

Name: .....

Centre/Index No: .....

School.....

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P525/1  
CHEMISTRY  
Paper 1  
July/August 2024  
2  $\frac{3}{4}$  hours



## WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 hours 45 minutes

### Instructions to Candidates

- Attempt *all* questions in section *A* and any *six* questions from section *B*.
- All questions are to be answered in the spaces provided.
- A Periodic Table with relevant atomic masses is supplied at the end of the paper.
- Mathematical tables (3 figures) and non-programmable silent scientific calculators may be used.
- Illustrate your answers with equations where applicable.
- Molar gas volume at s.t.p =  $22.4 \text{ dm}^3$

For Examiner's Use Only																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

## SECTION A (46 MARKS)

Attempt all questions in this section.

1. Electrode potentials for some half-cells are given below.

Table 1

Half cell	$E^\theta(V)$
$Zn^{2+}(aq)/Zn(s)$	-0.76
$Cr_2O_7^{2-}(aq), H^+(aq), Cr^{3+}(aq)/Pt$	+1.33

- (a) Write the cell notation for the cell formed when the two half-cells are connected. (01 mark)  
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- (b) Write an equation for the overall cell reaction. (1½ marks)  
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- (c) (i) Calculate the free energy change of the cell. ( $1F = 96500C$ ) (02 marks)  
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- (ii) State whether the cell reaction is feasible or not. (01 mark)  
 Give a reason for your answer.  
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2. 2-phenylpropane when oxidized in air at 5 atm formed liquid Q which reacts with dilute sulphuric acid to form compounds X and Y. Compound Y forms a crystalline white precipitate on addition of a saturated solution of sodium hydrogensulphite.
- (a) Identify;  
 (i) X: .....  
 ..... (01 mark)  
 (ii) Y: ..... (01 mark)  
 (iii) White precipitate..... (01 mark)
- (b) Name the reagent that can be used to confirm compound X. (01 mark)  
 .....
- (c) State what would be observed when the reagent named in (b) above is added to X. (01 mark)  
 .....

3. (a) Red lead oxide ( $\text{Pb}_3\text{O}_4$ ) was shaken with dilute nitric acid and the resultant mixture filtered. Identify the: (½ mark)
- (i) cation in the filtrate.  
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- (ii) residue (½ mark)  
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- (b) Write an equation for the reaction that took place. (1½ mark)  
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- (b) Potassium iodide solution was added to the filtrate in (a) above; (01 mark)
- (i) State what was observed.  
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- (ii) Write an equation for the reaction that took place. (1½ marks)  
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4. (a) Write the;
- (i) equation for the hydrolysis of ammonium sulphate in water. (01 mark)  
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- (ii) expression for the hydrolysis constant,  $K_h$  for ammonium sulphate. (01 mark)  
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- (b) (i) The pH of 20 cm<sup>3</sup> of 0.05M ammonium sulphate solution at 25 °C was found to be 5.125  
Calculate the hydrolysis constant of ammonium sulphate. (03 marks)  
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- (ii) State the assumptions you have made in b(i) above. (01 mark)  
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5. State what would be observed and write equation(s) for the reaction(s) that would take place when the following pairs of substances are mixed.

(a)  $\text{HO}-\text{CH}_2\text{COOH}$  and phosphorous (V) chloride.

**Observation:**


(½ mark)

.....

**Equation:**

(01 mark)

.....

(b)   $\text{NHCH}_3$  and an ice-cold mixture of sodium nitrite and concentrated hydrochloric acid.

**Observation:**

(½ mark)

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**Equation:**

(01 mark)

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(c) Cobalt (II) sulphate solution and excess concentrated hydrochloric acid.

**Observation:**

(½ mark)

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**Equation:**

(01 mark)

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6. The melting points of some fluorides of period 3 elements of the Periodic Table are shown in table 2.

**Table 2:**

Formula of fluoride	NaF	$\text{AlF}_3$	$\text{SiF}_4$
Melting point ( $^{\circ}\text{C}$ )	993	1290	-90.2

(a) State the trend in the melting points of the fluorides.

