CUET PRATICE PAPER

02

Q1. In an alloy composed of copper, silver, and gold, where copper forms a ccp lattice, silver atoms occupy the edge centers, and gold is located at the body center. What is the chemical formula of this alloy?

a) Cu_4Ag_2Au b) Cu_4Ag_4Au c) Cu_4Ag_3Au d) CuAgAu

Q2. Copper has a face-centered cubic (fcc) crystal structure with a unit cell length of 361 pm. What is the radius of a copper atom?

a) 157 pm b) 181 pm c) 127 pm d) 108 pm

Q3. Why do alkali halides not exhibit Frenkel defects?

a) Cations and anions have almost equal size.

b) There is a large difference in size between cations and anions.

c) Cations and anions have a low coordination number.

d) Anions cannot be accommodated in voids.

Q4. A solution containing urea (molecular mass: 56 g mol-1) boils at 100.18°C under atmospheric pressure. Given that the cryoscopic constant (Kf) and ebullioscopic constant (Kb) for water are 1.86 and 0.512 K kg mol-1, respectively, at what temperature will the solution freeze?

a) -0.654°C b) 0.654°C c) -6.54°C d) 6.54°C

Q5. Why does the solubility of a gas in a liquid decrease with an increase in temperature?

a) Dissolution of a gas in a liquid is an endothermic process.

b) Dissolution of a gas in a liquid is an exothermic process.

c) Gases are highly compressible.

d) All of the above.

Q6. **Assertion:** The process of solubility of any gas in any liquid is exothermic.

Reason: All gases are highly soluble in any liquid.\

(a) Both the assertion and reason are correct, and the reason is the correct explanation of the assertion.

(b) Both the assertion and reason are correct, but the reason is not the correct explanation of the assertion.

(c) The assertion is correct, but the reason is incorrect.

(d) Both the assertion and reason are incorrect.

Q7. Considering the standard electrode potentials of the following half-cells, arrange the metals in ascending order of reducing power:

(a) Ag < Cr < Mg < K

(b) Cr < Ag < Mg < K

(c) Mg < K < Cr < Ag

(d) K < Mg < Cr < Ag

Q8. Determine the quantity of charge needed to convert 1 mole of MnO^{4-} to Mn^{2+}.

(a) $1.8 \times 10^5 C$ (b) $3.2 \times 10^6 C$ (c) $4.1 \times 10^4 C$ (d) $4.8 \times 10^5 C$

Q9. What is the pressure of H2 required to neutralize the potential of an H2-electrode in pure water at 298 K?

(a) 10-14 atm (b) 10-12 atm (c) 10-10 atm (d) 10-4 atm

Q10. Which type of reaction maintains the same unit of rate and rate constant?

(a) second order reaction

(b) third order reaction

(c) first order reaction

(d) zero order reaction

Q11. If the volume of the vessel containing the reaction $2NO + O_2 \rightarrow 2NO_2$ is reduced to one-third of its original volume, how many times will the reaction rate increase?

(a) 3 times (b) 6 times (c) 27 times (d) 30 times

Q12. When alkaline $KMnO_4$ is exposed to KI, what does the iodide ion get oxidized to?

(a) IO^{3-} (b) I_2 (c) IO^- (d) IO^{4-}

Q13. Find the spin-only magnetic moment value for Cr^{3+} ion.

(a) 3.57 B.M (b) 3.47 B.M (c) 2.87 B.M (d) 3.87 B.M

Q14. Sort the following compounds based on their increasing magnetic moments:

$[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$, $[Ni(H_2O)_4]^{2+}$.

(a) (i) < (iii) < (ii) < (iv) (b) (i) < (ii) < (iv) < (iii)

(c) (ii) < (i) < (iv) < (iii) (d) (iii) < (ii) < (i) < (iv)

Q15. Zone refining relies on the concept that:

(a) impurities are more soluble in molten metal than in solid metal.

(b) vapors of volatile compounds can be decomposed into pure metal.

(c) different components of a mixture are adsorbed differently on an adsorbent.

(d) impurities of low-boiling metals can be separated by distillation.

Q16. Which of the following statements is accurate?

(a) Nickel is purified through zone refining.

