P525/1
Chemistry
Paper 1
July - August 2018
2¾ hours

MUNICEL

UGANDA MUSLIM TEACHERS 'ASSOCIATION

UMTA JOINT MOCK EXAMINATIONS - 2018

NAME.....MUNICEL.....

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.*
- *Illustrate your answers with equations where applicable*
- *Molar gas constant R=8.314 $Jmol^{-1}K^{-1}$.*
- *1 atmosphere =101325Nm^{-2}.*

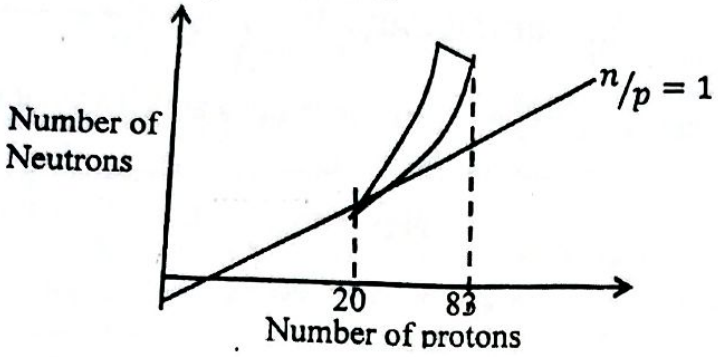
For Examiners Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
5	4	5	6	6	5	6	4½	4½	9	9	9	9	9	9	9	9	100

1. (a) Define nuclear stability. (01 mark)

The ability of a nucleus to react spontaneously decay to form other nuclei and emit particles and radiations. ✓ (1)

(b) (i) The graph below shows the variation of numbers of neutrons in an atom with proton numbers.



Explain why the band of nuclear stability deviates from $^n/_p = 1$ after atomic number 20. (02 marks)

As atomic numbers increases, the number of protons in the nucleus increases, this leads to a strong repulsive forces in the nucleus. More neutrons are therefore needed to stablise the nucleus which leads to an increase in the neutron proton ratio. (02)

(ii) Given that the respective mass numbers and atomic numbers of Thorium and Lead are, $Th = 232$ *and* 90; $Pb = 208$ *and* 82, determine the number of alpha and beta particles that must be emitted by Thorium to transform to lead (02 marks)

$^{232}_{90}Th \longrightarrow {}^{208}_{82}Pb + a\,{}^{4}_{2}He + b\,{}^{0}_{-1}e$ ✓

$208 + 4a + 0 = 232$ $\quad 82 + 2a - b = 90$ (02)

$a = 6$ ✓ $\quad b = 4$ ✓

6 alpha particles and 4 Beta particles. ✓

05

2. **Beryllium magnesium and calcium are group II elements.**

(a) **Write the general outer configuration of the elements.** **(01 mark)**

ns^2 ✓(1)

(b) **Each of these elements reacts with carbon to form carbides. Write the equation for the reaction which occurs when each carbide reacts with water.** **(4½ marks)**

$Be_2C_{(s)} + 4H_2O_{(l)} \longrightarrow 2Be(OH)_{2(s)} + CH_{4(g)}$ ✓

$Mg_2C_{3(s)} + 4H_2O_{(l)} \longrightarrow 2Mg(OH)_{2(s)} + C_3H_{4(g)}$ ✓ (03)

$CaC_{2(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(s)} + C_2H_{2(g)}$ ✓

04

3. $50cm^3$ of 0.1M aqueous ammonia was added to $50cm^3$ of 0.1M hydrochloric acid and the resultant solution had a pH less than seven.

(a) **Give a reason for this observation.** **(02 marks)**

Ammonia and hydrochloric acid react to form ammonium chloride ✓ The ammonium ions from the salt react with water / undergo hydrolysis to form hydrogen / hydroxonium ions ✓ which make the solution acidic ✓ (02½)

(b) **Calculate the pH of the solution (kh for ammonium chloride is $6.34 \times 10^{-8} mol\ dm^{-3}$)** **(03 marks)**

$NH_4^+{}_{(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(g)} + H_3O^+{}_{(aq)}$

Moles $NH_4Cl = \left(\frac{50 \times 0.1}{1000}\right) = 0.005 mole$ ✓

$[NH_4Cl] = \left(\frac{0.005 \times 1000}{100}\right) = 0.05M$ ✓

$K_h = \frac{[NH_3][H_3O^+]}{[NH_4^+]}$ ✓ (03)

At equilibrium: $[NH_3] = [H_3O^+]$

Complete dissociation of salt:

$[NH_4^+] = [salt]$

$6.34 \times 10^{-8} = \frac{[H_3O^+]^2}{0.05}$

$[H^+] = \sqrt{6.34 \times 10^{-8} \times 0.05}$

$= 5.63 \times 10^{-5} mol\ dm^{-3}$ ✓

$pH = -\log[H^+]$ ✓

$= -\log(5.63 \times 10^{-5})$

$= 4.249$ ✓

05½

05

4. State what would be observed and write equation between the following compounds and the reagents commonly used in identifying organic compounds. (02 marks)

(a) Neutral iron (III) chloride and phenol.

