

CUET UG Chemistry Sample Paper - 15

Duration: 1 Hour

Maximum Marks: 250

Instructions

- This paper contains a total of 50 Multiple Choice Questions.
- Each correct answer carries **+5 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. A 0.1 M aqueous solution of K_2SO_4 is found to be 80% dissociated. The Van't Hoff factor (i) for the solution is:

- (A) 2.4
- (B) 2.6
- (C) 3.0
- (D) 1.8

Q2. At a constant temperature, the vapor pressure of an ideal solution containing 2 moles of A and 3 moles of B is 500 mm Hg. If 1 mole of A is added, the vapor pressure increases to 550 mm Hg. The vapor pressure of pure A is:

- (A) 400 mm Hg
- (B) 600 mm Hg
- (C) 800 mm Hg
- (D) 1000 mm Hg



- Q3.** Which of the following liquid pairs shows a negative deviation from Raoult's law:2022
- (A) Ethanol and Acetone
 - (B) Benzene and Toluene
 - (C) Phenol and Aniline
 - (D) Chloroform and Benzene
- Q4.** The elevation in boiling point of a 0.01 M aqueous solution of $BaCl_2$ is $0.015^\circ C$. If K_b for water is $0.52 \text{ K kg mol}^{-1}$, the apparent degree of ionization of $BaCl_2$ is:
- (A) 85.3%
 - (B) 94.2%
 - (C) 75.0%
 - (D) 100%
- Q5.** A plant cell shrinks when placed in a solution that is:
- (A) Hypotonic
 - (B) Hypertonic
 - (C) Isotonic
 - (D) Pure water
- Q6.** The molar conductivity of 0.007 M acetic acid is $20 \text{ S cm}^2\text{mol}^{-1}$. If Λ_m° for acetic acid is $400 \text{ S cm}^2\text{mol}^{-1}$, the dissociation constant (K_a) is:
- (A) 1.75×10^{-5}
 - (B) 2.5×10^{-5}
 - (C) 1.5×10^{-4}
 - (D) 1.8×10^{-5}



- Q7.** For the cell reaction: $Ni(s) + 2Ag^+(0.002\text{ M}) \rightarrow Ni^{2+}(0.160\text{ M}) + 2Ag(s)$, given $E_{\text{cell}}^{\circ} = 1.05\text{ V}$. The E_{cell} is: (Take $2.303RT/F = 0.059$)
- (A) 0.71 V
(B) 0.91 V
(C) 1.02 V
(D) 0.59 V
- Q8.** How many coulombs are required for the oxidation of 1 mole of H_2O to O_2 ?
- (A) 96500 C
(B) 1.93×10^5 C
(C) 4.82×10^4 C
(D) 3.86×10^5 C
- Q9.** Which of the following is used as an electrolyte in a Hydrogen-Oxygen fuel cell?
- (A) Aqueous KOH
(B) $LiCl$ in alcohol
(C) Conc. H_2SO_4
(D) MnO_2
- Q10.** The limiting molar conductivities for $NaCl$, KBr and KCl are 126, 152 and $150\text{ S cm}^2\text{mol}^{-1}$ respectively. The Λ_m° for $NaBr$ is:
- (A) $128\text{ S cm}^2\text{mol}^{-1}$
(B) $176\text{ S cm}^2\text{mol}^{-1}$
(C) $278\text{ S cm}^2\text{mol}^{-1}$
(D) $302\text{ S cm}^2\text{mol}^{-1}$



Q11. Lead storage battery is a:

- (A) Primary cell
- (B) Secondary cell
- (C) Fuel cell
- (D) Concentration cell

Q12. For a first-order reaction, if the time taken for 50% completion is 20 minutes, the time required for 99.9% completion of the reaction is:

- (A) 100 min
- (B) 200 min
- (C) 150 min
- (D) 40 min

Q13. The rate of a reaction triples when the temperature changes from 20°C to 50°C . The energy of activation for such a reaction will be:

