

BIHAR BOARD CLASS 12 CHEMISTRY 2025 QUESTION PAPER WITH SOLUTIONS SET D

Time Allowed :3 Hours 15 mins

Maximum Marks :70

Total questions :96

General Instructions

Instructions to the candidates:

1. **Candidate must enter his/her Question Booklet Serial No. (10 Digits) in the OMR Answer Sheet.**
2. Candidates are required to give their answers in their own words as far as practicable.
3. Figures in the right-hand margin indicate full marks.
4. An extra time of 15 minutes has been allotted for the candidates to read the questions carefully.
5. This question booklet is divided into two sections — **Section-A** and **Section-B**.

Q1. Which of the following adsorptions forms multimolecular layer?

- (A) Physical adsorption
- (B) Chemical adsorption
- (C) Both (A) and (B)
- (D) None of these

Correct Answer: (C) Both (A) and (B)

Solution:

Step 1: Understanding physical and chemical adsorption.

- Physical adsorption occurs due to weak van der Waals forces and can form multilayer adsorption. - Chemical adsorption involves chemical bonds and generally forms a monolayer.

Step 2: Both physical and chemical adsorption.

- Physical adsorption can form a multilayer structure, while chemical adsorption forms a monolayer. - The combination of both processes in certain conditions can lead to a multilayer structure.

Final Answer:

Both (A) and (B)

Quick Tip

Multilayer adsorption is typically associated with physical adsorption, while chemical adsorption tends to form a single monolayer.

Q2. Impurities present in an ore are called

- (A) Flux
- (B) Gangue
- (C) Alloy
- (D) Slag

Correct Answer: (B) Gangue

Solution:**Step 1: Define flux, gangue, alloy, and slag.**

- Flux is a substance used to help in the extraction of metals, like in smelting. - Gangue refers to the unwanted minerals or impurities that are found in ore. - Alloy is a mixture of two or more metals. - Slag is the byproduct formed when impurities are separated from ore.

Step 2: Identify the correct term for ore impurities.

The impurities in ores are typically known as gangue.

Final Answer:

Gangue

Quick Tip

Gangue is the waste material found in ore, while flux is used in the extraction process to separate it.

Q3. The process of smelting involves reduction of metal oxide with

- (A) Al
- (B) C
- (C) Mg
- (D) S

Correct Answer: (B) C

Solution:**Step 1: Understand the process of smelting.**

Smelting is a metallurgical process where metal oxides are reduced to pure metal. It generally requires a reducing agent, which removes oxygen from the metal oxide.

Step 2: Identify the correct reducing agent.

- Aluminum (Al) and magnesium (Mg) can be used in certain reactions, but carbon (C) is the most common reducing agent for smelting. - Carbon reacts with oxygen in metal oxides to produce carbon dioxide and pure metal.

Step 3: Apply to the options.

Carbon (C) is widely used in smelting processes, making it the correct choice.

Final Answer:

C

Quick Tip

Carbon is commonly used as a reducing agent in smelting because it is cheap and effective at removing oxygen from metal oxides.

Q4. Lutetium (Lu) is

- (A) a transition element
- (B) a lanthanide
- (C) an actinide
- (D) a p-block element

Correct Answer: (B) a lanthanide**Solution:****Step 1: Understand Lutetium's classification.**

Lutetium is a chemical element with the symbol Lu and atomic number 71. It is part of the lanthanide series in the periodic table.

Step 2: Lanthanides and their properties.

- Lanthanides are a series of 15 chemical elements from Lanthanum (La) to Lutetium (Lu), found in the f-block of the periodic table. - Transition elements are found in the d-block of the periodic table, while actinides are in the f-block but are specifically elements 89–103.

Step 3: Apply to the options.

Lutetium is classified as a lanthanide, making option (B) the correct choice.

Final Answer:

B

Quick Tip

Lutetium is a lanthanide, which is a group of elements in the f-block of the periodic table, often referred to as rare earth metals.

Q5. Elements of which atomic numbers belong to 3d transition series?

- (A) 22 to 30
- (B) 21 to 30
- (C) 21 to 31
- (D) 21 to 29

Correct Answer: (B) 21 to 30

Solution:

Step 1: Understand the 3d transition series.

The 3d transition elements are those elements in which the last electron enters the 3d subshell. These elements are found in the transition metal block of the periodic table. The atomic numbers for the 3d transition series range from 21 to 30.

Step 2: Identify the atomic numbers.

- The elements that belong to the 3d transition series are Scandium (Sc) with atomic number 21, Titanium (Ti) with atomic number 22, and so on until Zinc (Zn) with atomic number 30.

Step 3: Apply to the options.

The range of atomic numbers from 21 to 30 covers the complete 3d transition series.

Therefore, the correct answer is (B).

Final Answer:

21 to 30

Quick Tip

The 3d transition series consists of elements with atomic numbers 21 through 30, starting from Scandium (21) to Zinc (30).

Q6. The process of purification of metal represented by the following equation is called



- (A) Cupellation
- (B) Poling
- (C) Van Arkel
- (D) Zone refining

Correct Answer: (D) Zone refining

Solution:

Step 1: Understand the given process.

The given equation shows the process where Titanium (Ti) reacts with chlorine to form Titanium tetrachloride (TiCl_4) and then undergoes a further reaction at a higher temperature, resulting in the formation of Titanium metal. This process is used for the purification of metals.

Step 2: Identify the purification process.

- **Cupellation** is a process used to separate noble metals from base metals by heating them in a special furnace. - **Poling** is a method used for removing dissolved gases from molten metals. - **Van Arkel** method is used for the purification of certain metals, especially titanium, by converting them into a volatile compound, which is then decomposed. - **Zone refining** is a process used to purify metals by melting a small region of the metal and then moving it along the metal rod, gradually purifying the material as impurities concentrate in the molten region.

Step 3: Apply to the options.

The process shown in the equation is similar to the Zone refining process, used extensively for purifying metals like titanium.

Final Answer:

Zone refining

Quick Tip

Zone refining is an efficient method for purifying metals by melting and recrystallizing them, often used for high-purity materials.

Q7. Which of the following metals is not obtained by electrolysis?

- (A) Na
- (B) Mg
- (C) Al
- (D) Fe

Correct Answer: (D) Fe

Solution:

Step 1: Understand the electrolysis process.

Electrolysis is the process of using electricity to break down compounds into their components. It is commonly used for extracting metals from their ores.

Step 2: Analyze each option.

- Sodium (Na) and Magnesium (Mg) are both extracted using electrolysis. - Aluminum (Al) is also extracted by electrolysis in the Bayer process. - Iron (Fe) is typically extracted by reduction using carbon, not by electrolysis.

Step 3: Apply to the options.

Iron (Fe) is the metal that is not obtained by electrolysis, making option (D) correct.

Final Answer:

Fe

Quick Tip

Electrolysis is used to extract highly reactive metals like sodium and magnesium, while less reactive metals like iron are extracted using reduction methods.

Q8. Which of the following oxides is paramagnetic?

- (A) CO₂
- (B) ClO₂
- (C) SO₂
- (D) SiO₂

Correct Answer: (B) ClO₂

Solution:

Step 1: Define paramagnetism.

Paramagnetism occurs in substances with at least one unpaired electron. These substances are attracted to magnetic fields.

Step 2: Check the magnetic properties of the options.

- CO₂ is diamagnetic as it has no unpaired electrons. - ClO₂ is paramagnetic as it has unpaired electrons in its molecular orbitals. - SO₂ and SiO₂ are also diamagnetic.

Step 3: Apply to the options.

Since ClO₂ has unpaired electrons, it is the only paramagnetic oxide among the options.

Final Answer:

ClO₂

Quick Tip

Paramagnetic substances have unpaired electrons, which make them attracted to magnetic fields.

Q9. Which of the following ions is diamagnetic?

- (A) Cr²⁺
- (B) V²⁺
- (C) Sc³⁺

(D) Ti^{3+}

Correct Answer: (C) Sc^{3+}

Solution:

Step 1: Define diamagnetism.

Diamagnetism is the property of materials that have no unpaired electrons. These materials are weakly repelled by a magnetic field.

Step 2: Check the electronic configuration of each ion.

- Cr^{2+} and V^{2+} both have unpaired electrons and are paramagnetic. - Sc^{3+} has no unpaired electrons and is diamagnetic. - Ti^{3+} also has unpaired electrons and is paramagnetic.

Step 3: Apply to the options.

Sc^{3+} is the only ion without unpaired electrons, making it diamagnetic.

Final Answer:



Quick Tip

Diamagnetic ions have all electrons paired, making them weakly repelled by magnetic fields.

Q10. The electronic configuration of copper ($Z = 29$) is

(A) $[\text{Ar}] 3d^9 4s^2$

(B) $[\text{Ar}] 3d^{10} 4s^1$

(C) $[\text{Ar}] 3d^8 4s^2$

(D) $[\text{Ar}] 3d^{10} 4s^2$

Correct Answer: (B) $[\text{Ar}] 3d^{10} 4s^1$

Solution:

Step 1: Understand electronic configuration.

The electronic configuration of an atom is the distribution of its electrons among various orbitals. Copper (Cu) has an atomic number of 29.

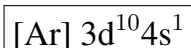
Step 2: Apply the Aufbau principle.

- The configuration for Copper (Cu) should fill up orbitals starting from the lowest energy level. - However, copper is an exception because it prefers to have a fully filled 3d orbital. This leads to the configuration $[\text{Ar}] 3d^{10}4s^1$.

Step 3: Apply to the options.

Option (B) is the correct configuration for copper, where the 4s orbital has one electron and the 3d orbital is completely filled.

Final Answer:



Quick Tip

Copper is an exception to the normal filling order and adopts a $[\text{Ar}] 3d^{10}4s^1$ configuration for stability.

Q11. Which of the following is the electronic configuration of Lanthanide elements?

- (A) $(n - 2)f^{14}(n - 1) 5s^2 4d^0 4n^2$
- (B) $(n - 2)f^{14}(n - 1) 4s^2 4d^{10}ns^2$
- (C) $(n - 2)f^{14}(n - 1) 4d^0 1n^0ns^2$
- (D) $(n - 2)d^0 1n^2$

Correct Answer: (A) $(n - 2)f^{14}(n - 1) 5s^2 4d^0 4n^2$

Solution:

Step 1: Lanthanides electronic configuration.

Lanthanides are elements with atomic numbers from 58 to 71. These elements are characterized by filling the 4f orbitals. The general configuration for Lanthanide elements involves the $(n - 2)f$ orbitals being filled after the $(n - 1) 4s$ orbital.

Step 2: Apply the options.

- Option (A) gives the correct configuration where the 4f orbital is filled and the 4s orbital remains as the second shell of electrons.

Final Answer:

$$(n - 2)f^{14}(n - 1) 5s^2 4d^0 4n^2$$

Quick Tip

Lanthanides have electrons filling the 4f orbitals, and their configuration generally follows the pattern $(n - 2)f^{14}$.

Q12. Which of the following compounds can be coloured?

- (A) Ag_2SO_4
- (B) CuF_2
- (C) Cu_2Cl_2
- (D) MgF_2

Correct Answer: (B) CuF_2

Solution:**Step 1: Understand the factors for colouration.**

Compounds can be coloured if they have partially filled d-orbitals, which allow the absorption of light in the visible spectrum. The transition metal compounds are typically the ones that can exhibit such properties.

Step 2: Apply to the options.

- Ag_2SO_4 and MgF_2 are both ionic and do not have partially filled d-orbitals, so they are colourless. - CuF_2 is a transition metal compound and can exhibit colour due to the partially filled 3d orbitals of copper.

Step 3: Conclude the correct answer.

The only coloured compound among the options is CuF_2 , so option (B) is correct.

Final Answer:



Quick Tip

Transition metal compounds often exhibit colour due to the presence of partially filled d-orbitals that allow electronic transitions.

Q13. The oxidation state of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$ is

- (A) +2
- (B) +3
- (C) 0
- (D) +4

Correct Answer: (A) +2

Solution:

Step 1: Understand the formula.

$\text{K}_4[\text{Fe}(\text{CN})_6]$ is a coordination compound. The cyanide ion (CN^-) has a charge of -1, and there are 6 cyanide ions in the complex, giving a total charge of -6.

Step 2: Calculate the oxidation state of Fe.

The overall charge of the complex is neutral, so the oxidation state of Fe must balance the charge of the cyanide ions and the 4 potassium ions. - Potassium (K) has a +1 charge, and there are 4 potassium ions, so the total charge from K is +4. - The total charge from the cyanide ions is -6. Thus, to balance the charges, the oxidation state of Fe must be +2.

Step 3: Apply to the options.

The oxidation state of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$ is +2, so the correct answer is (A).

Final Answer:



Quick Tip

In coordination compounds, the oxidation state of the central metal can be determined by balancing the charges from ligands and counterions.

Q14. The effective atomic number (E.A.N.) of cobalt in the complex ion $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is

- (A) 27
- (B) 36
- (C) 33
- (D) 35

Correct Answer: (B) 36

Solution:

Step 1: Understand the concept of Effective Atomic Number (E.A.N.).

The effective atomic number is calculated as the atomic number of the central metal ion plus the total number of electrons donated by the ligands. For a complex, the E.A.N. is given by:

$$\text{E.A.N.} = \text{Atomic number of metal} + \text{Total electrons donated by ligands.}$$

Step 2: Determine the atomic number and ligands.

- The atomic number of cobalt (Co) is 27. - The ethylenediamine (en) ligand donates 2 electrons per ligand, and there are 2 en ligands, so they donate 4 electrons. - The chloride (Cl) ion donates 2 electrons, and there are 2 chloride ions, so they donate 4 electrons. Thus, the total electrons donated by the ligands is 4 (from en) + 4 (from Cl) = 8 electrons.

Step 3: Calculate the E.A.N.