Observation

Purple coloration ✓ (1)

Equation

$6\ C_6H_5OH + FeCl_3(aq) \longrightarrow [Fe(OC_6H_5)_6]^{3-}(aq) + 6H^+(aq) + 3Cl^-(aq)$ ✓ (1)

$C_6H_5OH + FeCl_3(aq) \longrightarrow C_6H_5OFeCl_2(aq) + HCl(aq)$

(b) Sodium nitrite in presence of concentrated hydrochloric acid and ethyl methylamine. (02 marks)

Observation

Yellow oily liquid ✓ (1)

Equation

$CH_3CH_2NHCH_3 + HONO \longrightarrow CH_3CH_2\underset{\displaystyle CH_3}{\overset{|}{N}}-N=O + H_2O$ ✓ (1)

HNO_2

$NaNO_2 + HCl$

(c) Fehling's solution and ~~ethanol~~. Ethanal (02 marks)

Observation

Blue solution turned to a red precipitate. ✓ (1)

Equation

$CH_3CHO + 2Cu^{2+}(aq) + 5OH^-(aq) \longrightarrow CH_3COO^-(aq) + Cu_2O(s) + 3H_2O(l)$ ✓ (1)

06

5. (a) (i) **Define term ore.** **(01 mark)**

An impure naturally occurring substance from which a metal can be extracted using a suitable method. (1)

(ii) **Name the common ores for the following metals.** **(02 marks)**

Aluminium

Bauxite ✓+ deny chemical formular

Iron

Iron pyrites ✓+ / Haematite Magnetite Siderite (spathic iron)

Copper (02)

Copper pyrites ✓+ Copper glance cuprite Malachite

Zinc

Zinc blende ✓+ Calamine

(b) State the role of the following process in the extraction of metals. **(03 marks)**

(i) Froth flotation.

Concentration of the ore by separating the hydrophobic valuable mineral from the hydrophilic worthless material. ✓ Separating impurities from the metal.

(ii) Roasting

Oxidises the ore leading to elimination of unwanted elements as oxides in gaseous form.

(iii) smelting

Heating in presence of reducing agent which enables the ore to be reduced to molten metal and also removes impurities.

06

(1½ marks)

6. (a) **Explain the partition law.**

A dissolved solute irrespective of its amount distributes itself between two immiscible solvents in contact in such away that at equilibrium the ratio of its concentration in the two solvents is constant at constant temperature when the solute remains in the same molecular state in the two solvents.

(b) **An aqueous solution contains 10g of Y in a litre of solution. 100cm³ of this solution was shaken with 20cm³ of an ether and the ether extracted 0.8g of Y. Calculate the volume of the ether that is required to extract 80% of Y from 500cm³ of the aqueous solution.** (03 marks)

100 cm³ of aq solution contains $\left(\frac{10}{1000} \times 100\right) = 1g$

$K_D = \frac{[Y]_{ether}}{[Y]_{water}}$

$= \frac{0.8/20}{0.2/100}$

$= 20$

500cm³ of given solution contains $\left(\frac{10 \times 500}{1000}\right) = 5g$

80% Y = $\left(\frac{80}{100} \times 5\right) = 4g$ extracted by ether

Mass remaining in given aq layer = 1g

$K_D = 4/V \,/\, 1/500$

$20 = \frac{4}{V} \times \frac{500}{1}$

$V = 100cm^3$.

(c) **Give a reason why extracting using small aliquots improves the yield.**

(1½ marks)

Because after every extraction the solute re distributes itself uniformly in the solvent making it available for subsequent extraction.

