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Page

Set-A

1. Number of moles of solute dissolved in 1000gm of water is
(a) Molality (b) Molarity (c) Mole fraction (d) w% (W/V)

2. Enthalpy of a compound is equal to its
a) Heat of combustion (b) Heat of formation
c) Heat of solution d) Heat of dilution

3. The atomic number is changed by which type of radioactive decay?
(a) β b) α c) γ d) All of the above

4. Which of the following compound is known as Schweitzer's reagent?
a) $CuSO_4.5H_2O$ (b) $CaSO_4$
c) $[Cu(NH_3)_4]SO_4$ (d) Anhydrous Copper

5. Which of the following is not true regarding crystal field theory?
a) Action bet^n metal & ligands is electrostatic
b) Ligand are treated as point charge
c) There is no orbital interaction bet^n ligand & metal.
d) Hybridization explain the shape of the complexes.

6. Ether is always purified before distillation because,
a) It is highly poisonous is nature.
b) It forms poisonous phosgene gas
c) It is converted into explosive peroxide
d) All of above.

7. Which of the following is an organometallic compound?
a) CH_3ONa (b) CH_3SNa (c) CH_3MgCl (d) All of above

8. Solubility of a salt M_2X_3 is "x" moleL^{-1}. The solubility product of the salt will be
a) x^5 (b) $16x^2$ (c) $96x^5$ (d) $108x^5$

9. Alcoholysis of acid anhydride gives
a) carboxylic acid & ester (b) Ester & alcohol
(c) carbonylic acid & alcohol (d) only ester

10. An organic compound 'A' reacts with nitrous acid to form N-Methyl-N-nitroso ethanamine. It can be obtained by the reduction of
(a) Propanenitrile (b) Methylisocyanate
(c) Ethylisocyanide (d) Propylisocyanide.

11. Given, $E^\circ_{Cr/Cr^{+3}} = 0.74V$, $E^\circ_{Fe^{+2}/Fe} = -0.42V$. The standard cell potential for the cell $Cr/Cr^{+3}(0.1M)//Fe^{+2}(0.01M)/Fe$ is,
(a) 1.14 V (b) 0.492 V
(c) 0.329 V (d) -0.26 V

b) could we use sodium hydroxide to separate zinc and silver from each other? If yes how? (1)

=>

c) What happens when, zinc is exposed to moist air for long time? (1)

=> The action of air on zinc metal forms a very thin coating of zinc oxide all over it so it becomes dull.

2a) Define polymerization.

=> Polyme The process of formation of polymers from monomers is known as polymerization.

b) Write the reaction involved in the preparation of polyster. (2)

=>

$$n\,CH_2=CHCN \xrightarrow[\text{Peroxide}]{\text{Polymerization}} \left[CH_2-\underset{CN}{\underset{|}{CH}}\right]_n$$

Acrylonitrile (monomer) → (Polyacrylonitrile)

c) What is an ideal requirement for a dye? (1)

=> It must have suitable attractive colour(ic.) it should absorb light in the visible region.

d) Azobenzene is a colored compound but not a dye. Explain. (1)

=> because it unable to fix itself to a fibre.

3 Transition elements are defined as elements that have partially filled d-orbitals.

a) What is d-orbital degeneracy? (1)

=> Degenerate orbitals are the orbitals of the same subshell having equal energies. When the electrons of the orbitals are not influenced by any external factors like an eletric field or magnetic field, they have same energies.

b) Give a possible reason for a fact that transition metal have high heat of atomization. (1)

=> Transition elements have high effective nuclear charge and a large number of valence electrons. Therefore, they form very strong metallic bonds which results in high enthalpies of atomization.

c) A transition metal forms alloy with other transition metal easily, Explain (1).

=> Transition metals have very similar atomic sizes. One metal can easily replace the other metal from its lattice to form solid solution (alloy). Transition metals are miscible with one another in the molten state. The molten state solution of two or more transition metals on cooling forms alloy.

d) $K_4[Fe(CN)_6]$, potassium hexacyanoferrate(II) is a complex salt formed by iron. Write the complex ion present in it. (1)

=> oxidation no of K is +1, CN = -1, Fe = +2
oxidation no. of the $4K = +1 \times 4 = +4$, oxidation no. of the $6CN = -1 \times 6 = -6$, Oxidation no of the Fe = +2
So, the charge of the complex ion of pottasium ferr

e) Why $[Ti^{\circ}(H_2O)_6]^{3+}$ is violet in color in $[Ti(H_2O)_6]Cl_3$ but when water molecules are removed it becomes colorless? (1)

=>

When light corresponding to the energy of the yellow-green region is absorbed by the complex, this would excite the electron from t_{2g} level to the e_g level ($t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$). Thus the complex is violet in color.

4 The sum of the powers of concentration terms in the rate law equation is called the order of reaction.

a) write the three possible rate laws for the given second order reaction.

$A + B \rightarrow$ Product (3)

-) The given second order reaction is

$A + B \longrightarrow$ Product

The possible three rate laws are listed below.

Rate $= k[A]^1[B]^1$ $\therefore$ order $= 1+1 = 2$

Rate $= k[A]^2[B]^0$ $\therefore$ order $= 2+0 = 2$

Rate $= k[A]^0[B]^2$ $\therefore$ order $= 0+2 = 2$

b) solution,

Rate $= k[P]^1 [Q]^2$

i) Rate $= k[P]^1 [3Q]^2$

$= 9R$

∴ 9 times of initial rate

ii) $R' = Q' = 2$ (double the initial rate)

$R' = k[2P]^1 [2Q]^2$

$= 8R$

= 8 times of initial rate.

5 cement is one of the major component of construction field. Nepal has many cement factories. Limestone is a dominant raw material used for the manufacture of cement. When cement comes in contact with water, it sets to hard mass showing exothermic reaction.

a) You are asked to bring 1500 tons of cement for the dam construction of 400 MW hydropower station. What type of cement do you prefer and why? (2)

⇒ I will prefer PPC type of cement because PPC is cheaper & has low initial setting strength compared to OPPC but hardens over a period with proper curing. It has a slow hydration process and thus generates less heat than OPC. There it is suitable for mass ~~concrete~~ concreting and makes the concrete more durable.

b) While manufacturing the Portland cement, the % composition of MgO is not exceeded than 6%, why?

⇒ ~~Due to~~ cement should be expensive & due to cracking

c) After preparing the cement clinker it is cooled to a temperature of 60 - 150°c before grinding, why? (1)

=) Because In the clinker cooler, the hot clinker is rapidly cooled by air in order to obtain a high degree of efficiency

d) what is the role of Fe_2O_3 in the portland cement? (1)

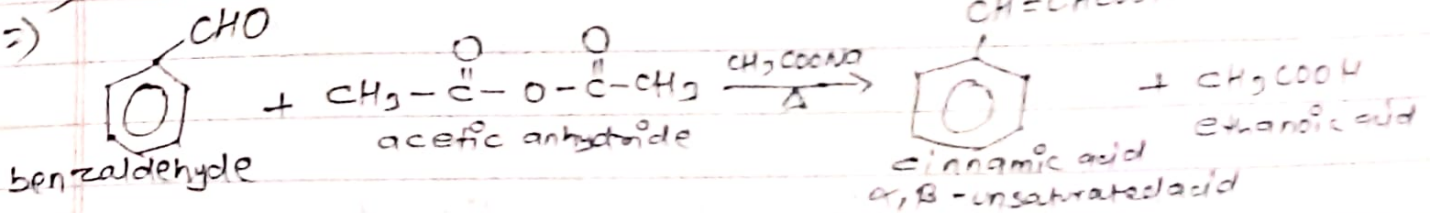
=) To increases the hardened cement stone flexural strength, and slightly decrease the compressive strength.

To impart characteristic gray colour, strength & hardness.

6 In an

a) Perkin condensation

=)



b) Hell - Volhard - Zelinsky reaction

=) $CH_3COOH \xrightarrow[-HCl]{Cl_2, red\ P} CH_2ClCOOH \xrightarrow[-HCl]{Cl_2, red\ P} CHCl_2COOH \xrightarrow[red\ P]{Cl_2} CCl_3COOH$

acetic acid — chloroacetic acid — dichloroacetic acid — trichloro... acetic acid

c) Wolff - Kishner reduction

$CH_3CHO + NH_2-NH_2 \xrightarrow[CH_2OH]{KOH\ or\ CH_2OH} CH_3CH_3 + H_2O$
(acetaldehyde) ethane

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + NH_2-NH_2 \xrightarrow{KOH} CH_3CH_2CH_3 + H_2O$
propanone (acetone) propane

d) Clemmenson's reduction

$CH_3-CHO + Zn-Hg \xrightarrow{conc.HCl} CH_3-CH_3 + H_2O$
ethanal (acetaldehyde) ethane

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + Zn-Hg \xrightarrow{conc.HCl} CH_3CH_2CH_3 + H_2O$
propane (acetone) propane

e) Cannizzaro's reaction

$HCHO + HCHO \xrightarrow{conc.NaOH} CH_3OH + HCOONa$
methanal methanal methanol sodium methanoate

OR,

Give a suitable reaction for the prepⁿ of ethanoic acid from

a) Ethanenitrile

$CH_3-CN + 2H_2O + HCl \xrightarrow{\Delta} CH_3-\overset{O}{\overset{\|}{C}}-OH + NH_4Cl$
ethan nitrile ethanoic acid

b) Methyl magnesium chloride

=>

c) Ethanol

=> $CH_3CH_2OH(l) + 2[O] \xrightarrow[\text{Alkaline } KMnO_4,\ \text{heat}]{\text{oxidising agent } K_2Cr_2O_7} CH_3COOH + H_2O$

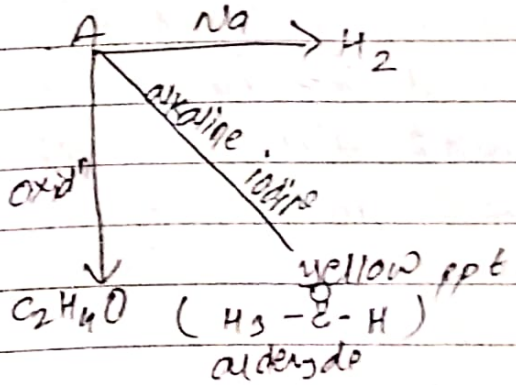
Also, convert ethanoic acid to propanic acid

=>

$CH_3COOH \xrightarrow[H_2O]{(i)\ LiAlH_4 \text{ ether}} CH_3CH_2OH \xrightarrow{PCl_5} CH_3CH_2Cl \xrightarrow{\text{Ethanolic } NaCN} CH_3CH_2CN \xrightarrow{H^+/H_2O} CH_3CH_2COOH$

Ethanoic acid — propanic acid

7



The compound (A) gives H_2 gas with sodium metal, yellow ppt with alkaline iodine is give aldehyde having molecular formula $C_2H_4O_2$ on oxidation with $K_2Cr_2O_7$

Q 12 gm of impure Zn is made to react with excess of dilute H_2SO_4. The total volume of H_2 gas liberated was found to be 4.2L at 570 mm of Hg pressure & 279 K temperature. Determine the percentage purity of zinc.

