KIBUGO DENNIS

Candidate's Name: .....Personal No. .....

Signature .....

PS25/1
CHEMISTRY
Paper 1
JULY 2024
2¾ hrs

MUKONO EXAMINATION COUNCIL 2024
Uganda Advanced Certificate of Education

CHEMISTRY
Paper 1
2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

- Answer all questions in Section A and six questions in Section B.
- All your answers must be written in the spaces provided.
- The 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.
- Where necessary, use the following;
- Molar gas constant, $R = 8.31JK^{-1}mol^{-1}$.
- Molar volume of a gas at s.t.p is 22.4 litres.
- Standard temperature = 273K.
- Standard pressure = $101325NM^{-2}$.

For Examiner's 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 from this Section

1. Electrode potentials for some half-cells are given below

Half cell	E^{θ} (V)
$SO^{2-}_{4(aq)}, H^{+}_{(aq)}, SO^{2-}_{3(aq)}/Pt$	+0.20
$MnO^{-}_{4(aq)}, H^{+}_{(aq)}, Mn^{2+}_{(aq)}/Pt$	+1.51

a) Write the cell notation for the cell formed when the two half cells are connected. (01 mark)

$Pt_{(s)} / SO^{2-}_{3(aq)}, SO^{2-}_{4(aq)} H^{+}_{(aq)} // MnO^{-}_{4(aq)}, H^{+}_{(aq)} Mn^{2+}_{(aq)} / Pt_{(s)}$ 01

b) Write equation for the overall cell reaction. (1½ marks)

$2MnO^{-}_{4(aq)} + 6H^{+}_{(aq)} + 5SO^{2-}_{3(aq)} \rightarrow 2Mn^{2+}_{(aq)} + 5SO^{2-}_{4(aq)} + 3H_2O_{(l)}$ 01½

c) i) Calculate the free energy of the cell. (1 Faraday = 96500C) (01 mark)

$E^{\theta}_{cell} = E^{\theta}_{right} - E^{\theta}_{left}$

$= +1.51 - 0.20$ ✓

$= +1.31V$

$Energy\ (\Delta G^{\theta}) = -nFE^{\theta}_{cell}$ ✓

$= -10 \times 96500 \times 1.31$ 01½

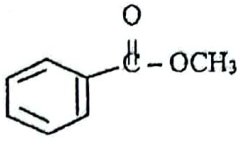
$= -1264150J$ ✓

ii) State whether the reaction is feasible or not. Give a reason for your answer. (01 mark)

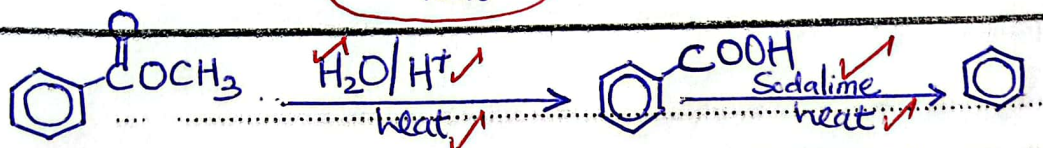
Feasible; because the free energy of the cell is negative 01

Accept; Feasible; because the emf of the cell is positive.

2. Write equations to show how the following conversions can be effected. Indicate the reagents and conditions for the reaction in each case.

a)  to  (2½ marks)

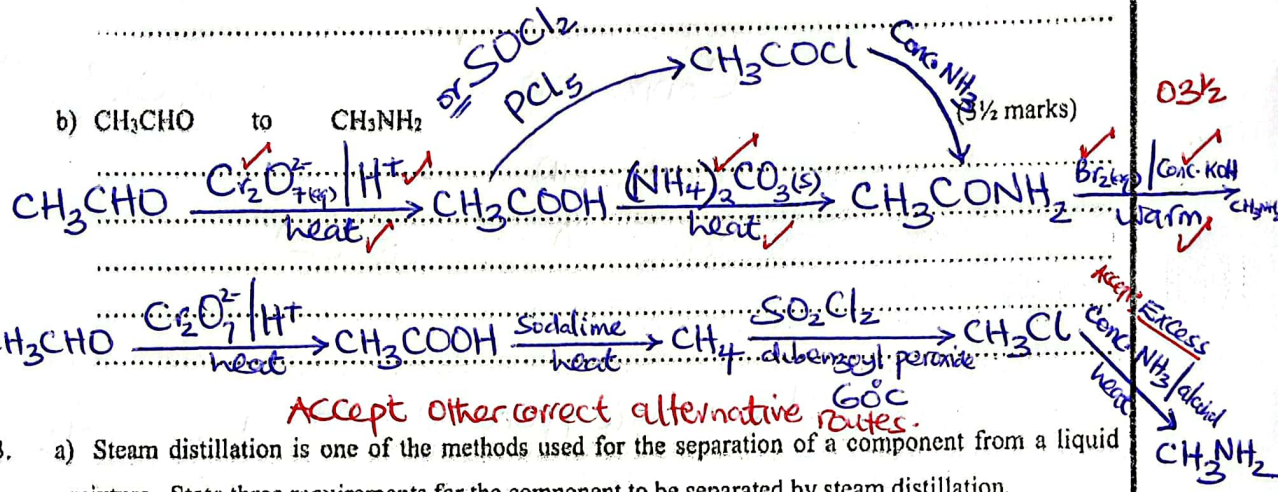
Accept; $\frac{H_2O/\bar{O}H_{(aq)}}{heat}$



