6 Copies

P525/1
Chemistry
Paper 1
July - August 2019
2¾ hours

UGANDA MUSLIM TEACHERS 'ASSOCIATION

UMTA JOINT MOCK EXAMINATIONS - 2019

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INDEX NO.....SIGNATURE.....

UGANDA ADVANCED CERTIFICATE OF EDUCATION
Chemistry

Paper 1

2 hour 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.*
- *The periodic table with relative atomic masses will be provided.*
- *Molar volume of a gas at s.t.p is 22.4 litres*
- *Standard temperature = 273K*
- *Illustrate your answers with equations where applicable*
- *Molar gas constant $R=8.314\ Jmol^{-1}K^{-1}$.*
- *1 atmosphere $=101325Nm^{-2}$.*

For Examiners Use Only																
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) State what happens to the nuclear particles of a radioactive atom on emission of the following

i) Alpha particle ✗ Both protons and neutrons reduce by 2 units / Mass number reduces by 4 and atomic number reduces by 2 ✓ (½ mark)

ii) Beta particle : Protons increase by one unit, neutrons remain unchanged // Mass no remains unchanged atomic number increases by one unit. ✓ (½ mark)

iii) ✗ – rays (½ mark)

No effect on nuclear particles ✓

b) A compound **P** was found to contain an element **Q** which emits ∝ - particles and has a half life of 5720 years. Calculate the percentage of **Q** that will have decayed after 22880 years. (3 marks)

$t_{\frac{1}{2}} = (0.693/\lambda) \Rightarrow \lambda = \frac{0.693}{5720} = 0.000121\ yr^{-1}$ ✓ ✗

$2.303 \log\left(\frac{100}{100-x}\right) = 0.000121 \times 22880$

$\log\left(\frac{100}{100-x}\right) = 2.772$

$10^{2.772} = \left(\frac{100}{100-x}\right)$ ✓

$\left(\frac{100}{100-x}\right) = 15.98$ ✓

$x = 0.9498$ ✓ ✗ 93.7%

ACC: Correct alternative.

ACC: 94% but not 94.0

5 2. Solid **M** dissolved in water to give a pale pink solution. Addition of excess sodium hydroxide produced a dirty white precipitate that rapidly turned brown on standing. When nitric acid was added to the solution of **M** followed by sodium bismuthate solution, the solution changed from pink to purple

a) Identify the cation in **M**. (½ mark)

Manganese (II) ions ✓ ✗ Mn^{2+}

Acc. Manganese (II)

Write equation for the reaction.

i) When ammonia solution was added to the pink solution. (1½ marks)

$Mn^{2+}(aq) + 2OH^-(aq) \longrightarrow Mn(OH)_2(s)$ ✓ ✓ 1½

ii) Leading to the formation of the brown solid. (1½ marks)

$Mn(OH)_2(s) + \frac{1}{2}O_2(g) \longrightarrow MnO_2.H_2O(s)$ ✓ ✗ 1½

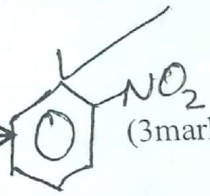
Acc: $2Mn(OH)_2(s) + \frac{1}{2}O_2(g) \longrightarrow Mn_2O_3.2H_2O(s)$

iii) Leading to the formation of the purple solution. (1 ½ marks) ✓ ✓

$2Mn^{2+}(aq) + 5BiO_3^-(aq) + 14H^+(aq) \longrightarrow 2MnO_4^-(aq) + 5Bi^{3+}(aq) + 7H_2O(l)$ 1½

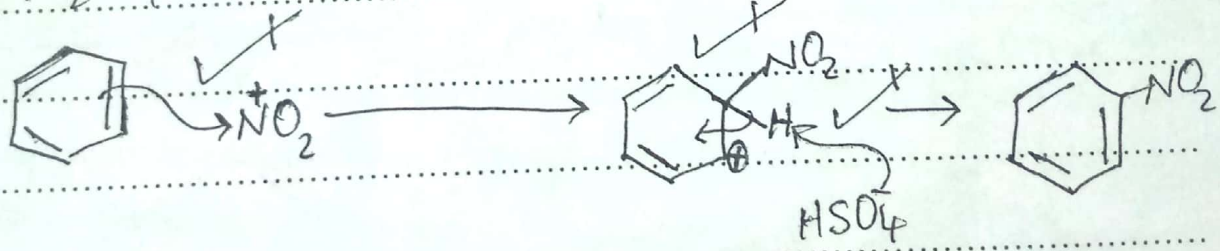
Acc:

5. 3. Complete the following reactions and in each case write a mechanism.

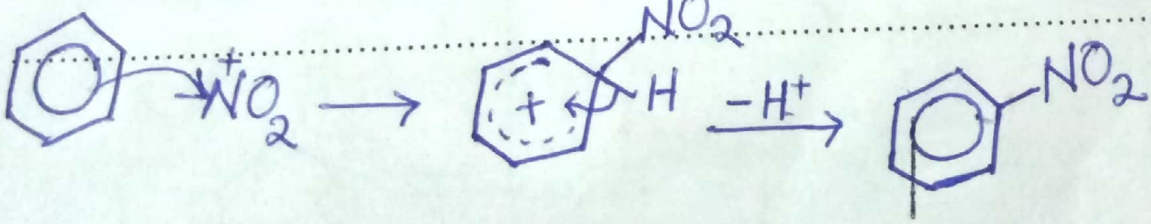
a)  + Conc. HNO_3 $\xrightarrow[60^oC]{Conc.H_2SO_4}$  (3marks)