=> solution

Here, volume of H_2 liberated at NTP

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

or, $\frac{760 \times V_1}{273} = \frac{570 \times 4.2}{279}$

$\therefore V_1 = 3.08\,L$

when Zn react with dil. H_2SO_4 then,

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

1 mole 1 mole

Here,

1 mole H_2 is liberated from 1 mole $ZnSO_4$

22.4L of H_2 = 65 gm of zinc

1L of $H_2 = \frac{65}{22.4} \times 3.08$ gm of zinc $= 8.9$ gram of zinc

Therefore,

$$\%\ \text{purity} = \frac{\text{Pure weight}}{\text{given weight}} \times 100\%$$

$$= \frac{8.9}{12} \times 100\%$$

$$= 74.16\%$$

G1 - C

2) a) Write the principle reactions of oxidation, chlorination & hydrolysis process using ethyl alcohol.

=> Oxidation

$CH_3CH_2OH + Cl_2 \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-H + 2HCl$

ethanol → ethanal

Chlorination

$CH_3-\overset{O}{\overset{\|}{C}}-H + 3Cl_2 \longrightarrow CCl_3-\overset{O}{\overset{\|}{C}}-H + 3HCl$

ethanal → 2,2,2-trichloro ethanal (chloral)

Hydrolysis

$Ca(OH)_2 + CCl_3-\overset{O}{\overset{\|}{C}}-H + \overset{O}{\overset{\|}{C}}-H \longrightarrow 2CHCl_3 + (HCOO)_2Ca$

chloroform; calcium formate

b) Why is chloroform always stored in a dark colored bottle?

=> Chloroform is slowly oxidised by air in the presence of light to an extremely poisonous gas, carbonyl chloride, also known as phosgene. It is therefore stored in closed dark coloured bottles completely filled so that air is kept out.

$2CHCl_3 + O_2 \xrightarrow{\text{Sunlight}} 2HCl + 2COCl_2$

chloroform → (Phosgene)

c) It is used as an anaesthetic in past but now discouraged. Why?

=> chloroform is not used as an anaesthetics these days because it may contain some poisonous phosgene due to oxidation by sunlight.

d) chloroform forms chloroetone drug with acetone in presence of aqueous alkali. write the chemical reaction & mention any one use of this drug.

=> $CHCl_3$ + $H_3C-C(=O)-CH_3$ $\xrightarrow{aq(KOH)}$ $(H_3C)_2C(OH)CCl_3$

chloroform — Acetone — chloroetone

The use of chloroetone is it acts as a hypnotic and nervous sedative.

e) What happens when, chloroform reacts with conc. Nitric acid? Write an important application of such product.

=>

$$CHCl_3 + HNO_3 \longrightarrow Cl_3C-NO_2 + H_2O$$

chloropicrin

It is used in agriculture as a soil fumigant. It was used in large quantities during world war I & was stockpiled during world war II.

(insecticide & war gas)

OR

A $\xrightarrow{\text{diazotization}}$ B $\xrightarrow[\text{water}]{\text{warmed with}}$ C $\xrightarrow[\Delta \text{ pyridine}]{\text{acetyl chloride}}$ D $\xrightarrow[\text{anhydrous}]{AlCl_3 \text{ \&}}$ E $\xrightarrow{CS_2}$ F

C $\xrightarrow{\text{zinc dust}}$ Parent hydrocarbon benzene

Remaining

7

⇒ Hence, the compound (A) must be alcohol containing two carbon atoms i.e. ethanol (CH_3CH_2OH)

$CH_3-CH_2-OH \xrightarrow{Na} CH_3-CH_2-ONa + H_2\uparrow$

Ethanol

$CH_3-CH_2OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 8NaI + 5H_2O$

Ethanol (A)

Iodoform (yellow ppt)

$CH_3CH_2OH + [O] \xrightarrow{K_2Cr_2O_7/H^+} CH_3-\overset{O}{\overset{\|}{C}}-H$

Ethanal (A) aldyde

Hence, the organic compound (A) is ethanol.

Q a) The solubility product of barium sulphate ($BaSO_4$) is 1×10^{-10} at 298 K. calculate its solubility in

i) Pure water

ii) 1×10^{-3} M H_2SO_4 solution.

i) ⇒ $BaSO_4$ ionized as,

$$BaSO_4 \rightleftharpoons Ba^{++} + SO_4^{--}$$

Here, $x = 1$, $y = 1$, $K_{sp} = 1 \times 10^{-10}$

$S = ?$

Now we have,

$$S = \left(\frac{K_{sp}}{x^x y^y}\right)^{\frac{1}{x+y}}$$

$$= \left(\frac{1 \times 10^{-10}}{1^1 \cdot 1^1}\right)^{\frac{1}{2}}$$

$$= 1 \times 10^{-5} \text{ mole } L^{-1}$$

ii) 1×10^{-3} M H_2SO_4 solution,

$$BaSO_4 \rightleftharpoons Ba^{++} + SO_4^{--}$$

Solubility s' → s' s'

H_2SO_4 →

$C_{10}H_8 + 6O$

(1+3).

b) write the eqn for the formation of naphthalen calculate the increase in entropy in the evaporation of 1 mole of water at 100°C. [Latent heat of vaporization of water is 2.26 kJ.

=> The eqn for the formation of naphthalene is $C_{10}H_8$.

For entropy change of vaporization can be given as,

$$\Delta S_v = \frac{\Delta H_v}{T}$$

Given values are, $\Delta H_v = 2.26$ kJ/gm
$= 2.26 \times 10^3$ J/gmol

$T = 373^\circ K$

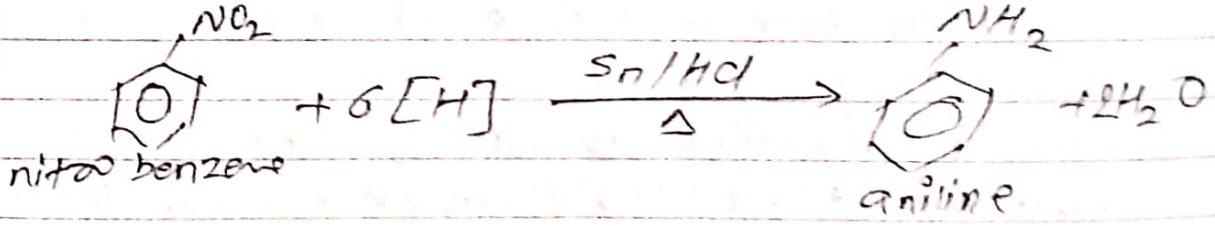
Therefore $\Delta S_v = \left(\frac{2.26 \times 10^3}{373}\right)$

$\therefore \Delta S_v = 8.273$ J/Kmol //

11

a) Give the preparation of aniline from nitro-benzene.

=>



b) Aniline is less basic than aliphatic amine.?

=> In case of aniline due to conjugation the lone pair density is less than that of methylamine. Due to this reason, aniline is less basic than aliphatic amine.

c) Why is it necessary to protect $-NH_2$ group before nitration of aniline?

=> The hurdles for the nitration of aniline are overcome by the protection of amino group by acetylation. The acetyl group reduces the reactivity of the ring & thus its oxidation does not occore easily with nitric acid HNO_3.

a) What is diazotization reaction? Why is diazotization always carried out at ice cold temperature?

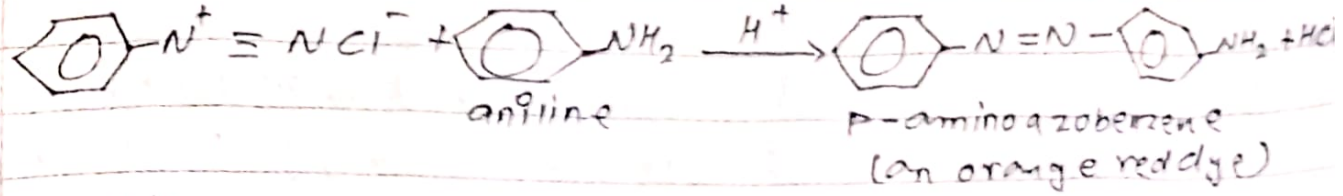
=> Diazotization reaction involves the formation of diazonium salts when aromatic amines amines are made to react with nitrous acid in presence of mineral acid.

Diazotization is usually carried out at low temperature bet^n 0-5°c. Wheare to maintain low temperature because if the temperature is above 5°c, diazonium salts which are in aqueous solution tend to decompose explosively.

e) Convert, Aniline into

i) P-aminoazobenzene (ii) Acetanilide.

