

NEET-UG Chemistry Sample Paper-9

Duration: 1 Hour

Maximum Marks: 180

Instructions

- This paper contains a total of 45 Multiple Choice Questions.
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. A hydrocarbon sample contains 85.7% carbon and 14.3% hydrogen by mass. If 1 mole of the compound occupies 22.4 L at STP and its molar mass is found to be 28 g/mol, determine its molecular formula. Also explain the concept of empirical formula, molecular formula, and their significance in stoichiometric calculations including limiting reagent problems.

- (A) C_2H_4
- (B) C_3H_6
- (C) CH_4
- (D) C_4H_8

Q2. Using Bohr's model, calculate the radius of the second orbit of hydrogen atom and explain quantization of angular momentum. Also compare energy difference between first and second energy levels.

- (A) 2.12
- (B) 1.06
- (C) 0.53
- (D) 4.24

Q3. An electron is accelerated through a potential difference of 150 V. Calculate its de Broglie wavelength and explain wave nature of matter proposed by de Broglie.



- (A) 0.1 nm
- (B) 1.0 nm
- (C) 10 nm
- (D) 0.01 nm

Q4. Using VSEPR theory, determine the shape of SF₆ molecule and explain hybridisation involved in bonding. Also discuss deviation from ideal bond angles in molecular structures.

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

Q5. Explain hybridisation in BF₃ molecule and calculate bond angle. Also justify why BF₃ is electron deficient.

- (A) sp², 120°
- (B) sp³, 109.5°
- (C) sp, 180°
- (D) dsp², 90°

Q6. According to Molecular Orbital Theory, compare stability of O₂ and O₂⁻ and calculate bond order. Explain paramagnetic nature of O₂.

- (A) O₂ has higher bond order
- (B) O₂⁻ has higher bond order
- (C) Both have same bond order
- (D) Both are diamagnetic

Q7. Explain hydrogen bonding in water and its effect on boiling point. Also compare intermolecular forces in H₂O, NH₃, and HF.

- (A) H₂O > HF > NH₃



(B) $\text{HF} > \text{H}_2\text{O} > \text{NH}_3$

(C) $\text{NH}_3 > \text{H}_2\text{O} > \text{HF}$

(D) $\text{H}_2\text{O} > \text{NH}_3 > \text{HF}$

Q8. For a reaction with $\Delta H = -40 \text{ kJ/mol}$ and $\Delta S = -100 \text{ J/molK}$, calculate Gibbs free energy at 300 K and determine spontaneity of reaction.

(A) -10 kJ/mol , spontaneous

(B) $+10 \text{ kJ/mol}$, non-spontaneous

(C) 0, equilibrium

(D) -40 kJ/mol , spontaneous

Q9. Explain the first law of thermodynamics and calculate work done when 2 moles of ideal gas expand isothermally from 1 L to 10 L at 300 K.

(A) 11.4 kJ

(B) 5.7 kJ

(C) 2.8 kJ

(D) 1.4 kJ

Q10. Calculate molarity of a solution prepared by dissolving 5.85 g NaCl in 500 mL solution. Also explain colligative properties and their dependence on solute particles.

(A) 0.2 M

(B) 0.1 M

(C) 0.5 M

(D) 1.0 M

Q11. A solution shows boiling point elevation of 0.52 K. If ebullioscopic constant is 0.52 K kg/mol , calculate molality and explain boiling point elevation phenomenon.

(A) 1 mol/kg



- (B) 2 mol/kg
- (C) 0.5 mol/kg
- (D) 0.1 mol/kg

Q12. For the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, explain effect of pressure and temperature on equilibrium according to Le Chatelier's principle. Also identify conditions favoring ammonia formation.

- (A) High pressure, low temperature
- (B) Low pressure, high temperature
- (C) Low pressure, low temperature
- (D) No effect of pressure

Q13. For a weak acid HA, explain degree of dissociation and derive expression for K_a . If pH is 3 for 0.1 M solution, calculate degree of dissociation.

- (A) 1%
- (B) 10%
- (C) 0.1%
- (D) 5%

Q14. A galvanic cell is constructed using Zn/Zn^{2+} and Cu/Cu^{2+} half-cells. If standard reduction potentials are $E^\circ_{Zn^{2+}/Zn} = -0.76 V$ and $E^\circ_{Cu^{2+}/Cu} = +0.34 V$, calculate the standard cell potential and explain the flow of electrons and role of salt bridge in maintaining electrical neutrality.

- (A) 1.10 V
- (B) 0.42 V
- (C) -1.10 V
- (D) 0.76 V

Q15. In an electrolysis process, a current of 2 A is passed through molten NaCl for 965 seconds. Calculate the mass of sodium deposited at the cathode and explain Faraday's laws of electrolysis.



- (A) 1.0 g
- (B) 2.3 g
- (C) 0.5 g
- (D) 4.6 g

Q16. For a first-order reaction, the rate constant is 0.0693 min^{-1} . Calculate the half-life of the reaction and explain how it remains independent of initial concentration.

- (A) 10 min
- (B) 5 min
- (C) 15 min
- (D) 20 min

Q17. A reaction doubles its rate when temperature is increased from 300 K to 310 K. Calculate the temperature coefficient and explain Arrhenius equation and activation energy concept.

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

Q18. Explain periodic trends in atomic radius across a period and down a group. Which of the following has the smallest atomic radius among Na, Mg, Al, and Si and justify using effective nuclear charge concept.

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

Q19. Explain structure of XeF_4 using VSEPR theory. Calculate hybridisation of xenon and predict molecular shape including lone pair effects.



- (A) Square planar
- (B) Tetrahedral
- (C) Trigonal bipyramidal
- (D) Octahedral

Q20. Compare acidic nature of oxides of period 3 elements (Na_2O , MgO , Al_2O_3 , SiO_2) and explain trend using periodic properties.

- (A) Na_2O is most acidic
- (B) SiO_2 is most acidic
- (C) MgO is most acidic
- (D) Al_2O_3 is most acidic

Q21. Explain preparation and structure of ozone (O_3) and calculate bond order using resonance structures.

- (A) 1.5
- (B) 2
- (C) 1
- (D) 3

Q22. Explain variable oxidation states of transition metals. Which of the following shows highest oxidation state: Mn, Fe, Cr, or Co and justify using electronic configuration.

- (A) Mn
- (B) Fe
- (C) Cr
- (D) Co

Q23. Lanthanide contraction leads to similarity in properties of 4d and 5d series. Explain its cause and effect on atomic radii trends.

- (A) Poor shielding by f-electrons



- (B) Increase in nuclear charge only
- (C) Decrease in electrons
- (D) Increase in shielding

Q24. Explain magnetic behaviour of transition metal complexes and identify paramagnetic species among Fe^{2+} , Zn^{2+} , and Cu^+ .

- (A) Fe^{2+}
- (B) Zn^{2+}
- (C) Cu^+
- (D) All are diamagnetic

Q25. In the complex $[\text{Co}(\text{NH}_3)_6]^{3+}$, determine oxidation state and hybridisation of central metal ion and explain Werner's coordination theory.