05 05 05

7. Both Aluminium and phosphorus form compounds in the oxidation state of +3.

(a) Briefly explain in terms of the electronic configuration why aluminium conducts electricity but all the common allotropes of phosphorus do not. (03 marks)

Aluminium $1s^2 2s^2 2p^6 3s^2 3p^1$ has a partially filled 3p-orbital whereas Phosphorus $1s^2 2s^2 2p^6 3s^2 3p^3$ has half filled 3p-orbital. Aluminium atom is less stable and so easily loses its electrons to the electron cloud when become delocalised and transfer an electric current. Phosphorus atom is stable thus doesn't readily lose electrons and so lack delocalised electrons and can not conduct electricity. (02) (03)

(b) Write equation for the reaction between each element with sodium Hydroxide solution. (03 marks)

$Al_{(s)} + 2\bar{O}H_{(aq)} + 6H_2O_{(l)} \longrightarrow 2Al(OH)_4^-{}_{(aq)} + 3H_{2(g)}$

$Al_{(s)} + 2\bar{O}H_{(aq)} + 2H_2O_{(l)} \longrightarrow 2AlO_2^-{}_{(aq)} + 3H_{2(g)}$

$P_{4(s)} + 3\bar{O}H_{(aq)} + 3H_2O_{(l)} \longrightarrow PH_{3(g)} + 3H_2PO_2^-{}_{(aq)}$ (06)

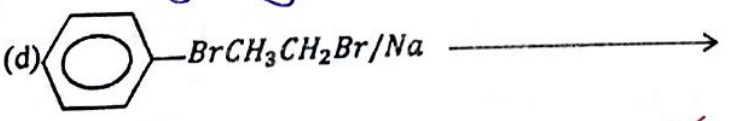
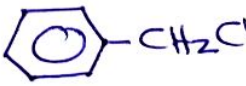
8. Complete the following equations and name the main organic product. (06 marks)

(a) $(CH_3CH_2COO)_2Ca \xrightarrow{Heat} CH_3CH_2\overset{O}{\overset{\|}{C}}CH_2CH_3$

Pentan-3-one

(b) $2CH_3\overset{O}{\overset{\|}{C}}H \xrightarrow{NaOH} CH_3\underset{OH}{C}HCH_2OH$ (04½)

3-Hydroxybutanal

(d)  $+ BrCH_3CH_2Br/Na \longrightarrow$  $+ NaBr$

Phenylethane (04½)

9. (a) State Graham's law of gaseous diffusion. (01 mark)

The rate of diffusion of a gas is inversely proportional to the square root of its density at constant temperature and pressure.

(b) Nickel forms a carbonyl: $Ni(CO)_n$; Deduce the value of n if carbon monoxide diffuses 2.46 times faster than the carbonyl compound. (03 marks)

$$\frac{\text{Rate CO}}{\text{Rate } Ni(CO)_n} = \sqrt{\frac{Mr\,Ni(CO)_n}{Mr\,CO}}$$

$$2.46 = \sqrt{\frac{Mr}{28}}$$

$$Mr\ Ni(CO)_n = 28 \times (2.46)^2$$

$$= 169$$

$$59 + 28n = 164$$

$$n = 4$$

$Ni(CO)_4$

(c) State;

(i) Oxidation state of Nickel in the compound. (½ mark)

0

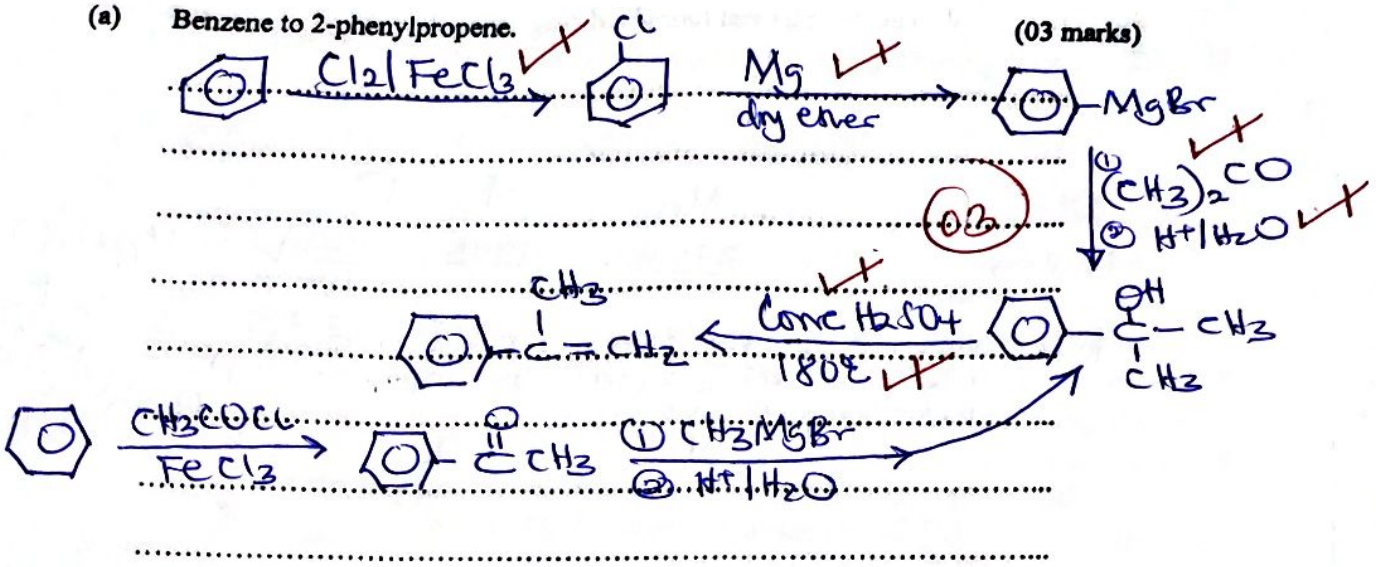
(ii) Co-ordination numbers of Nickel in the compound. (½ mark)