The E.A.N. of cobalt is:

$$\text{E.A.N.} = 27 + 8 = 36.$$

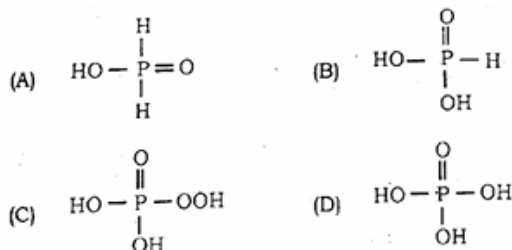
Final Answer:

36

Quick Tip

The E.A.N. helps determine the stability of a complex, and it's important for predicting the behaviour of the central metal in coordination compounds.

Q15. Which of the following is the structural formula of hypophosphorous acid?



Correct Answer: (C)

Solution:

Step 1: Understand the structure of hypophosphorous acid.

Hypophosphorous acid is a weak acid with the molecular formula H_3PO_2 . It contains one phosphorus atom bonded to two hydroxyl groups (-OH) and one -OOH group (hydroperoxide group).

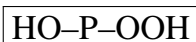
Step 2: Analyze each option.

- Option (A) is incorrect because it shows a double bond to oxygen, which is not the structure of hypophosphorous acid. - Option (B) is incorrect because it shows two hydrogen atoms attached to phosphorus, which is not typical for this acid. - Option (C) is the correct structure, showing the correct bonding with one hydroxyl group and one hydroperoxide group (-OOH). - Option (D) is incorrect because it shows two hydroxyl groups and no hydroperoxide group.

Step 3: Apply to the options.

The correct structural formula for hypophosphorous acid is shown in option (C).

Final Answer:



Quick Tip

Hypophosphorous acid contains a hydroperoxide group (-OOH) attached to phosphorus, which differentiates it from other phosphorous acids.

Q16. Ammonia can be dried by

- (A) CaO
- (B) P_4O_{10}
- (C) Conc. H_2SO_4
- (D) Anhydrous $CaCl_2$

Correct Answer: (B) P_4O_{10}

Solution:

Step 1: Understand the drying process for ammonia.

Ammonia (NH_3) is a gas that can be dried by removing its moisture content. Certain drying agents can be used to absorb the water vapor from ammonia gas.

Step 2: Analyze each option.

- **CaO** (Calcium oxide) is a desiccant but is generally used for drying gases like carbon dioxide and not ammonia. - **P_4O_{10}** (Phosphorus pentoxide) is a highly effective desiccant that is commonly used to dry ammonia by absorbing moisture and forming phosphoric acid. - **Conc. H_2SO_4** (Concentrated sulfuric acid) is also a drying agent but is more commonly used for drying gases like hydrogen chloride. - **Anhydrous $CaCl_2$** (Calcium chloride) is effective in absorbing water but is not as commonly used for drying ammonia specifically.

Step 3: Conclude the correct answer.

Phosphorus pentoxide (P_4O_{10}) is the most effective and common drying agent for ammonia.

Final Answer:



Quick Tip

Phosphorus pentoxide (P_4O_{10}) is highly hygroscopic and is commonly used to dry ammonia and other gases.

Q17. Which among the following is the strongest base?

- (A) AsH_3
- (B) SbH_3
- (C) PH_3
- (D) NH_3

Correct Answer: (D) NH_3

Solution:

Step 1: Understand the concept of basicity.

Basicity refers to the ability of a substance to accept protons (H^+) in a chemical reaction.

The stronger the base, the more readily it can accept protons.

Step 2: Analyze each option.

- AsH_3 (Arsine) is a weaker base because arsenic (As) is less electronegative than phosphorus, so its ability to donate electrons to bond with protons is lower. - SbH_3 (Stibine) is an even weaker base than arsine because antimony (Sb) is even less electronegative than arsenic. - PH_3 (Phosphine) is a weak base because phosphorus is less electronegative than nitrogen, and its lone pair is less available for protonation. - NH_3 (Ammonia) is the strongest base in this group because nitrogen is highly electronegative, making its lone pair more available to bond with protons.

Step 3: Apply to the options.

Ammonia (NH_3) is the strongest base among the options due to nitrogen's high electronegativity and its ability to donate its lone pair easily.

Final Answer:



Quick Tip

The basicity of a compound increases with the electronegativity of the central atom, and NH_3 is the strongest base because nitrogen is highly electronegative.

Q18. The hybridization of S in SO_3 is

- (A) sp^2
- (B) sp^3
- (C) sp^3d
- (D) sp^3d^2

Correct Answer: (A) sp^2

Solution:

Step 1: Understand the structure of SO_3 .

SO_3 (sulfur trioxide) has a trigonal planar structure with sulfur in the center and three oxygen atoms around it. The sulfur atom forms three bonds with oxygen atoms.

Step 2: Identify the electron domains around sulfur.

- Sulfur in SO_3 has 3 bonding pairs of electrons and no lone pairs of electrons. Therefore, the number of electron domains around sulfur is 3.

Step 3: Determine the hybridization.

- When there are 3 electron domains, the hybridization of the central atom is sp^2 .

Step 4: Apply to the options.

The hybridization of sulfur in SO_3 is sp^2 , so option (A) is correct.

Final Answer:

sp^2

Quick Tip

In molecules like SO_3 , sp^2 hybridization leads to a trigonal planar structure with 120° bond angles.

Q19. The maximum covalency of nitrogen is

- (A) 2
- (B) 3
- (C) 4
- (D) 5

Correct Answer: (D) 5

Solution:

Step 1: Understand covalency.

Covalency refers to the number of bonds an atom can form with other atoms. For nitrogen, the covalency is determined by the number of valence electrons and the available orbitals for bonding.

Step 2: Analyze nitrogen's bonding capacity.

- Nitrogen has 5 valence electrons and can form 3 single bonds (e.g., in NH_3) or 4 bonds in some cases (e.g., in NCl_3). - However, nitrogen can also form 5 bonds in compounds like nitrogen pentachloride (NCl_5), where it utilizes its empty d-orbitals.

Step 3: Apply to the options.

The maximum covalency of nitrogen is 5, so option (D) is correct.

Final Answer:

5

Quick Tip

The maximum covalency of nitrogen is 5, but it typically forms 3 bonds in most compounds due to the availability of d-orbitals for higher bonding.

Q20. The number of unpaired electrons in one molecule of liquid oxygen is

- (A) 0

- (B) 2
- (C) 3
- (D) 4

Correct Answer: (B) 2

Solution:

Step 1: Understand the molecular structure of oxygen.

Oxygen (O_2) has 8 electrons in its outermost shell, and each oxygen atom contributes 8 electrons, for a total of 16 electrons in the O_2 molecule.

Step 2: Apply the molecular orbital theory.

- According to the molecular orbital theory, oxygen molecules (O_2) have two unpaired electrons in the antibonding π^* orbitals. - These unpaired electrons result in the paramagnetic behavior of O_2 .

Step 3: Apply to the options.

The number of unpaired electrons in one molecule of liquid oxygen is 2, so option (B) is correct.

Final Answer:

2

Quick Tip

Oxygen molecules (O_2) have 2 unpaired electrons, making them paramagnetic, which is a result of the molecular orbital theory.

Q21. The most abundant noble gas in atmosphere is

- (A) He
- (B) Ar
- (C) Xe
- (D) Rn

Correct Answer: (B) Ar

Solution:

Step 1: Identify the noble gases in the atmosphere.

The noble gases in the atmosphere include helium (He), argon (Ar), xenon (Xe), and radon (Rn).

Step 2: Understand the abundance of noble gases.

Argon (Ar) is the most abundant noble gas in the Earth's atmosphere, constituting approximately 0.93

Step 3: Apply to the options.

Argon (Ar) is the most abundant noble gas in the atmosphere, so the correct answer is (B).

Final Answer:

Ar

Quick Tip

Argon is the most abundant noble gas in the Earth's atmosphere and is often used in light bulbs and as a protective atmosphere for welding.

Q22. The electromotive force of the following cell is



$$E^0 \text{Zn}^{2+} \text{---Zn} = -0.76 \text{ V}, E^0 \text{Fe}^{2+} \text{---Fe} = -0.44 \text{ V}$$

- (A) 1.2 V
- (B) 0.32 V
- (C) -1.2 V
- (D) -0.32 V

Correct Answer: (B) 0.32 V

Solution:

Step 1: Understand the formula for electromotive force.

The electromotive force (EMF) of a galvanic cell is calculated using the standard electrode potentials of the two half-reactions. The formula is:

$$\text{EMF} = E_{\text{cathode}}^0 - E_{\text{anode}}^0$$

Step 2: Identify the cathode and anode.

- Zinc (Zn) is the anode because it has a more negative standard electrode potential and will undergo oxidation ($\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$). - Iron (Fe) is the cathode because it has a less negative standard electrode potential and will undergo reduction ($\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe}$).

Step 3: Apply the electrode potentials.

- Standard electrode potential for zinc (Zn^{2+}/Zn) is -0.76 V. - Standard electrode potential for iron (Fe^{2+}/Fe) is -0.44 V. So, the EMF is:

$$\text{EMF} = (-0.44) - (-0.76) = 0.32 \text{ V}$$

Final Answer:

0.32 V

Quick Tip

The EMF is positive if the cathode has a higher potential than the anode, which corresponds to a spontaneous reaction.

Q23. The unit of specific conductance is

- (A) ohm cm^{-1}
- (B) ohm cm^{-2}
- (C) $\text{ohm}^{-1} \text{ cm}^{-1}$
- (D) $\text{ohm}^{-1} \text{ cm}^{-2}$

Correct Answer: (C) $\text{ohm}^{-1} \text{ cm}^{-1}$

Solution:

Step 1: Understand specific conductance.

Specific conductance (also called conductivity) is a property of a material that describes its ability to conduct electric current. It is the inverse of resistivity and is expressed in $\text{ohm}^{-1} \text{cm}^{-1}$.

Step 2: Apply to the options.

- The unit of specific conductance is the inverse of resistance per unit length, which is $\text{ohm}^{-1} \text{cm}^{-1}$, corresponding to option (C).

Final Answer:

$$\text{ohm}^{-1} \text{cm}^{-1}$$

Quick Tip

Specific conductance is the reciprocal of resistivity, and its unit is $\text{ohm}^{-1} \text{cm}^{-1}$.

Q24. Which among the following aqueous solutions has the highest boiling point?

- (A) 1% glucose
- (B) 1% sucrose
- (C) 1% NaCl
- (D) 1% CaCl_2

Correct Answer: (D) 1

Solution:

Step 1: Understand the concept of boiling point elevation.

Boiling point elevation occurs when a solute is added to a solvent, resulting in an increase in the boiling point. The extent of boiling point elevation depends on the number of particles in solution, which is determined by the van't Hoff factor (i).

Step 2: Analyze the van't Hoff factor.

- **Glucose** and **sucrose** are non-electrolytes, meaning they do not dissociate into ions in solution. Their van't Hoff factor (i) is 1. - **NaCl** dissociates into 2 ions (Na^+ and

Cl^-), so its van't Hoff factor (i) is 2. - **CaCl_2** dissociates into 3 ions (Ca^{2+} and 2 Cl^-), so its van't Hoff factor (i) is 3.

Step 3: Apply to the options.

The higher the van't Hoff factor, the higher the number of particles in solution, leading to a greater boiling point elevation. Therefore, the solution with the highest boiling point will be the one with CaCl_2 , which has the highest van't Hoff factor.

Final Answer:



Quick Tip

The boiling point elevation is directly proportional to the van't Hoff factor (i). The more ions a substance dissociates into, the greater the elevation in boiling point.

Q25. Which of the following is not a colligative property?

- (A) Vapour pressure
- (B) Depression of freezing point
- (C) Osmotic pressure
- (D) Elevation of boiling point

Correct Answer: (A) Vapour pressure

Solution:

Step 1: Understand colligative properties.

Colligative properties are properties that depend on the number of solute particles in a solution, not the identity of the solute particles. The common colligative properties include the depression of freezing point, elevation of boiling point, osmotic pressure, and vapour pressure lowering.

Step 2: Analyze each option.

- **Vapour pressure** is not a colligative property, as it depends on the nature of the solvent and solute. It is affected by the volatility of the solvent and solute, not just the number of

particles. - The other properties listed (depression of freezing point, osmotic pressure, and elevation of boiling point) are all colligative properties.

Step 3: Apply to the options.

Since vapour pressure is not a colligative property, the correct answer is (A).

Final Answer:

Vapour pressure

Quick Tip

Colligative properties depend only on the number of solute particles and not on their nature or identity.

Q26. An aqueous solution of which of the following compounds shows abnormal osmotic pressure?

- (A) Urea
- (B) Common salt
- (C) Glucose
- (D) Sucrose

Correct Answer: (B) Common salt

Solution:

Step 1: Understand osmotic pressure.

Osmotic pressure is the pressure exerted by a solution to prevent the flow of solvent into it through a semipermeable membrane. It depends on the concentration of solute particles in the solution.

Step 2: Analyze the compounds.

- **Urea**, **glucose**, and **sucrose** are non-electrolytes. They do not dissociate into ions and therefore contribute only one particle each in the solution. - **Common salt (NaCl)** dissociates into two ions (Na^+ and Cl^-), so it contributes two particles per formula unit, which leads to a higher osmotic pressure than the non-electrolytes.

Step 3: Apply to the options.

Since common salt dissociates into two ions, it will show abnormal osmotic pressure compared to the other non-electrolytes.

Final Answer:

Common salt

Quick Tip

Electrolytes like NaCl dissociate into multiple ions, leading to higher osmotic pressure compared to non-electrolytes like urea, glucose, and sucrose.

