ISC Solved Paper 2022 Semester-1

Chemistry

Class-XII

(Maximum Marks : 40)

(Time allowed : One and a half hours)

*Candidates are allowed an additional **15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time.*

ALL QUESTIONS ARE COMPULSORY.

Each question/subpart of a question carries one mark.

Select and write the correct option for each of the following questions.

***1. In sodium chloride crystal, how many chloride ions are there around sodium ion ?**

(a) 3 **(b)** 4

(c) 6 **(d)** 8

2. According to which law the solubility of a gas at equilibrium and constant temperature varies directly with the pressure of the gas, provided the gas does not undergo any chemical change during the dissolution ?

(a) Raoult's Law

(b) Nernst distribution Law

(c) Henry's Law

(d) van't Hoff Law

Ans. Option (c) is correct.

Henry's law states that at a constant temperature, the solubility of the gas is directly proportional to the pressure of a gas.

3. Which of the following statements is true for electrochemical cell ?

(a) Cations move towards zinc electrode

(b) Cations move towards copper electrode

(c) Current flows from zinc electrode to copper electrode

(d) Electrons flow from copper electrode to zinc electrode

Ans. Option (b) is correct.

Daniel cell is an electrochemical cell in which Cu acts as cathode and Zn acts as an anode. In Daniel cell,

(i) Electrons flow from Zn (anode) to Cu (cathode).

(ii) Current flows from Cu (cathode) to Zn (anode).

(iii) Cu^{2+} ions (cations) move towards Cu (cathode) and accumulated as Cu metal.

***4. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide (Cu_2O) with:**

(a) Cuprous sulphide (Cu_2S)

(b) Iron sulphide (FeS)

(c) Sulphur dioxide (SO_2)

(d) Carbon monoxide (CO)

***5. If chlorine gas is passed through hot and conc. aqueous sodium hydroxide solution, the products formed have chlorine in different oxidation states. These oxidation states are indicated as:**

(a) –1 and +5 **(b)** –1 and +3

(c) –1 and +1 **(d)** +1 and +5

6. When ethyl chloride is heated with alcoholic AgCN, the main product formed is:

(a) Ethyl isocyanide **(b)** Ethyl cyanide

(c) Ethyl nitrate **(d)** Ethyl amine

Ans. Option (a) is correct.

$$\underset{\text{Ethyl chloride}}{C_2H_5 - Cl} + AgCN \rightarrow \underset{\text{Ethyl isocyanide}}{C_2H_5 - NC} + AgCl$$

7. When phenol is treated with excess of bromine water, a white precipitate is formed. The compound formed is:

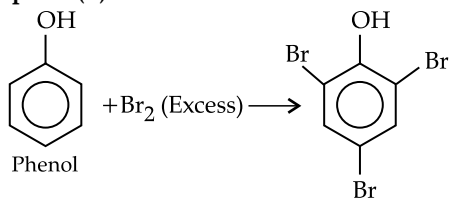
(a) m-bromophenol

(b) o and p-bromophenol

(c) 3,5 dibromophenol

(d) 2,4,6 tribromophenol

Ans. Option (d) is correct.



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***8. The ratio of number of atoms present in a face centred cubic, body centred cubic and simple cubic structure are respectively:**

(a) 1:2:4 **(b)** 4:2:1

(c) 8:1:6 **(d)** 4:2:3

9. Electrochemical equivalent (Z) is the amount of substance which gets deposited from its solution on passing electrical charge equal to:

(a) 96,500 Coulombs **(b)** 9650 Coulombs

(c) 965 Coulombs **(d)** 1 Coulomb

Ans. Option (a) is correct.

Electrochemical equivalent is the amount of substance which gets deposited from its solution on passing electrical charge equal to 96,500 Coulombs.

10. A solution containing components A and B follows Raoult's Law. With reference to the statement which of the following options is correct ?

(a) A-B attraction force is greater than A-A and B-B

(b) A-B attraction force is less than A-A and B-B

(c) A-B attraction force remains the same as A-A and B-B

(d) Total volume of solution is different from sum of volumes of both components A and B

Ans. Option (c) is correct.

Raoult's law is followed in ideal conditions. Such that A-A = B-B = A-B.

