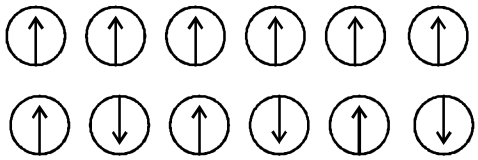


ferromagnetic

antiferromagnetic

Q 15. (a) Write the principle of electrolytic refining.
(b) Why does copper obtained in the extraction from copper pyrites have a blistered appearance ?
(c) What is the role of depressants in the froth floatation process ?

Ans 15. (a) Principle of electrolytic refining ⇒
Electrolytic refining is the process of refining impure metals by using electricity.
In this process, impure metal is made the anode and a strip of pure metal is made the cathode. A solution of a soluble salt of the same metal is taken as the electrolyte when an electric current is passed, metal ions from the electrolyte are deposited at the cathode as pure metal and impure metal from the anode dissolves into the electrolyte in the form of ions. The impurities present in the impure metal gets collected below the anode that is known as anode mud.

(b) The sulphur dioxide escapes the copper and this causes bubbles to appear and burst as SO_2 leaves. This causes the final product to have a very blistery appearance and hence it is called Blister Copper.

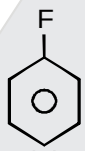
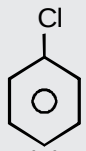
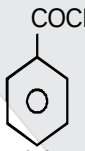
(c) In the froath floatation process, the role of the depressants is to seprate two sulphide ores by selectively preventing one ore from forming froath.

Q 16. Write the structures of compounds A, B and C in the following reactions :

(a) $CH_3-COOH \xrightarrow{NH_3/\Delta} A \xrightarrow{Br_2/KOH(aq)} B \xrightarrow{CHCl_3+alc.\ KOH} C$

(b) $C_6H_5N_2^+BF_4^- \xrightarrow[\Delta]{NaNO_2/Cu} A \xrightarrow{Fe/HCl} B \xrightarrow{CH_3COCl\ /\ pyridine} C$

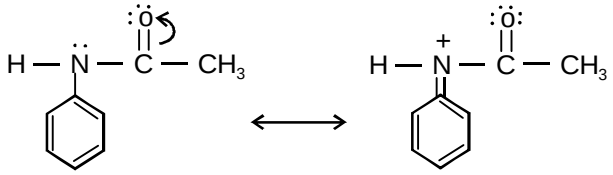
Ans 16. (a) $CH_3-COOH \xrightarrow{NH_3/\Delta} \underset{(A)}{CH_3CONH_2} \xrightarrow{Br_2/KOH(aq)} \underset{(B)}{CH_3NH_2} \xrightarrow[+\ alc.Kon]{CHCl_3} CH_3N \equiv C$

(b) $C_6H_5N_2^+\ BF_4^- \xrightarrow[\Delta]{NaNO_2Cu}$  $\xrightarrow{Fe|HCl}$  $\xrightarrow{CH_3COCl}$ 

(A) (B) (C)

Q 17. Give reasons for the following :
(a) Acetylation of aniline reduces its activation effect.
(b) CH_3NH_2 is more basic than $C_6H_5NH_2$.
(c) Although $-NH_2$ is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline.

Ans 17. (a) Direct nitration of aniline is not possible on account of oxidation of $-NH_2$ group. However, nitration can be carried after protecting the $-NH_2$ group by acelylation to give acetanilide which is then nitrated and finally hydrolysed to give o-and p-nitroaniline.
The acetyl group being electron withdrawing attracts the lone pair of electrons of the N– atom towards carbonyl group



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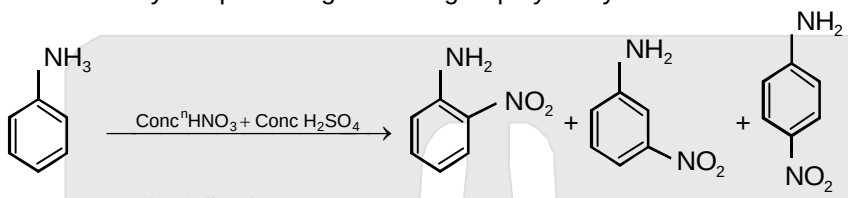
As a result the activating effct of $-NH_2$ group is reduced i.e. the lone pair of elctrons on nitrogen is less available for donation to benzene ring by resonance.

