Meghalaya Board
Class XII
Chemistry
Sample Paper 2 – Solution

PART-I

1.

(a)

(i)Based on the shape, structure and amino acid composition of the binding site, the receptors shows selectivity for the chemical messengers. Hence, different receptors in the body interact with different chemical receptors.

(b)

(iii) Dry ice is solid carbon dioxide which is generally used in packing frozen items is an example of molecular solid.

(c)

(i) Only one monomer adds repeatedly to give addition polymers like the monomer of polythene that is addition polymer is $CH_2=CH_2$.

(d)

(ii) According to Henry's Law at a constant temperature the solubility of gas in a liquid is directly proportional to the pressure of gas.

(e)

(ii) Both nucleotide and nucleoside have pentose sugar and nitrogenous base. Nucleotide differs from nucleoside with the presence of phosphoric acid as nucleoside does not have phosphoric acid.

(f)

(i)In an electrochemical cell,, the electrode having a lower reduction potential will act as anode because it will have a higher tendency to lose electrons and lower tendency to gain electrons.

(g)

(iv) Benzene diazonium chloride is colourless crystalline solid, stable in cold water but reacts in warm water, readily soluble in water and gives azo dye test.

(h)

(i)P (probability factor) takes into account the fact that in a collision, molecules must be properly oriented.

PART- II

2. Chemicals Chloroxylenol and Terpineol present in dettol are responsible for the antiseptic property.

3. The density of the element will be same in both the cases as the two structures will have the same coordination number and hence the same packing fraction.

4. The molal elevation constant of the solvent is defined as the elevation in its boiling point when one mole of non-volatile solute is dissolved per kilogram (1000g) of solvent. Its unit is $K.kg\ mol^{-1}$

5. PVC is used for making raincoats, hand bags, plastic dolls, shoe soles etc. It is a good electrical insulator and is used for coating wires, cables and other electrical goods.

6. The degree of ionisation of weak electrolytes increases with dilution and approaches unity at infinite dilution. This is in accordance with Ostwald's dilution law.

7. Tertiary amine with one methyl, one ethyl and one propyl group is N-Ethyl-N-methylpropanamine.

8. In metallurgical operations colloid is formed in concentration of ores by froth floatation. Sulphide ores are concentrated by adding pine oil and froth is formed between the ore and oil and floats on the surface.

9. Ethanoic acid on heating with sulphuric acid or P_2O_5 gives acetic anhydride or ethanoic anhydride.

PART-III

10. The various steps involved in metallurgy are:
(i) Crushing and grinding of the ore
(ii) Concentration of the ore
(iii) Preliminary treatment of the concentrated ore
(iv) Reduction
(v) Purification or refining of crude metal

11. Fluorine is the most electronegative element and cannot exhibit any positive oxidation state. Other halogens have d orbitals and therefore, can expand their octets and show + 1, + 3, + 5 and + 7 oxidation states also.

Or

Ammonia forms hydrogen bonds but phosphorus does not form hydrogen bonds with water as a result ammonia does dissolve in water.

12. The *d*–block occupies the large middle section of the periodic table and is flanked by *s*– and *p*– blocks elements. The name 'transition' given to the elements of *d*-block is because of their position between *s*– and *p*– block elements and thus showing transition in properties of s and p block elements.

13. Trimethylaluminium exists as a dimer. Here the two carbon atoms form two methyl groups acts as a bridge between the two Aluminium atoms and is a type of sigma bonded organometallic compound.

14. Due to its symmetry p-Dichlorobenzene fits in crystal lattice better as compared to *o*- and *m*-isomers. As a result the melting point and solubility of *p*-Dichlorobenzene is higher than ortho- and meta-isomers.

15. The formation of alkene depends on the stability of the intermediate carbonium ions formed during the dehydration reaction. Since the stability of the intermediate carbonium ion is Tertiary > Secondary > Primary, the ease of dehydration of alcohols also follows the order.

16. Clemmensen reduction and Wolf-Kishner Reduction are used to convert a carbonyl group into -CH_2 group.

17. Both nucleotide and nucleoside have pentose sugar and nitrogenous base. Nucleotide differs from nucleoside with the presence of phosphoric acid whereas nucleoside does not have phosphoric acid.

PART-IV

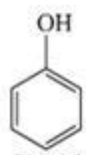
18. Analgesic medicines are those medicines which reduce or abolish pain causing impairment of consciousness, mental confusion, in coordination or paralysis or some other disturbances of nervous system. These are classified as follows:

(i) Non-narcotic (non-addictive) analgesics: These drugs are effective in relieving skeletal pain such as that due to arthritis and preventing platelet coagulation.

