THE UNITED REPUBLIC OF TANZANIA

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

NJOMBE REGION

FORM SIX PRE-NECTA EXAMINATION-2024

132/1 CHEMISTRY 1

12th, MARCH, 2024

CHEMISTRY 1

MARKING

SCHEME-2024

SECTION A

1. (a) (i) The following two point of Bohr's model can be used to derive the following formula:

(i) Electrons revolve around the Nucleus in definite energy Called orbits 01

(iii) Energy is emitted or absorbed only when an electron jumps from one orbit to another. 01

(ii) Derivation.

(a) According to Bohr, Energy of an electron in the n^{th} level is given as:

$$E_n = -\frac{2\pi^2 me^4}{n^2h^2}$$ where m - mass of electron
e - electron charge
h - plank's constant.

(ii) When electron jumps from outer orbit (n_2) to inner orbit (n_1), the difference in energy (ΔE) is emitted as:

$$\Delta E = E_2 - E_1$$

$$= \frac{2\pi^2 me^4}{n_2^2h^2} - \left(-\frac{2\pi^2 me^4}{n_1^2h^2}\right) \quad 01$$

$$= \frac{2\pi^2 me^4}{h^2}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

but $\Delta E = h\nu = \frac{hc}{\lambda} = h\bar{\nu}c$

$$\bar{\nu} = \frac{\Delta E}{hc} = \frac{2\pi^2 me^4}{ch^3}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

By substituting the value of c, h, π, m, e in the equation.

$$\bar{\nu} = 109677\ cm^{-1}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \quad 01$$

(b). The Energy required to remove an electron from H-atom = Ionization energy of H-atom. $= 2.18 \times 10^{-18}\ J\ atom^{-1}$

The amount of energy absorbed $= 1.50 \times 2.18 \times 10^{-18}\ J$. 01

$= 3.27 \times 10^{-18}\ J$.

01

Amount of energy converted to kinetic energy $= E_2 - E_1$

$$\Delta E = (3.27 \times 10^{-18} - 2.18 \times 10^{-18})\ J.$$

$$= 1.09 \times 10^{-18}\ J. \quad 0\frac{1}{2}$$

From

$$K.E = \frac{1}{2}MV^2$$

$$V = \sqrt{\frac{2K.E}{m}}$$

$$V = \sqrt{\frac{2 \times (1.09 \times 10^{-18})J}{9.1 \times 10^{-31} kg.}} \quad 0\frac{1}{2}$$

$$= \underline{1.55 \times 10^{6} ms^{-1}}.$$

Then

According to de-broglie equation.

$$\lambda = \frac{h}{MV}$$

$$\lambda = \frac{6.63 \times 10^{-34} Js}{(9.1 \times 10^{-31} kg \times 1.55 \times 10^{6} ms^{-1})}$$

$$\lambda = \underline{4.70 \times 10^{-10} m} \quad 0\frac{1}{2}$$

(C). Uncertainty in speed of ball $= \frac{90 \times 4}{100} = 3.6 ms^{-1}$

Uncertainty in position, $\Delta x = \frac{h}{4\pi m \Delta v}$ $0\frac{1}{2}$

$$= \frac{6.626 \times 10^{-34} Js}{4 \times 3.142 \times 10 \times 10^{-3} kg \times 3.6 ms^{-1}}$$

$$\Delta x = \underline{1.46 \times 10^{-33} m} \quad 0\frac{1}{2}$$

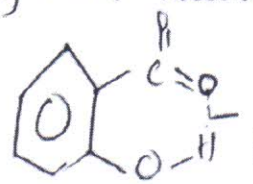
2. (a) (i) This is because BeH_2 is a linear molecule, therefore the resultant dipole moment of two Be–H bonds get cancelled & giving zero dipole moment. 01

$$H \leftarrow Be \rightarrow H \quad \mu = 0$$

(ii) NH_3 molecule has one lone pair while H_2O has two lone pair of electrons. Due to the presence of lone pairs the geometries of NH_3 and H_2O are distorted. The distortion is caused by lp–bp repulsion (lone pair – bond pair) than bp – bp repulsion, the bond angle in NH_3 is reduced from normal tetrahedral bond angle (109.5°) to 107°. In case of lp of electrons three the O–H bond are more closely than N–H bond in NH_3, so the bond angle decreases to a larger extent i.e 104.5°. 01½

(iii) In NaCl, the hydration energy is sufficient to overcome the lattice energy of ionic NaCl. Hence NaCl is soluble in water. The high hydration energy of NaCl is because of relatively high ionic character of NaCl with the result that water dipoles interact strongly with Na^+ and Cl^- ions.
On the other hand, CuCl has sufficiently covalent character because of greater polarization of Cu^{2+} ion. As a result of covalent character, its hydration energy is low and is not sufficient to overcome the lattice energy of CuCl, consequently it is insoluble in water. 01½

(iv). In O-hydroxy benzaldehyde, there is intramolecular hydrogen bonding which further prevents association of the molecules. However in p-hydroxy benzaldehyde, there is intermolecular hydrogen bonding and therefore, there is association among the molecules.