(b) Cast iron is obtained by remelting pig iron with scrap and coke using hot air blast.

(c) In the extraction of silver, silver is extracted as a cationic complex.

(d) Zr and Ti are purified using the van Arkel method.

Q17. Why is the use of aspartame limited to cold foods and drinks?

(a) It reacts with the food at cooking temperature.

(b) It is unstable to heat and decomposes at cooking temperature.

(c) It is 500 times sweeter than cane sugar.

(d) It becomes bitter at cooking temperature.

Q18. Match the substances in Column I with their correct uses in Column II.

Column I	Column II
Sodium perborate	Antiseptic
Chlorine	Soap
Bithional	Disinfectant
Potassium stearate	Milk bleaching agent

(a) A - (ii), B - (iii), C - (iv), D - (i)

(b) A - (i), B - (iii), C - (iv), D - (ii)

(c) A - (iv), B - (i), C - (ii), D - (iii)

(d) A - (iii), B - (iv), C - (i), D - (ii)

Q19. Connect the substances in Column I with their corresponding uses in Column II.

Column I	Column II
$CH_3(CH_2)_{10}CH_2OSO^{3-}Na^+$	Cationic detergents
$[CH_3(CH_2)_{15}N(CH_3)^{2-}CH_3]\ ^+Br^-$	Non-ionic detergent
$CH_3(CH_2)_{16}COO(CH_2CH_2O)\ nCH_2CH_2OH$	Soap
$C_{17}H_{35}COONa$	Anionic detergent

(a) A - (iii), B - (ii), C - (iv), D - (i)

(b) A - (ii), B - (iv), C - (i), D - (iii)

(c) A - (i), B - (iii), C - (iv), D - (ii)

(d) A - (iv), B - (i), C - (ii), D - (iii)

Q20. Among the options, which one is NOT a condensation polymer?

(a) Nylon-6, 6 (b) Nylon-6 (c) Dacron (d) Buna-S

Q21. Identify the synthetic polymer that closely resembles natural rubber.

(a) Neoprene (b) Chloroprene (c) Glyptal (d) Nylon

Q22. Which of the following sets exclusively consists of addition homopolymers?

(a) Polythene, natural rubber, cellulose

(b) Nylon, polyester, melamine resin

(c) Teflon, Bakelite, orlon

(d) Neoprene, PVC, polythene

Q23. The secondary structure of proteins is represented by:

(a) Alpha-helix structure

(b) Beta-pleated structure

(c) Both (a) and (b)

(d) None of the above

Q24. Uridine, present in RNA, is a:

(a) Nucleotide (b) Pyrimidine (c) Purine (d) Nucleoside

Q25. How many molecules of phenyl hydrazine react with glucose to produce glucosazone?

(a) 3 (b) 4 (c) 2 (d) 1

Q26. Which of the following is the correct formulation of the entity according to IUPAC?

(a) $[Co\ (CN)_6]^{3-}$ (b) $[Co\ (CN)_4]^{3-}$ (c) $[Co\ (CN)]^{3-}$ (d) $[Co\ (CN)_6]$

Q27. What is the appropriate naming for K3[Fe (CN)6]?

(a) Tripotassium hexacyanidoferrate(III)

(b) Potassium hexacyanoferrate(III)

(c) Tripotassium hexacyanoferrate(III)

(d) Potassium hexacyanidoferrate(III)

Q28. Pick out the correct statement with respect to [Mn (CN)63-]

(a) It is sp^2d^2 hybridized, tetrahedral

(b) It is d^2sp^3 hybridized, octahedral

(c) It is dsp^2 hybridized, square planar

(d) It is sp^3d^2 hybridized, octahedral

Q29. Secondary amines could be prepared by:

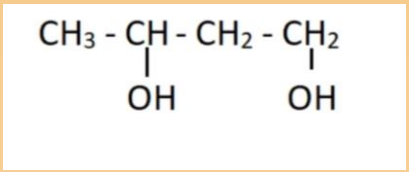
(a) Reduction of nitriles

(b) Hofmann bromamide reduction

(c) Reduction of amides

(d) Reduction of isonitriles

Q30. Identify the correct IUPAC name for the given compound.