(ii) Narcotic drugs: These analgesics are chiefly used for the relief of severe pain like postoperative pain, cardiac pain and pains of terminal cancer, and in child birth

19.

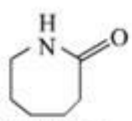
(i)



Phenol

HCHO
formaldehyde

(ii)

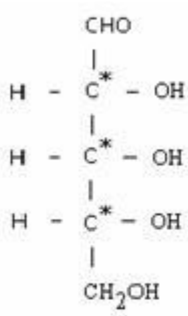


Caprolactam

(iii)

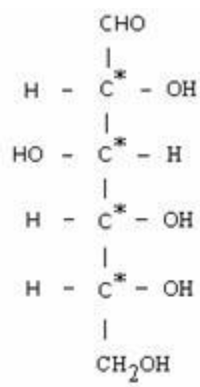
$CH_2 = CH_2$
Ethylene

20. The open chain structures of an aldopentose and aldohexose are:



No of asymmetric carbon atoms = 3

Aldopentose
D-(-)-Ribose



No of asymmetric carbon atoms =4

Aldohexose
D-(+)-Glucose

Or

DNA (Deoxyribonucleic acid)	RNA (Ribonucleic acid)
(i) DNA contains Cytosine and Thymine as pyrimidine bases and Guanine and Adenine as purine bases.	(i) RNA contains Cytosine and Uracil as pyrimidine bases and Guanine and Adenine as purine bases.
(ii) DNA has double stranded alpha-helix structure.	(ii) RNA has single stranded structure.
(iii) DNA occurs in nucleus of the cell.	(iii) RNA occurs in cytoplasm of the cell.

21. An amorphous substance, such as glass, tends to be isotropic. This difference may make it possible to distinguish between a glass and a crystal. Amorphous materials, like window glass, have no long-range order at all, so they have no translational symmetry. The structure of an amorphous solid (and indeed a liquid) is not truly random - the distances between atoms in the structure are well defined and similar to those in the crystal. This is why liquids and crystals have similar densities - both have short-range order that fixes the distances between atoms, but only crystals have long-range order. Amorphous materials like glass have no 'distinct' crystal directions, so anisotropic properties are generally not observed. For example Glass panes fixed to old building are thicker at the bottom than the top because amorphous solids do not melt at a sharp melting point. They soften over a range of temperature and can be molded and blown. Like liquids amorphous solids have a tendency to flow very slowly and the movement is not noticeable. Therefore they are called super cooled liquids or pseudo solids.

22. If we add a nonvolatile solute to that liquid, the amount of surface area available for the escaping solvent molecules is reduced because some of that area is occupied by solute particles. Therefore, the solvent molecules will have a lower probability to escape the solution than the pure solvent. That fact is reflected in the lower vapor pressure for a solution relative to the pure solvent. That statement is only true if the solvent is nonvolatile. If the solute has its own vapor pressure, then the vapor pressure of the solution may be greater than the vapor pressure of the solvent.

23. Strong electrolytes have high value of molar conductivity (Λm). It increases slightly with dilution of its solution. The plot of Λm vs. $\sqrt{c}$ at C = 0, gives a definite value of $\Lambda^0 m$. Weak electrolyte has low value of molar conductivity (Λm). It increases appreciably on dilution of its solution. The plot of $\Lambda m \text{ vs } \sqrt{c}$ at C = 0, does not give a definite value of $\Lambda^0 m$ because the plot becomes almost parallel to Λm axis.

24.

(i) Production of high vacuum: Traces of air can be adsorbed by charcoal from a vessel, evacuated by a vacuum pump to give a very high vacuum.

(ii) Heterogeneous catalysis:The gaseous reactants are adsorbed on the surface of the solid catalysts. As a result, the concentration of the reactants increases on the surface and hence the rate of the reaction increases.

(iii) Froth floatation process: This process is used to remove gangue from sulphide ores. The basic principle involved in this process is adsorption.

25. Soaps containing sodium salts are formed by heating fat i.e. glyceryl ester of fatty acids with aqueous sodium hydroxide solution. The reaction is known as Saponification reaction. In such reaction esters of fatty acids are hydolysed and the soap remains in colloidal form. It is precipitated from the solution by adding sodium chloride. The solution left after removing the soap contains glycerol.

26. Aluminium is extracted from bauxite which contains SiO_2, iron oxide and titanium IV oxide as impurities. The ore is concentrated by digesting the powdered ore with 45% caustic soda solution at 473-523 K and 35-36 bar pressure. In this way Al_2O_3 is leached out as sodium aluminate.

$$Al_2O_3.2H_2O(s) + 2NaOH\ (aq) + H_2O \longrightarrow 2Na\ [Al\ (OH)_4](aq)$$

The aluminate in solution is hydrolyzed by passing CO_2 gas and hydrated Al_2O_3 is precipitated. Now the solution is seeded with freshly prepared sample of hydrated Al_2O_3 which induces precipitation. The sodium silicate remains in the solution and hydrated alumina is dried, filtered and heated to give back pure Al_2O_3.

$$Al_2O_3.xH_2O(s) \xrightarrow{1470\ K} Al_2O_3(s) + xH_2O(g)$$

PART-V

27.