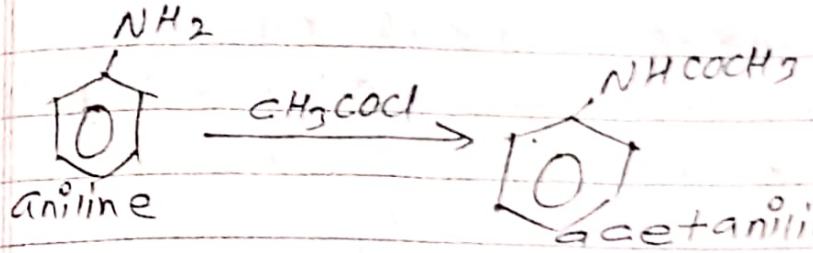
i)



aniline

p-aminoazobenzene
(an orange reddye)

ii)



Aniline

acetanilide

Set - B

1. The unit of rate constant for zero order reaction is

a) $mol^{-1}Ls^{-1}$ (b) $mols^{-1}$ (c) $molL^{-1}s^{-1}$ (d) Ls^{-1}

2. When an alkyl halide reacts with sodium alkoxide to form symmetrical as well as unsymmetrical ethers. This reaction is called

a) Hoffmann's reaction (b) Reimer-Tiemann's reaction
c) Kolbe's reaction (d) Williamson's reaction.

3. The curve obtained by plotting the pH of the solution during titration against the volume of alkali added from burette is known as a titration curve. The curve ABCH in the following curve represents

a) Titration curve of strong acid Vs strong base
b) Titration curve strong acid Vs weak base
c) Titration curve of weak acid Vs strong base
d) Titration curve of weak acid Vs weak base

4 An adiabatic process is the one in which
a) System is closed to energy transfer
b) System is closed to heat transfer
c) The System is closed to both heat & energ transfer
d) There is no enthalpy change.

5 Haloarenes are less reactive than benzene toward electrophilic substitution reaction due to
a) Positive inductive effect
b) Resonance effect
c) Negative inductive effect
d) Steric effect.

6 which of the following is generally used to prepare paper?
a) Protein (b) Fibers (c) cellulose (d) vitamins.

7 All transition element exhibit in general electronic configuration of
a) $(n-1)d^{1-10}\ ns^{1-2}$ (b) $(n-1)d^{0}\ ns^{1-2}$
c) $ns^{2}\ (n-1)\ d^{10}$ (d) None of above

8. Which of the following is the normality of 50ml of HCl required to neutralize 10gm of $CaCO_3$?

a) 2N b) 4N c) 5N d) 1N

9. Based on the systematic formula of Iron carbonyl, $Fe(CO)_5$, its conductivity is expected to be.....

a) zero (b) one (c) five (d) none

10. Which of the following reagent is used to make nitroethane from haloethane?

a) Alc. $AgNO_3$ (b) Alc. $AgNO_2$ (c) Alc. KNO_2 (d) Alc. $NaNO_2$

11. An acid chloride (A) on treating with methyl magnesium chloride followed by acid hydrolysis gives 2-methyl propan-2-ol as a major product. Which of the following is acid chloride (A)?

a) Methylanoyl chloride (b) Propanoyl chloride
c) Ethanoyl chloride (d) None of them.

Gr - B

1. Define the following terms:

a) Isolated system ⇒ A system that does not allow the exchange of either energy or matter with the surroundings is called isolated system.

b) Internal energy ⇒ The total sum of different form of energy associated with a particle in a system is known as Internal energy. It is denoted by a symbol 'E' or 'U'.

c) Enthalpy ⇒ Enthalpy is the heat content of the system at constant pressure. It is denoted by a symbol 'H'.

d) Entropy ⇒ Entropy is the measurement of randomness of disorder of the molecules present in the system. It is denoted by a symbol 'S'.

e) Isochoric process ⇒ When a thermodynamic process proceed from one state to another state at a constant volume then it is known as Isochoric process.

2. Sulphide ore is used in the extraction of mercury. Aristotle had named this element liquid silver.

a) write the chief ore of mercury.

⇒ Cinnabar (HgS)

b) Why does mercury forms alloy with gold & silver ?

⇒

c) How do you convert mercury into Nessler's reagent?

=> Alkaline solution of potassium tetra iodo mercurate(II), i.e. solution of K_2HgI_4 in KOH or NaOH is called Nessler's reagent. When mercuric chloride reacts with a potassium iodide solution, a yellow or scarlet red precipitate of HgI_2 is formed first which dissolves in excess KI to form soluble complex potassium tetraiodo mercurate(II)

$$HgCl_2 + 2KI \longrightarrow \underset{\text{scarlet ppt}}{HgI_2\downarrow} + 2KCl$$

$$\underset{\text{excess}}{HgI_2 + 2KI} \longrightarrow \underset{\text{soluble complex}}{K_2[HgI_4]}$$

d) Though mercury is metal, it exists in liquid state at room temperature. Why?

=> Mercury has a unique electron configuration which strongly resists removal of an electron, making it behave similarly to noble gas elements. As a result, mercury forms weak bonds & is a liquid at room temperature.

e) Instead of electrolytic refining, mercury is purified by treating it with 5% dil. HNO_3. Write reaction involved in it.

=>

At cathod $2H^+(aq) + 2e^- \longrightarrow H_2(g)$

At anode, $4OH^-(aq) \rightarrow O_2(g) + 1H_2O(l) + 4e^-$

Hence, at anode oxygen is formed

3 a) Differentiate between

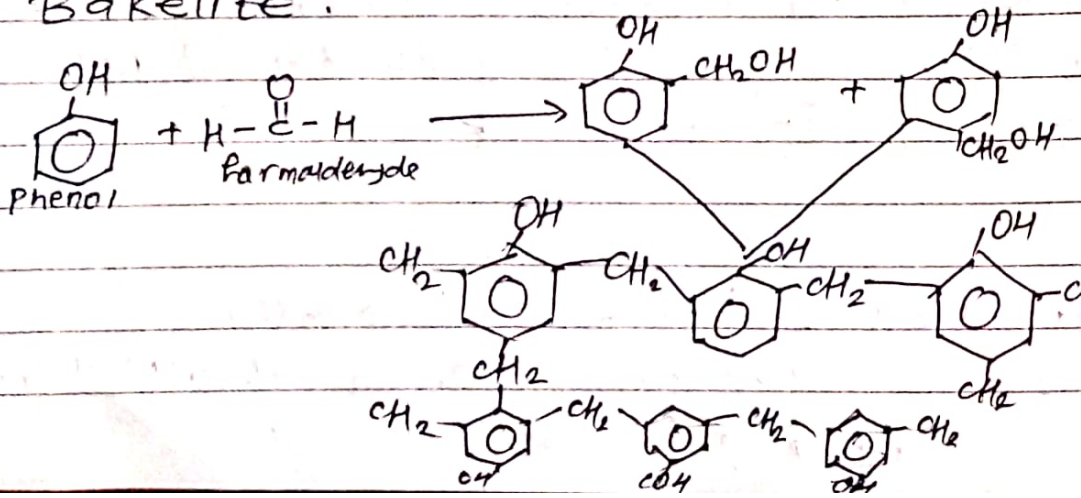
Condensation	Addition polymers
i) It involves two different monomers.	i) It involve one monomers.
ii) condensation of monomers result in polymers	ii) Addition of monomers results in polymers.
iii) common examples of condensation polymerization are nylon, silicon, etc.	iii) common examples of addition polymers are PVC, polyethene, Teflon, etc.

b) Why is nylon -6,6 called copolymers? (1)

⇒ Because it is obtained by the condensation of hexamethylene diamine & adipic acid. Both monomers contains 6 carbon so it is called Nylon -6, 6.

c) Which polymer is obtained, when phenol is treated with formaldehyde in the basic medium? Show pertinent reaction.

⇒ Bakelite.



4 $E^\circ_{Zn/Zn^{++}} = 0.76\,V$

$E^\circ_{Cu^{++}/Cu} = 0.34\,V$

a) write the cell reaction.

⇒ $E^\circ_{Zn/Zn^{++}} > E^\circ_{Cu^{++}/Cu}$. so Zn act as cathode Cu act as anode

cell reaction ⇒ $Zn + Cu^{+2} \longrightarrow Zn^{++} + Cu$

b) construct a galvanoic cell.

⇒

$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$

c) calculate the standard emf of the cell?

⇒ standard emf $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$.

$= 0.34 - 0.76$

$= -0.42$

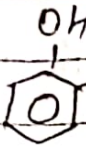
So given reaction is non feasible.

d) ~~Why~~ can you store the $CuSO_4$ in zinc vessel?

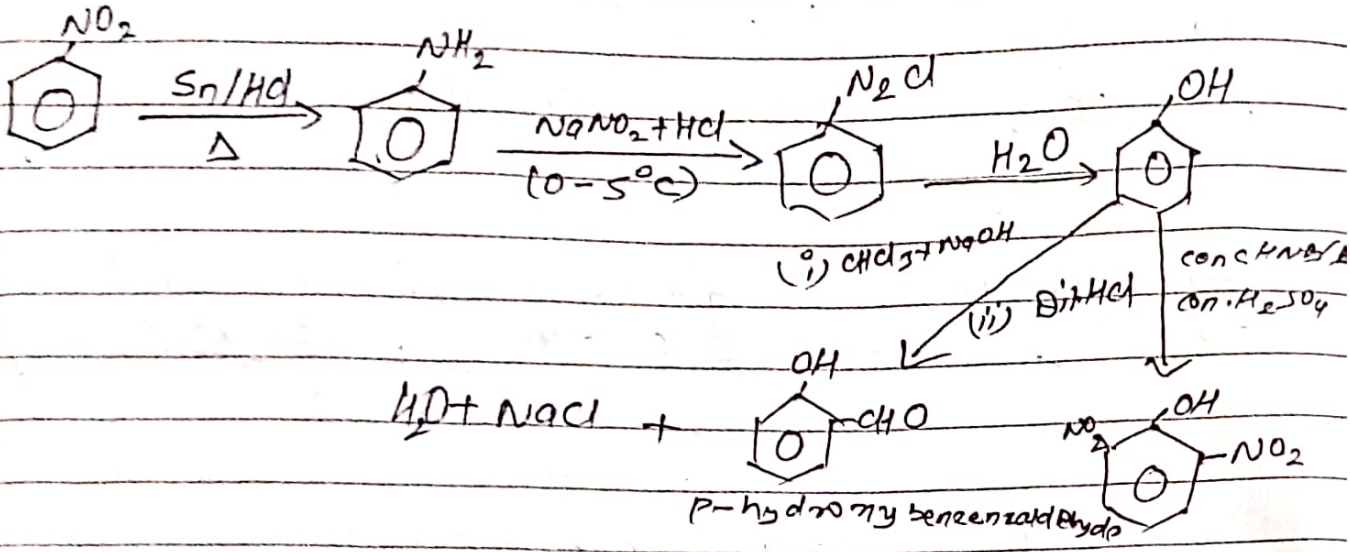
⇒ No, because the reactivity of Zn is more than Cu so, it displaces copper in $CuSO_4$ solution,

$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$

5 A $\xrightarrow[\Delta]{Sn/HCl}$ B $\xrightarrow[(0-5°C)]{NaNO_2+HCl}$ C $\xrightarrow[\Delta]{H_2O}$ D $\xrightarrow[conc.\ H_2SO_4]{conc.\ HNO_3/\Delta}$ E

D $\xrightarrow{(i)\ CHCl_3+NaOH,\ (ii)\ Dil.\ HCl,\ \Delta}$  + NaCl + H_2O

=>



A → Nitro benzene

B → Amino benzene

C → Benzene diazonium chloride

D → phenol

E → 2,4,6 - Trinitrophenol

6 What are the main assumptions of CFT (crystal field theory)? Explain, the crystal field splitting in octahedral complex.

