Code Number: **A**

Corp.Office: Aakash Educational Services Limited, 3rd Floor, IncuspazeCampus-2,
PlotNo.13, Sector- 18, Udyog Vihar, Gurugram, Haryana - 122015

Time:3 hrs. **Mock Test Paper for Class-XII** **Max.Marks: 60**

CHEMISTRY

Answers & Solutions

1. Raoult's law states that "At a given temperature the relative lowering of vapour pressure of a dilute solution containing non-volatile solute is equal to the mole fraction of solute" in the solution.

$P^0 - P_2/P^0 = X_2$, where P^0 = vapour pressure of pure solvent.

P_2 = vapour pressure of solution of non volatile solute, X_2 = mole fraction of solute.

$P^0 - P_2/P^0 = w/m \times M/W$

Limitations:

(i) It is applicable to dilute solution only

(ii) The solute must be non-volatile

(iii) Solute must not involve in either dissociation or association

2. **Primary battery:** The battery which is not previously charged up from an external source of current, but gives the electrical energy by the redox reaction of electrolyte is called primary cell (or) battery.

Eg: Leclanche cell or Dry cell, Mercury cell

3.

Metal	Ore	Formula
Aluminum	Bauxite Gibbsite	$Al_2O_3, 2H_2O$ $Al_2O_3, 3H_2O$
Zinc	Zinc blende Zincite	ZnS ZnO
Iron	Haematite Magnetite	Fe_2O_3 Fe_3O_4
Copper	Cuprite Copper glance	Cu_2O Cu_2S

4. The two N atoms in N_2 are bonded to each other by very strong triple covalent bonds (N≡N). Hence the bond dissociation enthalpy is very high (945 kJ/mol). As a result N_2 is less reactive and highly stable at room temperature.

5. SO_2 removes excess chlorine from fabric after bleaching. Hence SO_2 is used as an antichlor.

$Cl_2 + SO_2 + 2H_2O \rightarrow 2HCl + H_2SO_4$

6. A ligand which contains two or more donor atoms but only one atom forms coordinate covalent bond with central atom (or) ion is called an “ambidentate ligand”.

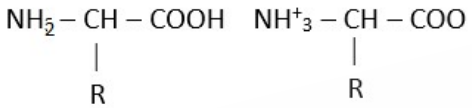
7. Chemical compounds which neutralize the excess acid in stomach and maintains pH to normal level are called antacids.

8. Antiseptics are chemical compounds that kill or inhibit the growth of micro-organism and are applied to living tissues like wound or cuts etc. Eg : Dettol, bithionol, tincture of iodine.

9. The mixture of triethyl aluminum and titanium tetrachloride is known as Zieglar-Natta catalyst ($TiCl_4 + Al(C_2H_5)_3$). It is used in the polymerization of ethene (or) ethylene.

10. The ion which carries positive charge at one end and negative charge on the other end is called Zwitter ion.

In aqueous solution of amino acids. -COOH group transfers a proton to $-NH_2$ group and gives zwitter ion.



Zwitter ion

11. Semiconductors are of two types. They are n-type semiconductors and p-type semi-conductors.

n-type semiconductors:

1) The semiconductors in which majority charge carries are electrons are known as n-type semiconductors.
2) These are obtained by addition of small amount of VA-group element (P, As or Sb) to pure Si or Ge.
3) When P or As is added to Si or Ge, some of the Si or Ge atoms in the crystal are replaced by P or As atoms.
4) Four out of five electrons of P or As atom, will be used for bonding with Si or Ge atoms while the fifth electron involves in the electrical conductivity.

p-type semiconductors:

1) The semiconductors in which majority charge carries are holes are known as p-type semiconductors.
2) These are obtained by addition of small amount IIIA group element (B, Al, Ga or In) to pure Si or Ge.
3) When B or Al is added to pure Si or Ge atoms, some of the Si or Ge in the crystal are replaced by B or Al atoms.
4) Three electrons of B or Al atom will be used for bonding with Si or Ge atoms while the fourth is missing and is the electron vacancy (hole) serve to conduct electricity.
5) The conductivity of these semiconductors is due to the migration of positive hole from one atom to other.