Q27. The solution which shows positive or negative deviation from Raoult's law is called

- (A) Ideal solution
- (B) True solution
- (C) Non-ideal solution
- (D) Colloidal solution

Correct Answer: (C) Non-ideal solution

Solution:**Step 1: Understand Raoult's law.**

Raoult's law states that the partial vapor pressure of each volatile component in a solution is directly proportional to its mole fraction in the solution. Ideal solutions obey Raoult's law perfectly, meaning they show no deviation from it.

Step 2: Understand deviations from Raoult's law.

- **Non-ideal solutions** show either positive or negative deviations from Raoult's law.

These deviations occur when the interactions between molecules in the solution differ from those between the pure components. - **Ideal solutions** obey Raoult's law exactly, showing no deviation. - **True solutions** and **colloidal solutions** are not classified based on their adherence to Raoult's law.

Step 3: Apply to the options.

Non-ideal solutions are the ones that show deviations from Raoult's law, making option (C) the correct answer.

Final Answer:

Non-ideal solution

Quick Tip

Non-ideal solutions show deviations from Raoult's law due to differences in intermolecular forces between the solute and solvent.

Q28. Isotonic solutions have equal

- (A) osmotic pressure
- (B) vapour pressure
- (C) relative lowering of vapour pressure
- (D) elevation of boiling point

Correct Answer: (A) osmotic pressure

Solution:**Step 1: Define isotonic solutions.**

Isotonic solutions are solutions that have the same osmotic pressure. This means that the concentration of solute particles in both solutions is the same, and there is no net movement of solvent when these solutions are separated by a semipermeable membrane.

Step 2: Apply to the options.

- **Osmotic pressure** is the pressure required to stop osmosis. Isotonic solutions must have equal osmotic pressure by definition. - The other options (vapour pressure, relative lowering of vapour pressure, and elevation of boiling point) are not necessarily equal in isotonic solutions.

Final Answer:

osmotic pressure

Quick Tip

Isotonic solutions have the same osmotic pressure, which results in no net movement of solvent across a semipermeable membrane.

Q29. The structure of complex ion $[\text{Ni}(\text{CN})_4]^{2-}$ is

- (A) Linear
- (B) Tetrahedral
- (C) Square planar
- (D) Octahedral

Correct Answer: (B) Tetrahedral

Solution:

Step 1: Understand the complex ion structure.

The complex ion $[\text{Ni}(\text{CN})_4]^{2-}$ involves nickel (Ni) at the center surrounded by four cyanide (CN^-) ligands. The geometry of such a complex is determined by the coordination number and the type of ligands involved.

Step 2: Determine the geometry.

Nickel (Ni) in this case has a coordination number of 4, which typically leads to a tetrahedral geometry. The CN^- ligand is a linear ligand, and in the absence of other factors, a tetrahedral structure is favored.

Step 3: Apply to the options.

The correct geometry for $[\text{Ni}(\text{CN})_4]^{2-}$ is tetrahedral, so the correct answer is (B).

Final Answer:

Tetrahedral

Quick Tip

For coordination complexes with a coordination number of 4, the most common geometry is tetrahedral, especially with ligands like CN^- .

Q30. The IUPAC name of complex compound $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is

- (A) Hexa-ammine cobalt (III) chloride
- (B) Hexa-ammine cobalt (II) chloride
- (C) Hexa-ammine trichloridocobalt (III)
- (D) None of these

Correct Answer: (A) Hexa-ammine cobalt (III) chloride

Solution:

Step 1: Understand the naming convention for coordination compounds.

The IUPAC name of a coordination compound follows the format:

Ligand names + Metal name + Oxidation state of metal + Counterion.

For the complex $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$, the ligands are NH_3 (ammine), cobalt (Co) is the metal, and the oxidation state of cobalt is +3 (since the complex is neutral and the chloride ions are -1 each).

Step 2: Apply the IUPAC naming conventions.

- The complex contains 6 NH_3 ligands, which are called "ammine". - The oxidation state of cobalt is +3, so it is named "cobalt (III)". - The counterion is chloride (Cl), which is written as "chloride" at the end.

Step 3: Apply to the options.

The correct IUPAC name for the compound $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is "Hexa-ammine cobalt (III) chloride".

Final Answer:

Hexa-ammine cobalt (III) chloride

Quick Tip

When naming coordination compounds, remember to list the ligands first, followed by the metal and its oxidation state in parentheses, and finish with the counterions.

Q31. Which of the following cannot show linkage isomerism?

- (A) NO_2^-
- (B) SCN^-
- (C) CN^-
- (D) NH_3

Correct Answer: (D) NH_3

Solution:

Step 1: Define linkage isomerism.

Linkage isomerism occurs when a ligand can bind to the metal center in more than one way. This typically happens with ligands that have more than one donor atom, such as NO_2^- , SCN^- , and CN^- .

Step 2: Analyze the options.

- NO_2^- can bind through the nitrogen atom or the oxygen atom, so it can exhibit linkage isomerism. - SCN^- can bind through either the sulfur or nitrogen atom, so it can also show linkage isomerism. - CN^- can bind through the carbon atom or the nitrogen atom, so it can show linkage isomerism. - NH_3 , however, only binds through the nitrogen atom and does not show linkage isomerism.

Step 3: Apply to the options.

Since NH_3 cannot show linkage isomerism, the correct answer is (D).

Final Answer:



Quick Tip

Linkage isomerism occurs in ligands that can coordinate through more than one atom, such as NO_2^- , SCN^- , and CN^- , but not NH_3 .

Q32. Reaction of primary amine with chloroform in the presence of alcoholic KOH is called

- (A) Hydrolysis
- (B) Reduction
- (C) Wurtz reaction
- (D) Carbymine reaction

Correct Answer: (D) Carbymine reaction

Solution:

Step 1: Understand the Carbymine reaction.

The Carbymine reaction is a reaction of primary amines with chloroform (CHCl_3) in the presence of alcoholic KOH to form an isocyanide (carbamine).

Step 2: Analyze the options.

- **Hydrolysis** is the reaction of a compound with water to break it down. It does not involve chloroform. - **Reduction** refers to the gain of electrons or decrease in oxidation state, which is not applicable here. - **Wurtz reaction** involves the coupling of two alkyl halides in the presence of sodium metal and is unrelated to amines or chloroform. - **Carbymine reaction** is the correct reaction, as it involves the formation of an isocyanide when a primary amine reacts with chloroform and KOH.

Step 3: Apply to the options.

The correct answer is (D) Carbymine reaction.

Final Answer:

Carbymine reaction

Quick Tip

The Carbymine reaction produces isocyanides (carbamines) and is specific to primary amines reacting with chloroform and KOH.

Q33. Which of the following is chloral?

- (A) CCl_3CHO
- (B) $\text{CCl}_3\text{COCH}_3$
- (C) $\text{CCl}_3\text{COCCl}_3$
- (D) $\text{CCl}_3\text{CH}_2\text{OH}$

Correct Answer: (A) CCl_3CHO

Solution:

Step 1: Identify chloral.

Chloral is an organic compound with the formula CCl_3CHO , consisting of a trichloromethyl group (CCl_3) attached to an aldehyde group (CHO). It is commonly used in the synthesis of chloral hydrate.

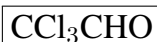
Step 2: Analyze the options.

- CCl_3CHO is the correct structure for chloral. - The other options are different compounds with varying groups attached to the trichloromethyl group but do not represent chloral.

Step 3: Apply to the options.

The correct formula for chloral is (A) CCl_3CHO .

Final Answer:



Quick Tip

Chloral (CCl_3CHO) is an aldehyde with three chlorine atoms attached to the carbon atom.

Q34. Which of the following has zero dipole moment?

- (A) CH_3Cl
- (B) CCl_4
- (C) CH_2Cl_2
- (D) CHCl_3

Correct Answer: (B) CCl_4

Solution:

Step 1: Understand dipole moment.

The dipole moment is a measure of the separation of charge in a molecule. Molecules with symmetrical structures where the dipoles cancel out have zero dipole moment.

Step 2: Analyze the options.

- CH_3Cl , CH_2Cl_2 , and CHCl_3 all have asymmetrical structures, so their dipoles do not cancel out, and they have non-zero dipole moments. - CCl_4 has a symmetrical tetrahedral structure, and the dipoles of the four C-Cl bonds cancel each other out, resulting in a zero dipole moment.

Step 3: Apply to the options.

The compound with zero dipole moment is (B) CCl_4 .

Final Answer:



Quick Tip

In molecules with symmetrical geometry, like CCl_4 , the dipoles of individual bonds cancel out, leading to zero dipole moment.

Q35. The IUPAC name of $\text{CH}_3\text{-CH-CH}_3\text{-CH}_2\text{Cl}$ is

- (A) 3-chloro-2-methyl butane
- (B) 2-chloro-3-methyl butane
- (C) 3-methyl-2-chlorobutane
- (D) 2-chloro-3-methylbutane

Correct Answer: (B) 2-chloro-3-methyl butane

Solution:

Step 1: Understand the structure of the compound.

The given structure is $\text{CH}_3\text{-CH-CH}_3\text{-CH}_2\text{Cl}$. This structure represents a butane chain with a chlorine atom (Cl) and a methyl group (CH_3) attached to it.

Step 2: Identify the functional groups and their positions.

- The chlorine atom is attached to the second carbon in the chain (2-chloro). - The methyl group is attached to the third carbon in the chain (3-methyl). Thus, the IUPAC name is "2-chloro-3-methyl butane".

Step 3: Apply to the options.

The correct IUPAC name is (B) 2-chloro-3-methyl butane.

Final Answer:

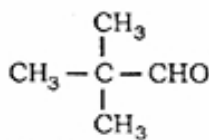
2-chloro-3-methyl butane

Quick Tip

When naming alkanes with substituents, number the chain starting from the end closest to the first substituent.

Q36. Which of the following would give Aldol condensation reaction?

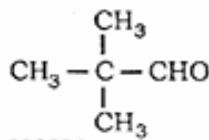
(A) CCl_3CHO



(B) HCHO

(C) CH_3CHO

(D) HCHO



Correct Answer: (B)

Solution:

Step 1: Understand Aldol condensation.

Aldol condensation is a reaction in which an enolate ion of an aldehyde or ketone reacts with another aldehyde or ketone molecule to form a β -hydroxy aldehyde or ketone, which then undergoes dehydration to give an α,β -unsaturated carbonyl compound.

Step 2: Identify the compounds capable of Aldol condensation.

- CCl_3CHO (Option A) is a chloro-aldehyde, which does not participate in Aldol condensation. - $\text{CH}_3\text{-C-CHO}$ (Option B) is an aldehyde with a hydrogen atom adjacent to the carbonyl group, making it suitable for Aldol condensation. - CH_3CHO (Option C) is acetaldehyde, but it is too simple for the reaction to take place effectively in this context. - HCHO (Option D) is formaldehyde, which is not typically used in Aldol condensation reactions.

Step 3: Apply to the options.

The correct compound for Aldol condensation is (B) $\text{CH}_3\text{-C-CHO}$.

Final Answer:



Quick Tip

Aldol condensation typically requires an aldehyde or ketone with a hydrogen atom on the alpha carbon (next to the carbonyl group) to form an enolate ion.

Q37. Vinegar contains

- (A) 10-20% acetic acid
- (B) 10% acetic acid
- (C) 6-10% acetic acid
- (D) 100% acetic acid

Correct Answer: (C) 6-10% acetic acid

Solution:

Step 1: Understand vinegar composition.

Vinegar is a dilute solution of acetic acid (CH_3COOH) in water. The concentration of acetic acid in vinegar typically ranges from 6% to 10%.

Step 2: Analyze the options.

- **10-20% acetic acid** (Option A) is too concentrated for vinegar. - **10% acetic acid** (Option B) is a common concentration, but the typical concentration range for vinegar is slightly lower. - **6-10% acetic acid** (Option C) is the correct range for typical vinegar concentration. - **100% acetic acid** (Option D) is pure acetic acid, which is not the composition of vinegar.

Step 3: Apply to the options.

The correct concentration of acetic acid in vinegar is 6-10%, so the correct answer is (C).

Final Answer:

6-10% acetic acid

Quick Tip

Vinegar typically contains 6-10% acetic acid, making it a weak acid solution used in cooking and as a preservative.

Q38. The IUPAC name of $\text{CH}_3\text{COOC}_2\text{H}_5$ is

- (A) Methyl propanoate
- (B) Ethyl ethanoate
- (C) Acetotheane
- (D) Ethoxyethane

Correct Answer: (B) Ethyl ethanoate

Solution:

Step 1: Understand the structure of the compound.

The given compound is $\text{CH}_3\text{COOC}_2\text{H}_5$, which is an ester formed by the reaction of acetic acid (CH_3COOH) and ethanol ($\text{C}_2\text{H}_5\text{OH}$).

Step 2: Analyze the options.

- **Methyl propanoate** (Option A) is incorrect because the ester is formed from acetic acid and ethanol. - **Ethyl ethanoate** (Option B) is the correct IUPAC name for $\text{CH}_3\text{COOC}_2\text{H}_5$, where "ethyl" comes from the ethanol part and "ethanoate" refers to the acetic acid part. - **Acetothane** (Option C) is not a valid name. - **Ethoxyethane** (Option D) refers to an ether, not an ester.

Step 3: Apply to the options.

The correct IUPAC name is (B) Ethyl ethanoate.

Final Answer:

Ethyl ethanoate

Quick Tip

Esters are named based on the alcohol and the acid from which they are derived, with the alkyl group named first followed by the acid component.

Q39. The general formula of an amine is

- (A) $\text{C}_n\text{H}_{2n+1}\text{N}$
- (B) $\text{C}_n\text{H}_{2n+2}\text{N}$
- (C) $\text{C}_n\text{H}_{2n+3}\text{N}$
- (D) $\text{C}_n\text{H}_{2n}\text{N}$

Correct Answer: (A) $\text{C}_n\text{H}_{2n+1}\text{N}$

Solution:**Step 1: Understand the structure of amines.**

Amines are organic compounds that contain nitrogen (N) attached to carbon atoms. The general formula for primary amines is $\text{C}_n\text{H}_{2n+1}\text{N}$, where "n" is the number of carbon atoms in the molecule.