02½

Accept; $\frac{NaOH_{(s)}/CaO_{(s)}}{heat}$

b) CH_3CHO to CH_3NH_2 (3½ marks)



03½

Accept other correct alternative routes.

3. a) Steam distillation is one of the methods used for the separation of a component from a liquid mixture. State three requirements for the component to be separated by steam distillation. (1½ marks)

Should be immiscible with water ✓
Should have a high Relative molecular mass. ✓
Should exert a high vapour pressure at about 100°C (near boiling point of water)
Any impurities present should be non-volatile

01½

b) A mixture containing substance X was steam distilled at 760mmHg and 98°C. The distillate contained 85% by mass of water. If the vapour pressure of water is 735mmHg at 98°C. Calculate the molecular masss of X. (03 marks)

Accept; $\frac{P_x}{P_{water}} = \frac{m_x \cdot Mr_{water}}{m_{water} \times Mr_x}$

$P_T = P_x + P_{water}$ ✓

$760 = P_x + 735$

$P_x = 25mmHg$ ✓

%mass of X = 100 − 85 = 15%

$\frac{\text{Mass of X}}{\text{Mass of water}} = \frac{P_x \cdot Mr_x}{P_{water} \cdot Mr_{water}}$ ✓

$\frac{15}{85} = \frac{25 \times Mr_x}{735 \times 18}$ ✓

03

$Mr_x = 93.4$ ✓

4. A green powder Z was dissolved in dilute sulphuric acid to form a blue solution. When concentrated hydrochloric acid was added to the solution of Z dropwise until in excess a yellow solution was formed.

a) Identify the cation in Z. (½ mark)

Copper(II) ion ✓ Accept; Cu^{2+} 0½

Accept; ...(II)

Reject ...(ii) Rej; ...(II)

b) Name the species present in the solution

i) Before addition of hydrochloric acid. (½ mark)

Hexaaquacopper(II) ion ✓ 0½

ii) After addition of excess hydrochloric acid. (½ mark)

Tetrachlorocuprate(II) ion ✓ 0½

c) Excess potassium iodide solution was added to the blue solution.

i) State what was observed. (01 mark)

White ✓ precipitate ✓ in a brown solution 01

ii) Write an equation for the reaction that took place. (1½ mark)

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

5. a) Write

i) Equation for the hydrolysis of ammonium chloride in water. (01 mark)

$NH^+_{4(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+_{(aq)}$ ✓ 01

deduct ½MK if → used.

ii) The expression for the hydrolysis constant, K_h of ammonium chloride. (01 mark)

$K_h = \frac{[NH_3][H_3O^+]}{[NH_4^+]}$ ✓ 01

b) The PH of 0.1M ammonium chloride solution is 5.13 at 25°C. $[H^+] = [H_3O^+]$

i) Calculate the hydrolysis constant of ammonium chloride. (03 marks)

$pH = -\log[H^+]$ ✗

$5.13 = -\log[H^+]$ ✗ ✓

$[H^+] = 7.413\times10^{-6}\ moldm^{-3}$ ✗ ✓

At equilibrium, $[NH_3] = [H_3O^+]$ ✓

$K_h = \frac{[H_3O^+]^2}{[NH_4^+]}$ ✗

$= \frac{(7.413\times10^{-6})^2}{0.1}$ ✗ ✓ 03

$K_h = 5.495\times10^{-10}\ moldm^{-3}$ ✗

Step marking if this condition is missing

ii) State the assumptions you have made in b(i) above. (01 mark)

$[NH_4^+] = [salt]$ ✓ OR $[NH_4^+] = [NH_4Cl]$

At equilibrium, $[NH_3] = [H_3O^+]$ ✓ ✓ 01

↑ Reject if it is missing.