(a) Butane-1,4-diol

(b) Butane-diol

(c) Butylene glycol

(d) Butane-1,3-diol

Q31. Hydrocarbons are formed when aldehydes and ketones react with KOH and ethylene glycol. This reaction is known as:

(a) Wolff-Kishner reduction.

(b) Clemmensen reduction

(c) Rosamund reduction

(d) Cannizzaro reaction

Q32. Which of the following will not give an aldol condensation?

(a) Phenyl acetaldehyde

(b) 2-Methylpentanal

(c) Benzaldehyde

(d) 1-Phenylpropanone

Q33. Arrange the following in the correct order of increasing acidic strength:

(a) Phenol < Ethanol < Chloroacetic acid < Acetic acid

(b) Ethanol < Phenol < Chloroacetic acid < Acetic acid

(c) Ethanol < Phenol < Acetic acid < Chloroacetic acid

(d) Chloroacetic acid < Acetic acid < Phenol < Ethanol

Q34. Aldehydes other than formaldehyde react with Grignard's reagent to give addition products which, upon hydrolysis, yield:

(a) Tertiary alcohols

(b) Secondary alcohols

(c) Primary alcohols

(d) Carboxylic acids

Q35. Which one is most reactive towards SN1 reaction?

(a) $C_6H_5CH(C_6H_5)Br$ (b) $C_6H_5CH(CH_3)Br$

(c) $C_6H_5C(CH_3)(C_6H_5)Br$ (d) $C_6H_5CH_2Br$

Q36. Which of the following is an example of nucleophilic substitution reaction?

(a) RX + KOH → ROH + KX (b) 2RX + 2Na → R-R + 2NaX

(c) RX + H2 → R-H + HX (d) RX + Mg → RMgX

Q37. The compound that responds to Tollen's test is:

(a) CH_3COCH_3 (b) CH_3CHO (c) CH_3COOH (d) $C_2H_5OC_2H_5$

Q38. When treated with alkali and iodine, which substance will not give the iodoform test?

(a) Acetone (b) Ethanol (c) Diethyl ketone (d) Isopropyl alcohol

Q39. Toluene reacts with a halogen in the presence of iron (III) chloride, giving ortho and para halo compounds. The reaction is:

(a) Electrophilic elimination reaction (b) Electrophilic substitution reaction

(c) Free radical addition reaction (d) Nucleophilic substitution reaction

Q40. What is the test to differentiate between pentan-2-one and pentan-3-one?

(a)Iodoform test (b)Benedict's test (c)Fehling's test (d)Aldol condensation

Read the passage given below and answer the following questions: (46-50)

Adsorption relies on the nature of the adsorbent. A rough solid surface possesses more pores and can adsorb a greater quantity of gases compared to a smooth surface. Commonly used adsorbents include silica gel and activated charcoal. The level of adsorption is also contingent on the surface area of the solid. The specific surface area of an adsorbent indicates the available surface for adsorption per gram of the adsorbent. A larger solid surface area equates to greater adsorption potential. Charcoal proves to be a more potent adsorbent than solid wood. Desorption, on the other hand, is the process of removing an adsorbed substance from a surface where it was absorbed.

Physisorption is a non-specific process; it can accommodate any gas. However, easily liquefiable gases like NH_3, HCl, and CO_2 are adsorbed at a faster rate and to a larger extent than less easily liquefiable gases such as H_2, O_2, and N_2. This phenomenon depends on the critical temperature of the gas. The higher the critical temperature, the more readily the gas can be liquefied, leading to a higher rate of adsorption. In contrast, chemisorption is specific in nature. Therefore, only gases capable of forming chemical bonds with the adsorbent can undergo chemisorption.

Q46. Choose the correct statement regarding desorption.

(a) It is done by cooling or by increasing the applied pressure.

(b) It is done by heating or by reducing the applied pressure.

(c) It is done by heating or by increasing the applied pressure.

(d) It is done by cooling or by increasing the applied pressure.

Q47. Which statement regarding the physical adsorption of a gas on the surface of a solid is incorrect?

(a) With increasing temperature, adsorption continuously increases.

(b) Enthalpy changes are negative.

(c) It is non-specific in nature.

(d) It is reversible in nature.

Q48. At the same temperature and pressure, select the correct order of adsorption of the following gases on the same mass of charcoal.