✓ ✗ 03

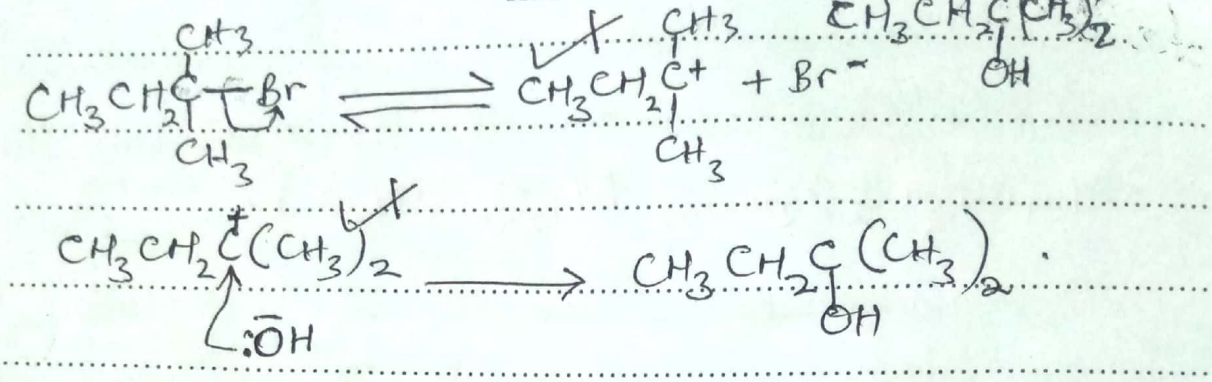
$H_2SO_4 + HNO_3 \longrightarrow \overset{+}{N}O_2 + HSO_4^- + H_2O$



Acc:

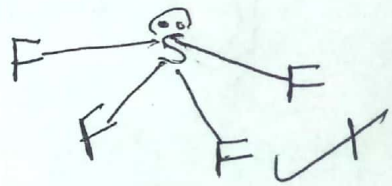
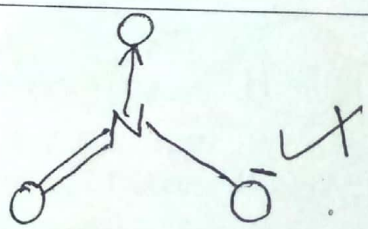
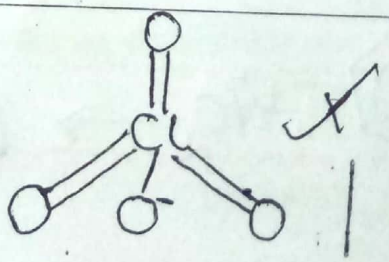
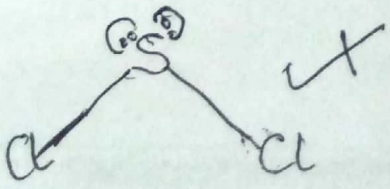


b) $CH_3CH_2C(CH_3)_2$ (Br) $\xrightarrow[\text{Heat}]{\text{NaOH (aq)}}$ $CH_3CH_2C(CH_3)_2$(OH) (02 marks)



4. Draw the structures and name the shapes adopted by the following species:

(4marks)

Species	Shape	Structure
SF_4	Distorted tetrahedral / Irregular tetrahedral / Seesaw	
NO_3^-	Trigonal planar	
ClO_4^-	Tetrahedral	
SCl_2	V-shaped / Bent shape	

. 20 cm^3 of a gaseous hydrocarbon Z with general formula C_nH_{2n-2} were exploded with 100cm^3 of oxygen and cooled to room temperature. When the residual gas mixture was bubbled through concentrated potassium hydroxide solution, the final volume was found to be 20cm^3

a) Calculate the value of n and hence deduce the molecular formula of Z. (2 ½ marks)

$C_nH_{2n-2} + n + \frac{2n-2}{4} O_2 \rightarrow n CO_2 + \frac{2n-2}{2} H_2O$

$20\left(n + \frac{2n-2}{4}\right) = 80$

$\frac{4n + 2n - 2}{4} = 4$

$4n + 2n - 2 = 16$

$6n = 18$

$n = 3$

Acc.

$C_nH_{2n-2} + \left(n + \frac{2n-2}{4}\right) O_2 \rightarrow n CO_2 + \frac{2n-2}{2} H_2O$

20 : 80

1 : 4

$n + \frac{2n-2}{4} = 4$

$4n + 2n - 2 = 16$

$n = 3$

(ii) C_3H_4 ✗ C_3H_4

b) Write the structures of the possible Isomers of Z. (01 marks)

$CH_3C{\equiv}CH$; $CH_2{=}C{=}CH_2$ any 2 01

ii) One of the Isomers react with a solution of copper (i) chloride in aqueous ammonia to give a red precipitate. Identify this isomer and write equation for the reaction leading to formation of the red precipitate. (1 ½ marks)

$CH_3C{\equiv}CH + Cu_2Cl_2/NH_3 \rightarrow CH_3C{\equiv}CCu + NH_4Cl$ 1½

6. Name a reagent, which when separately reacted with each member of the following pairs gives similar observation. In each case state what would be observed if the reagents you have named reacted with the compounds.

a) $CH_3CH_2NHCH_3$ and $CH_3CH_2CH_2NH_2$ (02marks)

Reagent Concentrated hydrochloric acid 01

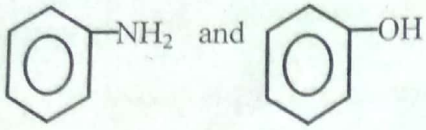
~~Cold sodium nitrite and (concentrated) hydrochloric acid.~~

Observation

~~$CH_3CH_2NHCH_3$ forms a yellow oil.~~ 01

Both form white fumes / solid.