(b) Aniline $C_6H_5-NH_2$ has resonance form that delocalise the nitrogen's lone pair, making the nitrogen less available to accept a proton. This gives aniline less basic character than ammonia and alkyl amine like CH_3-NH_2 where as in CH_3-NH_2 there is no delocalization of l.p occur so l.p are available to accept proton that is why CH_3-NH_2 is more basic

(c) Direct nitration of aniline is carried out with a mixture of conc^n HNO_3 + conc. H_2SO_4
In the presence of these acids, aniline gets protonated to form annililiun ion, which is meta directing. Hence nitration of aniline gives meta derivative along with ortho and para. So nitration of aniline is carried out by first protecting ammine group by acetylation.



Q 18. Give reasons for the following :
(a) Red phosphorus is less reactive than white phosphorus.
(b) Electron gain enthalpies of halogens are largely negative.
(c) N_2O_5 is more acidic than N_2O_3.

Ans 18. (a) White phosphorous has a tetrahedral basic unit where four phosphorous atoms arranged at the four corners of a tetrahedron are joined together. This creates a highly strained system which is unstable & very reactive while red phosphorus is polymeric.

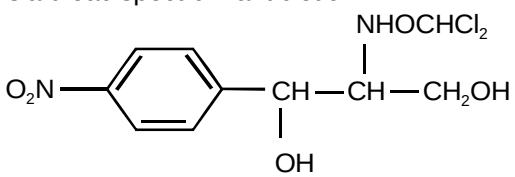
(b) Electron gain enthalpy of halogens are largely negative because it needs only one electron to achieve nearest noble gas configuration. so they have a great affinity for electrons & will accept them very easily by releasing energy.

(c) The acidic nature increases as the oxidation number of the element increases.

Q 19. Define the following :
(a) Cationic detergents
(b) Broad spectrum antibiotics
(c) Tranquilizers

Ans 19. (a) Cationic detergents :- A detergent that contains a cationic surfactants or a mixture of cationic surfactants as active ingredients in general, ionic surfactants are formulated in mixtures with non-ionic surfactants, therefore, purecationic detergents are relatively rare.

(b) Broad spectrum antibiotics :- Antibiotics that are effective against a wide range of gram positive and gram-negative bacteria are known as broad spectrum antibiotics.
Chloramphenicol is a broad spectrum antibiotic.



Chloramphenicol

(c) Tranquilizers :- Drugs which are used for treatment of stress, fatigue, mild and severe mental disease are called tranquilizers, they are essential components of all sleeping pills.

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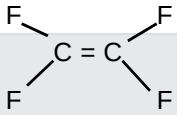
Tranquillizers are of many types and they work by different mechanism.

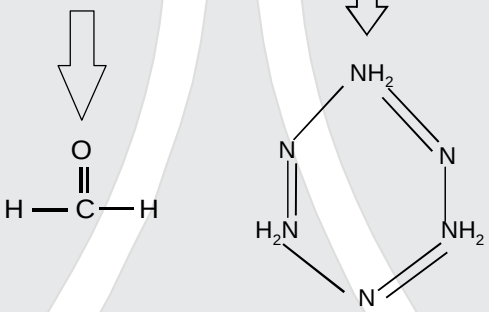
Eg. Noradrenaline → antidepressant drug.
(Iproniazed and phenelzine)
Chlordiazepoxide and meprobamate → mild tranquillizers
other examples are Equanil, Valium, Serotonin

Q 20. Write the structures of the monomers used for getting the following polymers :
(a) Teflon
(b) Melamine-formaldehyde polymer
(c) Neoprene

Ans 20. (a) Teflon ⇒
Monomer used is → Tetra fluoro ethylene

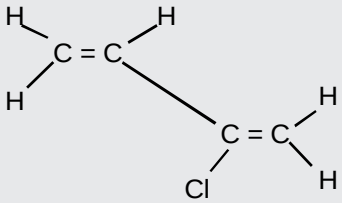


(b) Melamine – formaldehyde polymer
Monomers used are → formaldehyde & melamine



2, 4, 6 - Triamino -1, 3, 5 - triazine

(c) Neoprene ⇒
Monomer used is → Chloroprene



Q 21. The following compounds are given to you :
2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane
(a) Write the compound which is most reactive towards S_N2 reaction.
(b) Write the compound which is optically active.
(c) Write the compound which is most reactive towards β-elimination reaction.

Ans 21. (a) 1– Bromo pentane > 2 Bromopentane > 2 Bromo – 2 – methyl butane
(b) 2 Bromo pentane is optically active due to presence of chiral carbon.
(c) 2-Bromo-2-methyl butane, due to more substituted product.

