CHEMISTRY

Specimen Question Paper

Maximum Marks: 70

Time allowed: One and a half hours

*(Candidates are allowed additional **15 minutes** for **only** reading the paper.)*

ALL QUESTIONS ARE COMPULSORY.

The marks intended for questions are given in brackets [].

Select the correct option for each of the following questions.

Question 1. **[1]**

Na and Mg crystallise in bcc and fcc structures respectively. The value of Z (number of atoms) for their crystals is:

(a) 8 and 14 (b) 2 and 4

(c) 14 and 8 (d) 6 and 4

Question 2. **[1]**

Colligative properties depend on:

(a) The nature of solute particles in solution (b) The number of solute particles in solution

(c) The nature of solute and solvent particles (d) The physical properties of solute particles in solution

Question 3. **[1]**

On dilution, the specific conductance of a solution:

(a) Remains unchanged (b) Increases

(c) Decreases (d) First increases then decreases

Question 4. **[1]**

The flux used in the extraction of iron from haematite ore is:

(a) Limestone (b) Silica

(c) Coke (d) Calcium phosphate

Question 5. **[1]**

Which of the following xenon fluoride of xenon cannot be formed?

(a) XeF_2 (b) XeF_4

(c) XeF_6 (d) XeF_3

Question 6. **[1]**

The gas obtained on heating iodoform with silver powder is:

(a) Propane (b) Ethane

(c) Ethyne (d) Ethene

Question 7. **[1]**

Boiling point of ethyl alcohol is greater than diethyl ether due to:

(a) Vander Waals forces (b) London forces

(c) Polarity (d) Hydrogen bonding

Question 8. **[1]**

In a face centred cubic lattice, atom 'A' occupies the corner positions and atom 'B' occupies the face centred positions. If one atom of 'B' is missing from one of the face centred points, the formula of the compound will be:

(a) AB_2 (b) A_2B_3

(c) A_2B_5 (d) A_2B

Question 9. **[1]**

The standard reduction potential values of three metallic cations X, Y and Z are 0.52 V, – 3.03 V and –1.18 V respectively. The order of reducing power of the corresponding metals is:

(a) Y > Z > X (b) X > Y > Z

(c) Z > Y > X (d) Z > X > Y

Question 10. **[1]**

If molality of the dilute solution of a non-volatile, non-dissociating and non-associating electrolyte is doubled, the value of molal elevation constant or Ebullioscopic constant (K_b) will be:

(a) Doubled (b) Halved

(c) Tripled (d) Unchanged

Question 11. **[1]**

Extraction of zinc from zinc blende is achieved by :

(a) Electrolytic reduction

(b) Roasting, followed by reduction with carbon

(c) Roasting, followed by reduction with another metal

(d) Roasting, followed by self-reduction

Question 12. **[1]**

The most powerful oxidizing agent is:

(a) Fluorine (b) Chlorine

(c) Bromine (d) Iodine

Question 13. **[1]**

During the course of S_N1 reaction, the intermediate species formed is:

(a) A free radical (b) A carbanion

(c) A carbocation (d) An intermediate complex

Question 14. **[1]**

Which type of defect has the presence of cations in the interstitial sites?

(a) Schottky defect (b) Vacancy defect

(c) Frenkel defect (d) Metal deficiency defect

Question 15. **[1]**

Reaction between acetone and methyl magnesium chloride, followed by hydrolysis will give:

(a) tert-butyl alcohol (b) iso-butyl alcohol

(c) iso-propyl alcohol (d) sec-butyl alcohol

Question 16. **[1]**

If 5.85 g of NaCl are dissolved in 90 g of water, the mole fraction of solute is:

(a) 0.2632 (b) 0.0102

(c) 0.0196 (d) 0.1045

Question 17. **[1]**

When zinc granule is dipped into copper sulphate solution, copper is precipitated because:

(a) Both copper and zinc have a positive reduction potential.

(b) Both copper and zinc have a negative reduction potential.

(c) Reduction potential of zinc is higher than that of copper.

(d) Reduction potential of copper is higher than that of zinc.

Question 18. **[1]**

The optically active compound is:

(a) Butan-1-ol (b) Butan-2-ol

(c) Propan-1-ol (d) 2-methyl-propan-1-ol

Question 19. **[1]**

Chlorine reacts with cold and dilute NaOH under ordinary conditions to give:

(a) NaCl and Cl_2O (b) NaCl and ClO_2

(c) NaCl and NaClO (d) NaCl and $NaClO_3$

Question 20. **[1]**

Solutions which distil without any change in composition and temperature are called:

(a) Ideal (b) Super saturated

(c) Azeotropic (d) Isotonic

Question 21. **[1]**

The reaction: Sodium alkoxide + alkyl halide → Ether + Sodium halide is called:

(a) Wurtz reaction (b) Kolbe's reaction

(c) Perkin's reaction (d) Williamson's synthesis

Question 22. **[1]**

Benzene diazonium chloride on hydrolysis gives:

(a) Benzene (b) Phenol

(c) Chlorobenzene (d) Benzyl alcohol

Question 23. **[1]**

The vacant space in body centred cubic lattice unit cell is:

(a) 32% (b) 26%

(c) 48% (d) 68%

Question 24. **[1]**

For a spontaneous reaction ΔG^o and E^o cell will be respectively:

(a) –ve and –ve (b) +ve and +ve

(c) +ve and –ve (d) –ve and +ve

Question 25. **[1]**

A liquid is mixed with ethanol and few drops of conc. H_2SO_4 is added. A compound with a fruity smell is formed. The liquid is:

(a) HCHO (b) CH_3CHO

(c) CH_3COOH (d) CH_3COCH_3

Question 26. **[2]**

The chief ore of copper is copper pyrite ($CuFeS_2$)

(i) How is the sulphide ore concentrated?

