Chemistry 2016 (Outside Delhi) SET I

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

1. **What type of magnetism is shown by a substance if moments of domains are arranged in same direction ?**** [1]

2. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-Cl$ and $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-Cl$,

   which is more reactive towards S_N1 reaction and why ? [1]

   Answer : $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-Cl$, is more reactive towards SN^1 reaction as secondary (2°) carbonation formed as the reaction intermediate $\left(CH_3-CH_2-\overset{\oplus}{\underset{\displaystyle CH_3}{\underset{|}{C}}}\right)$ is more stable than primary (1°) carbocation $\left(CH_3\,\underset{\displaystyle CH_3}{\underset{|}{CH}}-\overset{\oplus}{C}H_2\right)$.

3. **On adding NaOH to ammonium sulphate a colourless gas with pungent odour is evolved which forms a blue coloured complex with Cu^{2+} ion. Identify the gas.** [1]

   Answer : The gas evolved is ammonia (NH_3).

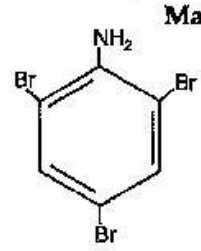
   $(NH_4)_2SO_4(aq) + 2NaOH \rightarrow Na_2SO_4(aq) + 2H_2O(l) + 2NH_3(g)$

   Ammonia react with solution of Cu^{2+} ion to form a deep blue coloured complex, $\left[Cu(NH_3)_4\right]^{2+}$.

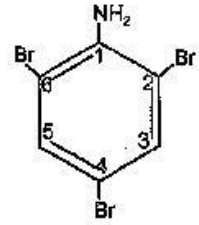
4. **Write the main reason for the stability of colloidal solutions.** [1]

   Answer : All the colloidal particles in a given solution carry the same charge and the dispersion medium has an opposite and equal charge; the system as a whole being electrically neutral. This is the main reason for the stability of the colloidal solution.

5. **Write the IUPAC name of the given compound.** [1]



Answer :



2,4,6-Tribromoaniline.

6. **When a coordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 mole of AgCl are precipitated per mole of the compound. Write** [2]

   (i) Structural formula of the complex.

   (ii) IUPAC name of the complex

   Answer : (i) Structural formula of the complex is $[Cr(H_2O)_5Cl]Cl_2.H_2O$, because two moles of chlorine are outside coordination entity to form two moles of AgCl from per mole compound.

   (ii) Pentaaquachlorido Chromium(III) chloride monohydrate.

7. **From the given cells :** [2]

   Lead storage cell, Mercury cell, Fuel cell and Dry cell

   Answer the following :

   (i) Which cell is used in hearing aids ?

   (ii) Which cell was used in Apollo Space Programme ?

   (iii) Which cell is used in automobiles and inverters ?

   (iv) Which cell does not have long life ?

   Answer : (i) Hearing aid–Mercury cell.

   (ii) Apollo Space Programme–Fuel cell.

   (iii) Automobile and inverters–Lead storage cell.

   (iv) Cell does not have long life–Dry cell.

8. **When chromite ore $FeCr_2O_4$ is fused with NaOH in presence of air, a yellow coloured compound**

** Answer not given due to change in present syllabus.

(A) is obtained which on acidification with dilute sulphuric acid gives a compound (B), compound (B) on reaction with KCl forms a orange coloured crystalline compound (C). [2]

(i) Write the formulae of the compounds (A), (B) and (C).

(ii) Write one use of compound (C).

OR

Complete the following chemical equations :

(i) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow$

(ii) $Cr_2O_3^{2-} + 3Sn^{2+} + 14\,H^+ \rightarrow$

Answer : (i) On fusing chromite ore with Sodium hydroxide in presence of air, yellow coloured "sodium chromate" (A) is formed.

$$FeCr_2O_4 + 16\,NaOH + 7O_2 \rightarrow 8Na_2CrO_4 + 2\,Fe_2O_3 + 8H_2O$$
(A)

On acidification with dil. H_2SO_4 it forms sodium dichromate (B).

$$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O.$$
(A) (B)

Compound (B) *i.e.* sodium dichromate forms potassium dichromate, orange coloured crystals (C) on treating with KCl.

