

Sample Paper 5 Solutions

Class XII 2023-24

Chemistry

Time: 3 Hours

Max. Marks: 70

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Directions (Q. Nos. 1-16) : The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. A Grignard reagent is prepared by the action of magnesium in dry ether on:

- (a) C_2H_5OH (b) C_2H_6
(c) C_2H_5Cl (d) C_2H_5CN

Ans : (c) C_2H_5Cl

The carbon atom of organic halide which is directly attached to the halogen is, of electrophilic nature. This electrophilic reactivity can be switched to nucleophilic reactivity by conversion to an organomagnesium halide.



2. Azeotropic mixture of HCl and H_2O has:

- (a) 48% HCl (b) 22.2% HCl
(c) 36% HCl (d) 20.2% HCl

Ans : (d) 20.2% HCl

The volume of water that must be added to a mixture of 250 ml of 0.6 M HCl and 750 ml of 0.2 M HCl to obtain 0.25 M solution of HCl is 20.2%.

3. If the rate of a reaction is expressed by, $\text{Rate} = k[A]^2[B]$. Then the order of reaction will be

- (a) 2 (b) 3
(c) 1 (d) 0

Ans : (b) 3

For the given rate-expression

$$(\text{Rate}) r = k[A]^2[B]$$

Since, the sum of powers of the concentration terms as given in the rate-law is known as the order of reaction.

Hence, order of reaction

$$= 2 + 1 = 3$$

4. For a zero order reaction:

- (a) $t_{1/2} \propto a$ (b) $t_{1/2} \propto \frac{1}{a}$
(c) $t_{1/2} \propto a^2$ (d) $t_{1/2} \propto \frac{1}{a^2}$

Ans : (a) $t_{1/2} \propto a$

The half life of a zero order reaction depends on initial concentration of reacting species and the rate constant, K. It is directly proportional to initial concentration of the reactant whereas it is inversely proportional to the rate constant, K.

5. The cannizzaro's reaction is not given by –

- (a) Formaldehyde (b) Acetaldehyde
(c) Benzaldehyde (d) Furfural

Ans : (b) Acetaldehyde

Compounds containing $\alpha - H$, in its compound do not show cannizzaro reaction with NaOH. As acetaldehyde has $\alpha - H$ in its structure [$CH_3 - CHO$].

Thus it will go for aldolcondensation rather than cannizzaro reaction.

6. Copper sulphate solution on treatment excess of KI gives white precipitate. The precipitate is

- (a) CuI_2 (b) Cu_2I_2
(c) Cu_2SO_4 (d) I_2

Ans : (a) CuI_2

The whitish precipitate is copper iodide.

The reaction is as follows:



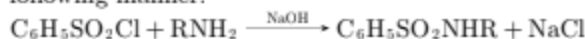
Here all the products and reactants are in aqueous state except CuI_2 which is the insoluble solid and is therefore the precipitate.

**Important MCQ Question For
Class 12 Chemistry**

7. An organic compound reacts with benzene sulphonyl chloride and product dissolves in aqueous NaOH. The compound is –
- (a) $R-NH_2$ (b) $\begin{matrix} R \\ \diagdown \\ N \\ \diagup \\ R \end{matrix}$
- (c) $\begin{matrix} R \\ \diagdown \\ N \\ \diagup \\ R \end{matrix}$ (d) All of these

Ans : (a) $R-NH_2$

Benzene sulphonyl chloride, an acid chloride, will react with amines containing a replacing hydrogen atom in the following manner:



As the product formed [$C_6H_5SO_2NHR$] contain H-atom, it will dissolved in $NaOH(aq.)$.



8. Sweetest of all sugars is:

- (a) Glucose (b) Lactose
(c) Sucrose (d) Fructose

Ans : (d) Fructose

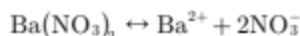
Fructose is the sweetest of all natural sugar types. Fructose is somewhat sweeter, being rated at 1.7 times the sweetness of sucrose. It is particularly effective at enhancing the flavour of fruit and berries.

