Sample Paper - 04
Chemistry (Theory)
Class – XII

Time allowed: 3 hours **Maximum Marks: 70**

General Instructions:

a) All the questions are compulsory.
b) There are **26** questions in total.
c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d) Questions **6** to **10** carry **two** marks each.
e) Questions **11** to **22** carry **three** marks each.
f) Questions **23**is value based question carrying **four** marks.
g) Questions **24**to **26** carry **five** marks each.
h) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
i) Use of calculators is **not** permitted. However, you may use log tables if necessary.

1. Write the structure of 1-chloro-2, 2-dimethylpropane.
2. What is the effect of presence of Schottky defects on the density of the crystal?
3. If a compound is formed by the elements X and Y crystallises in the cubic arrangement with X atoms at the corners of a cube and Y atoms at face centres, then give its formula of the compound?
4. Give any two main functions of hormone adrenaline.
5. Define co-enzyme.
6. Give reasons:
   (i) Phenol has higher boiling point than toluene.
   (ii) Unlike phenols, alcohols are easily protonated.
7. Write a note on:
   (i) Hoffmann bromamide reaction
   (ii) Hunsdiecker reaction
8. (i) Define co-ordination number.
   (ii) Give the co-ordination number of atoms in ccp and bcc structures.

   Or

   If three elements A, B and C crystallize in a cubic solid with A atoms at the corners, B atoms at the cube centres and C atoms at the faces of the cube, then give the formula of the compound.
9. An organic compound having molecular formula C_8H_{18} on monochlorination gives a single monochloride. Write the structure of the hydrocarbon.
10. Comment: Raoult's law as a special case of Henry's Law.
11. What mass of propene is obtained from 34.0 g of 1-iodo-propane on treating with ethanolicKOH, if the yield is 36%?
12. What are the forces that stabilize the protein structures?
13. Complete the reactions:
    (i) $POCl_3 + H_2O \rightarrow$

(ii) $P_4O_{10} + H_2O \rightarrow$

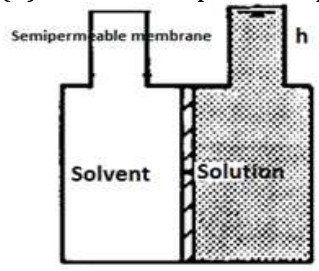
(iii) $P_4 + KOH + H_2O \rightarrow$

14. Define the following term with an example:
    (a) Tranquilizers
    (b) Analgesics
    (c) Antipyretics
15. Explain the termcopolymerisation with two examples.
16. Give four criterions to be followed for the selection of stationary phase in chromatography.
17. (i) Define chelation.
    (ii) What is meant by chelating ligand?
    (iii) What is denticity?

Or

What are cationic complex, anionic complex and neutral complex? Give examples.

18. (a) Give the sources of lead compounds.
    (b) Define the term 'chemotherapy'.
    (c) Name the macromolecules that are chosen as drug targets.
19. Write the possible sequences of the tripeptide which on complete hydrolysis gives glycine, alanine and phenylalanine.
20. What are the three ways to control the microbial diseases?
21. Explain pseudo first order reaction with an appropriate example.
22. Explain the term:
    (a) Electro-osmosis
    (b) Coagulation
23. If we apply pressure greater than the equilibrium osmotic pressure to the solution compartment shown below, pure solvent will flow from the solution to the solvent compartment.
    (a) What is the name of this process
    (b) Write an important application associated with this process. Explain

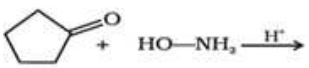


24. Give the name of the reagents to bring the following conversions:
    (a) Allyl alcohol to propenal
    (b) But-2-ene to ethanol
    (c) Cyclohexanol to cyclohexanone
    (d) Ethanenitrile to ethanol
    (e) Hexan-1-ol to hexanal

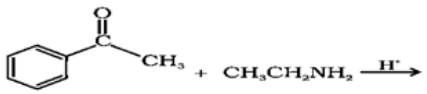
Or

Complete the reactions:

(a)



(b) $R\text{-}CH{=}CH\text{-}CHO + NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH\text{-}NH_2 \xrightarrow{H^+}$

(c) 

25. (a) Give the important advantages of fuel cells over ordinary batteries.
    (b) Define molar conductivity and equivalent conductivity.

Or

    (a) Represent the cell in which the following reaction takes place $Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$. Calculate its *E*(cell), if (cell) $E^{\Theta}_{cell} = 3.17$ V.
    (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.

26. (a) The standard electrode potential for Daniell cell is 1.1V. Calculate the standard Gibbs energy for the reaction: $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$
    (b) If the limiting molar conductivities for Nacl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm^2/mol respectively, then calculate Λ^0 for HAc.

