J.W Ogwang MARKS GUIDE:

Name: ..... Sign: .....

P525/1
CHEMISTRY
(Theory)
Paper 1
July 2024

2024. 08. 10

Uganda Advanced Certificate of Education

S.5 END OF TERM II CHEMISTRY EXAMINATION

Paper 1

2hours 45minutes

Instructions to Candidates:

Answer ALL Questions in Section A and any Six Questions in Section B. All Questions Must Be Answered in the spaces provided.

SECTION A (46 Marks)

1. a. $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$ ✓ ✓ 01 [01 mark]

b. $^{113}_{48}Cd + {}^{1}_{0}n \rightarrow {}^{114}_{48}Cd + \gamma$ ✓ 01 [01 mark]

c. $^{214}_{83}Bi \rightarrow 3\beta + {}^{206}_{82}Pb + 2\alpha$ ✓ 01 [01 mark]

d. When a radioactive isotope was stored for 420 days, it retained a eighth, ($\frac{1}{8}$) of its original activity. Calculate the half-life of the isotope. [03½ marks]

$\frac{N_t}{N_0} = e^{-\lambda t}$ ✓

$\frac{1}{8} = e^{-420\lambda}$

$\ln\frac{1}{8} = -420\lambda$.

$\lambda = \left(\frac{\ln\frac{1}{8}}{420}\right)$ ✓

$\lambda = 4.95 \times 10^{-3}\ day^{-1}$ ✓

$\therefore t_{\frac{1}{2}} = \frac{0.693}{\lambda}$ ✓

$= \frac{0.693}{4.95 \times 10^{-3}}$ ✓ 03½

$= 140\ days$ ✓

06½

2. a. State what would be observed and write equation for the reaction that would take place if a solution of potassium iodide was added to aqueous copper(II) sulphate. [02½ marks]

Observations:
A white precipitate in a brown solution formed. 01

Equation:
$2Cu^{2+}_{(aq)} + 4I^-_{(aq)} \longrightarrow Cu_2I_{2(s)} + I_{2(aq)}$ 01½

b. A few drops sodium thiosulphate solution was added to the mixture in(a) above. State what would be observed and write equation of reaction that took place. [02½ marks]

observations:
Brown solution turned colourless and a white solid remained. 01

equation:
$I_{2(aq)} + 2S_2O_3^{2-}{}_{(aq)} \longrightarrow 2I^-_{(aq)} + S_4O_6^{2-}{}_{(aq)}$ 01½

05

3. When a compound W was steam distilled at 86°C and 760mmHg pressure, the distillate was found to contain 85% of water by mass. Calculate the relative molecular mass of W. (*the vapour pressure of water at 86°C is 740mmHg*) [04 marks]

Using relation ship $\frac{\text{Mass of W}}{\text{Mass of } H_2O} = \frac{Mr\,W \times V.P \text{ of } W}{Mr\,H_2O \times V.P \text{ of } H_2O}$

$\frac{(100-85)}{85} = 15 = \frac{Mr\,W \times (760-740)}{18 \times 740}$

$\therefore$ Molecular Mass of $W = \left(\frac{15 \times 18 \times 740}{85 \times 20}\right)$

$= 118$

04

4. a. Write equation for the complete combustion of ethanal, CH_3CHO. [01½ marks]

$CH_3CHO_{(l)} + \frac{5}{2}O_{2(g)} \longrightarrow 2CO_{2(g)} + 2H_2O_{(l)}$

b. The enthalpies of combustion of carbon, hydrogen and ethanal are -394, -286 and -1187 $kMol^{-1}$ respectively. Calculate the enthalpy of formation of ethanol [04 marks]

5. Write equation for the reaction between: -

a. acidified potassium dichromate(VI) and sodium sulphite. [01½ marks]

$Cr_2O_{7(aq)}^{2-} + 8H^+_{(aq)} + 3SO_{3(aq)}^{2-} \longrightarrow 2Cr^{3+}_{(aq)} + 4H_2O_{(l)} + 3SO_{4(aq)}^{2-}$ ½

b. aqueous sodium hydroxide and beryllium [01½ marks]

$Be_{(s)} + 2\bar{O}H_{(aq)} + 2H_2O_{(l)} \longrightarrow Be(OH)_{4(aq)}^{2-} + H_{2(g)}$.