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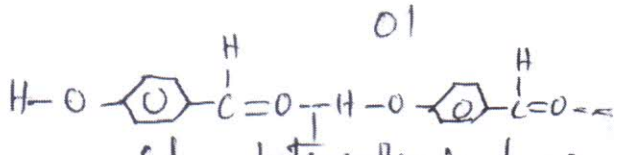
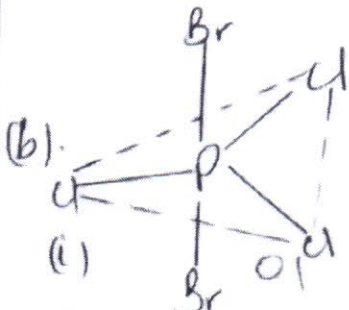


(b).



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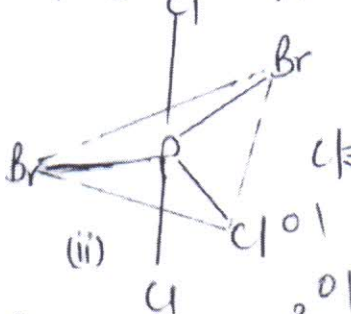

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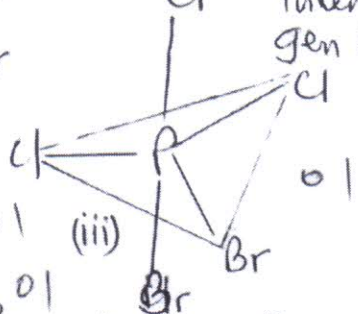

01

03 Hybridization of $PBr_2Cl_3 = sp^3d$, structure (ii) and (iii) 01

Q3 (a). (i) The volume occupied by the gas molecule is negligibly small in comparison to the total volume of the gas. 01

(ii) The forces of attraction b/tn the gas molecules are negligible 01

(b). FROM Let rate of N_2 and unknown gas is r_{N_2} and r_x

$r = \frac{k \cdot p}{\sqrt{M}}$, then $r_{N_2} = \frac{1}{38}$ mol/s^{-1}

$r_x = \frac{1}{57}$ mol/s^{-1}.

Then:

For N_2: $\frac{1}{38} = \frac{k \times 0.8}{\sqrt{28}}$ 01/2

For unknown gas: $\frac{1}{57} = \frac{k \times 1.6}{\sqrt{M_x}}$ 01/2

Then

$$\frac{1}{38} \times \frac{57}{1} = \frac{0.8}{1.6} \times \sqrt{\frac{M_x}{28}}$$

$$\frac{3}{2} = \frac{1}{2}\left(\frac{M_x}{28}\right)^{\frac{1}{2}}$$ 01

$M_x = 9 \times 28$

$M_x = 252$ gmol^{-1}.

Then Molecular Mass of Compound of Xe and F = 252.

Let the formula be ..., (Mr of Xe = 131).

Then

$131 + x \times 19 = 252$. 01

$131 + 19x = 252$

$19x = 252 - 131$

$\frac{19x}{19} = \frac{121}{19}$

$x = 6.36 \approx 6$. 01

Therefore, Molecular formula of $XeF_x = XeF_6$

03

3 (a) From

Amount of the gas = $\frac{\text{Mass of gas}}{\text{Molar mass}} = \frac{12g}{120g/mol} = 0.1\ Mol$

Then, since the gas is ideal:

$PV = nRT$, where $P = 1\ atm$, $V = V$, $T = t°C + 273 = (t+273)K$

$1 \times V = 0.1\ Mol \times 0.082\ L\ atm\ K^{-1}\ mol^{-1} \times (t+273)K$ ---(i). 00½

After the increase of temperature:

$P = 1\ atm \times \frac{110}{100} = 1.1\ atm$.

$1.1\ atm \times V = 0.1\ Mol \times 0.082 \times (t+10+273)K$

$1.1\ atm \times V = 0.1\ Mol \times 0.082 \times (t+283)K$ ---(ii). 01½

By dividing Eq(ii) by Eq(i).

$$\frac{1.1 \times VL}{1 \times VL} = \frac{0.1 \times 0.082 \times (t+283)}{0.1 \times 0.082 \times (t+273)}$$ 00½

$$1.1 = \frac{t+283}{t+273}$$

$1.1t - t = 283 - 1.1 \times 273$

$\frac{0.1t}{0.1} = \frac{-17.3}{0.1}$ 01

$t = -173°C$

Substituting the value of t in any of the above equations;

$1\ atm \times V = 0.1 \times 0.082 \times (-173 + 273)K$

$V = \frac{0.1 \times 0.082 \times 100K}{1\ atm}$ 00½

$V = 0.82L$ 01

04

4 (a)(i) Amphoteric properties of ZnO

Acidic property; for example reaction with sodium hydroxide:

$$ZnO(s) + 2NaOH(aq) \longrightarrow Na_2ZnO_2(aq) + H_2O(l)$$

Sodium zincate

(0.1 mark)

