

P525/2  
CHEMISTRY  
(THEORY)  
Paper 2  
July / August, 2024  
2½ hours



MASAKA DIOCESAN EXAMINATIONS BOARD  
JOINT MOCK EXAMINATIONS 2024  
Uganda Advanced Certificate of Education  
CHEMISTRY  
(Theory)  
Paper 2  
2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES**

*Answer five questions including three questions from section A and any two from section B.*

*Write the answers in the answer booklet(s) provided.*

*Begin each question on a fresh page.*

*Silent non-programmable scientific electronic calculators may be used.*

*Use equations where necessary to illustrate your answers.*

*Where necessary use the following:*

*(H = 1, C = 12, O = 16, K = 39)*



## SECTION A: (60 Marks)

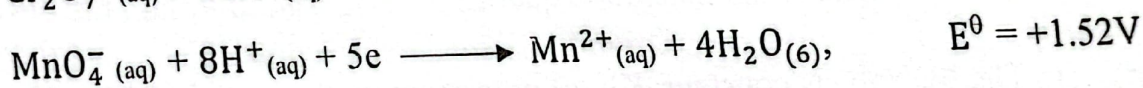
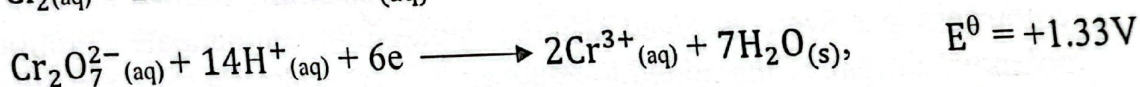
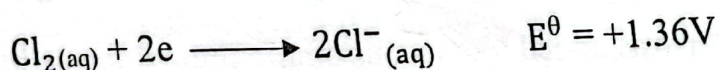
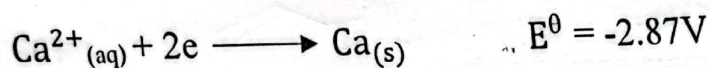
Answer any **three** questions from this section.

Any additional question answered will **not** be marked.

- (a) i) State what is meant by the **term** standard electrode potential. (01 mark)  
ii) Explain why it is not possible to measure the standard electrode potential absolutely. (02 marks)  
iii) State and explain the factors that affect the value of standard electrode potential. (03 marks)

- (b) Describe;  
i) a standard hydrogen electrode. (2½ marks)  
ii) how you would measure the standard electrode potential of a metal in a solution of its ions. (05 marks)

- (c) Some half-cells and their standard electrode potentials are given below



- i) If a cell was set up as  $\text{Mg}_{(\text{s})} / \text{Mg}^{2+}_{(\text{aq})} // \text{Ca}^{2+}_{(\text{aq})} / \text{Ca}_{(\text{s})}$ , calculate the cell e.m.f. State whether the cell arrangement is feasible or not. Explain your answer. (03 marks)  
ii) Using the half-cells above explain why hydrochloric acid can be used to acidify dichromate (VI) solutions but not manganate (VII) solution. (3½ marks)

2. The elements magnesium, aluminium, silicon, phosphorus and chlorine are members of period 3 of the periodic table.

- (a) Write the formula of the oxide of each element and state their nature. (05 marks)  
(b) Describe the reactions of the oxides in (a) above with;

- i) water, (4½ marks)  
ii) sodium hydroxide, (7½ marks)  
iii) hydrochloric acid. (03 marks)



3. (a)  $5\text{cm}^3$  of a hydrocarbon, Q, was mixed with  $30\text{cm}^3$  of oxygen and the mixture burnt. On cooling to room temperature, the volume gaseous residue was  $25\text{cm}^3$  and on treatment with aqueous potassium hydroxide there was a further decrease in volume to  $15\text{cm}^3$ .

i) Write equation for the combustion of Q. (1½ marks)

ii) Calculate the molecular formula of Q. (2½ marks)

- (b) Write equations to show how Q, in (a) above, can be converted to the following compounds indicating reagents and conditions.

i) methylbenzene. (04 marks)

ii) ethoxyethane. (02 marks)

- (c) Complete the equations below and outline a mechanism for the reaction.

i)  $\text{CH}_2\text{BrCH}_2\text{Br} \xrightarrow[\text{heat}]{\text{CH}_3\text{CH}_2\text{OK} / \text{CH}_3\text{CH}_2\text{OH}}$  (04 marks)

ii)   $\xrightarrow{\text{fuming H}_2\text{SO}_4}$  (03 marks)

iii)  $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{Br}_2 / \text{H}_2\text{O}}$  (03 marks)

4. (a) When magnesium powder was added to aqueous ammonium chloride bubbles of a colourless gas were evolved whereas potassium methanoate solutions forms a green precipitate when added to aqueous iron (II) salt. Explain the observations. (06 marks)

- (b) i) The hydrolysis constant,  $K_h$ , of potassium methanoate is  $6.25 \times 10^{-11} \text{ mol dm}^{-3}$  at  $25^\circ\text{C}$ . Calculate the pH of a solution containing 1.65 grams per litre of potassium methanoate solution. (04 marks)

- ii) to a litre of a 0.1M potassium methanoate was added  $10\text{cm}^3$  of 1M hydrochloric acid. Calculate the pH of the resultant solution.