Or

    (a) The conductivity of 0.001028 mol/L acetic acid is 4.95×10^{-5} S/cm. calculate its dissociation constant if the limiting molar conductivity for acetic acid is 390.5 S cm^2/mol.
    (b) Give a short not on nickel – cadmium cell. Give its overall reaction during discharge.

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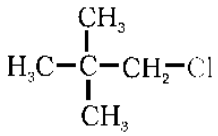
Answers

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 iron obtained from blast furnace is pig iron. It contains about 4% of carbon and many impurities in small amount. Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast. It contains slightly lower carbon content and is extremely hard and brittle.
7. (a) The reaction between water and aldehydes is a reversible reaction and so equilibrium lies almost towards left. On the other hand, in chloral the presence of three electron withdrawing chlorine atoms increases the positive charge on the carbonyl carbon. So, the weak nucleophiles readily add to the carbonyl group forming chloral hydrate and therefore shift the equilibrium towards right.
   (b) Acetic acid can be halogenated due to the presence of α-carbon atom. However, formic acid has no α-hydrogen atom and so cannot be halogenated.
8. Scuba divers must cope with high concentrations of dissolved gases while breathing air at high pressure underwater. Increased pressure increases the solubility of atmospheric gases in blood. When the divers come towards surface, the pressure gradually decreases. This releases the dissolved gases and leads to the formation of bubbles of nitrogen in the blood. This blocks capillaries and creates a medical condition known as bends, which are painful and dangerous to life.
9. This defect is shown by ionic solids. The smaller ion (usually cation) is dislocated from its normal site to an interstitial site. It creates a vacancy defect at its original site and an interstitial defect at its new location. Frenkel defect is also called dislocation defect. It does not change the density of the solid. Frenkel defect is shown by ionic substance in which there is a large difference in the size of ions, for example, ZnS, AgCl, AgBr and AgI due to small size of Zn^{2+} and Ag^{+} ions.

   Or

   Since the lattice is ccp, the number of silver atoms per unit cell = z = 4
   Molar mass of silver = 107.9 g mol^{-1}= 107.9×10^{-3} kg mol^{-1}
   Edge length of unit cell = a = 408.6 pm = 408.6×10^{-12} m

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

$$= \frac{4x\left(107.9x10^{-3}\,kgmol^{-1}\right)}{\left(408.6x10^{-12}\,m\right)^3\left(6.022x10^{23}\,mol^{-1}\right)} = 10.5x10^3\,kgm^{-3}$$

= 10.5 g/cm^3.

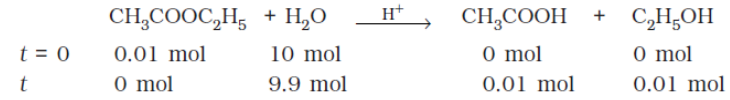
10. (a) Order of a reaction is an experimental quantity. It can be zero and even a fraction but molecularity cannot be zero or a non integer.
    (ii) Order is applicable to elementary as well as complex reactions whereas molecularity is applicable only for elementary reactions. For complex reaction molecularity has no meaning.
    (iii) For complex reaction, order is given by the slowest step and molecularity of the slowest step is same as the order of the overall reaction.
11. $CH_3CH_2CH_2I + KOH$ (alc.) → $CH_3CH= CH_2 + KI + H_2O$
    Molecular mass of iodopropane = 3 x 12 + 7 x 1 + 127 = 170
    Molecular mass of propene = 3 x 12 + 6 x 1 = 42
    170 g of iodopropane gives 42 g of propene
    Therefore,
    34 g of iodopropane gives 42/170 x 34 = 8.4 g
    But the actual yield is 36%, so
    The actual mass of propene obtained = 8.4 x 3.6/100 = 3.024 g.
12. (a) Hydrogen bonding – these are weak forces which arise between a partially positive hydrogen and a partially negative atom on the same or different molecule.
    (b) Ionic bonding – these takes place between an ionic and cationic side chains resulting side chain cross linking.
    (c) Covalent bonding –it is a inter chain bonding is the disulphide bond formed between the sulphur atoms of two cysteine residues.
    (d) Hydrophobic bonding – proteins in aqueous solutions fold so that most of the hydrophobic chains become clustered inside the folds. The polar side chains which are hydrophilic lie on the outside the protein.
13. (i) $POCl_3 + 3H_2O \rightarrow H_3PO_4 + 3HCl$
    (ii) $P_4O_{10} + H_2O \rightarrow 4\ H_3PO_4$
    (iii) $P_4 + KOH + H_2O \rightarrow PH_3 + 3\ KH_2PO_2$
14. (a) The chemical substances which are used for the treatment of stress, mild and severe mental diseases are called tranquilizers. Example – Iproniazid.
    (b) The chemical substances which are used to relieve pains without causing impairment of consciousness, mental confusion, paralysis and other disturbances of nervous system are called analgesics. Example – Novalgin.
    (c) The chemical substances which are used to lower the temperature of the body in high fever are called antipyretics. Example – Aspirin.
15. Copolymerization is defined as a process in which two or more monomers combine to form a polymer. It contains a multiple units of each monomer in the chain.
    Examples – 1,3-butadiene and acrylonitrile, 1,3-butadiene and styrene
16. (a) It should be high and selective adsorption power.
    (b) It should be finely divided to offer greater surface area for adsorption.
    (c) It should be pure.
    (d) It should not react chemically either with the sample components.
17. (i) When a di- or polydendate ligand uses its two or more donor atoms to bind the same central metal atom or ion, it is called chelation.