6. a) Name one source of vegetable oil. (½ mark)

Simsim seeds ✓ 01/2

Groundnuts

Sunflower seeds

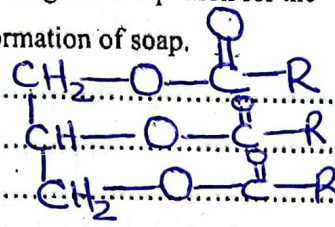
Reject: Simsim, G.nuts, Sunflowe

b) Describe briefly how soap can be prepared from one of the sources of vegetable oil you have named in (a) above. (03 marks)

oil is extracted from simsim seeds.
A mixture of simsim oil and concentrated sodium hydroxide solution is boiled while stirring until no more reaction
The resultant soap solution is cooled.
Concentrated sodium chloride solution is added to the resultant soap solution to precipitate out the soap.
Soap floats and it is skimmed off. 03

c) Write the general equation for the

i) Formation of soap. (01 mark)



01

ii) Reaction between hard water and soap. (01 mark)

$$Mg^{2+}_{(aq)} + 2RCOO^-_{(aq)} \longrightarrow Mg(RCOO)_{2(s)}$$

01

Accept; Ca^{2+}

7. a) $10cm^3$ of a hydrocarbon R, (C_xH_y) was exploded with $95cm^3$ of oxygen. On cooling to room temperature, the residual gases occupied, $70cm^3$.

When the residual gases were passed through potassium hydroxide solution, the volume reduced to $30cm^3$.

i) Write equation for the reaction between R and oxygen. (01 mark)

$$C_xH_{y(g)} + \left(x + \frac{y}{4}\right)O_{2(g)} \longrightarrow xCO_{2(g)} + \frac{y}{2}H_2O_{(l)}$$

01

ii) Determine the molecular formula of R. (03 marks)

Volume of $CO_2 = (70-30) = 40cm^3$; Volume of excess Oxygen $= 30cm^3$

Volume of reacted $O_2 = (95-30) = 65cm^3$

03

From equation; $10cm^3$ of C_xH_y reacts with $65cm^3$ of O_2 to produce $40cm^3$ of CO_2

$1cm^3$ of C_xH_y reacts with $\left(\frac{65}{10}\right)$ of O_2 to produce $\left(\frac{40}{10}\right)cm^3$ of CO_2

Thus; $\left(\frac{40}{10}\right) = x$ and $\frac{65}{10} = x + \frac{y}{4}$

$x = 4$

$\frac{65}{10} = 4 + \frac{y}{4}$

$y = 10$

∴ Molecular formula of R is C_4H_{10}

b) Write equations to show how R can be synthesized from an alcohol. (02 marks)

$CH_3CH_2CH_2CH_2CH_2OH \xrightarrow[\text{heat}]{MnO_4 / \text{Conc. } H_2SO_4} CH_3CH_2CH_2CH_2COOH \xrightarrow[\text{heat}]{\text{soda lime}} CH_3CH_2CH_2CH_3$

02

Accept any other correct alternative route.

8. a) State three reasons why beryllium differs from the other elements in group (II) of the periodic table. (1½ marks)

Beryllium atom has the smallest atomic radius.

Beryllium atom has the lowest positive electrode potential.

Beryllium atom has the highest electronegativity value.

01½

b) Write equation for the reaction between dilute hydrochloric acid and

i) beryllium carbide (1½ marks)

$Be_2C_{(s)} + 4HCl_{(aq)} \longrightarrow 2BeCl_{2(aq)} + CH_{4(g)}$

01½

ii) calcium carbide (1½ marks)

$CaC_{2(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + HC\equiv CH_{(g)}$ or $C_2H_{2(g)}$

01½

9. a) State the trend of the thermal stability of the tetrachlorides of elements in group (IV) of the periodic table. (01 mark)

Thermostability decreases from Carbon tetrachloride to lead tetrachloride.

01

In this case; Accept;..... Decreases down the group.

b) Explain your answer in (a). (04 marks)

Atomic radius increases from Carbon to lead. This leads to an increase in element–Chlorine bond length but bond strength decreases.

Consequently, less energy is required to break the bonds.

Thus ~~the~~ tetrachlorides of Carbon, Silicon and Germanium are thermally stable and don't decompose (04)

However, that of tin and lead decompose forming respective dichloride and chlorine gas.

$SnCl_4(l) \longrightarrow SnCl_2(s) + Cl_2(g)$

$PbCl_4(l) \longrightarrow PbCl_2(s) + Cl_2(g)$

Accept; $MCl_4(l) \longrightarrow MCl_2(s) + Cl_2(g)$ $(M = Sn, Pb)$

SECTION B (54 MARKS)

Answer **six** questions from this Section.

