodination of propanone is catalyzed by dilute sulphuric acid

$$\text{CH}_3\text{COCH}_3(\text{aq}) + \text{I}_2(\text{aq}) \longrightarrow \text{CH}_3\text{COCH}_2\text{I}(\text{aq}) + \text{HI}(\text{aq})$$
 The reaction is first order with respect to propanone and is independent of iodine and acid concentrations
 (i) Write the rate equation for the reaction. (01marks)
 (ii) Describe an experiment to show how the order of reaction with respect to iodine can be determined. (06marks)

- (c) The table below shows the results of the kinetic data for the reaction

$$\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \longrightarrow 2\text{HI}(\text{g})$$

Temperature T / K	555	606	645	714	769
Rate constant $k / \text{mol}^{-1}\text{dm}^3\text{s}^{-1}$	3.72×10^{-5}	3.72×10^{-4}	5.41×10^{-3}	0.111	0.819

- (i) Plot a graph of $\log_{10} k$ against $\frac{1}{T}$ (04marks)
 (ii) Use the graph to determine the activation energy of the reaction. (2½marks)

3. Carbon, silicon, germanium, tin and lead are elements of Group(IV) of the Periodic Table.

- (a) Write the outermost electronic configuration of
 (i) germanium (0½mark)
 (ii) lead (0½mark)
- (b) Discuss the reaction of carbon, silicon and tin with:
 (i) sodium hydroxide (4½marks)
 (ii) hot concentrated nitric acid (03marks)
 (iii) hot concentrated sulphuric acid (03marks)
- (c) An oxide **Q** consists of 90.66% by mass of lead.
 (i) Determine the formula of **Q**. (03marks)
 (ii) Describe the reaction of **Q** with sulphuric acid and sodium hydroxide. (5½marks)

4. (a) (i) Distinguish between vapour pressure and osmotic pressure. (02mark)
 (ii) State and explain how the **two** terms in a(i) above are affected by concentration of the solution. (03marks)

(b) The table below shows how osmotic pressure varies with concentration of soluble starch **T**, $(C_6H_{10}O_5)_n$ in $1dm^3$ of solution at $25^\circ C$.

Concentration of solution (gdm^{-3})	15	30	45	60	75	90	105	120
Osmotic pressure (Nm^{-2})	0.92	1.83	2.75	3.67	4.59	5.51	6.42	7.34

- (i) Plot a graph of osmotic pressure against concentration. (3½marks)
 (ii) Use the graph to determine the relative molecular mass of **T** and hence find the value of **n** in **T**. (3½marks)
- (c) Describe an experiment to determine the osmotic pressure a solution. (Diagram **not** required) (05marks)
- (d) Explain why osmotic pressure measurements are preferred to freezing point depression method when determining relative molecular mass of soluble starch. (03marks)

SECTION B (40marks)

Answer any two questions from this section

5. Using equations only show how the following conversions can be effected.

- (a) *N*-methyl aminobenzene from benzoic acid (4½marks)
 (b) propanone semicarbazone from ethanol (04½marks)
 (c) phenyl ethanoate from benzene (5½marks)
 (d) 3-hydroxybenzaldehyde from phenol (5½marks)

6. (a) Define the following terms

- (i) solubility product (01mark)
 (ii) common ion effect (01mark)

(b) Describe an experiment to determine the solubility product of lead(II) bromide at room temperature. (06marks)

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- (c) The solubility of lead(II) bromide at 25°C is 7.84gdm^{-3} . Calculate the
- mass of lead(II) bromide that precipitated when few drops of 0.2M lead(II) nitrate solution were added to 1 litre of a saturated solution lead(II) bromide at 25°C. (3½marks)
 - the percentage of lead(II) bromide that dissolved when 5.0g of lead(II) bromide were shaken with 1 litre of 0.1M sodium bromide at 25°C. (3½marks)
- (d) State and explain how the solubility of lead(II) bromide would be affected when the following were added to its saturated solution at 25°C.
- few drops of concentrated nitric acid solution. (02marks)
 - one small piece of magnesium ribbon. (02marks)
- (e) State **two** applications of solubility product. (01mark)
7. Explain the following observations;
- Benzoic acid is a stronger acid than ethanoic acid. (04marks)
 - When fluorine gas and chlorine gas were analyzed using mass spectrometer, the mass spectrum of fluorine had only one peak while that of chlorine had three peaks. (04marks)
 - Propene undergoes electrophilic addition reaction whereas propanone undergoes nucleophilic addition reaction. (05marks)
 - The bond dissociation energy of fluorine is unexpectedly lower than that of chlorine. (03marks)
 - When carbon dioxide gas was bubbled through potassium manganate (VI) solution, a green solution turned to purple and black precipitate formed. (04marks)
8. (a) What is meant by the term **ore**? (01mark)
- (b) Name the **principal ore** of copper from which copper is extracted. (0½marks)
- (c) Describe how pure copper can be extracted from the ore in (b) above. (7½marks)
- (d) Discuss the reaction of copper with
- sulphuric acid (03marks)
 - nitric acid (04marks)
- (e) State what would be observed and write equation for the reaction when:
- Potassium hexacyanoferrate(II) solution were added to copper (II) sulphate solution. (02marks)
 - Potassium iodide solution was added to copper(II) ethanoate solution. (02marks)

END