- (A) 28.8 kJ mol^{-1}
- (B) 34.5 kJ mol^{-1}
- (C) 45.2 kJ mol^{-1}
- (D) 52.3 kJ mol^{-1}

Q14. In a reaction $2A + B \rightarrow A_2B$, the rate $= k[A][B]^2$. If the concentration of A is doubled and B is halved, the rate will:

- (A) Double
- (B) Be halved
- (C) Remain same
- (D) Increase 4 times



- Q15.** The decomposition of phosphine (PH_3) on tungsten at low pressure is a:
- (A) Zero-order reaction
 - (B) First-order reaction
 - (C) Second-order reaction
 - (D) Fractional order reaction
- Q16.** Which of the following plots is linear for a first-order reaction?
- (A) $[A]$ vs t
 - (B) $\log[A]$ vs t
 - (C) $1/[A]$ vs t
 - (D) $\sqrt{[A]}$ vs t
- Q17.** The magnetic moment of a divalent ion in aqueous solution (Atomic number = 25) is:
- (A) 5.92 BM
 - (B) 2.84 BM
 - (C) 4.90 BM
 - (D) 3.87 BM
- Q18.** The reason for Lanthanoid contraction is:
- (A) Negligible screening effect of f -electrons
 - (B) Increasing nuclear charge
 - (C) Decreasing nuclear charge
 - (D) High screening effect of f -electrons



Q19. When $KMnO_4$ is titrated against ferrous ammonium sulfate in acidic medium, the change in oxidation state of Mn is:

- (A) $+7 \rightarrow +2$
- (B) $+6 \rightarrow +2$
- (C) $+7 \rightarrow +4$
- (D) $+5 \rightarrow +2$

Q20. Which of the following ions is colorless in aqueous solution?

- (A) Ti^{3+}
- (B) V^{3+}
- (C) Sc^{3+}
- (D) Cr^{3+}

Q21. The IUPAC name of $[Co(NH_3)_5(CO_3)]Cl$ is:

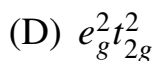
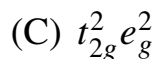
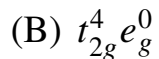
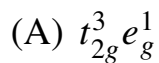
- (A) Pentaamminecarbonatocobalt(III) chloride
- (B) Pentaamminecarbonatocobalt(II) chloride
- (C) Carbonatopentaamminecobaltic chloride
- (D) Pentaamminecobalt(III) carbonate chloride

Q22. The number of geometrical isomers for $[Pt(NH_3)(NH_2OH)(Py)(NH_2)]$ is:

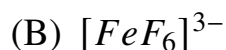
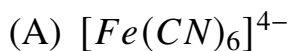
- (A) 2
- (B) 3
- (C) 4
- (D) 6



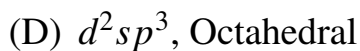
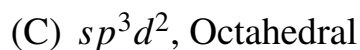
Q23. According to Crystal Field Theory (CFT), for a d^4 ion in an octahedral field, if $\Delta_o < P$, the electronic configuration is:



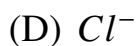
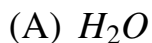
Q24. Which of the following is an inner orbital complex and is diamagnetic?



Q25. The hybridization and shape of $[Ni(CO)_4]$ are:



Q26. Linkage isomerism is shown by ligands like:



Q27. Which of the following will undergo S_N1 reaction most readily?

- (A) $(CH_3)_3C - Cl$
- (B) CH_3CH_2Cl
- (C) $(CH_3)_2CH - Cl$
- (D) CH_3Cl

Q28. The reaction of an alkyl halide with sodium in dry ether to give a hydrocarbon is known as:

- (A) Finkelstein reaction
- (B) Wurtz reaction
- (C) Sandmeyer reaction
- (D) Swarts reaction

Q29. S_N2 reactions proceed with:

- (A) Retention of configuration
- (B) Inversion of configuration
- (C) Racemization
- (D) Partial inversion

Q30. Which of the following is an example of an allylic halide?

