Solution

PREBOARD EXAM- 2 2025-26

Class 12 - Chemistry

Section A

1.

(d) $(CH_3)_3C—I$

Explanation:

S_N1 reactions are generally carried out mainly in polar protic solvents (like H_2O) and they follow first-order kinetics. This means that the rate of reaction depends only on one reactant. This reaction favours tertiary alkyl halides because of the high stability of the formed carbocation. The carbocation forms when the molecule is polarized in water to form a carbocation and halide ion attacked by the nucleophile. The reactivity of the halides are R–I> R–Br>R–Cl>>R–F. Hence, $(CH_3)_3C—I$ will undergo the reaction most readily.

2.

(c) secondary structure

Explanation:

Alpha helices and beta sheets are the two most known secondary structures of protein, As the protein folds into a three-dimensional structure, the secondary structure forms an intermediate.

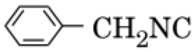
3. **(a)** CH_3COOH

Explanation:

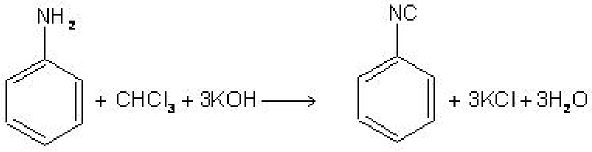
The product formed as a result of reaction of CH3MgBr and CO2 followed by hydrolysis is CH_3COOH.

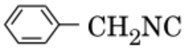
4.

(b)



Explanation:



 gives foul smell.

5. **(a)** $\frac{2\,d[P]}{dt} = \frac{-d[Y]}{dt}$

Explanation:

$$\frac{2\,d[P]}{dt} = \frac{-d[Y]}{dt}$$

6.

(d) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

Explanation:

(a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

7. **(a)** 1-Bromo-2-methylbutane

Explanation:

First, we need to identify the longest carbon chain. Once we do that, the actual structure should read $CH_3—CH_2—CH(CH_3)—CH_2—Br$. –Br, the functional halide group is attached to the first carbon atom (1- Bromo), so we start the numbering from that position. The methyl group branch is bond to the second carbon atom in the chain(2-methyl). The number of carbons in the unbranched parent chain is four, thus giving the name butane. The IUPAC is named 1-Bromo-2-methylbutane.

8.

(d) nitrogenous base, pentose sugar and phosphoric acid

Explanation:

nitrogenous base, pentose sugar and phosphoric acid

9. **(a)** s^{-1}

Explanation:

unit of rate constant for nth order reaction (k) = $(mol\ L^{-1})^{1-n}\ s^{-1}$

put, n=1 ;

unit of rate constant for 1st order reaction(k) = s^{-1}

10.

(d) Iodoform test

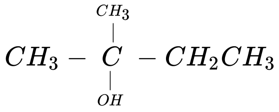
Explanation:

Iodoform test

11.

(b) 2-Methylbutan-2-ol

Explanation:



The correct IUPAC name of $CH_3 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2CH_3$ is 2-Methylbutan-2-ol

12.

(d) Dimethylamine

Explanation:

NH_3 < primary amine < tertiary amine < secondary amine

This is because:

i. Steric hindrance
   The size of an alkyl group is more than that of a hydrogen atom. So, an alkyl group would hinder the attack of a hydrogen atom, thus decreasing the basicity of the molecule. So, the more the number of alkyl groups attached, lesser will be its basicity.

ii. Solvation of ions
   When amines are dissolved in water, they form protonated amines. Also, the number of possibilities for hydrogen bonding also increases. More the number of hydrogen bonding more is the hydration that is released in the process of the formation of hydrogen bonds.

13.

(c) A is true but R is false.

Explanation:

A is true but R is false.

14. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

The high degree of polarity in HX as well as in carbonyl bond shows the easy addition of HX on carbonyl bond but as soon as the addition products are formed, the products loses HX to show the backward reaction.

15.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Both A and R are true but R is not the correct explanation of A.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Section B

17. The half reaction occurring during deposition is:

$Mg^{2+} + 2e^{-}$ ----------> Mg(s)

So to produce 1 mole of Mg we need 2 moles of electrons,

1 mol of Mg = 24 g

Thus 1.2 g of Mg = ($\frac{1.2}{24}$) = 0.05 moles

Hence no. of moles of electrons required to deposit = 0.05 x 2 = 0.1 moles

Qty. of electricity passed (Q) = moles of electrons passed x 96500

= 0.1 x 96500 = 9650 C

I = $\frac{Q}{t}$

I = $\frac{9650}{60\times 60}$ (converting 1 hr into seconds)

I = **2.68 A**.

