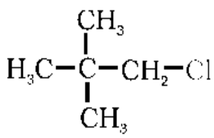
SAMPLE PAPER-02
CHEMISTRY (Theory)
Class – XII

Answers

1.



2. The overall density of a crystalline substance decreases due to Schottky defects.
3. Here, X atoms are at 8 corners, each shared by 8 cubes. Therefore,
   The number of X atoms in the unit cell is 8/8 = 1.
   Y atoms are at the centres of 6 faces and each face is shared by two cubes. Therefore,
   The number of Y atoms = 6/2 = 3.
   The formula of the compound = XY_3.
4. The main functions include –
   a. It increases the pulse rate and blood pressure.
   b. It releases glucose from glycogen and fatty acids from fats.
5. The non-protein component of an enzyme which is loosely held by the enzymes and is essential for its biological activity is called a co-enzyme.
6. The familiar brown ring test for nitrates depends on the ability of Fe^{2+} to reduce nitrates to nitric oxide, which reacts with Fe^{2+} to form a brown coloured complex. The test is usually carried out by adding dilute ferrous sulphate solution to an aqueous solution containing nitrate ion, and then carefully adding concentrated sulphuric acid along the sides of the test tube. A brown ring at the interface between the solution and sulphuric acid layers indicates the presence of nitrate ion in solution.

$$NO_3 + 3Fe^{2+} + 4H^+ \rightarrow NO + 3Fe^{3+} + 2H_2O$$

$$[Fe(H_2O)_6]^{2+} + NO \rightarrow \underset{Brown}{[Fe(H_2O)_5(NO)]^{2+}} + H_2O$$

7.
   i. The existence of charge on colloidal particles is confirmed by electrophoresis experiment. When electric potential is applied across two platinum electrodes dipping in a colloidal solution, the colloidal particles move towards one or the other electrode. The movement of colloidal particles under an applied electric potential is called electrophoresis.
   ii. It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane. Since particles (ions or smaller molecules) in a true solution can pass through animal membrane (bladder) or parchment paper or cellophane sheet but not the colloidal particles, the membrane can be used for dialysis. The apparatus used for this purpose is called dialyser.
8. The ccplattice is formed by the element Y. The number of octahedral voids generated would be equal to the number of atoms of Y present in it. Since all the octahedral voids are occupied

by the atoms of X, their number would also be equal to that of the element Y. Thus, the atoms of elements X and Y are present in equal numbers or 1:1 ratio. Therefore, the formula of the compound is XY.

Or

Volume of the unit cell = $(288\ pm)^3$

= $(288\times10^{-12}\ m)^3$ = $(288\times10^{-10}\ cm)^3$

= $2.39\times10^{-23}\ cm^3$

Volume of 208 g of the element,

= mass/ density = 208/7.2 = 28.88 cm^3

Number of unit cells in this volume,

= 28.88/2.39 x 10^{-23} = 12.08 x 10^{23} unit cells

Since each bcccubic unit cell contains 2 atoms, therefore, the total number of atoms in 208 g

= 2 (atoms/unit cell) × 12.08 × 10^{23}unit cells = 24.16×10^{23} atoms.

9. For a first order reaction,

$$\log\frac{[R]_1}{[R]_2}=\frac{k(t_2-t_1)}{2.303}$$

$$k=\frac{2.303}{(t_2-t_1)}\log\frac{[R]_1}{[R]_2}$$

$$=\frac{2.303}{(60\min 0\ 0\min)}\log\frac{1.24\ x\ 10^{-2}\ mol\ L^{-1}}{0.20\ x10^{-2}\ mol\ L^{-1}}$$

$$=\frac{2.303}{60}\log 6.2\min^{-1}$$

k =0.0304 min^{-1}

10.

i. Total vapour pressure over the solution can be related to the mole fraction of any one component.
ii. Total vapour pressure over the solution varies linearly with the mole fraction of component 2.
iii. Depending on the vapour pressures of the pure components 1 and 2, total vapour pressure over the solution decreases or increases with the increase of the mole fraction of component 1.

11.

a) In the given molecule, there are four different types of hydrogen atoms, so the replacement of these hydrogen atoms will give the following isomers, $(CH_3)_2CHCH_2CH_2Cl$
$(CH_3)_2CHCH(Cl)CH_3$
$(CH_3)_2C(Cl)CH_2CH_3CH_3CH(CH_2Cl)CH_2CH_3$
b) Since sulphuric acid is an oxidizing agent, it oxidizes HI produced during the reaction, thereby preventing the reaction to form alkyl iodide.
c) Alkyl halides are polar molecules and so their molecules are held together by dipole – dipole forces. But the molecules of water are held together by hydrogen bonds. When alkyl halides are added to water, the force of attraction between water and alkyl halide molecules are weaker than the forces of attraction already existing between alkyl halide-alkyl halide molecules and water – water molecules. Hence alkyl halides are immiscible with water.

