

Answer key of Chemistry of 12std science

CHAROTAR ENGLISH MEDIUM SCHOOL, ANAND

FIRST INTERNAL EXAMINATION-2018

STD-12(Part-1)

TOTAL MARKS-100

TIME-3Hrs

SUB-CHEMISTRY

DATE -3rd Oct 2018

Multiple Choice Questions (Marks 1) :

(1)is an insulator in all conditions.

- (a) Fe (b) NaCl (c) SiO₂ (d) NH₃

Ans : (c)

(2) At what temperature, the entropy of a perfectly pure crystalline solid is zero?

- (a) -273°C (b) 0 K (c) - 459.4° F (d) All of these

Ans : (d)

$$-273^{\circ}\text{C} = 0 \text{ K}$$

$$0^{\circ}\text{F} = 1.8^{\circ}\text{C} + 32$$

$$= 1.8 (-273) + 32$$

$$= -459.4^{\circ}$$

(3) Which defect does not disturb the stoichiometry of the solid?

- (a) Intrinsic defect (b) Thermodynamic defect
(c) Stoichiometric defect (d) All of these

Ans : (d)

(4) There are approximately schottky defects in one mole of NaCl crystal at room temperature.

- (a) 10⁶ (b) 10⁴ (c) 10² (d) 10⁸

Ans : (a)

(5) In which defect, the density of crystal does not change?

- (a) Schottky (b) Frenkel (c) Vacancy (d) All of these

Ans : (b)

(6) When ZnO is heated, it appears ofcolour due to metal excess defect.

- (a) pink (b) yellow (c) violet (d) blue

Ans : (b)

(7) Conductance of metals depends on.....

(a) number of electrons in the valence shell. (b) electric charge.

(c) distance between nucleus of two atoms. (d) metallic bond

Ans : (a)

(8) The conductivity ofis like metal.

- (a) TiO₂ (b) CrO₂ (c) ReO₃ (d) All of these

Ans : (d)

(9) Pickup the correct formula of potash alum.

(a) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ (b) $K_2SO_4 \cdot Al_2(SO_4)_2 \cdot 24H_2O$

(c) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 12H_2O$ (d) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Ans : (a)

(10) Solubility of.....is less in ethanol.

(a) NH_3 (b) H_2 (c) N_2 (d) O_2

Ans : (a)

(11) Presently which content is used by sea divers?

(a) 11.7% He, 56% N_2 , 23.1% O_2 (b) 11.7% He, 56% N_2 , 32.1% O_2

(c) 11.7% N_2 , 56.2% O_2 , 32.1% He (d) 11.7% He, 56.2% N_2 , 32% O_2

Ans : (a)

(12) Which of the following is not substitution solid solution?

(a) Monal metal (b) steel (c) Tungston Carbide (d) none

Ans : (x)

(13) Which is correct for the ideal solution?

(a) $\Delta H = 0, \Delta V = 0$ (b) $\Delta H \neq 0, \Delta V \neq 0$

(c) $\Delta H = 0, \Delta V \neq 0$ (d) $\Delta H \neq 0, \Delta V = 0$

Ans : (c)

(14) Which statement is true for the solution prepared by adding salt (NaCl) to water?

(a) Freezing point increase, while boiling point decrease

(b) F.P and B.P both increase

(c) F.P and B.P both decrease

(d) Freezing point decrease, while boiling point increase

Ans : (d)

(15) Which one is a natural semi permeable membrane?

(a) Cell wall (b) Cello phane (c) Butter paper (d) All of these

Ans : (a)

(16) What is the value of emf for spontaneous redox reaction?

(a) Negative (b) Positive

(c) Zero (d) Negative or positive

Ans : (b)

(17) What will be the mole ratio of Cu, Ag and Al respectively, when 1 mole electrons passed through $CuSO_4$, $AgNO_3$ and $AlCl_3$ solution?

(a) 1 : 1 : 1 (b) 1 : 2 : 3 (c) 2 : 1 : 3 (d) 3 : 6 : 2

Ans : (d)

(18) How much current required to get $\frac{1}{2}$ mole 'Ni' metal from the $NiSO_4$ solution?

(a) 2F (b) 1F (c) 0.5F (d) 4F

Ans : (b)

(19) Which is the correct formula of 2nd law of Faraday?