OR

$\wedge = \wedge^\circ \ (at\ C \to 0)$

$\wedge$ = Molar conductivity at a given concentration

$\wedge^\circ$ = Limiting molar conductivity or molar conductivity at infinite dilution

Then, degree of dissociation

$\alpha = \frac{\wedge}{\wedge^\circ}$

18. The solutions that show large negative deviation from Raoult's law form maximum boiling azeotrope at a specific composition because they have a composition having maximum boiling point. For example: Nitric acid and water - 68% nitric acid and 32% water by mass with a boiling point of 393.5 K.

19. The compounds (A), (B), (C) and (D) are given as under:

A = MnO_2, B = K_2, MnO_4, C = $KMnO_4$, D = KIO_3

The reactions are explained as under:

$$\underset{(A)}{2MnO_2} + 4KOH + O_2 \rightarrow \underset{(B)}{2K_2MnO_4} + 2H_2O$$

$$3MnO_4^{2-} + 4H^+ \rightarrow \underset{(C)}{2MnO_4^-} + MnO_2 + 2H_2O$$

$$2MnO_4^- + H_2O + KI \rightarrow \underset{(A)}{2MnO_2} + 2OH^- + \underset{(D)}{KIO_3}$$

20. Answer the following:
    (i) k increases.

    Reason: k is proportional to the rate of the reaction/temperature of the reaction.

    E_a unchanged/No effect.

    Reason: E_a only depends on the nature of reactants/depends on the difference between the energy of activated complex and reactants.

    (ii) For a reaction R $\rightarrow$ P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. Thus, it follows first order reaction.

21. i. $CH_2 = CH - CH_2OH \xrightarrow[CH_2Cl_2]{PCC} CH_2 = CH - CHO$

    Here, PCC is Pyridinium chlorochromate, a 1 : 2 complex of chromium trioxide pyridine ($CrO_3 \cdot 2C_5H_5N$) which only oxidises OH group and not the = bond.

    ii. $CH_3 - COOH \xrightarrow[-H_2O]{NH_3/heat} CH_3 - CONH_2$

Section C

22. a. We have

$E^\ominus_{(Cu^{2+}/Cu)} = 0.34V$ and $E^\ominus_{(Ag^+/Ag)} = 0.80V$

Standard emf of Cu is less than Ag, therefore it is strong reducing agent and is oxidised. Therefore Cu acts as Anode and Ag acts as Cathode.

Half cell reactions are:

At Cathode (Reduction):

$2Ag^+(aq) + 2e^- \rightarrow 2Ag(s)$

At Anode (Oxidation):

$Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$

b. The reactions are :

At Anode:

$Sn(s) \rightarrow Sn^{2+}(aq) + 2e^-$

At Cathode:

$2H^+(aq) + 2e^- \rightarrow H_2(g)$

Full cell reaction:

$Sn(s) + 2H^+(aq) \rightarrow Sn^{2+}(aq) + H_2(g)$

Standard emf of the cell is:

$E^0_{cell} = E^0_{H^+/H_2} - E^0_{Sn^{2+}/Sn}$

= 0 - (-0.14)V

= + 0.14V

For this reaction n=2 moles of electrons. Using Nernst equation,

$E_{cell} = 0.14 - \frac{0.0591}{2}\log\frac{[Sn^2+]}{[H^+]^2}$

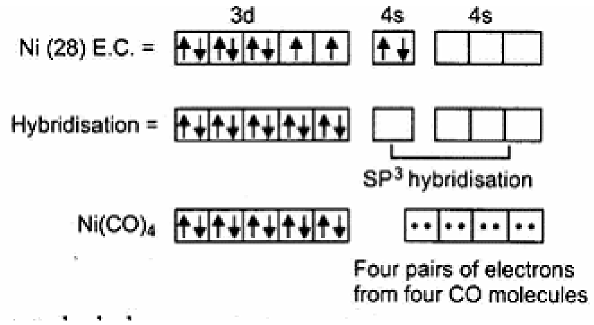
$= 0.14 - \frac{0.0591}{2}\log\frac{0.04}{(0.02)^2}$

$= 0.14 - \frac{0.0591}{2}\log\frac{4}{100} \times \frac{100}{2} \times \frac{100}{2}$

= 0.14 V - 0.0591 V

= 0.0809 V

23. a. Oxidation of Ni in Ni(CO)$_4$ is zero.