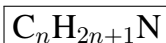
Step 2: Analyze the options.

- $C_nH_{2n+1}N$ (Option A) is the correct formula for primary amines. - $C_nH_{2n+2}N$ (Option B) would suggest an additional hydrogen, which is not typical for amines. - $C_nH_{2n+3}N$ (Option C) is incorrect for primary amines. - $C_nH_{2n}N$ (Option D) is also incorrect as it does not account for the extra hydrogen in primary amines.

Step 3: Apply to the options.

The correct formula for primary amines is (A) $C_nH_{2n+1}N$.

Final Answer:



Quick Tip

Amines have the general formula $C_nH_{2n+1}N$ for primary amines, with one nitrogen attached to a carbon chain.

Q40. Which of the following is Hinsberg reagent?

- (A) Benzene sulphonyl chloride
- (B) Benzene sulphonic acid
- (C) Ethyl oxalate
- (D) Acetyl chloride

Correct Answer: (A) Benzene sulphonyl chloride

Solution:

Step 1: Understand Hinsberg's reagent.

Hinsberg's reagent is benzene sulphonyl chloride ($C_6H_5SO_2Cl$). It is used in the Hinsberg test for the identification of amines.

Step 2: Analyze the options.

- Benzene sulphonyl chloride (Option A) is the correct answer as it is the Hinsberg reagent used for testing amines. - Benzene sulphonic acid (Option B) is a different compound used in other reactions. - Ethyl oxalate (Option C) is not involved in the

Hinsberg test. - **Acetyl chloride** (Option D) is used in the preparation of acyl derivatives but not in the Hinsberg test.

Step 3: Apply to the options.

The correct answer is (A) Benzene sulphonyl chloride.

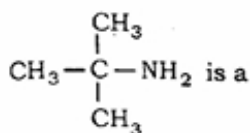
Final Answer:

Benzene sulphonyl chloride

Quick Tip

Benzene sulphonyl chloride is used in the Hinsberg test to differentiate between primary, secondary, and tertiary amines.

Q41.



- (A) Primary amine
- (B) Secondary amine
- (C) Tertiary amine
- (D) Ammonium salt

Correct Answer: (A) Primary amine

Solution:

Step 1: Understand the structure of the compound.

The given compound is $\text{CH}_3\text{-C(NH}_2\text{)}_2$, where an amine group (NH_2) is attached to a carbon atom (C). This is a simple primary amine, as there is only one alkyl group (CH_3) attached to the carbon atom.

Step 2: Analyze the options.

- **Primary amine** (Option A) is correct because the amine group is attached to one carbon atom. - **Secondary amine** (Option B) would have two carbon atoms attached to

the nitrogen. - **Tertiary amine** (Option C) would have three carbon atoms attached to the nitrogen. - **Ammonium salt** (Option D) would have a positively charged nitrogen atom, which is not the case here.

Step 3: Apply to the options.

The correct answer is (A) Primary amine.

Final Answer:

Primary amine

Quick Tip

A primary amine has one alkyl group (or hydrogen) attached to the nitrogen, whereas secondary and tertiary amines have two and three alkyl groups, respectively.

Q42. The source of fats and oils is

- (A) Milk
- (B) Butter
- (C) Cheese
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Understand the source of fats and oils.

Fats and oils are primarily obtained from animals and plants. Animal sources include milk, butter, and cheese, while plant-based oils are obtained from seeds and fruits.

Step 2: Analyze the options.

- **Milk** (Option A) is an animal product that contains fats. - **Butter** (Option B) is made from milk and contains a high percentage of fat. - **Cheese** (Option C) is another product derived from milk, which contains fat. - **All of these** (Option D) is correct because all of the options are sources of fats and oils.

Step 3: Apply to the options.

The correct answer is (D) All of these.

Final Answer:

All of these

Quick Tip

Fats and oils are derived from both animal sources like milk, butter, and cheese, and plant sources like seeds and fruits.

Q43. The specific rate constant of a first order reaction depends upon

- (A) concentration of reactants
- (B) concentration of products
- (C) time
- (D) temperature

Correct Answer: (C) time

Solution:**Step 1: Understand the rate constant.**

For a first order reaction, the rate constant (k) does not depend on the concentration of reactants or products but on the time for the reaction to occur.

Step 2: Analyze the options.

- **Concentration of reactants** (Option A) affects the rate of reaction but not the rate constant. - **Concentration of products** (Option B) is similarly related to reaction rate, not the rate constant. - **Time** (Option C) is the correct factor that the rate constant of a first order reaction depends on, since the rate constant remains constant over time. - **Temperature** (Option D) does affect the rate of reaction but not the rate constant for a given reaction.

Step 3: Apply to the options.

The correct answer is (C) time.

Final Answer:

time

Quick Tip

For first-order reactions, the rate constant is independent of the concentration of reactants or products and is only affected by time and temperature.

Q44. The hydrolysis of ethyl acetate in the presence of dil. NaOH is a reaction of which order?

- (A) 1
- (B) 2
- (C) 3
- (D) 0

Correct Answer: (A) 1

Solution:

Step 1: Understand the reaction.

The hydrolysis of ethyl acetate with dilute NaOH is a simple ester hydrolysis reaction. This reaction follows a first-order rate law with respect to both the ester and NaOH.

Step 2: Analyze the options.

- **1st order** (Option A) is correct as ester hydrolysis with dilute NaOH is a first-order reaction. - **2nd order** (Option B) would imply a second-order dependence, which is not the case for this reaction. - **3rd order** (Option C) is not typical for ester hydrolysis. - **Zero order** (Option D) would indicate that the reaction rate does not depend on concentration, which is not true for this reaction.

Step 3: Apply to the options.

The correct answer is (A) 1.

Final Answer:

1

Quick Tip

The hydrolysis of esters like ethyl acetate in the presence of NaOH typically follows first-order kinetics with respect to both reactants.

Q45. The temperature coefficient of most of the reactions lies between

- (A) 1 and 3
- (B) 2 and 3
- (C) 1 and 4
- (D) 2 and 4

Correct Answer: (A) 1 and 3

Solution:

Step 1: Understand the temperature coefficient.

The temperature coefficient of a reaction indicates how much the rate of the reaction increases with a 10°C increase in temperature. For most reactions, this coefficient lies between 1 and 3.

Step 2: Analyze the options.

- **1 and 3** (Option A) is the correct range for most reactions. - **2 and 3** (Option B) would suggest a higher rate of reaction, which is uncommon for most reactions. - **1 and 4** (Option C) suggests an unusually high temperature dependence. - **2 and 4** (Option D) is also not typical for most reactions.

Step 3: Apply to the options.

The correct answer is (A) 1 and 3.

Final Answer:

1 and 3

Quick Tip

For most chemical reactions, the temperature coefficient ranges between 1 and 3, indicating a moderate increase in reaction rate with temperature.

Q46. The expression of rate for a chemical reaction is, $\text{rate} = k[A][B]^n$; the order of reaction is

- (A) 1
- (B) n
- (C) $n + 1$
- (D) none of these

Correct Answer: (C) $n + 1$

Solution:

Step 1: Understand the rate expression.

The rate expression is given as $\text{rate} = k[A][B]^n$, where k is the rate constant, $[A]$ and $[B]$ are the concentrations of reactants, and n is the order with respect to reactant B.

Step 2: Analyze the options.

- **1** (Option A) suggests the reaction is first order, which is not always true in this case. - **n** (Option B) indicates that the reaction order depends on the concentration of B, which is true for a specific rate expression, but we are considering the combined order of reaction. - **$n + 1$** (Option C) is the correct choice, as the total order of the reaction is the sum of the orders with respect to each reactant. - **None of these** (Option D) is incorrect as we do have a correct option.

Step 3: Apply to the options.

The correct answer is (C) $n + 1$.

Final Answer:

$n + 1$

Quick Tip

For a rate expression like $\text{rate} = k[A][B]^n$, the order of the reaction is the sum of the exponents of the concentration terms.

Q47. Which of the following electrolytes is the least effective in causing coagulation of colloidal solution of ferric hydroxide?

- (A) KBr
- (B) K_2SO_4
- (C) K_2CrO_4
- (D) $\text{K}_3[\text{Fe}(\text{CN})_6]$

Correct Answer: (A) KBr

Solution:

Step 1: Understand coagulation of colloidal solutions.

The process of coagulation involves the addition of an electrolyte to a colloidal solution, which neutralizes the charges on the colloidal particles, causing them to aggregate and settle. The effectiveness of coagulation depends on the charge and the size of the ion.

Step 2: Analyze the options.

- **KBr** (Option A) is the least effective because bromide ions are smaller and have lower charge density, making them less effective at neutralizing the charge of the colloidal particles. - **K_2SO_4** (Option B) contains larger sulfate ions that are more effective at coagulating the colloidal solution. - **K_2CrO_4** (Option C) also has larger ions with a higher charge density. - **$\text{K}_3[\text{Fe}(\text{CN})_6]$** (Option D) is the most effective, as the hexacyanoferrate ions are highly charged, leading to strong coagulation effects.

Step 3: Apply to the options.

The correct answer is (A) KBr.

Final Answer:

KBr

Quick Tip

Electrolytes with high charge density are more effective at coagulating colloidal solutions due to their ability to neutralize the charges on colloidal particles.

Q48. Which of the following is an emulsifier ?

- (A) Soap
- (B) Oil
- (C) NaCl
- (D) Water

Correct Answer: (A) Soap

Solution:

Step 1: Define emulsifier.

An emulsifier is a substance that helps in the formation of an emulsion, a mixture of two immiscible liquids like oil and water. It stabilizes the mixture by reducing the surface tension between the two liquids.

Step 2: Analyze the options.

- **Soap** (Option A) is an emulsifier because it contains both hydrophobic and hydrophilic parts, allowing it to form emulsions between oil and water. - **Oil** (Option B) is not an emulsifier, as it is part of the mixture but does not help in stabilizing the emulsion. - **NaCl** (Option C) is a salt and does not have emulsifying properties. - **Water** (Option D) is a solvent and does not act as an emulsifier.

Step 3: Apply to the options.

The correct answer is (A) Soap.

Final Answer:

Soap

Quick Tip

Soap molecules have hydrophilic (water-attracting) and hydrophobic (water-repelling) ends, which enable them to act as emulsifiers.

Q49. Which of the following catalysts is used in Haber's process for the manufacture of ammonia ?

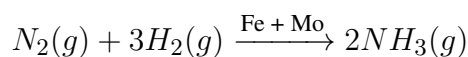
- (A) Al_2O_3
- (B) $\text{Fe} + \text{Mo}$
- (C) CuO
- (D) Pt

Correct Answer: (B) $\text{Fe} + \text{Mo}$

Solution:

Step 1: Understand Haber's process.

Haber's process is used to synthesize ammonia from nitrogen and hydrogen gas. The reaction is as follows:



Step 2: Identify the catalyst.

In Haber's process, the catalyst used is a mixture of iron (Fe) and molybdenum (Mo), which speeds up the reaction without being consumed.

Step 3: Analyze the options.

- **$\text{Fe} + \text{Mo}$** (Option B) is the correct catalyst used in the Haber process. - **Al_2O_3** (Option A) is used in some catalytic reactions but not in the Haber process. - **CuO** (Option C) is a catalyst for other reactions, but not for ammonia synthesis. - **Pt** (Option D) is a catalyst for hydrogenation reactions but not for ammonia synthesis.

Step 4: Apply to the options.

The correct answer is (B) $\text{Fe} + \text{Mo}$.

Final Answer:

$\text{Fe} + \text{Mo}$

Quick Tip

Iron with molybdenum is commonly used in the Haber process for ammonia synthesis due to its ability to lower the activation energy of the reaction.

Q50. Water soluble vitamin is

- (A) Vitamin E
- (B) Vitamin D
- (C) Vitamin K
- (D) Vitamin B

Correct Answer: (D) Vitamin B

Solution:

Step 1: Understand water-soluble vitamins.

Water-soluble vitamins are vitamins that dissolve in water and are not stored in the body. They are easily absorbed and excreted in the urine. The key water-soluble vitamins are B-complex vitamins and Vitamin C.

Step 2: Analyze the options.

- **Vitamin E** (Option A) is a fat-soluble vitamin. - **Vitamin D** (Option B) is a fat-soluble vitamin. - **Vitamin K** (Option C) is a fat-soluble vitamin. - **Vitamin B** (Option D) is a water-soluble vitamin.

Step 3: Apply to the options.

The correct answer is (D) Vitamin B.

Final Answer:

Vitamin B

Quick Tip

Water-soluble vitamins, like Vitamin B and C, are not stored in the body and need to be replenished through the diet regularly.

Q51. The purine base present in RNA is

- (A) Guanine
- (B) Thymine
- (C) Cytosine
- (D) Uracil

Correct Answer: (A) Guanine

Solution:

Step 1: Understand purine bases in RNA.

Purine bases in RNA include **adenine** and **guanine**. Pyrimidine bases in RNA include **cytosine** and **uracil**.

Step 2: Analyze the options.

- **Guanine** (Option A) is a purine base found in RNA. - **Thymine** (Option B) is found in DNA, not RNA. - **Cytosine** (Option C) is a pyrimidine base in RNA. - **Uracil** (Option D) is also a pyrimidine base in RNA.

Step 3: Apply to the options.

The correct answer is (A) Guanine.

Final Answer:

Guanine

Quick Tip

RNA contains purines (adenine and guanine) and pyrimidines (cytosine and uracil).