$CH_3CH_2CH_2NH_2$ – bubbles of a colourless gas.

b)  and (02marks)

Reagent

bromine water ✓

Observation

both give a white precipitate ✓ 02

c) CH_3COCH_3 and CH_3CH_2CHO (02marks)

Reagent

2,4-dinitrophenyl hydrazine (solution) ✓

Trivial name – deny ½ 02

Observation

both give a yellow precipitate/solid. ✓ acc orange ppt

7. Write equation for the reaction of aqueous sodium hydroxide with.

a) aluminum oxide (1½ marks)

$Al_2O_3(s) + 2\bar{O}H(aq) + 3H_2O(l) \longrightarrow 2Al(OH)_4^-(aq)$ ✓✓

acc $Al_2O_3(s) + 2\bar{O}H(aq) \longrightarrow 2AlO_2^-(aq) + H_2O(l)$

b) Zinc oxide (1½ marks)

$ZnO(s) + 2\bar{O}H(aq) + H_2O(l) \longrightarrow [Zn(OH)_4]^{2-}(aq)$ ✓✓

or $ZnO(s) + 2\bar{O}H(aq) \longrightarrow ZnO_2^{2-}(aq) + H_2O(l)$

c) Phosphorus (1½ marks)

$P_4(s) + 3\bar{O}H(aq) + 3H_2O(l) \longrightarrow PH_3(g) + 3H_2PO_2^-$ ✓✓ (a.e)

ACC: Molecular equation

...e standard electrode potentials of two half cells are shown below:

$Cu^{2+}_{(aq)} + e \longrightarrow Cu^{+}$ $+0.15$ V LHS – ox Anode –

$Cu^{+} + e \longrightarrow Cu$ $+0.52$ V RHS Cathode + E°/v

$Cu^{+}_{(aq)} \longrightarrow Cu^{2+}_{(aq)} + e$ -0.15 R – e

$Cu(s) \longrightarrow Cu^{+}_{(aq)} + e$ -0.52 L – O

a) Write the cell notation for the cell for the cell formed by combining the two half cells. (01mark)

$Pt_{(s)} | Cu^{+}_{(aq)}, Cu^{2+}_{(aq)} || Cu^{+}_{(aq)} | Cu_{(s)}$ ✓

Acc: ;;

Rej: $Pt_{(s)} | Cu^{+}_{(aq)} | Cu^{2+}_{(aq)} || Cu^{+}_{(aq)} | Cu_{(s)}$

b) Write equation for the:

i) reaction at the positive electrode (01mark)

$Cu^{+}_{(aq)} + e \longrightarrow Cu_{(s)}$ ✓

ii) reaction at the negative electrode. (01mark)

$Cu^{+}_{(aq)} \longrightarrow Cu^{2+}_{(aq)} + e$ ✓

iii) overall cell reaction (01mark)

$2Cu^{+}_{(aq)} \longrightarrow Cu_{(s)} + Cu^{2+}_{(aq)}$ ✓

Acc $Cu^{+}_{(aq)} + Cu^{+}_{(aq)} \longrightarrow Cu_{(s)} + Cu^{2+}_{(aq)}$

c) Calculate the e.m.f of the cell, and state whether the reaction is feasible or not. (1½ marks)

$E_{cell} = E_R - E_L$ ✓

$= +0.52 - +0.15$ ✓

$= +0.37V$ ✓

The reaction is feasible ✓

Rej: 0.37V (ie without +)

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

a) drops of sodium sulphite solution are added to acidified potassium dichromate solution. (02½ marks)

The orange solution turns to green solution;

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

Acc: Molecular equation

b) A Solution of phenylamine hydrochloride is mixed with a saturated solution of sodium hydrogen carbonate.

Bubbles of a colourless gas.

$C_6H_5NH_3^+(aq) + HCO_3^-(aq) \longrightarrow C_6H_5NH_2(aq) + CO_2(g) + H_2O(l)$

or $C_6H_5NH_3^+(aq) + HCO_3^-(aq) \rightarrow C_6H_5NH_2(aq) + CO_2(g) + H_2O(l)$

Acc: Molecular Equation.

c) Phenylethyne is reacted with ammoniacal silver nitrate solution. (01½ marks)

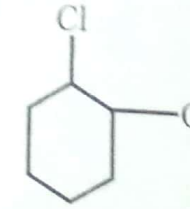
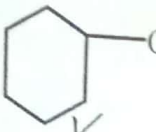
A white precipitate

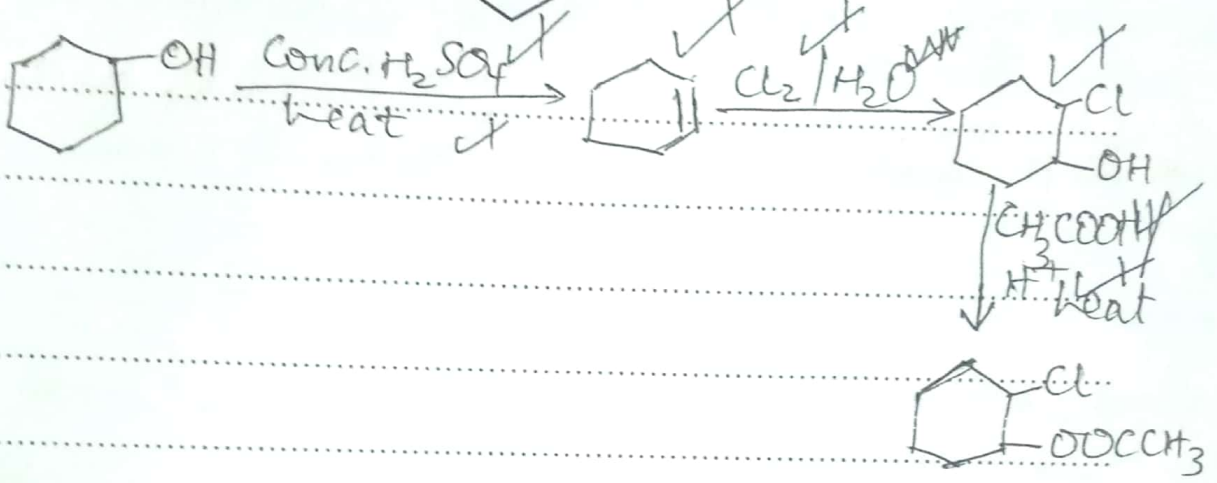
$C{\equiv}CH \xrightarrow{AgNO_3/NH_3(aq)} C{\equiv}CAg + NH_4NO_3$