(a) $W \propto Q$ (b) $W \propto \frac{1}{Q}$ (c) $W \propto Eq$ (d) $W \propto \frac{1}{Eq}$

Ans : (c)

(20) Pick the correct relation between Gibb's free energy and cell potential.

(a) $\Delta G^\circ = nFE^\circ_{\text{cell}}$

(b) $\Delta G^\circ = -nFE^\circ_{\text{cell}}$

(c) $K = \frac{\Delta G^\circ}{nFE^\circ_{\text{cell}}}$

(d) $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

Ans : (b)

(21) Ω^{-1} or Cm^{-1} is unit of

(a) Specific conductivity (conductance)

(b) Molar conductivity

(c) Resistance

(d) Equivalent conductance

Ans : (a)

(22) Which one is the ore of copper?

(a) Bauxite

(b) Malachite

(c) Siderite

(d) Calamine

Ans : (b)

(23) Which depressant is used in ore containing ZnS and PbS?

(a) NaCN

(b) $\text{Na}_2[\text{Zn}(\text{CN})_4]$

(c) Al_2O_3

(d) NaCl

Ans : (a)

(24) If the value of equilibrium constant is less than one than....

(a) more product is obtained

(b) less product is obtained

(c) equilibrium is established

(d) product cannot be obtained

Ans : (b)

(25) The graph of ΔG° versus T is known as...

(a) Ellingham diagrams

(b) Helmholtz diagrams

(c) Optimum diagrams

(d) Lechutelier's diagrams

Ans : (a)

(26) For which metals is mond carbonyl method of refining used?

(a) Ni

(b) Si

(c) Fe

(d) Al

Ans : (a)

(27) process is used for the higher grade of pyrite ores.

(a) Dry Metallurgical

(b) Wet Metallurgical

(c) Pyrometallurgical

(d) All of these

Ans : (a)

(28) How much oxygen is present in dry air?

(a) 20.946%

(b) 50%

(c) 2.0%

(d) 0.03 - 0.1%

Ans : (a)

(29) Which of the following is a neutral oxide?

(a) CO

(b) N_2O

(c) NO

(d) All of these

Ans : (d)

(30) Ozone possesses which color in gaseous form?

(a) Light blue

(b) Dark violet

(c) Dark blue

(d) None given

Ans : (a)

(31) Which form of sulphur is stable at room temperature?

(a) α -sulphur

(b) β -sulphur

(c) (a) and (b) both

(d) Mono clinic

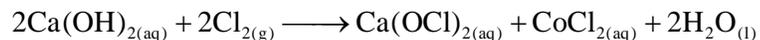
Ans : (a)

(32) Reaction of chlorine gas with which compound will give bleaching powder?

- (a) Ca(OH)_2 (b) CaO (c) CaCO_3 (d) None of these

Ans : (a)

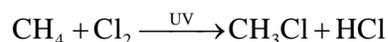
When dichlorine reacts with slaked lime it produces bleaching powder.



(33) Which hydrocarbon gives substituted product with Cl_2 gas?

- (a) Saturated (b) Unsaturated (c) Cyclic (d) All of these

Ans : (a)



(34) XeOF_4 possesses which structure?

- (a) Trigonal Pyramidal (b) Square pyramidal
(c) Square planar (d) Pentagonal bipyramidal

Ans : (b)

Multiple Choice Questions Competitive :

(35) What is the role of Fe(OH)_3 in the contact process?

- (a) To remove colloidal impurities (b) To remove moisture
(c) To remove dust particles (d) To remove impurities of Arsenic

Ans : (d)

(36) Which of the following compounds have O - O bonding?

- (a) $\text{H}_2\text{S}_2\text{O}_6$ (b) $\text{H}_2\text{S}_2\text{O}_8$ (c) $\text{H}_2\text{S}_2\text{O}_3$ (d) $\text{H}_2\text{S}_4\text{O}_6$

Ans : (b)

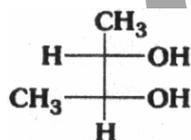
(37) Isopropyl chloride undergoes hydrolysis by... [AIPMT-2001]

- (A) $\text{S}_{\text{N}}1$ mechanism (B) $\text{S}_{\text{N}}2$ mechanism
(C) $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ mechanisms
(D) Neither $\text{S}_{\text{N}}1$ nor $\text{S}_{\text{N}}2$ mechanism

Ans : (C)

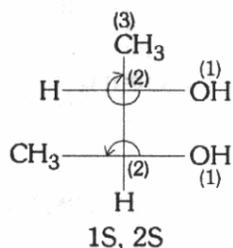
Isopropyl being 2° alkyl halide can undergo hydrolysis either by $\text{S}_{\text{N}}1$ or $\text{S}_{\text{N}}2$ reaction.