Important MCQ Question For Class 12 Chemistry

9. The van't Hoff's factor of 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of association is -

- (a) 91.3% (b) 87%
(c) 100% (d) 74%

Ans : (b) 87%



Initial	0.1 M	0	0
At eq.	$(0.1 - \alpha) M$	αM	αM

$$i = \frac{(0.1 - \alpha) + \alpha + 2\alpha}{0.1}$$

$$= \frac{0.1 + 2\alpha}{0.1} = 2.74$$

On solving, we get

$$\alpha = 0.087$$

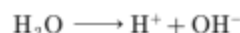
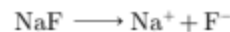
So, $\alpha\% = \frac{0.087}{0.1} \times 100 = 87\%$

10. A dilute aqueous solution of sodium fluoride is electrolysed; the products at the anode and cathode are :

- (a) F_2, Na (b) F_2, H_2
(c) O_2, Na (d) O_2, H_2

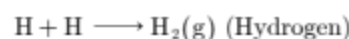
Ans : (d) O_2, H_2

When a dilute aqueous solution of sodium fluoride is electrolysed, the reaction is



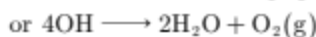
Reaction at Cathode

H^+ and Na^+ cations move towards the cathode but H^+ are deposited. This is due to the fact that hydrogen is below sodium in the electrochemical series. So, has lower discharge potential.



Reaction at Anode

OH^- and F^- ions migrate towards the anode but only OH^- ions gets deposited at anode. The reason is same i.e., OH^- ions have lower discharge potential.



Hence, product at cathode is hydrogen an product at anode is oxygen.

11. Which of the following compounds has tetrahedral geometry?

- (a) $[Ni(CN)_4]^{2-}$ (b) $[Pd(CN)_4]^{2-}$
(c) $[PdCl_4]^{2-}$ (d) $[NiCl_4]^{2-}$

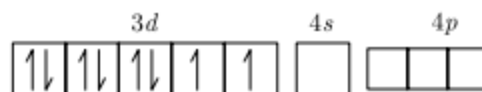
Ans : (d) $[NiCl_4]^{2-}$

Coordinate compounds with Sp^3 hybridisation for central metal can show tetrahedral geometry mostly with weak-ligand like Cl-ligand can form such complexes.

Since, They do not go for pairing.

In $[NiCl_4]^{2-}$, Ni is in Ni^{2+}

Outer most electronic configuration for Ni^{2+} is-



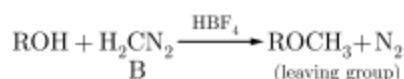
Chlorine is a weak-ligand, d-electron of Ni^{2+} do not go for pairing and $[NiCl_4]^{2-}$ show sp^3 hybridisation and tetrahedral geometry.

Note : $[PtCl_4]^{2-}$ will not show Sp^3 hybridisation because of empty d-orbital it has dsp^2 (square planar geometry).

12. $R-OH + CH_2N_2 \longrightarrow$ Leaving group in this reaction is -

- (a) CH_3 (b) R
(c) N_2 (d) CH_2

Ans : (c) N_2



The strong acid HBF_4 first protonated CH_2N_2 to give CH_3N_2^+ from which N_2 (an extremely good leaving group) is displaced, ROH serving as the nucleophile. Diazomethane is used in ethyl ether solution. This reagent is very toxic and explosive and should be used with extreme caution.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. Assertion : SN^2 reaction of an optically active aryl halide with an aqueous solution of KOH always gives an alcohol with opposite sign of rotation.

Reason : SN^2 reactions always proceed with retention of configuration.

- (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.
 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.
 (c) Assertion is correct but Reason is incorrect.
 (d) Both the Assertion and Reason are incorrect.

Ans : (d) Both the Assertion and Reason are incorrect.

Assertion is false, because aryl halides do not undergo nucleophilic substitution under ordinary conditions. This is due to resonance, because of which the carbon chlorine bond acquires partial double bond character, hence it becomes shorter and stronger and thus cannot be replaced by nucleophiles. Also, Reason is false because SN^2 reactions proceed with inversion of configuration.

Important MCQ Question For Class 12 Chemistry

14. Assertion : DNA as well as RNA molecules are found in the nucleus of a cell.

Reason : On heating, the enzymes do not lose their specific activity.

- (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.
 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.
 (c) Assertion is correct but Reason is incorrect.
 (d) Both the Assertion and Reason are incorrect.

Ans : (d) Both the Assertion and Reason are incorrect.

DNA is found mainly in the nucleus of the cell and RNA occurs mainly in the cytoplasm of the cell. So assertion given is false.

Enzymes are very good biological catalysts in certain temperature rang but they lose their specific activity on heating.

Hence reason is also a wrong statement.