- (A) $CH_2 = CH - CH_2Cl$
- (B) $CH_2 = CHCl$
- (C) C_6H_5Cl
- (D) $CH_3 - CH(Cl) - CH_3$



Q31. Lucas reagent is a mixture of:

- (A) Conc. HCl + anhydrous $ZnCl_2$
- (B) Conc. H_2SO_4 + anhydrous $ZnCl_2$
- (C) Conc. HNO_3 + anhydrous $ZnCl_2$
- (D) Conc. HCl + hydrous $ZnCl_2$

Q32. Phenol reacts with $CHCl_3$ and aqueous $NaOH$ to give salicylaldehyde. This reaction is:

- (A) Kolbe's reaction
- (B) Reimer-Tiemann reaction
- (C) Rosenmund reduction
- (D) Friedel-Crafts reaction

Q33. Which is the most acidic among the following?

- (A) *p*-Nitrophenol
- (B) *p*-Cresol
- (C) Phenol
- (D) Ethanol

Q34. In Kolbe's reaction, the electrophile involved is:

- (A) CO_2
- (B) CHO^+
- (C) CCl_2
- (D) SO_3



Q35. Anisole on reaction with HI gives:

- (A) Phenol and methyl iodide
- (B) Iodobenzene and methanol
- (C) Phenol and methanol
- (D) Iodobenzene and methyl iodide

Q36. Which of the following does NOT undergo aldol condensation?

- (A) Acetaldehyde
- (B) Acetone
- (C) Benzaldehyde
- (D) Propanal

Q37. Cannizzaro's reaction is not given by:

- (A) Trimethyl acetaldehyde
- (B) Benzaldehyde
- (C) Formaldehyde
- (D) Acetaldehyde

Q38. The order of reactivity of CH_3CHO , CH_3COCH_3 and $HCHO$ towards nucleophilic addition is:

- (A) $HCHO > CH_3CHO > CH_3COCH_3$
- (B) $CH_3COCH_3 > CH_3CHO > HCHO$
- (C) $CH_3CHO > HCHO > CH_3COCH_3$
- (D) $HCHO > CH_3COCH_3 > CH_3CHO$



Q39. Which acid is the strongest?

- (A) $ClCH_2COOH$
- (B) $Cl_2CHCOOH$
- (C) Cl_3CCOOH
- (D) CH_3COOH

Q40. CH_3CHO and C_6H_5CHO can be distinguished by:

- (A) Tollen's reagent
- (B) Fehling's solution
- (C) Schiff's reagent
- (D) 2, 4-DNP

Q41. Rosenmund reduction is used for the preparation of:

- (A) Alcohols
- (B) Aldehydes
- (C) Ketones
- (D) Acids

Q42. The correct order of basic strength of methyl amines in aqueous solution is:

- (A) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$
- (B) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$
- (C) $(CH_3)_2NH > (CH_3)_3N > CH_3NH_2 > NH_3$
- (D) $NH_3 > CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$



- Q43.** Gabriel Phthalimide synthesis is used for the preparation of:
- (A) Primary aromatic amines
 - (B) Primary aliphatic amines
 - (C) Secondary amines
 - (D) Tertiary amines
- Q44.** Benzene diazonium chloride reacts with phenol in basic medium to give:
- (A) *p*-Hydroxyazobenzene (orange dye)
 - (B) *p*-Aminoazobenzene (yellow dye)
 - (C) Chlorobenzene
 - (D) Benzene
- Q45.** Hinsberg's reagent is:
- (A) Benzene sulfonyl chloride
 - (B) Benzene sulfonic acid
 - (C) Phenyl isocyanide
 - (D) Benzene chloride
- Q46.** Glucose reacts with Br_2 water to give:
- (A) Gluconic acid
 - (B) Saccharic acid
 - (C) *n*-Hexane
 - (D) Sorbitol