Shape - tetrahedral

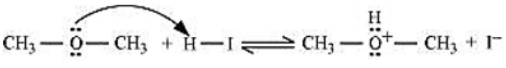
Hybridization - sp^3

No unpaired electron - diamagnetic

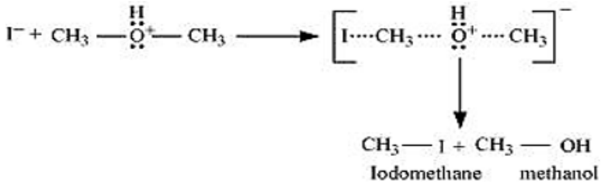
b. The platinum complex cis-platin [pt(NH$_3$)cl$_2$]

24. The mechanism of the reaction of HI with methoxymethane involves the following steps:

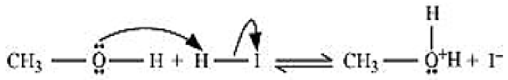
Step1: Protonation of methoxymethane:



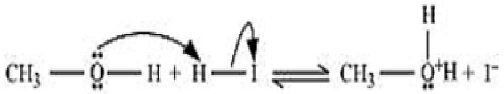
Step2: Nucleophilic attack of I$^-$:



Step3: When HI is in excess and the reaction is carried out at a high temperature, the methanol formed in the second step reacts with another HI molecule and gets converted to methyl iodide

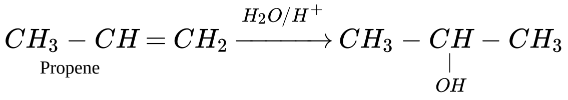


$I^- + CH_3-\overset{+}{O}H_2 \longrightarrow CH_3-I + H_2O$



$I^- + CH_3 - OH_2 \longrightarrow CH_3 - I + H_2O$

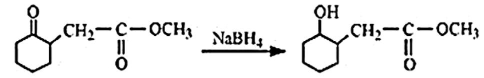
OR

i. 

$CH_3-CH=CH_2 \xrightarrow{H_2O/H^+} CH_3-\underset{\substack{| \\ OH}}{CH}-CH_3$

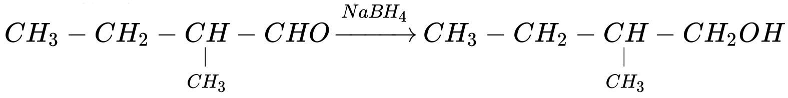
Propene

Propane - 2 - ol

ii. 

Methyl (2 – oxocyclohexyl) ethanoate

Methyl (2 – hydroxycyclohexyl) ethanoate

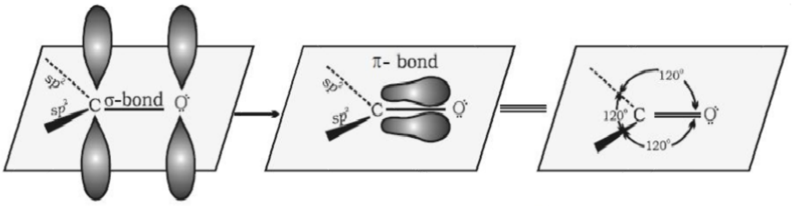
iii. 

$CH_3-CH_2-\underset{\substack{| \\ CH_3}}{CH}-CHO \xrightarrow{NaBH_4} CH_3-CH_2-\underset{\substack{| \\ CH_3}}{CH}-CH_2OH$

2 - Methylbutanal

2 - Methylbutan - l - ol

25. **Orbital diagram for the formation of carbonyl group:**

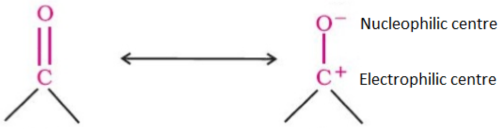


Orbital diagram for the formation of carbonyl group

i. **and**

ii. The carbonyl carbon atom is sp^2-hybridised and forms three sigma bonds. The fourth valence electron of carbon remains in its p-orbital and forms a pi-bond with oxygen by overlap with p-orbital of an oxygen. In addition, the oxygen atom also has two non bonding electron pairs. Thus the carbonyl carbon and the three atoms attached to it lie in the same plane and the pi-electron cloud is above and below this plane.

iii. The carbon-oxygen double bond is polarised due to higher electronegativity of oxygen relative to carbon. Hence, the carbonyl carbon is an electrophilic (Lewis acid) centre and carbonyl oxygen, a nucleophilic (Lewis base) centre.



