Scholars Den Mock Test: Sure Success Recipe
CBSE Class 12 Chemistry Solution

Section– A

1.
Ans. c

2.
Ans. c

3.
Ans. c

4.
Ans. b

5.
Ans. c

OR

Ans. c

6.
Ans.d

7.
Ans. a

8.
Ans. b

9.
Ans.d

OR

Ans.c

10.
Ans.c

Ans. 11 (b) 12 (d) 13 (b)

14.

Ans. IO_3^-

15.

Ans. +3

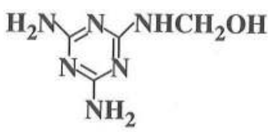
16.

Sol. $\Delta_{mix}H \neq 0$ and $\Delta_{mix}V \neq 0$

17.

Sol. Phenol is a weaker acid than carbonic acid (H_2CO_3) and hence does not liberate CO_2 from sodium bicarbonate.

18.



(Resin intermediate)

Sol. Melamine and formaldehyde are starting materials for this intermediate. Its polymerisation gives melamine polymer.

OR

Sol. Yes, step growth polymers are condensation polymers and they are formed by the loss of simple molecules like water leading to the formation of high molecular mass polymers.

19.

Sol. Copper exhibits +2 oxidation state where init has incompletely filled *d* orbitals ($3d^9\,4s^0$) hence a transition element.

OR

Sol. Chromatography

20.

Sol. It provides the flux CaO which removes the impurity SiO_2 present in the ore by forming fusible calcium silicate slag.

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2; \quad SiO_2 + \underset{\text{Flux}}{CaO} \longrightarrow \underset{\text{Slag}}{CaSiO_3}$$

Section– B

21.

Sol. 0.1 M KCl solution will have higher boiling point as KCl dissociates in the solution.

22.

Sol. (*i*) Impure nickel when heated in a current of CO forms volatile complex nickel tetracarbonyl, $Ni(CO)_4$ leaving behind impurities.

$$Ni + 4CO \xrightarrow{330-350K} Ni(CO)_4$$

The nickel tetracarbonyl complex thus obtained is then heated to a higher temperature so that it is decomposed to give pure metal.

$$Ni(CO)_4 \xrightarrow{450-470K} Ni + 4CO$$

(*ii*) Graphite rod acts as anode and steel vessel lined with carbon acts as cathode in the electrometallurgy of aluminium.

Carbon reacts with oxygen liberated at anode producing CO and CO_2 otherwise oxygen liberated at the anode may oxidise some of the liberated aluminium back to Al_2O_3.

At Anode: $C(s) + O^{2-}(\text{melt}) \longrightarrow CO(g) + 2e^-$

$C(s) + 2O^{2-}(\text{melt}) \longrightarrow CO_2(g) + 4e^-$

At Cathode: $Al^{3+}(\text{melt}) + 3e^- \longrightarrow Al\ (l)$

23.

Sol. $\Delta T_b = 353.93\text{ K} - 353.23\text{ K} = 0.7\text{ K}$

Substituting $W_B = 1.5$ g, $W_A = 90$ g, $\Delta T_b = 0.7$ K, $K_b = 2.52$ K kg mol^{-1} in the expression

$M_B = \dfrac{K_b \times W_B \times 1000}{\Delta T_b \times W_A}$, we get

$$M_B = \frac{2.52 \times 1.5 \times 1000}{0.7 \times 90}$$

$\mathbf{M_B = 60\ g\ mol^{-1}}$

OR

Sol. Here, $W_B = 60$ g, $M_B = 180$ g mol^{-1}, $W_A = 250$ g, $K_f = 1.86$ K kg mol^{-1}

Substituting these values in the expression

$\Delta T_f = \dfrac{K_f \times W_B \times 1000}{M_B \times W_A}$, we get

$$\Delta T_f = \frac{1.86 \times 60 \times 1000}{180 \times 250} = 2.48\text{ K}$$

Freezing point of solution, $T_f = T_f^{\circ} - \Delta T_f = 273.15\text{ K} - 2.48\text{ K} = \mathbf{270.67\ K}$

24.

Sol. The metal ions (Zn^{2+}) formed by the loss of electrons will accumulate in one electrode and the negative ions (SO_4^{2-}) will accumulate in the other. Thus, the solutions will develop charges and the current will stop flowing. Moreover, the inner circuit will not be completed.

OR

Sol. Negative E^{o}_{cell} value means $\Delta_r G^{o}$ will be +ve, and the cell will not work.

25.

Sol. As the reaction proceeds, concentration of ions in anodic half keeps on increasing while in the cathodic half it keeps on decreasing. Hence, their electrode potentials also keep on changing till ultimately they become equal and then e.m.f. of the cell becomes zero.