- Q47.** Which of the following is a non-reducing sugar?
- (A) Glucose
 - (B) Fructose
 - (C) Maltose
 - (D) Sucrose
- Q48.** Denaturation of protein leads to the loss of its:
- (A) Primary structure
 - (B) Secondary and tertiary structures
 - (C) Peptide bonds
 - (D) Sequence of amino acids
- Q49.** Deficiency of Vitamin K causes:
- (A) Night blindness
 - (B) Beri-beri
 - (C) Increase in blood clotting time
 - (D) Scurvy
- Q50.** The helical structure of proteins is stabilized by:
- (A) Hydrogen bonds
 - (B) Peptide bonds
 - (C) Disulphide bonds
 - (D) Van der Waals forces



Detailed Solutions

Q1.

Solution

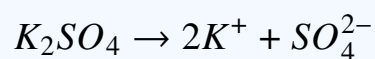
Concept: For electrolytes, Van't Hoff factor is given by:

$$i = 1 + (\nu - 1)\alpha$$

where ν = number of ions formed and α = degree of dissociation.

Solution:

Dissociation of K_2SO_4 :



Total number of ions:

$$\nu = 3$$

Given:

$$\alpha = 80\% = 0.8$$

Now,

$$i = 1 + (3 - 1)\alpha$$

$$i = 1 + 2 \times 0.8$$

$$i = 1 + 1.6 = 2.6$$

$$i = 2.6$$

Answer: (B)



Q2.

Solution**Concept:** Raoult's law:

$$P = x_A P_A^0 + x_B P_B^0$$

Solution:

Initial:

$$x_A = \frac{2}{5}, \quad x_B = \frac{3}{5}$$

$$500 = \frac{2}{5}P_A^0 + \frac{3}{5}P_B^0 \quad (1)$$

After adding 1 mole A:

$$x_A = \frac{3}{6} = \frac{1}{2}, \quad x_B = \frac{1}{2}$$

$$550 = \frac{1}{2}P_A^0 + \frac{1}{2}P_B^0 \Rightarrow P_A^0 + P_B^0 = 1100 \quad (2)$$

Solve:

$$\frac{2}{5}P_A^0 + \frac{3}{5}(1100 - P_A^0) = 500$$

$$2P_A^0 + 3300 - 3P_A^0 = 2500$$

$$P_A^0 = 800 \text{ mm Hg}$$

$$\boxed{800 \text{ mm Hg}}$$

Answer: (C)

Q3.

Solution

Concept: Negative deviation occurs when intermolecular attraction between unlike molecules is stronger.

Solution:

Phenol and aniline form strong H-bonding.

Phenol and Aniline

Answer: (C)

Q4.

Solution**Concept:**

$$\Delta T_b = iK_b m$$

Solution:

$$i = \frac{\Delta T_b}{K_b m} = \frac{0.015}{0.52 \times 0.01} \approx 2.88$$

For $BaCl_2$, $\nu = 3$:

$$i = 1 + 2\alpha$$

$$2.88 = 1 + 2\alpha \Rightarrow \alpha = 0.94 = 94.2\%$$

94.2%

Answer: (B)



Q5.

Solution**Concept:** Shrinkage occurs in hypertonic solution due to exosmosis.**Solution:**

Hypertonic

Answer: (B)

Q6.

Solution**Concept:**

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0}, \quad K_a = \frac{C\alpha^2}{1 - \alpha}$$

Solution:

$$\alpha = \frac{20}{400} = 0.05$$

$$K_a = \frac{0.007 \times (0.05)^2}{1 - 0.05} = \frac{0.007 \times 0.0025}{0.95} \approx 1.8 \times 10^{-5}$$

1.8×10^{-5}

Answer: (D)



Q7.

