Candidates Name:.....Sign:.....
P525/1
Chemistry
Paper 1
Apr/May, 2024
2¾ hours

END OF TERM I EXAMINATIONS 2024
S.5 CHEMISTRY
PAPER 1
2 HOURS 45 MINUTES

INSTRUCTIONS TO CANDIDATES:

- ✓ Answer all questions in section A and six questions in section B.
- ✓ All questions must be answered in the spaces provided.
- ✓ Periodic table with relative atomic masses is attached at the end of the paper.
- ✓ Mathematical tables (3-figure tables) are adequate or non-programmable scientific electronic calculators may be used.
- ✓ Illustrate your answers with equations where applicable. Where necessary, use the following.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)
Answer all questions in this section

1(a) What is meant by the term hydro carbon? (½mks)

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(b) Complete the table below; (3mks)

Hydro carbon	*General formula*	*Function group*
Alkane		
Alkene		
Alkyne		

(c) State what is observed when ethene is bubbled through acidified potassium manganate solution. (1mk)

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2. A solution of copper (I) sulphate was warmed.

(a)(i) State what was observed. (1½mks)

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(ii) Write the equation of the reaction that took place. (1½mks)

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(b)(i) Explain your observation in a(i) above. (1½mks)

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(ii) Name the reaction demonstrated in 2(a)(ii) above. (½mks)

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3(a) Define the term coordination number? (1mk)

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(b) Complete the table below; (04mks)

Species	***Coordination number***	***Oxidation***
$Cu(H_2O)_4^{2+}$		
$Cucl_4^{2-}$		
$Zn(NH_3)_4^{2+}$		
$Al(OH)_4^-$		

A solid Q contains 9.37% by mass of magnesium, 10.39% nitrogen, oxygen is 38.06% and 42.18% water.

(i) Calculate the empirical formula of Q. (3mks)

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(ii) Determine the molecular formula of Q (1mk)

(RFM of Q = 256)

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(b) Solution of Q reacts with Iron (II) sulphate in the presence of concentrated sulphuric acid to form a brown ring. Identify Q. (½mk)

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(c) Write equation for the reaction that would take place if Q was heated. (1½mks)

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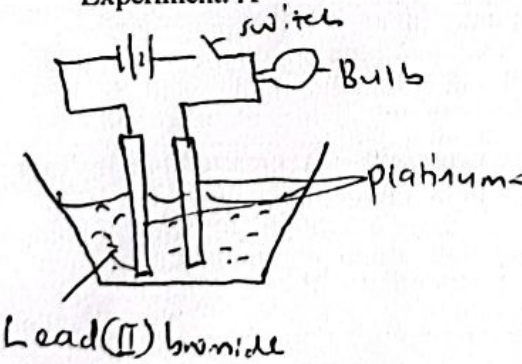
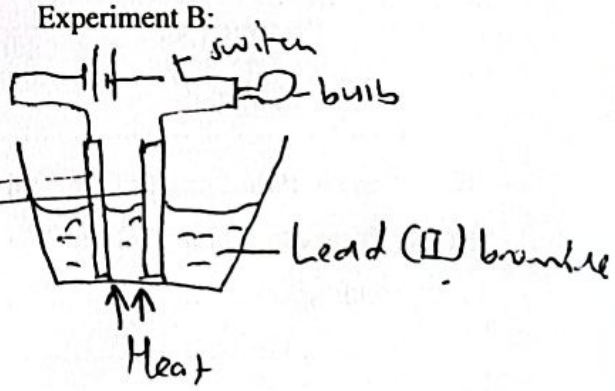
4(a) Study the experiments below;

Experiment: A



Experiment B:



In both experiments above , the switch was closed.

(i) State what was observed

In A (1mk)

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(ii) Explain your observation in experiment B. (1mk)

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(b) Write an equation taking place in B at each electrode.

Anode (1½mks)

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Cathode (1½mks)

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5. For each of the following pairs of ions. Name a reagent used to distinguish them and state what is observed in each case.

(a) Ni^{2+} and Cu^{2+} ions (2½mks)

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(b) Zn^{2+} and Pb^{2+} ions (2½mks)

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6. In the manufacture of ammonia in the haber process, nitrogen is reacted with hydrogen gas.

(a)(i) State one source of each; (1mk)

Nitrogen:.....

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Hydrogen:.....

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(ii) Write the equation of the reaction that takes place in the haber process. (1½mks)

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State any three factors which affect the maximum yield of ammonia in the haber process. (1½mks)

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7. An alkene R, diffuses through a porous in 2 minutes. Under similar conditions, the same volume of oxygen diffuses in 1.75 minutes.