$C{\equiv}CH \xrightarrow{Ag(NH_3)_2^+} C{\equiv}CAg + NH_4^+$

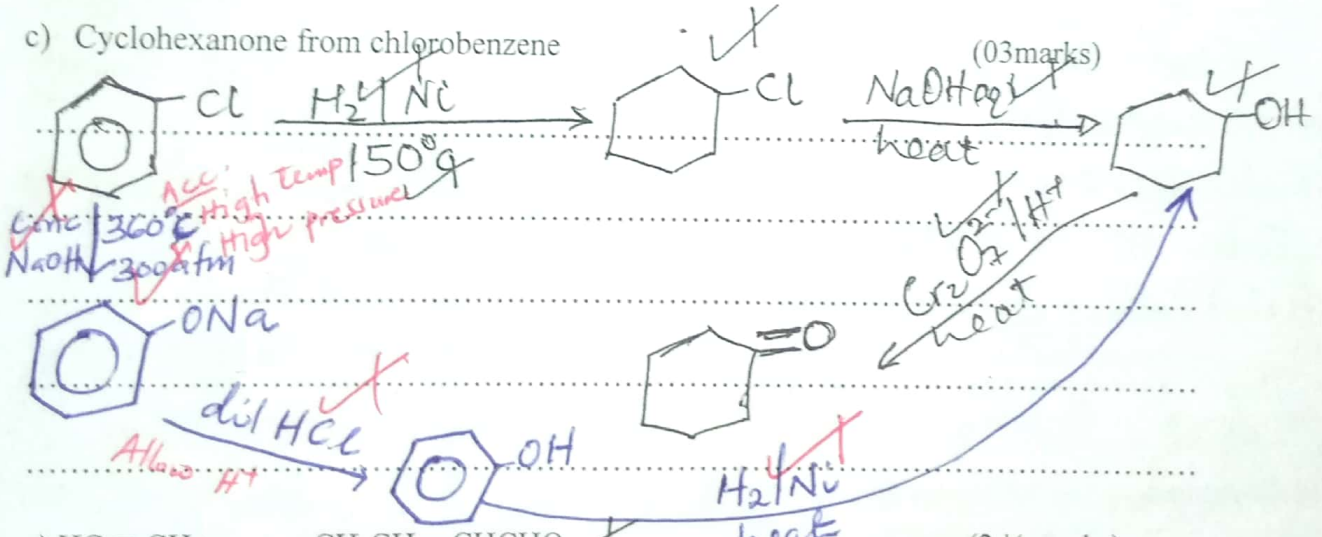
SECTION B (54 MARKS)

10. Using equations show how the following conversions cab be brought about.

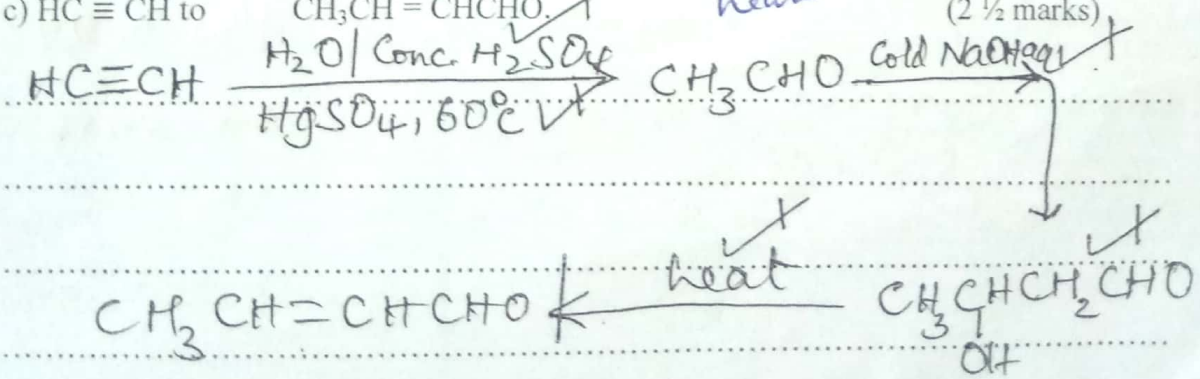
a)  from  (3 ½ marks)



c) Cyclohexanone from chlorobenzene (03marks)



c) HC ≡ CH to $CH_3CH = CHCHO$. (2 ½ marks)



11. (a) State Raoult's law. (01mark)

The partial vapour pressure of a given component in an ideal solution is equal to the vapour pressure of the pure component multiplied by its mole fraction at a given temperature.

Acc: Relative lowering of vapour pressure of solvent is equal to the mole fraction of the non-volatile solute.

b) The vapour pressures of propan -1- ol and butan-1- ol are 1460mmHg and 570 mmHg respectively at 24°C.