Solution**Concept:**

$$E = E^\circ - \frac{0.059}{n} \log Q$$

Solution:

$$Q = \frac{[Ni^{2+}]}{[Ag^+]^2} = \frac{0.160}{(0.002)^2} = 40000$$

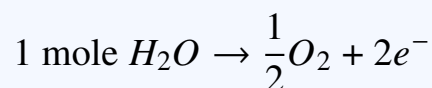
$$E = 1.05 - \frac{0.059}{2} \log(40000)$$

$$= 1.05 - 0.0295 \times 4.6 \approx 0.91 \text{ V}$$

$$\boxed{0.91 \text{ V}}$$

Answer: (B)

Q8.

Solution**Concept:****Solution:**

$$2F = 2 \times 96500 = 1.93 \times 10^5 \text{ C}$$

$$\boxed{1.93 \times 10^5 \text{ C}}$$

Answer: (B)

Q9.

Solution**Concept:** Hydrogen-oxygen fuel cell uses alkaline electrolyte.**Solution:**

Aqueous KOH

Answer: (A)

Q10.

Solution**Concept:** Kohlrausch law:

$$\Lambda_m^0(\text{NaBr}) = \Lambda_m^0(\text{NaCl}) + \Lambda_m^0(\text{KBr}) - \Lambda_m^0(\text{KCl})$$

Solution:

$$= 126 + 152 - 150 = 128$$

128 S cm² mol⁻¹**Answer: (A)**

Q11.

Solution**Concept:** Rechargeable cells are secondary cells.**Solution:**

Secondary cell

Answer: (B)

Q12.

Solution**Concept:** For a first-order reaction:

$$t = \frac{2.303}{k} \log \frac{[A]_0}{[A]}$$

Also,

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

Solution:

Given:

$$t_{1/2} = 20 \text{ min}$$

For 99.9% completion:

$$\frac{[A]}{[A]_0} = 0.001$$

$$t = \frac{2.303}{k} \log \left(\frac{1}{0.001} \right) = \frac{2.303}{k} \times 3 = \frac{6.909}{k}$$

Now,

$$k = \frac{0.693}{20}$$

$$t = \frac{6.909}{0.693/20} = 200 \text{ min}$$

200 min

Answer: (B)



Q13.

Solution**Concept:** Arrhenius equation:

$$\log \left(\frac{k_2}{k_1} \right) = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$$

Solution:

Given:

$$\frac{k_2}{k_1} = 3, \quad T_1 = 293K, \quad T_2 = 323K$$

$$\log 3 = \frac{E_a}{2.303 \times 8.314} \times \frac{30}{293 \times 323}$$

$$E_a \approx 28.8 \text{ kJ mol}^{-1}$$

$$28.8 \text{ kJ mol}^{-1}$$

Answer: (A)

Q14.

Solution**Concept:** Rate law:

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

Solution:

New rate:

$$= k(2[A]) \left(\frac{[B]}{2} \right)^2 = k \cdot 2[A] \cdot \frac{[B]^2}{4} = \frac{1}{2}k[A][B]^2$$

Rate is halved

Answer: (B)

Q15.

Solution

Concept: Surface-catalyzed reactions at low pressure show zero-order kinetics.

Solution:

Zero-order reaction

Answer: (A)

Q16.

Solution

Concept: First-order reaction integrated form:

$$\log[A] = \log[A]_0 - \frac{kt}{2.303}$$

Solution:

$\log[A]$ vs t

Answer: (B)



Q17.

Solution**Concept:** Magnetic moment:

$$\mu = \sqrt{n(n+2)} \text{ BM}$$

Solution:

Atomic number = 25 (Mn)

 $\text{Mn}^{2+}: 3d^5 \rightarrow n = 5$

$$\mu = \sqrt{5(5+2)} = \sqrt{35} \approx 5.92 \text{ BM}$$

5.92 BM

Answer: (A)

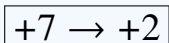
Q18.

Solution**Concept:** Lanthanoid contraction is due to poor shielding of f -electrons.**Solution:**Negligible screening effect of f -electrons

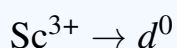
Answer: (A)



Q19.

Solution**Concept:** In acidic medium, $KMnO_4$ reduces from +7 to +2.**Solution:****Answer: (A)**

Q20.