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Q 22. A first order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed.
(Given : log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021)

Ans 22. For first order reaction $K = \frac{2\cdot303}{t}\log\frac{a}{a-x}$

For 25% decomposition time taken = 20 minutes

$a = 100$; $x = 25$

$$\Rightarrow K = \frac{2\cdot303}{20}\log\left(\frac{100}{100-25}\right)$$

$$\Rightarrow K = \frac{2\cdot303}{20}\log\left(\frac{100}{75}\right) \Rightarrow K = 0.0143\text{min}^{-1}$$

For 75% completion x = 75, a = 100

$$T = \frac{2\cdot303}{K}\log\left(\frac{100}{100-75}\right) \quad (\because K = 0.0143\text{min}^{-1})$$

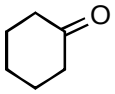
$$t = \frac{2\cdot303}{K}\log\left(\frac{100}{25}\right) = 96.96 \text{ minutes}$$

$$= 97 \text{ minutes}$$

Q 23. After watching a programme on TV about the presence of carcinogens (cancer causing agents) Potassium bromate and Potassium iodate in bread and other bakery products, Rupali a Class XII student decided to make others aware about the adverse effects of these carcinogens in foods. She consulted the school principal and requested him to instruct the canteen contractor to stop selling sandwiches, pizzas, burgers and other bakery products to the students. The principal took an immediate action and instructed the canteen contractor to replace the bakery products with some protein and vitamin rich food like fruits, salads, sprouts, etc. The decision was welcomed by the parents and the students.
After reading the above passage, answer the following questions :
(a) What are the values (at least two) displayed by Rupali ?
(b) Which polysaccharide component of carbohydrates is commonly present in bread ?
(c) Write the two types of secondary structures of proteins.
(d) Give two examples of water soluble vitamins.

Ans 23. (a) (i) She has the health conscious eating habits
(ii) She is very much concernes about her society too.
(b) Starch
(c) Alpha helices & beta pleated sheet
(d) Vitamin B & Vitamin C

Q 24. (a) Write the product(s) in the following reactions:

(i)  $+ \text{HCN} \longrightarrow ?$

(ii)  $+ \text{NaOH} \xrightarrow[\Delta]{\text{CaO}} ?$

(iii) $CH_3 - CH = CH - CN \xrightarrow[(b)\ H_2O]{(a)\ \text{DIBAL} - H} ?$

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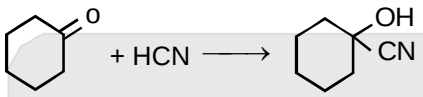
(b) Give simple chemical tests to distinguish between the following pairs of compounds :
(i) Butanal and Butan-2-one
(ii) Benzoic acid and Phenol

OR

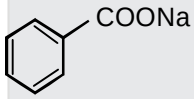
(a) Write the reactions involved in the following :
(i) Etard reaction
(ii) Stephen reduction

(b) How will you convert the following in not more than two steps :
(i) Benzoic acid to Benzaldehyde
(ii) Acetophenone to Benzoic acid
(iii) Ethanoic acid to 2-Hydroxyethanoic acid

Ans 24. (a) (i)



(ii)



$$+ NaOH \xrightarrow{CaO} C_6H_6 + Na_2CO_3$$

(iii) $CH_3 - CH = CH - CN \xrightarrow[H_2O]{DIBAL-H} CH_3 - CH = CH - \overset{O}{\overset{\|}{C}} - H$

(b) (i) Butanal and Butan-2-one - Aldehyde reduce tollen's reagent to Ag mirror. Aldehydes also reduce fehling solution (which is the mixture of fehling A - alkaline $CuSO_4$ solution and fehling B – alkaline solution of sodium potassium tartarate) gave a red precipitate of Cu_2O. Ketones don't give all of the above test.

(ii) Phenol and benzoic acid can be distinguisted by ferric chloride test

Phenol reacts with neutral $FeCl_3$ to form an iron-phenol complex giving violet colourism.

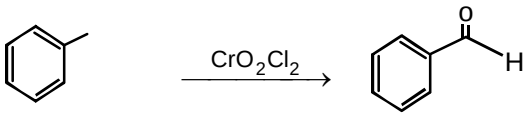
$$\underset{Phenol}{C_6H_5O_4} + FeCl_3 \longrightarrow \underset{\substack{Iron-phenol\ complex \\ violet\ colour}}{\left[Fe(OC_6H_5)_6\right]^{3-}} + 3H^+ + 3Cl_5$$

But benzoic acid reacts with neutral $FeCl_3$ to give a buff coloured ppt of ferric benzoate

$$3C_6H_5O_4 + FeCl_3 \longrightarrow \underset{\text{ferric benzoate}}{(C_6H_5COO)_3}\,Fe + 3\,HCl$$

OR

(a) (i) Etard react → It is a chemical reaction that involves the direct oxidation of an aromatic hetero cyclic bonded methyl group to an aldehyde using chromyl chloride.