Q52. The product of addition polymerization is

- (A) PVC
- (B) Nylon
- (C) Terylene

(D) Polyamide

Correct Answer: (A) PVC

Solution:

Step 1: Define addition polymerization.

Addition polymerization is a process where monomers with double bonds (unsaturated monomers) add together without losing any atoms, forming long-chain polymers. PVC (Polyvinyl chloride) is a typical product of addition polymerization.

Step 2: Analyze the options.

- **PVC** (Option A) is made by addition polymerization of vinyl chloride monomers. - **Nylon** (Option B) is made by condensation polymerization. - **Terylene** (Option C) is made by condensation polymerization. - **Polyamide** (Option D) refers to polymers formed by condensation polymerization.

Step 3: Apply to the options.

The correct answer is (A) PVC.

Final Answer:

PVC

Quick Tip

PVC is formed by addition polymerization of vinyl chloride monomers.

Q53. Which one of the following is a thermosetting plastic?

- (A) Polyvinyl chloride (PVC)
- (B) Polyvinyl acetate (PVA)
- (C) Bakelite
- (D) None of these

Correct Answer: (C) Bakelite

Solution:

Step 1: Define thermosetting plastics.

Thermosetting plastics are plastics that harden when heated and cannot be re-melted or re-shaped after the first heating.

Step 2: Analyze the options.

- **Bakelite** (Option C) is a thermosetting plastic that is formed by the polymerization of phenol and formaldehyde. It hardens permanently after heating and is used for electrical insulators. - **PVC** (Option A) and **PVA** (Option B) are thermoplastics, which can be re-melted and re-shaped. - **None of these** (Option D) is incorrect.

Step 3: Apply to the options.

The correct answer is (C) Bakelite.

Final Answer:

Bakelite

Quick Tip

Bakelite is a thermosetting plastic, while PVC and PVA are thermoplastics that can be re-shaped.

Q54. The medicines which lower fever are called

- (A) Analgesic
- (B) Antibiotic
- (C) Antipyretic
- (D) None of these

Correct Answer: (C) Antipyretic

Solution: Step 1: Understand the meaning of Antipyretic.

Antipyretic is a substance that reduces fever. It works by lowering the body temperature. Common examples include paracetamol and ibuprofen.

Step 2: Understand the other options.

- Analgesics relieve pain but do not necessarily lower body temperature. - Antibiotics fight bacterial infections but do not directly influence fever. - "None of these" is incorrect because Antipyretic is the correct term.

Final Answer:

Antipyretic

Quick Tip

Antipyretics like paracetamol or ibuprofen are used to reduce fever and bring the body temperature back to normal.

Q55. Which of the following is a disaccharide?

- (A) Sucrose
- (B) Glucose
- (C) Fructose
- (D) Starch

Correct Answer: (A) Sucrose

Solution: Step 1: Understanding disaccharides.

A disaccharide is a carbohydrate composed of two monosaccharide units. Sucrose is the most common disaccharide, consisting of glucose and fructose.

Step 2: Explanation of other options.

- Glucose is a monosaccharide (simple sugar), not a disaccharide. - Fructose is also a monosaccharide, not a disaccharide. - Starch is a polysaccharide composed of many glucose units, hence not a disaccharide.

Final Answer:

Sucrose

Quick Tip

Sucrose is a disaccharide composed of glucose and fructose. It is commonly known as table sugar.

Q56. Alkali salt of palmitic acid is known as

- (A) an alkoxide
- (B) an ester
- (C) a soap
- (D) an epoxide

Correct Answer: (C) a soap

Solution: Step 1: Understand the chemistry of palmitic acid.

Palmitic acid is a saturated fatty acid, and its alkali salt (when reacted with an alkali like sodium hydroxide) forms a soap. This is because soaps are typically the salts of fatty acids.

Step 2: Explanation of other options.

- An alkoxide refers to a compound with an oxygen anion bonded to an alkyl group, which is not the case for palmitic acid salts. - An ester would be formed if a fatty acid reacted with an alcohol, but that is not the case here. - An epoxide involves a three-membered cyclic ether, which is unrelated to palmitic acid.

Final Answer:

A soap

Quick Tip

Soaps are salts of fatty acids like palmitic acid. When fatty acids react with alkali, they form soap, a key ingredient in cleaning products.

Q57. The number of atoms present in body-centred cubic unit cell is

- (A) 2
- (B) 3
- (C) 4
- (D) 12

Correct Answer: (A) 2

Solution: Step 1: Understanding body-centred cubic (BCC) unit cell.

In a body-centred cubic unit cell, there is one atom at each corner of the cube (each shared by 8 neighboring cubes) and one atom in the centre of the cube. Therefore, the total number of atoms in a BCC unit cell is:

$$\text{Atoms per unit cell} = \frac{8 \times 1}{8} + 1 = 2$$

Step 2: Explanation of other options.

- The number of atoms in face-centred cubic (FCC) unit cells is 4. - In simple cubic unit cells, the number of atoms is 1. - The number of atoms in a unit cell with 12 atoms would correspond to a different structure.

Final Answer:

2

Quick Tip

A body-centred cubic unit cell has 2 atoms: 1 at the centre and 8 corners shared among adjacent unit cells.

Q58. Which of the following is not a crystalline solid?

- (A) KCl
- (B) CsCl
- (C) Glass
- (D) Rhombic sulphur

Correct Answer: (C) Glass

Solution: Step 1: Understanding crystalline and amorphous solids.

Crystalline solids have a well-ordered structure with atoms arranged in a regular pattern.

Amorphous solids, like glass, lack a well-defined structure.

Step 2: Explanation of other options.

- KCl and CsCl are both ionic solids that form a regular crystalline structure. - Rhombic sulphur is a crystalline form of sulfur.

Final Answer:

Glass

Quick Tip

Glass is an amorphous solid, meaning it lacks the orderly structure of crystalline solids like KCl or CsCl.

Q59. How many kinds of Bravais lattice are possible in a crystal?

(A) 23

(B) 7

(C) 30

(D) 14

Correct Answer: (B) 7

Solution: Step 1: Understanding Bravais lattices.

Bravais lattices describe the different ways atoms can be arranged in a crystalline solid.

There are 7 distinct types of Bravais lattices in three-dimensional space. These lattices are categorized based on their symmetry and are fundamental in crystallography.

Step 2: Explanation of other options.

- 23, 30, and 14 are incorrect as there are only 7 distinct Bravais lattices.

Final Answer:

7

Quick Tip

There are 7 types of Bravais lattices in three-dimensional space, based on the symmetry of the crystal.

Q60. The percentage of free space in a body-centred cubic unit cell is (A) 32

(B) 34

(C) 28

(D) 20

Correct Answer: (C) 28

Solution: Step 1: Understanding body-centred cubic (BCC) unit cell.

In a body-centred cubic (BCC) unit cell, atoms are located at the eight corners and at the center of the cell. The space not occupied by the atoms is free space.

Step 2: Calculation of free space.

- The volume of the BCC unit cell is determined by the length of its edge and the volume of the atoms inside it. - The percentage of free space is calculated by comparing the total volume of the unit cell to the volume occupied by the atoms.

The percentage of free space in a BCC unit cell is approximately 28

Final Answer:

28

Quick Tip

In a body-centred cubic unit cell, about 28

Q61. In electrolysis, oxidation takes place at:

- (A) Anode
- (B) Cathode
- (C) Both anode and cathode
- (D) Depends upon electrolyte used

Correct Answer: (A) Anode

Solution:

Step 1: Understand oxidation in electrolysis.

In electrolysis, oxidation is the loss of electrons, and it always occurs at the anode. The anode is the electrode where oxidation takes place, and electrons are released into the electrolyte.

Step 2: Compare the options.

- Option (A) Anode: Correct, because oxidation happens at the anode during electrolysis. - Option (B) Cathode: Incorrect, the cathode is where reduction (gain of electrons) occurs, not oxidation. - Option (C) Both anode and cathode: Incorrect, oxidation only occurs at the anode. - Option (D) Depends upon electrolyte used: Incorrect, oxidation always occurs at the anode, regardless of the electrolyte.

Final Answer:

Anode

Quick Tip

Remember: Oxidation always takes place at the anode in electrolysis, while reduction occurs at the cathode.

Q62. The quantity of electricity required to liberate 32 g of oxygen is:

- (A) 1 faraday
- (B) 2 faradays

(C) 3 faradays

(D) 4 faradays

Correct Answer: (B) 2 faradays

Solution:

Step 1: Apply the concept of Faraday's law.

The quantity of electricity required to liberate a specific mass of a substance during electrolysis is related to Faraday's law. The formula is:

$Q = n \times F$ where Q = Quantity of electricity, n = moles of substance, F = Faraday constant (96

Step 2: Calculate the moles of oxygen.

The molar mass of oxygen is 32 g, so 32 g of oxygen is equal to 1 mole of oxygen.

Step 3: Calculate the quantity of electricity.

To liberate 1 mole of oxygen, 4 moles of electrons are required (from the reaction $2\text{O}_2 + 4e^- \rightarrow 2\text{O}_2$). Therefore, the required quantity of electricity is 2 faradays.

Final Answer:

2 faradays

Quick Tip

1 mole of oxygen requires 2 faradays of electricity, as 4 moles of electrons are needed to reduce 1 mole of oxygen.

Q63. Rust is:

(A) Powdered iron

(B) Ferrous oxide

(C) Ferric oxide

(D) Hydrated ferric oxide

Correct Answer: (D) Hydrated ferric oxide

Solution:**Step 1: Define rust.**

Rust is a compound that forms when iron or its alloys react with oxygen and water. It typically appears as a reddish-brown color on iron surfaces.

Step 2: Understand the composition of rust.

Rust is primarily composed of hydrated ferric oxide, a compound that forms through the reaction of iron with oxygen and moisture. This is why the correct answer is hydrated ferric oxide.

Step 3: Eliminate the incorrect options.

- Option (A) Powdered iron: Incorrect, powdered iron is just iron in a fine powdered form, not rust. - Option (B) Ferrous oxide: Incorrect, ferrous oxide is FeO , a different compound from rust. - Option (C) Ferric oxide: Incorrect, ferric oxide is Fe_2O_3 , which is a component of rust but not the hydrated form. - Option (D) Hydrated ferric oxide: Correct, this is the actual chemical composition of rust, consisting of iron oxides mixed with water molecules.

Final Answer:

Hydrated ferric oxide

Quick Tip

Rust is chemically known as hydrated ferric oxide, formed by the oxidation of iron in the presence of oxygen and water.

Q64. Chloroform is:

- (A) Primary halide
- (B) Tertiary halide
- (C) Trihalogen derivative
- (D) Tetrahalogen derivative

Correct Answer: (C) Trihalogen derivative

Solution:**Step 1: Define chloroform.**

Chloroform is a chemical compound with the formula CHCl_3 . It is a type of halogenated hydrocarbon where three chlorine atoms are bonded to a single carbon atom, along with one hydrogen atom.

Step 2: Understand the classification of chloroform.

Since chloroform contains three chlorine atoms attached to a carbon, it is classified as a trihalogen derivative. A trihalogen derivative contains three halogen atoms attached to a carbon atom.

Step 3: Eliminate the incorrect options.

- Option (A) Primary halide: Incorrect, as chloroform is not a primary halide (it has three halogen atoms). - Option (B) Tertiary halide: Incorrect, a tertiary halide has three alkyl groups attached to the carbon atom, which is not the case with chloroform. - Option (C) Trihalogen derivative: Correct, chloroform is a trihalogen derivative because it contains three chlorine atoms attached to one carbon. - Option (D) Tetrahalogen derivative: Incorrect, chloroform has three halogen atoms, not four.

Final Answer:

Trihalogen derivative

Quick Tip

Chloroform is a trihalogen derivative, containing three chlorine atoms bonded to a single carbon atom.

Q65. General group(s) for alcohols is/are:

- (A) >C - OH
- (B) >CH - OH
- (C) $\text{-CH}_2\text{OH}$
- (D) all of these

Correct Answer: (D) all of these

Solution:

Step 1: Understanding the general structure of alcohols.

Alcohols are characterized by the presence of a hydroxyl group (-OH) attached to a carbon atom. The carbon can be part of various groups, including alkyl groups, depending on the structure of the alcohol.

Step 2: Review the options.

- Option (A) $\text{C} - \text{OH}$: Correct, this represents a general structure for alcohols, where the hydroxyl group is attached to a carbon atom. - Option (B) $\text{CH} - \text{OH}$: Correct, this represents a hydroxyl group attached to a carbon atom that is also part of a larger structure. - Option (C) $-\text{CH}_2\text{OH}$: Correct, this represents alcohols like methanol and ethanol, where the hydroxyl group is attached to a methylene group (-CH₂OH). - Option (D) all of these: Correct, since all of the structures mentioned are part of alcohol functional groups.

Final Answer:

all of these

Quick Tip

Alcohols are characterized by the -OH group, and the carbon to which it is attached can be part of different structures (e.g., -CH₂OH, -C-OH).

Q66. The number of isomeric alcohols of molecular formula C₄H₁₀O is:

- (A) 2
- (B) 4
- (C) 7
- (D) 8

Correct Answer: (B) 4

Solution:**Step 1: Determine the molecular formula.**

The molecular formula $C_4H_{10}O$ indicates a compound with four carbon atoms, ten hydrogen atoms, and one oxygen atom. This is the formula for alcohols.

Step 2: Identify possible alcohol isomers.

By rearranging the positions of the hydroxyl group ($-OH$) on the carbon chain and considering possible branching, the following alcohol isomers can be formed: 1. Butan-1-ol (straight-chain) 2. Butan-2-ol (straight-chain) 3. Isobutanol (branched-chain) 4. tert-Butanol (branched-chain)

Thus, there are four isomers.

Final Answer:

4

Quick Tip

For molecules with the same molecular formula, isomerism occurs due to the different arrangements of atoms and functional groups in space.