or $Be_{(s)} + 2\bar{O}H_{(aq)} \longrightarrow BeO_{2(aq)}^{2-} + H_{2(g)}$. ½

$K_2CrO_{4(aq)} + BaCl_{2(aq)} \longrightarrow BaCrO_{4(s)} + 2KCl_{(aq)}$

c. potassium chromate(VI) solution and barium chloride solution. [01½ marks]

$Ba^{2+}_{(aq)} + CrO_4^{2-}{}_{(aq)} \longrightarrow BaCrO_{4(s)}$ 01½

6. A hydrocarbon Q, with molecular formula C_xH_y reacts with oxygen according to the following equation.

$$C_xH_y + \frac{4x+y}{4}O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

When $10cm^3$ of Q was exploded in $90cm^3$ of an excess amount of oxygen, it burnt completely. The volume of the residual gas after cooling to room temperature was $70cm^3$. When the residual gases were passed through potassium hydroxide solution, the volume reduced to $40cm^3$.

a. Determine the molecular formula of Q. [03½ marks]

Volume of Carbon dioxide that rxted $= (70-40) = 30cm^3$.

$\therefore \frac{10x}{10} = \frac{30}{10}$

$x = 3$

Volume of oxygen that rxted $= (90-40) = 50cm^3$ 03½

$\therefore \left(\frac{4x+y}{4}\right)\frac{10}{10} = \frac{50}{10}$ $y = 8$ ∴ Molecular formula of Q $= C_3H_8$.

$4x3 + y = 5x4$

$12 + y = 20$

b. Write equations to show how Q can be synthesis from an alcohol. [02½ marks]

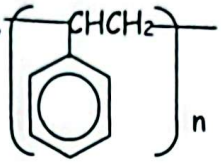
$CH_3CH_2CH_2OH \xrightarrow[\text{Heat}]{\text{conc } H_2SO_4} CH_3CH=CH_2$

$CH_3CH=CH_2 \xrightarrow[150^oC]{H_2|Ni\ cat} CH_3CH_2CH_3$ 02½

06

7. a. Define the term Osmotic pressure of a solution [01 mark]

Is the pressure that Must be applied to asolution to balance the tendency of solvent Mofeales to move from solvent side to the solution side across asemi-permeable Membrane. ✓ 01.

b. Polystyrene,  is formed by polymerization of phenylethene.

The osmotic pressure of a solution containing 5.5.g of polystyrene in 1.0dm^3 of benzene is 1.05 x 10^{-3} atmospheres at 20°C. (Given that R = 0.082atmK^{-1}mol^{-1})

i. Determine the molecular mass of polystyrene. [03 marks]

Using relationship $\Pi V = nRT$. ✓ 01

$1.05\times10^{-3} \times 1 = \frac{5.5}{Mr} \times 0.082 \times 293$ ✓½

$\therefore Mr = \frac{(5.5 \times 0.082 \times 293)}{1.05\times10^{-3} \times 1}$ ✓½

$= 125,850.5$ ✓½

OR $Mr = \frac{5.5 \times 8.314 \times 293}{101325 \times 1.05\times10^{-3}}$

$= 125850.9$ 02

ii. Determine the number of monomers that formed the polystyrene. [01½ marks]

Molar Mass of Polymer = $(C_6H_5CH{=}CH_2) = (12\times8+8) = 104$ ✓½

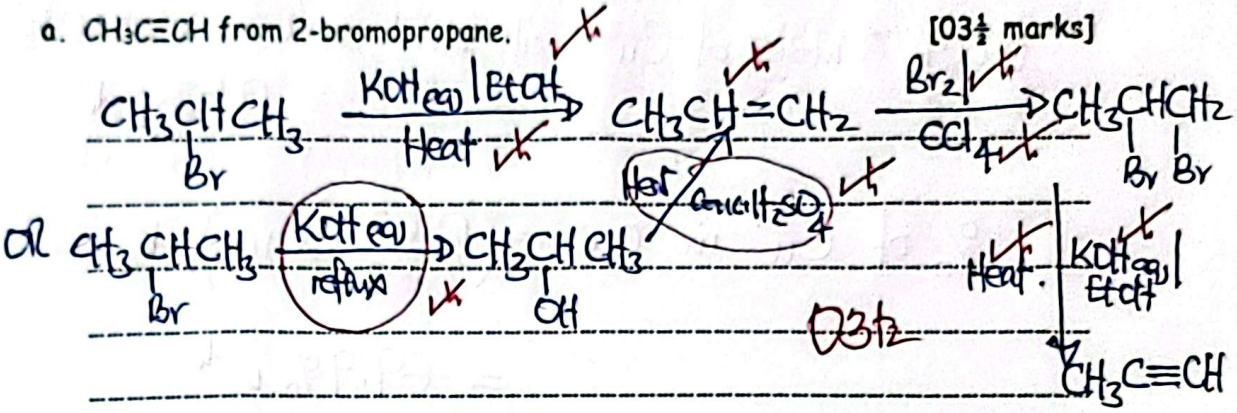
$\therefore$ Number of Monomers = $\frac{(125,850.5)}{104}$ ✓½ 01½