=>

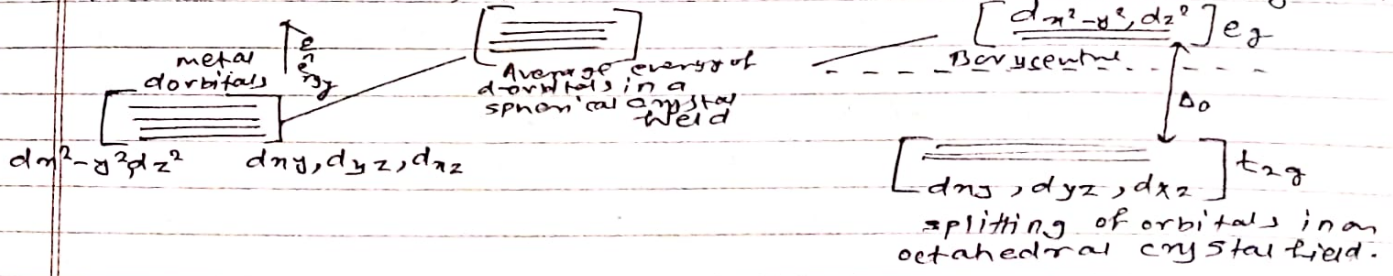
crystal field theory (CFT) assumes that the bond between central metal cation & ligand in a complex is purely ionic.

when negatively charged or neutral ligands having lone pair of electrons come closer to the central metal ion repulsive force creates between the electrons of the d-orbitals of metal cation & the electrons of ligands.

According to C.F.T at first there is an increase in the energy of d-orbitals relative to that of the free ion just as would be the case in spherical field. The two orbitals lying along the axis get repelled more strongly than other three (d_{xy}, d_{yz}, d_{xz}). The degenerate set of d-orbitals get split into two sets: the lower energy t_{2g} set and e_g set. The energy separation is denoted by Δ_o. The actual configuration adopted is decided by the relative values of Δ_o & P. P- represents the energy req^d for electron pairing in a single orbital.

(a) If $\Delta_o < P$ then fourth electron goes to e_g.

(b) when $\Delta_o > P$, then fourth electron pairs to t_{2g} orbital.



splitting of orbitals in an octahedral crystal field.

Date
Page

7. When propene reacts with HBr in presence of organic peroxide, it gives major product just opposite to Markovnikov's rule.

a) State the rule.

⇒ It state that the addition of halogen acid to unsymmetrical alkenes proceeds in such a way that the hydrogen of halogen acid adds to the double-bonded carbon having a greater number of hydrogen atoms.

b) Write a chemical eqn for above statement & the major product.

⇒ $(CH_3)_2CH = CH_2 + HBr \longrightarrow (CH_3)_2 CBr CH_3$

2-bromo-2-methyl propane

c) Why is HI not given Anti-markovnikvo's addition?

⇒ Because HI bond is weak & undergoes homolysis readily to form iodine free radical. The iodine free radical have greater tendency to combine together to form iodine molecule rather than adding to the ethylenic bond.

d) What happens when major product is heated with sodium metal in presence of dry ether?

⇒

$$2R-X + 2Na \xrightarrow[\Delta]{\text{dry ether}} R-R + 2NaX$$

$$C_2H_5Br + 2Na + C_2H_5Br \xrightarrow{\Delta} C_2H_5-C_2H_5 + 2NaBr$$

n-Butane.

Q a) write down the functional isomers of carbonyl compound with molecular formula C_3H_6O. which isomer will react faster with HCN & why?

=) CH_3CH_2CHO will react faster with HCN due to less steric hinderance & electronic reason than ~~of~~ CH_3COCH_3.

b) Alkenes (C=O) & carbonyl compound (C=O) contains a pie (π) bond but alkene show electrophilic addition whereas carbonyl compound shows nucleophilic addition reaction. Explain. (2)

=)

Alkenes undergo electrophilic addition whereas aldehydes & ketones undergo nucleophilic addition because in alkenes the double bond joins two carbon atoms & there is no resultant polarity. while in carbonyl compounds reactions due to the polarity in the carbonyl bond that makes them vulnerable to a nucleophile, an atom that donates electrons.

Gr-C

9 a) How would you distinguish propan-1-ol, propan-2-ol & 2-methyl propan-2-ol by victor meyers method?

=>

Propan-1-ol

$CH_3CH_2CH_2OH$

$\downarrow P_4 + I_2$

$CH_3CH_2CH_2I$

Iodo propane

$\downarrow AgNO_2$

$CH_3CH_2CH_2NO_2$

1° nitro propane

$\downarrow HONO$

$CH_3CH_2-\underset{\underset{N-O-H}{\|}}{C}-NO_2$

$\downarrow NaOH/KOH$

Blood red

Propan-2-ol

$CH_3-\underset{H}{\overset{OH}{C}}-CH_3$

$\downarrow P_4 + I_2$

$CH_3-\underset{H}{\overset{I}{C}}-CH_3$

2° Iodopropane

$\downarrow AgNO_2$

$H_3C-\underset{H}{\overset{NO_2}{C}}-CH_3$

2° nitropropane

$\downarrow HONO$

$H_3C-\underset{N=O}{\overset{NO_2}{C}}-CH_3$

$\downarrow NaOH/KOH$

blue

2-methyl propan-2-ol

$CH_3-\underset{CH_2}{\overset{OH}{C}}-CH_3$

$\downarrow P_4 + I_2$

$CH_3-\underset{CH_2}{\overset{I}{C}}-CH_3$

2° Iodo-2-methyl propane.

$\downarrow AgNO_2$

$CH_3-\underset{CH_2}{\overset{NO_2}{C}}-CH_3$

2 methyl 2 nitropropane

$\downarrow HONO$

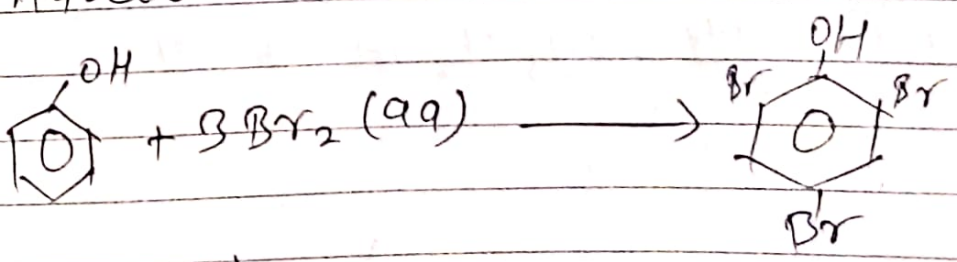
no reaction

$\downarrow NaOH/KOH$

colourless

b) What happens when, Phenol is treated with

i) Aqueous bromine



$+ 3Br_2(aq) \longrightarrow$ 2,4,6-tribromophenol $+ 3HBr$

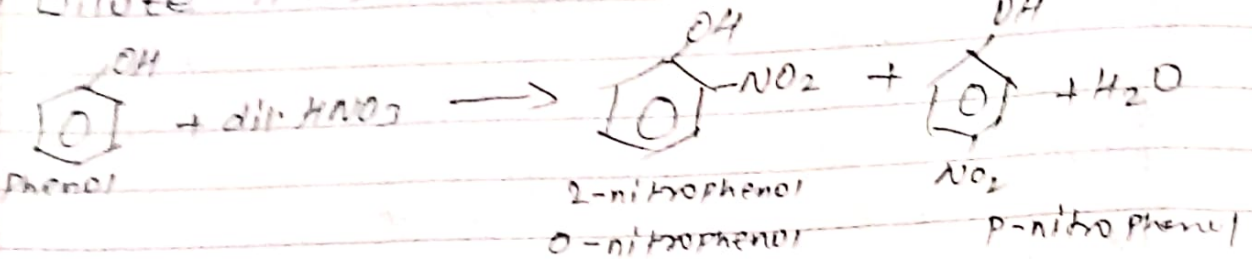
white ppt

ii) $FeCl_3$ solution

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

hexa phenoxide iron (III) ion — violet complex

iii) Dilute HNO_3



10

a) Methanoic acid is warmed with ammonical $AgNO_3$ solution?

$\Rightarrow HCOOH + (AgNO_3) \longrightarrow 2Ag\downarrow + CO_2\uparrow + 2H_2O$

b) Ethanoic acid reacts with Cl_2 in red phosphorus?

$\Rightarrow$

$CH_3COOH + Cl_2 \xrightarrow[-HCl]{\text{red } P} CH_2ClCOOH \xrightarrow[-HCl]{Cl_2} CHCl_2$

$CCl_3COOH \xleftarrow[-HCl]{Cl_2}$

c) Ethanoyl chloride is reduced with $LiAlH_4$?