12. (a) Molar mass of $C_2H_4O_2$ (GMW) = 12 x 2 + 1x4 + 16x2 = 60 g mol^{-1}

Wt. of solute (W_2) – 2.5 g, Wt. of solvent (W_1) = 75 g

Molality (m) = $\frac{Weigh\ \ of\ solute}{\text{Molar mass of solute}}$ x $\frac{1000}{\text{Wt.of solvent m gm}}$ = $\frac{2.5}{60} x \frac{1000}{75}$ = 0.556 m

(b) Weight of solute (w) = 5 g

Molar mass NaOH (GMW) = 40g, Volume of solution (v) = 450 ml

Molality (M) = $\frac{Weigh\ \ of\ solute}{\text{Molar mass of solute}}$ x $\frac{1000}{\text{Volume of solution in ml}}$

Molarity (M) = = $\frac{5}{40} x \frac{1000}{450} = 0.278\ M$

13. A catalyst is the substance that increases the rate of chemical reaction by without consumed in the reaction. This phenomenon is known as catalysis.

Catalysis can be classified into two types. These are :

(i) **Homogeneous catalysts:** The catalysis in which the catalyst and the reactants are present in the same phase (state) is known as homogeneous catalysis.

Eg : (a) Conversion of carbon monoxide to carbon dioxide in presence of NO.

$$2CO(g) + O_2(g) \xrightarrow{NO(g)} 2CO_2(g)$$

(b) Catalytic oxidation of SO_2 and SO_3 in presence of oxides of nitrogen.

$$SO_{2(g)} + O_{2(g)} + \xrightarrow{NO(g)} 2SO_{3(g)}$$

(ii) Heterogeneous catalysis: The catalysis in which the catalyst and the reactants are present in different phases (states) is known as heterogeneous catalysis.

Eg : (a) In Haber's process, 'iron' is used as catalyst

$$N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2NH_3(g)$$

(b) In contact process, platinum (or) vanadium pentoxide is used as a catalyst

$$2SO_2(g) + O_2(g) \xrightarrow[V_2O_5]{Pt_{(s)}\ or} 2SO_3(g)$$

14. Froth floatation process :

1) This method is based on the preferential wetting properties with the frothing agent and water.
2) This process is mainly used to concentrate low grade sulphide ores.
3) The finely powdered ore is added to water containing pine oil (as frothing agent) and taken in a tank. To this, sodium ethyl xanthate (collecting agent) is added. Cresols and aniline are also added which act as froth stabilizers.
4) Froth is formed when the suspension is agitated by bubbling air through it
5) A vigorous stream of air passing agitates the mixture.
6) Sulphide ore particles adhere to the froth and gangue particles settle down at the bottom of tank.
7) The principle of this process is that the mineral particles are wetted by oils and gangue particles by water.
8) The substance like lime, Na_2CO_3 are added which help the froth to float. Froth is light and skimmed off.
9) Finally, the froth is allowed to collapse and dried to recover particles.

Eg: Copper pyrites, iron pyrites, zinc blende (ZnS), Galena (PbS) are concentrated by the process.

15. The important postulates of Werner's theory are:

1) In coordination compounds, the metal atom exhibit two types of valencies

(a) Primary valency and (b) Secondary valency

Primary valency	Secondary Valency
1) It is equal to oxidation number of central metal atom/ion	1) It is equal to coordination number of central metal atom/ ion
2) It is denoted by dotted line (….)	2) It is denoted by thick line (_____)
3) It is satisfied by negative ions	3) It is satisfied by negative ions or neutral molecules
4) It is ionizable	4) It is non-ionisable
5) It cannot predict the geometry	5) It can predict the geometry

Some ligands satisfy both primary and secondary valency of a metal. They are also not ionizable. The central metal atom/ion along with ligands is written in a square bracket which is called ionizable ions which satisfy 1° valency ae written outside the square bracket.

Examples

(a) $CoCl_3$, $6NH_3$:

1) Primary valency of cobalt is 3, it is satisfied $3Cl^-$ ions
2) Secondary valency of cobalt is 6. It is satisfied by $6NH_3$ molecules
3) Shape of complex is octahedral
4) Its aqueous solution gives 4 ions
5) It gives 3 moles of AgCl with $AgNO_3$ solution

(b) $COCl_3$ $5NH_3$:

1) Primary valency of cobalt is 3. It is satisfied $3Cl^-$ ions.
2) Secondary valency of cobalt is 6
3) It is satisfied by $5NH_3$ molecules and one Cl^- ion
4) Shape of complex is octahedral
5) Its aqueous solution gives 3 ions.
6) It gives 2 moles of AgCl ppt with $AgNO_3$ solution

(c) $CoCl_3$, $4NH_3$:

1) Primary valency of cobalt is 3. It is satisfied $3\,Cl^{-}$ ions
2) Secondary valency of cobalt is 6.
3) It is satisfied by $4NH_3$ molecules and $2\,Cl^-$ ions.
4) Shape of complex is octahedral
5) It aqueous solution gives 2 ions

6) It gives one mole of AgCl ppt. with $AgNO_3$ solution.