(a) $SO_2 > CH_4 > H_2$

(b) $CH_4 > SO_2 > H_2$

(c) $H_2 > CH_4 > SO_2$

(d) $CH_4 > H_2 > SO_2$

Q49. When the adsorption of a gas on a solid metal surface is spontaneous and exothermic, what happens?

(a) ΔS increases. (b) ΔS decreases. (c) ΔG increases. (d) ΔH decreases.

Q50. Identify the incorrect statement from the following.

(a) Physical adsorption occurs at low temperatures, while chemisorption occurs at all temperatures.

(b) Physisorption has a low heat of adsorption, while chemisorption has a high one.

(c) Chemisorption is irreversible, and physisorption is reversible.

(d) The magnitude of chemisorption decreases with an increase in temperature, while physisorption increases with an increase in temperature.

HINTS AND SOLUTIONS

Q1. Answer: c) Cu_4Ag_3Au

Explanation: In the given alloy, copper (Cu) forms a face-centred cubic (fcc) lattice, which implies that there are 4 copper atoms at the corners and 1 at the centre of each face of the cube. Silver (Ag) atoms occupy the edge centres, contributing 1/4 of an Ag atom per unit cell. Gold (Au) is located at the body centre, which contributes 1 whole Au atom per unit cell. Therefore, the chemical formula of the alloy is Cu4Ag3Au.

Q2. Answer: b) 181 pm

Explanation: In a face-centred cubic (fcc) lattice, the relationship between the unit cell length (a) and the radius of the atom (r) is given by $a = 2\sqrt{2}r$. Given that a = 361 pm, we can solve for r:

361 pm = $2\sqrt{2}$r

r = $\frac{361\,pm}{2\sqrt{2}}$

r ≈ 181 pm

Q3. Answer: a) Cations and anions have almost equal size.

Explanation: Frenkel defects occur when a cation is displaced from its normal lattice site to an interstitial site. This typically happens in compounds where the cation and anion have a significant difference in size. Since alkali halides have cations (e.g., Na+) and anions (e.g., Cl-) with almost equal size, they do not exhibit Frenkel defects.

Q4. Answer: a) -0.654°C

Explanation: The freezing point depression (ΔTf) is given by the formula ΔTf = Kf × m, where Kf is the cryoscopic constant and m is the molality of the solution. Since the solution is urea in water, it will dissociate into two particles (urea and water). Thus, the molality (m) is 1 mol/kg.

ΔTf = (1.86 K kg mol-1) × (1 mol/kg) = 1.86 K

The freezing point of pure water is 0°C, so the solution will freeze at:

Freezing point = 0°C - ΔTf = 0°C - 1.86 K ≈ -1.86°C ≈ -0.654°C

Q5. Answer: b) Dissolution of a gas in a liquid is an exothermic process.

Explanation: When a gas dissolves in a liquid, it releases energy, making the process exothermic. This is why solubility of gases generally decreases with an increase in temperature.

Q6. Answer: c) The assertion is correct, but the reason is incorrect.

Explanation: The assertion is correct in stating that the solubility of any gas in any liquid is an exothermic process. However, the reason provided, stating that all gases are highly soluble in any liquid, is incorrect. Solubility varies depending on the specific gas and liquid involved.

Q7. Answer: b) Ag < Cr < Mg < K

Explanation: The reducing power of metals is related to their standard electrode potentials. Lower standard electrode potential values indicate a higher reducing power. The order from lowest to highest reducing power is: Ag < Cr < Mg < K.

Q8. Answer: a) $1.8 \times 10^5 C$

Explanation: The quantity of charge (Q) required for a redox reaction can be calculated using Faraday's laws of electrolysis. Given that 1 mol of MnO^{4-} is reduced to Mn^{2+}, the charge required can be calculated using the equation Q = nF, where n is the number of moles and F is Faraday's constant.

n = 1 mol

F = 96485 C/mol

Q = (1 mol) × (96485 C/mol) ≈ $1.8 \times 10^5 C$

Q9. Answer: d) 10^{-4} atm

Explanation: To make the potential of an H^{2-}electrode zero in pure water at 298 K, the pressure of H_2 required is approximately 10^{-4} atm.