10. Write a mechanism to show how each of the following conversions can be effected.

a) $CH_3CH(OH)CH_2CH_3$ to $CH_3CH=CHCH_3$ (03 marks)

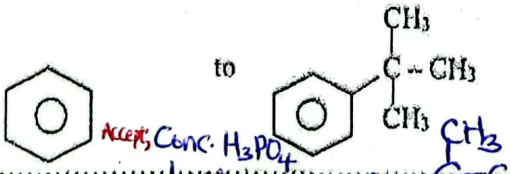
Accept $CH_3CHCH_2CH_3$ with $\delta-$ O and $\delta+$ H bonded to OSO_3H

$$CH_3CH(OH)CH_2CH_3 \xrightarrow[180^\circ C]{Conc.\ H_2SO_4} CH_3CH=CHCH_3$$

Mechanism; $H_2SO_4 \rightleftharpoons H^+ + \bar{O}SO_3H$ (03)

$CH_3CH(OH)CH_2CH_3 \longrightarrow CH_3\overset{+}{C}HCH_2CH_3 \xrightarrow{-H_2O} CH_3\overset{+}{C}HCH_2CH_3$

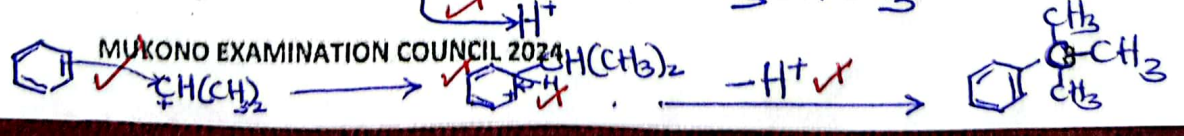
$CH_3\overset{+}{C}H\text{–}\underset{H}{\underset{|}{C}}CH_3 \longrightarrow CH_3CH=CHCH_3$ (03 marks)

b)  to

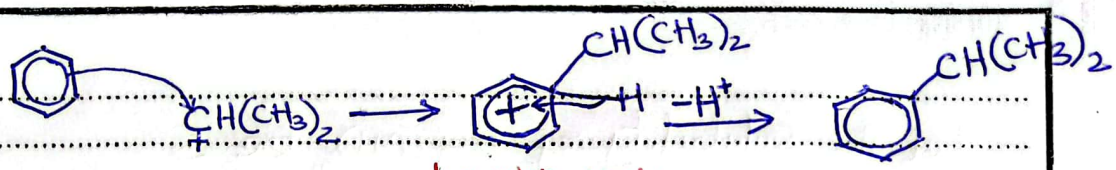
Accept; Conc. H_3PO_4

$CH_3CH=CH_2 / H^+$

Mechanism; $CH_3CH=CH_2 \longrightarrow CH_3\overset{+}{C}HCH_3$ (03)



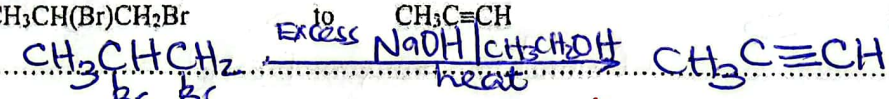
Accept;



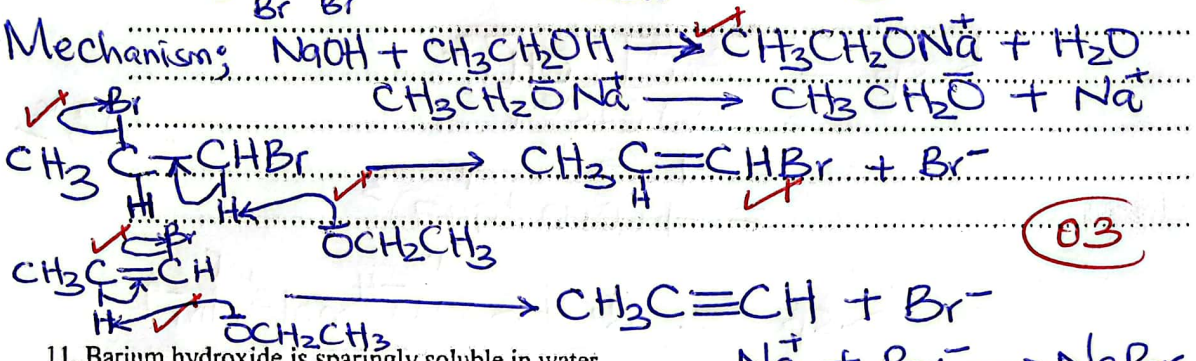
Incomplete circle

Should cover 5C atoms of the arene

c) $CH_3CH(Br)CH_2Br$ to $CH_3C{\equiv}CH$ (03 marks)



Mechanism;

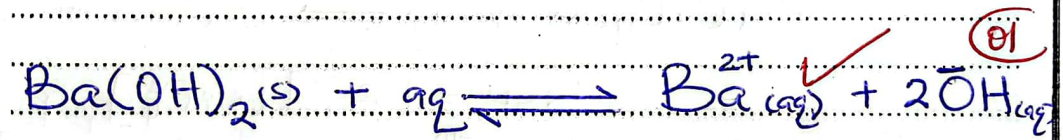


03

11. Barium hydroxide is sparingly soluble in water

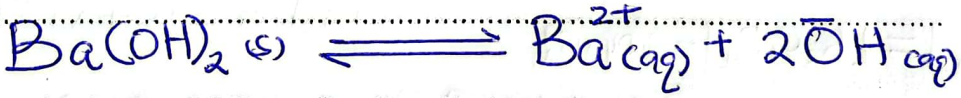
a) Write:

i) equation for the solubility of barium hydroxide in water. (01 mark)



01

Accept;



ii) an expression for the solubility product, Ksp of barium hydroxide.