(a) By Gravity separation process (b) By Froth-floatation process

(c) By Electromagnetic separation process (d) By Leaching process

(ii) Copper is purified by electrolytic refining of blister copper. The correct statement about this process is:

(a) Impure copper strip is used as cathode (b) Impurities do not settle as anode mud

(c) Pure copper deposits at cathode (d) Acidified silver nitrate is used as electrolyte

Question 27. **[2]**

The reaction: $CH_3Br + OH^- \rightarrow CH_3OH + Br^-$

(i) The expected mechanism of the above reaction is:

(a) S_N^1 mechanism (b) S_N^2 mechanism

(c) S_E^1 mechanism (d) S_E^2 mechanism

(ii) The above reaction is:

(a) Elimination reaction (b) Nucleophilic addition reaction

(c) Nucleophilic substitution reaction (d) Electrophilic substitution reaction

Question 28. **[2]**

For the extraction of metal, answer the following:

(i) The smelting of iron ore in blast furnace involves all the processes except:

(a) Combustion (b) Reduction

(c) Slag formation (d) Sublimation

(ii) Which of the following metal is obtained by leaching the concentrated ore with dilute sodium cyanide solution, followed by treatment with zinc?

(a) Aluminium (b) Iron

(c) Copper (d) Silver

Question 29. **[2]**

Phenol is heated with alcoholic KOH and chloroform:

(i) What is the name of the reaction?

(a) Cannizzaro reaction (b) Gattermann reaction

(c) Reimer –Tiemann reaction (d) Kolbe reaction

(ii) What is the main product formed in this reaction?

(a) Salicylaldehyde (b) Salicylic acid

(c) Aniline (d) Phenyl isocyanide

Question 30. **[2]**

For IF_7 molecule:

(i) The structure of the given molecule is:

(a) Octahedral (b) Tetrahedral

(c) Trigonal bipyramidal (d) Pentagonal bipyramidal

(ii) The type of hybridization of the given molecule is:

(a) sp^3 hybridisation (b) sp^3d^3 hybridisation

(c) sp^3d^2 hybridisation (d) sp^3d hybridisation

Question 31. **[2]**

Ethyl alcohol when reacts with PCl_5 gives a compound (A). When compound (A) is treated with alc. KOH, compound (B) is formed along with KCl and H_2O.

(i) The compound (A) is:

(a) $C_2H_4Cl_2$ (b) CH_3CHO

(c) C_2H_5Cl (d) CH_3OH

(ii) The compound (B) is:

(a) C_2H_2 (b) C_2H_4

(c) C_2H_6 (d) C_2H_5OH

Question 32. **[2]**

Copper pyrite or chalcopyrite ($CuFeS_2$) is the main ore of copper. The extraction of copper from its ore involves, concentration, partial roasting, removal of iron and self-reduction.

(i) On heating the mixture of Cu_2O and Cu_2S, which one of the following will be obtained?

(a) Cu_2SO_3 (b) $Cu + SO_3$

(c) $CuO + CuS$ (d) $Cu + SO_2$

(ii) Iron is removed during the extraction of copper as:

(a) FeO (b) FeS

(c) $FeSiO_3$ (d) Fe_2O_3

Question 33. **[2]**

Conversion of chlorobenzene into phenol.

(i) Which of the following statements is correct for the above conversion?

(a) Heating it with alc. KOH at room temperature

(b) Heating it with aqueous NaOH at 623 K under pressure followed by acidification with dilute HCl

(c) Heating it with CuCN followed by acidification with dilute HCl
(d) Heating it with sodium metal in the presence of dry ether

(ii) What is the name of the above reaction?
(a) Dow process (b) Wurtz reaction
(c) Sandmeyer's reaction (d) Kolbe's reaction

Question 34. **[2]**

With reference to XeF_6 molecule, answer the following questions.

(i) What is the hybridisation of Xe atom in the given molecule?
(a) sp^3d^3 (b) sp^3d^2
(c) sp^3 (d) sp^3d

(ii) What is the geometry of this molecule?
(a) Distorted octahedral (b) Square planer
(c) Pyramidal (d) Tetrahedral

Question 35. **[2]**

An unknown alcohol is treated with Lucas reagent to determine whether the alcohol is primary, secondary or tertiary.