***11. What is used in the blast furnace to obtain iron from haematite ore ?**

(a) Electrolytic reduction

(b) Carbon dioxide

(c) Carbon monoxide

(d) Aluminium

***12. Copper metal on treatment with conc. nitric acid (HNO_3) gives:**

(a) $Cu(NO_3)_2 + CuO + H_2O$

(b) $Cu(NO_3)_2 + NO + H_2O$

(c) $Cu(NO_3)_2 + NO_2 + H_2O$

(d) $Cu(NO_3)_2 + H_2SO_4 + H_2O$

***13. Haloform reaction does not take place with which of the following compounds?**

(a) Propanone

(b) 2–propanol

(c) Ethanol

(d) Methanol

14. A solid has a structure in which 'Y' atoms are located at the corners of a cubic lattice, 'O' atoms at the centre of edges and 'K' atoms at the centre of the cube. What is the formula of this compound ?

(a) KYO_2

(b) KYO_3

(c) K_2YO_3

(d) K_4YO_3

Ans. Option (b) is correct.

•In a unit cell, Y atoms are at eight corners of the cube. Each corner atom contributes one eighth to the unit cell.

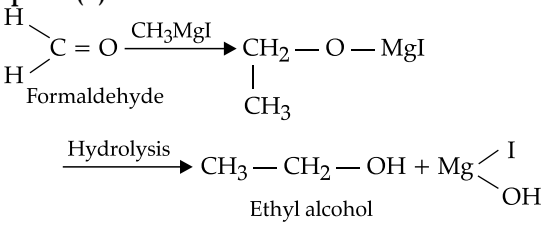
- The contribution of Y atoms to the unit cell $= 8 \times \frac{1}{8} = 1$
- K atom is at the centre of the cube. Body centre atom contributes one to the unit cell, i.e. $1 \times 1 = 1$
- O-atoms at the centre of 12 edges. Each edge centre atom contributes one fourth to the unit cell.
- The contribution of O atoms to the unit cell $= 12 \times \frac{1}{4} = 3$
- Thus, the formula is KYO_3.

15. Formaldehyde when reacts with CH_3MgI forms an additional product, which on hydrolysis gives:

(a) Ethyl iodide **(b)** Methyl alcohol

(c) Methyl iodide **(d)** Ethyl alcohol

Ans. Option (d) is correct.



16. A solution of urea (molecular mass =60) contains 8.6 g per litre. It is isotonic with a 5% solution of a non–volatile and non–electrolytic solute. What will be the molecular mass of the solute ?

(a) 34.9 g mol^{-1} **(b)** 349 g mol^{-1}

(c) 861 g mol^{-1} **(d)** 3490 g mol^{-1}

Ans. Option (b) is correct.

No of moles of urea $= \frac{8.6}{60}$ -----(i)

5% of unknown solution $= \frac{5g}{100ml} = 5gL$

Number of moles of unknown solute $= \frac{50}{m}$ -----(ii)

From equation (i) and (ii) $\frac{8.6}{60} = \frac{50}{m}$

$$m = \frac{50 \times 60}{8.6}$$

$$m = 349amu$$

17. The standard reduction electrode potential of Cu^{2+}/Cu is +0.34 V and that of Cr^{3+}/Cr is –0.74 V. These two electrodes are connected in their standard state to make an electrochemical cell. What will be the standard electrode potential (E°) of this cell ?

(a) 1.19 V **(b)** 1.08 V

(c) 0.69 V **(d)** 1.83V

Ans. Option (b) is correct.

$$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$$
$$= 0.34 - (-0.74)$$
$$= 0.34 + 0.74$$
$$= 1.08\ V$$

18. Acetyl chloride on heating with diethyl ether in the presence of anhydrous $ZnCl_2$ gives:

(a) Ethyl alcohol and acetic acid
(b) Methyl chloride and methyl alcohol
(c) Methyl acetate and methyl alcohol
(d) Ethyl acetate and ethyl chloride

Ans. Option (d) is correct.