(38) The configuration of the following is...



- (A) 1S, 2S (B) 1S, 2R (C) 1R, 2S (D) 1R, 2R

Ans : (A)



Change R to S since H

i.e., atom of lowest priority is on horizontal axis.

(39) Phenol is....

- (A) strong base than ammonia (B) weak acid than carbonyl acid
 (C) strong acid than carbonyl acid (D) neutral compound

Ans : (B)

(40) What is C in the following reaction ?



- (A) Ethyl iodide (B) Ethane
 (C) Propane (D) Methyl ethyl ether

Ans : (D)

(41) Which reagent is used to distinguish phenol and benzoic acid ?

- (A) Neutral FeCl_3 (B) Aq. NaOH
 (C) Tollen's reagent (D) Schiff's reagent

Ans : (A)

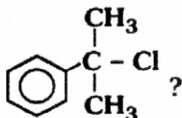
Multiple Choice Questions Text Book (Marks 1) :

(42) Which one is Allylic halide ?

- (A) $\text{CH}_2 = \text{CH} - \text{CH}_2\text{Cl}$ (B) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_2\text{Cl}$
 (C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ (D) $\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\ | \\ \text{Cl} \end{array}$

Ans : (A)

(43) What is the IUPAC name of



- (A) (1-chloroethyl) benzene (B) (1-chloro-1-methyl ethyl) benzene
 (C) (1-methyl ethyl) benzyl chloride (D) Benzylic chloride

Ans : (B)

(44) The reaction of alcohol with which reagent produce haloalkane ?

- (A) $\text{NaX} + \text{H}_2\text{SO}_4$ (B) PX_3 (C) SOCl_2 (D) All of these

Ans : (D)

(45) Toluene is obtained by reaction of mixture of chlorobenzene and methyl chloride with Na metal in dry ether. This reaction is called....

- (A) Wurtz fittig reaction (B) Fittig reaction
 (C) Grignard reaction (D) Friedel crafts reaction

Ans : (A)

(46) What is used under the name of pyrene for extinguishing the fire in substances like oil, fat and petrol ?

- (A) CHCl_3 (B) CH_2Cl_2 (C) CHI_3 (D) CCl_4

Ans : (D)

(47) $\text{R-CH}_2\text{OH} \xrightarrow[\text{CH}_2\text{Cl}_2]{\text{PCC} \begin{matrix} \text{[O]} \\ \text{---} \end{matrix}}$ X, what is X ?

- (A) R-COOH (B) R-CHO (C) R-CO-H (D) R-O-H

Ans : (B)

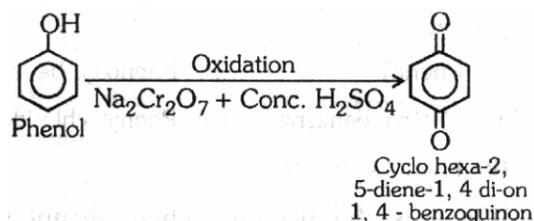


1° - Alcohol Aldehyde

(48) Which is the product when phenol is oxidised with chromic acid ($\text{Na}_2\text{Cr}_2\text{O}_7 + \text{Conc. H}_2\text{SO}_4$) ?

- (A) 1, 4 benzoquinon (B) Resorcinol
 (C) Benzoyl chloride (D) Hydro quinine

Ans : (A)



(49) Anisole is of which type ether ?

- (A) Symmetrical (B) Asymmetrical
 (C) Mix (D) (B) and (C) both

Ans : (D)

(50) Chemically salol is known as-

- (A) Acetyl salicylic acid (B) Sodium salicylate
 (C) Methyl salicylate (D) Phenyl salicylate

Ans : (D)

Answer as required. [2 marks]

(1) Give reason: The boiling point of a solution is higher than that of the pure solvent.