- (A) +3, d^2sp^3
- (B) +2, sp^3
- (C) +3, sp^3
- (D) +1, d^2sp^3

Q26. Explain isomerism in coordination compounds and identify type of isomerism in $[\text{CoCl}_2(\text{NH}_3)_4]^+$ complexes.

- (A) Geometrical isomerism
- (B) Optical isomerism
- (C) Chain isomerism
- (D) Functional isomerism

Q27. Calculate coordination number and geometry of $[\text{Ni}(\text{CO})_4]$ and explain role of ligand field in bonding.

- (A) 4, tetrahedral
- (B) 6, octahedral



- (C) 2, linear
- (D) 5, trigonal bipyramidal

Q28. A student is given a mixture of benzoic acid and naphthalene. Explain the principle of separation using sublimation and recrystallisation. Also describe how melting point determination helps in characterisation of organic compounds and purity analysis.

- (A) Pure compounds show sharp melting point
- (B) Impure compounds show higher melting point
- (C) Melting point is independent of purity
- (D) Only boiling point determines purity

Q29. Arrange the following carbocations in order of stability: tertiary, secondary, primary, and methyl carbocation. Explain stability using inductive effect and hyperconjugation.

- (A) tertiary > secondary > primary > methyl
- (B) methyl > primary > secondary > tertiary
- (C) primary > tertiary > secondary > methyl
- (D) secondary > tertiary > methyl > primary

Q30. Which of the following is most acidic: ethanol, phenol, water, or acetic acid? Explain acidity using resonance stabilization of conjugate base.

- (A) Acetic acid
- (B) Phenol
- (C) Water
- (D) Ethanol

Q31. Explain electrophilic substitution in benzene and identify the role of electron donating groups in activating the aromatic ring.

- (A) They deactivate ring



- (B) They activate ring
- (C) No effect on ring
- (D) Break aromaticity

Q32. Explain Markovnikov's rule in addition reactions of alkenes. Predict major product when HBr is added to propene.

- (A) 2-bromopropane
- (B) 1-bromopropane
- (C) Propanol
- (D) Propane

Q33. Describe ozonolysis of alkenes and identify products formed when but-2-ene undergoes ozonolysis followed by reduction.

- (A) Two molecules of acetaldehyde
- (B) Methanol and ethanol
- (C) Propanone only
- (D) Ethane and methane

Q34. Explain aromaticity using Huckel's rule. Determine whether cyclobutadiene is aromatic, antiaromatic, or non-aromatic.

- (A) Aromatic
- (B) Anti-aromatic
- (C) Non-aromatic
- (D) Highly stable aromatic

Q35. Explain SN1 and SN2 mechanisms. Which halogenoalkane undergoes SN1 reaction faster among tert-butyl chloride and methyl chloride and why?

- (A) tert-butyl chloride
- (B) methyl chloride



- (C) both equal
- (D) none undergo SN1

Q36. What is the major product when chloroethane reacts with alcoholic KOH? Explain elimination reaction mechanism (E2).

- (A) Ethene
- (B) Ethanol
- (C) Ethane
- (D) Ethanal

Q37. Explain acidity of carboxylic acids. Compare acidity of acetic acid and phenol using resonance and inductive effects.

- (A) Acetic acid is more acidic
- (B) Phenol is more acidic
- (C) Both equal
- (D) Neither is acidic

Q38. Describe nucleophilic addition reaction of aldehydes. What is the product when formaldehyde reacts with HCN?

- (A) Cyanohydrin
- (B) Alcohol
- (C) Ketone
- (D) Ether

Q39. Explain esterification reaction between ethanol and acetic acid. Identify catalyst used and nature of reaction.

- (A) Acid catalyzed reversible reaction
- (B) Base catalyzed irreversible reaction
- (C) Photochemical reaction



(D) Radical substitution reaction

Q40. Differentiate between aldehydes and ketones using Tollens' test. Which gives silver mirror test positive?

(A) Aldehydes

(B) Ketones

(C) Both

(D) Neither

Q41. Aniline undergoes diazotization reaction with NaNO_2/HCl at $0-5^\circ\text{C}$ to form benzene diazonium chloride. Explain the mechanism and importance of diazonium salts in organic synthesis. Also identify the major product when diazonium salt is treated with cuprous chloride.

(A) Chlorobenzene

(B) Phenol

(C) Nitrobenzene

(D) Anisole

Q42. Explain Hoffmann bromamide degradation reaction. Predict the product formed when propanamide is treated with Br_2/NaOH and discuss the role of rearrangement in formation of amines.

(A) Ethylamine

(B) Propylamine

(C) Methylamine

(D) Aniline

Q43. Explain the structure of glucose in its cyclic form and describe mutarotation phenomenon. Also compare alpha and beta anomers of glucose in terms of stability.

(A) α -glucose is more stable



- (B) β -glucose is more stable
- (C) Both have equal stability
- (D) Neither exists in solution

Q44. Describe the primary structure of proteins and explain peptide bond formation between amino acids. What is the effect of denaturation on protein structure?

- (A) Only primary structure changes
- (B) Secondary and tertiary structure destroyed
- (C) No change occurs
- (D) Protein becomes more stable

Q45. During qualitative analysis of an organic compound, sodium fusion test gives positive result for nitrogen. Explain the principle of Lassaigne's test and identify the compound formed during detection of nitrogen.

- (A) Prussian blue
- (B) Silver chloride
- (C) Sodium carbonate
- (D) Ferric oxide



Detailed Solutions

Q1.

Solution

Concept: The empirical formula represents the simplest whole number ratio of atoms in a compound, while the molecular formula gives the actual number of atoms present in a molecule. Molecular formula is an integer multiple of empirical formula. These concepts are essential in stoichiometry for determining composition, balancing equations, and solving limiting reagent problems, where the reactant present in least stoichiometric amount limits product formation.

Solution: Given composition: C = 85.7%, H = 14.3% Convert to moles:

$$\frac{85.7}{12} \approx 7.14, \quad \frac{14.3}{1} = 14.3$$

Divide by smallest:

$$\text{C} : \text{H} = 1 : 2$$

Empirical formula = CH_2 Empirical formula mass = $12 + 2 = 14$ Given molar mass = 28 g/mol

$$\text{Molecular formula factor} = \frac{28}{14} = 2$$

$$\text{Molecular formula} = (\text{CH}_2)_2 = \text{C}_2\text{H}_4$$

Final Answer: C_2H_4

Answer: (A)



Q2.

Solution

Concept: According to Bohr's model, electrons revolve in fixed circular orbits without radiating energy. The angular momentum is quantized as:

$$mvr = \frac{nh}{2\pi}$$

This leads to discrete energy levels and radii. Radius increases with square of principal quantum number. Energy difference between levels explains spectral line formation in hydrogen atom, where electron transitions emit or absorb photons of specific wavelengths.