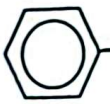
$= 1210$ Monomers. ✓½

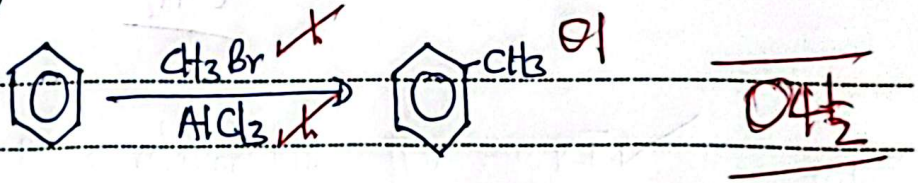
05½

8. Write equations to show how the following compounds can be synthesized.

a. $CH_3C\equiv CH$ from 2-bromopropane. [03½ marks]



b.  from benzene [01marks]



9. 0.89g of a copper ore was leached with dilute sulphuric acid and the resultant solution diluted to 250cm³. To 30cm³ of this solution was added 10% potassium iodide solution. The liberated iodine required 23.50cm³ of 0.05M sodium thiosulphate solution for complete reaction. Calculate the percentage of copper in the ore. The reactions taking place are: - [04½ marks]

$$2Cu^{2+}(aq) + 4I^- \rightarrow Cu_2I_2(s) + I_2(aq)$$

$$I_2(aq) + 2S_2O_3^{2-}(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq)$$

Overall eqn: $2Cu^{2+}_{(aq)} + 2I^-_{(aq)} + 2S_2O_3^{2-}{}_{(aq)} \rightarrow Cu_2I_{2(s)} + S_4O_6^{2-}{}_{(aq)}$

Number of Moles of $S_2O_3^{2-} = \left(\frac{23.50 \times 0.05}{1000}\right) = 1.175 \times 10^{-3}$ Moles.

Mole ratio $S_2O_3^{2-}{}_{(aq)} : Cu^{2+}$

$2 : 2$

$1.175\times10^{-3} : \frac{2\times1.175\times10^{-3}}{2}$

Number of Moles of $Cu^{2+} = 1.175\times10^{-3}$ 03

$\Rightarrow$ 30.0cm³ of Cu^{2+} solution contains 1.175×10^{-3}

$\therefore$ 250 cm³ of Cu^{2+} will contain $= \left(\frac{250\times1.175\times10^{-3}}{30.0}\right) = 0.009792$ Moles

1 mole of Cu^{2+} weighs 63.5g. ✓½

∴ 0.009792 moles of Cu^{2+} will weigh = (63.5 × 0.009792)

= 0.622g ✓½

% of Cu^{2+} in ore = $\left(\frac{0.622}{0.89} \times 100\right)$ ✓½

= 69.9%. ✓½

04½

SECTION B (54 Marks)

Attempt ANY SIX Questions from this Section.

Additional Questions Shall not be marked.

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10. Complete the following equations of reactions and in each case outline a mechanism for the reaction.

a) $CH_3CH_2Cl + HC\equiv C^-Na^+ \xrightarrow[\text{Dry ether}]{\text{Liq. } NH_3} CH_3CH_2C\equiv CH + NaCl$ **[02 marks]**

Mechanism: $HC\equiv C^-Na^+ \longrightarrow HC\equiv C^- + Na^+$

02.