4

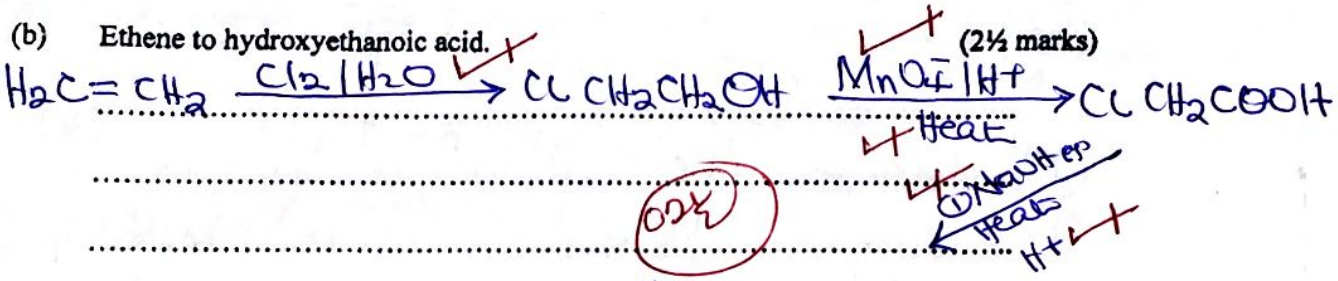
SECTION B

10. **Write equations to show how the following synthesis can be carried out. In each case indicate the necessary reagents and conditions.**

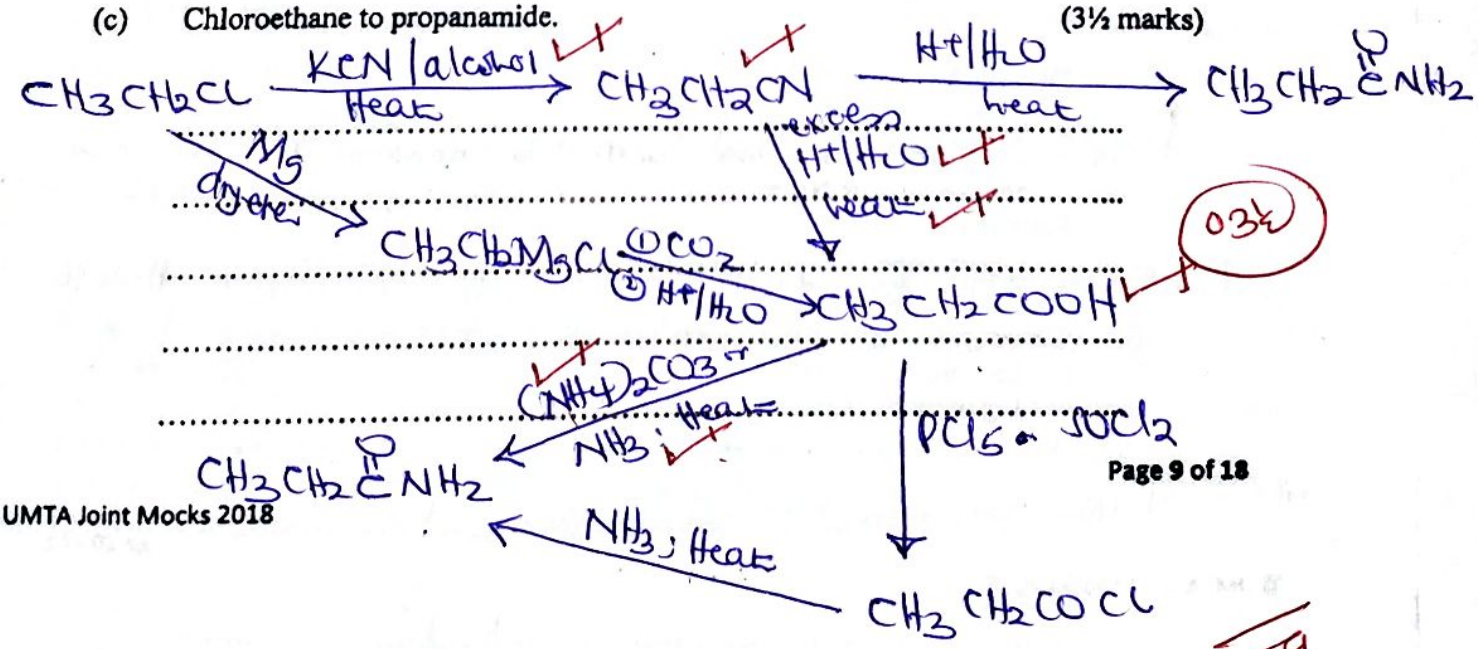
(a) **Benzene to 2-phenylpropene.** **(03 marks)**