15. Assertion : The rate of the reaction is the rate of change of concentration of a reactant or a product.

Reason : Rate of reaction remains constant during the course of reaction.

- (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.
 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.
 (c) Assertion is correct but Reason is incorrect.
 (d) Both the Assertion and Reason are incorrect.

Ans : (c) Assertion is correct but Reason is incorrect.

Rate of reaction does not remain constant during the complete reaction because rate depends upon the concentration of reactants which decreases with time.

16. Assertion : Disruption of the natural structure of a protein is called denaturation.

Reason : The change in colour and appearance of egg during cooking is due to denaturation.

- (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.
 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.
 (c) Assertion is correct but Reason is incorrect.
 (d) Both the Assertion and Reason are incorrect.

Ans : (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

During denaturation, the protein molecule uncoils, form a more random conformation and ultimately precipitates from the solution. Further during denaturation, a protein molecule loses its biological activity. Thus reason is correct but it is not the correct explanation of assertion.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. State the main advantage of molality over molarity as the unit of concentration.

Ans :

Molality does not change with change in temperature while molarity decreases with rise in temperature.

18. Why do transition metals show variable oxidation state?

Ans :

Transition metals show variable oxidation-states due to involvement of ns and $(n-1)d$ electrons, which have very small energy difference.

19. If in a chemical reaction $A + B \longrightarrow$ product, rate law is given by $R = K[A]^{\frac{1}{2}}[B]^{\frac{3}{2}}$, find the order of reaction.

Ans :

Given,

Rate law for a chemical reaction $A + B \longrightarrow$ product as :

$$(\text{Rate}) R = K[A]^{\frac{1}{2}}[B]^{\frac{3}{2}}$$

We know that, Order of any reaction is equal to the sum of powers of each concentration term given in the rate-law.

$$\text{Hence, Order of reaction} = \frac{1}{2} + \frac{3}{2} = 2$$

Important MCQ Question For Class 12 Chemistry

20. p-Nitrophenol is more acidic than p-methyl phenol. Why?

Ans :

The stability of negative ion formed after liberation of H^+ ion decides acidity of an acid. More stable the negative ion, more acidic is the compound. Liberation of H^+ ion forms phenoxide ion in case of phenol.

The methoxy group on para position shows +M/ +R effect and induces negative charge near the $-OH$ group leading to instability of phenoxide ion. In case of p-Nitrophenol and $-R$, it stabilises phenoxide ion due to its $-I$ effect group. Hence, p-Nitrophenol is more acidic.

or

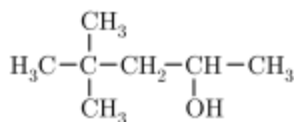
Write the structural formulae of the following :

1. 4, 4 dimethyl-2-pentanol
2. 2-butanol

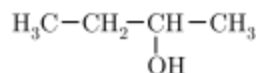
Ans :

Structural formula of-

1. 4, 4 dimethyl-2-pentanol



2. 2-butanol



21. What is chemical kinetics?

Ans :

The branch of chemistry which deals with the study of the rates of chemical reactions, the factors affecting the rates of the reactions and the mechanism by which the reactions proceed is known as Chemical kinetics (Greek; Kinesis = movement).

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Account for the following:

The treatment of an alkyl chloride with aqueous KOH leads to the formation of alcoholic whereas in the presence of alcoholic KOH, alkene is the major product.

Ans :

Aqueous KOH gives OH^- ions which can replace Cl^- ions and carry out the nucleophilic substitution reaction, whereas alc. KOH gives $C_2H_5O^-$ which is a stronger nucleophile and abstracts H^+ from the β carbon atom and carry out the elimination reaction, thus leading to the formation of an alkene.

23. Differentiate between molarity and molality of a solution. How can we change molality value of a solution into molarity value?

Ans :

Molarity is defined as the number of moles of the solute per kilogram of the solvent. It is

Represented by m .

$$\text{Molality } (m) = \frac{\text{Number of moles of solute} \times 1000}{\text{Mass of solvent (in g)}}$$

It does not change with change with in temperature.

Molarity is defined as the number of moles of solute dissolved in one litre or one cubic decimetre of the solution.

$$\text{Molarity } (m) = \frac{\text{Number of moles of solute} \times 1000}{\text{Volume of solution (in mL)}}$$

It decreases with increase in temperature (as $V \propto T$).