(i) Which alcohol reacts fastest and by what mechanism?
(a) Tertiary alcohol by S_N2 (b) Secondary alcohol by S_N1
(c) Tertiary alcohol by S_N1 (d) Secondary alcohol by S_N2

(ii) What is the chemical composition of the Lucas reagent used above?
(a) Anhydrous zinc chloride in concentrated HCl
(b) Anhydrous aluminium chloride in concentrated HCl
(c) Anhydrous lead chloride in concentrated HCl
(d) Anhydrous barium chloride in concentrated HCl

Question 36. **[2]**

Ozone is prepared from oxygen:

(i) Which method is used in the above preparation?
(a) Oxidation at high temperature (b) Oxidation using catalyst
(c) Silent electric discharge (d) Reduction at high temperature

(ii) The ozone obtained above acts as a:
(a) reducing agent (b) oxidising agent
(c) decomposer (d) dehydrating agent

Question 37. **[2]**

Copper metal crystallises with face centred cubic unit cell. If the edge length of copper atom is 361.5 pm. (Atomic weight of Cu = 63.5, $N_A = 6.02 \times 10^{23}$ mol^{-1})

(i) The density of copper metal is:
(a) 7.86 g/cm^3 (b) 8.93 g/cm^3
(c) 9.76 g/cm^3 (d) 10.5 g/cm^3

(ii) The radius of copper metal is:
(a) 180.75 pm (b) 156.53 pm
(c) 127.79 pm (d) 104.86 pm

Question 38. **[2]**

An aqueous solution containing one gram of urea (molecular weight = 60) boils at 100.25°C. The same solution freezes at –0.894 °C. The aqueous solution containing 3 gram of glucose (Molecular weight = 180) in the same volume of solution:

(i) What is the boiling point of glucose?
(a) 100.75 °C (b) 100.50 °C
(c) 100.25 °C (d) 100.08 °C

(ii) What is the freezing point of glucose?

(a) +0.894 °C (b) –0.894 °C

(c) +0.447 °C (d) –0.447 °C

Question 39. **[2]**

When two Faradays of electricity is passed through an aqueous solution of $CuSO_4$ and an aqueous solution of $AgNO_3$. (Atomic weight of Cu = 63.5 g mol^{-1}, Ag = 108 g mol^{-1})

(i) The mass of copper deposited at the cathode is:

(a) 127.02 g (b) 63.50 g

(c) 31.75 g (d) 15.87 g

(ii) The mass of silver deposited at the cathode is:

(a) 54 g (b) 108 g

(c) 216 g (d) 270 g

Question 40. **[2]**

Gold has cubic crystal whose unit cell has an edge length of 407.9 pm. Density of gold is 19.3 g cm^{-3}. Atomic weight of gold is 197 g mol^{-1}. ($N_A = 6.02 \times 10^{23}$ mol^{-1})

(i) The number of atoms (Z) in a unit cell of gold is:

(a) 1 (b) 2

(c) 3 (d) 4

(ii) The type of crystal structure of gold is:

(a) Simple cubic unit cell (b) Body centred cubic unit cell

(c) Face centred cubic unit cell (d) Side centred cubic unit cell

Question 41. **[2]**

A solution of sucrose (molecular weight 342 g mol^{-1}) has been prepared by dissolving 68.4 g of sucrose in 1000 g of water.

(K_f for water = 1.86 K kg mol^{-1})

(i) The freezing point of the solution obtained will be:

(a) –0.52 °C (b) +0.52 °C

(c) –0.372 °C (d) +0.372 °C

(ii) The molality of sucrose solution will be:

(a) 0.1 (b) 0.2

(c) 0.3 (d) 0.4

Question 42. **[2]**

The standard electrode potential for the reaction is:

(I) $Ag^+ + e^- \rightarrow Ag_{(s)}$; $E°Ag^+/Ag = +0.80$ V

(II) $Sn^{2+} + 2e^- \rightarrow Sn_{(s)}$; $E°Sn^{2+}/Sn = -0.14$ V

(i) The E°cell will be:

(a) 0.66 V (b) 0.88 V

(c) 0.94 V (d) 1.08 V

(ii) The value of standard Gibbs energy ($\Delta G°$) will be:

(F = 96,000 C mol^{-1})

(a) –181.42 kJ (b) –90.71 kJ

(c) –45.36 kJ (d) –22.68 kJ

Question 43. **[2]**

A metal has face centred cubic lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g/cm^3. ($N_A = 6.023 \times 10^{23}$ mol^{-1})

(i) The molar mass of the metal is:

(a) 20 g mol^{-1} (b) 27 g mol^{-1}

(c) 30 g mol^{-1} (d) 40 g mol^{-1}

(ii) The radius of the metal atom in centimetre (cm) is:

(a) 103.29×10^{-10} cm (b) 125.63×10^{-10} cm

(c) 142.81×10^{-10} cm (d) 175.76×10^{-10} cm

Question 44. **[2]**

A binary solution contains 92 g ethyl alcohol and 72 g water.

(Atomic weight of C = 12, H =1, O =16)

(i) Mole fraction of ethyl alcohol is:

(a) 0.40 (b) 0.80

(c) 0.66 (d) 0.33

(ii) Mole fraction of water is:

(a) 0.33 (b) 0.66

(c) 0.20 (d) 0.80

Question 45. **[2]**

The limiting molar conductivities ($\wedge^{\infty}_{m}$) for NaCl, KBr and KCl are 126, 152 and 150 ohm^{-1} cm^2 mol^{-1} respectively.