(a) Kohlrausch law of independent migration of ions: The law states that limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.

$$\Lambda^{o}_{m}(CH_3COOH) = \lambda^{o}_{CH_3COO^-} + \lambda^{o}_{H^+}$$

(b)

$$\Lambda^{o}_{m}(CH_3COOH) = \ ?$$
$$\Lambda^{o}_{m}(HCl) = 426\ S\ cm^2\ mol^{-1}$$
$$\Lambda^{o}_{m}(NaCl) = 126\ S\ cm^2\ mol^{-1}$$
$$\Lambda^{o}_{m}(CH_3COONa) = 91\ S\ cm^2\ mol^{-1}$$
$$\Lambda^{o}_{m}(CH_3COOH) = \Lambda^{o}_{m}(HCl) + \Lambda^{o}_{m}(CH_3COONa) - \Lambda^{o}_{m}(NaCl)$$
$$= 426 + 91 - 126$$
$$= 391\ S\ cm^2\ mol^{-1}$$

Or

(a) Lead storage battery:

Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

Cathode: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4\ (s) + 2H_2O\ (l)$

Overall reaction: $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

(b)

$$Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$$
$$2Ag^+(aq) + 2e^- \rightarrow 2Ag(s)$$

$$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$$

$$E^\theta_{cell} = E^\theta_{Ag^+/Ag} - E^\theta_{Cu^{2+}/Cu}$$
$$= +0.80\,V - 0.34\,V$$
$$= 0.46\,V$$

$n = 2$

$$E_{cell} = E^\theta_{cell} - \frac{0.059}{2}\log\frac{[Cu^{2+}]}{[Ag^+]^2}$$

$$\therefore 0.422\,V = 0.46\,V - \frac{0.059}{2}\log\frac{0.1}{[Ag^+]^2}$$

$$-0.038\,V = -\frac{0.059}{2}\log\frac{0.1}{[Ag^+]^2}$$

$$0.038\,V = \frac{0.059}{2}\log\frac{0.1}{[Ag^+]^2}$$

$$\Rightarrow \log\frac{0.1}{[Ag^+]^2} = \frac{+0.038\,V \times 2}{0.059} = 1.2881$$

$$\Rightarrow \frac{0.1}{[Ag^+]^2} = \text{Antilog}\,(1.2881) = 1.941 \times 10^1$$

$$[Ag^+]^2 = \frac{0.1}{1.941 \times 10^1}$$

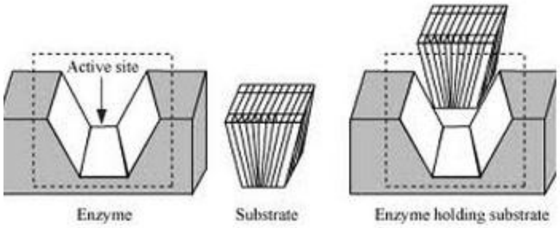
$$[Ag^+]^2 = 0.00515$$

$$[Ag^+] = 0.071\ mol\ L^{-1}$$

28. For understanding the interaction between a drug and an enzyme, it is important to know how enzymes catalyse the reaction. In their catalytic activity, enzymes perform two major functions:

1. The first function of an enzyme is to hold the substrate for a chemical reaction. Active sites of enzymes hold the substrate molecule in a suitable position, so that it can be attacked by the reagent effectively.

Substrates bind to the active site of the enzyme through a variety of interactions such as ionic bonding, hydrogen bonding, van der Waals interaction or dipole-dipole interaction.



2. The second function of an enzyme is to provide functional groups that will attack the substrate and carry out chemical reaction.

