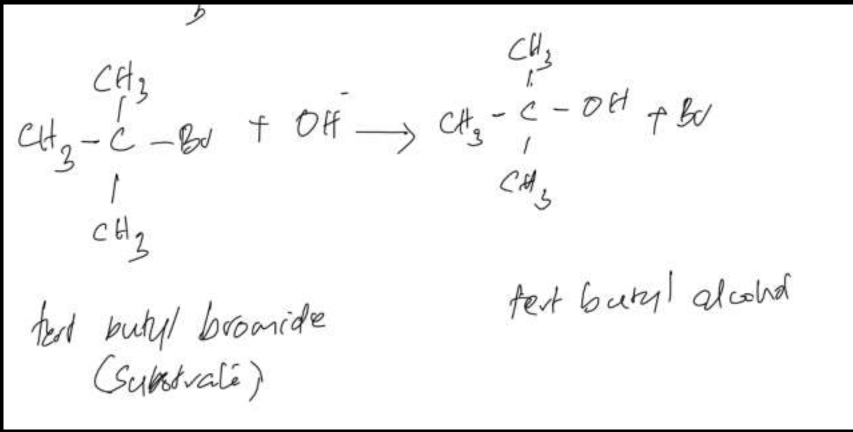
# Kerala Plus Two Board exam 2024

## Chemistry Answer Key

## Prepared by www.educationobserver.com

1. Eext > Ecell
2. $S^{-1}$
3. 4
4. Phosgene
5. glycosidic linkage or glycosidic bond.
6. Henry's law is essential in the carbonation process of beverages such as soda, beer, and sparkling water.
   Henry's law is crucial in understanding the behavior of gases in underwater diving.
7. $E^0 = E^0_{oxidation} + E^0_{reduction} = 0.76 + 0.34 = \underline{\underline{1.1 V}}$
8. Order of a reaction is the sum of the coefficients of the reacting species involved in the rate equation. Molecularity is the number of reacting species involved in simultaneous collisions in an elementary or simplest reaction. Order is an experimentally determined quantity. It may be equal to zero, positive, negative, whole number or fractional number. Molecularity is a theoretical concept, it is always in whole numbers.
9. The rate constant of a reaction increases with increase in temperature and becomes nearly double for every 10∘ rise in temperature. The effect can be represented quantitatively by Arrhenius equation,
   k=Ae−Ea/RT
   Where, Ea is the activation energy of the reaction and A represents the frequency factor.
10. X = $CH_3CH_2Cl$
    Y : $CH_3F$
11.




12. The law that helps to identify the major product in the β-elimination reactions of haloalkanes is Saytzeff's rule.

13. Alcohols are generally soluble in water due to their ability to form hydrogen bonds with water molecules. Water molecules are highly polar, with a partial positive charge on the hydrogen atoms and a partial negative charge on the oxygen atom. Similarly, alcohols contain hydroxyl (-OH) groups, which can also participate in hydrogen bonding.
When alcohols are mixed with water, the hydroxyl group of the alcohol can form hydrogen bonds with the water molecules. This interaction allows alcohol molecules to become effectively surrounded by water molecules, leading to their dissolution in water.

14. (i) Tollens' reagent, also known as silver mirror reagent, is a chemical reagent commonly used to test for the presence of aldehydes in a given sample. It is named after its discoverer, Bernhard Tollens.
(ii) $CH_3COHCH_3$

15. Between CH3NH2 (methylamine) and C6H5NH2 (aniline), methylamine (CH3NH2) is more basic.

The reason for this lies in the electron-donating or -withdrawing nature of the substituents on the nitrogen atom in each molecule. In methylamine, the methyl group (-CH3) is an electron-donating group, which increases the electron density around the nitrogen atom. This makes the lone pair of electrons on the nitrogen atom more available for donation, enhancing its basicity.

16. Ideal solutions are mixtures in which the interactions between the molecules of the different components are similar to those between the molecules of the same component. In other words, the enthalpy of mixing (ΔHmix) is approximately zero, and the volume of the solution is equal to the sum of the volumes of the pure components.

In ideal solutions, ΔmixH (enthalpy of mixing) is approximately zero. This means that there is no significant heat absorbed or released when the components of the solution are mixed together. In other words, the energy required to break the intermolecular forces between the molecules of the pure components and the energy released upon the formation of new intermolecular forces in the solution roughly balance each other out.