(a)(i) Calculate the formula mass of R. (1½mks)

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(ii) Determine the molecular formula of R. (2mks)

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(b) Write equations to show how R can be synthesized from propanone. (1½mks)

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8(a) What is meant by oxidation state? (1mk)

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(b) Calculate the oxidation state of manganese in the following;

(i) MnO_2 (½mk)

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(ii) MnO_4^- (½mk)

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(iii) Mn_2O_3 (½mk)

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9(a) State two colligative property of a dilute solution other than depression of freezing point. (1

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(b) Ethane – 1, 2 – diol ($HOCH_2CH_2OH$), is used as an antifreeze for water in car radiators. Calculate the mass of ethane – 1, 2-diol that should be added to 1kg of water to prevent it from freezing at -10^0c. (Freezing point depression constant for water $=1.86^0cKgmol^{-1}$). (2mks)

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SECTION B (54 MARKS)

Answer <u>six</u> questions from this section

10. For each of the following pairs, name a reagent used to distinguish between the pair and state what is observed in each case.

(a)  and CH_3COOH (03mks)

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(b) $CH_3C \equiv CCH_3$ and $CH_3CH_2C \equiv CH$. (03mks)

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(c) CH_3CH_2OH and $CH_3\underset{OH}{C}HCH_3$ (03mks)

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11(a). The atomic number of aluminium is 13.

Write the;

(i) Electronic configuration of aluminium. (01mk)

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(ii) Formula of the chloride of aluminium. (01mk)

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(b) Write equation for the reaction between aluminium chloride and;

(i) water (1½mks)

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(ii) Excess ammonia solution (1½mks)

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(iii) Excess sodium hydroxide solution (3mks)

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(c) Name one reagent that can be used to distinguish between aluminium and lead (II) ions in solution. (1mk)

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12(a) Define the term ore. (1mk)

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(b) Describe briefly how the ore is concentrated by;

(i) physical method (4mks)

(Give examples)

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(iii) Chemical method (4mks)

(Give examples)

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13(a) What is meant by standard electrode potential and state its units? (1½mks)

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(b) Equations for some half cell reactions are given below;

$SO_4^{2-}(aq) + H_2O_{(l)} + 2e \longrightarrow SO_3^{2-}(aq) + 2OH^-(aq)$ $E^0 = 0.90V$ $-0.90V$

$Cu^{2+}_{(aq)} + 2e \longrightarrow cu_{(s)}$ $E^0 = +0.34v$

(i) Write equation for the overall reaction that would take place if the half cells are combined. (1½mks)

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(ii) Calculate the *e.m.f* of the cell in (b)(i). (02mks)

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(i) Calculate Gibbs free energy (If = 96500C) (2mks)

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(ii) State whether the cell reaction would be feasible or not. Give a reason for your answer. (2mks)

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14. The cooling curves of a solution containing 1,2g of sulphur in 20.0g of carbondisulphide and that of pure carbon disulphide are shown in Figure 1 below.

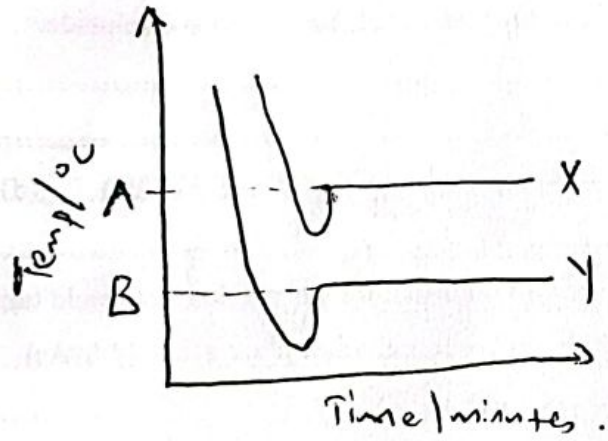

Fig 1.

(a)(i) Identify the curves X and Y (1mk)

X.....

Y.....

(ii) State what is represented by the points A and B. (1mk)

A.....

B.....

(b) Calculate the relative molecular mass of sulphur in carbon disulphide. (The freezing point depression constant for carbon disulphide is $6.10^0 cmol^{-1}Kg^{-1}$ and freezing point depression of carbon disulphide was $1.43^0 c$. (3½mks)

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(i) Comment on your result in (b) above. (1mk)

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(ii) Deduce and draw the molecular structure of sulphur in carbon disulphide. (2½mks)

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15. State what would be observed and write equation for the reaction that would take place when

(a) copper is added to a solution of hot concentrated nitric acid. (2½mks)

Observation:.....

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Equation:.....

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(b) Potassium sulphite solution is added to a solution of acidified potassium dichromate (VI) (2½mks)

Observation:.....

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Equation:.....

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Aqueous iron (II) sulphate solution is added to acidified potassium manganate (VII) solution. (2mks)

Observation:.....

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Equation:.....

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16. Complete the following equations with the possible mechanism outlined

(a) $CH_4 + Cl_2 \xrightarrow{H_2O_2}$ ..... (3mks)

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(b) $CH_3CH_3 + HNO_3 \xrightarrow[\text{heat}]{}$ ..... (3mks)

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(c) $CH_3CH_2OH \xrightarrow[180^0c]{Conc.H_2SO_4}$

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17(a) What is meant by electron affinity? (1mk)

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(b) Explain how the following affect first electron affinity down a group.

(i) Nuclear change. (3mks)

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(ii) Screening effect (3mks)

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(c) Explain why the first electron affinity of oxygen is -142KJmol^{-1} and second electron affinity of oxygen is +702KJmol^{-1}. (2mks)

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