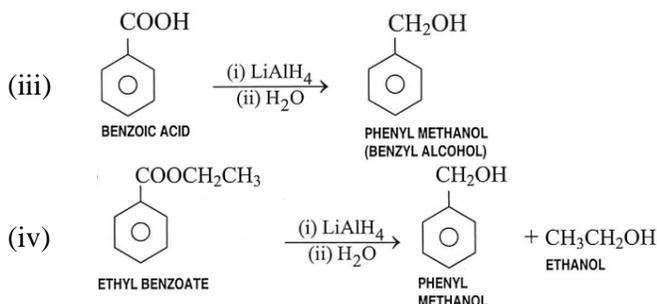
Ans : ➤ At 373 K (373.15 K) temperature vapour pressure of pure water becomes equal to 1 bar and hence it starts boiling.

➤ If a solution is prepared by using a non-volatile solute like sugar in water, vapour pressure of the solution decreases. Vapour pressure increasing the temperature. So, to raise its vapour pressure equal to 1 bar, the solution is required to be heated. Thus, boiling point of a solution is higher than that of the pure solvent.

(2) The ring of silver has fallen into the solution of an acid. Will there be reason to worry? Why?

Ans : ➤ No, there is nothing to worry about as Ag will not react with the acid under normal conditions :

➤ Reduction potential of Ag ($E_{\text{Ag}^+|\text{Ag}}^0 = +0.80\text{V}$) is greater than that of H_2 ($E_{\text{H}^+|\text{H}}^0 = 0.0\text{V}$)



(6) Write note on SN^2 reaction.

Ans : ➤ **Bimolecular Nucleophilic Substitution Reaction (SN^2)** :



➤ The reaction of chloromethane with :OH^- ion is second order nucleophilic substitution reaction. Here, the rate of reaction depends on both the reactants (CH_3Cl and OH^-) and so it is second order reaction.

$$\begin{aligned} \text{Rate of reaction} &\propto [\text{CH}_3\text{Cl}][\text{OH}^-] \\ &= K[\text{CH}_3\text{Cl}][\text{OH}^-] \end{aligned}$$

➤ **Mechanism:** Scientist Edward Davies, Hughes and Christopher Ingold proposed the reaction mechanism as follows:

➤ Here, as :OH^- approaches to CH_3Cl molecule from backside i.e. side opposite to bulky Cl atom. C-Cl bond partially breaks and C-OH bond is partially formed, and transition state is obtained. In transition state C-OH bond is not formed completely and C-Cl bond is not broken completely. At this time all the three H atoms with carbon are arranged in one plane only. Hybridisation of carbon changes from sp^3 to sp^2 . Next, Cl atom is completely released as :Cl^- ion and OH^- is completely combined with carbon and hybridization of carbon again becomes sp^3 . Here, in the product, the spatial arrangement is totally in opposite direction then the spatial arrangement of reactant.

➤ The rate of SN^2 reaction depends on concentration of both substrate and nucleophilic reagent.

➤ i.e. Rate of reaction = $K[S]^1[Nu]^{-1}$

➤ where, S = substrate, Nu^- = Nucleophilic reagent.

➤ Hence, SN^2 reaction is a second order reaction.

(7) Explain giving example how molal elevation in boiling point is a colligative property.

Ans : ➤ If 342 g sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$), 60 g urea (NH_2CONH_2) and 180 g glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) each is dissolved in 100 g of water, one molal solution of each is prepared.

➤ If these solutions are boiled, increase in the boiling point of all the three solutions will be the same. All the three solutions contain the same number of molecules (particles). This observation indicates that increase (elevation) in boiling point depends upon the number of molecules (particles) and not on the nature of the solute. Thus molal elevation in boiling point is a colligative property.

(8) Give the consequences of Metal Excess Defect?

Ans : ➤ Consequences of metal excess defect :

(i) The crystals with metal excess defect conduct electricity due to the presence of free e^- . However this conductivity is very low. Because of low conductivity compared to metals, they behave as semiconductors. These compounds are called n-type semiconductors as the current is carried by (negative) electrons in the normal way.

(ii) Crystals with metal excess defects are generally colored. E.g. Non-stoichiometric NaCl is yellow, KCl violet and LiCl pink.