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl.$$
(B) (C)

The formula of compounds are :

(A) Sodium chromate —Na_2CrO_4

(B) Sodium dichromate —$Na_2Cr_2O_7$

(C) Potassium dichromate —$K_2Cr_2O_7$

(ii) Potassium dichromate, $K_2Cr_2O_7$ is most commonly used as on oxidizing agent in various laboratory and industrial applications.

OR

(i) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

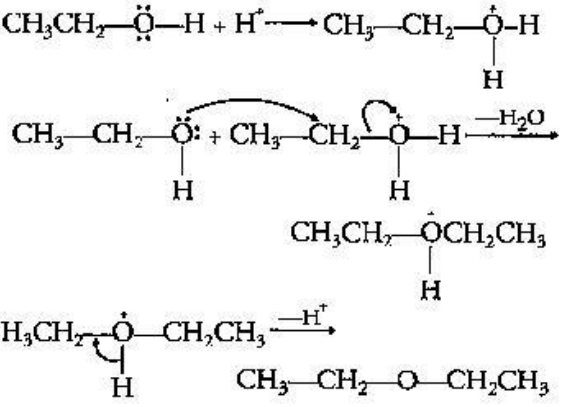
(ii) $Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \rightarrow 3Sn^{4+} + 2Cr^{3+} + 7H_2O$

9. Write the mechanism of the following reaction : [2]

$$2CH_3CH_2OH \xrightarrow[413K]{Conc.H_2SO_4} CH_3CH_2 - O - CH_2 - CH_3$$

Answer : Formation of ether from alcohol is a nucleophilic bimolecular reaction (S_N2). A protonated alcohol is attacked by another alcohol molecule.

Reaction Steps :



10. For a reaction : $2NH_3\,(g) \xrightarrow[Rate = k]{Pt} N_2\,(g) + 3H_2\,(g)$

(i) Write the order and molecularity of this reaction.

(ii) Write the unit of *k*. [2]

Answer : (i) For any reaction ; Rate = K [A] order

[A] = concentration of reactant.

Hence its a zero order reactions and its molecularity is two.

(ii) Unit of K for a zero order reaction is mol L^{-1} sec^{-1}.

11. The rate constant for the first order decomposition of H_2O_2 is given by the following equation :

$$\log k = 14.2 - \frac{1.0\times10^4}{T}K$$

Calculate E_a for this reaction and rate constant K if its half-life period be 200 minute. (Given : R = 8.314 J K^{-1} mol^{-1}) [3]

Answer : According to Arrhenius equation

$$\log k = \log A - \frac{1.0\times10^4}{T}K \quad ...(i)$$

So equating similar terms in the equations

$$\log K = 14.2 - \frac{1.0\times10^4}{T}K \quad ...(ii)$$

On comparing the equation no. (i) and (ii)

$$\frac{E_a}{2.303\,RT} = \frac{1.0\times10^4}{T}K;$$

$$E_a = \frac{2.30\times R\times T\times1.0\times10^4}{T}K$$

$\Rightarrow E_a = 2.303 \times 8.314\ K^{-1}\ Mol^{-1} \times 1.0 \times 10^4\ K$

$= 19.14 \times 10^4$ J Mol^{-1} = 191.4 kJ mol^{-1}

For a first order reaction :

$$t_{½} = \frac{0.693}{200} \quad \text{...(iii)}$$

$t_{½} = 200$ min

$$K = \frac{0.693}{200} = 3.465 \times 10^{-3} \text{ min}^{-1}.$$

12. (i) Differentiate between adsorption and absorption.