Solution**Concept:** Ions with d^0 or d^{10} configuration are colorless.**Solution:****Answer: (C)**

Q21.

Solution**Concept:** Name ligands first, then metal with oxidation state.**Solution:**Ligand: ammine (NH_3), carbonato (CO_3^{2-})

Co oxidation state:

$$x + 0 + (-2) = +1 \Rightarrow x = +3$$

Pentaamminecarbonatocobalt(III) chloride**Answer: (A)**

Q22.

Solution

Concept: For a square planar complex of the general formula $[Mabcd]$, the number of geometrical isomers is determined by fixing one ligand and rotating the others. There are 3 possible arrangements where a specific ligand is trans to each of the other three.

Solution: The given complex is $[Pt(NH_3)(NH_2OH)(Py)(NH_2)]$. Let: $a = NH_3$, $b = NH_2OH$, $c = Py$, $d = NH_2^-$. In a square planar geometry, we can fix ligand a (NH_3) and place the remaining ligands (b, c, d) in the position trans to it.
 Isomer 1: NH_3 is trans to NH_2OH
 Isomer 2: NH_3 is trans to Py
 Isomer 3: NH_3 is trans to NH_2^-
 Each of these configurations results in a unique spatial arrangement of the ligands. Therefore, there are a total of 3 geometrical isomers.

Answer: (B)

Q23.

Solution

Concept: For $\Delta_o < P$, high spin configuration.

Solution:

d^4 :

**Answer: (A)**

Q24.

Solution

Concept: Inner orbital complexes use d^2sp^3 hybridization and are diamagnetic.

Solution:

$[Fe(CN)_6]^{4-} \rightarrow$ strong field \rightarrow pairing \rightarrow diamagnetic



Answer: (A)

Q25.

Solution

Concept: $Ni(CO)_4$ forms sp^3 hybridization.

Solution:

Shape: tetrahedral



Answer: (A)

Q26.

Solution

Concept: Linkage isomerism occurs with ambidentate ligands, which possess two different donor atoms but coordinate through only one at a time. Examples include SCN^- (coordinates via S or N) and NO_2^- (coordinates via N or O).

Solution: Among the given options, SCN^- is an ambidentate ligand. H_2O , NH_3 , and Cl^- are monodentate ligands with only one type of donor atom.

Answer: (C)



Q27.

Solution

Concept: The reactivity of alkyl halides in S_N1 reactions depends on the stability of the carbocation formed. The order of stability is: $3^\circ > 2^\circ > 1^\circ > \text{methyl}$.

Solution:(A) $(CH_3)_3C - Cl$ forms a 3° carbocation (most stable).(B) CH_3CH_2Cl forms a 1° carbocation.(C) $(CH_3)_2CH - Cl$ forms a 2° carbocation.(D) CH_3Cl forms a methyl carbocation. Therefore, $(CH_3)_3C - Cl$ reacts most readily.

Answer: (A)

Q28.

Solution

Concept: The reaction of alkyl halides with metallic sodium in dry ether to form higher alkanes ($2RX + 2Na \rightarrow R - R + 2NaX$) is a standard named reaction.

Solution: This is the Wurtz reaction. Finkelstein and Swarts are halogen exchange reactions, and Sandmeyer is used for aryl halides from diazonium salts.

Answer: (B)

Q29.

Solution

Concept: In an S_N2 reaction, the nucleophile attacks from the side opposite to the leaving group in a single concerted step.

Solution: This "backside attack" leads to a complete change in the spatial arrangement of substituents around the carbon atom, known as Walden Inversion or Inversion of configuration.

Answer: (B)

Q30.

Solution

Concept: An allylic halide is a compound where the halogen atom is bonded to an sp^3 hybridized carbon atom which is adjacent to a carbon-carbon double bond ($C = C$).