Solution: Radius of nth orbit:

$$r_n = n^2 \times 0.53$$

For n = 2:

$$r_2 = 4 \times 0.53 = 2.12$$

Energy levels:

$$E_n = \frac{-13.6}{n^2}$$

$$E_1 = -13.6 \text{ eV}, \quad E_2 = -3.4 \text{ eV}$$

Energy difference:

$$\Delta E = 10.2 \text{ eV}$$

Final Answer:

Answer: (A)



Q3.

Solution

Concept: According to de Broglie hypothesis, every moving particle behaves like a wave. The associated wavelength is given by:

$$\lambda = \frac{h}{p}$$

For an electron accelerated through a potential difference V , its kinetic energy becomes eV , and momentum is:

$$p = \sqrt{2meV}$$

Thus,

$$\lambda = \frac{h}{\sqrt{2meV}}$$

This establishes wave nature of matter, showing that microscopic particles like electrons exhibit diffraction and interference.

Solution: Given: $V = 150 V$ Using standard shortcut formula:

$$\lambda(\text{in nm}) = \frac{1.227}{\sqrt{V}}$$

$$\lambda = \frac{1.227}{\sqrt{150}} = \frac{1.227}{12.25} \approx 0.10 \text{ nm}$$

Final Answer:

Answer: (A)

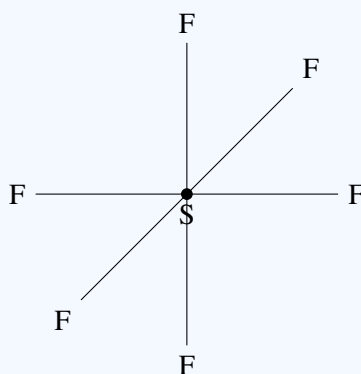


Q4.

Solution

Concept: According to VSEPR theory, the shape of a molecule depends on the repulsion between electron pairs around the central atom. In SF_6 , sulfur is the central atom bonded to six fluorine atoms with no lone pairs, leading to maximum symmetry. The steric number is 6, which corresponds to sp^3d^2 hybridisation. This results in an octahedral geometry. In ideal structures, bond angles are 90° and 180° , but slight deviations may occur due to lone pair–bond pair or bond pair–bond pair repulsions in other molecules (not in SF_6 as it has no lone pairs on central atom).

Solution: SF_6 has 6 bonding pairs and 0 lone pairs on sulfur. Steric number = 6 $\Rightarrow sp^3d^2$ hybridisation. Geometry = Octahedral.



Final Answer: Octahedral

Answer: (A)

Q5.

Solution

Concept: BF_3 is a covalent compound in which boron forms three sigma bonds with fluorine atoms. The central boron atom has three valence electrons and forms three bonding pairs with no lone pair. According to VSEPR theory, these electron pairs arrange themselves in a trigonal planar geometry to minimize repulsion. Hence, hybridisation is sp^2 and bond angle is 120° . BF_3 is electron deficient because boron has only six electrons in its valence shell after bonding, making it unstable and capable of accepting an electron pair.

Solution: In BF_3 , boron ($Z=5$) has electronic configuration $1s^2 2s^2 2p^1$. One electron from $2s$ is promoted, and hybridisation occurs among one $2s$ and two $2p$ orbitals, forming three sp^2 hybrid orbitals. These form three sigma bonds with fluorine atoms arranged in a planar triangular geometry. Due to absence of lone pairs on boron, bond pairs repel equally leading to bond angle of 120° . Since boron completes only six electrons in its valence shell, it remains electron deficient and tends to accept electron pairs from Lewis bases.

Final Answer: $sp^2, 120^\circ$

Answer: (A)



Q6.

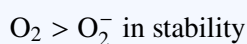
Solution

Concept: According to Molecular Orbital Theory, bond order is defined as:

$$\text{Bond order} = \frac{N_b - N_a}{2}$$

where N_b = bonding electrons and N_a = antibonding electrons. Higher bond order means greater stability and shorter bond length. O_2 has two unpaired electrons in antibonding π^* orbitals, making it paramagnetic. Addition of an extra electron in O_2^- increases antibonding electrons, reducing bond order and stability compared to O_2 .

Solution: For O_2 : Bond order = 2 For O_2^- : One extra electron enters antibonding π^* orbital, so antibonding electrons increase. Thus: Bond order of $O_2^- = 1.5$ Since higher bond order means higher stability, O_2 is more stable than O_2^- . Also, O_2 has two unpaired electrons in π^* orbitals, hence it is paramagnetic, while O_2^- has reduced but still unpaired character. Therefore:



Final Answer: O_2 has higher bond order

Answer: (A)

Q7.

Solution

Concept: Hydrogen bonding is a strong intermolecular force formed when hydrogen is bonded to highly electronegative atoms like F, O, or N. In water, each molecule forms extensive hydrogen bonds due to two lone pairs and two hydrogen atoms, creating a strong network. This significantly increases boiling point. Among H_2O , HF, and NH_3 , strength depends on number and extent of hydrogen bonds formed, along with molecular structure and electronegativity difference.

Solution: Water forms the most extensive hydrogen bonding network due to two H-bond donors and two acceptors, allowing a 3D structure. HF forms strong but chain-like hydrogen bonding, while NH_3 forms weaker hydrogen bonds due to lower electronegativity of nitrogen and fewer lone pair interactions. Hence boiling point order is:



Final Answer: $H_2O > HF > NH_3$

Answer: (A)



Q8.

Solution

Concept: Gibbs free energy determines spontaneity of a reaction and is given by:

$$\Delta G = \Delta H - T\Delta S$$

A reaction is spontaneous when $\Delta G < 0$, non-spontaneous when $\Delta G > 0$, and at equilibrium when $\Delta G = 0$. Careful unit conversion is essential when entropy is given in J/mol·K and enthalpy in kJ/mol.

Solution: Given:

$$\Delta H = -40 \text{ kJ/mol}, \quad \Delta S = -100 \text{ J/molK} = -0.1 \text{ kJ/molK}, \quad T = 300 \text{ K}$$

Now,

$$T\Delta S = 300 \times (-0.1) = -30 \text{ kJ/mol}$$

$$\Delta G = -40 - (-30) = -40 + 30 = -10 \text{ kJ/mol}$$

Since ΔG is negative, the reaction is spontaneous at 300 K.

Final Answer: -10 kJ/mol , spontaneous

Answer: (A)



Q9.

Solution

Concept: The first law of thermodynamics states that energy can neither be created nor destroyed, only converted from one form to another. It is expressed as:

$$\Delta Q = \Delta U + W$$

In an isothermal process for an ideal gas, temperature remains constant, so internal energy change $\Delta U = 0$. Hence, heat supplied is equal to work done by the gas:

$$W = nRT \ln \left(\frac{V_2}{V_1} \right)$$

Solution: Given:

$$n = 2, \quad T = 300 \text{ K}, \quad V_1 = 1 \text{ L}, \quad V_2 = 10 \text{ L}$$

$$W = 2 \times 8.314 \times 300 \times \ln(10)$$

$$\ln(10) = 2.303$$

$$W = 2 \times 8.314 \times 300 \times 2.303$$

$$W = 4988.4 \times 2.303 \approx 11490 \text{ J}$$

$$W \approx 11.4 \text{ kJ}$$

Final Answer:

Answer: (A)



Q10.