(The acid ionisation constant of methanoic acid  $K_a = 1.6 \times 10^{-4} \text{ mol dm}^{-3}$ )

- (c) Explain what would happen to the pH of a solution containing sodium methanoate and methanoic acid if to it was added a small amount of;

i) hydrochloric acid, (03 marks)

ii) sodium hydroxide. (03 marks)

- (d) State two uses of a buffer. (01 mark)



## SECTION B: (40 Marks)

Answer any two questions from this section.  
Any additional question(s) answered will not be marked.

- (a) The boiling points of the hydrides of group VII elements in the periodic table are given in the table below:

Hydride	HF	HCl	HBr	HI
Boiling point (°C)	+19.9	-85.0	-66.7	-35.4

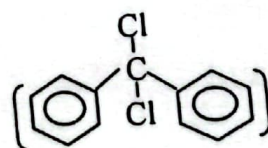
Explain the trend in the boiling points of the hydrides. (4½ marks)

- (b) Arrange the hydrogen halides in order of decreasing acid strength and explain your order. (04 marks)
- (c) Concentrated sulphuric acid was separately treated with each hydrogen halide. Use equations to illustrate your answers where necessary. (05 marks)
- (d) The oxo acids of chlorine are given below  $\text{HClO}_2$ ,  $\text{HClO}$ ,  $\text{CHlO}_4$ ,  $\text{HClO}_3$ .  
i) Name each oxide and arrange them in order of increasing acidity. (2½ marks)  
ii) Give reasons for the order written. (02 marks)
- (e) Write equation for the reaction between;  
i) concentrated sulphuric acid and sodium bromide. (1½ marks)  
ii) concentrated phosphoric acid and sodium iodide. (01 mark)

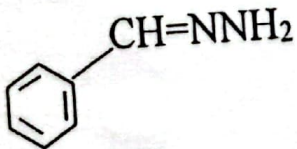
6. Write equations to show how the following conversions can be affected. Indicate reagents and conditions. (04 marks)

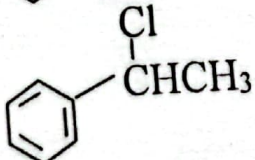
- (a) Propan-2-ol to chloroethane.

- (b) Benzene to dichlorodiphenylmethane



- (c) Propyne to  $(\text{CH}_3)_2\text{CHNH}_2$

- (d) Calcium carbide to 

- (e) 1-chloropropane to 



7. (a) A mixture of water and aminobenzene boils at  $96^{\circ}\text{C}$  at  $101.3\text{kPa}$ . The boiling point of water and aminobenzene are  $100^{\circ}\text{C}$  and  $112^{\circ}\text{C}$  respectively at the same pressure. Explain; (04 marks)
- (b) i) State what is meant by the term steam distillation. (01 mark)
- ii) State and explain the principles of steam distillation. (04 marks)
- iii) State the requirements for a compound to be isolated by steam distillation. (1½ marks)
- iv) Name a substance that can be separated by steam distillation other than aminobenzene. (½ marks)
- v) State one advantage of steam distillation over fractional distillation. (01 mark)
- (c) When compound T was steam distilled at standard atmospheric pressure and  $97^{\circ}\text{C}$ , the vapour pressure of water at this temperature was  $730\text{mmHg}$  and the distilled contained 74% water. Calculate the relative molecular mass of T. (2½ marks)
- (d) i) The vapour pressure of water at  $50^{\circ}\text{C}$  is  $92\text{mmHg}$ . A solution containing  $18.1\text{g}$  of a non-volatile solute Y in  $100\text{g}$  of water has a vapour pressure of  $87\text{mmHg}$  at the same temperature. Calculate the relative molecular mass of Y. (03 marks)
- ii) State and explain the effect of concentration of solute on the boiling point of a solution. (2½ marks)
8. (a) Spathic iron is one of the ores of iron. (½ mark)
- i) Write the formula of this ore. (06 marks)
- ii) Describe how iron is extracted from the above ore.
- (b) Describe the reaction of iron with; (03 marks)
- i) air (03 marks)
- ii) water (04 marks)
- iii) sulphuric acid
- (c) Sodium hydroxide solution was added to a solution of an iron (II) salt and left to stand. (1½ mark)
- i) State what was observed. (02 marks)
- ii) Write equation(s) for the reaction(s) that took place.

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