We can change molality value of a solution into molarity value by using following relation :

$$\text{Molarity } (m) = \frac{M \times 1000}{(1000 \times d) - (M \times M_2)}$$

Where, M is the molarity and M_2 is the molar mass of component 2 (generally solute) and d is the density of solution (in $g\text{ cm}^{-3}$).

24. Define standard electrode potential.

Ans :

Standard Electrode Potential : The electrode potential under the conditions of unit concentration of all the species in the half cell is called the standard electrode potential. According to the IUPAC convention, standard reduction potential of a cell is now called the standard electrode potential. The value of the oxidation potential of the same cell reaction will be the same with the sign reversed.

In a Daniel or galvanic cell, the half cell in which oxidation takes place is called anode and the other half cell in which reduction takes place is called cathode.

The potential difference between the two half cells is called the cell potential. It is the difference in standard reduction potential of cathode and standard reduction potential of anode.

$$E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$$

25. What are the characteristics of the transition elements and why are they called transition elements? Which of the *d*-block elements may not be regarded as the transition elements?

Ans :

Transition element : An element which has incompletely filled *d*-orbital in its ground state or in any of its oxidation state is called transition element. e.g. Cr, Fe, Ni etc.

Characteristics of transition elements :

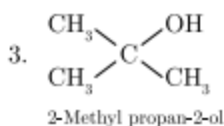
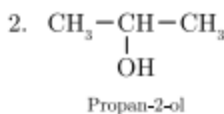
- All transition elements have metallic structure except Mercury (Hg) which is liquid.
- They have high melting and boiling point, high enthalpies of vaporisation and atomisation.
- Their first ionisation enthalpies are higher than *s*-block elements and less than *p*-block elements.
- They are electro-positive in nature.
- They show variable oxidation state, form coloured compounds, complexes interstitial compounds.

Zinc, cadmium and Mercury are not regarded as transition elements.

26. Give the structures and IUPAC names of products expected from the following reactions :

- Catalytic reduction of butanal.
- Hydration of propene in presence of concentrated sulphuric acid.
- Reaction of propanone with methyl magnesium bromide followed by hydrolysis.

Ans :



Important MCQ Question For Class 12 Chemistry

27. How will you distinguish between methanoic acid and ethanoic acid?

Ans :

Distinguish between methanoic acid and ethanoic acid are as follow:

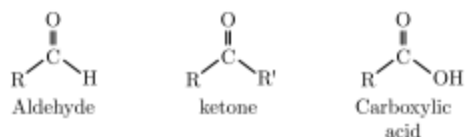
	Methanoic acid	Ethanoic acid
1.	Methanoic acid gives silver mirror test with tollen's reagent.	Ethanoic acid does not give that test.
2.	Methanoic acid gives white precipitate with mercuric chloride solution. $\text{HCOOH} + \text{HgCl}_2 \rightarrow \text{Hg}_2\text{Cl}_2 + \text{CO}_2 + 2\text{HCl}$	Ethanoic acid does not give that test.
3.	It is diffused fehling's solution.	It is no effect on Fehling's solution.

or

What are aldehydes, ketones, carboxylic acid?

Ans :

In aldehydes, the carbonyl group is bonded to a carbon and hydrogen while in the ketones, it is bonded to two carbon atoms. The carbonyl compounds in which carbonyl group is bonded to oxygen are known as carboxylic acids, and their derivatives (e.g. esters, anhydrides) while in compounds where carbon is attached to nitrogen and to halogens are called amides and acyl halides respectively. The general formula of these classes of compounds are given below:



28. Give the IUPAC names of the following:

- $\text{Cl}-\text{CH}_2\text{C}\equiv\text{C}-\text{CH}_2-\text{Br}$
- $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}(\text{C}_2\text{H}_5)\text{Cl}$

Ans :

- 1-Bromo-4-chlorobut-2-yne
- 3-chloro-4-methylhexane

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. There are 13 vitamins known till today. Four of which are fat soluble (A, D, E, K) and rest of which are water soluble ($B_1, B_2, B_3, B_5, B_6, B_7, B_9, B_{12}, C$). Let's know the history how vitamins were discovered. By the end of mid-1800 scientists had discovered that pathogens caused various diseases. It was assumed that patchy skin, falling eye-sight etc. is also caused by germs instead of vitamin deficiency. Dutch Bio Scientist Dr. Christiaan Eijkman reported in 1895, that chickens that ate polished rice developed beri-beri. He was awarded Noble Prize in 1929 for his contribution in discovery of vitamins. 'Vita' (Latin—for important to life), amine (a specific group which Funk believed is present in all vitamins). In the beginning vitamin C was called Scurvy Vitamin, Vitamin-B was called Beri-Beri vitamin when rats were fed a diet heavy in lard and olive oil, they died but with the addition of tiny amount of butter fat they survived. McCollum called vitamin in butter fat. Fat soluble Vitamin A, Vitamin B_{12} and Vitamin D were discovered later. Now we also know vitamin E, K and H also.