Solution

Concept: Molarity is defined as the number of moles of solute present in 1 litre of solution:

$$M = \frac{\text{moles of solute}}{\text{volume of solution in L}}$$

For NaCl: Molar mass of NaCl = 23 + 35.5 = 58.5 g/mol
Colligative properties are those properties of solutions which depend only on the number of solute particles present in solution, not on their nature. These include:

- Relative lowering of vapour pressure
- Elevation in boiling point
- Depression in freezing point
- Osmotic pressure

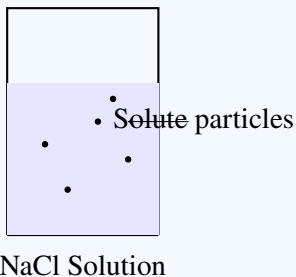
More solute particles lead to greater change in colligative properties.

Solution: Given: Mass of NaCl = 5.85 g Molar mass of NaCl = 58.5 g/mol Volume of solution = 500 mL = 0.5 L
Step 1: Calculate moles of NaCl

$$\text{Moles} = \frac{5.85}{58.5} = 0.1 \text{ mol}$$

Step 2: Calculate molarity

$$M = \frac{0.1}{0.5} = 0.2 \text{ M}$$



Final Answer:

Answer: (A)



Q11.

Solution

Concept: Boiling point elevation is a colligative property of solutions. It depends only on the number of solute particles present in the solution, not on their chemical nature. When a non-volatile solute is added to a solvent, the vapour pressure of the solution decreases, which results in an increase in boiling point. The relation is given by:

$$\Delta T_b = K_b \cdot m$$

where ΔT_b = elevation in boiling point K_b = ebullioscopic constant m = molality of solution

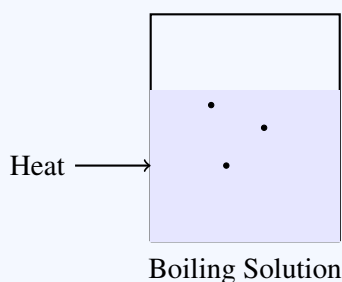
Solution: Given: $\Delta T_b = 0.52 \text{ K}$ $K_b = 0.52 \text{ K kg/mol}$ Step 1: Apply formula

$$m = \frac{\Delta T_b}{K_b}$$

Step 2: Substitute values

$$m = \frac{0.52}{0.52} = 1 \text{ mol/kg}$$

Explanation (Boiling Point Elevation): When a solute is added to a pure solvent, it reduces the vapour pressure of the solvent. As a result, more heat is required for the liquid to reach atmospheric pressure, leading to an increase in boiling point. This effect depends only on the number of solute particles present.



Final Answer:

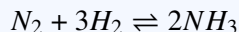
Answer: (A)



Q12.

Solution

Concept: According to Le Chatelier's principle, if a system at equilibrium is subjected to a change in pressure, temperature, or concentration, it shifts in the direction that opposes the change. For the Haber process:



Four moles of reactants produce two moles of product, so increase in pressure favors the side with fewer moles (ammonia). Since the reaction is exothermic, lowering temperature favors ammonia formation.

Solution: - Pressure: High pressure shifts equilibrium toward NH_3 (fewer moles). - Temperature: Low temperature favors exothermic formation of NH_3 , but too low slows reaction rate. Hence industrial compromise is moderate temperature and high pressure. Therefore, conditions favoring ammonia formation are:

High pressure, low temperature

Final Answer: High pressure low temperature

Answer: (A)

Q13.

Solution

Concept: Degree of dissociation (α) represents the fraction of acid that ionizes in solution. For a weak acid HA:



The acid dissociation constant is:

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

If initial concentration is C and degree of dissociation is α , then:

$$[H^+] = C\alpha, \quad [A^-] = C\alpha, \quad [HA] = C(1 - \alpha)$$

Solution: Given:

$$pH = 3 \Rightarrow [H^+] = 10^{-3} M, \quad C = 0.1 M$$

Degree of dissociation:

$$\alpha = \frac{[H^+]}{C} = \frac{10^{-3}}{0.1} = 10^{-2}$$

$$\alpha = 0.01 = 1\%$$

Final Answer: 1%

Answer: (A)



Q14.

Solution

Concept: In a galvanic cell, oxidation occurs at anode and reduction at cathode. Electrons flow from anode to cathode through the external circuit. The standard cell potential is given by:

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

A salt bridge maintains electrical neutrality by allowing migration of ions and preventing charge buildup in half-cells, ensuring continuous flow of electrons.

Solution: Given:

$$E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = +0.34 \text{ V}, \quad E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76 \text{ V}$$

Cu is cathode (higher reduction potential), Zn is anode.

$$E_{\text{cell}}^{\circ} = 0.34 - (-0.76) = 1.10 \text{ V}$$

Final Answer:

Answer: (A)

Q15.

Solution

Concept: According to Faraday's laws of electrolysis, the mass of substance deposited is directly proportional to the quantity of electricity passed:

$$m = \frac{It \cdot M}{nF}$$

where I is current, t is time, M is molar mass, n is electrons exchanged, and F is Faraday constant (96500 C/mol). For Na^+ , $n = 1$.

Solution: Given:

$$I = 2 \text{ A}, \quad t = 965 \text{ s}, \quad M_{\text{Na}} = 23 \text{ g/mol}$$

Charge passed:

$$Q = It = 2 \times 965 = 1930 \text{ C}$$

Using formula:

$$m = \frac{1930 \times 23}{96500}$$

$$m = \frac{44390}{96500} \approx 0.46 \text{ g} \approx 0.5 \text{ g}$$

Final Answer:

Answer: (C)



Q16.

Solution

Concept: For a first-order reaction, the half-life is independent of the initial concentration and is given by:

$$t_{1/2} = \frac{0.693}{k}$$

This is a characteristic feature of first-order kinetics, meaning the time required for half of the reactant to decompose remains constant regardless of how much reactant is initially present.

Solution: Given:

$$k = 0.0693 \text{ min}^{-1}$$

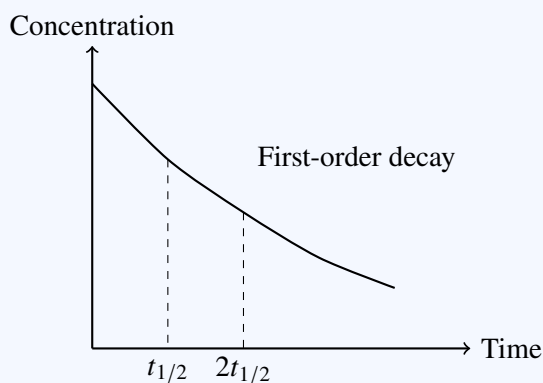
Step 1: Apply formula

$$t_{1/2} = \frac{0.693}{0.0693}$$

Step 2: Calculate

$$t_{1/2} = 10 \text{ min}$$

Explanation (Independence of Initial Concentration): In a first-order reaction, the rate depends only on the concentration of one reactant raised to the power one. The mathematical form leads to a constant ratio for decay over equal time intervals, so the half-life remains constant even if the initial concentration changes.