Q67. Methyl alcohol on oxidation with acidified $K_2Cr_2O_7$ gives:

- (A) CH_3COCH_3
- (B) CH_3CHO
- (C) $HCOOH$
- (D) CH_3COOH

Correct Answer: (C) $HCOOH$

Solution:**Step 1: Understand the oxidation reaction.**

Methyl alcohol (methanol, CH_3OH) undergoes oxidation with acidified potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$), where it is oxidized to formaldehyde (HCHO) and further oxidized to formic acid (HCOOH).

Step 2: Identify the correct product.

When methyl alcohol undergoes oxidation, it is first converted to formaldehyde (HCHO), which is further oxidized to formic acid (HCOOH).

Step 3: Eliminate the incorrect options.

- Option (A) CH_3COCH_3 : Incorrect, this is acetone, not the product of methanol oxidation. - Option (B) CH_3CHO : Incorrect, this is formaldehyde, an intermediate in the oxidation process. - Option (C) HCOOH : Correct, formic acid is the final product of methanol oxidation. - Option (D) CH_3COOH : Incorrect, this is acetic acid, which is produced from ethanol, not methanol.

Final Answer:

HCOOH

Quick Tip

Methyl alcohol (methanol) is oxidized to formic acid (HCOOH) when reacted with acidified potassium dichromate.

Q68. Diethyl ether finds its use in medicine as:

- (A) Pain killer
- (B) Hypnotic
- (C) Antiseptic
- (D) Anaesthetic

Correct Answer: (D) Anaesthetic

Solution:

Step 1: Understand the function of diethyl ether.

Diethyl ether, commonly known simply as ether, was historically used as an anaesthetic for surgeries due to its ability to cause unconsciousness and loss of sensation.

Step 2: Evaluate the options.

- Option (A) Pain killer: Incorrect, while diethyl ether can relieve pain indirectly by inducing unconsciousness, it is not primarily classified as a pain killer. - Option (B) Hypnotic: Incorrect, although it has hypnotic (sleep-inducing) properties, the term "hypnotic" is more commonly associated with substances specifically designed to induce sleep. - Option (C) Antiseptic: Incorrect, diethyl ether has antiseptic properties, but it is not commonly used for this purpose. - Option (D) Anaesthetic: Correct, diethyl ether is most widely known and used as an anaesthetic, particularly in the past for surgeries.

Final Answer:

Anaesthetic

Quick Tip

Diethyl ether was historically used as an anaesthetic before being replaced by newer, safer agents.

Q59. The general formula of carbonyl compound is:

- (A) $C_nH_{2n}O$
- (B) $C_nH_{2n+2}O$
- (C) $C_nH_{2n+1}O$
- (D) None of these

Correct Answer: (A) $C_nH_{2n}O$

Solution:

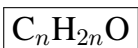
Step 1: Understand carbonyl compounds.

Carbonyl compounds include aldehydes and ketones, which have a carbonyl group ($C=O$) as their functional group. The general formula for aldehydes and ketones is $C_nH_{2n}O$, where n is the number of carbon atoms.

Step 2: Eliminate the incorrect options.

- Option (A) $C_nH_{2n}O$: Correct, this is the general formula for carbonyl compounds like aldehydes and ketones. - Option (B) $C_nH_{2n+2}O$: Incorrect, this is the general formula for alkanes, not carbonyl compounds. - Option (C) $C_nH_{2n+1}O$: Incorrect, this formula doesn't represent carbonyl compounds. - Option (D) None of these: Incorrect, as option (A) is correct.

Final Answer:



Quick Tip

Aldehydes and ketones are carbonyl compounds with the general formula $C_nH_{2n}O$.

Q70. At room temperature, formaldehyde is

- (A) gas
- (B) liquid
- (C) solid
- (D) none of these

Correct Answer: (B) liquid

Solution:

Step 1: Understanding the properties of formaldehyde.

Formaldehyde (CHO) is a simple organic compound. At room temperature, it is typically found in the form of a gas, but in a concentrated form (such as in formalin), it exists as a liquid.

Step 2: Room temperature state of formaldehyde.

At standard room temperature (around 25°C), formaldehyde is in a gaseous state, but when dissolved in water or in a concentrated solution, it appears as a liquid (formalin).

Step 3: Apply to the options.

Formaldehyde at room temperature is most commonly a liquid when dissolved in water, which is why option (B) is correct.

Final Answer:

liquid

Quick Tip

Formaldehyde is usually found as a gas at room temperature but is often stored as a liquid in formalin (a water-based solution).

SECTION - B

Q1. Write the names of the catalysts used in contact process and Ostwald process.

Solution:

Step 1: Understand the Contact Process.

In the Contact Process, the catalyst used is **Vanadium(V) oxide** (V_2O_5). This catalyst helps in the oxidation of sulfur dioxide to sulfur trioxide.

Step 2: Understand the Ostwald Process.

In the Ostwald Process, the catalyst used is **Platinum** or **Platinum-Rhodium alloy**. This catalyst is used for the oxidation of ammonia to nitric oxide.

Final Answer: For the Contact Process: Vanadium(V) oxide (V_2O_5)

For the Ostwald Process: Platinum or Platinum-Rhodium alloy

Final Answer:

Vanadium(V)oxide (V_2O_5), Platinum or Platinum – Rhodium alloy

Quick Tip

Vanadium(V) oxide is used in the Contact Process due to its ability to facilitate the oxidation reaction. Platinum is used in the Ostwald Process due to its catalytic properties in high-temperature reactions.

Q2. Write the formula of Tetra-aminoaquachlorido-cobalt (III) chloride.

Solution:

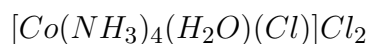
Step 1: Understand the compound's structure.

The name *Tetra-aminoaquachlorido-cobalt (III) chloride* refers to a coordination complex where cobalt (III) is the central metal ion. The ligand names give us the following:

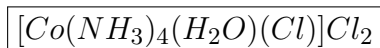
- **Tetra-amino:** Four ammine groups (NH_3) - **Aqua:** Water molecule (H_2O) - **Chlorido:** Chlorine ion (Cl^-)

Step 2: Formulate the compound.

The metal ion is Cobalt(III) (Co^{3+}). The ligands are attached to the cobalt ion, and the formula is written as:



Final Answer:



Quick Tip

In coordination complexes, the metal ion is followed by the ligands in brackets, and the charge is balanced with counterions outside the brackets.

Q3. What is metamerism?

Solution:

Step 1: Define Metamerism.

Metamerism is a phenomenon where compounds with the same molecular formula have different structural arrangements of atoms or groups. These compounds are known as metamers. The difference arises in the alkyl chains or groups attached to a functional group.

Step 2: Understand with an Example.

For example, in the case of ethers, metamerism can occur when the alkyl groups attached to the oxygen atom differ in structure, although both compounds have the same molecular formula.

Final Answer: Metamerism refers to the phenomenon where isomers have the same molecular formula but different structural arrangements due to the position or nature of substituent groups.

Final Answer:

Metamerism is the occurrence of isomers with the same molecular formula but different structural arrangements.

Quick Tip

Metamerism is common in organic chemistry, especially in compounds like ethers, where different alkyl groups can result in different structural forms.

Q4. What are chiral and achiral compounds?

Solution:

Step 1: Define Chiral Compounds.

A chiral compound is a molecule that is not superimposable on its mirror image. This means that the compound has a specific asymmetry or handedness, often due to the presence of a carbon atom attached to four different groups, forming a chiral center.

Step 2: Define Achiral Compounds.

An achiral compound, on the other hand, is a molecule that is superimposable on its mirror image. These compounds do not exhibit chirality and can be symmetric, lacking a chiral center.

Step 3: Key Difference Between Chiral and Achiral Compounds.

- Chiral compounds are optically active, meaning they can rotate plane-polarized light. - Achiral compounds do not show optical activity as they can be superimposed on their mirror image.

Final Answer: Chiral compounds are those that are not superimposable on their mirror image and are optically active. Achiral compounds can be superimposed on their mirror image and do not show optical activity.

Final Answer:

Chiral compounds are non-superimposable on their mirror image, while achiral compounds are superimposable on their mirror image.

Quick Tip

Chirality is often found in organic molecules with a carbon center bonded to four different groups. Achirality is common in symmetric molecules.

Q5. What are essential amino acids?

Solution:

Step 1: Define Essential Amino Acids.

Essential amino acids are amino acids that cannot be synthesized by the human body and must be obtained through diet. These amino acids are vital for various bodily functions such as protein synthesis, enzyme function, and cell repair.

Step 2: List of Essential Amino Acids.

The essential amino acids include: 1. Histidine 2. Isoleucine 3. Leucine 4. Lysine 5. Methionine 6. Phenylalanine 7. Threonine 8. Tryptophan 9. Valine

Step 3: Importance of Essential Amino Acids.

These amino acids play a crucial role in maintaining health, as they are building blocks for proteins and other vital processes in the body.

Final Answer: Essential amino acids cannot be synthesized by the body and must be obtained from food. They are crucial for proper functioning and protein synthesis.

Final Answer:

Essential amino acids are those that must be obtained from the diet as the body cannot synthesize them.

Quick Tip

Ensure your diet includes a variety of protein-rich foods to provide all nine essential amino acids for optimal health.

Q6. "(O₃)behaves as a strong oxidising agent." Explain.

Solution:**Step 1: Understand the concept of oxidizing agent.**

An oxidizing agent is a substance that gains electrons in a chemical reaction, causing the oxidation of another substance. It essentially facilitates the oxidation process by accepting electrons.

Step 2: Understand why O₃ is a strong oxidizing agent.

Ozone (O₃) is a strong oxidizing agent because of its molecular structure. The oxygen-oxygen bonds in ozone are weak, making it easy for the molecule to decompose and release oxygen atoms. These released oxygen atoms can react with other molecules, oxidizing them.

Step 3: Reaction example.

When ozone reacts with an electron donor (such as a metal or organic compound), it gains electrons and forms O₂, thereby oxidizing the other substance. For example:



The released atomic oxygen (O) is highly reactive and can readily oxidize other substances.

Final Answer: Ozone behaves as a strong oxidizing agent due to its ability to release reactive oxygen atoms, which readily oxidize other substances.

Final Answer:

Ozone (O₃) is a strong oxidizing agent due to its ability to release reactive oxygen atoms and oxidize other substances.

Quick Tip

Ozone's strong oxidizing nature is used in applications like water treatment, where it helps break down pollutants by oxidation.

Q7. What is slag?

Solution:

Step 1: Definition of Slag.

Slag is a by-product of metal smelting, formed when impurities in the metal ore combine with flux (a substance used to remove impurities during smelting). Slag consists of metal oxides and other compounds and floats on top of the molten metal due to its lower density.

Step 2: Formation of Slag.

During the smelting of metals like iron or copper, the flux combines with the gangue (impurities) to form slag. The slag is then removed from the top of the molten metal.

Step 3: Uses of Slag.

- Slag is used in the production of cement and as a building material. - It can also be used as a fertilizer due to its mineral content.

Final Answer: Slag is the by-product of metal smelting, consisting of metal oxides and other compounds, and is used in various industrial applications.

Final Answer:

Slag is a by-product of metal smelting, composed of metal oxides, and used in industries like cement pr

Quick Tip

Slag is often considered a valuable resource for industries, particularly in the production of cement and other materials.

Q8. What are macromolecules?

Solution:**Step 1: Define Macromolecules.**

Macromolecules are large molecules composed of smaller subunits (monomers) that are chemically bonded together to form a larger, more complex structure. These molecules have high molecular weights and can be organic or inorganic.

Step 2: Examples of Macromolecules.

Common examples of macromolecules include: - **Proteins**: Made of amino acids linked by peptide bonds. - **Polysaccharides**: Made of sugar molecules (e.g., starch, cellulose). - **Nucleic acids**: DNA and RNA, made of nucleotides. - **Polymers**: Synthetic macromolecules like plastic, made from repeated monomers.

Step 3: Importance of Macromolecules.

Macromolecules play essential roles in biological systems. For example, proteins function as enzymes, hormones, and structural components, while nucleic acids store and transfer genetic information.

Final Answer: Macromolecules are large, complex molecules made up of smaller monomeric units. They are essential in biology and can include proteins, nucleic acids, and polymers.

Final Answer:

Macromolecules are large molecules made from smaller monomers and are vital for biological function

Quick Tip

Macromolecules are crucial in biology as they perform a wide variety of functions, from genetic information storage to catalyzing chemical reactions.

Q9. Write Faraday's 2nd law of Electrolysis.

Solution:**Step 1: Understand Faraday's Second Law of Electrolysis.**

Faraday's Second Law of Electrolysis states that the amount of substance deposited or liberated at an electrode is directly proportional to the quantity of electric charge passed through the electrolyte.

Mathematically, it is given as:

$$\frac{m_1}{m_2} = \frac{M_1}{M_2} \times \frac{Q_1}{Q_2}$$

Where: - m_1 and m_2 are the masses of the substances deposited or liberated. - M_1 and M_2 are the molar masses of the substances. - Q_1 and Q_2 are the electric charges passed.

Step 2: Explanation.

This law helps in understanding how different substances react when electric current is passed through an electrolyte and how much of each substance is involved in the electrolysis process.

Final Answer: Faraday's Second Law of Electrolysis relates the amount of substance deposited or liberated to the electric charge passed.

Final Answer:

Faraday's 2nd Law states that the amount of substance deposited is directly proportional to the quantity

Quick Tip

The key idea of Faraday's second law is the relationship between the amount of substance and the electric charge during electrolysis.

Q10. Write the IUPAC name of complex compound $K_3[Cr(C_2O_4)_3]$.

Solution:

Step 1: Identify the components of the complex.

The complex consists of: - Chromium (Cr) as the central metal ion. - Oxalate ($C_2O_4^{2-}$) as the ligand, with three oxalate ions attached to the chromium ion.