(01 mark)

01

b) The solubility of barium hydroxide is 0.675g per $100cm^3$ of water at 25^0C. calculate the:

i) solubility product of barium hydroxide at 25^0C and state its units.

(3½ marks)

Molar mass of $Ba(OH)_2 = 137 + 2(16+1) = 171\ g$

171g of $Ba(OH)_2$ Contain 1 mole

0.675g of $Ba(OH)_2$ Contain $\left(\frac{0.675 \times 1}{171}\right)$ moles

$= 3.947 \times 10^{-3}$ moles.

$100cm^3$ of solution Contain 3.947×10^{-3} moles

$1000cm^3$ of solution Contain $\left(\frac{3.947 \times 10^{-3} \times 1000}{100}\right)$ moles

$= 0.03947M$

$\therefore [Ba(OH)_2] = 0.03947M.$

Let the solubility of $Ba(OH)_2$ be S

$Ba(OH)_2(s) + aq \rightleftharpoons Ba^{2+}(aq) + 2OH^-(aq)$

S S 2S

$[Ba^{2+}] = S$, $[OH^-] = 2S$

$K_{sp} = [Ba^{2+}][OH^-]^2$

$= (S)(2S)^2$ ✓ 02½

$= 4S^3$ ✓

$= 4(0.03947)^3$ ✓

$K_{sp} = 2.46 \times 10^{-4} mol^3 dm^{-9}$ ✓

ii) volume of a 0.01M potassium chromate (VI) solution that must be added to 1dm³ of a saturated solution of barium hydroxide to precipate barium chromate (VI).
(Ksp of barium chromate (VI) is $1.2 \times 10^{-10} mol^3 dm^{-9}$ at 25°C). (02 marks)

$BaCrO_4(s) + aq \rightleftharpoons Ba^{2+}(aq) + CrO_4^{2-}(aq)$

$K_{sp} = [Ba^{2+}][CrO_4^{2-}]$ ✓

$1.2 \times 10^{-10} = (0.03947)[CrO_4^{2-}]$ ✓

$[CrO_4^{2-}] = 3.04 \times 10^{-9} mol dm^{-3}$ ✓

$K_2CrO_4(aq) \rightarrow 2K^+(aq) + CrO_4^{2-}(aq)$

$[CrO_4^{2-}] = [K_2CrO_4] = 3.04 \times 10^{-9} M$

02

∴ 0.01 moles of K_2CrO_4 contain 1000 cm³ ✓

3.04×10^{-9} moles of K_2CrO_4 contain $\left(\frac{3.04 \times 10^{-9} \times 1000}{0.01}\right) cm^3$ ✓

$= 3.04 \times 10^{-4} cm^3$

c) Sodium hydroxide was added to a saturated solution of barium hydroxide.

i) State what happened to the solubility of barium hydroxide. (½ mark)

Decreases ✓ 0½

ii) Give a reason for your answer in c(i) above. (a) Kalis (01 mark)

Sodium hydroxide is a strong electrolyte that completely ionises to produce hydroxide and sodium ions. This leads to an increase in concentration of hydroxide ions (similar to those) in the saturated solution of barium hydroxide. The excess hydroxide ions react with barium ions precipitating barium hydroxide hence decreasing the solubility of barium hydroxide. 01

12. Ammonium dichromate dissolves in water to form an orange solution and decomposes on heating to form a green solid

a) Write equation to show the effect of heat on ammonium dichromate.

(1½ marks)

$(NH_4)_2Cr_2O_7(s) \xrightarrow{heat} N_2(g) + Cr_2O_3(s) + 4H_2O(l)$

01½

b) State what would be observed and write equation for the reaction that would take place when the following substances are added to a solution of ammonium dichromate.

i) Acidified hydrogen peroxide solution (02 marks)

Observation

Orange solution turns to an intense blue solution

Equation

$Cr_2O_7^{2-}(aq) + 2H_2O_2(aq) + 2H^+(aq) \rightarrow CrO_5(aq) + 4H_2O(l)$

02

ii) Aqueous sodium hydroxide (02 marks)

Observation

Orange solution turns to yellow solution

Equation

$Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightarrow 2CrO_4^{2-}(aq) + H_2O(l)$

02

iii) Acidified Iron (II) sulphate solution (02 marks)

Observation

Orange solution turns to brown. 01½

Equation

$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 6Fe^{3+}(aq) + 7H_2O(l)$ ✓✓ 01½

c) To the resultant solution in b(ii) was added silver nitrate solution.