(ii) Out of $MgCl_2$ and $AlCl_3$, which one is more effective in causing coagulation of negatively charged sol and why ?

(iii) Out of sulphur sol and proteins, which one forms multimolecular colloids ? **[3]**

Answer : (i)

	Adsorption	Absorption
1.	It is a surface phenomenon, Adsorbate molecules are held at the surface of adsorbent.	Absorption occurs in the bulk of absorbing substance.
2.	Initially, rate of adsorption is rapid.	Absorption occurs at uniform rate.
3.	The concentration of the adsorbent surface is much more than that in the bulk.	Absorbed material is uniformly distributed throughout the bulk means concentration is same throughout and it is essentially a bulk phenomenon.
4.	E.g., water vapours on silica gel.	E.g., Water vapours are absorbed by anhydrous $CaCl_2$.

(ii) According to Hardy-Schulze law the ions carrying opposite charge to that on sol are responsible for coagulation of the sol. These are called active ions. Hence as the sol is negative, Mg^{2+} and Al^{3+} ions will cause coagulation.

As coagulation power of electrolyte is proportional to the valency of oppositely charged ion, so $AlCl_3$ will be more effective than $MgCl_2$.

(iii) Sulphur sol will form the multimolecular colloid. A sol of sulphur consists of colloidal particles which are aggregates of S_8 molecules.

13. Give reasons : **[3]**

(i) C–Cl bond length in chlorobenzene is shorter than C–Cl bond length in CH_3–Cl.

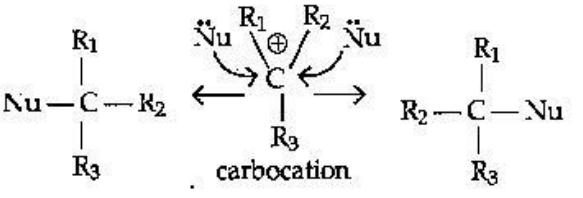
(ii) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

(iii) S_N1 reactions are accompanied by racemization in optically active alkyl halides.

Answer : (i) C–Cl bond length in chlorobenzene is shorter than CH_3–Cl, C–Cl bond as in chlorobenzene due to resonance C–Cl bond has partial double bond character which reduces the bond length.

(ii) In cyclohexyl chloride, carbon in C–Cl bond is sp^3 hybridised whereas in chlorobenzene C–Cl bond carbon is sp^2 hybridised, sp^2 is more electronegative than sp^3 carbon. Hence C–Cl bond of chlorobenzene is less polar.

(iii) In S_N1 reaction a carbocation intermediate is formed. In case of optically active alkyl halide the attack of nucleophile in the next step to carbocation can occur from both the faces of the trigonal planar species in equal probability. Thus 50 : 50 racemic mixture is obtained.



14. An element crystallizes in a f.c.c. lattice with cell edge of 250 pm. Calculate the density if 300 g of this element contain 2×10^{24} atoms. ** **[3]**

15. Give reasons : **[3]**

(i) Mn shows the highest oxidation state of +7 with oxygen but with flourine it shows the highest oxidation state of +4

(ii) Transition metals show variable oxidation states.

(iii) Actinoids show irregularities in their electronic configurations.

Answer : (i) Mn shows the highest oxidation state of +7 with oxygen because it can form $p\pi$-$d\pi$ multiple bonds. On the other hand Mn shows

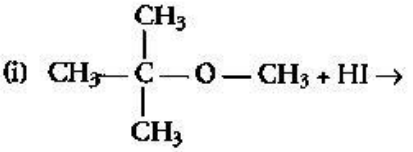
****Answer not given due to change in present syllabus.**

highest oxidation state of +4 with flourine because it can form only single bond.

(ii) Transition metals show variable oxidation state because of use of ns and (n–1) d shell electrons while bonding as the shells have similar energy.