Basic property; for example, reaction with hydrochloric acid:

$$ZnO(s) + 2HCl(aq) \longrightarrow ZnCl_2(aq) + H_2O(l)$$

(0.1 mark)

(ii) Amphoteric properties of Al_2O_3

Acidic property; for example, reaction with sodium hydroxide:

$$Al_2O_3(s) + 2NaOH(aq) \longrightarrow 2NaAlO_2(aq) + H_2O(l)$$

Sodium aluminate

(0.1 mark)

Basic property; for example, reaction with sulphuric acid:

$$Al_2O_3(s) + 3H_2SO_4(aq) \longrightarrow Al_2(SO_4)_3(aq) + 3H_2O(l)$$

Aluminium Sulphate (0.1 mark)

(b) $$Pb_3O_4(s) + 4HNO_3(aq) \longrightarrow 2Pb(NO_3)_2(aq) + PbO_2(s) + 2H_2O(l)$$

$$Fe_3O_4(s) + 8HCl(aq) \longrightarrow FeCl_2(aq) + 2FeCl_3(aq) + 4H_2O(l)$$

(0.1 mark @)

c)- Aluminium carbonate ($Al_2(CO_3)_3$) and iron(III) carbonate ($Fe_2(CO_3)_3$) do not exist. For the case of $Al_2(CO_3)_3$, smaller and more charged cations of Al^{3+} have high charge density but easily distort the electron cloud of the carbonate ions (polarisation). The polarisation weakens the C–O bond in the carbonate ion, hence making it highly exposed to water or water vapour and attached to form hydroxide and carbondioxide gas.

$$Al_2(CO_3)_3(aq) + 3H_2O(l) \longrightarrow 2Al(OH)_3(s) + 3CO_2(g)$$

(02 marks)

- Similarly, iron(III) carbonate does not exist in a solution because, iron(III) bounds to water molecules and exists as $[Fe(H_2O)_6]^{3+}$. Due to a strong interaction between Fe^{3+} ions and aqua ligand, the complex dissociate into negatively charged complex and H^+ ions. Because carbonate is a base, it captures H^+ to form hydroxyl complexes which produces Carbonic acid (H_2CO_3) and iron(III) hydroxide, $Fe(OH)_3$.

(02 marks)

5 (a)(i) Concentration:

For a liquid to be colligative its concentration must be dilute with less or equal to 0.2M. This is so in order to avoid the soluble particle to interact with each other as a result of change in concentration.

(01)

(ii) Electrolyte

-The liquid should be non-electrolyte. This prevent the dissociation into free ions in solution as a result of affecting the number of moles of solute particles, hence affect colligative property.

(01)

5 (a) (iii) Volatility.

The liquid should be non-volatile. This help to prevent much escape (evaporation) of solute particle relatively to change in temperature, hence keeping the number of mole at constancy. 01

(b). FROM:

$$\frac{\Delta P}{P} = \frac{n}{n+N} = \frac{\frac{m_1}{M_1}}{\frac{m_1}{M_1} + \frac{m_2}{M_2}}$$

where $\Delta P = P^{\circ}_{solvent} - P_{solvent}$
$= 760 mmHg - 745 mmHg$
$= 15 mmHg$.
$m_1 = 5g$, $M_1 = 18$
$m_2 = 95g$, $M_2 = ?$

$$\frac{(760-745) mmHg}{760 mmHg} = \frac{5g \times 18 g/mol}{95g \times M_r} \quad 01$$

$$M_r = \frac{760 mmHg \times 5g \times 18 g/mol}{15 mmHg \times 95g.} \quad 01$$

$$M_r = 48 g/mol \quad 01$$

(c) Let us calculate the molar masses of AB_2 and AB_4.

For AB_2, Compound.

$$\Delta T_f = \frac{K_f \times m_B \times 1000}{m_A \times M_{rB}}$$

where $\Delta T_f = 2.3K$
$m_B = 1.0g$.
$m_A = 20.0g$.
$K_f = 5.1 K kg mol^{-1}$

$$M_{rB} = \frac{K_f \times m_B \times 1000}{m_A \times \Delta T_f}$$

$$M_{rB} = \frac{5.1 \times 1.0 \times 1000}{20 \times 2.3}$$

$$M_B = 110.87 g/mol \quad 01$$

07

5 (c) For AB_4 Compound.

$$M_{AB_4} = \frac{K_f \times m_B \times 1000}{m_A \times \Delta T_f}$$ where $\Delta T_f = 1.3K$, $K_f = 5.1$, $m_B = 1.0g$, $m_A = 20g$.

$$= \frac{5.1 \times 1 \times 1000}{20 \times 1.3}$$

$M_{AB_4} = 196.15 g/mol$, 01

Then, let $\underline{a}$ is the atomic mass of A and b for B.