$CH_3CH_2Cl + C\equiv CH^- \longrightarrow CH_3CH_2C\equiv CH + Cl^-$

b) $CH_3CH=CH_2 \xrightarrow[\text{Warm}]{\text{Bromine } /H_2O} CH_3CH(OH)CH_2Br$ **[04 marks]**

Mechanism:

$H_2O + Br_2 \rightleftharpoons HOBr + HBr$

$CH_3CH=CH_2 \longrightarrow CH_3\overset{+}{C}HCH_2Br + \overset{-}{O}H$

OR $CH_3CH=CH_2 \longrightarrow CH_3\overset{+}{C}HCH_2$ (Br–Br) $\longrightarrow CH_3CH(OH_2)CH_2Br$

$CH_3CH(OH_2)CH_2Br \xrightarrow{-H^+} CH_3CH(OH)CH_2Br$

04.

$CH_3CH(OH)CH_2Br$

c) $CH_3CH(Br)CHBrCH_3 \xrightarrow[\text{Heat}]{C_2H_5O^-Na^+/C_2H_5OH} CH_3C\equiv CCH_3$ **[03 marks]**

Mechanism:

$CH_3CH_2O^-Na^+ \longrightarrow CH_3CH_2O^- + Na^+$

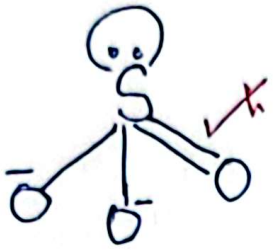
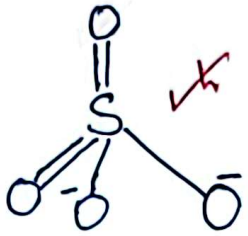
03

$CH_3CHBrCHBrCH_3 \longrightarrow CH_3C\equiv CCH_3$

$CH_3C\equiv CCH_3 + CH_3CH_2OH$

09

11. a. Draw the structure and name the shape of the following oxyanions. In each case, state the oxidation state of the sulphur atom. [04½ marks]

Oxyanion	Structure:	Shape	Oxidation state of sulphur
SO_3^{2-}		Trigonal Pyramidal	+4
SO_4^{2-}		Tetrahedral.	+6

03

b. Explain the structure of the SO_3^{2-} ion. [03½ marks]

Sulphite posses alone pair of electron on sulphur atom and three bonding pairs of electrons. The bonding pairs of electrons repel each other but lone pair - bond pair repulsion is greater reducing the bond angle forming atrigonal pyramidal shape. 03½

c. Name the reagent(s) that can be used to distinguish between the oxyanions in(a) above. [01 mark]

Acidified potassium dichromate (VI) soln 01
or Acidified potassium Manganate (VII) soln.

c. State what would be observed if each of the oxyanion is treated with the reagent(s) you have named in(b) above [01 mark]

SO_3^{2-} : orange solution turns green. ✓½

SO_4^{2-} : No observable change. ✓½ 01

09

d. Write the equation(s) for any reaction that would take place when a solution of each of the oxyanions is treated separately with the reagent(s) you have named in(c) above. [01½marks]

$3SO_3^{2-}(aq) + Cr_2O_7^{2-}(aq) + 8H^+(aq) \longrightarrow 3SO_4^{2-}(aq) + 2Cr^{3+}(aq) + 4H_2O(l)$ ✓½ ✓½ 01½

or: $5SO_3^{2-}(aq) + 2MnO_4^-(aq) + 6H^+(aq) \longrightarrow 5SO_4^{2-}(aq) + 2Mn^{2+}(aq) + 3H_2O(l)$.

12. A hydrocarbon M contains 85.7% carbon and has a density of 2.5gl^{-1} at s.t.p.

a) Calculate the empirical formula of M. [02 marks]

Elements:	C	:	H
%mass	85.7		100 − 85.7 = 14.3 ✓½
Moles	$\frac{85.7}{12} = 7.142$	:	$\frac{14.3}{1} = 14.3$
Ratio	$\frac{7.142}{7.142}$	:	$\frac{14.3}{7.142}$ ✓½
	1	:	2. ✓½

Empirical formula of M = CH_2 ✓½ 02.

b) Determine the molecular formula of M. [02 marks]

1litre of M at stp weighs 2.5g. ∴ Molecular formula = $(CH_2)_n$ ✓½

∴ 22.4litre of M at stp will $\frac{22.4 \times 2.5}{1}$ ✓½ $= \frac{14n}{14} = \frac{56}{14}$ ✓½

Molar Mass of M = 56. ✓½ 02. $n = 4$

$= C_4H_8$. ✓½

c) Write the structural formulae of all the possible open chain isomers of M. [01½ marks]

