

CBSE 2019 Sample Question Paper

CHEMISTRY

SOLUTION

Section A

1. The excess energy (over and above the average energy of reactants) which must be supplied to the reactants to undergo a chemical reaction.
2. When the molecules of the adsorbate are held to the surface of the adsorbent by the chemical forces or chemical bonds, the adsorption is called chemical adsorption.
3. $3\text{Cu} + 8\text{HNO}_3 \text{ (dilute)} \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$
4. The strength of a ligand is determined by the amount of crystal field energy. Since 'CO' causes more crystal field splitting than Cl^- , it has more crystal field energy and thus is a stronger ligand than Cl^- .
5. Lower alcohols and water are miscible in all proportions due to hydrogen bonding between alcohol and water molecules.
6. Adenine and Guanine
7. 3-Bromo-2-methyl prop-1-ene.
8. Pentan-2-one and Pentan-3-one can be distinguished by iodoform test.

9. Packing efficiency = $\frac{z \times \text{Volume of each sphere in unit cell}}{\text{Total volume of unit cell}} \times 100$

For simple cubic

$$\begin{aligned} \text{Packing efficiency} &= \frac{1 \times \frac{4}{3} \pi r^3}{a^3} \times 100 = \frac{\frac{4}{3} \pi r^3}{(2r)^3} \times 100 = \frac{\frac{4}{3} \pi r^3}{8r^3} \times 100 \\ &= 52.4\% \end{aligned}$$



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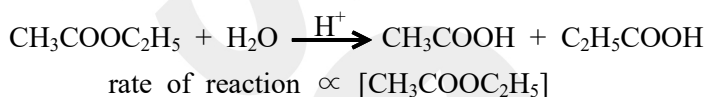
10. Paramagnetism : The substances which have permanent magnetic dipoles and are attracted by the magnetic field are known as paramagnetic substances. They lose their magnetism in the absence of magnetic field. Ex. - Cu^{2+} , Fe^{3+} , Ti_2O_3 etc.

Section B

11. **Weak Electrolyte** : The electrolyte which does not ionize easily and completely. Ex- CH_3COOH , NH_4OH etc.

Strong Electrolyte : The electrolyte which ionized easily and completely. Ex- HCl , H_2SO_4 , NaOH etc.

12. **Pseudo First Order Reaction** : Reactions which are not truly of the first order but under certain conditions become reactions of the first order are called Pseudo-first order reactions.

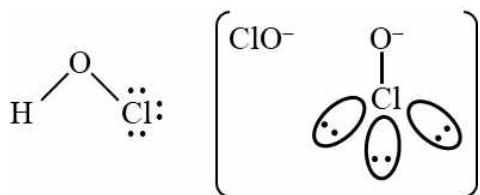


13.

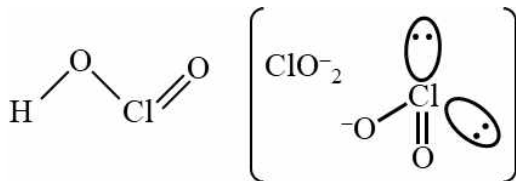
- (i) Elementary step in a reaction : The reaction taking place in one step is called elementary reaction, in case of simple reactions, elementary step is only one step in which all atoms, ions or molecules of the reactants present in the balanced chemical reaction can come together simultaneously to collide with each other.
- (ii) Rate determining step of a reaction : In case of complex reactions, there are more than one step involved in the reaction but the overall rate of the reaction depends upon the slowest step. Hence, the slowest step is called the rate determining step.

14.

- (i) HOCl



- (ii) HOClO



15.

- (i) Oxygen exists in diatomic form as O_2 due to the strong tendency to form multiple bonds ($P\pi-P\pi$ interaction) with other oxygen atom because of which the intermolecular forces in it are weak Vander Waal forces as it is small in size with high electron density which tend to repel the other O_2 molecules. As a result it exists as gas.
- (ii) On the other hand sulphur exist or staggered 8-atom rings. Which are hold together by strong Co-valent bonds and exists as a polyatomic molecule, in which intermolecular forces are strong. So, it exists as a solid

16.