Solution:(A) $CH_2 = CH - CH_2Cl$: The Cl is on a carbon next to a double bond (Allylic).(B) $CH_2 = CHCl$: The Cl is on the double bond carbon (Vinylic).(C) C_6H_5Cl : Chlorobenzene (Aryl).(D) $CH_3 - CH(Cl) - CH_3$: 2-chloropropane (Secondary alkyl).

Answer: (A)

Q31.

Solution

Concept: Lucas reagent is used to distinguish between primary, secondary, and tertiary alcohols based on the speed of turbidity formation. **Solution:** The reagent consists of a mixture of concentrated HCl and anhydrous $ZnCl_2$.

Answer: (A)

Q32.

Solution

Concept: The conversion of phenol to salicylaldehyde using chloroform ($CHCl_3$) and alkali ($NaOH$) involves the formation of a dichlorocarbene intermediate.

Solution: This specific organic transformation is the Reimer-Tiemann reaction.

Answer: (B)

Q33.

Solution

Concept: Acidity depends on the stability of the conjugate base (phenoxide ion). Electron-withdrawing groups (EWG) like $-NO_2$ increase acidity, while electron-donating groups (EDG) like $-CH_3$ decrease it. **Solution:**(A) p-Nitrophenol: Contains $-NO_2$ (Strong EWG), most acidic.(B) p-Cresol: Contains $-CH_3$ (EDG), less acidic than phenol.(C) Phenol: Baseline acidity.(D) Ethanol: Alcohols are much less acidic than phenols.

Answer: (A)

Q34.

Solution

Concept: Kolbe's reaction involves the treatment of sodium phenoxide with a weak electrophile to form salicylic acid.

Solution: In this reaction, the phenoxide ion undergoes electrophilic substitution. The electrophile is Carbon dioxide (CO_2), which is a weak electrophile but reacts with the highly reactive phenoxide ring.

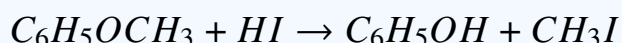
Answer: (A)

Q35.

Solution

Concept: The reaction of an ether with HI depends on the stability of the intermediates. With aryl-alkyl ethers, the bond between Oxygen and the aromatic ring is stronger due to partial double bond character.

Solution: In Anisole ($C_6H_5OCH_3$), the $O - CH_3$ bond is broken. The I^- attacks the smaller methyl group (S_N2 mechanism), while the proton attaches to the phenoxide oxygen.



The products are Phenol and methyl iodide.

Answer: (A)

Q36.

Solution

Concept: Aldol condensation requires the presence of at least one α -hydrogen atom in the aldehyde or ketone.

Solution: Acetaldehyde (CH_3CHO): Has 3 α -hydrogens. Acetone (CH_3COCH_3): Has 6 α -hydrogens. Propanal (CH_3CH_2CHO): Has 2 α -hydrogens. Benzaldehyde (C_6H_5CHO): The $-CHO$ group is attached to a benzene ring carbon that has no hydrogens. Thus, it does not undergo aldol condensation.

Answer: (C)



Q37.

Solution

Concept: Cannizzaro's reaction is given by aldehydes that do not have any α -hydrogen atoms.

Solution: Formaldehyde, Benzaldehyde, and Trimethyl acetaldehyde lack α -hydrogens and give this reaction. Acetaldehyde (CH_3CHO) has α -hydrogens and undergoes Aldol condensation instead.

Answer: (D)

Q38.

Solution

Concept: Reactivity towards nucleophilic addition depends on steric hindrance and the electronic effect (inductive effect) of alkyl groups. Alkyl groups decrease reactivity.

Solution: $HCHO$ (Formaldehyde): No alkyl groups, least hindered, most reactive. CH_3CHO (Acetaldehyde): One methyl group. CH_3COCH_3 (Acetone): Two methyl groups, most hindered, least reactive. Order: $HCHO > CH_3CHO > CH_3COCH_3$.

Answer: (A)

Q39.

Solution

Concept: The acidity of carboxylic acids increases with the presence of electron-withdrawing groups (like Chlorine) due to the $-I$ effect.