$\Rightarrow CH_3COCl \xrightarrow[\Delta]{LiAlH_4} CH_3CH_2OH + HCl$

d) Ethanoic anhydride reacts with ammonia?

=> $CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow{NH_3} CH_3-\overset{O}{\overset{\|}{C}}-OH + CH_3CONH_2$

e) Ethyl ethanoate is hydrolyzed in acidic medium?

=> $CH_3-\overset{O}{\overset{\|}{C}}-O-C_2H_5 \xrightarrow{H^+/H_2O} CH_3COOH + C_2H_5OH$

Justify with reasons.

i) Acetic acid is weaker acid than formic acid.

=> Acetic acid has methyl group attached to carboxylic acid COOH that shows positive inductive effect & increases the electron density on the C of COOH group, thereby reduces its ~~ac~~ acidity.

ii) Amide is amphoteric in nature.

=> Amides behave both as weak acid as well as weak base & thus show amphoteric in nature.

iii) Acyl halide is most reactive acid derivatives.

=> Inductive electron withdrawal by Cl increases the electrophilic character of the carbonyl carbon & increases its reactivity toward nucleophiles. Thus acyl halide is most reactive acid derivatives.

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11 a) The process of determining the concentration of unknown solution is titration. Define redox titration. calculate the molality of one litre of 93% H_2SO_4 solution (weight by volume). The density of the solution is 1.84 gm/L.

b) Those titration in which the strength of oxidizing agent is determined by using standard reducing agent or vice-versa are known as redox titration.

Given, 93% H_2SO_4 solution (weight/volume).
It means 93 g of H_2SO_4 present in 100 ml of solution,

weight of H_2SO_4 = 93 g
volume of solution = 100 ml
∴ weight of solution = 100 × 1.84 = 184 g
Thus,
weight of water = 184 − 93 = 91 g

$$\text{Molality} = \frac{\text{moles of } H_2SO_4}{\text{weight of water in (g)}} \times 1000.$$

$$\text{Moles of } H_2SO_4 = \frac{93}{98} = 0.948$$

$$\text{Molality} = \frac{0.948}{91} \times 1000$$

$$= 10.42 \text{ //}$$

11 b) => Acetic acid is a weak acid & ionized as,

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

for weak acid,

$[H]^+ = \sqrt{K_a C}$

$= \sqrt{1.8 \times 10^{-5} \times 1}$

$= 4.2426 \times 10^{-3}$

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

$= -\log (4.2426 \times 10^{-3}) = 2.37$

Now, PH of diluted solution,

$PH = 2 \times 2.37 = 4.7447$

& $-\log [H^+] = 4.74$

$[H^+] = 1.81 \times 10^{-5}$

For weak acid,

$[H^+] = \sqrt{K_a C}$

squaring on both side.

$[H^+]^2 = K_a C$

$C = \frac{[H^+]^2}{K_a}$

$= \frac{(1.8 \times 10^{-5})^2}{1.8 \times 10^{-5}}$

$= 1.82 \times 10^{-5}$

Now,

$M_1 V_1 = M_2 V_2$

$1 \times 1 = V_2 \times 1.82 \times 10^{-5}$

$\therefore V_2 = 54945.05$ A

C

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Gr - B

1

a) Bronsted Lowery Acid

=> It is define as a substance (ion or molecule) that has a tendency to donate proton.

Example,

$$\underset{\text{Acid}}{HCl} + NH_3 \rightleftharpoons NH_4^+ + Cl^-$$

b) Bronsted Lowery Base

=> It is define as a substance that has a tendency to accept proton i.e. proton donating species are acid but proton accepting species are base.

Example,

$$HCl + H_2O \rightleftharpoons \underset{\text{Base}}{H_3O^+} + Cl^-$$

c) Lewis Acid => It is define as a substance i.e. (atom, ion or molecule) that has a tendency to accept the lone pair of electron from base through a co-ordinate covalent bond.

Example, $FeCl_3$, Cu^{++}, Ag^+, etc.

d) Lewis Base => A base is a species that has a tendency to donate a lone pair of electron from base through a co-ordinate covalent bond. Example, OH^-, CN^-, CaO, etc.

$R = k[A]^0[B]^2$ $R = k[A]^1[B]^1$

c) conjugate acid/base of NH_3

=> Ammonia or NH_3 is a base. It accepts a proton to give its conjugate NH_4^+. similarly, NH_4^+ looses a proton to give conjugate base NH_3. Therefore, NH_4^+ is the conjugate acid of ammonia.

2 ~~Not~~

a) Why is blister copper called so?

=> The slightly impure copper had impurities, mostly sulphur dioxide which bubbled up through the copper as it solidified. That gave a blistered surface and the results of the smelting were called blister of copper.

b) Write the composition of bronze.

=> Bronze is a metal alloy that primarily contains copper and 12% tin.

c)

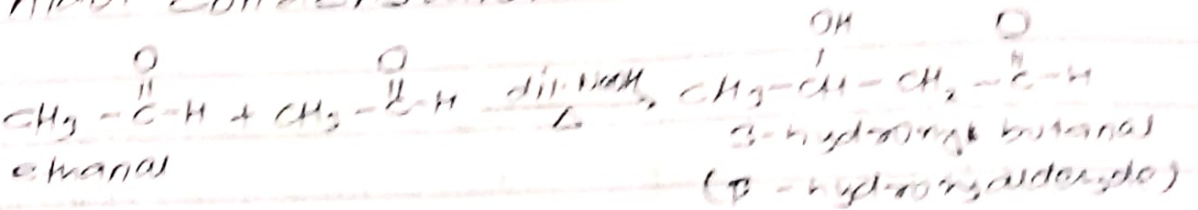
The prevention of rusting are:-

i) Passing steam over red hot iron. Here a thin layer of ferroso-ferric oxide (Fe_3O_4) is deposited, which prevents the rusting of it is Bard's protection.

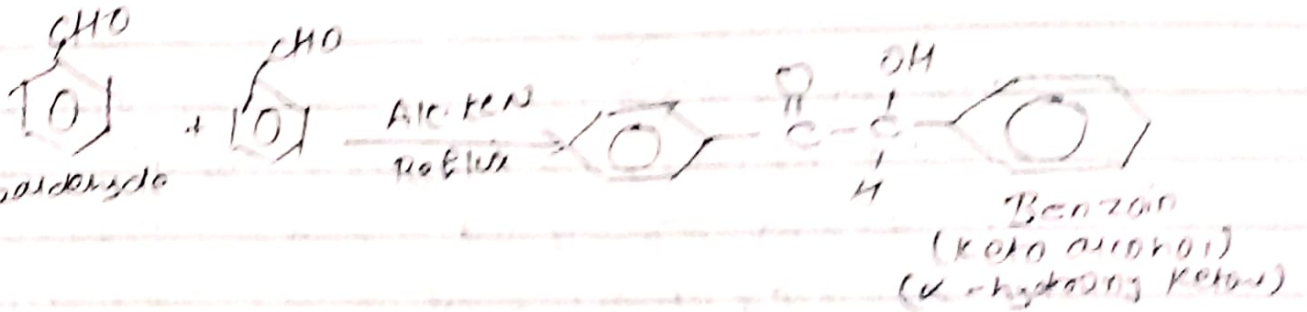
ii) oxide, phosphate or other chemical coating like Fe_3O_4, zinc phosphate, etc.

4.

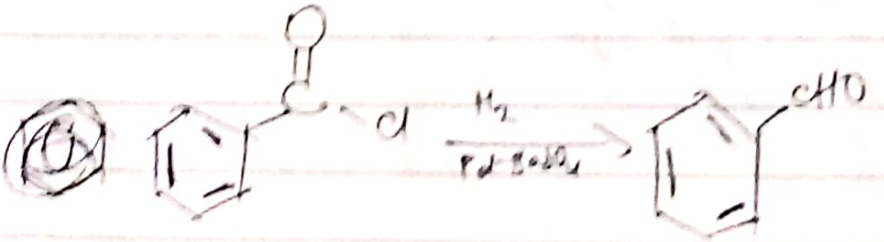
a) Aldol condensation.



b) Benzoin condensation



c) Rosenmund's reaction



OR

a) Chloroethane ~~reacts~~ with moist silver oxide.

$CH_3-CH_2Cl + AgOH \xrightarrow{\text{Boil}} CH_3-CH_2OH + AgCl$

Chloroethane → Ethanol

b) Ethanamine reacts with nitrous acid in cold condition.

=) $CH_3CH_2NH_2 \xrightarrow{NaNO_2+HCl} [CH_3CH_2N^+Cl^-]$

$[CH_3CH_2N^+Cl^-] \xrightarrow{H_2O} CH_3CH_2OH + N_2 + HCl$

c) Propan-2-ol is oxidized with acidified $KMnO_4$ solution.

=) $CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 \xrightarrow{KMnO_4/H^+} CH_3CH_2COOH$

(Propanoic acid)

d) Ethanol is warmed with iodine in presence of NaOH

$CH_3CH_2OH \xrightarrow[\text{oxidation}]{[O]} CH_3CHO \xrightarrow{I_2} CI_3CHO \xrightarrow{NaOH}$

Ethanol → Ethanal → Iodination → Triiodo acetaldehyde

$CHI_3\downarrow + HCOONa$

Iodoform → Sod. Formate

~~e) Reaction of acetone is~~

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3. Describe the electrochemical theory for the rusting of iron. List any two method of prevention of rusting.

=>

The chemical corrosion of iron by oxidation with moist air to give hydrated ferric oxide is called rusting. The rusting process is accelerated by acidic oxide like CO_2, SO_2, NO_2, etc.

$$2Fe + O_2 + xH_2O \longrightarrow \underset{\text{Rust}}{Fe_2O_3 \cdot xH_2O}$$

According to the electrochemical theory, rusting of iron occurs due to formation of galvanic cell in the iron. At anode, iron atom onides to Fe^{++} ion by losing 2 electrons.

At anode, $Fe \rightarrow Fe^{++} + 2e$

The electron moves to cathode where oxygen reduces to OH^- by gaining electron.