Answer the following questions:

- (a) Name four vitamins that are stored in liver and adipose (fat storing) tissues.
 (b) Out of B, C and B_{12} which vitamin cannot be stored in our body and why?
 (c) Name a vitamin which helps in blood clotting and name source of this vitamin.

or

- (d) Name a vitamin which is fat soluble and anti-oxidant. What are sources of this vitamin and its deficiency disease?

Ans :

- (a) A, D, E, K are stored in liver and adipose tissues.
 (b) B and C are water soluble vitamins, therefore, cannot be stored in our body.
 (c) Vitamin K helps in clotting of blood. It is present in green leafy vegetables.

or

- (d) Vitamin 'E' is fat soluble and anti-oxidant. Its deficiency leads to loss of reproductive power. Its sources are vegetable oils, wheat germ oil, sun flower oil, etc.

Important MCQ Question For Class 12 Chemistry

30. Electrolytes dissociate into ions. In case of electrolytes if we determine their molar mass using colligative property, the value of molar mass is found to be abnormal because colligative property depends on number of ions. Greater the number of ions, more will be colligative property. van't Hoff factor (i) is ratio of normal molar mass to the abnormal molar mass. It is also equal to ratio of observed colligative property to the calculated colligative property.

A student determined value of i at various concentration of NaCl, KCl, $MgSO_4$ and K_2SO_4 . The values are given in the

following table.

Table: Values of van't Hoff factor, i , at Various Concentrations for NaCl, KCl, $MgSO_4$ and K_2SO_4 .

Salt	Values of i			van't Hoff Factor i for complete dissociation of solute
	0.1 m	0.01 m	0.001 m	
NaCl	1.87	1.94	1.97	2.00
KCl	1.85	1.94	1.98	2.00
$MgSO_4$	1.21	1.82	1.82	2.00
K_2SO_4	2.32	2.84	2.84	3.00

* represent i values for incomplete dissociation. Answer the following questions based on above table.

- (a) How is van't Hoff factor related to molality and why?
 (b) What is value of i in case of (i) electrolyte (ii) non-electrolyte?
 (c) Determine the amount of $CaCl_2$ ($i = 2.47$) dissolved in 2.5 L of water such that its osmotic pressure is 0.75 atm at $27^\circ C$. [$R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$] [Ca 40u, Cl = 35.5u]

or

- (d) Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 L solution at $25^\circ C$ Assuming it is completely ionised. [$R = 0.082 \text{ L atm K}^{-1}$, $K = 39u$, $s = 32u$, $O = 16u$]

Ans :

- (a) As molality decreases, van't factor increases because degree of ionisation is inversely proportional to concentration.
 (b) (i) $i > 1$, (ii) $i = 1$

$$\pi V = i n R T = i \frac{W_B}{M_B} \times R \times T$$

$$0.75 \text{ atm} \times 2.5 \text{ L} = 2.47 \times \frac{W_B}{111} \times 0.082 \times 300 \text{ K}$$

$$W_B = \frac{0.75 \times 2.5 \times 111}{2.47 \times 24.6} = 3.425 \text{ g}$$

$$\text{No. of moles} = \frac{3.425}{111} = 0.03 \text{ mol}$$

or

- (d)
- $$K_2SO_4 \longrightarrow 2K^+ + SO_4^{2-}$$
- $$i = n = 3$$
- $$\pi V = i n_B R T \quad [\text{Hence, } \alpha = 100\%]$$

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

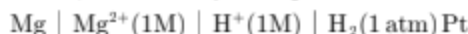
31. How would you determine the standard electrode potential of $Mg^{2+} | Mg$?

Ans :

We will set up a cell Consisting of $Mg | MgSO_4$ (1M) as one electrode (by dipping a magnesium plate in 1 M $MgSO_4$

solution) and standard hydrogen electrode Pt, $H_2(1 \text{ atm}) | H^+(1M)$ as the second electrode and measure the EMF of the cell. Note the direction of deflections which shows that electrode flow from magnesium electrode to hydrogen electrode i.e., oxidation takes place on magnesium electrode and reduction on hydrogen electrode.