Final Answer: 10 min

Answer: (A)



Q17.

Solution

Concept: The temperature coefficient of a reaction is defined as the ratio of rate constants at two temperatures differing by 10 K. For many reactions, rate approximately doubles for every 10 K rise in temperature. This behavior is explained by the Arrhenius equation:

$$k = Ae^{-E_a/RT}$$

where E_a is activation energy. Increase in temperature increases the fraction of molecules having energy greater than E_a , hence rate increases.

Solution: Given:

$$T_1 = 300 \text{ K}, \quad T_2 = 310 \text{ K}, \quad \text{Rate doubles}$$

Temperature coefficient (Q_{10}):

$$Q_{10} = \frac{R_2}{R_1} = 2$$

Final Answer:

Answer: (A)

Q18.

Solution

Concept: Atomic radius decreases across a period from left to right due to increase in effective nuclear charge (Z_{eff}), which pulls electrons closer to the nucleus. Down a group, atomic radius increases due to addition of new electron shells and increased shielding effect.

Solution: Across the period $\text{Na} \rightarrow \text{Mg} \rightarrow \text{Al} \rightarrow \text{Si}$: Nuclear charge increases- Shielding remains almost constant- Hence Z_{eff} increases progressively Therefore atomic radius decreases in order:

$$\text{Na} > \text{Mg} > \text{Al} > \text{Si}$$

Thus, the smallest atomic radius is:

Si

Final Answer:

Answer: (D)



Q19.

Solution

Concept: According to VSEPR theory, the shape of a molecule depends on the number of bond pairs and lone pairs around the central atom. Xenon in XeF_4 has 8 valence electrons. It forms 4 bonds with fluorine atoms and retains 2 lone pairs. Thus, there are 6 electron pairs (4 bond pairs + 2 lone pairs), giving an octahedral electron pair geometry. Lone pairs occupy opposite positions to minimize repulsion.

Solution: Total electron pairs around Xe = 6 Hybridisation corresponds to:



Out of these, 2 are lone pairs and 4 are bond pairs. Lone pairs occupy axial positions, leaving four fluorine atoms in one plane. Hence, the molecular shape becomes square planar due to lone pair–lone pair repulsion minimization.

Final Answer:

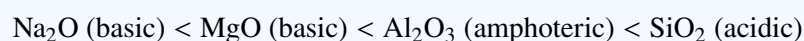
Answer: (A)

Q20.

Solution

Concept: Across a period, the acidic nature of oxides increases from left to right due to increase in electronegativity and decrease in metallic character. Metals form basic oxides (Na_2O , MgO), aluminium forms amphoteric oxide (Al_2O_3), while non-metals form acidic oxides (SiO_2). This trend is governed by effective nuclear charge and ability to attract electrons, which enhances covalent character and acidity of oxides.

Solution: In period 3:



Na_2O is strongly basic, MgO is less basic, Al_2O_3 shows both acidic and basic nature, while SiO_2 is strongly acidic. Hence acidity increases across the period.

Final Answer:

Answer: (B)



Q21.

Solution

Concept: Ozone (O_3) is an allotrope of oxygen formed by passing silent electric discharge through oxygen. Its structure is explained using resonance theory, where two canonical forms contribute to the actual structure. Each O–O bond is equivalent due to delocalisation of π electrons. Bond order is defined as the average number of bonds between two atoms in resonance structures. Thus, ozone has fractional bond order indicating partial double bond character.

Solution: The two resonance structures of ozone are:



In one structure, one bond is double and the other is single. Total bonds = 2 + 1 = 3 distributed over 2 bonds.

$$\text{Bond order} = \frac{\text{Total number of bonds}}{\text{Number of bond positions}} = \frac{3}{2} = 1.5$$

Thus, both O–O bonds are identical with bond order 1.5, shorter than single bond but longer than double bond.

Final Answer: 1.5

Answer: (A)

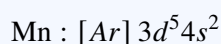


Q22.

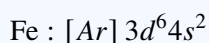
Solution

Concept: Transition metals exhibit variable oxidation states due to the involvement of both $(n - 1)d$ and ns electrons in bonding. Since the energy difference between these orbitals is small, electrons can be removed from both, leading to multiple oxidation states. The maximum oxidation state is generally equal to the total number of valence electrons ($ns + (n - 1)d$ electrons). Elements with half-filled or near half-filled d-orbitals tend to show higher oxidation states due to extra stability.

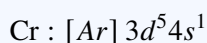
Solution: Step 1: Electronic configurations



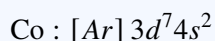
Total valence electrons = 7 \Rightarrow Maximum oxidation state = +7



Maximum oxidation state = +6 (less common, usually +2, +3)



Maximum oxidation state = +6



Maximum oxidation state = +5 (rare, usually +2, +3) Step 2: Comparison Mn has the highest number of unpaired electrons and can utilize all 7 valence electrons, achieving +7 oxidation state.

Explanation: The half-filled $3d^5$ configuration of Mn provides extra stability, allowing it to lose all valence electrons and attain the highest oxidation state among the given elements.

Mn: +7	Cr: +6
Fe: +3	Co: +3

Final Answer: Mn

Answer: (A)



Q23.

Solution

Concept: Lanthanide contraction refers to the gradual decrease in atomic and ionic radii across the lanthanide series (La to Lu). This occurs because 4f-electrons have very poor shielding ability. As nuclear charge increases, the ineffective shielding by f-electrons causes greater attraction between nucleus and outer electrons, leading to contraction in size. This effect influences properties of subsequent elements, especially 5d transition metals.

Solution: Due to poor shielding by 4f-electrons, the atomic radii of 5d elements become nearly equal to those of corresponding 4d elements. This results in similar chemical properties between pairs like Zr–Hf. Hence, lanthanide contraction explains the unexpected similarity in size and behavior of 4d and 5d series elements.

Final Answer:

Answer: (A)



Q24.

Solution

Concept: Magnetic behaviour of transition metal complexes depends on the presence of unpaired electrons in their d-orbitals.

- **Paramagnetic:** Species having one or more unpaired electrons.
- **Diamagnetic:** Species having all electrons paired.

The number of unpaired electrons can be determined from electronic configuration. Greater the number of unpaired electrons, stronger is paramagnetism.

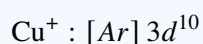
Solution: Step 1: Electronic configurations



This has 4 unpaired electrons (in high spin case) \Rightarrow Paramagnetic

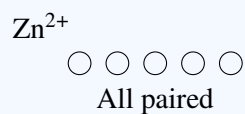
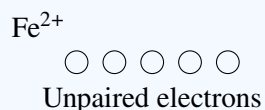


All electrons paired \Rightarrow Diamagnetic



All electrons paired \Rightarrow Diamagnetic

Explanation: Only Fe^{2+} contains unpaired electrons, hence shows paramagnetism. Zn^{2+} and Cu^+ have completely filled d-orbitals, so they are diamagnetic.