At cathode,

$$O_2 + 2H_2O + 4e^- \longrightarrow 4OH^-$$

The ferrous & anhydronylated iron then diffuse & under the influence of dissolved oxygen, Fe^{++} is oxidized to Fe^{+++}, which then it combines with OH^- to form rust.

$$4Fe^{++} + 2H_2O + O_2 + OH^- \longrightarrow \underset{\text{rust}}{2Fe_2O_3 \cdot 6H_2O} \text{ or } 4Fe(OH_3)$$

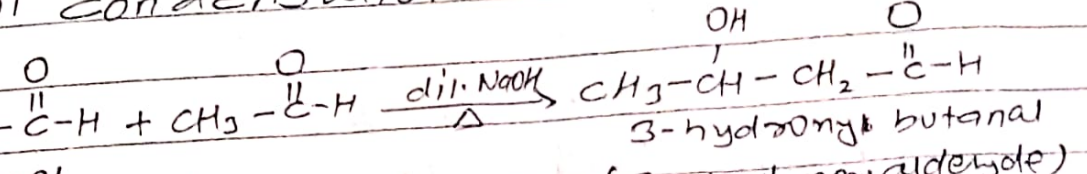
The prevention of rusting are:-

i) Passing steam over red hot iron. Here a thin layer of ferrosoferric oxide (Fe_3O_4) is deposited, which prevents the rusting. It is Barf's protection.

ii) Oxide, phosphate or other chemical coatings like Fe_3O_4, Zinc phosphate, etc.

4

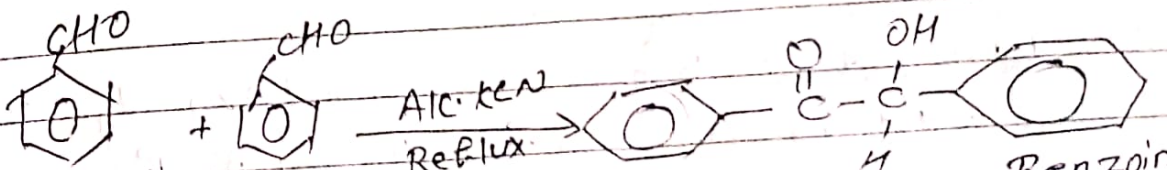
a) Aldol condensation.



ethanal

3-hydroxy butanal
(β-hydroxyaldehyde)

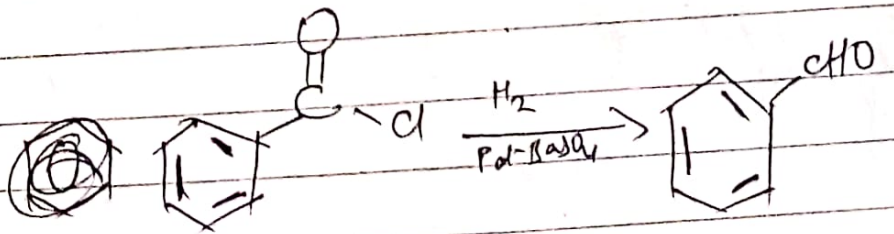
b) Benzoin condensation



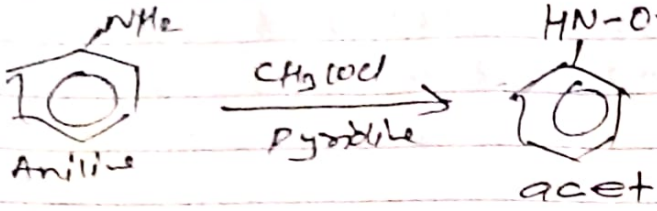
Benzaldehyde

Benzoin
(keto alcohol)
(α-hydroxy ketone)

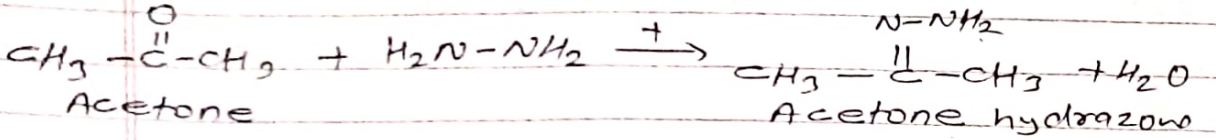
c) Rosenmund's reaction



d) Oxidation reaction of acetaldehyde



e) Reaction of acetone with hydrazine



5 Write different isomers of organic compound having formula C_2H_7N. How would you distinguish them by nitrous acid test?

=>

(i) $H_3C \diagdown NH-CH_3$ (ii) H_3C-NH_2 (Ethylamine)

We will get a bright coloured azo dye. But if we add nitrous acid to aliphatic amines, then effervescence of nitrogen gas is obtained. Thus, we can distinguish between ethylamine & aniline by using azo dye test.

OR

a) Chloroethane ~~reacts~~ with moist silver oxide.

$CH_3-CH_2Cl + AgOH \xrightarrow{Doil} CH_3-CH_2OH + AgCl$

Chloroethane → Ethanol

b) Ethanamine reacts with nitrous acid in cold condition.

⇒ $CH_3CH_2NH_2 \xrightarrow{NaNO_2+HCl} [CH_3CH_2N^+Cl^-]$

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c) Propan-2-ol is oxidized with acidified $KMnO_4$ solution.

⇒ $CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 \xrightarrow{KMnO_4/H^+} CH_3CH_2COOH$

(propanoic acid)

d) Ethanol is warmed with iodine in presence of NaOH

$CH_3CH_2OH \xrightarrow[\text{oxidation}]{[O]} CH_3CHO \xrightarrow[\text{Iodination}]{I_2} CI_3CHO \xrightarrow{NaOH}$

Ethanol → Ethanol → Triiodo acetaldeyde

$CHI_3\downarrow + HCOONa$

Iodoform → Sod. Formate

e) ~~Reaction of acetone w~~

e) Ethyl alcohol is heated with acetic acid in presence of conc. H_2SO_4

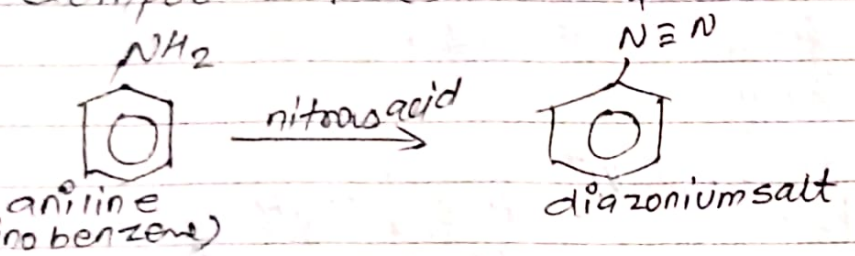
⇒

$$CH_3COOH + C_2H_5OH \xrightarrow{conc.\ H_2SO_4} CH_3COOC_2H_5 + H_2O$$

6

a) Give an example of diazotisation reaction using compound A. (1)

⇒

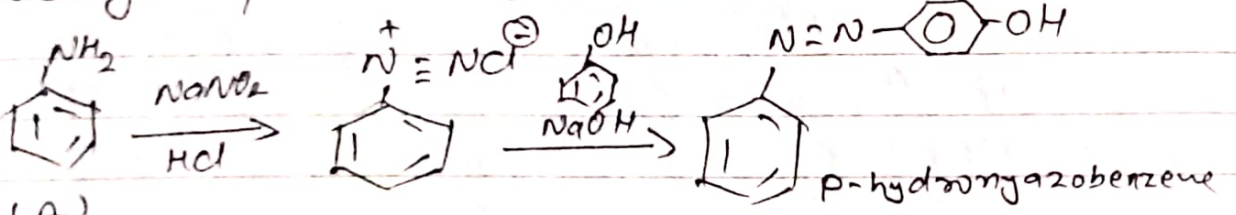


aniline (aminobenzene)

diazoniumsalt

b) How would you prepare p-hydroxyazobenzene using compound A & B.

⇒



(A)

p-hydroxyazobenzene

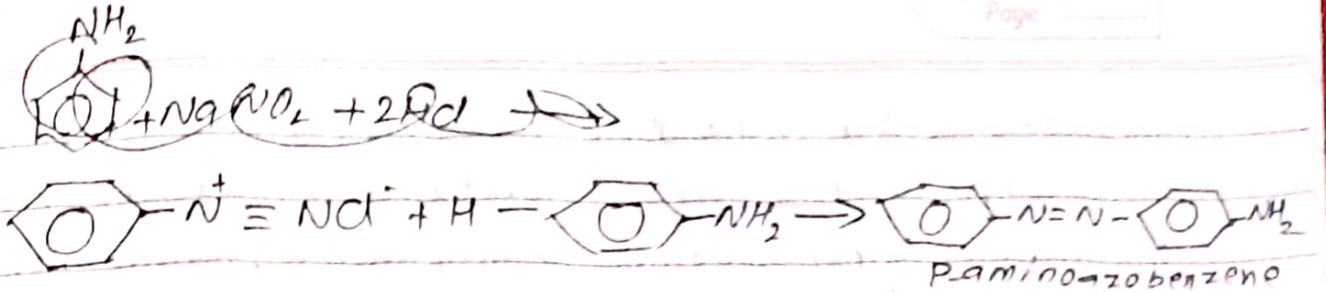
Benzene diazonium chloride

$+ C_6H_5OH \xrightarrow{OH^-} C_6H_5-N=N-C_6H_4-OH$

Phenol

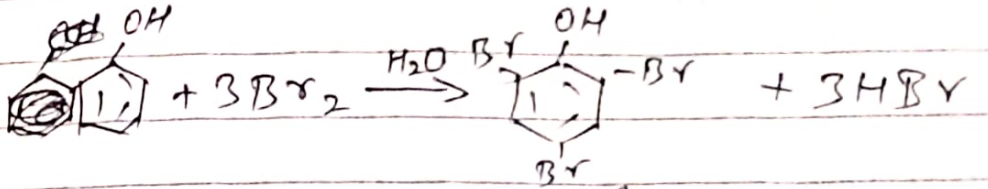
p-hydroxyazobenzene

c)



d)