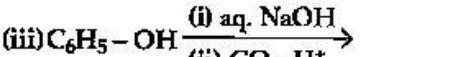
(iii) Actinoids show irregularities in their electronic configurations because *6d*, *7s* and *5f* electrons or shells have less energy difference and electrons can be accommodated in any of them.

16. Write the main product(s) in each of the following reactions : [3]

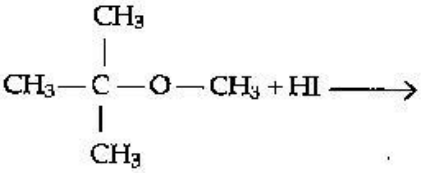


(i) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-O-CH_3 + HI \rightarrow$

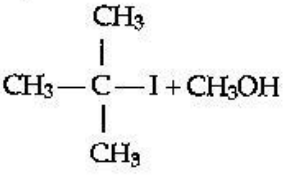
(ii) $CH_3-CH=CH_2 \xrightarrow[(ii)\ 3H_2O_2/OH^-]{(i)\ B_2H_6}$



(iii) $C_6H_5-OH \xrightarrow[(ii)\ CO_2,\ H^+]{(i)\ aq.\ NaOH}$

Answer : (i) 

$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-O-CH_3 + HI \longrightarrow$



$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-I + CH_3OH$

(ii) $3CH_3-CH=CH_2 \xrightarrow[(ii)\ 3H_2O_2/OH^-]{(i)\ B_2H_6}$

$3CH_3-CH_2-CH_2-OH + B(OH)_3$

Antimarkovnikov addition.

(iii) $C_6H_5OH \xrightarrow[(ii)\ CO_2,\ H^+]{(i)\ aq.\ NaOH}$

Salicylic acid

17. (i) Name the method of refining of metals such as Germanium.

(ii) In the extraction of Al, impure Al_2O_3 is dissolved in conc. NaOH to form sodium aluminate and leaving impurities behind. What is the name of this process ?

(iii) What is the role of coke in the extraction of iron from its oxides ? [3]

Answer : (i) Zone refining method is used for refining of metals such as germanium which is based on the principle that the impurities are more soluble in the molten state (melt) than in the solid state of the metal.

(ii) Leaching : This method consists of treating the powdered ore with a suitable reagent which can selectively dissolve the ore but not the impurities.

(iii) Coke act as a reducing agent and it reduces the iron ore hematite.

18. Calculate e.m.f. of the following cell at 298 K. [3]

$2Cr(s) + 3Fe^{2+}(0.1M) \rightarrow 2Cr^{3+}(0.01M) + 3\ Fe\ (s)$

Given : $E^\circ_{(Cr^{3+}\,|\,Cr)} = -0.74$ V $E^\circ_{(Fe^{2+}\,|\,Fe)} = -0.44$ V

Answer : $Cr\,|\,Cr^{3+}(0.01M)\,||\,Fe^{2+}(0.1M)\,|\,Fe_{(s)}$.

The half cell reactions for they given cell :

$Cr \rightarrow Cr^{3+} + 3e^-\ ] \times 2$

$Fe^{2+} + 2e^-\ Fe\ ] \times 3$

Hence $n = 6$, $T = 298$ K, $R = 8.314\ J\ K^{-1}\ mol^{-1}$.

Nernst equation for the cell ;

$$E_{cell} = E^\circ_{cell} - \frac{2.303RT}{nF}\log\frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$

$$E^\circ cell = [E^\circ_R - E^\circ_L]V$$

$$[-0.44 - (-0.74)]V = +0.30\ V.$$

$$E_{cell} = 0.30\ V - \frac{2.303 \times 8.314 \times 298}{6 \times 96500}\log\frac{[0.01]^2}{[0.1]^3}$$

$$= 0.30V - \frac{0.059}{6}\log\frac{[10^{-2}]^2}{[0.1]^3}$$

$$= 0.30 - \frac{0.059}{6}\log 10^{-1}\ V = 0.30\ V \cdots \frac{0.059}{6}(-1)\ V$$

$$= 0.30\ V + \frac{0.059}{6}\ V = 0.30 + 0.0098$$

$$= 0.3098\ V$$

19. (i) Write the name of two monosaccharides obtained on hydrolysis of lactose sugar.