Step 2: Name the complex according to IUPAC rules.

- The name of the oxalate ion is oxalato. - The chromium ion is in the +3 oxidation state (since K_3 indicates a charge of +3). - The complex is an anionic complex, and the counterion K^+ is used to balance the charge.

The IUPAC name of the complex is:

Potassium tris(oxalato)chromate(III)

Final Answer: The IUPAC name of $K_3[Cr(C_2O_4)_3]$ is Potassium tris(oxalato)chromate(III).

Final Answer:

Potassium tris(oxalato)chromate(III)

Quick Tip

When naming coordination compounds, always start with the cationic part, followed by the anionic part and the oxidation state of the metal.

Q11. Why is ethyl alcohol not dried by anhydrous $CaCl_2$?

Solution:

Step 1: Understand the role of anhydrous $CaCl_2$.

Anhydrous calcium chloride ($CaCl_2$) is commonly used as a drying agent for liquids, as it absorbs water by forming hydrated calcium chloride.

Step 2: Why it doesn't dry ethyl alcohol.

However, ethyl alcohol (ethanol) contains a hydroxyl group ($-OH$) that can form hydrogen bonds with calcium chloride, causing it to react with the alcohol. This prevents anhydrous $CaCl_2$ from effectively drying ethanol.

Step 3: Alternative drying agents.

To dry ethanol, substances like molecular sieves or anhydrous magnesium sulfate are more effective, as they do not react with the alcohol.

Final Answer: Anhydrous $CaCl_2$ is not used to dry ethyl alcohol because it reacts with the alcohol, preventing it from absorbing water effectively.

Final Answer:

Anhydrous CaCl_2 reacts with ethanol, forming hydrogen bonds and preventing it from drying effectively.

Quick Tip

Use molecular sieves or anhydrous magnesium sulfate to dry alcohols like ethanol without any reaction.

Q12. Write Arrhenius equation.

Solution:**Step 1: Understand the Arrhenius Equation.**

The Arrhenius equation describes the relationship between the rate of a chemical reaction and the temperature. It is given by the equation:

$$k = Ae^{-\frac{E_a}{RT}}$$

Where: - k is the rate constant of the reaction. - A is the pre-exponential factor (frequency factor), which represents the number of collisions that result in a reaction. - E_a is the activation energy of the reaction. - R is the universal gas constant ($8.314 \text{ J/mol}\cdot\text{K}$). - T is the temperature in Kelvin.

Step 2: Explanation.

This equation shows that the rate constant k increases with temperature, as the exponential factor $e^{-\frac{E_a}{RT}}$ becomes larger as T increases. Thus, higher temperatures result in more frequent and energetic collisions, which speeds up the reaction.

Final Answer: The Arrhenius equation relates the rate constant of a reaction to the temperature and activation energy, given by:

$$k = Ae^{-\frac{E_a}{RT}}$$

Final Answer:

$$k = Ae^{-\frac{E_a}{RT}}$$

Quick Tip

The Arrhenius equation is crucial for understanding how temperature affects the rate of chemical reactions, and is widely used in reaction kinetics.

Q13. How would you prepare ethane from methyl iodide?

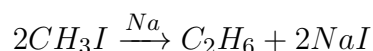
Solution:

Step 1: Understand the reaction.

To prepare ethane (C_2H_6) from methyl iodide (CH_3I), we need to use a nucleophilic substitution reaction. This can be done by using a strong nucleophile, such as a cyanide ion (CN^-) or an alkoxide ion (RO^-), in a reaction called the Wurtz reaction.

Step 2: Wurtz Reaction.

The Wurtz reaction involves two molecules of methyl iodide reacting in the presence of sodium metal (Na). Sodium provides electrons, which initiate the formation of a new carbon-carbon bond, resulting in the formation of ethane. The reaction proceeds as follows:



Step 3: Mechanism.

- Sodium (Na) donates electrons to methyl iodide (CH_3I), resulting in the formation of two methyl radicals ($CH_3\bullet$).
- These methyl radicals then combine to form ethane (C_2H_6), while iodine (I^-) is displaced.

Final Answer: Ethane can be prepared from methyl iodide through the Wurtz reaction by using sodium metal.

Final Answer:

Ethane can be prepared by the Wurtz reaction using sodium metal.

Quick Tip

The Wurtz reaction is a common method for forming carbon-carbon bonds by using sodium metal to initiate the reaction.

Q14. How would you prepare iodoform from acetylene?

Solution:

Step 1: Understand the reaction.

To prepare iodoform (CHI_3) from acetylene (C_2H_2), we use the reaction between acetylene and iodine in the presence of a base. The process involves the halogenation of the acetylene molecule.

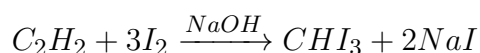
Step 2: Reaction mechanism.

The reaction is a halogenation reaction, where acetylene reacts with iodine (I_2) in the presence of a base, such as sodium hydroxide (NaOH), leading to the formation of iodoform.

The steps are:

1. Acetylene (C_2H_2) reacts with iodine to form a diiodo compound. 2. Further halogenation leads to the formation of triiodomethane (iodoform, CHI_3).

The reaction is as follows:



Step 3: Explanation.

In this reaction, the iodine atoms replace the hydrogen atoms on the acetylene molecule, leading to the formation of iodoform.

Final Answer: Iodoform can be prepared from acetylene by halogenating acetylene with iodine in the presence of sodium hydroxide.

Final Answer:

Iodoform can be prepared from acetylene by reacting it with iodine in the presence of NaOH .

Quick Tip

The iodoform reaction is a common method for halogenating compounds like acetylene and alcohols to form iodoform (CHI_3).

Q15. Why is PCl_5 a known compound, but NCl_3 is not?

Solution:

Step 1: Analyze the structure and stability of PCl_5 and NCl_3 .

- PCl_5 (phosphorus pentachloride) is a stable compound because phosphorus can expand its valence shell to accommodate five chlorine atoms. Phosphorus has a relatively large atomic size and can form stable bonds with chlorine atoms. The molecule adopts a trigonal bipyramidal structure, which is stable.
- NCl_3 (nitrogen trichloride), however, is not as stable. Nitrogen is smaller and does not have the ability to expand its valence shell in the same way phosphorus does. Therefore, nitrogen can only form three bonds, making NCl_3 less stable. Additionally, NCl_3 is highly reactive and unstable, especially when exposed to heat or light, making it difficult to isolate.

Step 2: Conclusion.

- PCl_5 is stable due to the ability of phosphorus to form five bonds, while NCl_3 is unstable because nitrogen cannot accommodate more than three bonds.

Final Answer: PCl_5 is stable because phosphorus can expand its valence shell to form five bonds, whereas NCl_3 is unstable because nitrogen cannot expand its valence shell beyond three bonds.

Final Answer:

PCl_5 is stable due to the ability of phosphorus to form five bonds, while NCl_3 is unstable due to nitrogen

Quick Tip

Phosphorus can expand its valence shell, allowing for stable compounds like PCl_5 , whereas nitrogen cannot, making NCl_3 unstable.

Q16. Why are alcohols more soluble in water than alkanes of the same molecular weight?

Solution:

Step 1: Understanding the structure of alcohols and alkanes.

Alcohols ($R - OH$) contain a hydroxyl group ($-OH$), while alkanes ($R - H$) consist of only carbon and hydrogen atoms. The key factor in solubility is the ability of a molecule to form hydrogen bonds with water molecules.

Step 2: Hydrogen bonding in alcohols.

The hydroxyl group in alcohols is highly polar and can form hydrogen bonds with water molecules. These hydrogen bonds increase the solubility of alcohols in water, as water molecules can interact effectively with alcohol molecules.

Step 3: Lack of hydrogen bonding in alkanes.

Alkanes, on the other hand, are nonpolar and cannot form hydrogen bonds with water. As a result, alkanes are less soluble in water because they cannot interact effectively with water molecules.

Step 4: Conclusion.

Alcohols are more soluble in water than alkanes of the same molecular weight due to the ability of alcohols to form hydrogen bonds with water, which alkanes cannot do.

Final Answer: Alcohols are more soluble in water than alkanes because the hydroxyl group in alcohols forms hydrogen bonds with water molecules, increasing their solubility.

Final Answer:

Alcohols are more soluble in water due to hydrogen bonding between the hydroxyl group and water molecules.
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Quick Tip

The solubility of alcohols in water is largely due to the ability of the hydroxyl group to form hydrogen bonds with water.

Q17. What do you understand by elevation of boiling point?

Solution:

Step 1: Define Elevation of Boiling Point.

The elevation of boiling point refers to the increase in the boiling point of a solvent when a non-volatile solute is dissolved in it. This phenomenon occurs due to the reduction in the vapor pressure of the solvent, which requires a higher temperature to reach the boiling point.

Step 2: Explanation.

When a non-volatile solute is added to a solvent, it lowers the vapor pressure of the solvent because the solute particles occupy space on the surface of the liquid, thereby reducing the number of solvent molecules escaping into the vapor phase. As a result, the solvent must be heated to a higher temperature to achieve the necessary vapor pressure for boiling.

The relationship between the elevation in boiling point (ΔT_b) and the amount of solute is given by the equation:

$$\Delta T_b = K_b \times m$$

Where: - ΔT_b is the elevation in boiling point. - K_b is the ebullioscopic constant (a property of the solvent). - m is the molality of the solute.

Final Answer: The elevation of boiling point is the increase in the boiling point of a solvent when a non-volatile solute is added, caused by the lowering of vapor pressure.

Final Answer:

The elevation of boiling point is the increase in the boiling point due to the addition of a non-volatile solute.

Quick Tip

The elevation of boiling point is a colligative property, meaning it depends on the number of solute particles, not their identity.

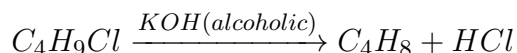
Q18. What happens when n-butyl chloride reacts with alcoholic KOH?

Solution:**Step 1: Understand the reaction.**

When n-butyl chloride ($\text{C}_4\text{H}_9\text{Cl}$) reacts with alcoholic potassium hydroxide (KOH), a dehydrohalogenation reaction occurs. In this reaction, the hydroxyl group from KOH removes a hydrogen atom from the carbon adjacent to the carbon bonded to the chlorine atom, resulting in the elimination of hydrogen chloride (HCl).

Step 2: Mechanism of the reaction.

Alcoholic KOH induces an elimination (E2) reaction, where the chlorine atom is replaced by a double bond, forming butene. The reaction can proceed as follows:



In this case, n-butyl chloride undergoes elimination to form butene, which is an alkene.

Step 3: Conclusion.

Thus, when n-butyl chloride reacts with alcoholic KOH, it undergoes an elimination reaction to form butene and hydrogen chloride.

Final Answer: When n-butyl chloride reacts with alcoholic KOH, butene is formed through an elimination reaction, releasing HCl.

Final Answer:

n-Butyl chloride reacts with alcoholic KOH to form butene through an elimination reaction, releasing H

Quick Tip

The reaction between alkyl halides and alcoholic KOH is a typical elimination reaction, often leading to the formation of alkenes.

Q19. Distinguish between Alcohol and Phenol.

Solution:

Step 1: Alcohols.

Alcohols are organic compounds containing one or more hydroxyl (-OH) groups attached to a saturated carbon atom. Alcohols are classified based on the number of hydroxyl groups and the type of carbon to which the hydroxyl group is attached (primary, secondary, or tertiary).

Examples: Methanol (CH₃OH), Ethanol (C₂H₅OH).

Step 2: Phenols.

Phenols are organic compounds in which a hydroxyl group (-OH) is attached to a benzene ring (C₆H₅). The hydroxyl group is directly bonded to an aromatic carbon.

Examples: Phenol (C₆H₅OH), 2,4-Dichlorophenol.

Step 3: Key Differences.

- **Structure**: Alcohols have the hydroxyl group attached to a saturated carbon atom, whereas phenols have the hydroxyl group attached to an aromatic ring. - **Acidity**: Phenols are more acidic than alcohols because the negative charge on the oxygen after deprotonation is stabilized by resonance with the benzene ring. Alcohols do not have this resonance stabilization. - **Reactivity**: Phenols undergo electrophilic substitution reactions due to the presence of the aromatic ring, whereas alcohols mainly undergo substitution or elimination reactions.

Final Answer: Alcohols have a hydroxyl group attached to a saturated carbon, while phenols have a hydroxyl group attached to a benzene ring, making phenols more acidic and reactive.

Final Answer:

Alcohols have a hydroxyl group attached to a saturated carbon, while phenols have a hydroxyl group at

Quick Tip

Phenols are more acidic than alcohols due to the resonance stabilization of the phenoxide ion.

Q20. Why is nitrogen molecule less reactive?

Solution:

Step 1: Understand the structure of nitrogen.

Nitrogen (N_2) is a diatomic molecule with a triple bond between the two nitrogen atoms. The triple bond consists of one sigma bond and two pi bonds, making it very strong and stable.

Step 2: High bond dissociation energy.

The high bond dissociation energy required to break the NN triple bond makes nitrogen molecules less reactive. This means that a significant amount of energy is needed to break the bond and initiate a reaction.

Step 3: Electron pairing and stability.

Nitrogen atoms in the N_2 molecule have a stable electron configuration with a full outer shell, and the molecule has no available lone pairs or empty orbitals to react easily with other molecules. This lack of reactivity is due to the inertness of the nitrogen molecule.

Step 4: Conclusion.

Nitrogen molecules are less reactive due to the strength of the triple bond and the stability of the molecule.

Final Answer: Nitrogen molecules are less reactive because of the strong triple bond between nitrogen atoms and the stability of the molecule.

Final Answer:

Nitrogen molecules are less reactive due to the strong triple bond and the stability of the molecule.