- (i) “CO” is in +3 oxidation state.



Hybridization $\rightarrow d^2sp^3$ (octahedral), Paramagnetic

- (ii) $[Ni(CN)_4]^{2-}$

Ni is in +2 oxidation state

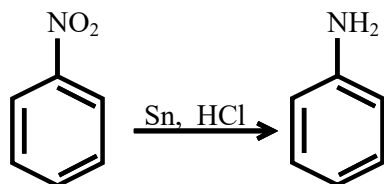


Hybridization $\rightarrow dsp^2$ (square planar), Diamagnetic

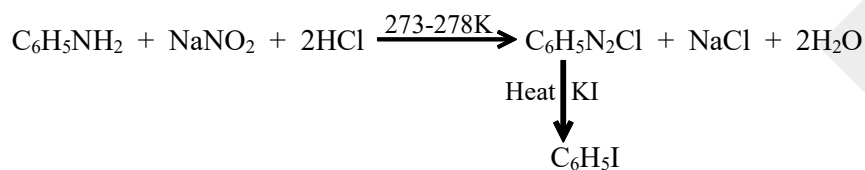
Section C

17.

- (i) Reduction of nitrobenzene will produce aniline



- (ii)

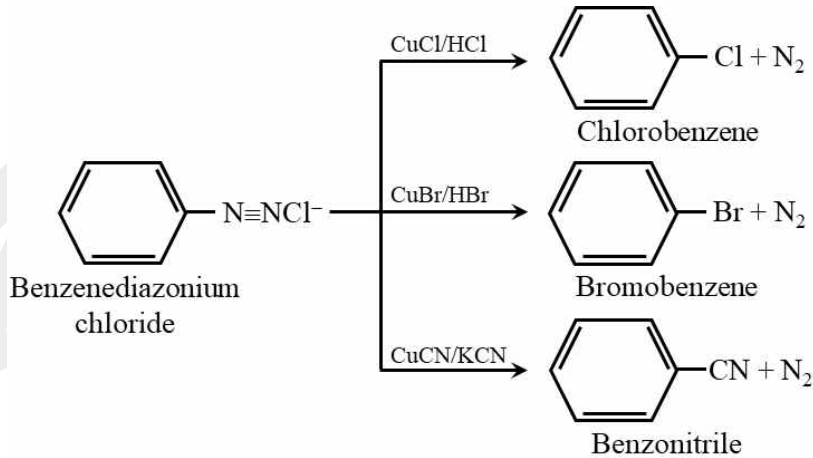


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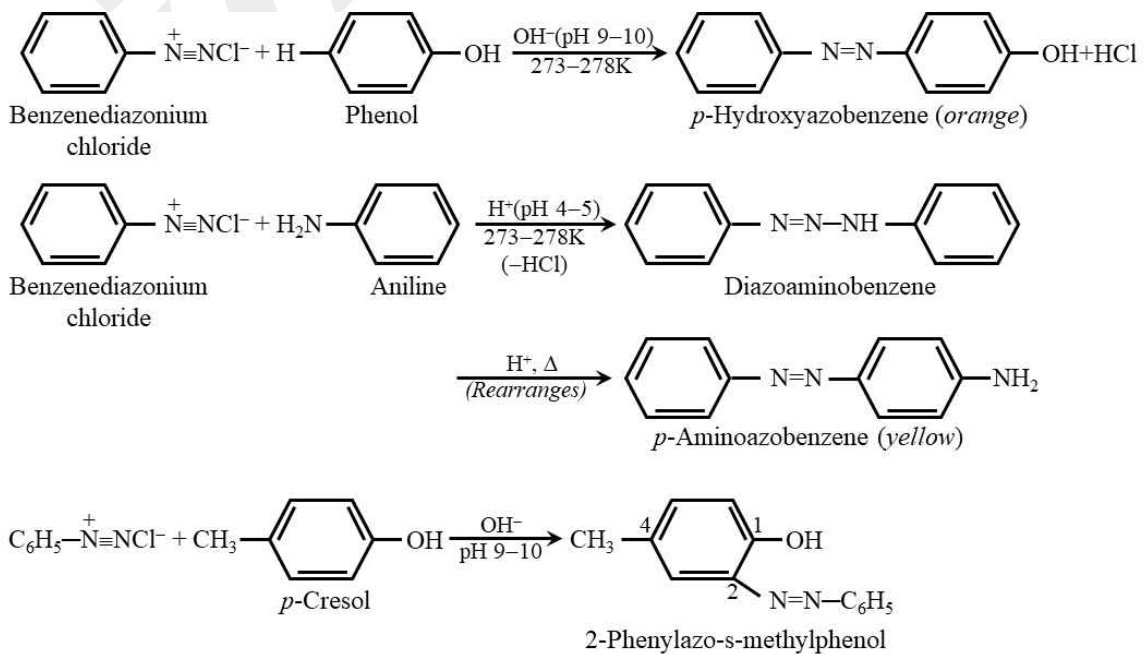
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18.