12. Sulphur dioxide can be detected by the following tests:
a) It has a pungent characteristic smell.
b) It decolourises acidified potassium permanganate solution.
c) It turns blue litmus to red.
d) It turns acidified potassium dichromate solution green.

13.
Molar mass of CH_2Cl_2 = 12 x 1 + 1 x 2 + 35.5 2 = 85 g mol^{-1}

Molar mass of $CHCl_3$ = 12 x 1 + 1 x 1 + 35.5 3 = 119.5 g mol^{-1}

Moles of $CH_2Cl_2 = \frac{40}{85} = 0.47$ mol

Moles of $CHCl_3 = \frac{25.5}{119.5} = 0.213$ mol

Total number of moles = 0.683 mol

$x_{CH_2Cl_2} = \frac{0.47}{0.683} = 0.688$

$x_{CHCl_3} = 1.00 - 0.688 = 0.312$

Using equation,

$\rho_{total} = \rho_1^0 + (\rho_2^0 - \rho_1^0)x_2 = 200 + (415 - 200)\ 0.688 = 347.9$ mm Hg

14.
a) $3\ HgCl_2 + 2\ PH_3 \rightarrow Hg_3P_2 + 6\ HCl$
b) $2\ NaClO_3 + I_2 \rightarrow 2\ NaIO_3 + Cl_2$
c) $2\ SCl_2 + 4\ NaF \rightarrow SF_4 + 4\ NaCl + S$

15.
a) A carbohydrate that cannot be hydrolysed further to give simpler unit of polyhydroxy aldehyde or ketone is called a monosaccharide.
b) Carbohydrates that yield two to ten monosaccharide units, on hydrolysis, are called oligosaccharides. They are further classified as disaccharides, trisaccharides, tetrasaccharides, etc., depending upon the number of monosaccharides, they provide on hydrolysis.

c) Carbohydrates which yield a large number of monosaccharide units on hydrolysis are called polysaccharides.

16. Assume that we have 100 g of solution. Solution will contain 20 g of ethylene glycol and 80 g of water.

Molar Mass of $C_2H_6O_2$ = 12 2 + 1 6 + 16 2 = 62 g mol^{-1}

$$\text{Moles of } C_2H_6O_2 = \frac{20g}{62gmol^{-1}} = 0.322mol$$

$$\text{Moles of water} = \frac{80g}{18gmol^{-1}} = 4.444mol$$

$$x_{glycol} = \frac{\text{moles of } C_2H_6O_2}{\text{moles of } C_2H_6O_2 + \text{moles of } H_2O}$$

$$= \frac{0.322mol}{0.322mol + 4.444mol} = 0.068$$

$$\text{Similarly } x_{water} = \frac{4.444 \text{ mol}}{0.322 \text{ mol} + 4.444 \text{ mol}} = 0.932$$

17.

a) $[CoCl_2(NH_3)_4]^+$ion.

b) $[CoCl(en)_2(NH_3)]^{2+}$ ion.

c) $K_3[Al(C_2O_4)_3]$

Or

a) It involves a number of assumptions.

b) It does not distinguish between weak and strong ligands.

c) It gives only the qualitative explanations for complexes.

d) It does not explain the thermodynamic and kinetic stabilities of different coordination compounds.

e) It does not explain the detailed magnetic properties of the complexes.

f) It does not explain the spectral properties of the coordination compounds.

g) The rate constants of a reaction at 500K and 700K are $0.02s^{-1}$ and $0.07s^{-1}$ respectively.

18.

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

$$\log \frac{0.07}{0.02} = \left(\frac{E_a}{2.303x8.314JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700x500}\right]$$

$0.544 = E_a \text{ x } 5.714 \text{ x } 10^{-4} / 19.15$

$E_a = 0.544 \text{ x } 19.15 / 5.714 \text{ x } 10^{-4} = 18230.8$ J

Since $k = Ae^{-Ea/RT}$

$0.02 = Ae^{-18230.8/8.314x500}$

A = 0.02/0.012 = 1.61

19.

Globular proteins	Fibrous proteins
These proteins are cross linked condensation products of basic and acidic amino acids.	These proteins are linear condensation products.
These are soluble in water and insoluble in strong acids and bases.	These are insoluble in water but are soluble in strong acids and bases.
It includes all enzymes and hormones.	It includes bifroin in silk, collagen in tendons, myosin in muscles and keratin in hair.

20. Based on the structure, polymers are classified into three types namely,
    a. Linear polymers
    b. Branched chain polymers
    c. Cross linked polymers

    Linear polymers

    These are polymers in which monomeric units are linked together to form long and linear chains. Example – PVC.

    Branched chain polymers

    These are polymers in which monomeric units are joined together to form chains with side chains or branches of different lengths. Example – starch.

    Cross linked polymers

    These are polymers in which monomeric units are cross linked to form a three dimensional network. Example – Bakelite.
21. Drugs are classified as follows:
    a) On the basis of pharmacological effect.
    b) On the basis of action on a particular biochemical process.
    c) On the basis of chemical structure.
    d) On the basis of molecular targets.
22.