(b) **Ethene to hydroxyethanoic acid.** **(2½ marks)**



(c) **Chloroethane to propanamide.** **(3½ marks)**



09

11. (a) A compound Z contains 19.15% Nitrogen; ~~42.6%~~ 43.6 oxygen and the rest being manganese.

(i) Calculate the empirical formula of Z. (1½ mark)

Elements	Mn	N	O
Moles	$\frac{37.35}{55}$	$\frac{19.15}{14}$	$\frac{43.5}{16}$
Mole ratio	$\frac{0.6791}{0.6791}$	$\frac{1.368}{0.6791}$	$\frac{2.719}{0.6791}$
	1	2	4

MnN_2O_4 (#2) (02)

(ii) 10g Z in 1000g of water lowered to freezing point of water by 0.127°C. Calculate the molecular formular of Z. (kf for water is $1.86^0C\ mol^{-1}kg^{-1}$) (02 marks)

10g g Z in 1000g water cause a freezing depression 0.127°C
Mr y Z in 1000g water cause freezing depression 1.86°C

$Mr = \left(\frac{1.86 \times 10}{0.127}\right) = 146.45$

$(MnN_2O_4)n = 146.45$ | $n = 1$ (03)

$(55 + 28 + 64)n = 146.45$ | Molecular formular $Mn_2N_2O_4$

(b) Z was dissolved in water to form a pink solution and divided into two portions. State would be observed and write equation for the reaction that took place when;

(i) acidified potassium manganate (VII) solution was added to the first portion. (02 marks)

Observation.

Purple solution turned colourless

Equation.

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

(ii) Concentrated nitric acid and lead (IV) oxide were added to the second portion and the mixture boiled. (02 marks)

Observation.

Pink solution turned purple

Equation.

$2Mn_{(aq)}^{2+} + 5PbO_{2(s)} + 4H_{(aq)}^+ \rightarrow 2MnO_{4(aq)}^- + 5Pb_{(aq)}^{2+} + 2H_2O_{(l)}$

09

12. 25moles of hydrogen and 18 moles of iodine vapour were heated in a 1litresealed tube at 465°C. When equilibrium was attained; the tube was rapidly cooled and found to contain 30.8 moles of hydrogen iodide.

(a) Give a reason why the tube was rapidly cooled. (02 marks)

To stop the reaction and fix the equilibrium such that it doesn't adjust itself to the equilibrium value at a lower temperature. (02)

(b) Calculate the

(i) Value of the equilibrium constant Kc for the reaction taking place in the flask. (03 marks)

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

$(a-x)$ $(b-x)$ $2x$

Equilibrium moles

$HI = 2x = 30.8$

$x = 15.4$

$[H_2] = (a-x) = (25-15.4)$

$= 9.6 mol\,l^{-1}$

$[I_2] = (b-x)$

$= (18-15.4) = 2.6 mol\,l^{-1}$

$[HI] = 30.8 mol\,l^{-1}$

$K_c = \frac{[HI]^2}{[H_2][I_2]}$

$= \frac{(30.8)^2}{9.6 \times 2.6}$ (03)

$= 38$

(ii) Degree of dissociation of hydrogen iodide. (02 marks)