Then:

$M_{AB_2} = a + 2b = 110.87$ --(i)

$M_{AB_4} = a + 4b = 196.15$ --(ii) 01

By subtracting eqn. (ii) from eqn (i).

$-2b = -85.28$

$b = \underline{42.64}$ 01

By also substituting the value of b in eqn(i).

$a + 2 \times 42.64 = 110.87$

$a = 110.87 - 85.28$

$a = 25.59$. 01

Hence:

Atomic mass of A = 25.59

Atomic mass of B = 42.64

08

6 (a).(i) The use of renewable energy must be emphasized as well as increasing investment in Renewable energy production. 01

(ii) Wherever practical, synthetic Methodologies should be designed to use and generate substances that posses little or no toxicity to human health and environment. Also industrial influents should be treated before their disposal to reduce the level of contaminants. 01

(iii) Car exhausts should be installed with catalyst Converters which reduce toxic air by Converting harmful pollutants into less harmful emissions such as water, Carbondioxide and nitrogen. 01

(b). Soil Colloids are tiny suspension particles in medium of soil solution. They are formed during Weathering process where some minerals and organic matter are broken down to extremely small particles. Chemical changes further reduces these particles until they cannot be seen with naked eye. Now these particles suspended in the soil solution known as soil colloid. 02

The significance of soil colloid are

- They are the source of ions for plant nutrition. 01
- They Control soil pH.
- They promote and improves soil structure and fertility 01

(c). Mass of soil = 100g.

volume of water = $200cm^3 = 0.2dm^3$.

Mass of liming material $Ca(OH)_2 = 0.0074g$.

Equation:

$$Ca(OH)_2 + 2H^+ \longrightarrow Ca^{2+} + H_2O$$

Then, mole ratio : 1 : 2

But number of mole of $Ca(OH)_2 = M/Mr = \frac{0.0074}{74} = 1 \times 10^{-4}$ mol

Therefore. 1 mole of $Ca(OH)_2 \equiv$ 2 mole of H^+

1×10^{-4} mole of $Ca(OH)_2 \equiv$? 01

$= 2 \times 10^{-4}$ mole of H^+.

09

6 (c) Hence Concentration of H^+ ion can be Calculate from.

$$[H^+] = \frac{n}{V} = \frac{2\times10^{-4}\,mol}{0.2dm^3}$$ 01

$$[H^+] = 0.001M.$$

Therefore:

$$pH = -\log[H^+]$$
$$pH = -\log[0.001]$$
$$pH = 3$$ 01

---

7 (a). Amount of the energy given to athlete = 1560kg.

Energy lost in the event $= \frac{1560\times50}{100} = 780kg$. 01

Energy stored in the body $= 1560 - 780$

Then $= 780kJ$. 01

For Evaporation of water:

$$H_2O_{(l)} \longrightarrow H_2O_{(g)} \quad \Delta H = 44kJ/mol.$$ 01

For Consumption of 44kJ of energy, water evaporated = 18g.
For Consumption of 780kg of energy, water evaporated = ? 01

$$44kg = 18g.$$
$$780kJ = ?$$
$$= \frac{18g\times780kJ}{44kg.}$$ 01
$$= 319.1g.$$ 01

(b). (i) Weight of Coal = 100g.

Weight of Carbon in Coal $= \frac{100\times80}{100} = 80kg.$

Weight of Carbon converted to $CO_2 = \frac{80\times60}{100} = 48kg.$ 01/2

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7 (b). Weight of Carbon converted to CO $= \frac{80 \times 40}{100} = 32kg$.

Now According to reaction:

$$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} + 394\,kJ.$$

12g of Carbon on Combustion to $CO_2 \equiv 394\,kJ$.

48×10^3 g of Carbon on Combustion to $CO_2 \equiv ?$

$$= \frac{48 \times 10^3 g \times 394\,kJ}{12.}$$

$$= 1576 \times 10^3\,kJ \quad 0|$$

Similarly:

$$C_{(s)} + \tfrac{1}{2} O_{2(g)} \rightarrow CO + 111\,kJ.$$

12g of Carbon $\equiv 111\,kJ$.

32×10^3 g Carbon $\equiv ?$

$$= \frac{32 \times 10^3 g \times 111\,kJ}{12g.}$$

$$= 296 \times 10^3\,kJ. \quad 0|$$

Then:

Total heat evolved $= (1576 \times 10^3 + 296 \times 10^3)\,kJ.$

$$= 1872 \times 10^3\,kJ \quad 0|$$

(ii) When more efficient oven is used, only CO_2 will be formed from 80kg of Carbon.

Hence 12g of Carbon $\equiv 394\,kJ$.

80×10^3 g Carbon $= ?$

$$= \frac{80 \times 10^3 \times 394}{12g}$$

$$= 2626.7 \times 10^3\,kJ. \quad 0|$$

(iii) Percentage loss in heating value of inefficient oven may be calculated as

Percentage loss $= \frac{(2626.7 \times 10^3 - 1872 \times 10^3)}{2626.7 \times 10^3} \times 100 = 28.7\%$. 0|

8 (a) (i) Le Chatelier's principle.