Answer the following [3 marks]

(9) 0.75 g unknown substance is dissolved in 200 g water and solution is prepared. If the elevation in boiling point is 0.15 K and molal elevation constant is $7.5 \text{ K kg mole}^{-1}$, then find the molar mass of the unknown substance.

$$\begin{aligned} \text{Ans: } \therefore M_2 &= \frac{K_b \times 1000 \times W_2}{\Delta T_b \times W_1} \\ &= \frac{7.5 \times 1000 \times 0.75}{0.15 \times 200} = 187.5 \text{ g/mole} \end{aligned}$$

➤ Where, $K_b = 7.5 \text{ K kg mole}^{-1}$

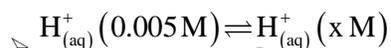
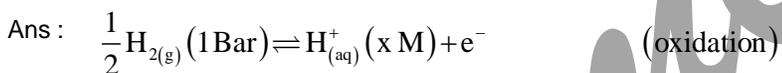
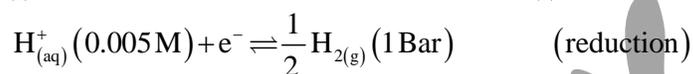
$$W_2 = 0.75 \text{ g}$$

$$W_1 = 200 \text{ g}$$

$$\Delta T_b = 0.15 \text{ K}$$

➤ \therefore The molar mass of the unknown substance will be 187.5 g/mole.

(10) Potential of the following cell is 0.53 volt. Calculate the ionic product of water (K_w).



The change only in the concentration of (x M)

$$\therefore E_{\text{cell}}^0 = 0.0 \text{ Volt for this cell.}$$

The concentration of OH^- ions 0.002 M KOH solution is 0.002 M.

In only aqueous solution H^+ and OH^- ions always present due to presence of water and the product of their concentration is equal to K_w .

$$\text{i.e. } [\text{H}^+] [\text{OH}^-] = K_w, \text{ but } [\text{OH}^-] = 0.002 \text{ M}$$

$$\therefore [\text{H}^+] \text{ in KOH solution} = \frac{K_w}{0.002}$$

According to Nernst equation,

$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.059}{n} \log \frac{[\text{H}^+] \text{ in KOH solution}}{[\text{H}^+] \text{ in HCl solution}}$$

$$\therefore 0.53 = 0.0 - \frac{0.059}{1} \times \log \frac{K_w}{0.002 \times 0.005} \quad (n = 1)$$

$$\therefore \frac{0.53}{0.059} = -\log \frac{K_w}{0.002 \times 0.005}$$

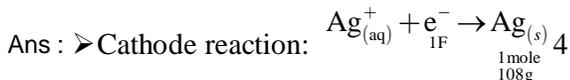
$$8.983 = -\log \frac{K_w}{10^{-5}} = -\log K_w - 5$$

$$\therefore \log K_w = -5 - 8.983 = -13.983 = \overline{14.017}$$

$$\therefore K_w = AL \overline{14.0.17} = 1.04 \times 10^{-14}$$

OR

If 1.08 gram silver is deposited on the cathode when 7.5 ampere current is passed through aqueous solution of AgNO₃ for 200 seconds. Calculate the efficiency of the cell.



∴ Theoretically 0.01554 F liberated 0.01554 mole Ag.

➤ Theoretically weight of Ag = n × Atomic Weight
= 0.01554 × 108
= 1.678 g

➤ Cell efficient = $\frac{\text{Experimental mass}}{\text{Theoretically mass}} \times 100$
= $\frac{1.08}{1.678} \times 100 = 64.36\%$

(11) Write a detailed note on energy gap, conduction band and valance band. OR

Explain band theory about conductivity in solid substances. OR

What is band theory explaining conductivity?

Ans : ➤ Band theory in metals : According to band theory, there are two bands in a metal or substance. One band is called valence band in which the valence electrons are present. The second band is over this valence band and it is called conduction band. The space between these two bands is called Energy Gap.

➤ The distance of this energy gap is the most important aspect for the electrons of valence band to go to conduction band.

➤ As the energy gap is very less in metals, electrons can easily go to conduction band from valence band. So, conduction of electricity in metals is very easy. Thus metals are called good conductors.

➤ In some substances the distance of the energy gap is more. So in normal condition, e⁻ from valence band cannot go to conduction band and conduction of electricity does not occur. Such substances are called non-conductors. Non-metals are mostly non-conductors.