$2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$

$(1-x)$ $x/2$ $x/2$

$K_c = \frac{[H_2][I_2]}{[HI]^2}$

$= \frac{x/2 \cdot x/2}{(1-x)^2}$

$\frac{x^2}{4(1-x)^2} = \frac{1}{38}$ (02)

$x = 0.245$

$K_c = 1/38$

(c) State what would happen to the equilibrium position of the reaction in the flask above when sodium thiosulphatesolution was added to the flask. Give a reason for your answer. (02 marks)

Equilibrium position will shift from right to left. This is because sodium thiosulphate reacts with iodine from the equilibrium mixture, thus lowers the concentration of iodine. More hydrogen iodide dissociate to restore the concentration of iodine. Shifting the equilibrium position to the left. 02

13. Complete the following equations and write the mechanism for each reaction.

(a) $CH_3CH_2CH_2CH_2OH \xrightarrow[180^0C]{concentrated\ H_2SO_4}$ (3½ marks)

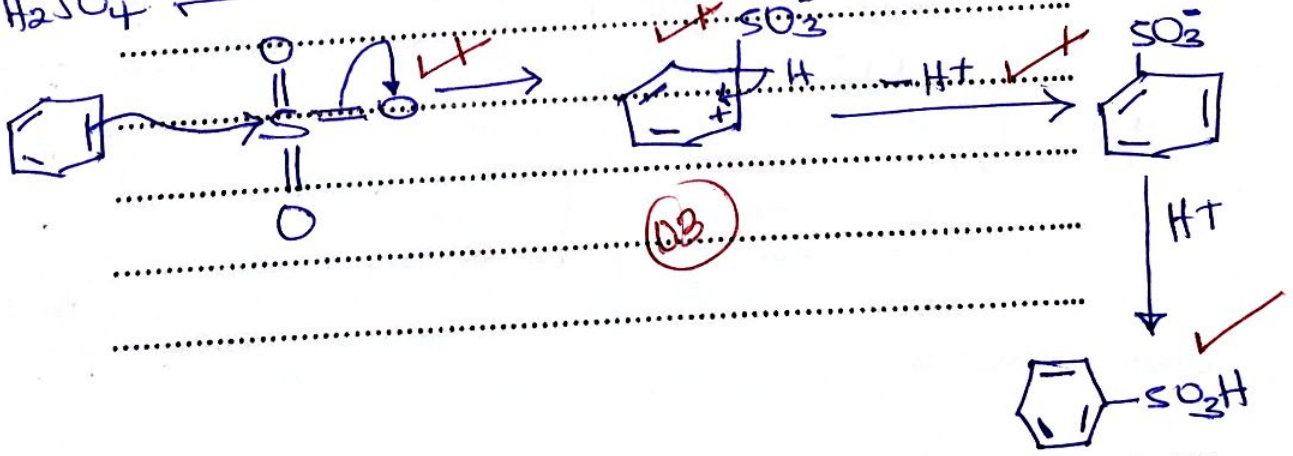
$CH_3CH_2CH_2CH_2OH \rightarrow CH_3CH_2CH_2CH_2\overset{+}{O}H_2$ $-H_2O$ 03½

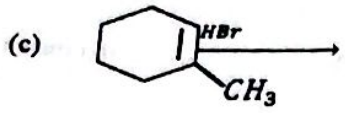
$CH_3CH_2CH_2CH_2OH \xrightarrow{H^+}$

$CH_3CH_2CH_2\overset{+}{C}H_2 \xrightarrow{Hydride\ shift} CH_3CH_2\overset{+}{C}HCH_3 \xrightarrow{proton\ loss} CH_3CH=CHCH_3$

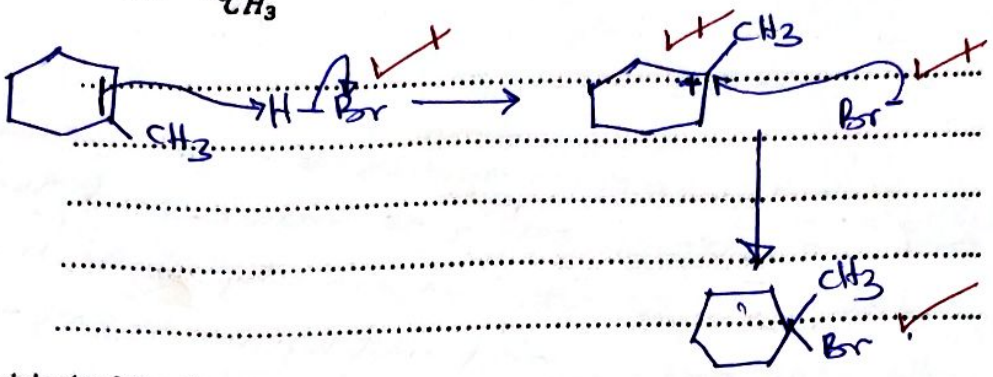
(b) $\xrightarrow[35^0C]{fuming\ H_2SO_4}$ (03 marks)

$2H_2SO_4 \rightleftharpoons SO_3 + H_3O^+ + HSO_4^-$ Lewis mechanism not written.