Q10. Answer: a) zero order reaction

Explanation: In a zero-order reaction, both the rate and the rate constant have the same unit. This means that the reaction rate is independent of the concentration of the reactants.

Q11. Answer: c) 27 times

Explanation: When the volume is reduced to $\frac{1}{3}$ of its original volume, the concentration of the reactants increases by a factor of 3. According to the rate equation, the rate is directly proportional to the concentration. Therefore, the rate of the reaction will increase by $3^3 = 27$ times.

Q12. Answer: c) IO^{3-}

Explanation: When alkaline KMnO4 is treated with KI, iodide ions (I^-) get oxidized to iodate ions (IO^{3-}).

Q13. Answer: b) 3.47 B.M

Explanation: The spin-only magnetic moment of Cr^{3+} ion is approximately 3.47 Bohr Magneton (B.M).

Q14. Answer: b) (i) < (ii) < (iv) < (iii)

Explanation: The increasing order of magnetic moments is:

$[Fe(CN)_6]^{4-} < [Fe(CN)_6]^{3-} < [Ni(H_2O)_4]^{2+} < [Cr(NH_3)_6]^{3+}$.

Q15. Answer: a) impurities are more soluble in molten metal than in solid metal.

Explanation: Zone refining is based on the principle that impurities are more soluble in the molten state of a metal than in its solid state. This allows for the purification of the metal.

Q16. Answer: d) Zr, Ti are purified by the van Arkel method

Explanation: Zirconium (Zr) and Titanium (Ti) are purified by the van Arkel method, which involves the formation and decomposition of metal iodides.

Q17. Answer: a) It is unstable to heat and decomposes at cooking temperature.

Explanation: Aspartame is unstable to heat and decomposes at cooking temperature. This limits its use to cold foods and drinks.

Q18. Answer: (b) A - (i), B - (iii), C - (iv), D - (ii)

Explanation: The correct matching is:

A - Sodium perborate (Milk bleaching agent)

B - Chlorine (Disinfectant)

C - Bithional (Antiseptic)

D - Potassium stearate (Soap)

Q19. Answer: (A) - (iii), (B) - (ii), (C) - (iv), (D) - (i)

Explanation: The correct matching is:

A - $CH_3(CH_2)_{10}CH_2OSO^{3-}Na^+$ (Cationic detergents)

B - $[CH_3(CH_2)_{15}N(CH_3)^{2-}CH_3]^+Br^-$ (Non-ionic detergent)

C - $CH_3(CH_2)_{16}COO(CH_2CH_2O)\ nCH_2CH_2OH$ (Soap)

D - $C_{17}H_{35}COONa$ (Anionic detergent)

Q20. Answer: d) Buna-S

Explanation: Buna-S is not a condensation polymer. It is a copolymer of butadiene and styrene, which is formed through addition polymerization.

Q21. Answer: a) Neoprene

Explanation: Neoprene is a synthetic polymer that closely resembles natural rubber. It is a type of synthetic rubber.

Q22. Answer: d) Neoprene, PVC, polythene

Explanation: Among the options, the set that exclusively consists of addition homopolymers is Neoprene, PVC, polythene. These are all formed through addition polymerization.

Q23. Answer: c) Both (a) and (b)

Explanation: The secondary structure of proteins is represented by both alpha-helix and beta-pleated structures.

Q24. Answer: d) Nucleoside

Explanation: Uridine, present in RNA, is a nucleoside. It consists of a uracil base linked to a ribose sugar.

Q25. Answer: a) 3

Explanation: Three molecules of phenyl hydrazine react with glucose to produce glucosazone.

Q26. Answer: (b) $[Co\ (CN)_6]^{3-}$

Explanation: The correct formulation of the entity according to IUPAC is $[Co\ (CN)_6]^{3-}$, where the charge is correctly placed as a superscript after the square brackets, and the coordination sphere is enclosed within parentheses.

Q27. Answer: (a) Tri potassium hexacyanoferrate (III)

Explanation: The appropriate naming for $K_3[Fe\ (CN)_6]$ is "Tri potassium hexacyanoferrate (III)" since it contains three potassium ions and is in the ferric (Fe^{3+}) state.