Ethers react with acid chloride or acid anhydride in presence of $AlCl_3$ or $ZnCl_2$ to form esters and haloalkanes.

$$\underset{\text{Diethyl ether}}{CH_3CH_2OCH_2CH_3} + CH_3COCl \xrightarrow{AlCl_3 \text{ or } ZnCl_2} \underset{\text{Ethyl acetate}}{CH_3COOCH_2CH_3} + \underset{\text{Ethyl chloride}}{CH_3CH_2Cl}$$

***19. In compounds XeF_2, XeF_4 and XeF_6, the number of lone pair(s) on Xe atom respectively is :**

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

20. The value of molal depression constant or cryoscopic constant (K_f) depends on which of the following?

(a) Nature of solvent.
(b) Heat of the solution of the solute in the solvent.
(c) Nature of solute.
(d) Vapour pressure of the solution.

Ans. Option (a) is correct.

The value of molal depression constant or cryoscopic constant (K_f) depends on nature of solvent and not on the nature of solute dissolved in it.

21. Anti–Markownikoff addition of HBr is not observed in which of the following alkenes?

(a) Propene **(b)** But-1-ene
(c) But-2-ene **(d)** Pent-1-ene

Ans. Option (c) is correct.

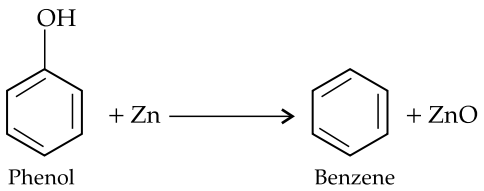
Anti-Markovnikov's addtion of HBr is observed in unsymmetrical alkenes like propene, 1-butene and pent-2-ene. Since, 2-butene is symmetrical, therefore, antimarkovnikov's addtion of HBr is not observed in this case.

22. When phenol is treated with zinc dust, it gives:

(a) Benzoic acid **(b)** Benzaldehyde
(c) Benzene **(d)** Toluene

Ans. Option (c) is correct.

When phenol is treated with zinc dust, it gives benzene.



***23. The appearance of colour in solid alkali metal halides is generally due to:**

(a) Schottky defect **(b)** Frenkel defect
(c) Interstitial positions **(d)** F-centres

24. The ionic conductance at infinite dilution for Ba^{2+} and Cl^- ions are 127 $ohm^{-1}cm^2mol^{-1}$ and 76 ohm^{-1} cm^2mol^{-1} respectively. What will be the molar conductance of $BaCl_2$ at infinite dilution ?

(a) 139.5 ohm^{-1} cm^2 mol^{-1}
(b) 279.0 ohm^{-1} cm^2 mol^{-1}
(c) 203.0 ohm^{-1} cm^2 mol^{-1}
(d) 101.5 ohm^{-1} cm^2 mol^{-1}

Ans. Option (a) is correct.

The required molar conductance is 139.5 $ohm^{-1}cm^2$ mol^{-1}

The chemical equation is :

$$BaCl_2 \rightarrow Ba^{2+} + 2Cl^-$$

$$\text{The equivalent weight of } BaCl_2 = \frac{\text{molecular weight}}{2}$$

$$\lambda^\infty_m \text{ for } BaCl_2 = \lambda^\infty_m Ba^{2+} + 2\lambda^\infty_m Cl^-$$

$$\lambda^\infty_{eq} \text{ for } BaCl_2 = \frac{1}{2}\lambda^\infty_m\ Ba^{2+} + \lambda^\infty_m\ Cl^-$$

$$= \frac{127}{2} + 76$$

$$= 139.5\ ohm^{-1}\ cm^2\ mol^{-1}$$

25. When excess of ethanol is heated with conc. H_2SO_4 at 413K, which compound is obtained ?

(a) Diethyl sulphate
(b) Ethyl hydrogen sulphate
(c) Ethoxy ethane
(d) Ethene

Ans. Option (c) is correct.

$$\underset{\text{Ethanol}}{2C_2H_5OH} \xrightarrow{\text{Conc.}H_2SO_4 \text{ at } 140^\circ C(413K)} \underset{\substack{\text{Ethoxy}\\\text{ethane}}}{C_2H_5 - O - C_2H_5} + H_2O$$

***26. With reference to the extraction of metal, answer the following:**

(i) What is the process of removing impurity from crude metal called ?
(a) Roasting **(b)** Calcination
(c) Refining **(d)** Concentration

(ii) Which of the following is not a method for the concentration of ores ?
(a) Forth floatation **(b)** Smelting
(c) Magnetic separation **(d)** Gravity separation

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Ans. Option (b) is correct.