(12) Describe the industrial production of Sulphuric acid by contact process. (

Ans : ➤ Contact process of manufacturing H₂SO₄ involves the following three ateps:

(i) To obtain SO₂ by burning of sulphur or sulphide ore in presence of air.

(ii) Oxidation of SO₂ to SO₃ using catalyst V₂O₅. This is an important step. This is the key step in the manufacture of H₂SO₄.

(iii) Absorption of SO₃ in conc. H₂SO₄ to get fuming sulphuric acid or oleum - H₂S₂O₇.

➤ 1st Step: Generation of SO₂:

(i) Sulphur or sulphide mineral is combusted in presence of air to get SO₂.



Mineral

➤ 2nd Step: Oxidation of SO₂ to SO₃:

(ii) This is a very important step. In the second step before oxidation of SO₂ to SO₃, the sulphur dioxide obtained from the first step, is purified. SO₂ contains impurities of arsenic compounds (particularly from pyrites burning), dust particles and other gases. These impurities are removed completely before oxidation

of SO₂. Arsenic impurities are removed by gelatinous hydrated ferric oxide kept in arsenic purifier.

➤ The purified SO₂ is oxidized in catalytic converter in presence of catalyst V₂O₅



➤ This reaction is exothermic. The volume of the system decreases in the forward reaction (2 + 1 → 2 moles). Hence according to Le Chatelier's principle, low temperature and high pressure are required to obtain more product.

➤ But by decreasing the temperature very low, the rate of oxidation reaction decreases.

➤ In practice the reaction is carried out at 2 bar pressure and 720 K temperature along with the catalyst V₂O₅.

➤ 3rd Step: Absorption of SO₃ in conc. H₂SO₄.

(iii) SO₃ obtained from catalytic converter is absorbed in conc. H₂SO₄. SO_{3(g)} meets descending stream of conc. H₂SO₄ as a result fuming sulphuric acid or oleum (H₂S₂O₇) is obtained.



➤ H₂SO₄ of desired concentration can be obtained by dilution of oleum with water.



➤ 96-98% pure H₂SO₄ can be obtained by contact process.

(13) Give following electrophilic reactions of chlorobenzene: (i) Sulphonation (ii) Friedel - craft's alkylation (iii) Friedel - craft's acylation.

Ans : ➤ **Electrophilic substitution reactions of chlorobenzene:**

(i) Sulphonation:

(ii) Friedel - Crafts Alkylation:

(iii) Friedel - Crafts Acylation:

(14) Explain with scientific reason.

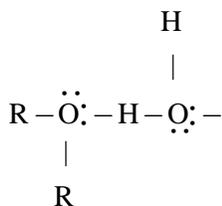
(1) Ethers have lower boiling points than corresponding alcohols having same molecular mass.

(2) Solubilities of ethers in water are similar to those of alcohols with same molecular mass.

Ans : (1) Compared to alcohols ethers have lower boiling points because in ethers, intermolecular hydrogen bonds are not present, whereas in alcohols due to intermolecular hydrogen bonding intermolecular attraction is strong. As a result, their boiling points are higher as compared to corresponding ethers having similar molecular masses.

➤ e.g. b. pt of methoxy methane (molar mass = 46g. mole⁻¹, b. pt = 248 K) is lower than that of ethanol (molar mass = 46g. mole⁻¹, b. pt = 351 K)

(2)



- Like alcohol, ether forms intermolecular H - bond with molecule of water. Therefore, solubilities of ether in water are similar to those of alcohols with the same molecular mass.
- e.g. Same molecular mass containing butan - 1 - ol and methoxy ethane have same solubility in water, which is approximately 8 g/100 g water.

Answer the following for four marks

(15) Explain Dissociation and Association.

Ans : ➤ **Dissociation:** when the polar solute is dissolved in polar solvent, the solute ionises into ions and the number of particles in the solution increases e.g. if NaCl, K₂SO₄, FeCl₃ and Fe₂(SO₄)₃ are dissolved in water, they ionize to produce respectively 2, 3, 4 and 5 ions (particles) from their molecules. This is called dissociation.

- Due to dissociation, molar mass calculated experimentally is less than the real molar mass.
- **Association :** When dissolved in solvent, two or more molecules of some solute combine to form associated molecules. As a result, the number of particles in the solution decreases. This is called association e.g. when dissolved in benzene two molecules of acetic acid or benzenic acid combine to form associated molecules.
- Due to association, molar mass calculated experimentally is more than the real molar mass.