(d) $CoCl_3, 3NH_3$:

1) Primary valency of cobalt is 3. It is satisfied $3\,Cl^-$ ions.

2) Secondary valency of cobalt is 6

3) It is satisfied by $3NH_3$ molecules and $3\,Cl^-$ ions

4) Shape of complex is octahedral

5) Its aqueous solution contains one particle only

6) No AgCl ppt. formation with $AgNO_3$

16. 1) Polyvinyl chloride – Monomer is vinyl chloride ($CH_2 = CH - Cl$)

2) Teflon – Monomer is tetrafluoroethylene ($CF_2 = CF_2$)

3) Bakelite – Monometers are (i) Phenol (C_6H_5OH) and (ii) Formaldehyde

$$\left(H - \underset{\underset{O}{||}}{C} - H\right)$$

4) Polystyrene – Monomer is styrene or vinyl benzene $CH_2 = CH - C_6H_5$

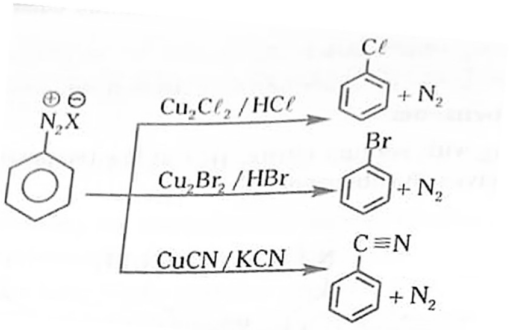
17. Sources and deficiencies of fat-soluble vitamins

Name of the vitamin	**Source**	**Deficiency diseases**
Vitamin A (Retinol)	Fish liver oil, carrots, butter and milk	Night blindness, Xerophthalmia (hardening of cornea of eye)
Vitamin D (Calciferol)	Exposure to sun light, fish and egg yolk	Rickets in children (bow legs) Osteomalacia in adults (soft bones and joint pain in adults)
Vitamin E (Tocoferol derivative)	Vegetable oils like wheat germ oil, sunflower oil etc.	Muscular weakness, increased fragility of RBCs
Phyllo quinone	Green leaf vegetables	Vitamin K (Anti haemorrhagic)

18. (i) Sandmeyer reaction:

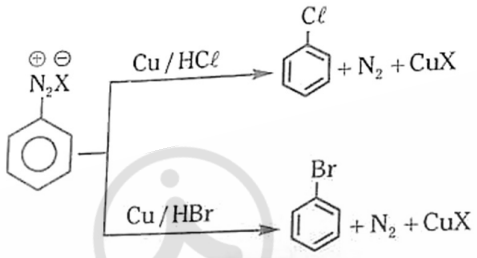
Benzene diazonium halide reacts with cuprous halides (or) cyanides forms halo benzene (or) cyano benzene.

The neucleophiles like Cl^-, Br^- and CN^- can easily be introduced in the benzene ring in the presence of Cu(I) ion. This reaction is called Sandmeyer reaction.



(ii) Gattermann reactions :

The chlorine or bromine can be introduced in the benzene ring by treating the diazonium salt solution with corresponding halogen acid in the presence of copper powder. This reaction is called as Gattermann reaction.



19. **(a)** **Galvanic cell:** The electrochemical cell which converts chemical energy into electrical energy by spontaneous redox reaction is called as Galvanic cell.

Eg: Daniel cell

Construction and working:

i) Daniel cell consists of two half cells
(a) Anode half cell (b) Cathode half cell

ii) The two half cells are connected by a salt bridge containing a saturated solution of KNO_3 in agar-agar gel.

iii) The anode half cell consists of zinc rod dipped in $ZnSO_4$ solution and the cathode half cell consists of a copper plate dipped in $CuSO_4$ solution.

iv) When the two half cells are connected externally through a voltmeter, current flows out from the cell due to potential difference

v) The reaction taking place are :

At anode : $Zn \rightarrow Zn^{+2} + 2e^-$ (oxidation)

At cathode : $Cu^{+2} + 2e^- \rightarrow Cu$ (reduction)