Hence, the cell may be represented as follows :



$$E_{\text{cell}}^{\circ} = E_{H^+}^{\circ} - E_{Mg^{2+}}^{\circ}$$

$$Pt \quad E_{H^+}^{\circ} = 0$$

$$\text{Hence, } E_{Mg^{2+}, Mg}^{\circ} = -E_{\text{cell}}^{\circ}$$

The electrode potential of an electrode is given a negative sign if oxidation takes place at this electrode when connected to hydrogen electrode. The standard electrode potential of an electrode is given a positive sign if reduction takes place at this electrode when connected with standard hydrogen electrode to form the cell.

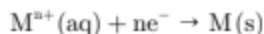
or

Explain Nernst equation.

Ans :

If the electrolyte concentration is different from 1M and temperature is different from 298 K the electrode potential has a different value. This value is obtained using Nernst equation. Nernst established a relation between the electrode potential and concentration of ions in solution.

For the reaction :



$$E = E^{\circ} - \frac{2.303 RT}{nF} \log \frac{[M]}{[M^{n+}]}$$

Here, E is reduction potential E° is standard reduction potential, R is gas constant ($8.314 \text{ JK}^{-1}\text{Mol}^{-1}$). T is temperature on Kelvin scale, F is one Faraday (96500 Coulombs) and $[M^{n+}]$ is molar concentration of ions in solution. Since molar concentration of solids, liquids or a gas at one atmosphere is taken as unity.

$$\text{Thus, } [M] = 1$$

$$E = E^{\circ} - \frac{2.303 RT}{nF} \log \frac{[1]}{[M^{n+}]}$$

Substituting value of $R(8.314 \text{ JK}^{-1}\text{mol}^{-1})$, $T(298 \text{ K})$ and $F(96500 \text{ C})$

$$E = E^{\circ} - \frac{0.0591}{n} \log \frac{1}{[M^{n+}]}$$

Thus reduction potential of an electrode is directly proportional to the concentration of its ions in solution.

Important MCQ Question For Class 12 Chemistry

32. (a) State Werner's coordination theory.
(b) What are ligands? Classify them with examples.

Ans :

(a) Based on his extensive research on coordination compound. Alfred warner in 1893 put forward a theory to explain the nature of bonding in coordination or

complex compounds. In brief the warner's theory may be stated as follows:

1. Central ion in any complex ion/compound exhibits two types of valencies : Primary valency and Secondary valency.
 2. The primary valency is ionisable and corresponds to the oxidation state of the metal forming the central ion. The secondary valency is non-ionisable.
 3. Every central ion has a fixed number of secondary valencies. This number is called the coordination number of the central ion.
 4. The primary valency of the metal ion is always satisfied by negative ion.
 5. The secondary valencies are satisfied by negative ions or neutral molecules.
 6. Every element must satisfy all its primary and secondary valencies. In order to meet this requirement the negative ion may have a dual role, i.e., in satisfying both the primary and secondary valencies.
- (b) Monodentate ligands have only one atom capable of binding to a central atom or ion. H_2O is a ligand, oxygen is the donor atom binding to the metal.

or

List various types of isomerism possible for coordination compounds give one example of each.

Ans :

Isomers

Two or more compounds having the same molecular formula but different structural or spatial arrangements are called isomers and the phenomenon is called isomerism.

Types of Isomerism

There are two main types of isomerism:

1. Structural isomerism
 2. Stereo isomerism
1. **Structural Isomerism**
It arises due to the difference in structure of coordination compounds.
 - (i) **Ionisation Isomerism** : The compounds which have the same molecular formula but give different ions in solution are called ionisation isomers. Example:
 $[Co(NH_3)_5Br]SO_4 \rightleftharpoons [Co(NH_3)_5Br]^{2+} + SO_4^{2-}$ and
 $[Co(NH_3)_5SO_4]Br \rightleftharpoons [Co(NH_3)_5SO_4]^+ + Br^-$
 - (ii) **Hydrate or Solvate Isomerism** : The compounds which have the same composition but differ in the number of solvent or water molecules present as ligands.
 Example : $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl \cdot H_2O$
(Violet) (Blue green)
 - (iii) **Linkage Isomerism** : It occurs in compounds which having ambidentate ligands showing different modes of attachment.
 $[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$
 - (iv) **Coordination Isomerism** : It arises when both the cation and anion are complexes which differ in the distribution of ligands. Example :
 $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$
 2. **Stereo Isomerism**
It arises due to different position of ligands in space

around the metal atom/ion.