In the extraction of copper from its sulphide ore, when ore is subjected to roasting, some of it is oxidised to Cu_2O which reacts with the remaining Cu_2S (sulphide ore) to give copper metal.

Cu_2S behaves as reducing agent.

Smelting is a process of heating the ore in order to extract the base metal.

27. An alkyl halide reacts with metallic sodium in the presence of dry ether.

(i) What is this reaction known as ?

(a) Frankland's reaction
(b) Sandmeyer's reaction
(c) Wurtz reaction
(d) Kolbe's reaction

Ans. Option (c) is correct.

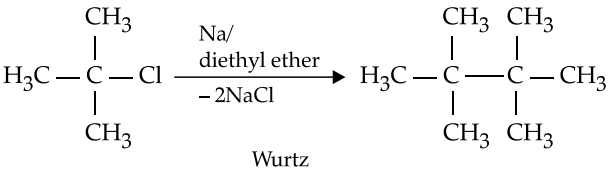
When an alkyl halide reacts with metallic sodium in presence of dry ether, it forms symmetrical alkane and the reaction is known as wurtz reaction.

$$\underset{\text{Alkyl halide}}{R-X} + 2Na + X-R \xrightarrow{\text{dry ether}} \underset{\text{Alkane}}{R-R} + \underset{\text{Sodium halide}}{2Na-X}$$

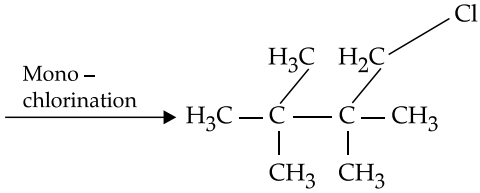
(ii) An organic compound 'A' on reaction with sodium metal in dry ether gives a compound, 2, 2, 3, 3 tetramethyl butane. Identify compound 'A'.

(a) tert-butyl chloride **(b)** sec-butyl chloride
(c) iso-butyl chloride **(d)** n-butyl chloride

Ans. Option (a) is correct.



Tertiary butyl chloride — Wurtz coupling — 2,2,3,3-tetramethylbutane



1-chloro-2,2,3,3-tetramethylbutene

***28. Answer the following questions with reference to the extraction of copper from its ore. Which one of the following is the sulphide ore ?**

(i) Which one of the following is the sulphide ore ?

(a) Cuprite
(b) Malachite
(c) Azurite
(d) Chalcopyrite

(ii) In the Bessemer converter, copper sulphide is reduced to copper by which one of the following reaction ?

(a) $Cu_2S + FeO \longrightarrow 2Cu + FeO + S$
(b) $Cu_2S + FeS \longrightarrow 2Cu + FeS_2$
(c) $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$
(d) $Cu_2S + Fe \longrightarrow 2Cu + FeS$

Ans. Option (c) is correct.

In the extraction of copper from its sulphide ore, when ore is subjected to roasting, some of it is oxidised to Cu_2O which reacts with the remaining Cu_2S (sulphide ore) to give copper metal.

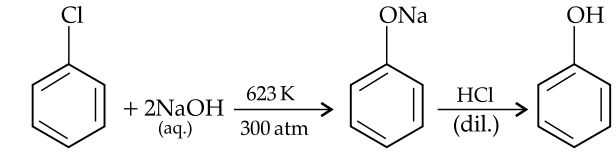
Here Cu_2S behaves as a reducing agent.

29. Chlorobenzene is fused with aqueous sodium hydroxide at 623K and 300 atm followed by hydrolysis with dil. HCl.

(i) The organic product formed is:

(a) Phenol
(b) Sodium phenoxide
(c) Benzene
(d) Cyclohexyl chloride

Ans. Option (a) is correct.



Chlorobenzene — Sodium phenoxide — Phenol

(ii) What is the name of the above reaction ?

(a) Williamson's synthesis
(b) Dow's process
(c) Rosenmund's reduction
(d) Kolbe's reaction

Ans. Option (b) is correct.

When chlorobenzene is fused with aqueous sodium hydroxide at 623 K and 300 atm followed by hydrolysis with dil.HCl, phenol is formed and the process is known as Dow's process.