Calculate:

i) the vapour pressure of a mixture of 50g of propan -1- ol and 36g of butan -1- ol. (3 ½ marks)

$M_r\ CH_3CH_2CH_2OH = 60\ g$ ✗

$CH_3CH_2CH_2CH_2OH = 74g$ ✓

Moles: $CH_3CH_2CH_2OH = 50/60 = 0.833$ ✗

moles $CH_3CH_2CH_2CH_2OH = 36/74 = 0.486$ ✓

Total moles $= 0.833 + 0.486 = 1.319$ ✓

Partial Pressures: $CH_3CH_2CH_2OH = \frac{0.833}{1.319} \times 1460$ ✓ ✗

$= 922.05$ mmHg

P.P $CH_3CH_2CH_2CH_2OH = \frac{0.486}{1.319} \times 570$ ✓ ✗

$= 210.02$ mmHg

Total v.p of mixture: (Partial pressures (Propan-1-ol + Butan-1-ol)) ✓ ✗

$= 922.05 + 210.02$

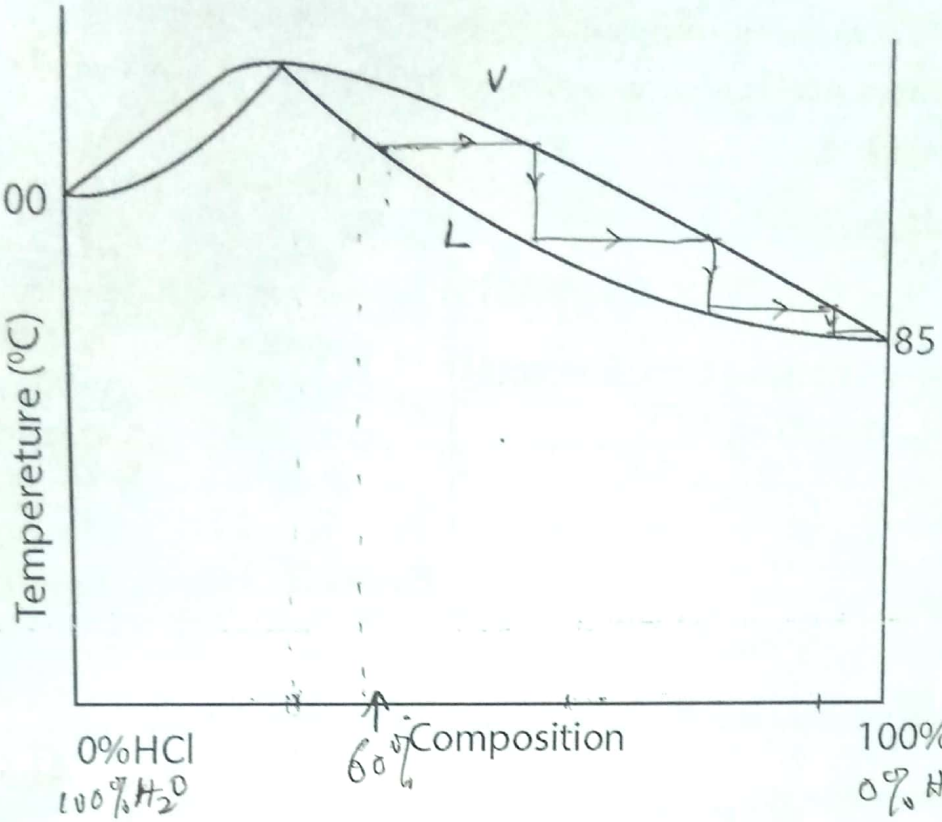
$= 1132.07$ mmHg ✓ ✗

ii) the composition of the vapour above the mixture. (01mark)

Propan-1-ol $= \left(\frac{922.05}{1132.07} \times 100\right) = 81.4\%$ ✓ ✗ Allow 0.814

Butan-2-ol $= \left(\frac{210.02}{1132.07} \times 100\right) = 18.6\%$ ✓ ✗ Acc. 0.186

A mixture of hydrochloric acid and water deviation from Raoult's law. The temperature – composition diagram for this mixture is shown below.



i) Identify the type of deviation exhibited. (½ mark)

Negative deviation ✓+

i) What would happen if a liquid mixture of composition 60% water is distilled? (3marks)

The liquid mixture boils at constant temperature ✓+ to give a vapour, richer in hydrochloric acid, when cooled, ✓ the vapour gives a liquid of the same composition as the vapour. On repeated boiling and cooling, pure hydrochloric acid is obtained as the distillate and the azeotrope as the residue. 03

12. When **0.0291g** of an organic compound, **J** containing carbon, hydrogen and oxygen only w burnt in excess oxygen, 0.0581g of carbon dioxide and **0.0239g** of water were formed. Calculate the empirical formula of **J**. (03marks)

Carbon; $\frac{12}{44} \times 0.0581 = 0.01589$ C

Hydrogen $\frac{2}{18} \times 0.0239 = 0.00266$ H

Oxygen $= 0.0291 - (0.0158 + 0.0026)$

$= 0.0106$g

	C	H	O
	$\frac{0.0158}{12}$	$\frac{0.0026}{1}$	$\frac{0.0106}{16}$
	0.00132	0.0026	0.00066
	$\frac{0.00132}{0.000665}$	$\frac{0.0026}{0.000665}$	$\frac{0.00066}{0.000665}$
	1.98	3.9	1
	≃ 2	4	1

Empirical formula is C_2H_4O

b) 0.14g of J when vaporized at 20°C and 740 mmHg occupied 39.5cm^3. Determine:

i) the molecular mass of J (02marks)

Acc; 1st Principles ~~of assuming~~ Volume obtained from $P_1V_1 = P_2V_2$

from $PV = nRT$.