States that:

When an external disturbance is applied to a system at equilibrium, the system shift in the opposite direction to offset the change. 01 Marks

(ii) - It is applied only when the concentrations of reactants and products have attained their equilibrium state.

- The value of equilibrium constant is independence of the original concentration of reactants.
- The equilibrium constant has a definite value for every reaction at a particular temperature, however it varies with temperature.
- For a reversible reaction, the equilibrium constant for the forward reaction is inverse of the equilibrium constant for the backward reaction.

any 4, $00\frac{1}{2}$ @ 02 Marks

(b). Let the total mass of the mixture at 1127K be 100g.

Then: For CO = 90.55 g and CO_2 = 100 - 90.55 = 9.45g.

Mole fraction for CO $= \frac{n_{CO}}{n_{CO} + n_{CO_2}} = \frac{\frac{90.55}{28}}{\frac{90.55}{28} + \frac{9.45}{44}} = 0.938$ 01 Mark

Mole fraction for CO_2 $= \frac{n_{CO_2}}{n_{CO} + n_{CO_2}} = \frac{\frac{9.45}{44}}{\frac{90.55}{28} + \frac{9.45}{44}} = 0.062$. 01 Mark

Chemical reaction:

$$C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$$ $00\frac{1}{2}$ Marks

$$K_P = \frac{(P_{CO})^2}{(P_{CO_2})} = \frac{(0.938)^2}{(0.062)}$$ 01 Mark

$$K_P = 14.19.$$

Then: $\Delta n_g = 2 - 1 = 1$

Hence, $K_P = K_C RT^{\Delta n_g}$

(b) $K_c = \frac{K_p}{RT^{\Delta n}} = \frac{14.19}{0.0821 \times 1127}$ (1 0/2 marks)

$K_c = 0.153$ (1 mark)

(c) (i) $ice_{(s)} \longrightarrow water_{(l)}$

The melting of ice is favoured at high pressure since there is decrease in volume in the forward reaction, since at high altitude, the atmospheric pressure is low, ice melts slowly.

(0/1 mark)

(ii) Equilibrium cannot be achieved btn water and its vapour in an ~~open~~ vessel, this is due to water vapour diffuse into air and their concentration above water surface is negligible. This ~~is~~ result into reverse process of condensation of vapour into liquid water is almost negligible, and therefore, evaporation continues till the whole water diffuse into air as water vapour

(0/1/2 marks)

(iii) For the concentration of pure liquid or solid

$$[\text{solid}] \text{ or } [\text{Liquid}] = \frac{\text{Number of moles}}{\text{Volume in L}} = \frac{\text{Mass}/\text{Molar mass}}{\text{Volume}}$$

$$= \frac{\text{Mass}}{\text{Volume}} \times \frac{1}{\text{Molar mass}} = \frac{\text{Density}}{\text{Molar mass}}$$

(0/1/2 marks)

(iii)

(c) Since the density of pure solid and liquid is constant at constant temperature and molar mass is also constant. Therefore their molar concentrations are also constant and not included in the equilibrium constant expression

(d)

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$, $K_c = 0.061$

Then

$$Q_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$ (01 mark)

$$Q_c = \frac{(0.50)^2}{(3)(2)^3}$$ (01 mark)

$$Q_c = 0.0104$$

Since $Q_c \neq K_c$ the reaction is not at equilibrium and as $Q_c < K_c$, the reaction will proceed forward to form product. (01 mark)

9 (a) (i) Markovnikov's rule states that "When hydrogen halide (HBr) is added to the unsymmetrical alkene or alkyne, the hydrogen (Electrophile) is added to the carbon carrying large number of hydrogen" ie the rich get richer. 01

(ii) $CH_3CH=CH_2 + HBr \xrightarrow{CCl_4} CH_3\underset{Br}{C}HCH_3 + CH_3CH_2CH_2Br$ 01

Mechanism:

- Formation of Electrophile

$HBr \longrightarrow H^+ + Br^-$

- Attack of Electrophile to double bond

$CH_3CH=CH_2 + H^+ \longrightarrow CH_3\overset{\oplus}{C}HCH_3$ 01

- Termination of reaction, where the negative part attack the carbocation

$CH_3\overset{+}{C}HCH_3 + Br^- \longrightarrow CH_3\underset{Br}{C}HCH_3$ 2-Bromopropane 01

Major product

(b) (i) This is because Carbon is slightly more electronegative than hydrogen. Thus carbon atom in alkyl group has higher electron density around it as compared with a hydrogen atom. As result alkyl groups are able to donate electrons inductively when attached to a π-system (01)

9 (b) (ii) Halogens are o-p-directors despite being deactivators through -I effect, This is because halogens are also electron releasing groups by resonance due to presence of lone pairs (through mesomerism).