(i)

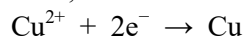


(ii)

19. $I = 1.5\text{A}$

$$t = 16 \times 60 = 960 \text{ sec}$$

$$Q = It = \frac{1.5}{10} \times 960$$

Now, $Q = 1440 \text{ coulomb}$ 
 $2F(2 \times 96500\text{C})$ of electricity required to deposit 63.5gm Cu.

$$\therefore 1440 \text{ coulomb will deposit} = \frac{63.5 \times 1440}{2 \times 96500} = \frac{9144}{2 \times 9650} = 0.47\text{gm}$$


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20.

S.NO.	Property	True Solutions	Colloidal Solutions	Suspensions
1.	Nature	Homogeneous	Heterogeneous	Heterogeneous
2.	Particle size (diameters)	Less than 10^{-9} m or nm (i.e., 10\AA)	Between 10^{-9} to 10^{-6} m or 1 nm (i.e., 10\AA to 10000\AA).	More than 10^{-6} m or 1000 nm (i.e., $>10000\text{\AA}$)
3.	Settling	Do not settle.	Do not settle	Settle on standing.
4.	Diffusion	Diffuse quickly.	Diffuse slowly.	Do not diffuse.
5.	Appearance	Clear and transparent	Translucent.	Opaque.

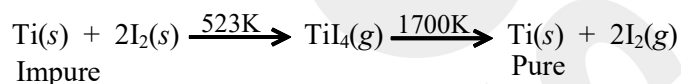
21.

- (i) Pig iron is converted into steel as follows :
- The carbon content from 3-4% present in pig iron is reduced to 0.05-1.5% in steel.
 - The impurities of S, P, Si, Mn etc. Present in pig iron are removed either by oxidizing them to volatile oxides or through slag formation.
 - Alloying elements such as Cr, Ni, Mn, V, Mo and W are added to obtain steel of desirable properties.



It should be noted that $\Delta_f G^\circ$ of CO_2 from CO is always higher than that of ZnO, Therefore, Co can not be used for reduction of ZnO to Zn.

(iii)

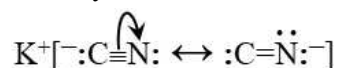


22.

- (i) Since PtF_6 oxidises O_2 to O_2^+ , Bartlett thought that PtF_6 should also oxidise Xe to Xe^+ because the ionization enthalpies of O_2 (1175 kJ mol^{-1}) and Xe (1170 kJ mol^{-1}) are quite close.
- (ii) **Uses of Neon :** Neon is mainly used in discharge tubes and fluorescent lamps for advertising purposes. Neon when used in a discharge tube produces an orange red glow which can be seen at long distances even in mists and fogs. However, when neon is mixed with other gases and used in discharge tubes, glows of different colours known as neon signs are produced. These are widely used for advertising purposes. Neon bulbs are also used in botanical gardens and green houses.
- Uses of Argon :** Argon is used mainly to provide an inert atmosphere in high temperature metallurgical processes such as are welding of metals and alloys.