ΔmixV (volume change upon mixing) is also approximately zero. This means that the volume of the solution is equal to the sum of the volumes of the pure components. In an ideal solution, the molecules of the components do not significantly change their arrangement upon mixing, resulting in negligible volume changes.

17. (i)Molar conductivity (Λm) of a solution is a measure of the conductivity of that solution normalized by the concentration of the electrolyte. It is defined as the conductance of a solution containing one mole of the electrolyte dissolved in one liter of the solution, measured using a conductance cell.

For strong electrolytes: Molar conductivity decreases with increasing concentration.

For weak electrolytes: Molar conductivity increases with increasing concentration.

(ii) The law that helps to determine the limiting molar conductivity of electrolytes is Kohlrausch's Law of Independent Migration of Ions, also known as Kohlrausch's Law.

18. (i) The half-life of a reaction is the time it takes for the concentration of a reactant (or product) to decrease (or increase) to half of its initial concentration. In other words, it is the time required for the concentration of a substance involved in a chemical reaction to decrease (or increase) to half of its initial value.

(ii)

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{5.5\times10^{-14}\,s^{-1}} = 1.26\times10^{13}\,s$$

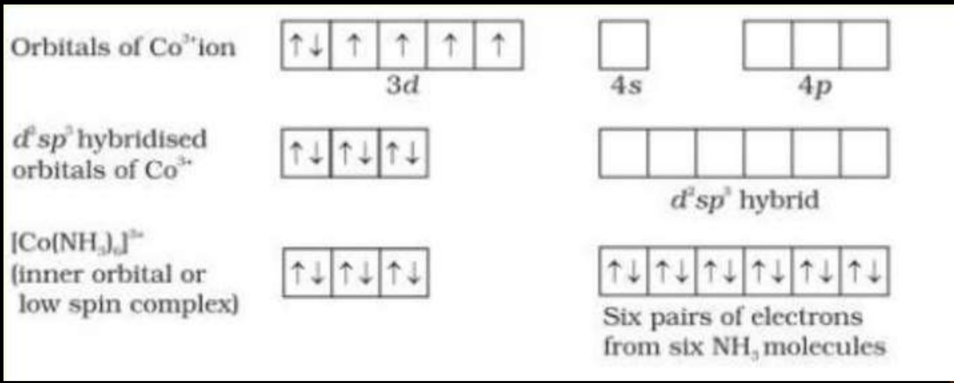
19. (i) $Ti^{3+}$, $Cr^{3+}$

(ii) Transition metals often form colored ions due to the presence of partially filled d orbitals in their electronic configurations. This phenomenon arises from the absorption of visible light by the transition metal ions, leading to the promotion of electrons from one d orbital to another.

20. (i) Lanthanoid contraction, also known as the "lanthanide contraction," refers to the steady decrease in the atomic and ionic radii of the lanthanide elements (also called lanthanoids) as you move across the lanthanide series from left to right. This contraction occurs due to the imperfect shielding of the outer electrons by the f-electrons in the inner shells.

Consequences: **Similarity in Atomic Radii, Coordination Chemistry, F-Block Contraction and Contraction Effects in Periodic Table**

21.

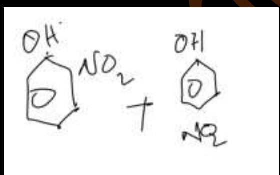



According to valence bond theory, the complex ion [Co(NH3)6]3+ has an octahedral geometry and is diamagnetic. The complex has the following properties:

- Oxidation state: +3
- Electronic configuration: 3d6
- Hybridization: d2sp3
- Geometry: Octahedral
- Magnetic behavior: Diamagnetic

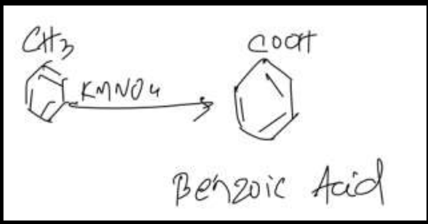
22. (i) a. $[Co(NH_3)_5Cl]Cl_2$
    b. $K_3[Fe(CN)_6]$
    (ii) $[Co(NH_3)_5Cl]Cl_2$

23. a.



b. With concentrated nitric acid, phenol is converted to 2,4,6−Trinitrophenol. The product is commonly known as picric acid.

24. The organic compound A in this reaction is toluene (methylbenzene). When toluene reacts with chromyl chloride (CrO2Cl2) in CS2 followed by acidification, it undergoes oxidation to form benzaldehyde. This reaction is known as the Etard reaction or Etard oxidation.
    b.