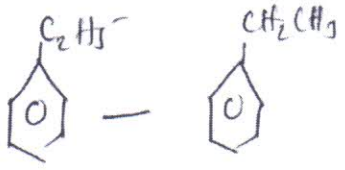
01

c(i) C_8H_{10} appears to be unsaturated hydrocarbon, but since it does not decolourise bromine water, hence it should be an arene.

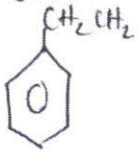
- The hydrocarbon A when treated with acyl halide form B and when treated with $K_2Cr_2O_7$ give benzoic acid, so it should contain benzene ring with side chain

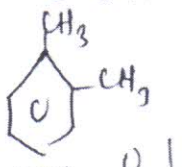
9 (c) – The hydrocarbon A gives three more isomers, so the side chain must contain more than one carbon.
With these facts, the possible side chain in hydrocarbon (A) is

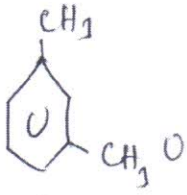
$C_8H_{10} - C_6H_5^- = C_2H_5^-$
Phenyl group (benzene ring) ethyl group

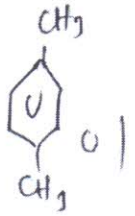
Thus formula of A is 

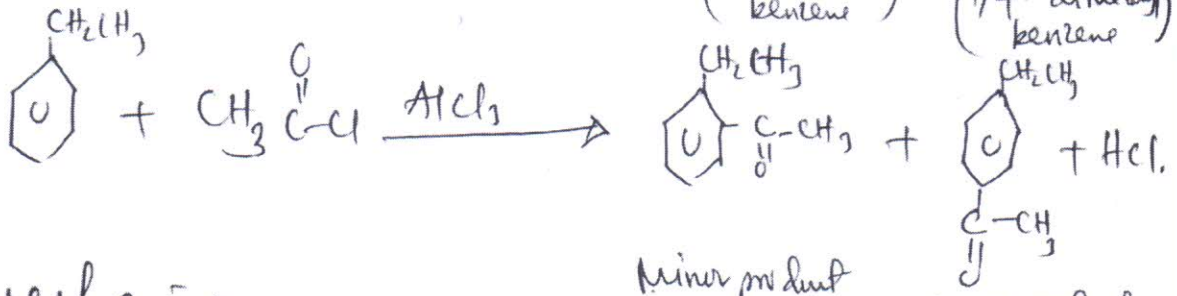
Then
The possible isomers are


(A)
Ethyl benzene


(C)
O-methyl toluene (1,2-dimethyl benzene)

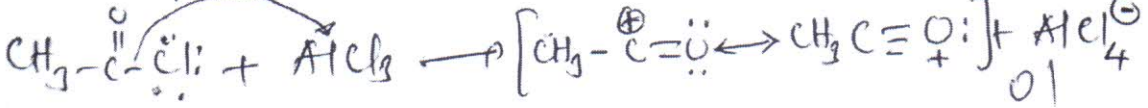

D
m-methyl toluene (1,3-dimethyl benzene)


F
p-methyl toluene (1,4-dimethyl benzene)

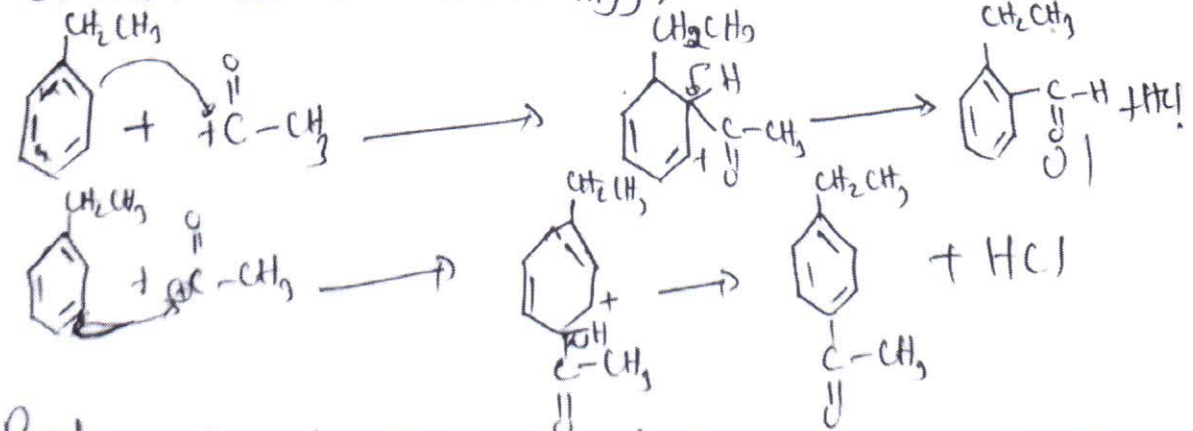
(ii) 
Minor product
Major product

Mechanism

- Generation of Carbocation (electrophile)



- Carbocation attack benzene ring.