$CH_3CH_2CH=CH_2$ ✓½ $CH_3C(CH_3)=CH_2$ ✓½

$CH_3CH=CHCH_3$ ✓½ 01½

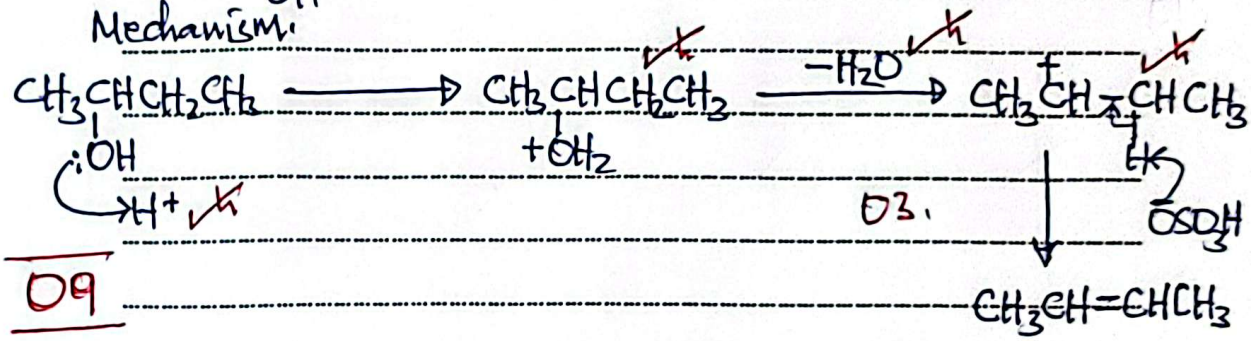
d) Ozonolysis of M and subsequent work-up gave one compound. Identify M. [0½ mark]

$CH_3CH=CHCH_3$ or But-2-ene.

d. Write an equation to show how M can be synthesized from butan-2-ol and indicate the mechanism for the reaction. [03 marks]

$$CH_3\underset{\underset{OH}{|}}{C}HCH_2CH_3 \xrightarrow[\text{Heat.}]{\text{Conc. } H_2SO_4} CH_3CH=CHCH_3 + H_2O.$$

Mechanism:



09

13. Beryllium and magnesium are elements in group (II) of the Periodic Table.

a) Explain the following:

i. The first ionization energy of beryllium is higher than that of magnesium. [02 marks]

Beryllium has small atomic radius and ahigher effective nuclear charge than Magnesium so its outermost electron is highly experiencing stronger attraction leading to higher first ionization than Magnessium. 02

ii. The polarizing power of magnesium ions is lower than that of beryllium ions. [01 mark]

Beryllium has asmaller ionic radius and higher charge density than Magnesium. 01

b) Beryllium reacts with aqueous sodium hydroxide solution. Write equation for the reaction. [01½ marks]

$Be_{(s)} + 2\bar{O}H_{(aq)} + 2H_2O_{(l)} \longrightarrow Be(OH)_4^{2-}{}_{(aq)} + H_{2(g)}$

OR: $Be_{(s)} + 2\bar{O}H_{(aq)} \longrightarrow BeO_2^{2-}{}_{(aq)} + H_{2(g)}$.

c) State the conditions under which beryllium ~~oxide~~ and magnesium ~~oxide~~ reacts with the following substances and where applicable, write equation(s) for the reaction(s).

Q9

i. Water. [02 marks]

Beryllium doesnot rxt with water however, heated Magnium burns with abrilliant flame in steam to form magnesium oxide and hydrogen gas: $Mg_{(s)} + H_2O_{(l)} \longrightarrow MgO_{(s)} + H_{2(g)}$. O2

ii. Sodium hydroxide. [02½ marks]

Mg does not rxt with hot conc. Sodium hydroxide however, Beryllium rxts with hot conc. sodium hydroxide to form sodium beryllate and hydrogen

$Be_{(s)} + 2\bar{O}H_{(aq)} + 2H_2O_{(l)} \longrightarrow Be(OH)_4^{2-}{}_{(aq)} + H_{2(g)}$ O2½

14. Ammonium ferrous sulphate-hexahydrate, $(NH_4)_2SO_4FeSO_4.6H_2O$ is normally used to standardize a solution of potassium manganate(VII) solution acidified with using sulphuric acid.

a. Write equation for the reaction between potassium manganate(VII) and the iron(II) salt solution. [01½ marks]

$5Fe^{2+}_{(aq)} + MnO_4^-{}_{(aq)} + 8H^+_{(aq)} \longrightarrow Mn^{2+}_{(aq)} + 4H_2O_{(l)} + 5Fe^{3+}$

OH2

b. State why hydrochloric acid is not usually used to acidify solution of potassium manganate(VII) during volumetric analysis. [02½ marks]

Bcoz Potassium Manganate (VII) oxidises hydrochloric acid to Molecular chlorine which is also an oxidising agent thus they will compete for reducing agent leading to wrong results.