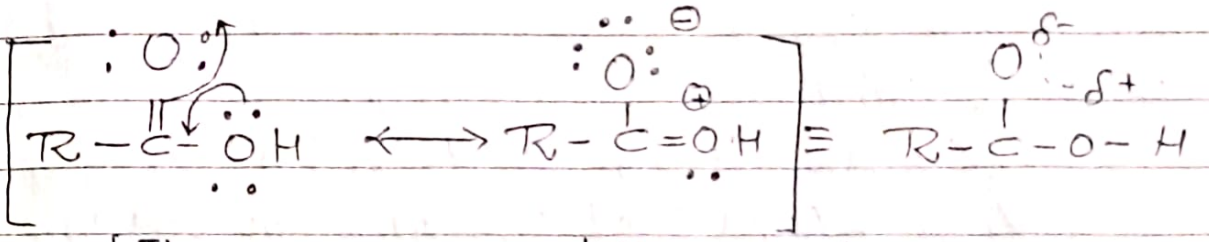
e)



2,4,6-tribromo phenol
(White ppt)

7a) carboxylic acid contains the carbonyl group but donot show the nucleophilic addition reaction like aldehyde or ketone. Why? (2)

=>



(I) less stabilized

Due to resonance, the carbonyl group has a partial double bond character instead of the double bond. Hence they donot give the chemical properties of aldehyde & ketones (carbonyl group)

5) Arrange the following in decreasing order of their acidic strength. Explain the arrangement. 2,4,6 - Trinitrophenol, p-nitrophenol, phenol, m-nitrophenol. (1+2).

8

⇒ Soln Given,

~~Sp. gravity =~~ $V_1N_1 = V_2N_2$

$V_1N_1 = 0.03 \times 0.1 = 0.003$ equivalents

$N_1 = ??$ 10ml, volume of dil. acid neutralized.

$N_1 = \frac{0.003}{0.01L} = 0.3N$

0.3N is the normality of the 10ml of the 1L diluted solution.

mass of the solute in 10mL

$\frac{x}{49} / 0.01 = 0.3$

$x = 0.147g$

0.147g = 10mL

x = 1000mL

x = 14.7g

% C = m/V (100)

= 14.7 / (1.8 × 10mL) (100)

= 81.67 %

The mass percentage for 1.8 g/mL - 86.9 %.

Q 2) Sp. gravity = 1.8

For diluted acid

V_1 = 10ml

N_1 = ?

N_2 = 30

V_2 = 0.1

Now, $N_1V_1 = N_2V_2$

Or, $10 \times N_1 = 30 \times 0.1$

$\therefore N_1 = 0.3$

For concentrated,

V_1 = 1000ml

N_1 = 0.3

V_2 = 10ml

N_2 = ?

Now, $N_1V_1 = N_2V_2$

$1000 \times 0.3 = 10 \times N_2$

$\therefore N_2 = 30$

Hence,

$N = \frac{\% \times \text{Sp. gravity} \times 10}{\text{Eq. wt}}$

$\% = \frac{30 \times 49}{10 \times 1.8}$

$\% = 81.67\%$

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OR

a) Is the titration redox or acid base?

=>

b) Why does $KMnO_4$ act as self-indicator? Define indicator.

=> $KMnO_4$ solution are dark purple. When used as a titrant, as soon as the endpoint is reached & the $KMnO_4$ is in excess, the solution has a permanent pink hue. Thus $KMnO_4$ acts as its own indicator.

Indicator is a substance which is used to determine the end point in a titration.

c) $KMnO_4$ is not primary standard substance, why?

=> Because it is difficult to obtain the pure state of $KMnO_4$ as it is not free from MnO_2. Also, the colour is so intense that it acts as its own indicator.

d) If 100cc of N/10 $KMnO_4$ solution is to be prepared in acidic condition, what mass of $KMnO_4$ is required?

=>

100ml of 0.1 $KMnO_4$

$$\frac{w}{E} = \frac{VN}{1000}$$

Or, $\frac{w}{31.6} = \frac{100 \times 0.1}{1000}$ [E is $KMnO_4$ in acidic medium is 31.6]

$\therefore w = 0.316$ gram

b) A reference electrode is an electrode which has a stable & well-known electrode potential.

The standard hydrogen electrode consists of a plantinum electrode coated with platinum black. The electrode is dipped in an acidic solution & pure hydrogen gas is bubbled through it.

Act as a cathode

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

Act as anode

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

10

For this reason, doctors may sometimes recommend medications called antipyretics to lower a person's temperature. Tylenol can also reduce a fever.

Penicillin are a group of antibacterial drugs that attack a wide range of bacteria.

It work as bursting the cell wall of bacteria.

Gr-B

1. a) Discuss cyanide process for extraction of silver from horn silver.

⇒ silver is extracted from the ore- argentite (Ag_2S). The process of extraction of silver is called as cyanide process as sodium cyanide solution is used. The ore is crushed, concentrated & the heated with sodium cyanide solution. This reaction forms sodium argento cyanide.

The solution of sodium argento cyanide combines with zinc dust & forms sodium tetra cyanozicate & precipitated silver. This precipitated silver is called spongy silver.

The sponge silver is fused with potassium nitrate to obtain pure silver. Then the silver obtained is purified by electrolytic process.

b) Why does indelible ink made of silver nitrate is used to produce stain during election or polio drop campaign? Elucidate showing valid reaction.

⇒ When silver nitrate solution comes in contact of skin in presence of sunlight, it is reduced by organic compound present in the skin into metallic silver producing black stain.

$$2AgNO_3 \xrightarrow{h\upsilon} 2Ag\downarrow + 2NO_2 + O_2.$$

2 a) How does the surface area of the reactant affect the rate of reaction? (1)

=> Surface area of the reactant alters the rate of reaction. Larger the surface area of the reactant, higher will be the rate of reaction & vice versa.

b) What is the role of temperature in the rate of reaction? (2)

=> The rate of chemical reaction can be changed by altering the temperature. If the temperature is increased: the reactant particles move move quickly. They have more energy.

c) What do you mean by catalyst? What is the role of catalyst in Kinetics? (2)

=> catalyst is a substance which can change the speed of a chemical reaction without itself undergoing any change in its mass & chemical composition.

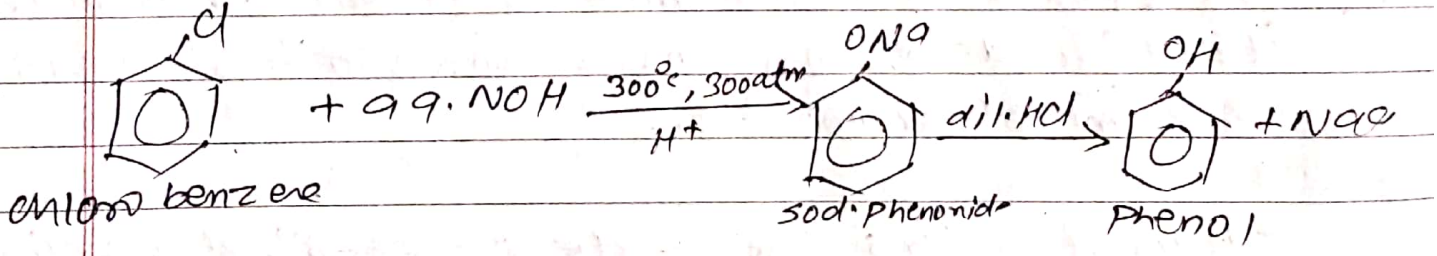
catalyst alters the rate of chemical reaction. posifive catalyst increase the rate of reaction but negative catalyst decreases the rate of reaction.

3 ⇒ The S_N1 reaction is a unimolecular substitution reaction & follow's the first order kinetics i.e. the rate of reaction depends on the concentration of substrate only (Rate = k (substrate).

The S_N2 reaction is a bimolecular substitution reaction & follow's the second order kinetics i.e. the rate of reaction depends in the concentration of substrate & nucleophile.

~~As C-X bond~~

The halogen atom attached to the benzene ring in Aryl halides are slightly deactivating & also ortho-para directing. Since the ring gets deactivated as compared to that of benzene, haloarenes are less reactive than haloalkane toward nucleophilic substitution reaction.



4

a) How are α & β -rays produced?

» During radioactive particles like α & β rays are emitted by an atom due to unstable atom trying to gain stability. Hence, the atoms

eventually decay be emitting a particle that transforms when they are unstable & transforms the nucleus into a lower energy state so this ~~reaction~~ reason the α & β - rays are produced.

b) For nuclear ~~reaction~~, α-particles & protons are accelerated but neutrons must be slowed down. Explain. (2)

=) The positively charged bombarding particles called projectiles suffer repulsion therefore α & β particles should be accelerated with high energy. On the other hand, neutrons are neutral particles & these have to be slowed down so that they could be captured by the nucleus.

c) Write the medical uses of radioisotopes. (1)

y) They can be used for imaging to study the dynamic processes taking place in various parts of the body.

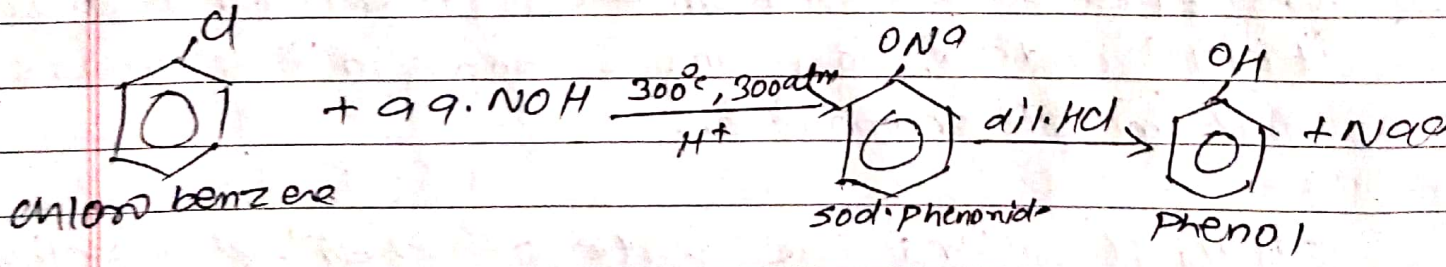
5 Describe chemical method for the separation of primary, secondary & tertiary amines by Hoffmann's method. (5)

3 ⇒ The S_N1 reaction is a unimolecular substitution reaction & follow's the first order kinetics i.e. the rate of reaction depends on the concentration of substrate only (Rate = k (substrate).