Final Answer: $\boxed{\text{Fe}^{2+}}$

Answer: (A)



Q25.

Solution

Concept: In coordination compounds, oxidation state is obtained by balancing the overall charge of the complex ion. Werner's coordination theory distinguishes between primary valency (oxidation state) and secondary valency (coordination number). The hybridisation of the central metal ion depends on ligand field strength; strong field ligands like NH_3 can cause pairing of electrons leading to inner orbital complexes.

Solution: For $[\text{Co}(\text{NH}_3)_6]^{3+}$: Let oxidation state of Co = x

$$x + 6(0) = +3 \Rightarrow x = +3$$

NH_3 is a neutral ligand, and in Co^{3+} complexes it leads to electron pairing due to strong ligand field effect. Hence inner orbital complex is formed with:

d^2sp^3 hybridisation

Final Answer: $+3, d^2sp^3$

Answer: (A)

Q26.

Solution

Concept: Isomerism in coordination compounds arises when compounds have the same molecular formula but different spatial arrangement of ligands around the central metal ion. The most common types include geometrical, optical, ionisation, linkage, and coordination isomerism. In octahedral complexes, geometrical isomerism occurs when identical ligands occupy different relative positions (cis or trans).

Solution: The complex $[\text{CoCl}_2(\text{NH}_3)_4]^+$ has coordination number 6, hence octahedral geometry. The two Cl^- ligands can be arranged either adjacent to each other (cis form) or opposite each other (trans form), leading to geometrical isomerism. Since all ligands are not arranged to produce chirality, optical isomerism is not possible. Other isomerism types like chain or functional isomerism do not apply to coordination complexes of this type.

Final Answer: Geometrical isomerism

Answer: (A)



Q27.

Solution

Concept: Coordination number is the number of ligand donor atoms directly bonded to the central metal atom. In $[\text{Ni}(\text{CO})_4]$, carbon monoxide is a strong field ligand that promotes pairing of electrons. Ligand field theory explains bonding in terms of d-orbital splitting and hybridisation, which determines molecular geometry.

Solution: In $[\text{Ni}(\text{CO})_4]$, four CO ligands are coordinated to Ni, so coordination number = 4. Nickel is in the zero oxidation state with electronic configuration $3d^84s^2$. Due to strong field nature of CO, electron pairing occurs and hybridisation becomes sp^3 . This leads to a tetrahedral geometry with bond angles close to 109.5° . The ligand field stabilizes this arrangement.

Final Answer: 4, tetrahedral

Answer: (A)

Q28.

Solution

Concept: Separation of organic mixtures depends on differences in physical properties. Sublimation is used when one component directly converts from solid to vapour (like naphthalene), while the other (benzoic acid) does not. Recrystallisation is used to purify solids based on differences in solubility in hot and cold solvents. Melting point determination is a key method for purity analysis; pure compounds have a sharp melting point, while impurities cause melting point depression and broadening.

Solution: In this mixture, naphthalene is sublimable, so it can be separated by heating under controlled conditions, leaving benzoic acid behind. Benzoic acid is purified by recrystallisation using suitable solvents like water or alcohol. After purification, melting point is measured. A sharp and constant melting point indicates purity, whereas a range indicates impurities. Thus melting point is an important identification and purity check tool in organic chemistry.

Final Answer: Pure compounds show sharp melting point

Answer: (A)



Q29.

Solution

Concept: Carbocation stability depends on electron-releasing effects that stabilize positive charge. Inductive effect (+I effect) of alkyl groups pushes electron density toward the positively charged carbon. Hyperconjugation further stabilizes carbocations by delocalization of σ -electrons from adjacent C–H bonds into the empty p-orbital. More substituted carbocations have more hyperconjugative structures, hence greater stability.

Solution: Methyl carbocation has no alkyl groups, so least stable. Primary has one alkyl group, secondary has two, and tertiary has three alkyl groups providing maximum +I effect and hyperconjugation. Therefore stability increases with substitution. Hence order is: tertiary > secondary > primary > methyl carbocation.

Final Answer: tertiary > secondary > primary > methyl

Answer: (A)

Q30.

Solution

Concept: Acidity depends on the stability of the conjugate base formed after loss of a proton. Greater resonance stabilization and electron-withdrawing effects increase acidity. Carboxylic acids form resonance-stabilized carboxylate ions, making them much more acidic than phenols, water, or alcohols. In phenol, resonance stabilizes phenoxide ion, but less effectively than in carboxylic acids.

Solution: Among the given compounds, acetic acid forms acetate ion after losing H^+ . The negative charge is delocalized over two oxygen atoms through resonance, strongly stabilizing the conjugate base. Phenol forms phenoxide ion, which has resonance but less effective stabilization. Water and ethanol lack resonance stabilization, so they are weaker acids. Therefore acidity order is: acetic acid > phenol > water > ethanol.

Final Answer: Acetic acid

Answer: (A)



Q31.

Solution

Concept: Electrophilic substitution in benzene occurs due to its delocalized π electron cloud, which attracts electrophiles. Substituents already present on the benzene ring influence its reactivity. Electron donating groups (EDGs) increase electron density in the ring through resonance or inductive effects, making the ring more reactive toward electrophiles.

Solution: Electron donating groups such as $-OH$, $-NH_2$, and alkyl groups release electron density into the benzene ring. This increases activation of the aromatic ring and stabilizes the intermediate carbocation (sigma complex) formed during electrophilic substitution. Hence, EDGs increase the rate of reaction and direct substitution to ortho/para positions.

Final Answer: They activate ring

Answer: (B)

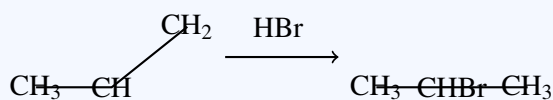
Q32.

Solution

Concept: Markovnikov's rule states that when an unsymmetrical reagent like HBr adds to an unsymmetrical alkene, the hydrogen atom attaches to the carbon having more hydrogen atoms already, while the halide (Br^-) attaches to the carbon having fewer hydrogen atoms. This is due to the formation of a more stable carbocation intermediate during the reaction. For propene ($CH_3-CH=CH_2$), the double bond breaks and addition occurs according to carbocation stability. The secondary carbocation is more stable than the primary carbocation, so the major product follows Markovnikov's rule.

Solution: Step 1: Structure of propene $CH_3-CH=CH_2$ Step 2: Protonation step H^+ adds to terminal carbon (CH_2 group), forming a more stable secondary carbocation at middle carbon. Step 3: Nucleophilic attack Br^- attacks the carbocation to form final product. Thus, product formed is: $CH_3-CHBr-CH_3$

Explanation: The reaction proceeds via carbocation intermediate. The more substituted carbocation is more stable due to hyperconjugation and inductive effect, leading to Markovnikov addition.



Final Answer: 2-bromopropane

Answer: (A)



Q33.