(i) The molar conductivity at infinite dilution for NaBr is:

(a) 128 ohm^{-1} cm^2 mol^{-1} (b) 176 ohm^{-1} cm^2 mol^{-1}

(c) 278 ohm^{-1} cm^2 mol^{-1} (d) 302 ohm^{-1} cm^2 mol^{-1}

(ii) The law applied to determine the molar conductivity of infinite dilution is known as:

(a) Faraday's Law (b) Avogadro's Law

(c) Kohlrausch's Law (d) Ohm's Law

Question 46. **[1]**

Assertion: Haloalkanes when treated with alcoholic KCN forms alkane nitrile as a major product.

Reason: Potassium cyanide is a covalent compound.

(a) Assertion is false but reason is true.

(b) Assertion is true but reason is false.

(c) Both assertion and reason are false.

(d) Both assertion and reason are true and reason is the correct explanation of the assertion.

Question 47. **[1]**

Assertion: Iron is found free in nature.

Reason: Iron is highly reactive element.

(a) Assertion is false but reason is true.

(b) Assertion is true but reason is false.

(c) Both assertion and reason are true but reason is not correct explanation of the assertion.

(d) Both assertion and reason are true and reason is the correct explanation of the assertion.

Question 48. **[1]**

Assertion: Ethers are more volatile than alcohols having the same molecular formula.

Reason: Alcohols have intermolecular hydrogen bond.

(a) Assertion is false but reason is true.

(b) Assertion is true but reason is false.

(c) Both assertion and reason are true but reason is not correct explanation of the assertion.

(d) Both assertion and reason are true and reason is the correct explanation of the assertion.

Question 49. **[1]**

Assertion: SO_2 decolorises pink colour of acidified $KMnO_4$ solution.

Reason: SO_2 is an oxidising agent

(a) Assertion is false but reason is true.

(b) Assertion is true but reason is false.

(c) Both assertion and reason are true but reason is not the correct explanation of the assertion.

(d) Both assertion and reason are true and reason is the correct explanation of the assertion.

Question 50. **[1]**

Assertion: Sulphide ores are concentrated by froth floatation process.

Reason: Sulphide ores are wetted by pine oil forming the froth while impurities are vetted by water.

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

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

(c) Assertion is correct and the reason is wrong.

(d) Both assertion and reason are wrong.

Answers

1. (b) 2 and 4

Explanation: In bcc unit cell:

8 corners × 1/8 per corner atom + 1 body center atom(1 × 1) = 2 atoms

In fcc unit cell:

8 corners × 1/8 per corner atom + 6 face centred atom × ½ atom per unit cell = 4 atoms

2. (b) The number of solute particles in solution

Explanation: All the colligative properties depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution.

3. (c) Decreases

Explanation: Specific conductivity is the conductance by an electrolytic solution of unit volume kept between two platinum electrodes of unit length .It depends upon concentration of the solution. On dilution, volume increases, so number of ions per unit volume carrying the current decreases. Hence, specific conductivity also decreases.

4. (a) Limestone

Explanation: The flux used in the extraction of iron from haematite ore is limestone. This flux is added for the removal of silica impurities from the haematite ore. The reactions are as follows:

$$CaCO_3 \rightarrow CaO + CO_2$$

$$CaO + SiO_2 \rightarrow \underset{\text{(slag)}}{CaSiO_3}$$

5. (d) XeF_3

Explanation: Xenon is an inert gas with electronic configuration [Kr]$4d^{10}5s^25p^6$.

When one, two or three electrons are promoted from 5*p* (filled) to 5*d* (empty) orbitals, two, four and six half-filled orbitals are formed.

Xenon can combine with even number of F atoms to form XeF_2, XeF_4 or XeF_6. It cannot combine with odd number of F atoms.

Thus, from the given options formation of XeF_3 is not possible.

6. (c) Ethyne

Explanation: When 2 moles of iodofrom reacts with 6 moles of silver powder, it forms ethyne gas and silver iodide is formed as a by-product.

$$CHI_3 + 6Ag + CHI_3 \rightarrow \underset{\text{Ethyne}}{CH \equiv CH} + 6AgI$$

7. (b) Hydrogen bonding

Explanation: The boiling point of ethanol is higher than diethyl ether due to extensive intermolecular hydrogen bonding. Hydrogen bonding increases the boiling point because a lot of energy is required to break the hydrogen bond. In case of ethanol, from the functional group -OH, one hydrogen atom is attached to a very electronegative oxygen atom directly. Due to which both hydrogen and oxygen become polar and results in the formation of hydrogen bond. whereas, in case of diethyl ether, oxygen is not directly attached to the oxygen, due to the formation of hydrogen bond is not possible in diethylether. Thus, ethanol has higher boiling point than diethylether.

While in diethyl ether, there is no hydrogen bonding and the intermolecular attraction present is weaker than intermolecular forces *i.e,* due to hydrogen bonding between molecules of ethyl alcohol. Hence, ethanol has a higher boiling point than diethyl ether.