The S_N2 reaction is a bimolecular substitution reaction & follow's the second order kinetics i.e. the rate of reaction depends in the concentration of substrate & nucleophile.

~~As C-X bond~~

The halogen atom attached to the benzene ring in Aryl halides are slightly deactivating & also ortho-para directing. Since the ring gets deactivated as compared to that of benzene, haloarenes are less reactive than haloalkane toward nucleophilic substitution reaction.



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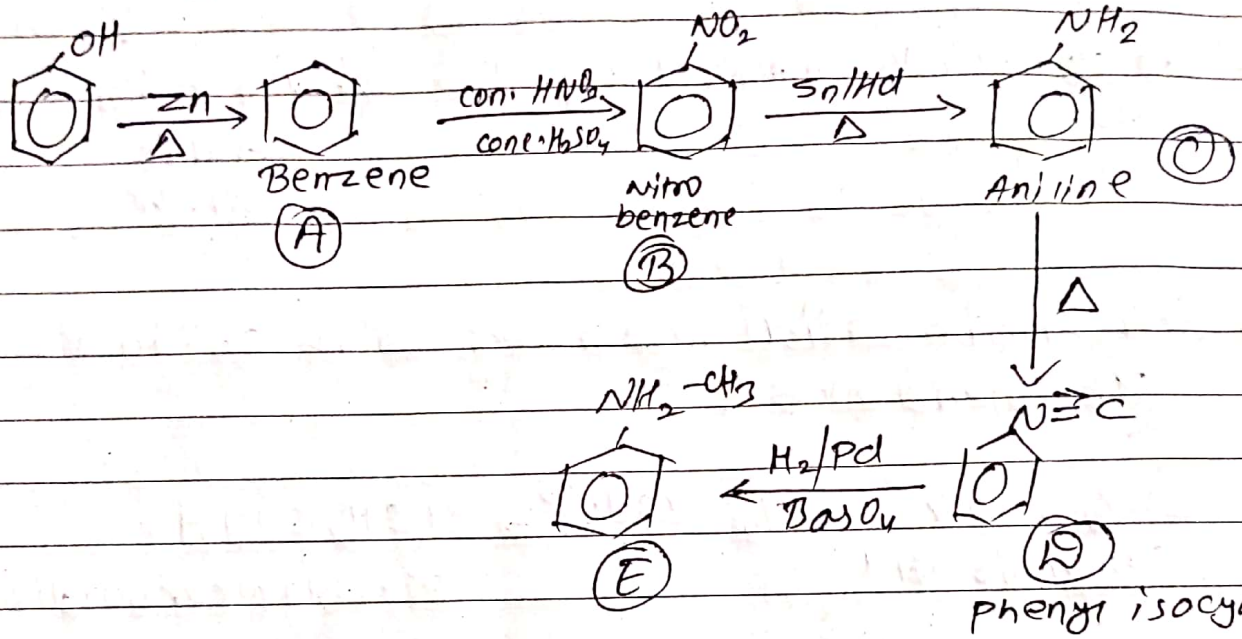
OR

Identify A, B, C, D & E with their names.



6

>>

Date
Page

7 a) Methanoic acid is warmed with ammonical $AgNO_3$

⇒ $HCOOH + \text{ammonical } AgNO_3 \longrightarrow Ag + CO_2 + H_2O + NH_3$

methanoic acid — metallic silver

b) Ethanoic acid reacts with Cl_2 in red Phosphorous?

⇒ $CH_3COOH + Cl_2 \xrightarrow{\text{red. P}} ClCH_2COOH$

Ethanoic acid — α-chloro carboxylic acid

c) Ethanoyl chloride is reduced?

⇒ $CH_3-\overset{O}{\overset{\|}{C}}-Cl + H_2 \xrightarrow{Pd/BaSO_4} CH_3-\overset{O}{\overset{\|}{C}}-H + HCl$

Ethanoyl chloride — Acetaldehyde

d) Ethanoic anhydride reacts with ammonia?

⇒ $CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3 + NH_3 \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-NH_2 + CH_3-\overset{O}{\overset{\|}{C}}-OH$

Ethanoic anhydride — Ethanamide

e) Ethyl ethanoate reacts with $LiAlH_4$?

⇒ $CH_3COOC_2H_5 \xrightarrow{LiAlH_4} CH_3CH_2OH + C_2H_5OH$

Ethyl ethanoate — Ethanol — Ethanol.

Q a) calomel with ammonia.

=>

$$HgCl_2 + 2NH_3 \longrightarrow Hg + Hg(NH_2)Cl + NH_4Cl$$

(grey - black colour)

b) corrosive sublimate with potassium thiocyanate.

=>

$$HgCl_2 + 2KSCN \longrightarrow Hg(SCN)_2 + 2KCl$$

mercurry (II) thiocyanate.

c) mercuric sulphate when grinded with sodium chloride in presence of MnO_2.

=> $HgSO_4 + NaCl \xrightarrow{MnO_2} Na_2SO_4 + HgCl_2$

d) Mercury with excess chloride.

=>

$$Hg + Cl_2 \longrightarrow HgCl_2$$

excess — mercuric chloride

e) Mercury (II) chloride with potassium iodide.

=> $HgCl_2 + 2KI \longrightarrow HgI_2 + 2KCl$

OR

Give reason:

a) Open hearth process provides better quality of steel than any other method.

=> Because

i) oxidation of impurities done by haematite ore instead of air.

ii) Fuel is saved by using regenerating system of heat.

iii) Percentage of carbon and silicon are decreased by adding scrap (unused) iron and low grade wrought iron.

~~b) corrosive sublimate with potassium thiocyanate.~~

b) A piece of Al or Zn can partially protect iron tank from rusting.

=> The iron or steel is wated in a thin layer of zinc. This stop oxygen and water reaching the ~~surface~~ metal underneath but the zinc also act as a sacrifical metal. zinc is more reactive than iron, so it oxidises in preference to the iron object.

c) Presence of acidic gases in the atmosphere increases the rate of rusting.

=> Due to formation of galvanic cell.

d) Haematite ore is separated by gravity separation method but not with froth floatation method.

=) Because froth floatation method is mainly used for the sulphide mineral & gravity separation method is gravity of ore and associated impurities. Hence, this ~~oxid~~ method is used for concentration of heavy oxide ore. Haematite ore is combination of iron & oxide & also it is heavy mineral oxide. Hence gravity separation is used.

G-C

9 a) From alcohols:-

a) Reaction with halogen acid (HX):

$$R-OH + \text{conc. } HCl \xrightarrow[\Delta]{\text{anhy. } ZnCl_2} R-Cl + H_2O$$

Alcohol — chloroalkane.

$$CH_3CH_2OH + \text{conc. } HCl \xrightarrow[\Delta]{\text{anhy. } ZnCl_2} CH_3CH_2Cl + H_2O$$

Ethanol — chloroethane.

b) Reaction with phosphorous halide (PX_5 or PX_3):-

$$R-OH + PX_5 \xrightarrow{\Delta} R-X + POX_3 + HX$$

$$CH_3CH_2OH + PCl_5 \xrightarrow{\Delta} CH_3CH_2Cl + POCl_3 + HCl$$

Ethanol — chloroethane — phosphoryl chloride

c) Rxn with thionyl chloride ($SOCl_2$) (Darzen's Rxn)

$$R-OH + SOCl_2 \xrightarrow[\Delta]{\text{Pyridine}} R-Cl + SO_2\uparrow + HCl$$

chloroethane.

$$CH_3CH_2OH + SOCl_2 \xrightarrow[\Delta]{\text{pyridine}} CH_3CH_2Cl + SO_2\uparrow + HCl$$

Ethanol — chloroethane

a) What is Lucas reagent?

⇒ The mixture of conc. HCl & anhydrous $ZnCl_2$ is called lucas reagent.

b) Is $ZnCl_2$ necessary for tertiary alcohol with HCl? If not why?

⇒ $ZnCl_2$ is not necessary for tertiary alcohol with HCl because the tertiary alcohol is more reactive.

c) Haloalkanes are slightly soluble in water. Give reason.

⇒ Due to intermolecular attraction bet^n haloalkanes & water molecules.

d) What is the order of boiling point for n-propyl chloride, isopropyl chloride & tertiary butyl chloride? Describe with suitable reason.

⇒

Given,

b) ⇒ $E^\circ_{Cu^{+2}/Cu} = 0.34V$

$E^\circ_{Ag^+/Ag} = 0.80V$

Now,

$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$

$= +0.80 - 0.34$

$= +0.846V$

Here,

E°_{cell} = +ve. so given reaction is feasible.

The KCl - bride cannot be used when any salt of lead, or silver is used in the cell because lead chloride & silver chloride are insoluble in water.

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⇒ Solution we have,

$$N = \frac{\%(w/W) \times \text{sp.grain} \times 10}{\text{Eq.wt.}}$$

$$= \frac{24.7 \times 1.18 \times 10}{49} = 5.948N$$

From law of equivalent proportions,

No of g.equ. of H_2SO_4 - No. of g-eq. of aluminium
= No. of g-equ. of remaining H_2SO_4 in dilute solution.

or, $\frac{N_1 \times V_1}{1000} - \frac{w}{E} = \frac{N_2 \times V_2}{1000}$

Or, $\frac{5.948 \times 75}{1000} = \frac{2.7}{27/3} = \frac{8 \times N_2 \times 100}{1000}$

Or, $N_2 = 0.365\ N$

Or, Normality of the free H_2SO_4 in the resulting solution $= 0.365\ N$.

Now, we have

Normality = Molarity x basicity

Or, molarity of free H_2SO_4 in the resulting solution

$= \frac{0.365}{2} = 0.182\ M$