Solution: The more Chlorine atoms attached to the α -carbon, the stronger the acid. Cl_3CCOOH (Trichloroacetic acid) has three Cl atoms, making it the strongest.

Answer: (C)

Q40.

Solution

Concept: While both are aldehydes, Fehling's solution can distinguish between aliphatic and aromatic aldehydes.

Solution: CH_3CHO (Aliphatic) reduces Fehling's solution to give a red precipitate, whereas C_6H_5CHO (Aromatic) does not react with Fehling's solution.

Answer: (B)

Q41.

Solution

Concept: Rosenmund reduction involves the hydrogenation of an acyl chloride over a catalyst ($Pd/BaSO_4$) poisoned with sulfur or quinoline.

Solution: This reaction specifically reduces acid chlorides to Aldehydes.

Answer: (B)

Q42.

Solution

Concept: In aqueous solution, basic strength of methyl-substituted amines is governed by the inductive effect, solvation effect, and steric hindrance.

Solution: For methyl amines, the experimental order is: Secondary > Primary > Tertiary > Ammonia ($(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$).

Answer: (A)

Q43.

Solution

Concept: Gabriel Phthalimide synthesis is a method used to produce pure amines without contamination of secondary or tertiary amines.

Solution: Due to the steric hindrance and the nature of the nucleophilic substitution (S_N2), it is used to prepare Primary aliphatic amines. It cannot be used for aromatic amines because aryl halides do not undergo S_N2 readily.

Answer: (B)

Q44.

Solution

Concept: This is a coupling reaction where diazonium salts react with phenols in mildly basic conditions (pH 9–10).

Solution: The product is p-Hydroxyazobenzene, which is an orange dye.

Answer: (A)

Q45.

Solution

Concept: Hinsberg's reagent is used to distinguish between 1° , 2° , and 3° amines. **Solution:** The chemical name for Hinsberg's reagent is Benzene sulfonyl chloride ($C_6H_5SO_2Cl$).

Answer: (A)

Q46.

Solution

Concept: Bromine water is a mild oxidizing agent that specifically oxidizes the aldehyde group of glucose.

Solution: Glucose ($C_6H_{12}O_6$) is oxidized to Gluconic acid. (Stronger agents like HNO_3 would yield Saccharic acid).

Answer: (A)

Q47.

Solution

Concept: A non-reducing sugar is one that does not have a free aldehyde or ketone group (as they are involved in the glycosidic bond).

Solution: Sucrose is a non-reducing sugar because the reducing groups of glucose and fructose are involved in the glycosidic linkage.

Answer: (D)

Q48.

Solution

Concept: Denaturation involves the disruption of the higher-order folding of a protein due to heat, pH change, or chemicals.

Solution: Denaturation destroys the Secondary and tertiary structures (and quaternary if present), but the Primary structure (sequence of amino acids) remains intact as peptide bonds are not broken.

Answer: (B)

Q49.

Solution

Concept: Different vitamins have specific physiological roles; Vitamin K is essential for the synthesis of proteins needed for blood coagulation.

Solution: Deficiency of Vitamin K leads to an increase in blood clotting time (excessive bleeding).

Answer: (C)

Q50.

Solution

Concept: The α -helix is a common motif in the secondary structure of proteins.

Solution: The helical structure is stabilized by Hydrogen bonds between the $-NH$ group of one amino acid residue and the $>C=O$ group of an adjacent turn of the helix.

Answer: (A)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	C	4	B	5	B
6	D	7	B	8	B	9	A	10	A
11	B	12	B	13	A	14	B	15	A
16	B	17	A	18	A	19	A	20	C
21	A	22	B	23	A	24	A	25	A
26	C	27	A	28	B	29	B	30	A
31	A	32	B	33	A	34	A	35	A
36	C	37	D	38	A	39	C	40	B
1	B	42	A	43	B	44	A	45	A
46	A	47	D	48	B	49	C	50	A