- (i) **Geometrical Isomerism** : This type of isomerism arises when ligands occupy different position around the central metal atom.

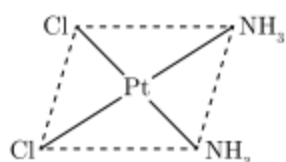
cis-isomer : When two identical ligands occupy adjacent position.

trans-isomer : When two identical ligands are opposite to each other.

Geometrical isomerism is not possible for complexes with Co. No. = 2, 3 and tetrahedral complexes (Co. No. = 4) Because in these arrangement all the positions are equivalent.

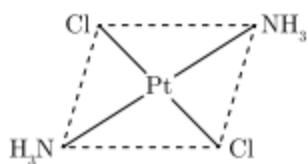
Examples of geometrical isomerism:

- (a) **Square Planar Complexes (Co. No. = 4)** :
[Pt(NH₃)₂Cl₂].



cis-isomer

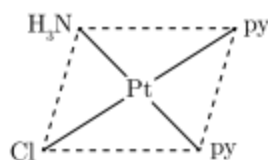
cis-diamminedichloroplatinum (II)



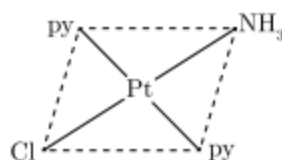
trans-isomer

trans-diamminedichloroplatinum (II)

- (b) **Square Planar Complex (Co. No. = 4)** :
[Pt(NH₃)Cl(Py)₂].

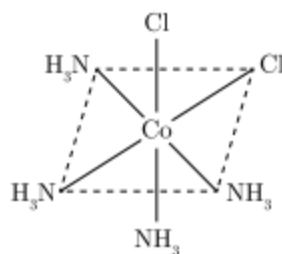


cis-

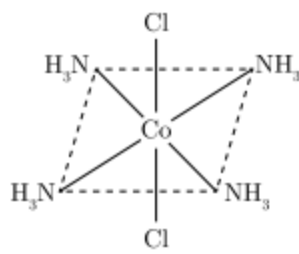


trans-

- (c) **Octahedral Complex (Co. No. = 6)** :
[Cr(NH₃)₄Cl₂]⁺.

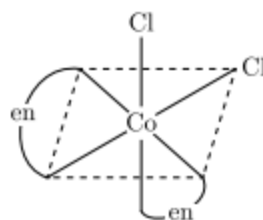


cis-

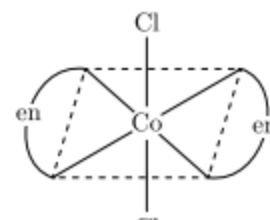


trans-

- (d) **Octahedral Complex (Co. No. = 6)** :
[CoCl₂(en)₂]⁺.



cis-



trans-

- (e) **Octahedral Complex (Co. No. = 6)** :
[Pt(NH₃)(Br)(Cl)(I)(NO₂)(py)] forms 15 different geometrical isomers.

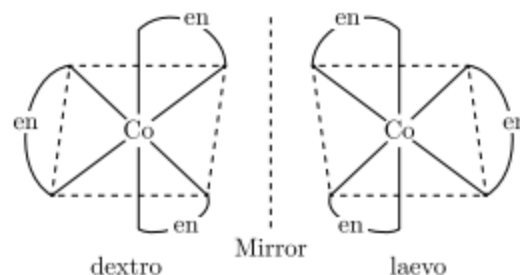
- (ii) **Optical Isomerism** : Optical isomers rotate the plane polarised light in opposite direction i.e., right and left are called **dextro** (d) and **laevo** (l) isomers.

The d and l isomers of a compound are called enantiomers.

The two isomers are non-superimposable mirror image of each other are called **Chiral** and this property is called **Chirality**.