8. (c) A_2B_5

Explanation: In fcc cubic lattice

A at corners = 8 corners × 1/8 per corner atom = 1

B at face centres = 5 centres × ½ per face centre atom= 5/2

Ratio of A : B = 1:5/2 = 2:5

Formula = A_2B_5

9. (a) Y > Z > X

Explanation: We know, $E^{\circ}_{OP} = -E^{\circ}_{RP}$

Higher the oxidising potential, higher is the tendency to lose an electron and higher is the reducing nature. Thus, smaller the reduction potential of a substance, more is its reducing power (Y > Z > X).

10. (d) Unchanged

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

$\Delta T_f = K_f \times m$

Where, m = molality

K_b and K_f are the proportionality constant which depends on the nature of solvent, not on molality i.e., they are independent of molality.

11. (b) Roasting, followed by reduction with carbon

Explanation: The extraction of zinc from zinc blende is carried out by first roasting and then reduction with carbon. The reactions are as follows:

$$ZnS + O_2 \rightarrow ZnO + SO_2 \quad \text{Roasting}$$

$$ZnO + C \xrightarrow{\Delta} Zn + CO\uparrow \quad \text{Carbon reduction}$$

12. (a) Fluorine

Explanation: Strong oxidising agents have high tendency to oxidise other element and itself get reduced. Flourine is a strong oxidising agent as compared to chlorine, bromine and iodine because it has high electronegativity and reduction potential. Thus, out of the given options fluorine is a powerful oxidising agent.

13. (c) A carbocation

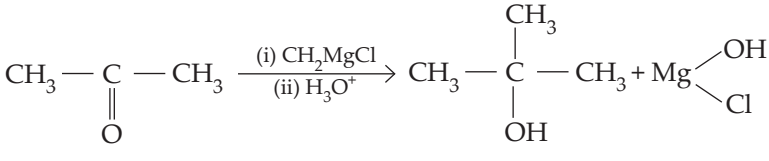
Explanation: In the S_N1 reaction mechanism, the carbocation species is a reaction intermediate.

14. (d) Frenkel defect

Explanation: Frenkel defect arises when an ion (usually cation) is missing from its lattice site and occupies an interstitial position in the crystal. Some examples include AgBr, ZnS, AgCl, and AgI.

15. (a) tert. butyl alcohol

Explanation: Reaction of acetone whith methyl magnesium bromide (Grignard reagent) forms a complex which on hydrolysis to gives tert. butyl alcohol.



16. (c) 0.0196

Explanation: $$\text{Moles of NaCl} = \frac{5.85\text{gm NaCl in solution}}{58.5}$$

$$= 0.1 \text{ mol}$$

$$\text{Moles of } H_2O = \frac{90\text{gm of } H_2O}{18}$$

$$= 5 \text{ mol}$$

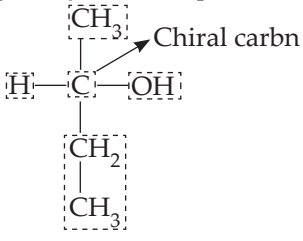
$$\text{Mole fraction of NaCl} = \frac{0.1}{5 + 0.1} = 0.0196$$

17. (d) Reduction potential of copper is higher than that of zinc.

Explanation: when zinc granules are dipped in copper sulphate solution, having higher reduction potential of copper (0.34 V) than zinc (–0.76 v), zinc easily displaces copper from its copper sulphate solution and make its own salt.

18. (b) Butan-2-ol

Explanation: A compound to be optically active requires atleast 1 chiral carbon.



19. (c) NaCl and NaClO

Explanation: When chlorine reacts with dilute and cold NaOH, sodium chloride and sodium hypochloride.

$$2NaOH_{(aq)} + Cl_{2(g)} \longrightarrow NaCl_{(aq)} + NaOCl_{(aq)} + H_2O_{(l)}$$

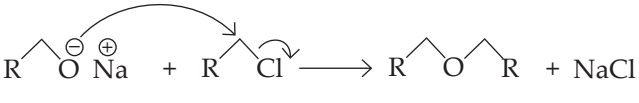
Cold Dilute — Sodium chlorate(i)

20. (c) Azeotropic

Explanation: A constant boiling mixture in which the composition of the mixture remains same throughout the boiling is an azeotropic mixture. For such solution, the composition of vapour is same as that of liquid solution at its boiling point. Thus, such mixtures distill without change in composition or temperature.

21. (d) Williamson's synthesis

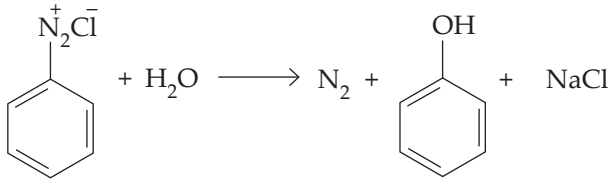
Explanation:



Sodium alkoxide — Ether

22. (b) Phenol

Explanation: Benzene diazonium chloride on hydrolysis gives phenol and nitrogen gas.



23. (a) 32%

Explanation: 68% of the available volume is occupied by spheres. Thus, vacant space is 32%.