Explain abnormal molar mass.

Ans : ➤ When the solute undergoes dissociation or association in the solvent, the number of particles changes i.e. increases or decreases respectively. E.g. two molecules of benzoic acid dissolved in benzene produce one associated molecule (particle) whereas Fe₂(SO₄)₃ molecule in water will get dissociated to produce five ions (particles). As a result, molar mass calculated experimentally on the basis of colligative properties will be different from the expected or theoretical (i.e. real or normal) value of molar mass. Such molar mass experimentally calculated is called abnormal molar mass.

- Due to association, the number of particles decrease and the molar mass experimentally determined is greater than the real (theoretical) molar mass.
- Due to dissociation, the number of particles increase and the molar mass experimentally determined is less than the real (theoretical or normal) molar mass.
- Colligative properties apply to only dilute solutions. As concentrated solution contains large number of molecules, they are very close to one another. As a result, they exert appreciable molecular attractive force. So, real molar mass cannot be obtained, on the basis of colligative properties and abnormal molar mass is obtained.

OR

The depression in freezing point observed is 0.3 K, when 2 g FeCl₃ is dissolved in 0.2 litre water. Find the Van't Hoff factor. The molal elevation constant for solvent is 1.5 K kg mole⁻¹.

Ans : ➤ 0.2 litre water = 200 ml water.

- As density of water is 1g/ml, its weight will be 200 g.
- Experimental molar mass of FeCl₃,

$$M_2 = \frac{K_f \cdot 1000 \times W_2}{\Delta T_f \cdot W_1}$$

$$= \frac{1.5 \times 1000 \times 2}{0.3 \times 200}$$

= 50 g/mole - Experimental molar mass of FeCl₃

- Where,
- $K_f = 1.5 \text{ K kg mole}^{-1}$
- $\Delta T_f = 0.3 \text{ K}$
- $W_1 = 200 \text{ g}$
- $W_2 = 2 \text{ g}$
- $M_2 = ?$
- Theoretical molar mass of FeCl₃ = 56 + 3(35.5) = 162.5 g/mole
- Van't Hoff factor (i) = $\frac{\text{Theoretical molar mass of FeCl}_3}{\text{Experimental molar mass of FeCl}_3}$

$$= \frac{162.5}{50} = 3.25$$

(16) What is electrolysis? Explain electrolysis of aqueous solution of CuSO₄ between electrodes.

Ans : ➤ Electrolysis is a phenomenon in which electrical energy is converted into chemical energy by a non-spontaneous redox reaction.

➤ Oxidation of SO₄²⁻ ions in the solution is difficult compared to oxidation of H₂O at anode. Hence, water instead of SO₄²⁻ ions is oxidized and O₂ and H⁺ ions are produced at anode. Cu²⁺ ions are reduced to copper metal at cathode.

➤ The following reactions take place :

➤ Cathode (graphite): $\text{Cu}_{(\text{aq})}^{2+} + 2e^- \rightarrow \text{Cu}_{(\text{s})}$ (Reduction)

➤ Anode (Graphite) : $\text{H}_2\text{O}_{(\text{l})} \rightarrow 2\text{H}_{(\text{aq})}^+ + \frac{1}{2}\text{O}_{2(\text{g})} + 2e^-$ (Oxidation)

➤ As H⁺ are produced due to anodic oxidation and SO₄²⁻ ions are already present in the solution, H₂SO₄ is formed in the solution.

Explain electrolysis of molten NaCl.

Ans : ➤ When molten NaCl is electrolysed using cathode of steel and anode of graphite, the following reactions occur and Na metal and Cl₂ gas are obtained at cathode and anode respectively.

$\text{NaCl}_{(\text{l})} \rightarrow \text{Na}_{(\text{l})}^+ + \text{Cl}_{(\text{l})}^-$ (Ionisation)

Cathode (Steel) : $\text{Na}_{(\text{l})}^+ + e^- \rightarrow \text{Na}_{(\text{s})}$ (Reduction)

Anode (Graphite) : $\text{Cl}_{(\text{l})}^- \rightarrow \frac{1}{2}\text{Cl}_{2(\text{g})} + e^-$ (Oxidation)

➤ Thus, Na⁺ ions are reduced to Na metal at cathode and Cl⁻ ions are oxidized to Cl₂ gas at anode.