$Mr = \frac{MRT}{PV}$

$= \left(\frac{0.14 \times 8.314 \times 293}{39.5 \times 10^{-6} \times 98658.6}\right) = 87.5$

≃ 88g

ii) the molecular formula of **J**. (1½ mark)

$(C_2H_4O)_n = 88$

$44n = 88$; $n = 2$

MF of J is $C_4H_8O_2$

c) When a saturated solution of sodium carbonate was added to **J**, effervescence of a colourless gas occurred.

i) Write the structural formula of **J**. (½ mark)

$CH_3CH_2CH_2COOH$ or $CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-OH$

ii) Write equation(s) to show how J can be converted to 1-aminopropane. (2½ marks)

$CH_3CH_2CH_2COOH \xrightarrow[\text{dewy without lick}]{(NH_4)_2CO_3 \text{ Heat}} CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-NH_2$

OR

$CH_3CH_2CH_2COOH \xrightarrow{PCl_5} CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{\text{Conc. } NH_3} CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-NH_2$

$CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow[\text{warm}]{Br_2/NaOH(aq)} CH_3CH_2CH_2NH_2$ 02

Differentiate between order and molecularity of a reaction. (02marks)

Order of reaction refers to the sum of the powers to which concentration terms are raised in an experimentally determined rate equation law, whereas molecularity refers to number of molecules or species involved at the rate determining step of a reaction.

- Order of reaction can be a whole number or fraction whereas Molecularity is always a whole number.

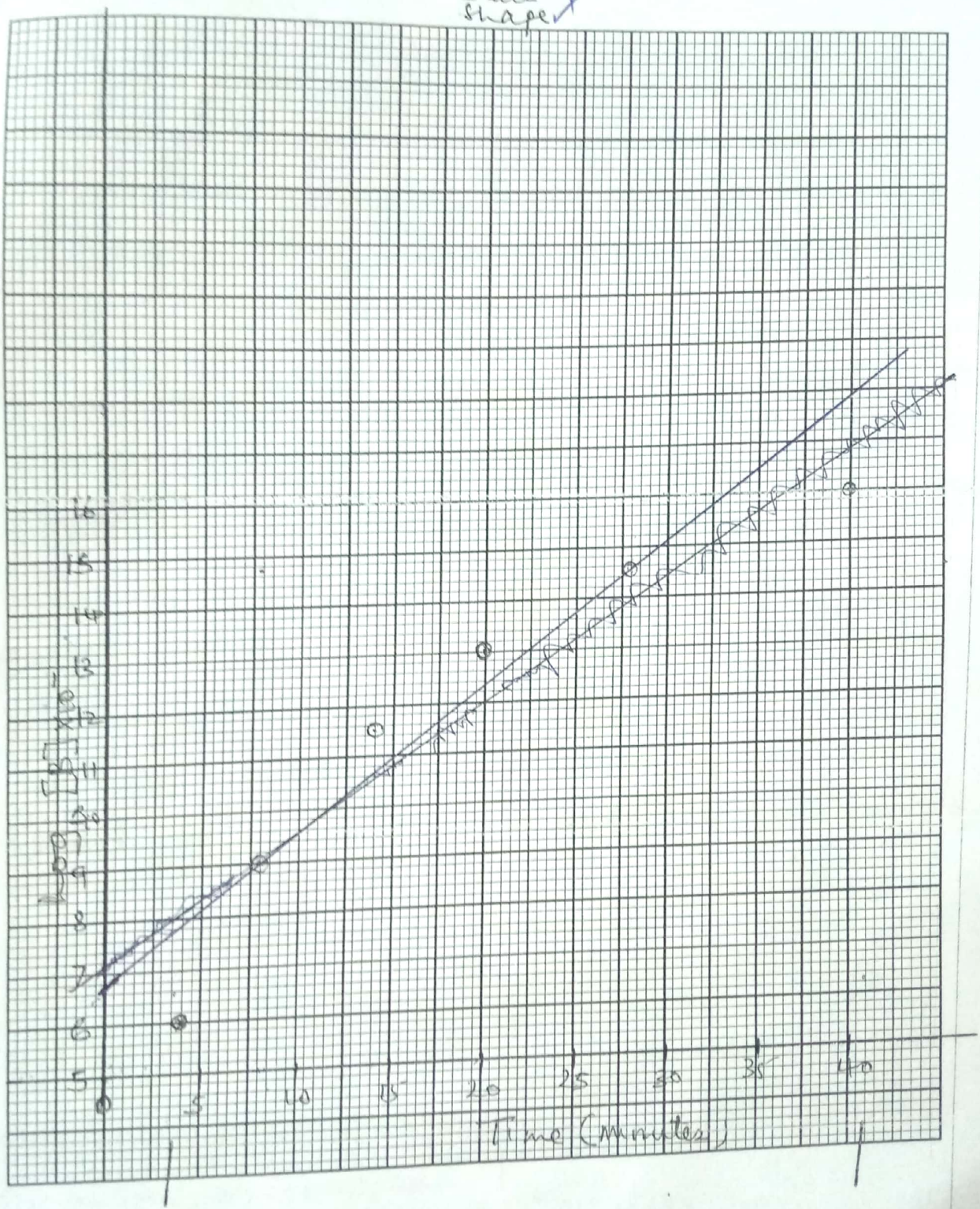
b) The data in the table below was obtained for the reactions.

$2B \longrightarrow$ Products

Time (minutes)	4.0	8.0	14.0	20.0	28.0	40.0
$Log_{10}[B]$	0.602	0.903	1.146	1.301	1.447	1.602

Plot a graph of $Log_{10}[B]$ against time. (3 marks)

plotting ✓
Axes ✓
Scale —
Shape ✓



Determine the:

i) original concentration of **B**

$\log_{10}[B] = 0.68$ (½ mark)

$[B]_0 = 10^{0.68}$ / $[B]_0 = 4.7863\ mol\,dm^{-3}$ ✗

ii) order of reaction.