(d). 1-Butyne can be distinguished from 2-Butyne by silver mirror test, when, 1-butyne give positive test due to presence of terminal hydrogen while 2-butyne does not.

09. (d)(i) $CH_3CH_2C\equiv CH + 2[Ag(NH_3)_2]^+OH^- \longrightarrow AgC\equiv CAg + 2H_2O + 4NH_3$ white ppt ½

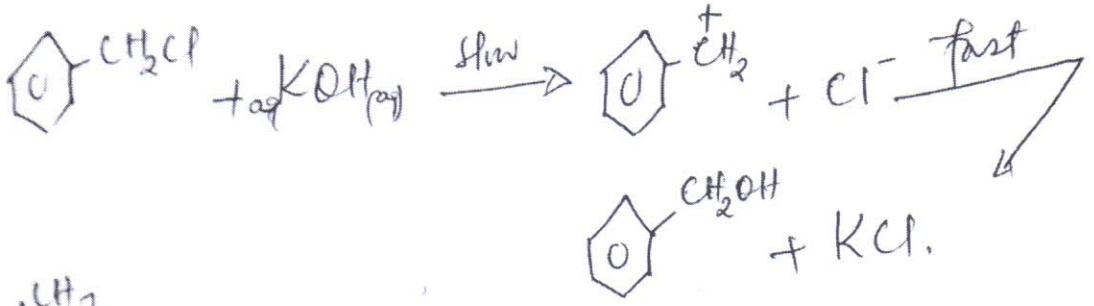
or using Tollen's reagent.

$CH_3CH_2C\equiv CH + 2[Cu(NH_3)_2]^+OH^- \longrightarrow Cu-C\equiv C-Cu + 2H_2O + 4NH_3$ Red ppt.

but

$CH_3C\equiv CCH_3 + 2[Ag(NH_3)_2]^+OH^- \rightarrow$ NO reaction.

(ii) 1-chloro methyl benzene gives positive test to aqueous ~~alk~~ alkali via S_N1 mechanism but 4-chloromethyl benzene does not. ½



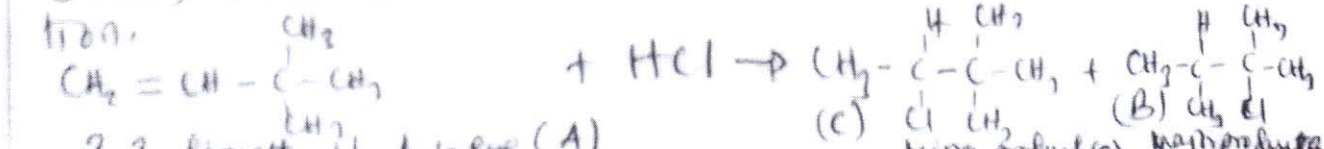
$\xrightarrow{KOH_{(aq)}}$ NO reaction.

10 (a).(i) The molecule should contain a cyclic cloud of delocalised π-electrons above and below the plane of the molecule. 0|

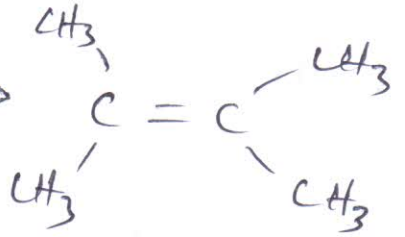
(ii) The ring must be planar (planarity). For dedocation of π-electrons, the ring must be planar to allow cyclic to overlap its p-orbitals. 0|

(iii) $(4n+2)\pi$ electrons Huckel rule. For aromaticity, the π-electrons cloud must contains a total of $(4n+2)\pi$-electrons 0|

(b) The compound (A C_6H_{12}) is an alkene. The addition of HCl gives two isomeric alkyl halide B and C (based on Markovnikov's rule) due to 1,2-methyl shift became a tertiary carbocation is more stable than a secondary carbocation.

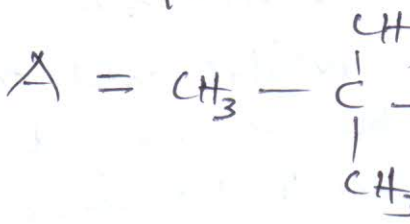


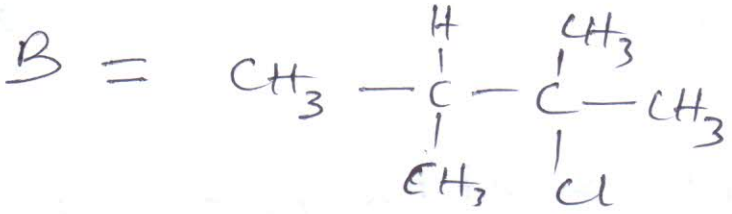
16

10 (b) B $\xrightarrow{\text{alc KOH}}$  (D)