(01 mark)

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(b) Explain your answer in (a).

(04 marks)

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7. The empirical formula of compound **R** is **CHO**. 20 cm<sup>3</sup> of **R** were mixed with 110 cm<sup>3</sup> of oxygen and the mixture exploded. The residual gas was cooled to room temperature and on absorption by concentrated potassium hydroxide, there was a contraction of 80 cm<sup>3</sup>.

(a) Calculate the molecular formula of **R**. (2½ marks)

- (b) **R** decolourises bromine water and reacts with sodium carbonate solution with effervescence.

Write the structural formulae and IUPAC names of two geometric isomers of **R**. (03 marks)

8. (a) Define the term **standard enthalpy of combustion**. (01 mark)

- (b) The enthalpies of combustion of some substances are shown in table 3.

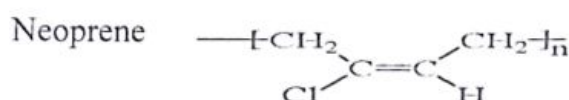
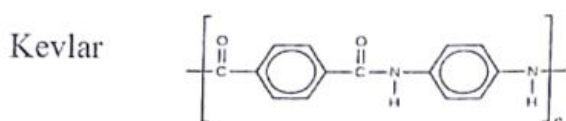
**Table 3:**

Substance	Enthalpy of combustion (KJmol <sup>-1</sup> )
Carbondisulphide	-1108.8
Carbon	-393.5
Sulphur	-296.8

Calculate the enthalpy of formation of carbon disulphide. (03 marks)

- (c) Comment on the stability of carbondisulphade. Give a reason for your answer. (01 mark)

9. The molecular structures of two polymers; Kevlar and Neoprene are shown below.



- (a) Name the type of polymer.
- (i) Kevlar (½ mark)
- (ii) Neoprene (½ mark)
- (b) Write the structural formula(e) of the monomer(s) of;
- (i) Kevlar (01 mark)
- (ii) Neoprene (½ mark)
- (c) State one use of each of the polymers above. (02 marks)

### SECTION B (54 MARKS)

Attempt any six questions from this section.

Any additional question(s) answered will **not** be marked.

10. (a) Zinc is extracted from zinc blende.
- (i) State **one** method by which the ore can be concentrated. (½ mark)

- (ii) Write equation(s) to show how zinc is obtained from the concentrated ore. (02 marks)

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- (b) Zinc dust was added to an alkaline aqueous solution containing nitrate ions.

- (i) State what was observed. (01 mark)

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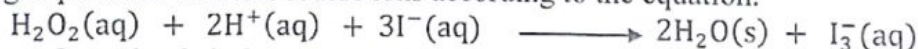
- (ii) Write an ionic equation for the reaction that took place. (1½ marks)

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- (c) 1.50 g of an ore of zinc were dissolved in excess concentrated ammonia and the resultant solution shaken with trichloromethane. The concentrations of ammonia in the aqueous layer and trichloromethane layer at equilibrium were  $0.08 \text{ mol dm}^{-3}$  and  $0.0025 \text{ mol dm}^{-3}$  respectively at  $25^\circ\text{C}$ . Calculate the percentage by mass of zinc in the ore. (Partition coefficient,  $K_p$  of ammonia between water and trichloromethane is 25) (04 marks)

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- (a) Hydrogen peroxide oxidises iodide ions according to the equation.



The rate of reaction is **independent of the concentration of hydrogen** ions and the reaction is **first order** with respect to hydrogen peroxide.

Given the kinetic data in the table 1 below obtained at  $25^\circ\text{C}$ .

Table 1:

$[\text{H}_2\text{O}_2] \text{ mol dm}^{-3}$	$[\text{I}^-] \text{ mol dm}^{-3}$	$[\text{H}^+] \text{ mol dm}^{-3}$	Initial rate $\text{mol dm}^{-3} \text{ s}^{-1}$
0.025	0.02	0.50	$5.20 \times 10^{-3}$
0.05	0.04	1.00	$2.08 \times 10^{-2}$

- (i) State two methods by which the rate of reaction above can be determined. (02 marks)

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(ii) Determine the rate equation for the reaction. (02 marks)

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(iii) Calculate the value of the rate constant and state its units. (1½ marks)

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(b) One of the experiments in Table 1 was repeated at 40 °C using the same concentrations of all reactants.