26.

Sol. $\Lambda_m = \frac{\kappa \times 1000}{C} = \frac{0.025\ S\ cm^{-1} \times 1000\ cm^3\ L^{-1}}{0.2\ mol\ L^{-1}} = \mathbf{125\ S\ cm^2\ mol^{-1}}$

OR

Sol. $\Lambda_m = \frac{\kappa \times 1000}{M}$

$\kappa = \frac{\Lambda_m \times M}{1000}$

$\kappa = \frac{138.95\ S\ cm^2 mol^{-1} \times 1.5\ mol\ L^{-1}}{1000\ cm^3\ L^{-1}} = 0.208\ Scm^{-1}$

27.

Sol. During an elementary reaction, the number of atoms or ions colliding to react is referred to as molecularity. Had this been an elementary reaction the order of reaction with respect to B would have been 1, but in the given rate law it is $\frac{3}{2}$. This indicates that the reaction is not an elementary reaction.

Section– C

28.

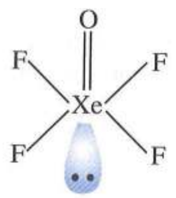
Sol. (*i*) $2Fe^{3+} + SO_2 + 2H_2O \longrightarrow 2Fe^{2+} + 4H^+ + SO_4^{2-}$

(*ii*) $S + 2H_2SO_4 \longrightarrow 3SO_2 + 2H_2O$

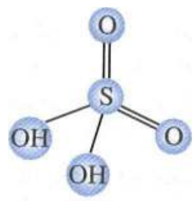
(*iii*) $XeF_6 + \underset{\text{(excess)}}{3H_2O} \longrightarrow XeO_3 + 6HF$

OR

Sol.



$XeOF_4$



H_2SO_4

29.

Sol. (*i*) The electronic configuration of Mn^{2+} is [Ar] $3d^5$ which is half filled and hence stable. So, Mn^{2+} cannot lose third electron easily. On the other hand, Fe^{2+} has electronic configuration [Ar] $3d^6$. It tends to lose one electron to acquire stable [Ar] $3d^5$ electronic configuration. Hence Mn^{2+} is more stable than Fe^{2+} towards oxidation.

(*ii*) Ti^{3+} has one unpaired electron in *d*-orbitals ($3d^1$) which can absorb light in visible region for *d–d* transition. Hence, it is coloured in aqueous solution. Sc^{3+} has no *d* electron ($3d^0$), therefore, no light is absorbed for *d–d* transition. Hence, it is colourless in aqueous solution.

(*iii*) Oxometal anions have the highest oxidation state, *e.g.*, Cr in $Cr_2O_7^{2-}$ has an oxidation state of +6 whereas Mn in MnO_4^- has an oxidation state of +7. This is again due to the combination of the metal with oxygen, which is highly electronegative and oxidising element.

30.

Sol. (*i*) Because the sum of sublimation enthalpy and hydration enthalpy to convert Cu(*s*) to $Cu^{2+}(aq)$ is so high that it is not balanced by its hydration enthalpy.

(*ii*) Cr is strongest reducing agent in +2 oxidation state. Cr^{2+} has configuration $3d^4$. After losing one electron it forms Cr^{3+} which has stable half filled t_{2g} level.

(*iii*) $Zn^{2+}(3d^{10})$ has completely filled *d*-orbitals. As a result of this, *d*-*d* transition cannot occur and hence Zn^{2+} salts are colourless.

OR

Sol. (*i*) The catalytic activity of transition metals is attributed to the following reasons:

(*a*) Because of their variable oxidation states transition metals form unstable intermediate compounds and provide a new path with lower activation energy for the reaction.

(*b*) In some cases, the transition metal provides a suitable large surface area with free vacancies on which reactants are adsorbed.

(*ii*) This is due to filling of 4*f*-orbitals which have poor shielding effect or due to lanthanoid contraction.

(*iii*) This is due to more comparable energies of 5*f*, 6*d* and 7*s* orbitals in actinoids.

31.

Sol. (*i*) (*a*) As oxygen stabilises manganese more than fluorine by forming multiple bonds.

(b) $n + l$ rule: For $3d = n + l = 3 + 2 = 5$

$4s = n + l = 4 + 0 = 4$

So, electron will enter in 4*s* orbital.

Ionisation enthalpy is responsible for the ionisation of atom, 4*s* electrons are loosely held by the nucleus. So, electrons are removed from 4*s* orbital prior to 3*d*.