(ii) Stephen reduction → Stephen reaction is used to synthesis aldehydes from nitriles. In this reaction, the nitrile compound is first converted to an iminium salt in presence of catalyst tin (II) Chloride. This is simple the reduction of CN group to $CHNH_2^+\ Cl^-$ (iminium salt). The

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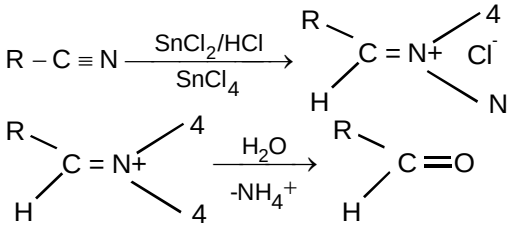
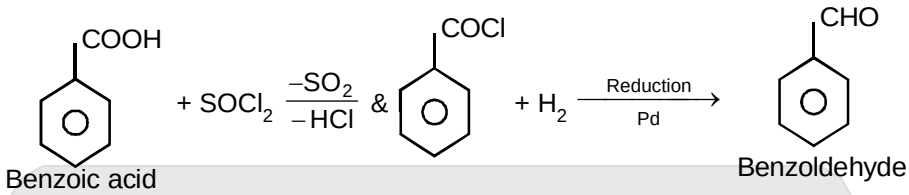
imminium salt formed as an intermediate undergoes hydrolysis reaction to form an aldehyde.



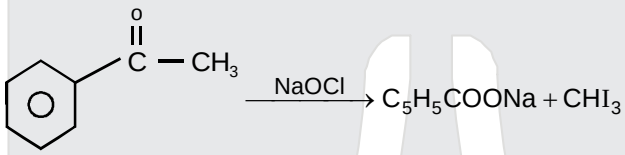
(b) (i)



Benzoic acid

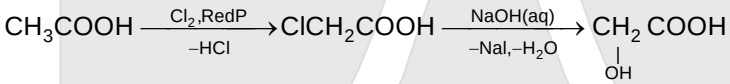
Benzoldehyde

(ii)



(iii) $C_6H_5COONa + H_2O \longrightarrow C_6H_5COOH + NaOH$

(c)



Q 25. (a) Account for the following :

(i) Transition metals show variable oxidation states.

(ii) Zn, Cd and Hg are soft metals.

(iii) E° value for the Mn^{3+}/Mn^{2+} couple is highly positive (+ 1.57 V) as compared to Cr^{3+}/Cr^{2+}.

(b) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

OR

(a) Following are the transition metal ions of 3d series :

Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}

(Atomic numbers : Ti = 22, V = 23, Mn = 25, Cr = 24)

Answer the following :

(i) Which ion is most stable in an aqueous solution and why ?

(ii) Which ion is a strong oxidising agent and why ?

(iii) Which ion is colourless and why ?

(b) Complete the following equations :

(i) $2\,MnO_4^- + 16\,H^+ + 5\,S^{2-} \longrightarrow$

(ii) $KNnO_4 \xrightarrow{\text{heat}}$

Ans 25. (a) (i) The transition metals have there valence electrons in (n–1)d and ns orbitals, since there is very little energy difference between these orbitals both energy levels can be used for bond formation thus transition elements exhibits variable oxidation states.

(ii) Zinc, cadmium, mercury are metals with low melting point. This is because they have stable electron configuration.

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$Zn \rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2$

$Cd \rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3d^{10}, 4s^2, 4p^6, 4d^{10}, 5s^2$

$Hg \rightarrow [Xe]\ 4f^{14}, 5d^{10}, 6s^2$

fully filled configuration Hence, the metallic bonding is very weak.

(iii) E° value for the Mn^{3+}/ Mn^{2+} couple is highly positive (+ 1.57V) as compared to Cr^{3+} / Cr^{2+}. The reason to this is –

(a) half filled configuration of Mn^{+2} :- Mn^{+2} exists in $3d^5$ configuration which is half filled configuration and such half filled configurations provide extra stability to the metal ion, while Mn^{+3} will exist in $3d^4$ configuration which is less stable than $3d^5$, Hence the conversion from +3 to +2 is very feasible, Hence E° value is +ve depicting that $\Delta G°$ being –ve, and we know when $\Delta G°$ becomes –ve the reaction is feasible.

(b) half filled configuration of Cr^{+3} :- Because of $3d^3$ half filled d orbitals extra stability is attained by Cr^{+3} than Cr^{+2} hence $Cr^{+3} \longrightarrow Cr^{2+}$ is less feasible, Hence reaction being against the stability has less E° value.