(01mark)

First ✓ order reaction; Because plot of $\log_{10}[B]$ against time is a straight line ✗ with a positive gradient which is a first order reaction.

iii) the rate constant.

(1½ mark)

rate constant (k) = slope ✗ / $= \frac{1.08}{39}$

$\text{slope} = \frac{\text{change in } \log_{10}[B]}{\text{change in time}}$

$\text{slope} = \frac{1.78 - 0.7}{40 - 1}$ ✓ ✗ / $K = 0.02769\ min^{-1}$ ✓ ✗ $\times 2.303$

Ignore the unit $= 0.064\ min^{-1}$

iv) the half life for the reaction.

(01mark)

$t_{1/2} = \frac{\ln 2}{k}$

$t_{1/2} = \frac{0.693}{0.02769}$ ✓ ✗ $=$ ~~10 minutes~~ 10.83 minutes ✓

14. Trilead tetraoxide (red lead oxide), Pb_3O_4 can be prepared when lead (II) oxide is heated with excess oxygen.

a) Write equation for the reaction leading to the formation of Pb_3O_4. (1½mark)

$3PbO(s) + \frac{1}{2}O_2(g) \longrightarrow Pb_3O_4(s)$ ✓ ✗

or $6PbO(s) + O_2(g) \longrightarrow 2Pb_3O_4(s)$

b) Write equation for the reaction of Pb_3O_4 with;

i) Hot concentrated sodium hydroxide solution. (1 ½ marks)

$Pb_3O_4(s) + 6OH^-(aq) \longrightarrow 2PbO_2^{2-}(aq) + PbO_3^{2-}(aq)$ ✓ ✗

or $Pb_3O_4(s) + 6OH^-(aq) + 4H_2O(l) \longrightarrow 2Pb(OH)_4^{2-}(aq) + Pb(OH)_6^{2-}(aq)$

ii) Hot concentrated hydrochloric acid. (1½ marks)

$Pb_3O_4(s) + 8HCl(aq) \longrightarrow 3PbCl_2(aq) + Cl_2(g) + 4H_2O(l)$ ✓✓

c) Lead (II) oxide is almost insoluble in dilute hydrochloric acid, but readily dissolves in concentrated hydrochloric acid. Explain this observation. (4 ½ marks)

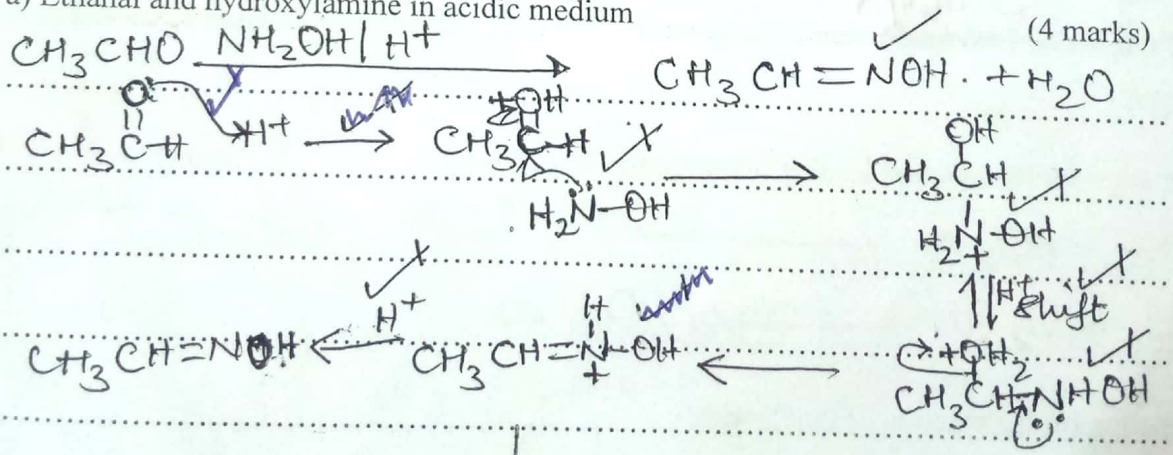
In the cold lead(II) oxide reacts with dilute hydrochloric acid to form lead(II) chloride which is sparingly soluble. $Pb^{2+}(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s)$ ✓

In concentrated hydrochloric acid, the excess chloride ions from the hydrochloric acid react with lead(II) chloride to form a soluble complex of tetrachloroplumbate(II) ion

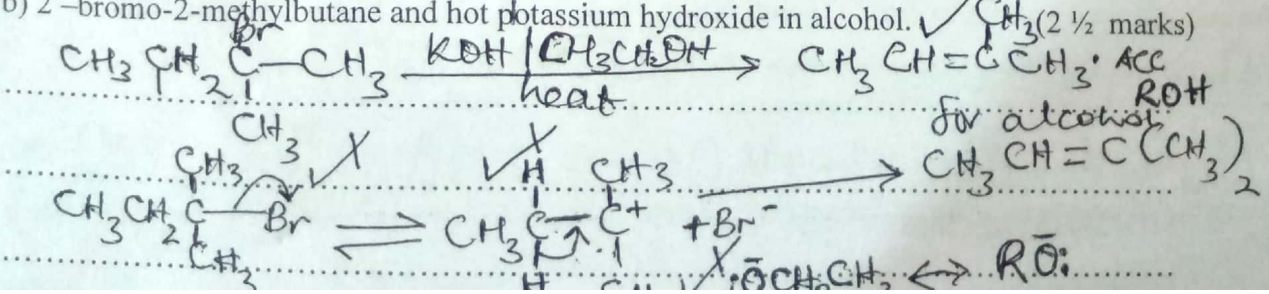
$PbCl_2(s) + 2Cl^-(aq) \longrightarrow PbCl_4^{2-}(aq)$ ✓ 4½

15. Write equations for the reactions that take place when the following compounds react. In each case write a mechanism.

a) Ethanal and hydroxylamine in acidic medium (4 marks)



b) 2 –bromo-2-methylbutane and hot potassium hydroxide in alcohol. (2 ½ marks)



c) Propan -1- ol and concentrated sulphuric acid at 0^0C.