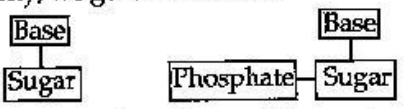
(ii) Why Vitamin C cannot be stored in our body?

(iii) What is the difference between a nucleoside and nucleotide ? [3]

Ans : (i) The two monosaccharides are β-D-galactose and β-D-glucose.

(ii) Vitamin C is, a water soluble vitamin and hence get excreted by urine. So it cannot be stored in body and needs to be supplemented regularly.

(iii) When a base (purine or pyriamidine) get attached to 1′ position of a pentose sugar a nucleoside is formed. When a nucleoside is further linked to phosphoric acid at 5′ position of sugar moeity, we get a nucleotide.

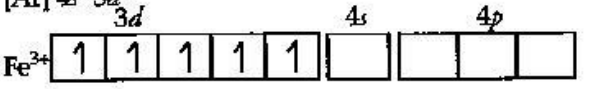


20. (a) For the complex $[Fe(CN)_6]^{3-}$, write the hybridization type, magnetic character and spin nature of the complex. (At number Fe = 26).

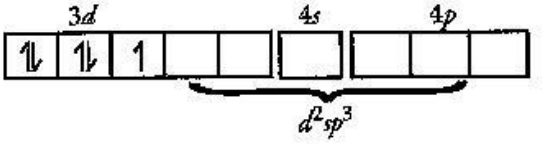
(b) Draw one of the geometrical isomers of the complex $[Pt\ (en)_2\ Cl_2]^{2+}$, which is optically active ? **[3]**

Answer : (a) $[Fe(CN)_6]^{3-}$, Fe, Z = 66 $[Ar]\ 4s^2\ 3d^6$

Fe has +3 oxidation state : Electronic configuration; $[Ar]\ 4s^0\ 3d^5$



CN^- is a strong field ligand hence pairing will take place to accommodate 6 pair of ligand electrons.



Hence the complex has d^2sp^3 hybridization.

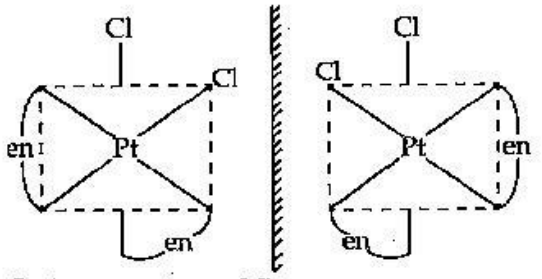
Type : Octahedral complex, inner orbital complex.

Magnetic character : One unpaired electron hence paramagnetic.

It will have a total electron spin moment of 1 electron :

$(\mu) = \sqrt{1(1+2)} = \sqrt{3}$ BM, ∴ Low spin complex

(b) $[Pt\ (en)_2Cl_2]^{2+}$, that is isomer is optically active.



Cis isomer Mirror

Optically active.

21. Write the structure of A, B and C in the following :

(i)

$$C_6H_5—CO—NH_2 \xrightarrow{aq./KOH} A \xrightarrow[0–5°\ C]{NaNO_2 + HCl} B \xrightarrow{KI} C$$

(ii)

$$CH_3—Cl \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow{CHCl_3 + alc\ KOH} C$$

[3]

Answer : (i) $C_6H_5—CO—NH_2 \xrightarrow{Br_2/aq.\ KOH}$ $C_6H_5NH_2$ (A) Aniline

$\xrightarrow[0–5°C]{NaNO_2 + HCl}$ $C_6H_5N^+{}_2Cl^-$ (B) Benzene diazonium chloride

$\xrightarrow{KI}$ C_6H_5I (C) Iodobenzene

(ii)

$$CH_3Cl \xrightarrow{KCN} CH_3CN \xrightarrow{LiAlH_4} CH_3CH_2NH_2$$

(A) Ethanenitrile (B) Ethanamine

$\xrightarrow{\Delta}$ CH_3CH_2NC (C) (Ethyl isocyanide) ← CH_3Cl + alc. KOH

22. (i) What is the role of *t*-butyl peroxide in the polymerization of ethane ?