Solution

Concept: Ozonolysis is the oxidative cleavage of carbon-carbon double bonds using ozone (O_3). The alkene first forms an ozonide intermediate, which on reductive workup (Zn/H_2O or $(CH_3)_2S$) yields carbonyl compounds (aldehydes or ketones) depending on substitution. This reaction is useful for identifying the position of double bonds in alkenes.

Solution: But-2-ene has the structure $CH_3-CH=CH-CH_3$. On ozonolysis, the double bond is cleaved at the $C=C$ bond. Each carbon of the double bond carries a CH_3 group, so both fragments form acetaldehyde (CH_3CHO). Thus two identical molecules of acetaldehyde are produced after reductive workup.

Final Answer: Two molecules of acetaldehyde

Answer: (A)

Q34.

Solution

Concept: Aromaticity is explained using Huckel's rule, which states that a planar, cyclic, fully conjugated system is aromatic if it contains $(4n+2)\pi$ electrons. If a system is cyclic and conjugated but has $4n\pi$ electrons, it becomes antiaromatic and highly unstable. Non-aromatic compounds fail to satisfy planarity or conjugation conditions.

Solution: Cyclobutadiene has 4π electrons (2 double bonds in a cyclic conjugated structure). Since it follows the $4n$ rule (where $n = 1$), it is antiaromatic. It is highly unstable due to electron delocalization leading to destabilization. It also distorts from planarity to avoid antiaromaticity, but theoretically it is classified as antiaromatic.

Final Answer: Anti-aromatic

Answer: (B)

Q35.

Solution

Concept: SN_1 reaction proceeds via a two-step mechanism involving formation of a carbocation intermediate. The rate depends on carbocation stability: tertiary carbocations are most stable due to hyperconjugation and inductive effects. SN_2 is a one-step backside attack mechanism and is favored by less hindered substrates like methyl halides. Thus, tertiary halides favor SN_1 , while methyl halides favor SN_2 .

Solution: tert-butyl chloride forms a stable tertiary carbocation due to three alkyl groups providing strong +I effect and hyperconjugation. This stabilizes the intermediate, making SN_1 reaction fast. Methyl chloride cannot form a stable carbocation, so it does not undergo SN_1 easily. Hence, tert-butyl chloride undergoes SN_1 much faster.

Final Answer: tert-butyl chloride

Answer: (A)



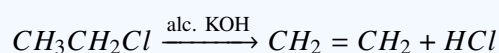
Q36.

Solution

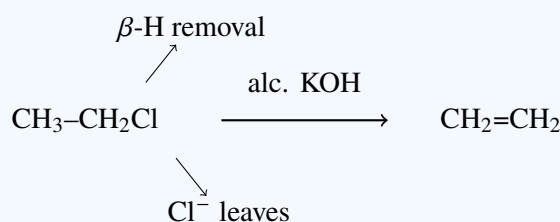
Concept: Alcoholic KOH promotes elimination reactions (dehydrohalogenation) in alkyl halides, leading to the formation of alkenes. This reaction follows the E2 (bimolecular elimination) mechanism. In an E2 reaction:

- It is a single-step (concerted) process.
- A strong base (OH^-) abstracts a β -hydrogen.
- Simultaneously, the leaving group (Cl^-) departs.
- A double bond is formed between α and β carbons.

Solution: Given: Chloroethane ($\text{CH}_3\text{CH}_2\text{Cl}$) + alcoholic KOH
Step 1: Base (OH^-) removes β -hydrogen
Step 2: C-Cl bond breaks simultaneously
Step 3: Formation of double bond
Reaction:



Explanation: The reaction proceeds via E2 mechanism where bond breaking and bond formation occur at the same time. Since chloroethane has only one possible β -carbon, the product formed is ethene.



Final Answer: Ethene

Answer: (A)



Q37.

Solution

Concept: Acidity depends on the stability of the conjugate base formed after loss of H^+ . Greater stabilization (by resonance and inductive effects) increases acidity. Carboxylic acids form carboxylate ions where the negative charge is delocalized over two oxygen atoms by strong resonance, while phenol forms phenoxide ion with less effective resonance stabilization.

Solution: Acetic acid (CH_3COOH) forms acetate ion (CH_3COO^-) after dissociation. The negative charge is delocalized over two electronegative oxygen atoms, providing strong resonance stabilization. In phenol, the phenoxide ion has resonance into the aromatic ring, but the negative charge is less effectively stabilized compared to carboxylate ion. Also, the alkyl group in acetic acid has a mild +I effect but does not overcome resonance stabilization. Hence, acetic acid is significantly more acidic than phenol.

Final Answer: Acetic acid is more acidic

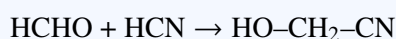
Answer: (A)

Q38.

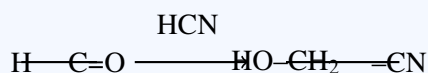
Solution

Concept: Aldehydes undergo nucleophilic addition reactions due to the presence of a polar carbonyl group ($C=O$). The carbon atom of the carbonyl group carries a partial positive charge, making it susceptible to attack by nucleophiles. In nucleophilic addition, the nucleophile attacks the carbonyl carbon, breaking the π bond and forming a tetrahedral intermediate, which is then protonated to give the final product. When formaldehyde ($HCHO$) reacts with hydrogen cyanide (HCN), the cyanide ion (CN^-) acts as a nucleophile and adds to the carbonyl carbon.

Solution: Step 1: Nucleophilic attack CN^- attacks carbonyl carbon of formaldehyde ($HCHO$). Step 2: Formation of alkoxide intermediate The $C=O$ bond breaks and an alkoxide ion is formed. Step 3: Protonation The intermediate gets protonated to form cyanohydrin. Reaction:



Explanation: The product formed contains both hydroxyl ($-OH$) and cyano ($-CN$) groups on the same carbon atom. Such compounds are known as cyanohydrins.



Final Answer: Cyanohydrin

Answer: (A)



Q39.

Solution

Concept: Esterification is the reaction between a carboxylic acid and an alcohol to form an ester and water. It is a reversible equilibrium process and is catalyzed by a strong acid (usually concentrated H_2SO_4), which also acts as a dehydrating agent. The reaction is known as Fischer esterification.

Solution: Ethanol reacts with acetic acid in presence of concentrated H_2SO_4 to form ethyl acetate and water. The acid protonates the carbonyl group, increasing its electrophilicity and facilitating nucleophilic attack by alcohol. Since water is formed, the reaction is reversible and establishes equilibrium. Thus, it is an acid-catalyzed reversible reaction.

Final Answer: Acid catalyzed reversible reaction

Answer: (A)

Q40.

Solution

Concept: Tollens' test is used to distinguish aldehydes from ketones. Tollens' reagent contains $[\text{Ag}(\text{NH}_3)_2]^+$, which is a mild oxidizing agent. Aldehydes are easily oxidized to carboxylic acids, reducing Ag^+ to metallic silver, forming a silver mirror. Ketones generally do not undergo oxidation under these mild conditions.

Solution: Aldehydes contain a terminal carbonyl group ($-\text{CHO}$) and are readily oxidized by Tollens' reagent, producing a silver mirror on the test tube wall. Ketones have internal carbonyl groups and are resistant to oxidation under these conditions. Therefore, only aldehydes give a positive Tollens' test.