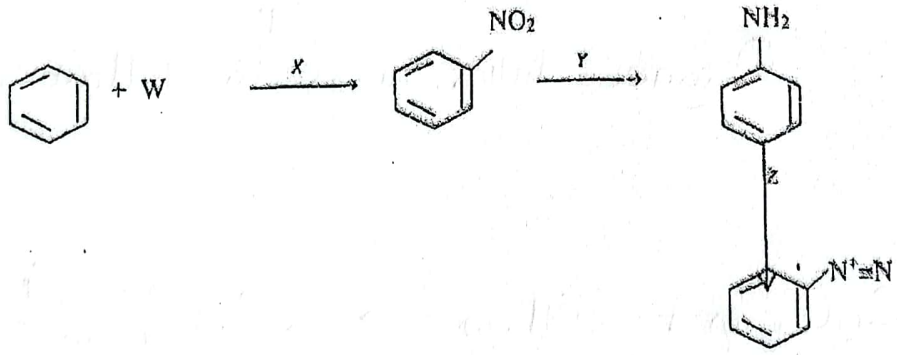
i) State what was observed. (½ mark)

Red precipitate ✓ 0½

ii) Write equation for the reaction that took place. (1½ marks)

$2Ag^+(aq) + CrO_4^{2-}(aq) \rightarrow Ag_2CrO_4(s)$ ✓✓ 01½

13. a) Consider the following reaction scheme:



i) Identify substance (01 mark)

W. Concentrated nitric acid ✓

X. Concentrated sulphuric acid ✓ 01

ii) Name the reagent(s) (02 marks)

y. Tin, Concentrated hydrochloric acid, Concentrated sodium hydroxide solution 01

z. Sodium nitrite solution and Concentrated hydrochloric acid 01

Accept; dilute

iii) State the condition for the reaction between aminobenzene and z. (½ mark)

Temperature of 0–5°C 0½

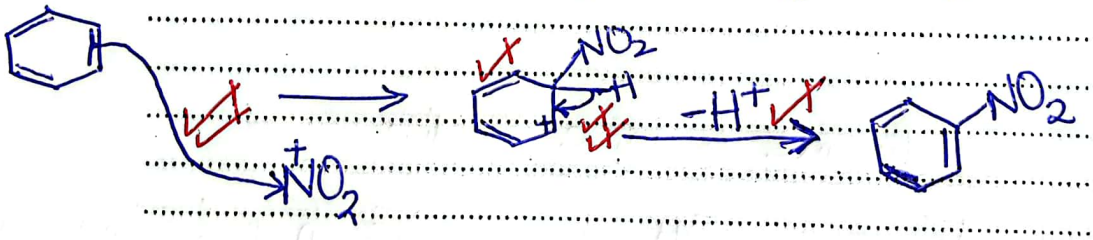
Accept; 0°C Accept; Ice cold conditions.

Reject; >10°C

iv) Write a mechanism for the reaction leading to the formation of nitrobenzene. (04 marks)

$2H_2SO_4 + HNO_3 \rightleftharpoons \overset{+}{N}O_2 + H_3\overset{+}{O} + 2HSO_4^-$

Accept; $H_2SO_4 + HNO_3 \rightleftharpoons \overset{+}{N}O_2 + H_2O + HSO_4^-$



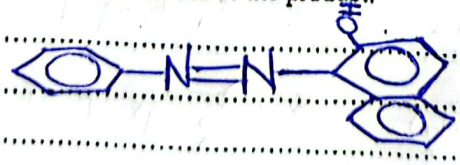
04

b) Benzene diazonium salt was reacted with 2 – naphthol in the presence of sodium hydroxide.

i) State what was observed. (½ mark)

Bright red precipitate 0½

ii) Write the structural formula of the product. (01 mark)



01

14. Compare the reactivity of fluorine and chlorine with the following compounds. (In each case illustrate your answer with equations)

a) water (03 marks)

Fluorine vigorously reacts with water

$2F_2(g) + 2H_2O(l) \longrightarrow 4HF(aq) + O_2(g)$

Chlorine moderately reacts with water

$Cl_2(g) + H_2O(l) \rightleftharpoons HCl(aq) + HOCl(aq)$

03

b) cold dilute sodium hydroxide solution. (03 marks)

Fluorine is more reactive

$F_2(g) + 2\bar{O}H(aq) \longrightarrow OF_2(g) + 2F^-(aq) + H_2O(l)$

$Cl_2(g) + 2\bar{O}H(aq) \longrightarrow Cl^-(aq) + ClO^-(aq) + H_2O(l)$

03

c) hot concentrated sodium hydroxide solution. (03 marks)

Fluorine is more reactive

$2F_2(g) + 4\bar{O}H(aq) \longrightarrow O_2(g) + 4F^-(aq) + 2H_2O(l)$

$3Cl_2(g) + 6\bar{O}H(aq) \longrightarrow 5Cl^-(aq) + ClO_3^-(aq) + 3H_2O(l)$

03

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

a) Cold concentrated hydrochloric acid is added to lead (IV) oxide (2½ marks)