26. We have,

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$

At Cathode (Reduction):

$2Ag^+(aq) + 2e^- \rightarrow 2Ag(s)$

At Anode (Oxidation):

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

The cell will be represented as:

$Zn(s)|Zn^{2+}(aq)||Ag^+(aq)|Ag(s)$

i. From half cell reaction, Zinc acts as Anode, i.e. zinc electrode will be negatively charged.

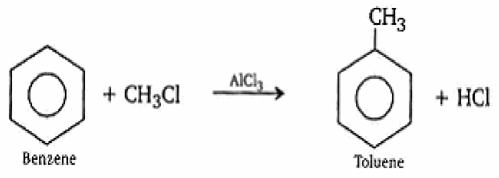
ii. The current will flow from silver to zinc in the external circuit and inside the solution, ions are responsible as shown in the half cell reaction. Zn^{2+} is formed in the anode container and goes to the solution and in the cathode container, Ag$^+$ goes from solution to the silver metal(cathode) and gets deposited. To maintain the concentration of ions in both the containers, salt bridge is used which contain an electrolyte i.e. KCl.

iii. At anode : $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

At cathode: $Ag^+(aq) + e \rightarrow Ag(s)$

27. i. Anti-markownikoff reaction: $\underset{\text{Propene}}{CH_3CH = CH_2} + HBr \xrightarrow{Peroxide} \underset{1-Bromoprepane}{CH_3CH_2CH_2Br}$

ii. Friedel-craft alkylation:



28. Let the concentration of the reactant be [A] = a

Rate of reaction,$R = k[A]^2 = ka^2$

a. If the concentration of the reactant is doubled, i.e. [A] = 2a, then the rate of the reaction would be

$R' = k(2a)^2 = 4ka^2$

= 4R

Therefore, the rate of the reaction would increase by 4 times.

b. If the concentration of the reactant is reduced to half, i.e.,$[A] = \frac{1}{2}a$ then the rate of the reaction would be $R' = k\left(\frac{1}{2}a\right)^2$

$= \frac{1}{4}ka^2 = \frac{1}{4}R$

Therefore, the rate of the reaction would be reduced to $\frac{1}{4}th$.

Section D

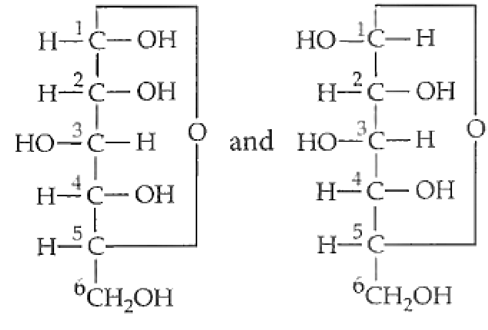
29. i. Ordinary glucose is α-glucose, with a fresh aqueous solution having specific rotation, $[\alpha]_D$ = +111°. On keeping the solution for some time, α-glucose slowly changes into an equilibrium mixture of α-glucose (36%) and β-glucose (64%) and the mixture has specific rotation + 52.5°.

ii. This structure is an example of pyranose and aldohexose. Here, the structure of the carbohydrate is of the β-pyranose form.

iii. C-1 is the anomeric carbon.

OR

α-D-(+)-glucose and β-D-(+)-glucose differ in configuration at C_1 (i.e., anomeric or glycosidic carbon) and hence are called anomers.



α-D(+)-glucose β-D(+)-glucose

30. i. CO is a stronger complexing ligand than NH_3 because it contains both σ and π character and can form a back bond (M → CO) also. Therefore, CO forms a stronger bond with the metal. It is also called a strong field ligand.

ii. The molecular shape of $[Ni(CO)_4]$ is tetrahedral because this complex nickel involves sp^3 hybridisation. In $[Ni(CN)_4]^{2-}$, nickel involves dsp^2 and its shape is square planer.

iii. [Ni(CO)] involves sp^3 hybridization of nickel and the complex is tetrahedral. Magnetic behaviour: Diamagnetic.