(*ii*) $\underset{\text{Manganate ion}}{3MnO_4^{2-}} + 4H^+ \longrightarrow \underset{\text{Permanganate ion}}{2MnO_4^-} + MnO_2 + 4H_2O$

32.

Sol. (*i*) **Crystal field splitting:** When the ligands approach the central metal ion, the electrons in the *d*-orbitals of central metal ion will be repelled by the lone pairs of the ligands. Because of these interactions the degeneracy of *d*-orbitals of the metal ion is lost and these split into two sets of orbitals having different energies. This is known as crystal field splitting, *e.g.*, for d^4, configuration is $t_{2g}^3\, e_g^1$, in the presence of weak field ligand.

(*ii*) **Linkage isomerism:** The isomers which have same molecular formula but differ in the linkage of ligand atom to the central metal atom are called linkage isomers, *e.g.*,

$[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$

(*iii*) **Ambidentate ligand:** A unidentate ligand which can bind to the central metal atom through any of the two donor atoms present in it is called ambidentate ligand, *e.g.*, NO_2 can bind to metal either through nitro-N ($\leftarrow N\lessgtr^{O}_{O}$) or through oxygen atom, *i.e.*, as nitrito-O ($\leftarrow$ O—N═O)

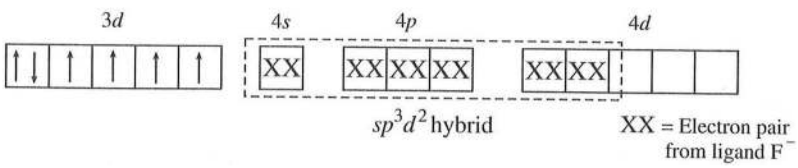
OR

Sol. (*i*) Hydration isomerism is shown by complex $[Cr(H_2O)_6]Cl_3$.

(*ii*) If $\Delta_0 > P$, electronic configuration becomes $t_{2g}^4\, e_g^0$.

(*iii*) $Co^{3+} : 3d^6\, 4s^0$

$[CoF_6]^{3-}$:
(outer orbital complex)



Hybridisation = sp^3d^2; Shape = Octahedral

33.

Sol. (*i*) The linkage between two monosaccharides through oxygen atom in an oligosaccharide or a polysaccharide is known as glycosidic linkage.

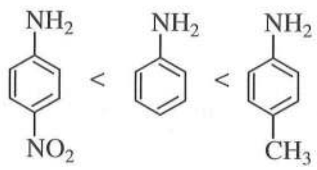
(*ii*) Sucrose is dextrorotatory (+ 66.5°) but after hydrolysis it gives an equimolar mixture of D-(+)-glucose and D-(–)-fructose, which is laevorotatory. This change of specific rotation from dextrorotation to laevorotation is called inversion of sugar and the mixture obtained is called invert sugar.

(*iii*) Carbohydrates which on hydrolysis give two to ten molecules of monosaccharides are called oligosaccharides *e.g.*, sucrose.

34.

Sol. (*i*) $C_6H_5NH_2 < C_6H_5NHCH_3 < C_6H_5CH_2NH_2$

(*ii*)



Section– D

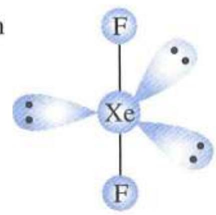
35.

Ans.

(*i*) (*a*) The increase in acidic character from H_2O to H_2Te is due to decrease in bond enthalpy for the dissociation of H—E bond down the group.

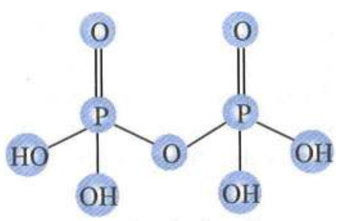
(*b*) F_2 is more reactive than ClF_3 because F–F bond in F_2 is weaker than Cl–F bond in ClF_3. In contact Cl—F bond in ClF_3 is weaker that Cl—Cl in Cl_2, therefore, ClF_3 is more reactive than Cl_2.

(*ii*) (*a*) There are two bond pairs and three lone pairs electrons around central Xe atom in XeF_2. Therefore, according to VSEPR theory XeF_2 should be linear.



XeF_2

(*b*)

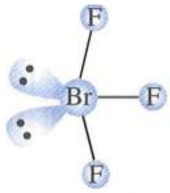


Pyrophosphoric acid
($H_4P_2O_7$)

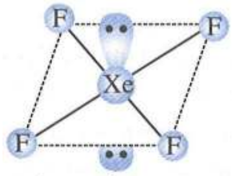
OR

Sol. (*i*) Bond dissociation enthalpy decreases as the bond distance increases from F_2 to I_2 because of the corresponding increase in the size of the atom as we move from F to I. The F—F bond dissociation enthalpy is, however, smaller than that of Cl—Cl and even smaller than that of Br—Br. This is because F atom is very small and hence the three lone pairs of electrons on each F atom repel the bond pair holding the F-atoms in molecule resulting lower bond enthalpy than Cl_2.