Observation

Dark brown solid dissolves in the acid forming a yellow liquid

Accept (solution) 02½

Equation

$PbO_2(s) + 4HCl(aq) \longrightarrow PbCl_4(l) + H_2O(l)$

b) Acidified potassium manganate (VII) solution is added to hot ethanedioic acid. (2½ marks)

Observation

Purple solution turns to colourless solution and bubbles of a colourless gas evolved. 01 01½

Equation

$2MnO_4^-(aq) + 8H^+(aq) + 5C_2O_4^{2-}(aq) \longrightarrow 2Mn^{2+}(aq) + 8H_2O(l) + 10CO_2(g)$

c) Ammoniacal silver nitrate is added to methanoic acid. (02 marks)

Observation

Silver mirror 01½

Reject; grey precipitate

Equation

$HCOOH(aq) + 2Ag(NH_3)_2^+(aq) + 2OH^-(aq) \longrightarrow 2Ag(s) + 2H_2O(l) + CO_2(g) + 4NH_3(g)$ 01½

Accept; $HCOOH(aq) + 2Ag^+(aq) + OH^-(aq) \longrightarrow 2Ag(s) + 2H_2O(l) + CO_2(g)$

Accept;

$CH_3CH(OH)CH_3(l) + 4I_2(aq) + 6NaOH(aq) \rightarrow CHI_3(s) + CH_3COONa(aq) + 5NaI(aq) + 5H_2O(l)$

d) Aqueous solution of iodine and sodium hydroxide is warmed with propane – 2 – ol (02 marks)

Observation

Yellow precipitate, ✓ ✓ (02)

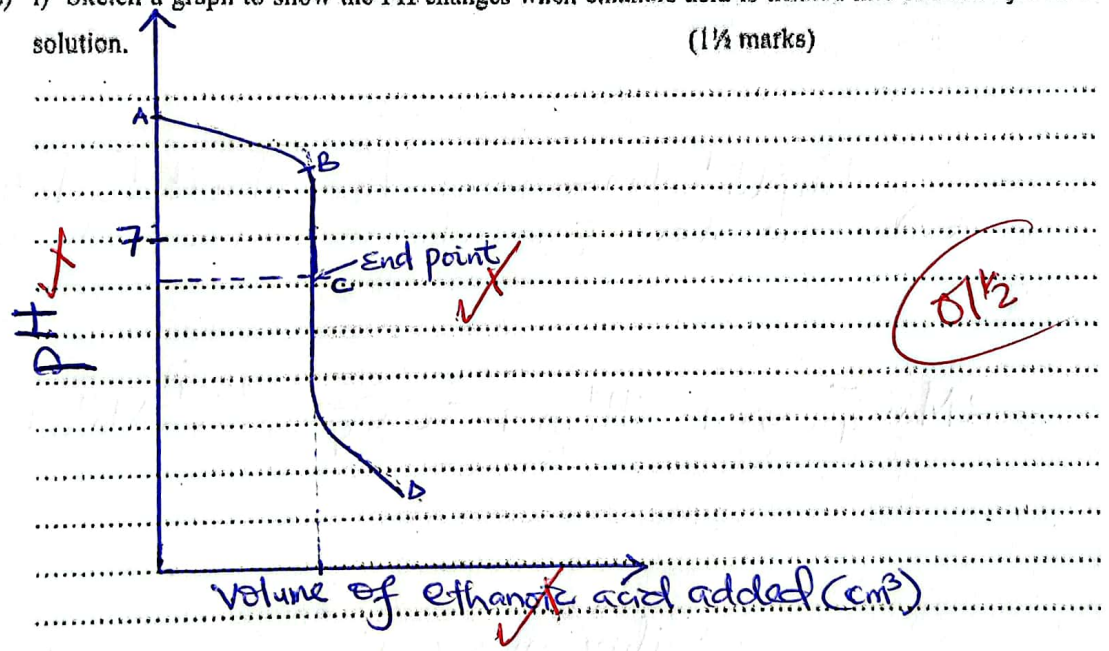
Equation $CH_3CH(OH)CH_3 + I_2(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + CHI_3(s)$

-½ for missing or wrong state symbol.