(i) State the effect on the value of the rate constant in a(iii) above. (01 mark)

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(ii) Explain your answer in b(i) (2½ marks)

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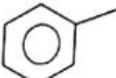
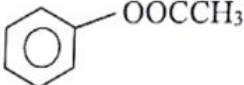
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12. Write a mechanism to show how each of the following conversions can be effected.

(a)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$  to  $\text{CH}_3\text{CH}(\text{I})\text{CH}_3$  (03 marks)

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(b)  to  (03 marks)

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(c)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{Br}$  to  $\text{CH}_3\text{C}\equiv\text{CH}$  (03 marks)

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13. Explain each of the following observations.  
(a) When anhydrous aluminium chloride is exposed to moist air, misty fumes are formed. (03 marks)

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- (b) Aqueous solutions of Copper (I) salts are colourless while solutions of Copper (II) salts are coloured. (03 marks)

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- (d) When hydrogen sulphide gas is bubbled into acidified ammonium dichromate solution, the orange solution turns green and a yellow precipitate is formed. (03 marks)

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14. (a) Fluorine and Iodine belong to group VII of the Periodic Table. Explain why;  
(i) Fluorine and Iodine have different physical states at room temperature. (2½ marks)

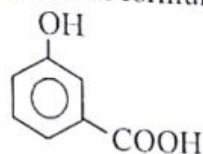
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- (ii) Fluorine reacts directly with carbon while Iodine does not. (02 marks)

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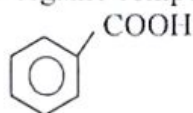
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 (b) Write an equation for the reaction between; (1½ marks)  
 (i) Fluorine and water.  
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 (ii) Iodine and hot concentrated sodium hydroxide solution. (1½ marks)  
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 (iii) hydride of Iodine and excess concentrated sulphuric acid. (1½ marks)  
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 15. Lead (II) Iodide is sparingly soluble in water.  
 (a) Write the;  
 (i) equation for the solubility of Lead (II) iodide in water. (01 mark)  
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 (ii) expression for the solubility product,  $K_{sp}$  of Lead (II) iodide. (01 mark)  
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 (b) The solubility product of Lead (II) iodide is  $1.39 \times 10^{-8} \text{ mol}^3 \text{ dm}^{-3}$  at 25 °C.  
 Calculate the solubility of Lead (II) iodide in  $\text{g dm}^{-3}$ . (03 marks)  
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 (c) Explain how the solubility of lead (II) iodide would be affected if to its saturate solution;  
 (i) a few drops of potassium iodide are added. (02 marks)  
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 (ii) magnesium ribbon is added. (02 marks)  
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16. (a) The structural formulae of two aromatic organic compounds are



and



- (i) Name the reagent(s) that can be used to distinguish between the compounds. (01 mark)

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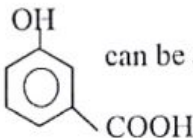
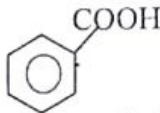
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- (ii) State what would be observed when each compound is separately treated with the reagent in a(i) above. (02 marks)

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- (b) Using equations only, show how  can be synthesized from  (04 marks)

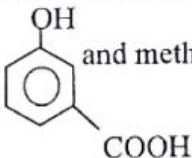
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- (c) A mixture of  and methanol was heated in the presence of sulphuric acid.

- (i) State what was observed. (01 mark)

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- (ii) Write an equation for the reaction that took place. (01 mark)

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17. (a) The vapour pressures of acetone and benzene are 30 Kpa and 12.68 kPa at 25 °C respectively. A solution containing 20% acetone and 80% benzene at 25 °C exerted a vapour pressure of 18.00 Kpa.

- (i) Calculate the vapour pressure above the solution assuming it is ideal. (03 marks)

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**Turn Over**