***30. BrF_5 molecule is an interhalogen compound.**

(i) What is the structure of the given molecule ?

(a) Pentagonal bipyramidal
(b) Square pyramidal
(c) Square planar
(d) Tetrahedral

(ii) What is the type of hybridisation shown by central atom of the above molecule ?

(a) sp^3 **(b)** sp
(c) sp^3d^2 **(d)** sp^3d^3

31. When ethene reacts with HBr, a compound (X) is formed. When compound (X) reacts with sodium ethoxide then compound (Y) is formed along with sodium bromide.

(i) Identify the compound (X) ?

(a) C_2H_6 **(b)** C_2H_5Br

(c) CH_3Br **(d)** $C_2H_4Br_2$

(ii) Identify the compound (Y) ?

(a) CH_3OH **(b)** C_2H_5OH

(c) CH_3OCH_3 **(d)** $C_2H_5OC_2H_5$

Ans. (i) Option (b) is correct.

$$\underset{\text{Ethene}}{CH_2 = CH_2} + HBr \rightarrow \underset{\substack{\text{Ethylbromide}\\(X)}}{CH_3CH_2Br} + C_2H_5ONa \rightarrow NaBr + \underset{\substack{\text{Ethoxyethane}\\(Y)}}{CH_3CH_2OCH_2CH_3}$$

So, X is Ethylbromide

(ii) Option (d) is correct.

$$CH_2 = CH_2 + HBr \rightarrow \underset{X}{CH_3CH_2Br} + C_2H_5ONa \rightarrow NaBr + \underset{Y}{CH_3CH_2OCH_2CH_3}$$

So, Y is $C_2H_5OC_2H_5$ i.e., Ethoxyethane

***32. Extraction of silver metal is done mainly from argentite (Ag_2S) ore:**

(i) The concentrated ore on treatment with dil. NaCN solution and then followed by continuous agitation for several hours, which of the following products are obtained ?

(a) AgCN and Na_2S

(b) Ag and NaCN

(c) Na_2SO_4 and Na_2SO_3

(d) $Na[Ag(CN)_2]$ and Na_2S

(ii) What is the above process of extraction of silver using dilute sodium cyanide known as ?

(a) Deacon's process

(b) Pattinson's process

(c) Mac-Arthur-Forrest cyanide process

(d) Parke's process

33. Silver acetate is refluxed with bromine in carbon tetrachloride.

(i) What are the products formed ?

(a) Ethane, silver bromide and water

(b) Ethanoyl bromide and silver

(c) Ethanoic acid and silver bromide

(d) Bromomethane, silver bromide and carbon dioxide

Ans. Option (d) is correct.

When silver acetate is refluxed with bromine in presence of CCl_4 then bromomethane is formed along with and carbon dioxide.

$$\underset{\text{Silver acetate}}{CH_3COOAg} + Br_2 \xrightarrow{CCl_4,\ \text{heat}} \underset{\text{Bromomethane}}{CH_3Br} + \underset{\substack{\text{Silver}\\\text{bromide}}}{AgBr} + \underset{\substack{\text{Carbon}\\\text{dioxide}}}{CO_2}$$

(ii) What is the above reaction known as ?

(a) Finkelstein reaction

(b) Swarts reaction

(c) Hunsdiecker reaction

(d) Sandmeyer's reaction

Ans. Option (c) is correct.

Hunsdiecker reaction is the reaction of a silver salt of a carboxylic acid with halogens to give organic halides.

34. With reference to $XeOF_4$ molecule, answer the following questions:

(i) What is the type of hybridisation of Xe atom in the given molecule ?

(a) sp^3d **(b)** sp^3d^2

(c) sp^3d^3 **(d)** sp^3

Ans. Option (b) is correct.

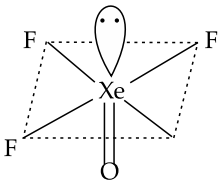
In $XeOF_4$ molecule, there are 5-sigma bond, 1-pi bond and 1 lone pair of electron. This makes it sp^3d^2 hybridisation.

(ii) What is the geometry of this molecule ?

(a) Octahedral **(b)** Square pyramidal

(c) Square planar **(d)** Tetrahedral

Ans. Option (b) is correct.