Net cell reaction :

$$Zn(s) + Cu^{+2}(aq) \rightleftharpoons Cu^{+2}(aq) + Cu(s)$$

vi) Galvanic cell is represented by $Zn_{(s)} / Zn^{2+}_{(aq)} || Cu^{2+}_{(aq)} / Cu_{(s)}$

vii) The e.m.f. of the cell is calculated by the following formula

$$E_{cell} = E^{\circ}_{cell} = \frac{0.059}{2} \log \frac{\left[Zn^{2+}\right]}{Cu^{2+}}$$

(b) Kohlrausch law :

i) The equivalent conductance at infinite dilution ($\wedge_\infty$) of an electrolyte is equal to the algebraic sum of the equivalent conductances (or) mobilities of the cation (λ^+_0) and the anion (λ^-_0)of the electrolyte at infinite dilution.

ii) Mathematically Kohlrausch law is written as $\wedge_0$ (electrolyte) = $\lambda^+_0 + \lambda^-_0$ (ions)

where λ^+_0 equivalent conductance of cation at infinite dilution.

λ^-_0 = equivalent conductance of anion at infinite dilution

$\wedge_0$ = equivalent conductance of an electrolyte at infinite dilution.

iii) The equivalent conductance of ion is directly proportional to the mobility of ion

$\therefore \lambda^+_0 \propto \mu^+_0$

$\lambda^+_0 = k\mu^+_0, \mu^+_0 = \lambda^+_0 / k$

Similarly $\lambda^-_0 \propto \mu^-_0$; $\lambda^-_0 = k\mu^-_0 = \lambda^-_0 / k$

$\therefore \lambda_0 = K(\mu^+_0 + \mu^-_0)$, where μ^+_0 and μ^-_0 are the mobilities of cation and anion

K = proportionally constant and its value is 96500 coulombs (Faraday)

$\therefore \mu^+_0 = \lambda^+_0 /F$, $\mu^-_0 = \lambda^-_0 /F$

20. **(a) Ostwald's Process**

On a large scale, nitric acid is prepared by Ostwald's process.

i) On catalytic oxidation of ammonia by atmospheric oxygen, nitric oxide is formed.

$$4NH_3(g) + 5O_2(g) \xrightarrow[500K\ ,9\ bar]{Pt/Rh\ gauge\ catalyst} 4NO(g) + 6H_2O(g)$$

ii) 'NO" is then oxidised to NO_2 by air

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$$

iii) NO_2 is dissolved in water in the presence of oxygen to get HNO_3.

$$3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO(g)$$

iv) Nitric acid is concentrated in three stages:

(a) The dilute HNO_3 is concentrated by distillation. Then **68% HNO_3** is obtained.

(b) This on dehydration with pure concentrated H_2SO_4 gives **98% HNO_3**.

(c) It is cooled in a freezing mixture to get crystals of **pure 100% HNO_3**.

Chemical Reactions

(a) Reaction with Copper:

Copper reacts with dilute nitric acid to form cupric nitrate and nitric oxide.

$$3Cu + 8HNO_3(dil) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$$

Copper reacts with concentrated nitric acid to form cupric nitrate and nitrogen dioxide.

$$Cu + 4HNO_3(conc) \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

(b) Reaction with Zinc:

Zinc reacts with dilute nitric acid to form zinc nitrate and nitrous oxide.

$$4Zn + 10HNO_3(dil) \rightarrow 4Zn(NO_3)_2 + 5H_2O + N_2O$$

Zinc reacts with concentrated nitric acid to form zinc nitrate and nitrogen dioxide.

$$Zn + 4HNO_3(conc) \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$$

(c) Reaction with S_8:

Sulphur reacts with nitric acid to form sulphuric acid and nitrogen dioxide.

$$S_8 + 48HNO_3 \rightarrow 8H_2SO_4 + 48NO_2 + 16H_2O$$

(d) Reaction with P_4:

Phosphorus reacts with nitric acid to form phosphoric acid and nitrogen dioxide.

$$P_4 + 20HNO_3 \rightarrow 4H_3PO_4 + 20NO_2 + 4H_2O$$

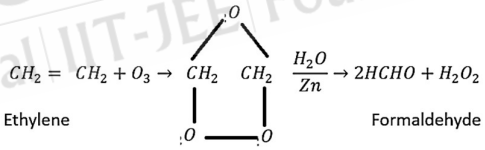
(b) Principle: When cold, dry stream of oxygen is subjected to silent electric discharge, oxygen is converted to ozone upto 10% only. The product is known as ozonised oxygen.

$$3O_2(g) \underset{\text{discharge}}{\overset{\text{Silent Electric}}{\rightleftharpoons}} 2O_3(g), \Delta H = +142 \text{ KJ / Mol.}$$

The formation of ozone is an endothermic process, so it is necessary to use silent electric discharge in its preparation to prevent decomposition of ozone. If concentration of ozone greater than 10% are required ozonisers are used.