23.

- (i) KCN is a resonance hybrid of the following two contributing structure :

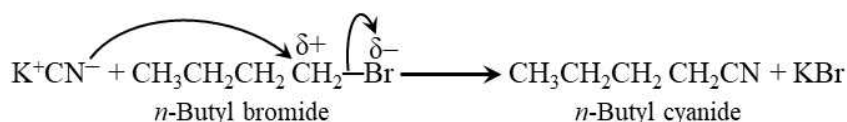


Thus, CN^- ion is an ambident nucleophile. Therefore, it can attack the carbon atom of C—Br bond in *n*-BuBr either through C or N. Since C—C bond is stronger than C—N bond, therefore, attack occurs through C to form *n*-butyl cyanide.



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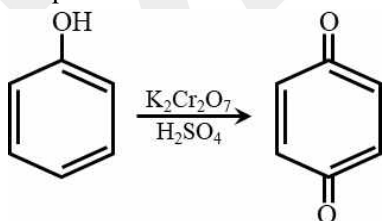
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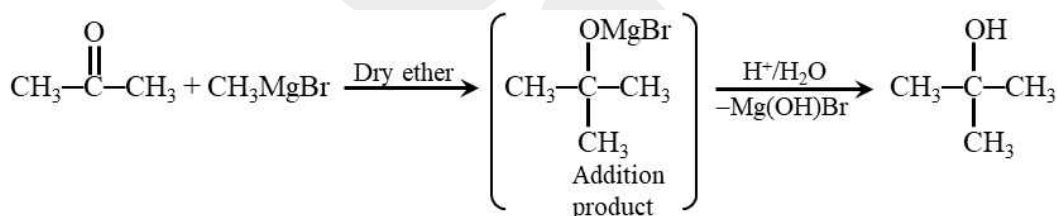
- (ii) Due to greater s -character, a sp^2 -hybrid carbon is more electronegative than a sp^3 -hybrid carbon. Therefore, the sp^2 -hybrid carbon of C—Cl bond in chlorobenzene has less tendency to release electrons to Cl than a sp^3 -hybrid carbon of cyclohexyl chloride. As a result, the C—Cl bond in chlorobenzene is less polar than in cyclohexyl chloride. In other words, the magnitude of negative charge, i.e., δ^- is less on Cl atom of chlorobenzene than in cyclohexyl chloride. Therefore, chlorobenzene has lower dipole moment than cyclohexyl chloride due to lower magnitude of $-ve$ charge on the Cl atom and shorter C—Cl distance.

24.

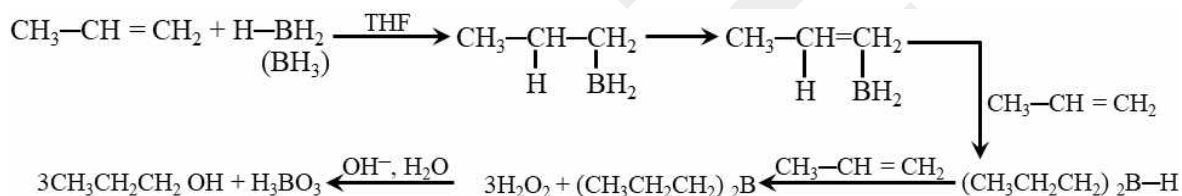
- (i) **Oxidation** : Oxidation of phenol with chromic acid produces a conjugated diketone known as p-benzoquinone.



(ii)



(iii)



25.