(b) Similarity between lanthanides and actinides

(1) Both the series show+3 oxidation state.

(2) In both the series the f-orbitals are filled gradually.

(3) Ionic radius of the elements in both the series decreases with the increase in atomic no.

Difference between lanthanides and actinides

(1) lanthanides have the ability to show a maximum oxidation state of +4 while actinides show oxidation state of +3, +4, +5, +6 and +7

(2) lanthanides do not form complexes easily, Actinides have a greater tendency to form complexes with ligands such as thioethers.

(3) lanthanides do not from oxocations, but actinides form oxocation such as Uo^+, PuO^+, NpO_2^+.

OR

(a) Cr^{+3} is more stable because it has half filled t_{2g} level (i.e t_{2g}^3)

(b) Mn^{+3} is strong oxidising agent because Mn^{+3} has $3d^4$ configuration, which is less stable and it has tendency to be reduced into more stable (half filled) Mn^{+2} ($3d^5$).

(c) Ti^{+4} is colourless because (Ti^{4+} (z = 22) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^0$,) have completely empty d-orbitals and there are no. electrons for the d-d transition thus they are colourless.

(b) (i) $2MnO_4^- + 16H^+ + 5S^{2-} \longrightarrow 2Mn^{2+}(aq) + 5(s) + 8H_2O(l)$

(ii) $KMnO_4 \xrightarrow{\text{heat}} K_2MnO_4 + MnO_2 + O_2\uparrow$

Q 26. (a) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K
Given :

(Molar mass of sucrose = 342 g mol^{-1})

(Molar mass of glucose = 180 g mol^{-1})

(b) Define the following terms :

(i) Molality (m)

(ii) Abnormal molar mass

OR

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(a) 30 g of urea (M = 60 g mol^{-1}) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

(b) Write two differences between ideal solutions and non-ideal solutions.

Ans 26. (a) Let the solution's mass be 100 gm

10% solution (by mass) of sucrose contains

10 gm sucrose in 90 gm of water

$$\text{molality} = \frac{A_Z\ (solute)}{W_1\ (solvent)}$$

$$= \frac{\frac{10}{342}}{\frac{90}{1000}} \qquad \Rightarrow \quad m = \frac{10}{342} \times \frac{1000}{90}$$

$$m = 0.3248 \text{ molal}$$

for sucrose solution, $T_f = 269.15$ K

for pure water $T_f^\circ = 273.15$

$\Delta T_f = K_f \cdot m$

$(273.15 - 269.15) = K_f \cdot \times 0.3248$

$$K_f = \frac{4}{0.342}$$

$$K_f = 12.31 \text{ K kg mol}^{-1}$$

$\Rightarrow$ 10% solution of glucose, in 100 gm solution

10 gm glucose , 90 gm water

$$\text{molality} = \frac{\frac{10}{180}}{\frac{90}{1000}} = \frac{10}{180} \times \frac{1000}{90} = 0.617 \text{ molal}$$

$$\Delta T_f = K_f \cdot m$$

$$\Delta T_f = 12.31 \times 0.617$$

$$\Delta T_f = 7.595 \text{ K}$$

$$\approx 7.6 \text{ K}$$

freezing point of glucose solution $= 273.15 - 7.6$

$$= 265.55 \text{ K}$$

(b) (i) Molality (m) : It is defined as number of moles of solute, dissolved in per k.g. of solvent.

(ii) Abnormal Molar mass :- The compounds which are dissociated or associated in solvent provide different theoretical and experimental values for colligative properties and molar mass calculated are different than expected value such a molar mass that is either higher or lower than expected or normal value is called Abnormal molar mass

OR

(a) 30 gm of urea dissolved in 846 gm of water given,

for pure water $P^\circ = 23.8$ mm Hg.

Number of moles $n_{urea} = \frac{30}{60} = 0.5$

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$$n_{H_2O} = \frac{846}{18} = 47$$

R.L.V.P. $\Rightarrow$

$$\frac{P^0 - P_s}{P_0} = \frac{n_{urea}}{n_{urea} + n_{HZO}}$$

$$\frac{23.8 - P_s}{23.8} = \frac{0.5}{0.5 + 47}$$

$$23.8 - Ps = 0.0105 \times 23.8$$

$$Ps = 23.55 \text{ mmHg}$$

(b)

Ideal solution	Non-ideal Solution
1. Obey's Raoult's law	1. Does not obey Raoult's
2. $\Delta_{mix}V = 0$, $\Delta_{mix}H = 0$	2. $\Delta_{mix}V \neq 0$, $\Delta_{mix}H \neq 0$

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