Reaction of Ozone:

a) With ethylene (C_2H_4) : Ozone reacts with theylene to given ethylene ozonide which on hydrolysis in the presence of zinc dust to form formaldehyde.



b) Reaction with KI: Ozone oxidizes moist potassium iodide (KI) to Iodine (I_2)

$$2KI + H_2O + O_3 \rightarrow 2KOH + O_2 + I_2$$

c) Reaction with Hg : Ozone on reaction with mercury gives mercurous oxide.

$$2Hg + O_3 \rightarrow Hg_2O + O_2$$

d) Reaction with PbS : Ozone oxidizes black lead sulphide (PbS) to white lead sulphate ($PbSO_4$)

$$PbSO_4 \rightarrow 4O_3 \rightarrow PbSO_4 + 4O_2$$

e) Reaction with NO : Ozone oxidizes nitric oxide to nitrogen dioxide.

$$NO + O_3 \rightarrow NO_2 + O_2$$

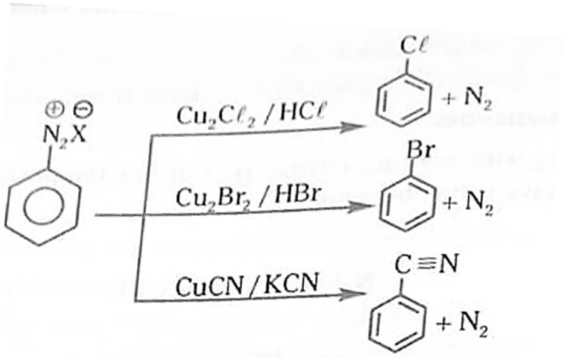
f) Reaction with Ag: Ozone oxidises silver metal to silver oxide (Ag metal is tarnished).

$$2Ag + O_3 \rightarrow Ag_2O + O_2$$

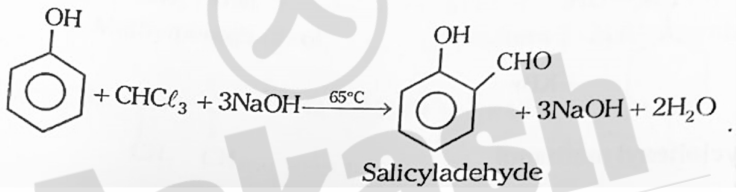
21. **(a)** **Sandmeyer reaction** :

Benzene diazonium halide reacts with cuprous halides (or) cyanides forms halo benzene (or) cyano benzene.

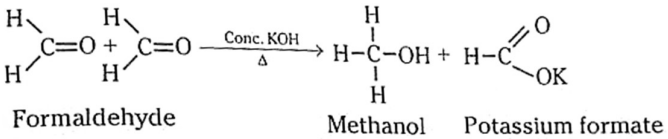
The neucleophiles like Cl^-, Br^- and CN^- can easily be introduced in the benzene ring in the presence of Cu(I) ion. This reaction is called sandimayer reaction.

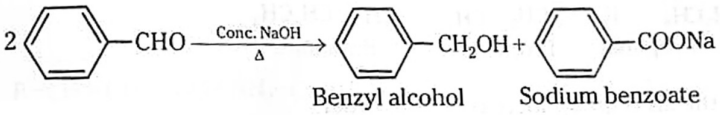


(b) **Reimer – Tiemann reaction :** Chloroform reacts with phenol in the presence of KOH (or) NaOH to form salicyaldehyde. This reaction is known as "Reimer-Tiemann reaction".



(c) **Cannizaro reaction :** Aldehydes which do not have an α- hydrogen atom, undergo self oxidation and reduction (dis-proportionation) reaction on heating with concentrated alkali. In this reaction, one molecule of the aldehyde is reduced to alcohol while another is oxidized to carboxylic acid salt





(d) **Decarboxylation:** Carboxylic aids lose carbon dioxide to form hydrocarbons when their sodium salts are heated with sodalime (NaOH and CaO in the ratio of 3:1). The reaction is known as decarboxylation.

$$R-COONa \xrightarrow[\text{Heat}]{\text{NaOH \& CaO}} R-H + Na_2CO_3$$

$$CH_3COONa + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$$