- (i) **Peptide linkage** : Proteins are condensation polymers of α -amino acids in which the same or different α -amino acids are connected by peptide bonds. Chemically, a peptide bond is an amide linkage formed between $-\text{COOH}$ group of one α -amino acid and $-\text{NH}_2$ group of the other α -amino acid by loss of a molecule of water.
- (ii) **Primary structure** : Proteins may contain one or more polypeptide chains. Each polypeptide chain has a large number of α -amino acids which are linked to one another in a specific sequence. The specific sequence in which the various α -amino acids present in a protein are linked to one another is called its primary structure. Any change in the sequence of α -amino acids creates a different protein.
- (iii) **Denaturation** : Each protein in the biological system has a unique three-dimensional structure and has specific biological activity. This is called native form of a protein. When

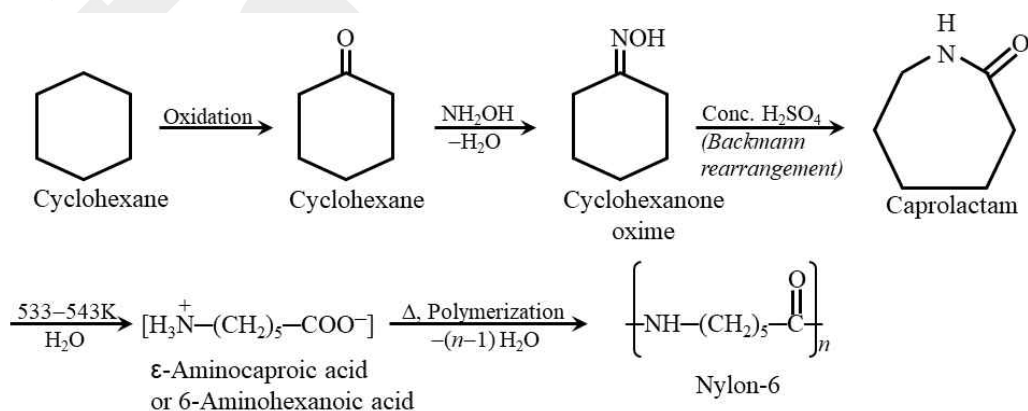

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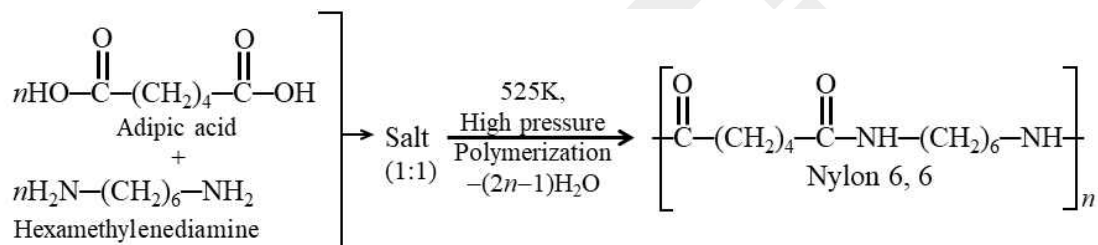
a protein in its native form is subjected to physical changes such as change in temperature, pH, etc. hydrogen bonds are broken. Due to cleavage of hydrogen bonds, unfolding of protein molecule occurs and the protein loses its biological activity. This loss of biological activity is called denaturation. As a result of denaturation, globular proteins (soluble in H₂O) are converted into fibrous proteins (insoluble in H₂O). In other words, denaturation leads to coagulation. That is why coagulated proteins are also called denatured proteins. The most common example of denaturation of proteins is the coagulation of albumin present in the white of an egg. When the egg is boiled hard, the soluble globular protein present in it is denatured and is converted into insoluble fibrous protein. Another example is curdling of milk which is caused due to formation of lactic acid by the bacteria present in milk.

26.

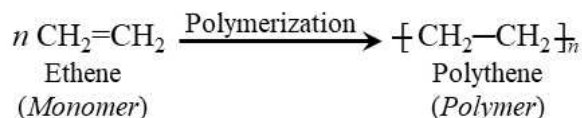
(i)



(ii)



(iii)



27.