OR

+3

Section E

31. Attempt any five of the following:

(i) $\mathrm{Cr_2O_7^2/CrO_4^2/K_2Cr_2O_7/K_2CrO_4}$

(ii) i. Mn

ii. Mischmetal

(iii)Due to lanthanide contraction (filling of 4f before 5d orbital) , the atomic radii of the second and third row transition elements are almost same. Therefore, they resemble each other much more as compared to first row elements.

(iv)Zinc does not show variable oxidation state because it has completely filled d-orbital.

(v) Fe

(vi) i. Due to comparable radii/comparable size.

ii. In Mn_2O_3, Mn is in +3 (lower) oxidation state while in Mn_2O_7, Mn is in higher oxidation state (+7)

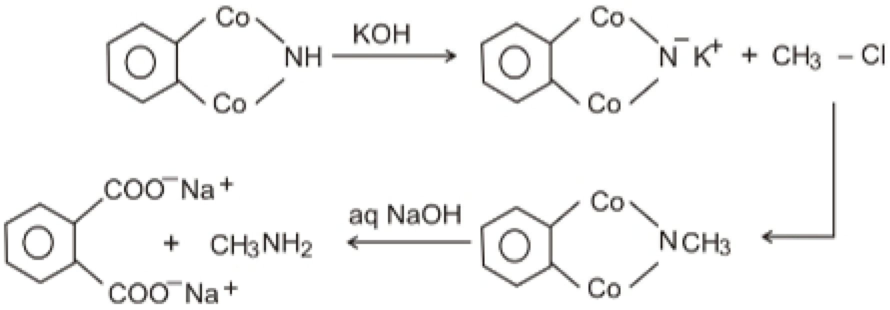
(vii)The overall decrease in atomic and ionic radii from lanthanum to lutetium is a unique feature in the chemistry of the lanthanoids. The cumulative effect of the contraction of size of lanthanide elements is known as lanthanoid contraction. It causes the radii of the members of the third transition series to be very similar to those of the corresponding members of the second series. For example radii of Zr (160 pm) and Hf (159 pm) are almost identical.

32. a. i. Hoffmann bromamide reaction:

$Ar/R\text{-}CONH_2 + Br_2 + 4NaOH \rightarrow Ar/RNH_2 + 2NaBr + Na_2CO_3 + 2H_2O$

ii. $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{273-278K} C_6H_5N_2^+Cl^- + NaCl + 2H_2O$

iii. Gabriel phthalimide synthesis:

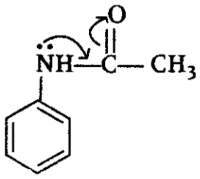


b. i. Because of the combined factors of inductive effect and solvation or hydration effect.

ii. Due to resonance stabilisation or structural representation /resonating structures.

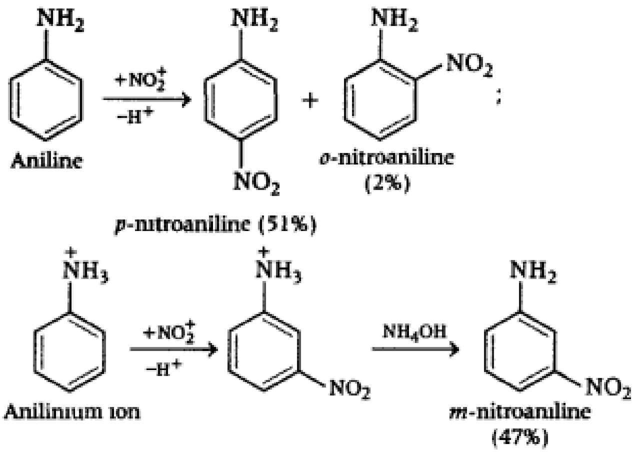
OR

a. i. Due to the electron-withdrawing effect of the acetyl group, the lone pair of electrons on N-atom is attracted by the acetyl group. As a result, the lone pair of electrons on N-atom is not exclusively available for donation to the benzene ring and hence, activating the effect of the - NH_2 group is reduced.