(c) 

(2½ marks)



02½

05

14. Explain the following.

(a) When sodium carbonate solution was added to a solution of chromium (III) sulphate, bubbles of a colourless gas and green precipitate were observed. (03 marks)

Chromium (III) ion has a very high charge density and polarising power. So in aqueous solution undergoes hydrolysis to form hydroxonium ions which react with the carbonate ions to form carbondioxide gas. Chromium(III) hydroxide is formed as a green precipitate.

03

$2Cr^{3+}_{(aq)} + 3CO_3^{2-}_{(aq)} + 3H_2O_{(l)} \longrightarrow 2Cr(OH)_{3(s)} + 3CO_{2(g)}$

(b) The bond angle of phosphorus trifluonde is 96^0 while that of phosphorus trichloride is 100^0. (03 marks)

Both molecules adopt a trigonal pyramidal shape. Fluorine atom in phosphorus trifluoride has a greater electronegativity than the chlorine atom in phosphorus trichloride. Fluorine atom draws bonded pairs of electrons away from the central atom, more than chlorine atom does. This makes the bonded pairs to be far apart reducing on the repulsion between them thus a smaller bond angle than in phosphorus trichloride.

03

(c) Aluminium utensils should not be cleaned using soap. (03 marks)

Soap is an organic salt of an organic acid and sodium hydroxide. In solution undergoes hydrolysis to form the weak organic acid and hydroxide ions which react with the aluminium utensils causing wearing off or tarnishing them.

$Al_{(s)} + 2\bar{O}H_{(aq)} + 6H_2O_{(l)} \longrightarrow 2Al(OH)_4^-{}_{(aq)} + 3H_{2(g)}$

03

15. (a) State the rate law. (01 mark)

The rate of reaction is directly proportional to the molar concentration of reactants raised to the appropriate powers at a given temperature.

(b) Explain why reactions with high molecularity are rare. (01 mark)

The rate of chemical reaction is proportional to the number of collision between reacting molecules. The chances of simultaneous collisions of reacting molecules decrease with increase in the number of reacting molecules thus making reactions with high molecularity rare.

(c) A solution of hydrogen peroxide titrated against acidified potassium manganite (VII) solution at different time intervals, gave the following results;

Time (minutes)	0	10	20
Volume acidified $KMnO_4$ used/cm^3	23.8	14.7	9.1

(i) Show that the decomposition of hydrogen peroxide is first. (3½ marks)

First order reaction: $\ln\left(\frac{a_0}{a}\right) = kt$ ✓

Volume $KMnO_4$ used ∝ inverse of concentration of H_2O_2 in solution ✓

$\ln\left(\frac{23.8}{47}\right) = K \times 10$ ✓

$K = \frac{\ln(1.619)}{10}$ ✓

$= 0.04881 \text{ minute}^{-1}$

Since K is almost constant the decomposition of H_2O_2 is first order.

$\ln\left(\frac{23.8}{9.1}\right) = 20K$ ✓

$K = \frac{\ln 2.615}{20}$ ✓

$= 0.04807 \text{ minute}^{-1}$ (03½)

(ii) Calculate the half-life of decomposition of hydrogen peroxide. (1½ marks)

$t_{½} = \frac{\ln 2}{K}$ ✓ $= \frac{0.693}{0.048}$ ✓ $= 14.44$ minute. ✓

09

16. (a) The chemistry of fluorine differs from that of chlorine.

(i) State two differences between the chemistry of chlorine and fluorine besides their reactions with sodium hydroxide. (02 marks)

- Fluorine reacts with phosphorus to form phosphorus pentafluoride only while chlorine reacts to form phosphorus trichloride and phosphorus pentachloride. (1)
- Fluorine reacts with sulphur to form sulphur hexafluoride whereas chlorine reacts with sulphur to form disulphur dichloride. (1)
- Fluorine reacts with water to form oxygen gas while chlorine reacts to form hypochlorous acid
- Fluorine reacts directly with carbon but chlorine doesn't.