Ideal solution	Non-ideal solution
The interactions between the components are similar to those in the pure components.	The interaction between the components are different from those in the pure components.
There is no enthalpy change on mixing.	There is enthalpy change on mixing.
There is no volume change on mixing.	There is volume change on mixing.

23.
    a. This process is called Reverse –osmosis (RO).
    b. An important application of reverse osmosis is the desalination of sea water. As compared to other methods, RO is more appealing, as it does not involve a phase change and is economically sound for large amounts of water.
    Sea water is approximately 0.7 M in NaCl, has an additional 60 atm would have to be applied on the sea water-side compartment to cause reverse osmosis.

24.

a.

$C_5H_5NH^+CrO_3Cl^-$ - PCC

b.

O_3/ H_2O – Zn dust

c.

Potassium dichromate in acidic medium

d.

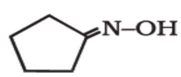
(DIBAL – H): (Diisobutyl) aluminium hydride

e.

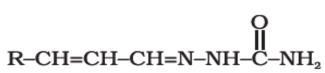
$C_5H_5NH^+CrO_3Cl^-$ -PCC

Or

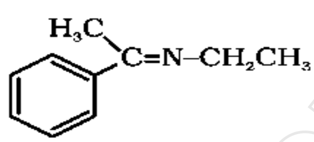
a.



b.



c.



25.

a)

i. High efficiency – The fuel cells convert the energy of a fuel directly into electricity and so, they are more efficient than the conventional methods of generating electricity on a large scale by burning hydrogen, carbon fuels. The efficiency of fuel cell is 60 – 70% whereas the efficiency of conventional methods is about 40%.

ii. Pollution free – There are no objectionable by-products and so they do no cause pollution problems.

iii. Continuous source of energy – There is no electrode material to be replaced as in ordinary battery. The fuel can be fed continuously to produce power.

b)

Molar conductivity – It is defined as the conducting power of all the ions produced by dissolving one mole of an electrolyte in solution.

Equivalent conductivity – It is defined as the conducting power of all the ions produced by dissolving one gram equivalent of an electrolyte in solution.

Or

a) The Cell can be written as $Mg|Mg^{2+}(0.130M)||Ag^{+}(0.0001M)|Ag$

$$E_{(cell)} = E^{\theta}_{(cell)} - \frac{RT}{2F} In \frac{[Mg^{2+}]}{[Ag^{+}]^2}$$

$$= 3.17V - \frac{0.059V}{2} \log \frac{0.130}{(0.0001)^2} = 3.17V - 0.21V = 2.96V$$

b) Calculate the equilibrium constant of the reaction: $Cu(s) + 2Ag^{+}(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$, if $E^{\theta}_{cell} = 0.46$ V.

Ans:

$$E^{\theta}_{(cell)} = \frac{0.059V}{2} \log K_c = 0.46V$$

$$logK_C = \frac{0.46Vx2}{0.059V} = 15.6$$

$$K_C = 3.92x10^{15}$$

26.

a) $\Delta_r G' = -nFE^{\theta}_{(cell)}$

N in the above equation is 2. F = 96487 C mol^{-1} and $E^{\theta}_{(cell)}$ =1.1 V

Therefore $\Delta_r G'$ = - 2 x 1.1 V x 96487 C mol^{-1}

= -21227 J mol^{-1}

= -212.27 kJ mol^{-1}

b) $$\wedge^0_{m(HAC)} = \lambda^0_{H^+} + \lambda^0_{AC^-} = \lambda^0_{H^+} + \lambda^0_{Cl^-} + \lambda^0_{AC^-} + \lambda^0_{Na^+} - \lambda^0_{Cl^-} - \lambda^0_{Na^+}$$

$$= \wedge^0_{m(HCl)} + \wedge^0_{m(NaAc)} - \wedge^0_{m(NaCl)}$$

= (425.9 + 91.0 – 126.4) S cm^2 mol^{-1}

= 390.5 S cm^2 mol^{-1}

Or

a) $$\wedge_m = \frac{k}{c} = \frac{4.95\ x\ 10^{-5}\ Scm^{-1}}{0.001028\ mol\ L^{-1}} x \frac{1000\ cm^3}{L} = 48.15\ S\ cm^3 mol^{-1}$$

$$\alpha = \frac{\wedge_m}{\wedge^0_m} = \frac{48.15\ S\ cm^2\ mol^{-1}}{390.5\ S\ cm^2\ mol^{-1}} = 0.1233$$

$$k = \frac{c\alpha^2}{(1-\alpha)} = \frac{0.001028\ mol\ L^{-1} x(0.1233)^2}{1-0.1233} = 1.78x10^{-5} mol\ L^{-1}$$

b) Another important secondary cell is the nickel-cadmium cell which has longer life than the lead storage cell but more expensive to manufacture. The overall reaction during discharge is:

$Cd\ (s) + 2Ni(OH)_3\ (s) \rightarrow CdO\ (s) + 2Ni(OH)_2\ (s) + H_2O\ (l)$