Square pyramidal

35. Phenol and ethyl alcohol can be distinguished by a single chemical test.

(i) Which of the following is the reagent use to distinguish phenol from ethyl alcohol ?

(a) Solid PCl_5

(b) Dry sodium metal

(c) Neutral $FeCl_3$

(d) Acetyl chloride in presence of pyridne

Ans. Option (c) is correct.

With neutral $FeCl_3$, phenol gives violet coloured complex. Ethanol does not react.

(ii) Which colour is developed in the solution due to the addition of the above reagent to phenol ?

(a) Blue **(b)** Green

(c) Red **(d)** Violet

Ans. Option (d) is correct.

Phenols react with the Fe^{3+} ion in a neutral ferric chloride ($FeCl_3$) solution to give complex ions with

***Out of Syllabus**

strong colours from red to purple. Ethanol does not undergo any such reaction.

***36. Ozone is an allotropic form of oxygen. It acts as a powerful oxidizing agent.**

(i) During the oxidation of mercury (Hg) by ozone, the sub oxide (Hg_2O) formed dissolves in mercury causing it to lose its meniscus and starts sticking to the sides of glass. What is this phenomenon called?

(a) Branching of mercury
(b) Tailing of mercury
(c) Breaking of meniscus
(d) Distorted meniscus

(ii) Which one of the following compounds is formed when ozone reacts with black lead sulphide ?

(a) Blue coloured lead trioxide
(b) White coloured lead sulphate
(c) Green coloured lead oxide
(d) Red coloured trilead tetroxide

***37. An element 'X' having atomic mas 60 has density 623 g/cm^3. The edge length of its cubic unit cell is 400 pm. ($N_A = 6.023 \times 10^{23}$ mol^{-1}.)**

(i) What is this type of unit cell known as ?

(a) Body centred cubic **(b)** Face centred cubic
(c) Simple cubic **(d)** Side centred cubic

(ii) What is the radius of an atom of this element ?

(a) 210.5 pm **(b)** 346.4 pm
(c) 141.4 pm **(d)** 115.3 pm

38. 0.76g of glucose (molecular mass = 180g mol^{-1}) is dissolved in 20 ml of aqueous solution at 298 K. (R = 0.0821 Lit-atm K^{-1} mol^{-1}).

(i) What is the osmotic pressure of solution at 298K ?

(a) 8.41 atm **(b)** 0.48 atm
(c) 4.81 atm **(d)** 5.16 atm

Ans. Option (d) is correct.

Osmotic pressure is:

$$\pi = CRT$$

where π = osmotic pressure
C = concentration
gas constant = 0.0821 atm L/K/mol
T = temperature

$$C = \frac{\text{moles of solute}}{\text{volume of solution}}$$

$$= \frac{0.76 \times 1000}{180 \times 20} = 0.2111 \text{ M}$$

$$\pi = 0.211 \times 0.0821 \times 298$$

$$\pi = 5.16 \text{ atm}$$

(ii) What is the molarity of the glucose solution ?

(a) 0.42 M **(b)** 0.21 M
(c) 4.01 M **(d)** 2.02 M

Ans. Option (b) is correct.

$$C = \frac{\text{moles of solute}}{\text{volume of solution}}$$

$$= \frac{0.76 \times 1000}{180 \times 20} = 0.21\text{m}$$

39. A conductivity cell is filled with 0.05 M NaOH solution offering a resistance of 31.6 ohm. If the cell constant of the cell is 0.367 cm^{-1}, calculate the following:

(i) The value of specific conductance :

(a) $1.29 \times 10^{-2}\ \Omega^{-1}\ cm^{-1}$ **(b)** $1.29 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$
(c) $1.16 \times 10^{-2}\ \Omega^{-1}\ cm^{-1}$ **(d)** $11.6 \times 10^{-2}\ \Omega^{-1}\ cm^{-1}$

Ans. Option (c) is correct.