(*ii*) (*a*) BrF_3 (*b*) XeF_4



Slightly bent "T"



Square planar

36.

Sol. (*i*) 1-Chloropentane will have higher boiling point as branching lowers the surface area and hence the strength of van der Waal's forces.

(*ii*) (*a*) —CH_2Cl is primary halide therefore undergoes S_N2 reaction faster.

(*b*) As iodine is a better leaving group because of its large size, it will be released at a faster rate in the presence of incoming nucleophile. So, I reacts faster than Cl.

(iii) (*a*) S_N2 reaction occurs with inversion of configuration.

(*b*) S_N1 reaction occurs with racemisation.

OR

Sol. (i) (*a*) This is due to steric and electronic reasons. Sterically, the presence of two relatively large substituents in ketones hinders the approach of nucleophile to carbonyl carbon than in aldehydes having only one such substituent. Electronically two alkyl groups reduce the positivity of the carbonyl carbon more effectively in ketones than in aldehydes.

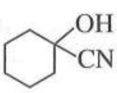
(*b*) This is because for aldol condensation to take place, at least one α-hydrogen (*i.e.*, hydrogen at carbon adjacent to carbonyl carbon) should be available, which is not present in $(CH_3)_3C—CHO$.

(*c*) This is due to more extensive association of carboxylic acid molecules through intermolecular hydrogen bonding. The hydrogen bonds do not break completely even in the vapour phase.

(ii) 2–Hydroxy benzoic acid

(iii) Because of –I effect of Cl atom in $ClCH_2COOH$ and +I effect of CH_3 group in CH_3COOH the electron density in the O—H bond in $ClCH_2COOH$ is much lower than CH_3COOH. As a result O—H bond in $ClCH_2COOH$ is much weaker than in CH_3COOH therefore loses a proton more easily than CH_3COOH. Hence, $ClCH_2COOH$ acid is stronger acid than CH_3COOH.

37.

Sol. (*i*) (*a*) 

Cyclohexane cyanohydrin

(*b*) 
Benzene

(*c*) $CH_3—CH=CH—CHO$
But-2-en-1-al

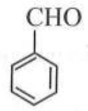
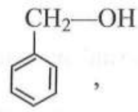
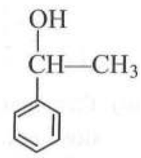
(*ii*) (*a*) Butanal being an aldehyde reduces Tollens' reagent to give silver mirror but butan-2-one being a ketone does not.

$$\underset{\text{Butanal}}{CH_3—CH_2—CH_2—CHO} + \underset{\text{Tollens' reagent}}{2[Ag(NH_3)_2]^+} + 3OH^- \longrightarrow \underset{\text{Butanoate ion}}{CH_3—CH_2—CH_2—COO^-} + \underset{\text{Silver mirror}}{Ag\downarrow} + 4NH_3 + 2H_2O$$

(*b*) Benzoic acid decomposes $NaHCO_3$ to produce brisk effervescence due to evolution of CO_2 while phenol does not.

$$\underset{\text{Benzoic acid}}{C_6H_5COOH} + NaHCO_3 \longrightarrow \underset{\text{Sodium benzoate}}{C_6H_5CO\overset{-}{O}\overset{+}{N}a} + CO_2\uparrow + H_2O$$

OR

Sol. (*i*) A =  , B or C =  , C or B =  , D = 

A = Benzaldehyde, B or C = Sodium benzoate, C or B = Benzyl alcohol, D = 1-Phenyl ethanol

(*ii*) (*a*) $C_6H_5COCH_3$ being a methyl ketone gives iodoform test while $C_6H_5COCH_2CH_3$ does not.

$$\underset{\text{Acetophenone}}{C_6H_5COCH_3} + 3NaOI \longrightarrow C_6H_5COONa + \underset{\substack{\text{Iodoform}\\\text{(Yellow ppt.)}}}{CHI_3\downarrow} + 2NaOH$$

(*b*) Benzoic acid gives brisk effervescence with $NaHCO_3$ solution whereas phenol does not.

$$\underset{\text{Benzoic acid}}{C_6H_5COOH} + NaHCO_3 \longrightarrow C_6H_5CO\overset{-}{O}\overset{+}{N}a + \underset{\substack{\text{Brisk}\\\text{effervescence}}}{CO_2\uparrow} + H_2O$$

(*iii*)