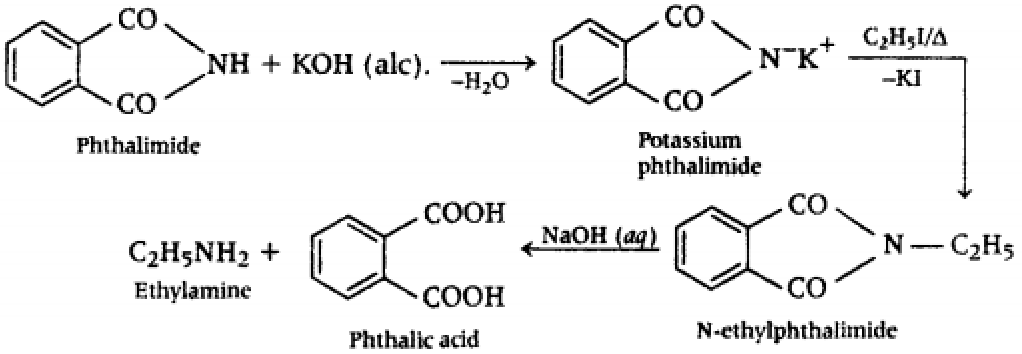


ii. In aromatic amines, the lone pair of electrons present on nitrogen takes part in resonance and hence, not available for donation. Alsoaniline is more stable than anilinium ion. Hence aniline has a very little tendency to accept a proton to form anilinium ion. However, in aliphatic amines, the lone pair is easily available for donation. That's why aliphatic amines are more basic than aromatic amines.

iii. Nitration is usually carried out with a mixture of conc. HNO_3 and cone. H_2SO_4. So in the presence of these acids, aniline gets protonated to form anilinium ion. Therefore, the reaction mixture consists of aniline + and anilinium ion. -NH_2 group in aniline is o,p-directing and activating, whereas the $\overset{+}{NH_3}$group in anilinium ism-directing and deactivating. Now, nitration of aniline mainly gives p-nitroaniline due to steric hindrance at a-position and the nitration of anilinium ion gives m-nitroaniline.



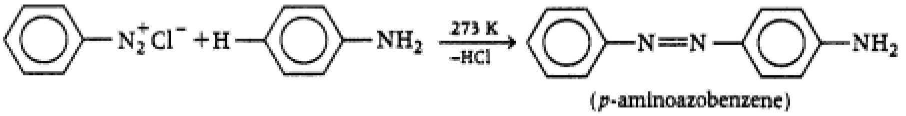
b. i. Gabriel phthalimide reaction Phthalimide on treatment with ethanolic KOHgives potassium phthalimide which on heating with a suitable alkyl halide gives N-substituted phthalimide, which upon subsequent hydrolysis with alkali gives primary amines.



This reaction is called Gabriel phthalimide reaction.

ii. Coupling reaction Arenediazonium salts react with highly reactive (i.e. electron-rich) aromatic compounds such as aniline, phenols to form brightly coloured azo compounds, Ar-N = N-Ar. This reaction is called a coupling reaction. e.g. Benzene diazonium chloride reacts with aniline in faintly acidic medium (pH 4- 5) at 273·278K, in which the molecule at its para-position is coupled with the diazonium salt to form p-aminoazobenzene.

This is an example of a coupling reaction.



33. $P_A{}^0 = 854\,mm,\ P_A = 848.9\,m,\ W_B = 2.0\,g$

$W_A = 100\ g,\ M_B = ?$

$M_A = 12 + 2\,(32) = 76 g/mol\ /CS^2)$

$\frac{P_A{}^0 - P_A}{P_A{}^0} = \mathrm{X_B} = \frac{W_B}{M_B} / \frac{W_A}{M_A}$

$M_B = W_B \times \frac{W_A}{M_A} \times \frac{P_A{}^0}{P_A - P_A}$

$= 2 \times \frac{100}{76} \times \frac{854}{854 - 848.9}$

= 254.5 g/mol.

Let the formula = S_x

$X \times 32\ = 254.5 g/mol$

$X = \frac{254.5}{32}$

= 7.95 = 8.

Formula = S_8

OR

i. $\mathrm{P_T} = \mathrm{p_A}{}^0 x_A + \mathrm{p_B}{}^0 x_B$

$\mathrm{P_T}$ = 75 × 0.4 + 25 × 0.6

$\mathrm{P_T}$ = 30 + 15 = 45 mm Hg

In Vapour phase

$\mathrm{p_B}$ = $y_{B\times} P_T$

$\mathrm{y_B}$ = $p_B / P_T = \frac{p_B^o x_B}{P_T}$

$\mathrm{y_B}$ = $\frac{15}{45} = \frac{1}{3}$ = 0.33 mm Hg

ii. The property which depends upon the number of solute particles but not on the nature of solute; Osmotic pressure.

iii. Because sodium chloride undergoes dissociation (i=2) in water while glucose does not./ π = i C R T; For NaCl, i = 2 and for glucose i = 1.