24. (d) –ve and +ve

Explanation: $\Delta G^\circ < 0$

For spontaneous reaction $\Delta E^\circ > 0$

$\because$ $\Delta G^\circ = nFE^\circ_{cell}$

Thus, both have opposite signs.

25. (d) CH_3COCH_3

Explanation: when A liquid is mixed with ethanol and few drops of conc. H_2SO_4 is added. A compound with a fruity smell is formed and is called as ethyl acetate. This process is known as esterification.

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3\overset{\overset{O}{\|}}{C} - OC_2H_5 + H_2O$$

Ethyl acetate
(Fruity smell)

26. (i) (b) By Froth-floatation process

Explanation: Copper pyrite is sulphide ore. Sulphide ores are first concentrated by froth floatation method.

(ii) (c) Pure copper deposits at cathode

Explanation: Anode is made of impure copper.

Pure copper during electrolytic refining deposit at cathode.

Impurities such as Ag, Au settle down as anode mud.

Acidified $CuSO_4$ aqueous solution is used to increase conduction.

27. (i) (b) S_N2 mechanism

Explanation: : S_N2 reaction is second order reaction and its rate depends on the concentration of the substrate as well as the nucleophile.

Thus, the rate of conversion of methyl bromide to methanol is given by the expression rate = $k[CH_3Br][OH^-]$.

(ii) (c) Nucleophilic substitution reaction

Explanation: In this reaction, nucleophile Br^- is replaced by another nucleophile OH^-. So, it is a nucleophilic substitution reaction.

28. (i) (d) Sublimation

Explanation: Sublimation is the transition of a substance directly from the solid to the gas phase without passing through the intermediate liquid phase.

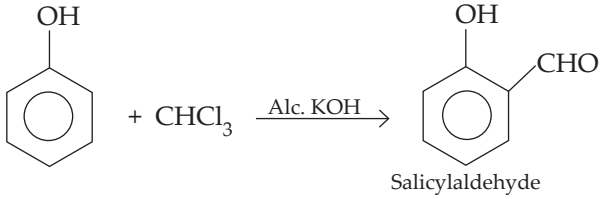
(ii) (d) Silver

Explanation: Silver is obtained by leaching its ore with dilute cyanide solution.

29. (i) (c) Reimer –Tiemann reaction

(ii) (a) Salicylaldehyde

Explanation: When phenol is treated with chloroform in the presence of alcoholic potassium hydroxide, salicylaldehye is formed and this reaction is known as Reimer-Tiemann reaction.

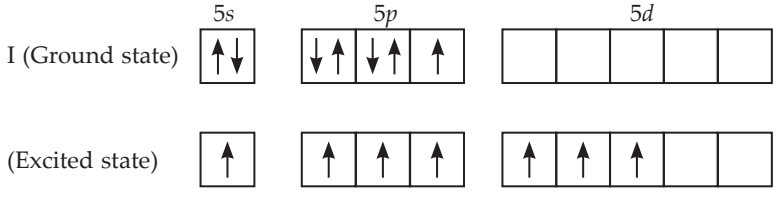


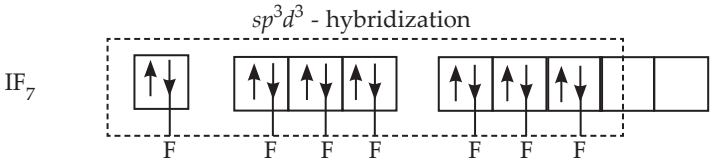
Salicylaldehyde

30. (i) (d) Pentagonal bipyramidal

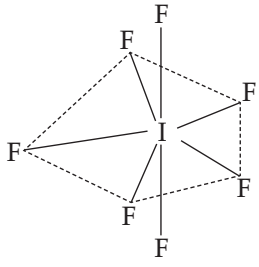
(ii) (b) sp^3d^3 hybridisation

Explanation:





Formation of IF_7 molecule involving sp^3d^3 hybridization



Pentagonal bipyramidal geometry of IF_7 molecule and is has sp^3d^3 hybridisation

31. (i) (c) C_2H_5Cl

(ii) (b) C_2H_4

Explanation: $C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$

$$C_2H_5Cl \xrightarrow[(alc.KOH)]{\Delta} C_2H_4 + KCl + H_2O$$

32. (i) (d) $Cu + SO_2$

(ii) (c) $FeSiO_3$

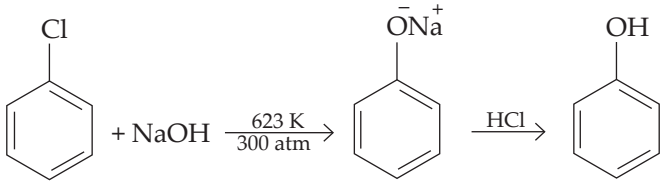
Explanation: On heating the mixture of Cu_2O and Cu_2S, Cu and SO_2 is obtained. Iron is removed during the extraction of copper as $FeSiO_3$

$2CuS + 3O_2 \rightarrow 2CuO + SO_2$	Roasting
$Cu_2O + C \rightarrow 2Cu + CO$	Carbon reduction
$FeO + SiO_2 \rightarrow FeSiO_3$	Slag formation

33. (i) (b) Heating it with aqueous NaOH at 623 K under pressure followed by acidification with dilute HCl.