- (i) DMSA
- (ii) Cannabinoid compounds
- (iii) Herbal medicine, Macrobiotic diets, Gerson regimen
- (iv) By using the chelate therapy, We can overcome the problems in medicinal chemistry


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Section D

28.

- (i) 15% H
- ₂
- SO
- ₄
- solution means 15gm of H
- ₂
- SO
- ₄
- is present in 100gm of water (solution)

$$\text{No. of moles of H}_2\text{SO}_4 = \frac{15}{98} = 0.153 \text{ mol.}$$

$$\text{Weight of solvent (water)} = 100\text{gm} - 15\text{g} = 85\text{gm}$$

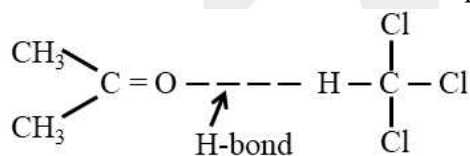
$$\therefore \text{molality (m)} = \frac{0.153}{85} \times 10^3 = 1.8 \text{ molal}$$

Now,

$$\text{Volume of solution} = \frac{\text{mass}}{\text{density}} = \frac{100}{1.020} \text{ g/cm}^3 = 98.03 \text{ g/cm}^3 = 0.098 \text{ litre}$$

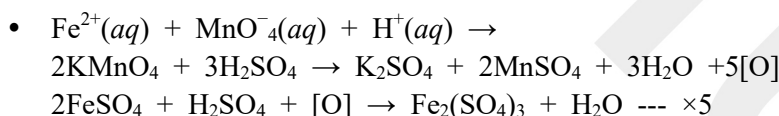
$$\therefore M = \frac{0.153}{0.098} = 1.56 \text{ molar}$$

- (ii) When Acetone and chloroform are mixed, there are new attractive forces due to intermolecular hydrogen bonding. Thus, the attractive forces become stronger and the escaping tendency of each liquid from the solution decreases. Therefore, the vapour pressure of the solution is less than that expected for an ideal solution.

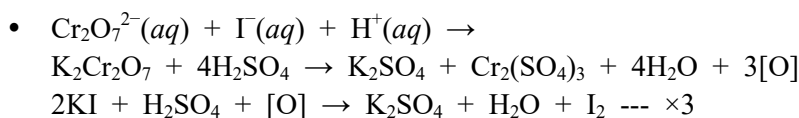
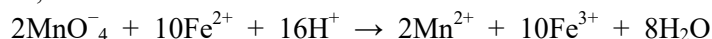


29.

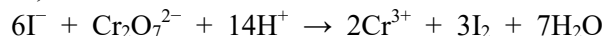
(i)



or,



or,


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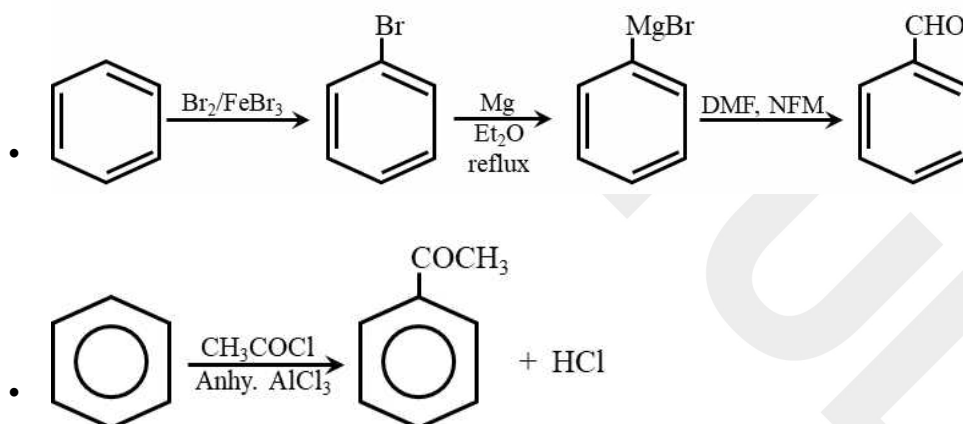
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(ii)