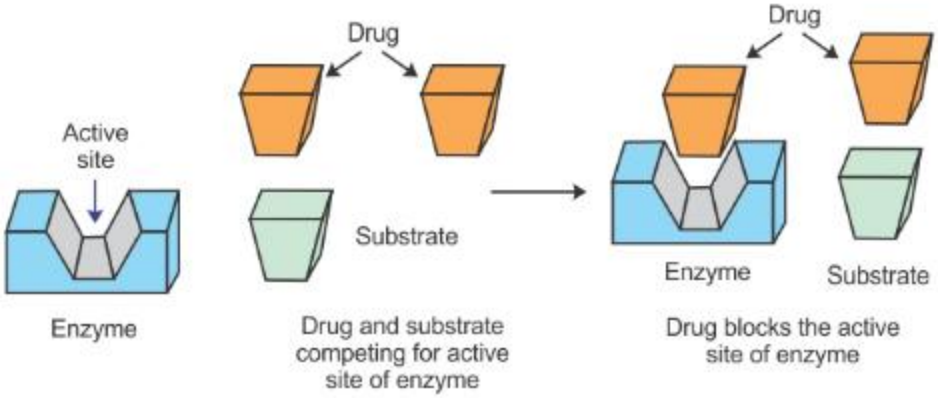
Or

Drug-enzyme interaction

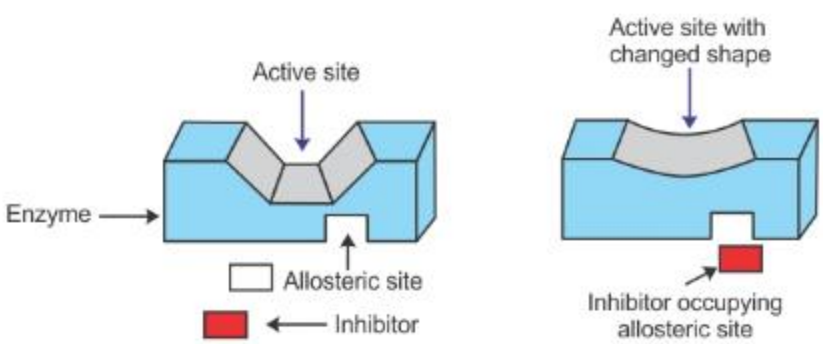
Drugs inhibit any of the above mentioned activities of enzymes. These can block the binding site of the enzyme and prevent the binding of substrate, or can inhibit the catalytic activity of the enzyme. Such drugs are called enzyme inhibitors.

Drugs inhibit the attachment of substrate on active site of enzymes in two different ways;

(i) Drugs compete with the natural substrate for their attachment on the active sites of enzymes. Such drugs are called competitive inhibitors



(ii) Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called allosteric site. This binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate cannot recognise it.



If the bond formed between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then the enzyme is blocked permanently.

The body then degrades the enzyme-inhibitor complex and synthesises the new enzyme.

29.

(a)

(i)

Sc			+3				
Ti		+2	+3	+4			
V		+2	+3	+4	+5		
Cr	+1	+2	+3	+4	+5	+6	
Mn		+2	+3	+4	+5	+6	+7
Fe		+2	+3	+4	+5	+6	
Co		+2	+3	+4	+5		
Ni		+2	+3	+4			
Cu	+1	+2	+3				
Zn		+2					

It is evident from the above table that the maximum number of oxidation states is shown by Mn, varying from +2 to +7. The numbers of the oxidation states increase on moving from Sc to Mn. On moving from Mn to Zn, the numbers of the oxidation states decrease due to a decrease in the number of available unpaired electrons. The relative stability of the +2 oxidation state increases on moving from top to bottom. This is because on moving from top to bottom, it becomes more and more difficult to remove the third electron from the *d* orbital.

(ii) The elements of the first series of transition metals form a variety of oxides of different oxidation states having general formulae MO, M_2O_3, M_3O_6, MO_2, MO_3, etc. All metals except Sc form MO oxides which are ionic in nature. Beyond group 7, no higher oxides except Fe_2O_3 are known. The oxocations stabilise as VO_2^+, VO_2^+ and TiO^{2+}.

(b)

(i) Transition metals have incompletely filled *d* orbitals. As a result, they exhibit variable oxidation states.

(ii) Transition metal ions undergo *d-d* transition of electrons by absorbing light from the visible region of electromagnetic spectrum. Due to this *d-d* transition, colour is imparted to transition metal ions.

Or

(a)

(i) $2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(Sodium Chromate) (Sodium dichromate)

$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$

(Sodium Dichromate (Pottasium dichromate)

(ii) The potassium manganate is oxidised to potassium permanganate by oxidation with chlorine.

$2K_2MnO_4 (aq) + Cl_2(g) \rightarrow 2KMnO_4 (aq) + 2KCl(aq)$

(iii) $HgCl_2 + Hg \rightarrow Hg_2Cl_2$

Calomel (Mercury (I) Chloride)

(b) Lanthanoid Contraction: The steady decrease in the atomic and ionic radii of lanthanoid elements with increase atomic number is called lanthanoid contraction.

Consequences:

(i)The basic strength of the oxides and hydroxides of lanthanoids decreases with increasing atomic number.

(ii) Lanthanum hydroxide La $(OH)_3$ is most basic and Lutetium hydroxide Lu $(OH)_3$ is least basic.