(ii) (a) Dow process

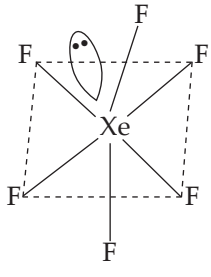
Explanation: By the Dow's process . When chlorobenzene is heated with NaOH at 623K under 300 atm and it forms sodium phenoxide which upon acidification gives phenol.



34. (i) (a) sp^3d^3

(ii) (a) Distorted octahedral

Explanation: Due to the presence of one lone pair of electrons, there will be lone-pair –bond-pair repulsion in the molecule and the geometry will be distorted octahedral.



35. (i) (c) Tertiary alcohol by S_N1

Explanation: Tertiary alcohol reacts faster because of the formation of tertiary carbocation during the reaction which is very stable carbocation.

(ii) (a) Anhydrous zinc chloride in concentrated HCl

Explanation: Lucas' reagent is a solution of anhydrous zinc chloride in concentrated hydrochloric acid.

36. (i) (c) Silent electric discharge

Explanation: Ozone is prepared in laboratory by passing silent electric discharge through dry oxygen. By passing the electric current some of the oxygen molecules dissociate and then atomic oxygen combines with oxygen molecules to form ozone.

(ii) (b) Oxidising agent

Explanation: Ozone is an oxidizing agent: Ozone serves as a strong oxidizing agent as an atom of nascent oxygen that is more reactive than oxygen and will quickly decompose to give oxygen.

37. (i) (b) 8.93 g/cm^3

(ii) (c) 127.79 pm

Explanation: Given,

$$a = 361.5 \text{ pm} = 3.61 \times 10^{-8} \text{ cm}$$

$$a = 2\sqrt{2}r$$

$$\therefore \quad r = \frac{361.5}{2\sqrt{2}} = 127.79 \text{ pm}$$

$$M = 63.5 \text{ g/mol}$$

Number of atoms in unit cell of fcc, Z = 4

$$\therefore \quad \text{Density} = \frac{Z \times M}{a^3 N_A} = \frac{4 \times 63.5}{(3.61 \times 10^{-8})^3 \times 6.023 \times 10^{23}}$$

$$= 8.92 \text{ g/cm}^3$$

38. (i) (c) 100.25 °C

(ii) (b) –0.894 °C

Explanation: Moles of urea = $\frac{1}{60}$ mol

Moles of glucose = $\frac{3}{180} = \frac{1}{60}$ mol

When moles are same, then molality is also similar and Kb and Kf will remain unchanged. Thus, temperature will also remain unchanged.

39. (i) (b) 63.50 g

Explanation: Cathode reaction: $Cu^{2+}_{(aq.)} + 2e^- \rightarrow Cu$

According to the above equation, 2 mol of electrons, *i.e,* 2 faradays of electricity will deposit 1 mol of Cu.

1 mol Cu = 63.5gm

(ii) (c) 216 gm

Explanation: Cathode reaction: Ag^+ (aq.) + $1e^- \rightarrow Ag$

According to the above equation, 1 mol of electrons, *i.e,* 2 faradays of electricity will deposit 2 mol of Ag.

2mol Ag = 2 x 108 gm = 216gm

40. (i) (d) 4

(ii) (c) face centred cubic unit cell

Explanation:

$$\text{Density} = \frac{z \times M}{a^3 \times N_A}$$

$$z = \frac{\rho \times a^3 \times N_A}{M}$$

$$z = \frac{(19.3 g cm^{-3}) \times (407.9 \times 10^{-10}\ \text{cm})^3 \times (6.022 \times 10^{23})\ \text{mol}^{-1})}{197 g\ \text{mol}^{-1}}$$

$$z = 4$$

Hence, structure is face centred cubic lattice.

41. (i) (d) +0.372 °C

(ii) (b) 0.2

Explanation: Depression in freezing point,

$$\Delta T_f = K_f \times m$$

where, $$m = \text{molality} = \frac{W_B \times 1000}{M_B \times W_A}$$

$$m = \frac{68.4 \times 1000}{342 \times 1000} = 0.2$$

$$\Delta T_f = 1.86 \times 0.2 = 0.372\ °C$$

$$T_f = T°_f - \Delta T_f = 0 - 0.372 = 0.372\ °C$$

42. (i) (c) 0.94 V

(ii) (a) –181.42 kJ

Explanation: $Ag^+_{(aq)} + e^- \rightarrow Ag_{(s)}$

$Sn^{2+}_{(aq)} + 2e^- \rightarrow Sn_{(s)}$

$Sn[Sn^{2+}(1M||Ag^{2+}(1M)|Ag$ is :

$$E°_{Ag} = 0.80V$$

$$E°_{Sn} = -0.14\ V$$

$$E°_{cell} = E°_{Cathode} - E°_{Anode}$$

$$\Delta G° = -nFE°_{cell}$$

$$= 0.80 - (-0.14)\ Vz\ 0.94\ V$$

$$\Delta G° = -2 \times 96{,}000 \times 0.94J$$

$$\Delta G° = -181.42\ kJ$$

43. (i) (b) 27g mol^{-1}

(ii) (c) 142×10^{-10} cm

Explanation: Edge length of fcc unit cell :