- The transition metals form a large number of interstitial compounds in which small atoms such as hydrogen, carbon, boron and nitrogen occupy the empty spaces (interstitial sites) in their lattices. They are represented by formulae like TiC, TiH₂, Mn₄N, Fe₃H, Fe₃C* etc. However, actually they are non-stoichiometric materials, e.g., TiH_{1.7}, VH_{0.56} etc. and the bonds present in them are neither typically ionic nor covalent.
- Cr²⁺ has the configuration 3d⁴. It can lose electron to form Cr³⁺ which has the stable 3d³ configuration (as it has half-filled t_{2g} level). Hence, it is reducing. On the other hand, Mn³⁺ also has 3d⁴ configuration but it can gain electron to form Mn²⁺ which has stable 3d⁵ configuration (as it is exactly half-filled). Hence, it is oxidizing.
Alternatively : E° value for Cr³⁺/Cr²⁺ is negative (−0.41V) whereas E° value for Mn³⁺/Mn²⁺ is positive (+1.57V). Hence, Cr²⁺ ion can easily undergo oxidation to give Cr³⁺ ion and, therefore, acts as strong reducing agent whereas Mn³⁺ can easily undergo reduction to give Mn²⁺ and hence acts as oxidizing agent.
- Cu²⁺(aq) is much more stable than Cu⁺(aq). This is because although second ionization enthalpy copper is large but Δ_{hyd} H for Cu²⁺(aq) is much more negative than that for Cu⁺(aq) and hence it more than compensates for the second ionization enthalpy of copper. Therefore, many copper (I) compound are unstable in aqueous solution and undergo disproportionation as follows : 2Cu⁺ → Cu²⁺ + Cu.

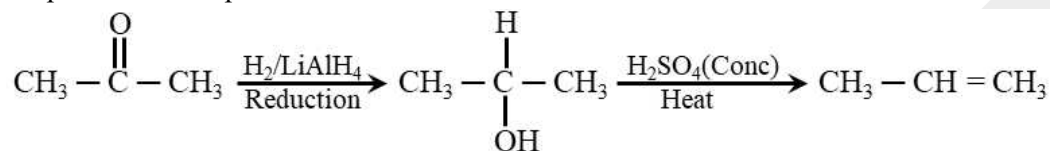
30.

(i)

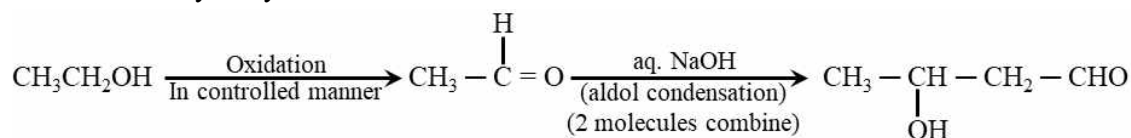


(ii)

- Propanone to Propene

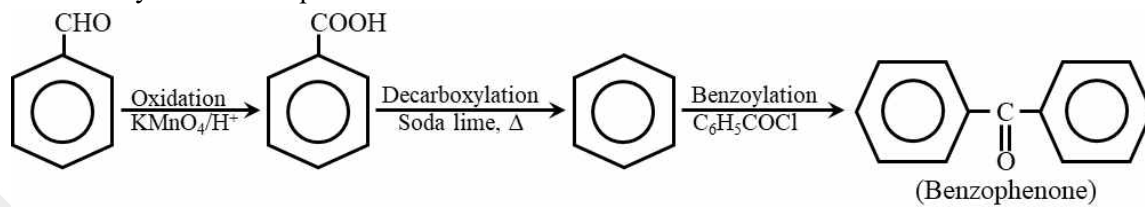


- Ethanol to 3-hydroxy butanal


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- Benzaldehyde to benzophenone

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