(17) Explain Anomalous behavior of the oxygen that distinguishes it from the rest of the members of group - 16.

Ans : ➤ Anomalous behavior of oxygen:

- (1) Oxygen is a gas while other members are solids at room temperature.
- (2) O₂ exists as diatomic molecules, the others in the group exist as polyatomic molecules. (e.g. S₈ and Se₈).
- (3) O₂ is purely non-metal, with increase in atomic number, metallic property increases.
- (4) Oxygen does not have d-orbitals in the valence shell. Hence, it shows only lower oxidation states

(-2, -1, +1, +2).

➤ In other members of the group, d- orbitals are available. Expansion of valence shell is possible. Hence they show higher oxidation states (-2, 2, 4, 6).

(5) Because of small size and high electronegativity, oxygen forms strong H - bond with H - atom of water. (This results in abnormally high boiling point of water). Such phenomenon is not observed in H₂S.

(18) Explain Wurtz - Fittig reaction of chlorobenzene.

Ans : ➤ **Wurtz - Fittig reaction:** Toluene is obtained by reaction of mixture of chlorobenzene and methyl chloride with sodium metal in dry ether. This reaction is called Wurtz - Fittig reaction.

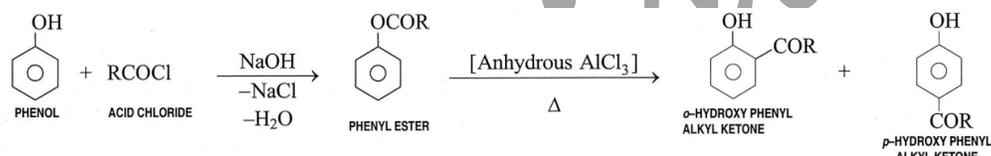
➤ Similarly ethyl benzene is obtained by reacting chlorobenzene with ethyl chloride in the presence of sodium metal in dry ether.

Write a short note on 'Fries rearrangement'.

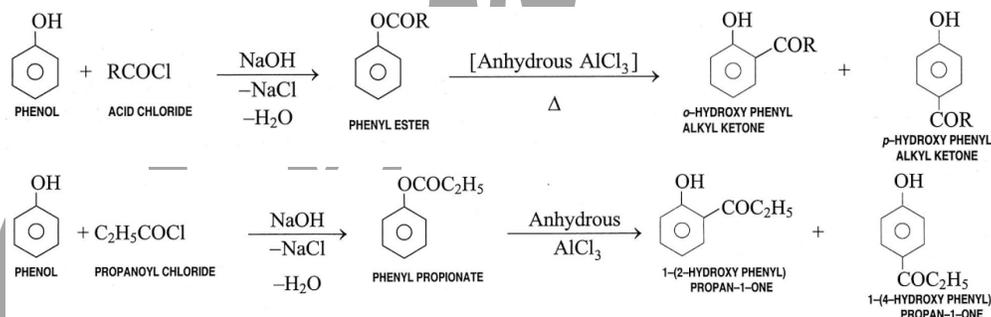
Ans : ➤ **Fries rearrangement:** The rearrangement reaction in which o - acetyl group present in phenol migrates to ortho and para positions in presence of anhydrous AlCl₃ to give a mixture of phenolic ketones is called Fries rearrangement.

➤ For this, first phenol is reacted with acid chloride or acid chloride or acid anhydride to form phenyl ester. On heating it with anhydrous AlCl₃, acyl group (-COR) attached with phenolic oxygen is migrated at its ortho and para position in aromatic nucleus.

➤ i.e.



➤ e.g.



Write a short note on 'Reimer - Tiemann reaction'.

Ans : ➤ **Reimer - Tiemann reaction:** When solution in aqueous NaOH is heated in presence of chloroform, the aldehyde group enter in phenol at ortho position producing salicylaldehyde. This reaction is called Reimer - Tiemann reaction.

➤ In this reaction substituted dichlorophenyl methane (benzal chloride) is produced as an intermediate compound which is then hydrolysed in alkaline medium to produce 2 - hydroxyl benzaldehyde (salicylaldehyde).