(2 ½ marks)

$CH_3CH_2CH_2OH \xrightarrow[0^0C]{Conc.\ H_2SO_4} CH_3CH_2CH_2OSO_3H + H_2O$

$CH_3CH_2CH_2OH \xrightarrow{H^+} CH_3CH_2CH_2\overset{+}{O}H_2$

$CH_3CH_2CH_2\overset{+}{O}H_2 \xrightarrow{-H_2O} CH_3\overset{+}{C}H_2CH_3 + H_2O$

$CH_3\overset{+}{C}H_2CH_3 + HSO_3^- \rightarrow CH_3CH_2CH_2OSO_3H$

16.a) Name and write the formula of the major ore used in extraction of aluminium. (01mark)

Bauxite, $Al_2O_3 \cdot 2H_2O$

b) using equations, state how the ore named in (a) is converted to pure aluminum oxide.

(6marks)

- $SiO_2(s) + 2OH^-(aq) \longrightarrow SiO_3^{2-}(aq) + H_2O(l)$
- $Al_2O_3(s) + 2OH^-(aq) + 3H_2O(l) \longrightarrow 2Al(OH)_4^-(aq)$ · Acc $Al(OH)_6^{3-}$

  or $Al_2O_3(s) + 2OH^-(aq) \longrightarrow 2AlO_2^-(aq) + H_2O(l)$
- $Al(OH)_4^-(aq) \longrightarrow Al(OH)_3(s) + OH^-(aq)$

  or $2Al(OH)_4^-(aq) + CO_2(g) \longrightarrow 2Al(OH)_3(s) + CO_3^{2-} + 2H_2O$

  or $AlO_2^-(aq) + 2H_2O(l) \longrightarrow Al(OH)_3(s) + OH^-(aq)$

  $AlO_2^-(aq) + CO_2(g) + 3H_2O(l) \longrightarrow 2Al(OH)_3(s) + CO_3^{2-}(aq)$
- $2Al(OH)_3(s) \longrightarrow Al_2O_3(s) + 3H_2O(g)$

c) The aluminium oxide obtained in (b) is mixed with molten cryolite and electrolysed between carbon electrodes to obtain molten aluminium.

State:

i) why the carbon anodes have to be replaced from time to time. (½ mark)

Since they are being continuously burnt in hot oxygen produced at the anode OR to carbon dioxide. The oxygen produced at anode reacts with them. (½)

ii) the role of cryolite (½ mark)

It lowers the melting point of the ore/

d.i) explain one use of aluminum (Use and property for the use) (01mark) 01

For electric conducting wires; since its a good conductor of electricity: Acc any correct use with respective property)

17(a) 25cm^3 of 0.5M hydrochloric acid was added to 225cm^3 of water,

Calculate the pH of the resultant solution. (2 ½ marks)

1000cm^3 of HCl contains 0.5 moles

25cm^3 of HCl contain $\left(\frac{0.5}{1000} \times 25\right) = 0.0125$ moles

Total volume $= (225+25) = 250$cm^3. 2½

250cm^3 of HCl contains 0.0125 moles

1000cm^3 of HCl contains $\left(\frac{0.0125}{250} \times 1000\right)$

$= 0.05$ moles/l

$PH = -\log [H^+]$

$= -\log 5.0 \times 10^{-2}$

$= 2 - 0.699$

$= 1.3$

Determine the mass of ammonium chloride that should be added to 1dm^3 of a 0.1M ammonia solution at 25^{0}C to give a solution whose pH is 8.5.

(Kb for ammonia = 1.8 x 10^{-5} mol dm^{-3}, Kw = 1.0 X 10^{-14} mol^2 dm^{-6}) (5marks)

$NH_3(aq) + H_2O_{(l)} \rightleftharpoons NH_4^+(aq) + OH^-(aq)$ ✓

$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]}$ ✓ ✗ $\Rightarrow [OH^-] = K_b \frac{[base]}{[Salt]}$

but $[OH^-] = \frac{K_w}{[H^+]}$ ✓ ✗

$\frac{K_w}{[H^+]} = K_b \frac{[base]}{[Salt]}$ ✓ ✗

$[H^+] = \frac{K_w [Salt]}{K_b [base]}$ ✓ ✗ ACC any correct working

$pH = -\log[H^+] = 8.5$ ✓ ✗

$[H^+] = (10^{-8.5}) = 3.16 \times 10^{-9}$ M.

$\frac{1.0 \times 10^{-14} \times [Salt]}{1.8 \times 10^{-5} \times 0.1} = 3.16 \times 10^{-9}$ ✓ ✗

$[Salt] = \frac{3.16 \times 10^{-9} \times 1.8 \times 10^{-5} \times 0.1}{1.0 \times 10^{-14}}$

$= 0.569$M. ✓ ✗

MM $NH_4Cl = 53.49$ ✓ ✗

Mass $NH_4Cl = 53.4 \times 0.569$

$= 30.39$g ✓ ✗

d) A few drops of sodium hydroxide were added to the solution in (b).

i) State what happened to the pH of the solution. (½ marks)

✓ ✗

It remained constant / The PH didnot significantly change.

(01mark)

ii) Give a reason for your answer in (i)

✓

The ammonium ions in solution react and remove the added hydroxide ions / ~~The hydrogen / hydroxonium ions react and remove the hydroxide ions~~.

THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																1.0 H 1	4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 TI 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															

139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

END