$a = 2\sqrt{2}r$

$$\therefore r = \frac{a}{2\sqrt{2}} = \frac{404 \times 10^{-10}}{2\sqrt{2}}\ \text{cm} = 142.81 \times 10^{-10}\ \text{cm}$$

Density of unit cell is given as :

$$d = \frac{\text{mass of unit cell}}{\text{volume of unit cell}} = \frac{z \times M}{a^3 \times N_A}$$

$$M = \frac{d \times a^3 \times N_A}{z}$$

$$M = \frac{(2.72 g / cm^3) \times (4.4 \times 10^{-10} cm)^3 \times (6.02 \times 10^{23}\ mol^{-1})}{4}$$

$$M = 26.9g\ mol^{-1} \approx 27g\ mol^{-1}$$

44. (i) (d) 0.33

(ii) (b) 0.66

Explanation: Number of moles $= \frac{\text{Given mass}}{\text{Molar mass}}$

$$\text{Moles of ethyl alcohol} = \frac{92}{46} = 2\ \text{mol}$$

$$\text{Moles of water} = \frac{72}{18} = 4 \text{ mol}$$

$$\therefore \quad \text{Mole fraction of ethanol} = \frac{2}{2+4} = \frac{1}{3} \approx 0.33$$

$$\text{Mole fraction of water} = \frac{4}{2+4} = \frac{2}{3} \approx 0.66$$

45. (i) (a) 128 s cm^3

Explanation: we have,

$$\wedge^{\circ}_{NaCl} = 128s \text{ cm}^3$$
$$\wedge^{\circ}_{KBr} = 152s \text{ cm}^3$$
$$\wedge^{\circ}_{KCl} = 150s \text{ cm}^3$$

As,

$$\wedge^{\circ}_{NaCl} = \wedge^{\circ}_{Na^+} + \wedge^{\circ}_{Cl^-} \quad \text{....(i)}$$
$$\wedge^{\circ}_{KBr} = \wedge^{\circ}_{K^+} + \wedge^{\circ}_{Br^-} \quad \text{....(ii)}$$
$$\wedge^{\circ}_{KCl} = \wedge^{\circ}_{K^+} + \wedge^{\circ}_{Cl^-} \quad \text{....(iii)}$$

Including all equations as (i) + (ii) – (iii)

$\because$ $\wedge^{\circ}_{NaCl} = \wedge^{\circ}_{Na^+} + \wedge^{\circ}_{Br^-}$

$\wedge^{\circ}_{NaBr} = 126 + 152 - 150 = 128s \text{ cm}^3$

(ii) (c) Kohlrausch's Law

Explanation: Kohlrausch's law states that the equivalent conductivity of an electrolyte at infinite dilution is equal to the sum of the conductance of the anions and cations.

46. (i) (b) Assertion is true but reason is false.

Explanation: For example : Alkyl halide (Bromoethane) react with alc. KCN to give Alkyl cyanide.

Alkyl halide reacts with alcoholic KCN to form alkyl cyanide (alkane nitrile)

$$\underset{\text{Bromoethane or ethyl bromide}}{CH_3 - CH_2 - Br} + \text{alc. KCN} \longrightarrow \underset{\text{Ethyl cyanide propane nitrile}}{CH_3 - CH_2 - CN} + KBr$$

KCN is predominantly ionic compound. The attack takes place through the carbon atom and not through nitrogen atom because the C-C bond is more stable than C-N bond. Thus, assertion is true but reason is false.

47. (a) Assertion is false but reason is true.

Explanation: Iron is not found freely in nature because it is highly reactive. Thus, assertion is false but reason is true.

48. (d) Both assertion and reason are true and reason is the correct explanation of the assertion.

Explanation: Alcohols are less volatile than ether because alcohols contain a hydrogen atom attached to the strongly electronegative oxygen atom. Therefore they form intermolecular hydrogen bonding. Thus, both assertion and reason are true but reason is not the correct explanation of assertion.

49. (b) Assertion is true but reason is false.

Explanation: Sulphur dioxide (SO_2) is passed through an acidified solution of potassium permagnate ($KMnO_4$) which is purple in colour. On doing so, sulphur dioxide being a strong reducing agent, reduces the purple coloured solution to form a colourless solution.

$$\underset{\text{(purple)}}{2KMnO_4} + 5SO_2 + 2H_2O \rightarrow K_2SO_4 + \underset{\text{(colourless)}}{2MnSO_4} + 2H_2SO_4$$

Moist sulphur dioxide behaves as a reducing agent, as it reduces MnO^{4-} to Mn^{2+}. Thus, assertion is true but reason is false.

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

Explanation: Froth floatation method is used to concentrate sulphide ores. Wet pine oil is used in froth flotation process because it does not have an affinity towards water. It attracts impurities which can be washed away. Thus, both and assertion and reason are true and reason is the correct explanation of assertion.