 O2½

$2MnO_4^-{}_{(aq)} + 16H^+_{(aq)} + 10Cl^-_{(aq)} \longrightarrow 2Mn^{2+}_{(aq)} + 8H_2O_{(l)} + 5Cl_{2(g)}$

c. 25.00cm³ of an acidified solution of a 0.02M manganate(VII) ion solution required exactly 26.55cm³ of a solution containing 5.10g per liter of an impure sodium nitrite, ($NaNO_2$). Determine the percentage of the nitrite in salt. [Na=23, N=14, O=16] [05 marks]

Number of Moles of MnO_4^- = $\left(\frac{25.0 \times 0.02}{1000}\right)$ = 5.0×10^{-4} Mole

$2MnO_{4(aq)}^- + 6H_{(aq)}^+ + 5NO_{2(aq)}^- \longrightarrow 2Mn_{(aq)}^{2+} + 3H_2O_{(l)} + 5NO_{3(aq)}^-$

Mole ratio $MnO_4^-{}_{(aq)} : NO_2^-$

$2 : 5$

$\therefore 5.0 \times 10^{-4} : \frac{5 \times 5 \times 10^{-4}}{2}$

$\therefore$ No of Moles of NO_2^- = 0.00125 Moles.

$\Rightarrow$ 26.55cm³ of NO_2^- Soln contains 0.00125 Moles

$\therefore$ 1000cm³ of NO_2^- will = $\left(\frac{1000 \times 0.00125}{26.55}\right)$

Molar Concentration of NO_2^- = 0.0471 Moldm⁻³

Mass of $NaNO_2$ = (23+14+32) = 69g.

Mass of Pure $NaNO_2$ = 69 x 0.0471 = 3.2499gdm⁻³

% of $NaNO_2$ = $\frac{3.2499}{5.10} \times 100$ = 63.72%

05

09

15. a Write the formula and the name of one ore from which aluminium can be extracted. [01 mark]

$Al_2O_3 \cdot 2H_2O$ — Bauxite. 01

b. Name two main impurities in the ore you have named in(a) above. [01 mark]

Silicon (IV) oxide.

Iron (III) oxide. 01

c. In the extraction of aluminium, after the removal of the impurities, the ore is mixed with cryolite and then electrolyzed to extract aluminium.

i. State the purpose of adding cryolite. [01 mark]

To lower the melting point of aluminium oxide. 01

ii. Name the electrode used in the electrolysis. [0½ mark]

Carbon graphite. ✓½ 0½

iii. Write equation for the reaction that took place when an electric current was passed through the molten electrolyte. [01½ marks]

$Al_2O_{3(l)} \longrightarrow 2Al^{3+}_{(l)} + 3O^{2-}_{(l)}$ ✓✓ 01½

d. Aluminium powder was added to dilute sodium hydroxide solution.

i. State what was observed. [01 marks]

Grey solid dissolved in excess alkali to form colourless solution. ✓½ 01

ii. Write equation for the reaction that took place. [01½ marks]

$2Al_{(s)} + 2OH^-_{(aq)} + 3H_2O_{(l)} \longrightarrow 2Al(OH)^-_{4(aq)} + H_{2(g)}$

or: $2Al_{(s)} + 4OH^-_{(aq)} \longrightarrow 2AlO^-_{2(aq)} + 2H_{2(g)}$. ✓✓ 01½

e. Aluminium powder was mixed with trimanganese tetra oxide, Mn_3O_4 and the mixture heated. Write equation for the reaction that took place.

[01½ marks]

$3Mn_3O_{4(s)} + 8Al_{(s)} \longrightarrow 9Mn_{(s)} + 4Al_2O_{3(s)}$. ✓½ 01½

09

16. a. Define the term Isotopes. [01 mark]

Isotopes are atoms of the same element with the same atomic number ✓½ but different atomic mass. 01

b. The table below shows the information from the mass spectrum of a lead sample.