Accept; $CH_3CH(OH)CH_3(l) \xrightarrow[\text{heat}]{I_2(aq)/NaOH(aq)} CHI_3(s) + CH_3COONa(aq)$

Reject; CH_3COOH

16. a) i) Sketch a graph to show the PH changes when ethanoic acid is titrated into sodium hydroxide solution. (1½ marks)



✓ ✓ ✓ (01½)

ii) Explain the shape of your sketch graph in a(i). (3 ½ marks)

At A; Initially the pH is very high. This is because sodium hydroxide is a strong base that completely ionises in aqueous solution producing excess hydroxide ions ✓

At A to B; pH slightly decreases. This is because some of the hydroxide ions are being neutralised by hydrogen ions from ethanoic acid being added. Also, due to formation of acidic buffer that resist change in pH ✓ ✓ (03½)

B to C; pH sharply increases. This is because all the hydroxide ions are fully neutralised by hydrogen ions from ethanoic acid added ✓

Point C; The end-point is below 7. This is because the salt formed (CH_3COONa) undergoes anionic hydrolysis ✓ forming hydroxide ions that are alkaline that make ✓

C to D; pH gradually decreases because of excess hydrogen ions from excess ethanoic acid being added. ✓

b) Calculate the PH of the resultant solution formed when 20cm^3 of 0.1Msodium hydroxide solution was added to 100cm^3 of 0.1M ethanoic acid at 25^{0}C.
(Dissociation constant of ethanoic acid at 25^{0}C is 1.7 x 10^{-5} mol dm^{-3}) (04 marks)

Moles of NaOH = $\left(\frac{20\times0.1}{1000}\right)$ = 2×10^{-3} moles ; Moles of CH_3COOH = $\left(\frac{0.1\times100}{1000}\right)$ = 0.01 mole

Excess moles of acid = $(0.01-2\times10^{-3})$ = 8×10^{-3} moles.

Total volume of resultant solution = (20 + 100) = 120cm^3

∴ 120cm^3 of solution contain 8×10^{-3} moles of acid

1000cm^3 of solution contain $\left(\frac{8\times10^{-3}\times1000}{120}\right)$ = 0.067M

∴ [acid] = [CH_3COOH] = 0.067M

$CH_3COOH_{(aq)} + NaOH_{aq} \rightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

Mole ratio; NaOH : CH_3COONa = 1 : 1 hence moles of CH_3COONa = 2×10^{-3} moles

120cm^3 of solution contain 2×10^{-3} moles

1000cm^3 of solution contain $\left(\frac{2\times10^{-3}\times1000}{120}\right)$ = 0.0167M

∴ [salt] = [CH_3COONa] = 0.0167M

From $pH = pKa + \log\frac{[salt]}{[acid]}$

$= -\log 1.7\times10^{-5} + \log\left(\frac{0.0167}{0.067}\right)$

pH = 5.37

04

17. a) i) State what is meant by the term thermosetting plastic. (02 marks)

These are plastics which when heated can not be softened to be remoulded as they contain a three-dimensional network of bonds that are cross linked and held by strong covalent bonds.

02

ii) Give one example of a synthetic thermosetting plastic. (01 mark)

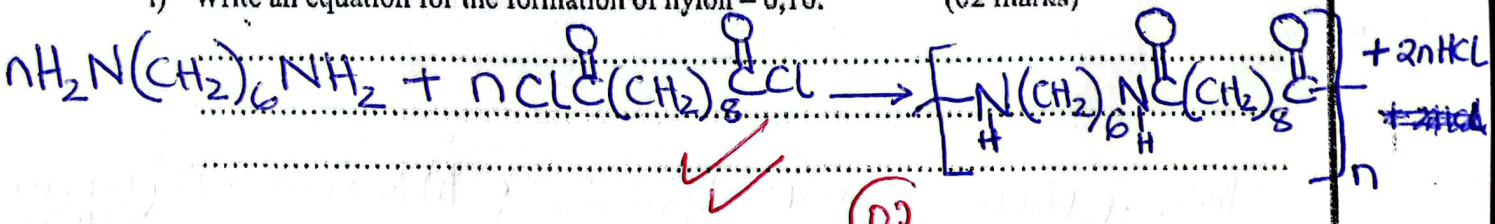
Melamine

01

Accepts; Bakelite, Epoxyresins

b) Nylon – 6,10 can be formed by reacting hexane – 1,6 – diamine with decane dioyl dichloride, $ClOC(CH_2)_8COCl$.

i) Write an equation for the formation of nylon – 6,10. (02 marks)



02

ii) State the type of polymerisation involved in the formation of nylon – 6,10.

(01 mark)

Condensation ✓ 01

c) The osmotic pressure of a solution containing $2gdm^{-3}$ of nylon – 6,10 at 25^0C was 0.188 mmHg. Calculate the relative molecular mass of nylon – 6,10.

(2½ marks)

from $JV = nRT$; $JV = \frac{m}{M_r}RT$ ✓ ✗

$\left(\frac{101325 \times 0.188}{760}\right) \times 1 \times 10^{-3} = \frac{2}{M_r} \times 8.31 \times (25+273)$ ✓ ✗ 02½

$M_r = 197.599.761$ ✓

d) State one use of nylon – 6,10. (½ mark)

- Manufacture of fishing nets, ropes ✓ ✗ 01/2
- Manufacture of clothing fabrics
- Manufacture of tarpulins.

END

GOOD LUCK