25. The Hinsberg test is a chemical test used to distinguish between primary (1°), secondary (2°), and tertiary (3°) amines based on their reactivity with benzenesulfonyl chloride (Hinsberg's reagent).

Preparation of Hinsberg's Reagent: Hinsberg's reagent is prepared by dissolving benzenesulfonyl chloride ($C6H5SO2Cl$) in a suitable solvent, typically aqueous sodium hydroxide solution ($NaOH$).

Reaction with Primary Amine: When a primary amine reacts with Hinsberg's reagent, it forms a sulfonamide. The primary amine has two hydrogens on the nitrogen atom available for substitution.

Reaction with Secondary Amine: Secondary amines also react with Hinsberg's reagent to form sulfonamides. However, in this case, only one hydrogen on the nitrogen atom is replaced by the sulfonyl group, while the other remains intact

Reaction with Tertiary Amine: Tertiary amines do not react with Hinsberg's reagent under normal conditions because they lack a hydrogen atom on the nitrogen atom available for substitution. Therefore, no sulfonamide is formed, and no reaction occurs.

26. Classification of proteins on the basis of molecular shapes are following :
Fibrous proteins: The proteins in which the polypeptide chains lie parallel(side by side) to form fibre-like structure are called fibrous proteins. The polypeptide chains held together by hydrogen bonds. These proteins are insoluble in water. The fibrous proteins are tough and insoluble in water, and dilute acids or bases. Example: myocin(in muscles), keratin(in hair, nails, skin), fibroin(in silk,coolagen,in tendons), etc.
Globular proteins: The proteins are folded to form spherical structure and have intramolecular hydrogen bonding are called globular proteins. They are soluble in water and dilute acids or bases. Example: Haemoglobin (in blood), albumin(in eggs), insulin(in pancreas), etc

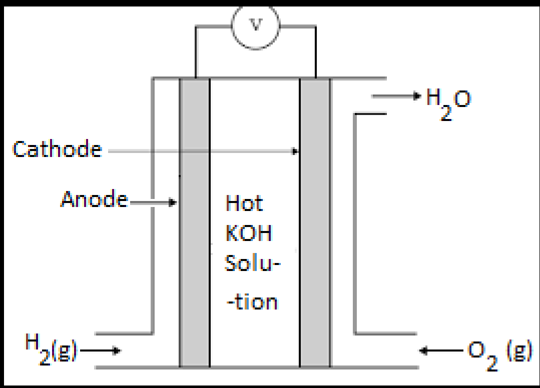
27. (i) Colligative properties are physical properties of solutions that depend on the concentration of solute particles in the solution, regardless of the identity of the solute particles.

(ii)

$$M_2 = \frac{K_b \times W_2 \times 1000}{\Delta T_b \times W_1} = \frac{2.53 \times 1.8 \times 1000}{0.88 \times 90} = 57.5\ g/mol$$

28.

(i)




(ii) The reaction occurs at cathode of the cell is $O_2(g)+2H_2O(l)+4e^- \rightarrow 4OH^-(aq)$.

Oxygen is reduced to hydroxide ions.

(iii) The reactants are continuously supplied to the electrodes from the reservoir. Unlike conventional cells, the fuel cells do not have to be discharged when the chemicals are consumed.

They are non polluting because the only reaction product is water (for hydrogen-oxygen fuel cell).

29. Structural isomerism in coordination compounds arises due to different possible arrangements of ligands around the central metal ion. There are several types of structural isomerism observed in coordination compounds:

**Ionization Isomerism**:

In ionization isomerism, the coordination compound undergoes a change in the identity of an anionic ligand with a neutral molecule or ion.
Example: $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$. In the first compound, the sulfate ion ($SO_4^{2-}$) is coordinated, while in the second compound, the bromide ion ($Br^-$) is coordinated.

**Hydrate Isomerism**:

Hydrate isomerism occurs when the same compound exists in different forms differing only in the number of water molecules associated with them.
Example: $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2(H_2O)$. In the first compound, six water molecules are coordinated to the chromium ion, while in the second compound, five water molecules are coordinated along with one water molecule outside the coordination sphere.

**Coordination Isomerism**:

Coordination isomerism involves the interchange of ligands between the coordination sphere and the ionized part of the complex.
Example: $[Co(NH_3)_4(NO_2)Cl]$ and $[Co(NH_3)_4Cl(NO_2)]$. In the first compound, the $NO_2^-$ ion is coordinated, while in the second compound, the $Cl^-$ ion is coordinated.