Quick Tip

The strong triple bond in nitrogen (N_2) makes it less reactive and requires high energy to break the bond for chemical reactions.

Q21. Explain Raoult's law. How would you distinguish between ideal and non-ideal solutions on its basis?

Solution:

Step 1: Understand Raoult's Law.

Raoult's Law states that the partial vapor pressure of each volatile component in a solution is directly proportional to its mole fraction in the solution. The law is given by the equation:

$$P_A = X_A \cdot P_A^0$$

Where: - P_A is the partial vapor pressure of component A in the solution. - X_A is the mole fraction of component A in the solution. - P_A^0 is the vapor pressure of pure component A. Raoult's law is valid for ideal solutions, where intermolecular forces between the solute and solvent are similar to those in the pure components.

Step 2: Ideal Solutions.

An ideal solution follows Raoult's law exactly. The intermolecular forces between the solute and solvent are similar to the forces between the solute molecules and solvent molecules. As a result, the vapor pressure of the solution is a linear function of the mole fraction of each component.

Examples: Benzene and Toluene.

Step 3: Non-ideal Solutions.

Non-ideal solutions deviate from Raoult's law. These deviations occur because the intermolecular forces between the solute and solvent molecules are different from the forces in the pure components. In non-ideal solutions, the vapor pressure is either higher or lower than predicted by Raoult's law.

- Positive deviation: Occurs when the intermolecular forces between solute and solvent are weaker than those between the solute-solute and solvent-solvent molecules. - Negative deviation: Occurs when the intermolecular forces between solute and solvent are stronger than those between solute-solute and solvent-solvent molecules.

Examples: Acetone and chloroform exhibit negative deviation, and alcohol and ether show positive deviation.

Final Answer: Raoult's law describes the vapor pressure of an ideal solution. Ideal solutions obey Raoult's law strictly, while non-ideal solutions deviate from it due to differences in intermolecular forces.

Final Answer:

Raoult's law describes the vapor pressure of ideal solutions, which obey it strictly, while non-ideal solutions deviate from it.

Quick Tip

Raoult's law is crucial for understanding how solute and solvent interact in ideal solutions and how deviations arise in non-ideal solutions.

Q22. What do you understand by concentration of an ore? Discuss the different methods of concentration of ores.

Solution:**Step 1: Understand the concept of ore concentration.**

Concentration of an ore refers to the process of removing impurities (gangue) from the ore, so that the metal content becomes more concentrated. This is an essential step in metallurgy, as it increases the efficiency of the extraction process.

Step 2: Methods of Concentration of Ores.

There are several methods used to concentrate ores, depending on the nature of the ore and the gangue. These methods include:

1. **Hydraulic Washing (Gravity Separation):** This method is used when the ore and gangue have different densities. The ore is washed with water, and the denser ore particles settle at the bottom, while the lighter gangue particles are washed away.
2. **Froth Flotation:** This method is used for ores that are sulfide ores, such as copper and lead ores. The ore is mixed with water and a frothing agent to form a froth. The ore particles attach to the bubbles and rise to the surface, where they can be separated from the gangue.
3. **Magnetic Separation:** This method is used for ores containing magnetic minerals. A magnetic field is applied to attract the magnetic ore particles, which are then separated from the non-magnetic gangue.
4. **Leaching:** Leaching involves using a solvent to dissolve the metal from the ore. This method is often used for ores of aluminum (bauxite) and gold. The ore is treated with a chemical solvent (e.g., cyanide for gold), and the metal is then recovered from the solution.
5. **Electrostatic Separation:** In this method, the ore is subjected to an electrostatic field, and the charged particles are separated. This method is used for separating ores of non-metallic minerals.

Step 3: Conclusion.

The concentration of ores is an essential part of the extraction process. The method used depends on the physical and chemical properties of the ore and the gangue.

Final Answer: Concentration of an ore is the process of separating the useful metal from the gangue, and various methods like hydraulic washing, froth flotation, magnetic separation, leaching, and electrostatic separation are used depending on the nature of the ore.

Final Answer:

Concentration of an ore involves separating the metal from gangue using methods like gravity separation

Quick Tip

The choice of concentration method depends on the properties of the ore, such as its density, magnetic properties, and chemical reactivity.

Q23. (a) Differentiate between Methanoic acid and Ethanoic acid.

Solution:**Step 1: Definition of Methanoic Acid.**

Methanoic acid, also known as formic acid (HCOOH), is the simplest carboxylic acid. It has a single carbon atom in its structure and is commonly found in ants and other insects.

Step 2: Definition of Ethanoic Acid.

Ethanoic acid, also known as acetic acid (CH_3COOH), is a carboxylic acid that contains two carbon atoms. It is the main component of vinegar, besides water.

Step 3: Key Differences.

- **Molecular Formula**: - Methanoic acid: HCOOH - Ethanoic acid: CH_3COOH -
- **Number of Carbon Atoms**: - Methanoic acid has 1 carbon atom. - Ethanoic acid has 2 carbon atoms. - **Occurrence**: - Methanoic acid is found in ants and some plants. - Ethanoic acid is found in vinegar and is used in food processing. - **Acidity**: - Both are weak acids, but methanoic acid is slightly stronger than ethanoic acid due to its simpler structure.

Final Answer: Methanoic acid has one carbon atom and is found in ants, while ethanoic acid has two carbon atoms and is found in vinegar.

Final Answer:

Methanoic acid has 1 carbon atom and is found in ants, while ethanoic acid has 2 carbon atoms and is found in vinegar.

Quick Tip

Methanoic acid is simpler and stronger compared to ethanoic acid, due to its lack of alkyl groups.

Q23. (b) Write IUPAC names of the following compounds:

Solution:

Step 1: Identify the structure of the compounds.

- (i) $\text{CH}-\text{CH}-\text{N}-\text{CH}$ This is an amine compound. The structure consists of a two-carbon chain with a nitrogen atom attached to both a methyl group (CH) and an ethyl group (CH).
- (ii) $\text{CH}-\text{CH}-\text{CONH}$ This compound is an amide. It has a two-carbon chain with a carbonyl group ($\text{C}=\text{O}$) attached to an amine group ($-\text{NH}$).

Step 2: Assign IUPAC names.

- (i) The IUPAC name of the compound $\text{CH}-\text{CH}-\text{N}-\text{CH}$ is **N-Ethylmethanamine**.
- (ii) The IUPAC name of the compound $\text{CH}-\text{CH}-\text{CONH}$ is **Ethanamide**.

Final Answer: (i) N-Ethylmethanamine

(ii) Ethanamide

Final Answer:

(i) N-Ethylmethanamine, (ii) Ethanamide

Quick Tip

In amines, the nitrogen is named as a substituent on the parent hydrocarbon chain, while in amides, the $-\text{CONH}$ group is named as "amide".

Q24. What are carbohydrates? How are they classified?

Solution:

Step 1: Define Carbohydrates.

Carbohydrates are organic compounds made up of carbon, hydrogen, and oxygen, generally with a hydrogen-to-oxygen ratio of 2:1, as in water. They are a major source of energy for living organisms.

Step 2: Classification of Carbohydrates.

Carbohydrates are classified into three main categories based on their structure: 1.

****Monosaccharides****: Simple sugars that cannot be hydrolyzed into simpler sugars.

Examples: Glucose, Fructose, Galactose. 2. ****Disaccharides****: Formed by the combination of two monosaccharides by a glycosidic bond. Examples: Sucrose (Glucose + Fructose), Lactose (Glucose + Galactose). 3. ****Polysaccharides****: Large, complex carbohydrates composed of many monosaccharide units. Examples: Starch, Cellulose, Glycogen.

Step 3: Explanation.

- Monosaccharides are the building blocks of more complex carbohydrates. - Disaccharides are formed when two monosaccharides undergo a condensation reaction. - Polysaccharides are formed by the polymerization of many monosaccharide units and serve as energy storage or structural components.

Final Answer: Carbohydrates are organic compounds classified into monosaccharides, disaccharides, and polysaccharides based on the number of sugar units present.

Final Answer:

Carbohydrates are classified into monosaccharides, disaccharides, and polysaccharides based on their structure.

Quick Tip

Monosaccharides are the simplest form of carbohydrates, and polysaccharides serve as energy storage in plants and animals.

Q25. (a) Differentiate between DNA and RNA.

Solution:

Step 1: Structure of DNA and RNA.

- **DNA (Deoxyribonucleic Acid)**: DNA is a double-stranded molecule that contains the genetic blueprint for the cell. The strands are held together by hydrogen bonds between complementary nitrogenous bases. - **RNA (Ribonucleic Acid)**: RNA is a single-stranded molecule that plays a role in protein synthesis and gene expression.

Step 2: Key Differences.

1. **Sugar**: - DNA contains deoxyribose sugar, which lacks one oxygen atom compared to ribose in RNA. - RNA contains ribose sugar.
2. **Strands**: - DNA is double-stranded (forming a double helix). - RNA is single-stranded.
3. **Bases**: - DNA contains adenine (A), thymine (T), cytosine (C), and guanine (G). - RNA contains adenine (A), uracil (U), cytosine (C), and guanine (G), replacing thymine with uracil.
4. **Function**: - DNA stores and transmits genetic information. - RNA is involved in protein synthesis (mRNA, tRNA, rRNA) and gene expression.

Final Answer: DNA is double-stranded with deoxyribose sugar and thymine, whereas RNA is single-stranded with ribose sugar and uracil.

Final Answer:

DNA is double-stranded with deoxyribose sugar and thymine, while RNA is single-stranded with ribose sugar and uracil.

Quick Tip

DNA stores genetic information, while RNA is essential for protein synthesis and gene expression.

Q25. (b) What are nucleic acids?

Solution:

Step 1: Define Nucleic Acids.

Nucleic acids are biopolymers composed of long chains of nucleotides. They are the carriers of genetic information in living organisms and play key roles in protein synthesis.

Step 2: Types of Nucleic Acids.

There are two main types of nucleic acids: 1. **DNA (Deoxyribonucleic Acid)**: Carries genetic information used in growth, development, functioning, and reproduction. 2. **RNA (Ribonucleic Acid)**: Involved in protein synthesis and gene expression.

Step 3: Structure of Nucleic Acids.

Nucleic acids are made of nucleotides, each consisting of: - A phosphate group. - A sugar (ribose in RNA, deoxyribose in DNA). - A nitrogenous base (adenine, thymine, cytosine, guanine, and uracil in RNA).

Final Answer: Nucleic acids are biopolymers made up of nucleotides and are responsible for carrying genetic information and protein synthesis.

Final Answer:

Nucleic acids are biopolymers made of nucleotides, responsible for genetic information storage and protein synthesis.

Quick Tip

DNA stores genetic information, while RNA helps in gene expression and protein synthesis.

Q26. (a) Differentiate between Electrochemical cell and Electrolytic cell.

Solution:

Step 1: Electrochemical Cell.

An electrochemical cell is a device that converts chemical energy into electrical energy. It consists of two electrodes (anode and cathode) immersed in an electrolyte. The flow of electrons from the anode to the cathode through an external circuit produces electricity.

- **Spontaneous reaction**: The reactions occurring in the electrochemical cell are spontaneous, meaning they occur naturally. - **Example**: Galvanic cell (e.g., Daniell cell).

Step 2: Electrolytic Cell.

An electrolytic cell is a device that converts electrical energy into chemical energy. In this cell, electrical energy is used to drive a non-spontaneous reaction, forcing ions to migrate and undergo chemical changes at the electrodes.

- **Non-spontaneous reaction**: The reactions occurring in the electrolytic cell are non-spontaneous and require an external power source. - **Example**: Electrolysis of water.

Step 3: Key Differences.

- **Function**: Electrochemical cell generates electricity, while electrolytic cell requires electricity. - **Reactions**: Electrochemical cell involves spontaneous reactions, while electrolytic cell involves non-spontaneous reactions. - **Energy Conversion**: Electrochemical cell converts chemical energy to electrical energy, and electrolytic cell converts electrical energy to chemical energy.

Final Answer: An electrochemical cell generates electricity through spontaneous reactions, while an electrolytic cell uses electricity to drive non-spontaneous reactions.

Final Answer:

Electrochemical cells convert chemical energy to electrical energy, while electrolytic cells convert electrical energy to chemical energy.

Quick Tip

The key difference is that electrochemical cells generate power (spontaneous), while electrolytic cells consume power to induce reactions (non-spontaneous).

Q26. (b) What are the importances of salt bridge in an electrochemical cell?

Solution:

Step 1: Function of a Salt Bridge.

A salt bridge is an essential component of an electrochemical cell that maintains electrical neutrality by allowing the flow of ions between the two half-cells. It connects the anode and cathode compartments of the cell.

Step 2: Importance of the Salt Bridge.

- **Maintaining electrical neutrality**: The salt bridge helps maintain the balance of charges in the two half-cells by allowing ions to move between them. As oxidation occurs at the anode, positive ions accumulate, and as reduction occurs at the cathode, negative ions

accumulate. The salt bridge neutralizes this charge buildup by providing a pathway for ion movement. - ****Prevention of liquid junction potential****: The salt bridge prevents the formation of a potential difference between the two solutions due to the difference in ion concentrations, which could disrupt the cell's functioning. - ****Facilitating ion flow****: It enables the flow of ions, which is necessary to complete the circuit and allow the redox reactions to proceed.

Step 3: Materials Used.

A common salt bridge is made of a gel containing a neutral salt like potassium chloride (KCl) or sodium sulfate (NaSO).

Final Answer: The salt bridge is important in an electrochemical cell for maintaining electrical neutrality, preventing liquid junction potential, and facilitating ion flow between the two half-cells.

Final Answer:

The salt bridge maintains electrical neutrality, prevents liquid junction potential, and facilitates ion flow

Quick Tip

The salt bridge is crucial for completing the electrical circuit in an electrochemical cell and ensuring the reaction continues without interference from charge buildup.