Isotope	Detector current/mA
204	0.16
206	2.72
207	2.50
208	5.92

Calculate: - Total current $= (0.16 + 2.72 + 2.5 + 5.92) = 11.3\ mA$.

i. relative abundance of the different isotopes of lead in the sample [03 marks]

% of Isotope 204 $= \left(\frac{0.16}{11.3} \times 100\right) = 1.42\%$

% of Isotope 206 $= \left(\frac{2.72 \times 100}{11.3}\right) = 24.07\%$

% of Isotope 207 $= \left(\frac{2.5}{11.3} \times 100\right) = 22.12\%$

% of Isotope $= \left(\frac{5.92}{11.3} \times 100\right)$

03 $= 52.40\%$.

ii. the relative atomic mass of lead. [01½ marks]

RAM $=$ Σ all isotopic mass × % abundance / 100

$$RAM = \frac{(1.42 \times 204) + (24.07 \times 206) + (207 \times 22.12) + (52.4 \times 208)}{100}$$

$= 207.26$; 01½

d. The initial counts of a radioactive nucleus was 680 per second. After 350 seconds, the count rate was 125 per second. Calculate the: -

i. Decay constant. [02 marks]

Using relationship $2.303 \log \frac{N_0}{N_t} = \lambda t$.

$$\frac{2.303}{350} \log \frac{680}{125} = \frac{\lambda \times 350}{350}$$

02

$\lambda = 4.84 \times 10^{-3}\ s^{-1}$.

ii. Half-life of the nucleus. [01 ½marks]

$t_{\frac{1}{2}} = \frac{0.693}{\lambda}$

$= \frac{0.693}{4.84 \times 10^{-3}} = 143.2$ seconds.

17. a. A compound W contains 37.3% manganese, 19.1% nitrogen, the rest being oxygen. Calculate the empirical formula of compound W. [02½ marks]
[Mn=54.9, N=14, O=16]

Elements:	Mn	: N	: O
% Mass	37.3	19.1	100 − (37.3 + 19.1) = 43.6
Molec	$\frac{37.3}{54.9}$	$\frac{19.1}{14}$	$\frac{43.6}{16}$
		1.3643	2.725
Atomic Ratio	$\frac{0.6794}{0.6794}$	$\frac{1.3643}{0.6794}$	$\frac{2.725}{0.6794}$
	1	2	4.

02½

Empirical formula of W = MnN_2O_4.

b. 10.0g of compound W in 1000g of water lowered the freezing point of water by 0.127°C. Determine the molecular formula of W. [02 marks]
[Kf for water = 1.86°Cmol^{-1}kg^{-1}]

10.0g of W depressed freezing point by 0.127°C.
∴ Mr g of W will depressed freezing point by 1.86°C.
∴ Molar Mass of W = $\left(\frac{10 \times 1.86}{0.127}\right) = 146.4$. 02

∴ Molecular formula of W = $(MnN_2O_4)_n = 146.4$ n = 1
$(54.9 + 28 + 64)n = 146.4$ ≡ MnN_2O_4.

c. When a few drops of concentrated nitric acid were added to a solution of W, followed by a little lead(IV) oxide and the mixture boiled, a purple coloured solution was formed. Write:

i. formula and name of W. [01 mark]

formula: $Mn(NO_2)_2$

Name:

Manganese (II) Nitrite. ✓½ 01/2

ii. equation for the reaction leading to the formation of the purple coloured solution. [01½ marks]

$2Mn^{2+}_{(aq)} + 5PbO_{2(s)} + 4H^{+}_{(aq)} \longrightarrow 2MnO_4^{-}{}_{(aq)} + 5Pb^{2+}_{(aq)} + 2H_2O_{(l)}$ ✓½ 01/2

e. A few drops of aqueous sodium carbonate was added to a solution of W.

i. State was observed. [01 mark]

White precipitate formed. ✓ 01

ii. Write an equation for the reaction that took place. [01½ marks]

$Mn^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} \longrightarrow MnCO_{3(s)}$. ✓½ 01/2

OR: $Mn^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} + 2OH^{-}_{(aq)} \longrightarrow MnCO_3 \cdot Mn(OH)_{2(s)}$.

END

09

Dedicated to Excellence and Destined to Win