(ii) Write the equation of reaction between hot concentrated potassium hydroxide solution and; (03 marks)

Fluorine

$2F_{2(g)} + 4\bar{O}H_{(aq)} \longrightarrow 4F^-_{(aq)} + 2H_2O_{(l)} + O_{2(g)}$ (1½)

Chlorine

$Cl_{2(g)} + 6\bar{O}H_{(aq)} \longrightarrow 5Cl^-_{(aq)} + ClO^-_{3(aq)} + 3H_2O_{(l)}$ (1½)

(b) Write equations for ionization of hydrogen fluoride in aqueous solutions that are. (03 marks)

(i) Dilute

$HF_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + F^-_{(aq)}$ (1½)

$HF_{(aq)} \rightleftharpoons H^+_{(aq)} + F^-_{(aq)}$

(iii) Concentrated.

$HF_{(aq)} + F^-_{(aq)} \rightleftharpoons HF_2^-{}_{(aq)}$ (1½)

$H_2F_{2(aq)} \rightleftharpoons H^+_{(aq)} + HF_2^-{}_{(aq)}$

(c) State **one** reason why the chemistry of fluorine differs from that of chlorine.

Fluorine has a smaller atomic radius compared to chlorine (1)

Fluorine has a more positive electrode potential than chlorine.

Fluorine is more electronegative than chlorine. (04)

Fluorine molecule has lower bond dissociation energy than chlorine molecule.

17. (a) (i) Define **enthalpy of a reaction.** (01 mark)

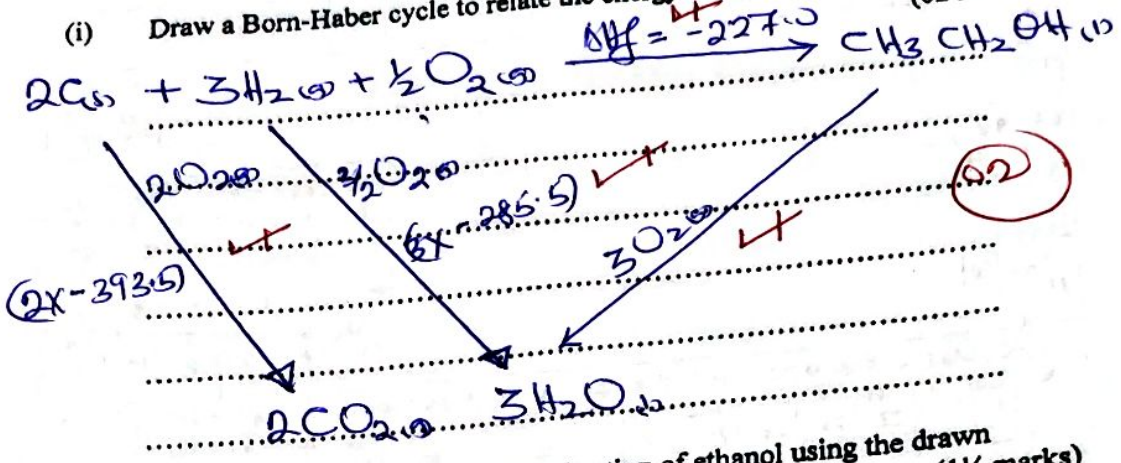
This is the difference between the total energy content of products and the total energy content of the reactants when the reactants and products are in their standard states at standard conditions. (1)

(ii) State **four** factors affecting the quantity of an enthalpy change of a reaction. (02 marks)

- Amount of reactants and products
- physical states of reactants and products. (02)
- Temperature
- Pressure
- Allotropic modifications

(b) The standard heat of formation of ethanol carbondioxide and water are -227.0; -393.5; and -285.5kJmol^{-1} respectively.

(i) Draw a Born-Haber cycle to relate the energy changes stated above. (02 marks)



(ii) Calculate the standard heat of combustion of ethanol using the drawn cycle. (1½ marks)

$\Delta H_f C_2H_5OH = 2X\Delta H_{CO_2} + 3\Delta H_{H_2O} - \Delta H_c C_2H_5OH$

$-277 = (2X-393.5) + (3X-285.5) - \Delta H_c C_2H_5OH$

$\Delta H_{C_2H_5OH} = -1366.5\ kJmol^{-1}$

(iv) From your calculation in (ii) above and energy changes in b(i), what can be the ideal use of ethanol in chemistry. Give a reason for your answers. (1½ marks)

Used as a fuel because it has a high enthalpy of combustion or evolves a lot of heat.

09

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 Tl 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															

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