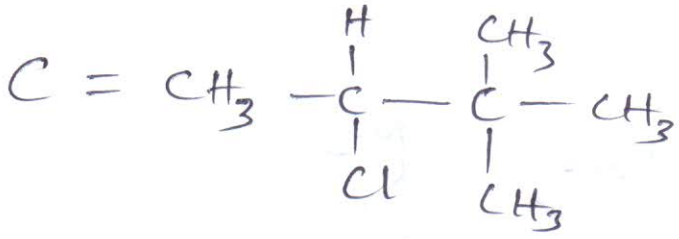
2, 3 – Dimethylbut-2-ene

Therefore:

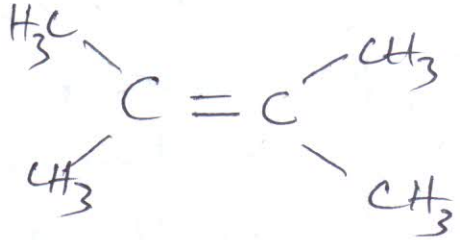
A =  (3,3-dimethylbut-1-ene) (01)

B = 

2-chloro-2,3-dimethylbutane

C =  (01)

2-chloro-2,2-dimethylbutane (01)

D = 

2, 3-dimethylbut-2-ene (01)

(c)(i) Nucleophile are electrons rich chemical species, therefore under normal condition cannot combine together but when the reaction is carried under acidic medium the two nucleophile combines since the acid will initiate the reactions by providing (01½) (1½)

10 c(i) protons (H^+).

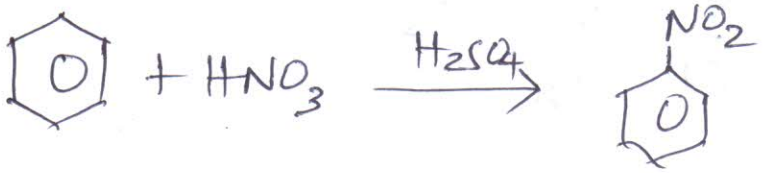
(ii) A free radical do combine among themselves but they can never combine with an electrophile since a free radical has one ~~free~~ electron that uses it on combining with themselves, therefore when combines with an $E^{\oplus}$ an orbital will only one electron which is not possible according to bonding theory or according to Pauli's Exclusion Principle.

(01½ mark)

(d) (i) Benzene prefers substitution reaction than addition reaction Due to stability of benzene ring which is stabilized by delocalization of π-electrons

(01)

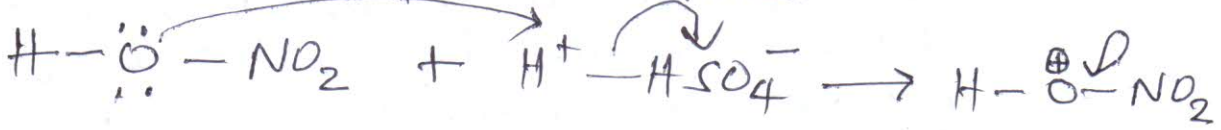
(ii)



The effect of NO_2 is reativity of benzene is that, NO_2 is deactivator, hence it tend to withdraw electrons from benzene ring as a result of lowering electron density in Benzene, hence lowers its reactivity

(01)

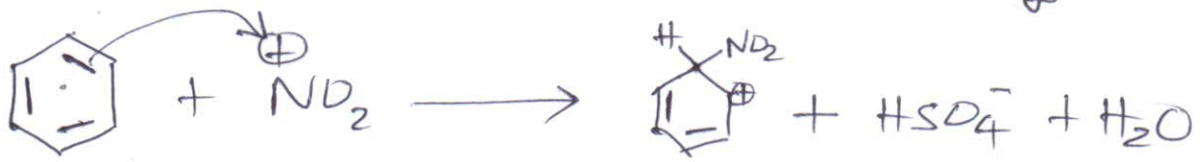
(iii) -Formation of Electrophile



01

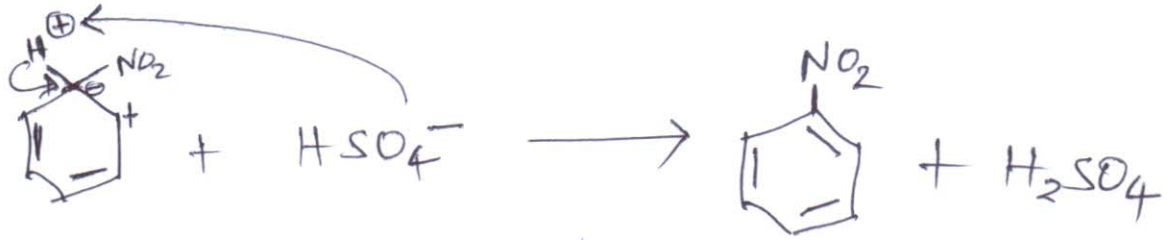
10 (d) $NO_2^+ + H_2O$

- Attack of Electrophile to benzene ring



01

- Protonation of hydrogen from benzene Carbocation



Nitrobenzene 01