**Linkage Isomerism**:

Linkage isomerism arises due to the different ways in which a ligand can bind to the metal center through different atoms.

Example: $[Co(NH_3)_4(NO_2)Cl]$ and $[Co(NH_3)_4(NO_2)Cl]$. In the first compound, the nitrite ion ($NO_2^-$) binds to the metal center through nitrogen, while in the second compound, it binds through oxygen.

**Coordination Position Isomerism**:

Coordination position isomerism occurs when the ligands occupy different positions on the coordination sphere.
Example: $[Co(NH_3)_4(NO_2)Cl]$ and $[Co(NH_3)_3(NO_2)Cl_2]$. In the first compound, the $NO_2^-$ ligand occupies a position adjacent to the chloride ion, while in the second compound, it occupies a position opposite to the chloride ion colyeast converts the sugars present in molasses into ethanol and carbon dioxide. Here's a general overview of the process:

30.

(i) Molasses is a dark coloured syrupy liquid left after the crystallization of sugar from the concentrated sugarcane juice. Molasses still contains about 30% of sucrose which cannot be separated by crystallization. It is converted into ethanol by the following steps:

Dilution

Molasses is first diluted with water to bring down the concentration of sugar to about 8 to 10 percent.

Addition of Ammonium Salts

Molasses usually contains enough nitrogenous matter to act as food for yeast during fermentation. If the nitrogen content of the molasses is poor, it may be fortified by the addition of ammonium sulphate or ammonium phosphate.

Addition of Yeast

The solution from the above is collected in large 'fermentation tanks' and yeast is added to it. The mixture is kept at about 303K for a few days. During this period, the enzymes invertase and zymase present in yeast, bring about the conversion of sucrose into ethanol. The fermented liquid is technically called wash.

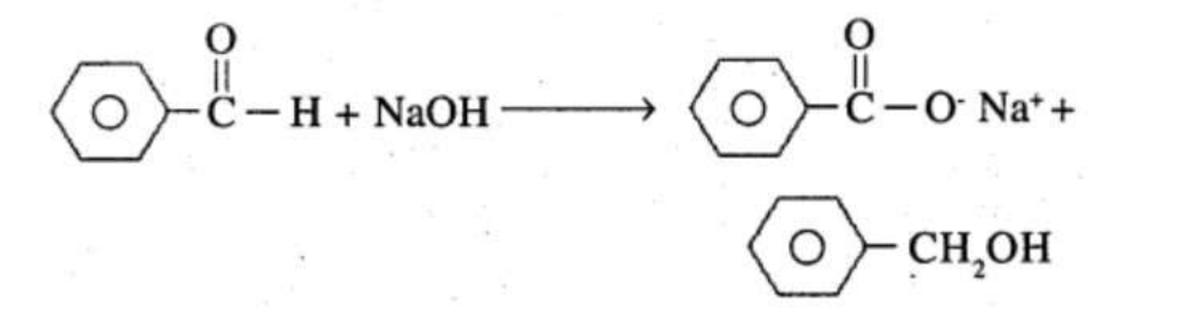
Distillation of Wash

The fermented liquid containing 15 to 18 percent alcohol and the rest of the water is now subjected to fractional distillation. The main fraction drawn is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water. This is called rectified spirit. This mixture is then heated under reflux over quicklime for about 5 to 6 hours and then allowed to stand for 12 hours. On distillation of this mixture, pure alcohol (100%) is obtained. This is called

2. The term 'denatured alcohol' refers to alcohol products adulterated with toxic and/or bad tasting additives (e.g., methanol, benzene, pyridine, castor oil, gasoline, isopropyl alcohol, and acetone), making it unsuitable for human consumption.
3. Ethene

31. (i) Cannizzaro reaction: Aldehydes which do not contain hydrogen when treated with a concentrated solution of an alkali undergo self oxidation-

reduction. As a result, one molecule of aldehyde is reduced to corresponding alcohol while the other molecule is oxidized to the corresponding acid. This reaction is called Cannizzaro reaction.




Stephen reaction: Alkyl nitriles on reduction with stannous chloride and hydrochloric acid in dry ether give corresponding imine hydrochlorides which on acid hydrolysis, give corresponding aldehydes. This reaction is known as Stephen's reaction.