Final Answer: Aldehydes

Answer: (A)

Q41.

Solution

Concept: Diazotization is the reaction of primary aromatic amines (like aniline) with nitrous acid (generated in situ from NaNO_2 and HCl) at low temperature ($0-5^\circ\text{C}$) to form stable benzene diazonium salts. These diazonium salts are highly useful intermediates because the diazonium group can be replaced by various nucleophiles, enabling synthesis of a wide range of substituted aromatic compounds. **Solution:** Aniline reacts with NaNO_2/HCl at $0-5^\circ\text{C}$ to form benzene diazonium chloride ($\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$). This intermediate undergoes substitution reactions. When treated with cuprous chloride (CuCl) in Sandmeyer reaction, the diazonium group is replaced by Cl , forming chlorobenzene with liberation of nitrogen gas. This reaction is widely used for introducing halogens into aromatic rings.

Final Answer: Chlorobenzene

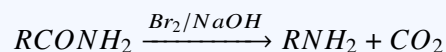
Answer: (A)



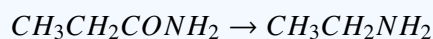
Q42.

Solution

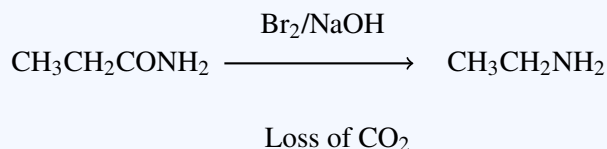
Concept: Hoffmann bromamide degradation reaction is a method for converting primary amides into primary amines using bromine (Br_2) and a strong base (NaOH). In this reaction, the amide loses one carbon atom (as CO_2), forming an amine with one carbon less than the original amide. The reaction proceeds via formation of an isocyanate intermediate, followed by rearrangement (migration of alkyl group from carbonyl carbon to nitrogen), and hydrolysis to yield the amine. General reaction:



Solution: Given: Propanamide ($\text{CH}_3\text{CH}_2\text{CONH}_2$)
Step 1: Formation of N-bromoamide
Amide reacts with Br_2 in alkaline medium.
Step 2: Rearrangement Alkyl group (C_2H_5) migrates from carbonyl carbon to nitrogen forming isocyanate.
Step 3: Hydrolysis Isocyanate reacts with water to give amine and CO_2 .
Final product:



Explanation: The key step is rearrangement, where the alkyl group shifts to nitrogen. This leads to loss of one carbon atom, hence the product amine has one carbon less than the original amide.



Final Answer: Ethylamine

Answer: (A)



Q43.

Solution

Concept: Glucose exists mainly in a cyclic hemiacetal form in aqueous solution. The aldehyde group at C-1 reacts with the hydroxyl group at C-5 to form a six-membered ring called pyranose structure. This ring formation creates a new chiral center at C-1 known as the anomeric carbon. Based on the position of the hydroxyl group at the anomeric carbon, two anomers are formed:

- α -D-glucose: OH at C-1 is opposite side to CH_2OH group
- β -D-glucose: OH at C-1 is same side as CH_2OH group

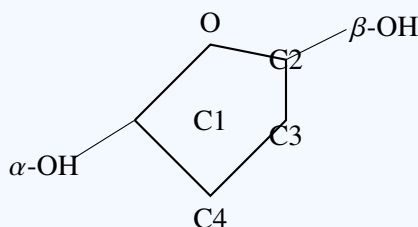
Mutarotation is the spontaneous change in optical rotation due to interconversion of α and β anomers via the open-chain form until equilibrium is reached.

Solution: Step 1: Cyclization of glucose Open-chain aldehyde glucose reacts intramolecularly to form a six-membered pyranose ring. Step 2: Formation of anomers New chiral center at C-1 leads to α and β forms. Step 3: Mutarotation In aqueous solution:



leading to change in optical rotation until equilibrium mixture is reached.

Stability comparison: β -D-glucose is more stable because the OH group at anomeric carbon is in equatorial position, reducing steric strain, while in α -form it is axial.



Final Answer: β -glucose is more stable

Answer: (A)



Q44.

Solution

Concept: The primary structure of proteins refers to the linear sequence of amino acids linked by peptide bonds. A peptide bond is formed by condensation between the carboxyl group (-COOH) of one amino acid and the amino group (-NH₂) of another, releasing a molecule of water. Denaturation of proteins involves disruption of hydrogen bonding, ionic interactions, and hydrophobic interactions, which destroys secondary and tertiary structures while leaving the primary structure intact.

Solution: In proteins, amino acids are joined through peptide linkage (-CONH-) formed by elimination of water between -COOH and -NH₂ groups. This forms a stable polypeptide chain known as the primary structure. Denaturation (due to heat, pH change, or chemicals) breaks weak interactions like hydrogen bonds and disulfide bridges. As a result, the secondary (-helix, -sheet) and tertiary structures are destroyed, but the primary structure remains unchanged.

Final Answer: Secondary and tertiary structure destroyed

Answer: (B)

Q45.

Solution

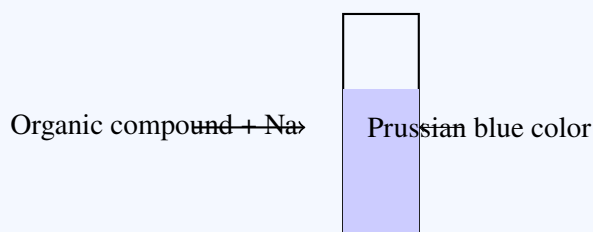
Concept: Lassaigne's test (sodium fusion test) is used for the detection of elements like nitrogen, sulfur, and halogens in an organic compound. The principle involves fusing the organic compound with metallic sodium so that covalently bonded elements are converted into ionic sodium salts, which can then be easily detected in aqueous solution. For nitrogen detection, during sodium fusion, nitrogen present in the organic compound combines with sodium to form sodium cyanide (NaCN). This extract is then treated with ferrous sulfate and ferric ions under acidic conditions to form a complex compound known as Prussian blue.

Solution: Step 1: Fusion reaction



Step 2: Formation of ferrocyanide complex NaCN reacts with FeSO₄ to form sodium ferrocyanide. Step 3: Oxidation step In presence of Fe³⁺, a deep blue colored complex is formed.

Explanation: The formation of Prussian blue confirms the presence of nitrogen in the organic compound. This is a characteristic qualitative test for nitrogen detection in Lassaigne's extract.



Final Answer: Prussian blue

Answer: (A)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	A	3	A	4	A	5	A
6	A	7	A	8	A	9	A	10	A
11	A	12	A	13	A	14	A	15	C
16	A	17	A	18	D	19	A	20	B
21	A	22	A	23	A	24	A	25	A
26	A	27	A	28	A	29	A	30	A
31	B	32	A	33	A	34	B	35	A
36	A	37	A	38	A	39	A	40	A
41	A	42	A	43	A	44	B	45	A