Q28. Answer: (b) It is d^2sp3 hybridized, octahedral

Explanation: $[Mn\ (CN)_6]^{3-}$ has an octahedral geometry, and it is d^2sp^3 hybridized. The coordination number is 6, and the central Mn ion forms six sigma bonds with cyanide ligands.

Q29. Answer: (c) Reduction of amides

Explanation: Secondary amines can be prepared by the reduction of amides, which involves the conversion of the carbonyl group in amides to an amino group.

Q30. Answer: (a) Butane-1,4-diol

Explanation: The correct IUPAC name for the given compound is "Butane-1,4-diol" because it is a four-carbon chain with hydroxyl groups at positions 1 and 4.

Q31. Answer: (b) Clemmensen reduction

Explanation: Hydrocarbons are formed when aldehydes and ketones react with KOH and ethylene glycol, and this reaction is known as the Clemmensen reduction.

Q32. Answer: (a) Phenyl acetaldehyde

Explanation: Phenyl acetaldehyde will not give an aldol condensation reaction. Aldol condensation typically occurs between aldehydes or ketones with alpha-hydrogens. Phenyl acetaldehyde lacks alpha-hydrogens.

Q33. Answer: (d) Chloroacetic acid < Acetic acid < Phenol < Ethanol

Explanation: The correct order of increasing acidic strength is Chloroacetic acid < Acetic acid < Phenol < Ethanol.

Q34. Answer: (b) Secondary alcohols

Explanation: Aldehydes other than formaldehyde react with Grignard's reagent to give addition products that, upon hydrolysis, yield secondary alcohols.

Q35. Answer: (c) $C_6H_5C(CH_3)(C_6H_5)Br$

Explanation: The compound $C_6H_5C(CH_3)(C_6H_5)Br$ has a benzylic carbon, which is highly reactive toward SN1 reactions.

Q36. Answer: (a) $RX + KOH \rightarrow ROH + KX$

Explanation: The reaction $RX + KOH \rightarrow ROH + KX$ represents a nucleophilic substitution reaction (SN1 or SN2).

Q37. Answer: (b) CH_3CHO

Explanation: Tollen's test is used to detect the presence of aldehydes. CH3CHO (acetaldehyde) responds to Tollen's test.

Q38. Answer: (b) Ethanol

Explanation: Ethanol will not give the iodoform test. The iodoform test is typically positive for methyl ketones and aldehydes but not for primary alcohols like ethanol.

Q39. Answer: (b) Electrophilic substitution reaction

Explanation: Toluene reacts with a halogen in the presence of iron(III) chloride to give ortho and para halo compounds, which is an example of electrophilic substitution reaction.

Q40. Answer: (a) Iodoform test

Explanation: The test to differentiate between pentan-2-one and pentan-3-one is the iodoform test, which gives a positive result for pentan-3-one but not for pentan-2-one.

Q46. Answer: (b) It is done by heating or by reducing the applied pressure.

Explanation: Desorption is typically done by heating the adsorbent or by reducing the applied pressure. This allows the adsorbed substance to be released from the surface.

Q47. Answer: (a) With increasing temperature, adsorption continuously increases.

Explanation: The statement that "with increasing temperature, adsorption continuously increases" is incorrect. In physical adsorption, adsorption decreases with increasing temperature. The correct statement is that adsorption isotherms show a decrease in adsorption with increasing temperature.

Q48. Answer: (a) $SO_2 > CH_4 > H_2$

Explanation: The correct order of adsorption on the same mass of charcoal at the same temperature and pressure is $SO_2 > CH_4 > H_2$. This order is based on the ease of liquefaction and subsequent adsorption.

Q49. Answer: (b) ΔS decreases.

Explanation: When the adsorption of a gas on a solid metal surface is spontaneous and exothermic, the entropy change (ΔS) decreases. This is because adsorption reduces the randomness of the gas molecules on the solid surface.

Q50. Answer: (a) Physical adsorption occurs at low temperatures, while chemisorption occurs at all temperatures.

Explanation: The statement that "physical adsorption occurs at low temperatures, while chemisorption occurs at all temperatures" is incorrect. Physical adsorption can occur at various temperatures, while chemisorption typically occurs at higher temperatures due to the formation of chemical bonds.