(ii) The resulting complex structure having ring structure and the ligand coordinating through two or more donor groups are called chelating ligand.
(iii) The number of ligating groups indicates the denticity of the ligand.

Or

(i) A complex ion or coordination entity which has a net positive charge is called cationic complex. Example – $[Co(NH_3)_6]^{3+}$
(ii) A complex ion or coordination entity which has a net negative charge is called anionic complex. Example – $[Ag(CN)_2]^-$
(iii) A complex or coordination entity which has no net charge is called neutral complex. Example – $[Ni(CO)_4]$

18. (a) Lead compounds can be obtained from natural sources such as plants, trees, bushes, venoms and metabolites of micro-organisms. These compounds have also been isolated from fish, coral sponges and marine micro-organisms.
(b) The branch of chemistry which deals with the treatment of diseases using chemicals is called chemotherapy.
(c) It includes carbohydrates, proteins, lipids and nucleic acids.
19. The possible sequences are:
(a) Gly – Ala – Phe
(b) Gly – Phe – Ala
(c) Ala – Gly – Phe
(d) Ala – Phe – Gly
(e) Phe – Gly – Ala
(f) Phe – Ala – Gly
20. (a) By drugs which kill the organism in the body – bactericidal.
(b) By drugs which inhibit the growth of the organism – bacteriostatic.
(c) By increasing immunity and resistance to infection of the body – immunity.
21. The order of a reaction is sometimes altered by conditions. Consider a chemical reaction between two substances when one reactant is present in large excess. During the hydrolysis of 0.01 mol of ethyl acetate with 10 mol of water, amounts of the various constituents at the beginning ($t = 0$) and completion (t) of the reaction are given as



	$CH_3COOC_2H_5$	+ H_2O	$\xrightarrow{H^+}$	CH_3COOH	+	C_2H_5OH
$t = 0$	0.01 mol	10 mol		0 mol		0 mol
t	0 mol	9.9 mol		0.01 mol		0.01 mol

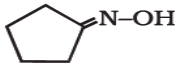
The concentration of water does not get altered much during the course of the reaction. So, in the rate equation,
Rate = $k'[CH_3COOC_2H_5]\,[H_2O]$ the term $[H_2O]$ can be taken as constant.
The equation, thus, becomes
Rate = $k\,[CH_3COOC_2H_5]$ where $k = k'[H_2O]$
This reaction behaves as first order reaction. Such reactions are called pseudo first order reactions.

22. (a) When electrophoresis, i.e., movement of particles is prevented by some suitable means, it is observed that the dispersion medium begins to move in an electric field. This phenomenon is termed electro-osmosis.
(b) The stability of the lyophobic sols is due to the presence of charge on colloidal particles. If, somehow, the charge is removed, the particles will come nearer to each other to form aggregates (or coagulate) and settle down under the force of gravity. The process of settling of colloidal particles is called coagulation or precipitation of the sol.
23. (a) This process is called Reverse –osmosis (RO).

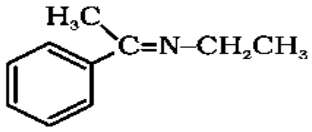
(b) An important application of reverse osmosis is the desalination of sea water. As compared to other methods, RO is more appealing, as it does not involve a phase change and is economically sound for large amounts of water.
Sea water is approximately 0.7 M in NaCl, has an additional 60 atm would have 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 $Mg|Mg^{2+}(0.130M)||Ag^+(0.0001M)|Ag$

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

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

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

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

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

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

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

$k = \frac{c\alpha^2}{(1-\alpha)} = \frac{0.001028\ mol\ L^{-1} x (0.1233)^2}{1-0.1233} = 1.78 x 10^{-5}\ mol\ L^{-1}$

(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) → CdO (s) + $2Ni(OH)_2$ (s) + H_2O (l)