Specific conductance = conductance × cell constant

$$= \frac{1 \times 0.367}{31.6} = 0.01161 = 1.16 \times 10^{-2} \Omega^{-1} cm^{-1}$$

(ii) The value of molar conductance:

(a) $232.20\ \Omega^{-1}\ cm^2\ mol^{-1}$ **(b)** $23.22\ \Omega^{-1}\ cm^2\ mol^{-1}$
(c) $119.07\ \Omega^{-1}\ cm^2\ mol^{-1}$ **(d)** $165.36\ \Omega^{-1}\ cm^2\ mol^{-1}$

Ans. Option (b) is correct.

$$R = 31.6 \text{ ohm}$$

$$\therefore \quad G = \frac{1}{R} = \frac{1}{31.6} \text{ohm}^{-1} = 0.0316 \text{ ohm}^{-1}$$

Specific conductance (k)

k = conductance × cell constant

$$k = 0.0316 \text{ ohm}^{-1} \times 0.367 \text{ cm}^{-1}$$

$$k = 0.0116 \text{ ohm}^{-1} \text{ cm}^{-1}$$

Now, molar concentration = 0.5 M

$$= 0.5 \times 10^{-3} \text{ mole cm}^{-3}$$

$$\therefore \quad \text{Molar conductance} = \frac{k}{\text{molar conc.}}$$

$$\Lambda_m = \frac{0.0116}{0.5 \times 10^{-3}}$$

$$\Lambda_m = 23.2 \text{ S cm}^2\text{mol}^{-1}$$

***40. The radius of silver atom is 143.5 pm and it crystallises in face centred cubic arrangement (molecular mass of Ag = 107.87, $N_A = 6.023 \times 10^{23}$).**

(i) What is the edge length of the unit cell ?

(a) 405.8 pm **(b)** 40.6 pm
(c) 331.4 pm **(d)** 287.0 pm

(ii) What is the density of silver metal ?

(a) 5.36 g/cm^3 **(b)** 8.60 g/cm^3
(c) 10.72 g/cm^3 **(d)** 7.07 g/cm^3

41. A solution contains 54g of glucose (molecular mass = 180g mol^{-1}) in 250g of water (K_f for water = 1.86 K kg mol^{-1})

(i) What will be the freezing point of this glucose solution ?

(a) 276.402 K **(b)** 270.768 K
(c) 370.402 K **(d)** 272.563 K

Ans. Option (b) is correct.

Mass of glucose (W_B) = 54 g

Molecular mass of glucose (M_B) = 180
Mass of water (W_B) = 250 g
K_f for water = 1.86 k mol^{-1} kg

Applying the formula, $\Delta T_f = \frac{K_f \times W_B \times 1000}{M_B \times W_A}$

$$\Delta T_f = \frac{1.86 \times 54 \times 1000}{180 \times 250} = 2.23$$

$$T_f = T°_f - \Delta T_f = 0 - (2.23)$$

$$T_f = -2.23° C$$

$$T_f = -2.23 + 273 = 270.768 K$$

(ii) What will be the molality of this glucose solution ?

(a) 1.20 m **(b)** 0.12 m
(c) 2.40 m **(d)** 0.24 m

Ans. Option (a) is correct.

Molality = Moles per kg

$$m = \frac{54 \times 1000}{180 \times 250} = 1.20 m$$

42. The standard reduction electrode potential for Sn^{4+}/Sn^{2+} couple is +0.15V and that for the Cr^{3+}/Cr couple is –0.74 V. These two couple in their standard state are connected to make a cell. (1 Faraday = 96, 500 mol^{-1})

(i) What will be the value of E° cell ?

(a) +1.19V **(b)** +0.89V
(c) +0.18V **(d)** +1.83V

Ans. Option (b) is correct.

$E°_{Sn^{4+}/Sn^{2+}} = +0.15V$

$E°_{Cr^{3+}/Cr} = -0.74V$

Now,

$E°_{cell} = E°_{Cathode} - E°_{Anode} = 0.15 - (-0.74)$

$E°_{cell} = +0.89 V$

(ii) What will be the value of standard Gibbs energy (ΔG°)?

(a) –650.3 kJ **(b)** –515.3 kJ
(c) –226.4 kJ **(d)** –406.8 kJ

Ans. Option (b) is correct.

$\Delta G° = -nFE°_{cell}$

$\Delta G° = -6 \times 96.500 \times 0.89$

$= -515310J = -515.310 kJ$

***43. Niobium crystallises in body centred cubic structure. Its density is 8.55g cm^{-3} and its atomic mass is 93g mol^{-1}. ($N_A = 6.023 \times 10^{23}$).**

(i) What is the edge length of the Niobium ?