Examples:

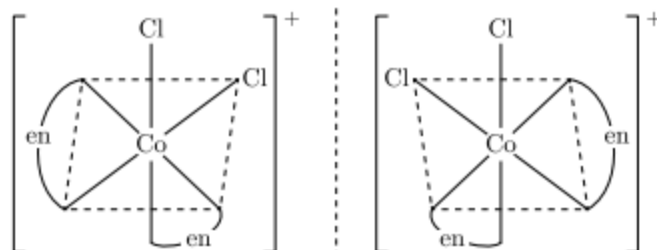
- (a) [Co(en)₃]³⁺



dextro

laevo

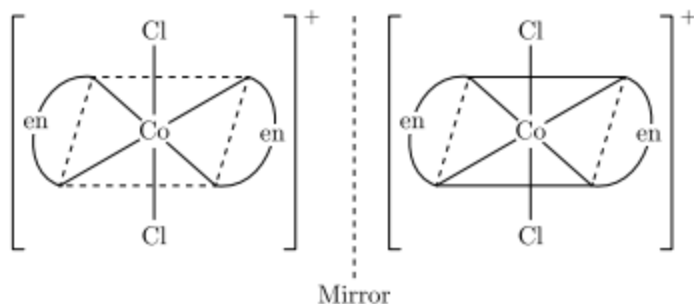
- (b) [CoCl₂(en)₂]⁺ : Its isomers is optically active but trans isomer is optically inactive.
dis-chlorobis (ethane-1, 2-diamine)
cobalt (III) ion.
cis[CoCl₂(en)₂]⁺



Mirror

optically active (Non-superimposable mirror images)

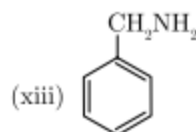
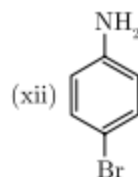
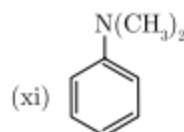
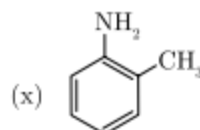
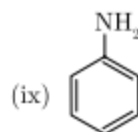
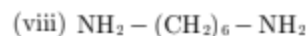
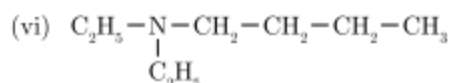
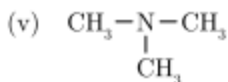
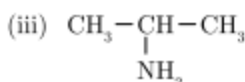
trans[CoCl₂(en)₂]⁺



optically inactive (Superimposable mirror images)

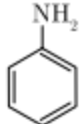
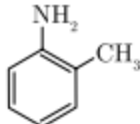
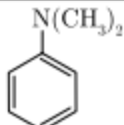
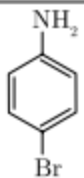
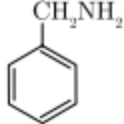
Square planar complexes do not show optical because they contain a plane of symmetry.

33. Write common name and IUPAC name of following amines.



Ans :

	Amine	Common name	IUPAC name
(i)	$\text{CH}_3\text{CH}_2 - \text{NH}$	Ethylamine	Ethanamine
(ii)	$\text{CH}_3\text{CH}_2\text{CH}_2 - \text{NH}_2$	n-Propylamine	Propan-1-amine
(iii)	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\ \\ \text{NH}_2 \end{array}$	Isopropylamine	Propan-2-amine
(iv)	$\begin{array}{c} \text{CH}_3 - \text{N} - \text{CH}_2 - \text{CH}_3 \\ \\ \text{H} \end{array}$	Ethyl methylamine	N-Methylethanamine
(v)	$\begin{array}{c} \text{CH}_3 - \text{N} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	Trimethylamine	N,N-Dimethyl-methanamine
(vi)	$\begin{array}{c} \text{C}_2\text{H}_5 - \text{N} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\ \\ \text{C}_2\text{H}_5 \end{array}$	N,N-Diethylbutyl-amine	N,N-Dimethylbutan-1-amine
(vii)	$\text{NH}_2 - \text{CH}_2 - \text{CH} = \text{CH}_2$	Allylamine	Prop-2-en-1-amine
(viii)	$\text{NH}_2 - (\text{CH}_2)_6 - \text{NH}_2$	Dexamethylene diamine	Hexane-1,6-diamine

(ix)		Aniline	Aniline or Benzenamine
(x)		<i>o</i> -Toluidine	2-Methylaniline
(xi)		N,N-Dimethyl aniline	N,N-Dimethyl benzenamine
(xii)		<i>p</i> -Bromo aniline	4-Bromoaniline
(xiii)		Benzylamine	Phenylmethanamine

**Important MCQ Question For
Class 12 Chemistry**

□□□□□□