(a) 314.50 pm **(b)** 330.56 pm
(c) 340.43 pm **(d)** 346.30 pm

(ii) What is the atomic radius of Niobium ?

(a) 136 pm **(b)** 140 pm
(c) 143 pm **(d)** 149 pm

44. 5 moles of sucrose (molecular mass = 342g mol^{-1}) dissolved in 1000g of water (molecular mass = 18g mol^{-1}). Vapour pressure of pure water at 298 K = 4.57 m Hg.

(i) What will be the vapour pressure of sucrose solution at the same temperature ?

(a) 0.419 mm Hg **(b)** 6.570 mm Hg
(c) 4.190 mm Hg **(d)** 0.657 mm Hg

Ans. Option (a) is correct.

According to Raoult's law

$$P_{solution} = P°_{solvent} \times X_{solvent}$$

$$= 4.57 \times \frac{\frac{1000}{18}}{\frac{1000}{18} + 5} = 0.419 \text{ mm of Hg}$$

(ii) What will be mole fraction of sucrose in water ?

(a) 0.8261 **(b)** 0.0826
(c) 0.4376 **(d)** 0.0435

Ans. Option (b) is correct.

Xsucrose = 5/((1000/18) +5)

= 0.0826

45. A solution containing 2g of anhydrous barium chloride in 400 cm^3 of water has a specific conductivity of 0.0058 S cm^{-1}. (at. wt. of Ba = 137, Cl = 35.5)

(i) What is the molarity of the above solution ?

(a) 0.204 M **(b)** 0.024 M
(c) 4.020 M **(d)** 4.021 M

Ans. Option (b) is correct.

Mass of $BaCl_2$ = 2 g

Molar mass of $BaCl_2$ = 137 + 2 × 35.5 = 208 g

Volume of solution = 400 cm^3 = 0.4 L

$$\text{Molarity(M)} = \frac{\text{mass of } BaCl_2}{\text{Molar mass of } BaCl_2 \times \text{volume in litres}}$$

$$\text{Molarity(M)} = \frac{2 \times 1000}{208 \times 400} = 0.024 M$$

(ii) What is the molar conductivity of the above solution ?

(a) 241.67 S cm^2/mol **(b)** 261.47 S cm^2/mol
(c) 247.17 S cm^2/mol **(d)** 361.47 S cm^2/mol

Ans. Option (a) is correct.

$$\text{Molar conductivity} = \frac{\kappa \times 1000}{M}$$

Conductivity (κ) = 0.0058 S cm^{-1}

Molar conductivity

$$= \frac{0.0058 \times 1000}{0.024} = 241.67 Scm^2/\text{mole}$$

46. Assertion : Nitration of chlorobenzene leads to the formation of m-nitro chlorobenzene.

Reason : Nitro (–NO_2) group is m-directing group.

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

Ans. Option (d) is correct.

The assertion is incorrect but the reason is correct as the chlorination of nitrobenzene (not the nitration of chlorobenzene) leads to the formation of *m*-nitrochlorobenzene because $-NO_2$ group deactivates the ring because it is meta directing. The reason is true that the NO_2 group is an *m*-directing group.

***47. Assertion : Copper obtained after bessemerisation is known as blister copper.**

Reason : Blisters are produced on the surface of the metal due to escaping of sulphur dioxide gas during cooling.

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

48. Assertion : Phenol reacts with neutral ferric chloride ($FeCl_3$) and gives violet colour solution.

Reason : The violet colour solution is due to the formation of $[Fe(OC_6H_5)_6]^{3-}$ complex ion.

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

Ans Option (a) is correct.

On reaction of phenol with neutral ferric chloride gives violet colour due to the formation of $Fe[OC_6H_5)_6]^{3-}$ complex ion.

***49. Assertion : Inter halogen compounds are more reactive than constituent halogens.**

Reason : Bond between two different halogens is stronger than the bond between two similar halogen atoms.

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

***50. Assertion : The minerals from which the metals are conveniently and economically extracted are called ores.**

Reason : All the metals can be extracted from their ores by one method.

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

■■

***Out of Syllabus**