(ii) Identify the monomers in the following polymer :

$—[NH—(CH_2)_6—NH—CO—(CH_2)_4—CO—]_n$

(iii) Arrange the following polymers in the increasing order of their intermolecular forces.

Polystyrene, Terylene, Buna-S. **[3]**

OR

Write the mechanism of free radical polymerisation of ethene.

Ans : (i) Polymerisation of ethene to low density polyethene (L.D.P.) needs presence of a free radical generating initiator (catalyst). *t*-butyl peroxide helps in starting the chain of radical formations.

(ii) $\left[+NH—[CH_2]_6NH—\underset{\underset{O}{\|}}{C}—(CH_2)_4—\underset{\underset{O}{\|}}{C}+\right]_n$

This is Nylon–6, 6 and its monomers are :

hexamethylene diamine

$H_2N—(CH_2)_6—NH_2$ and adipic acid

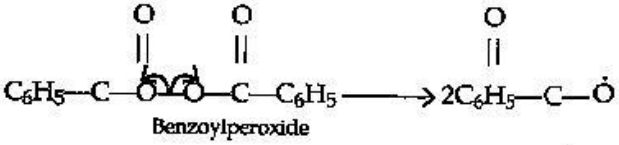
$HOOC—(CH_2)_4—COOH$.

(iii) Buna–S <Polystyrene <Terylene
(Elastomer)(Thermoplast) (Fibre)

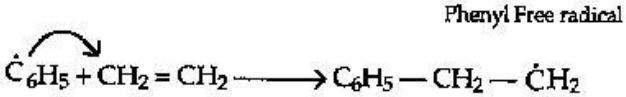
OR

Mechanism of Polymerisation of ethene.

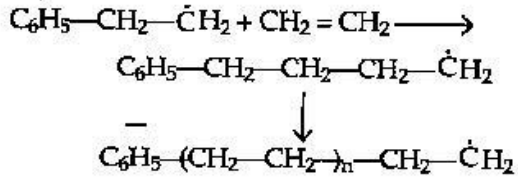
(1) **Initiation** : The process starts with the formation of a free radical by addition of catalyst free radical like phenyl or benzoyl etc., generating a new and larger free radical.



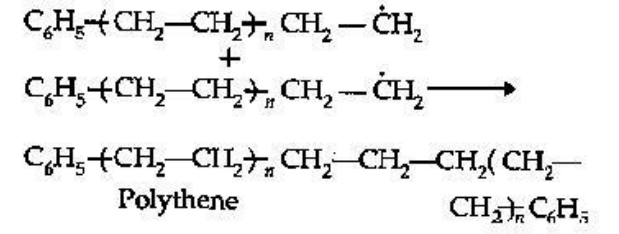
$\longrightarrow 2\dot{C}_6H_5$
Phenyl Free radical



(2) **Propagation** : The radical reacts with another molecule of ethene thus forming a bigger radical molecule. The process continues till the required length of chain we need.



(3) **Chain Termination** : When free radical combine with each other the chain terminates resulting in formation of a polymer.



23. Due to hectic and busy schedule Mr. Angad made his life full of tensions and anxiety. He started taking sleeping pills to overcome the depression without consulting the doctor. Mr. Deepak a close friend of Mr. Angad advised him to stop taking sleeping pills and suggested to change his lifestyle by doing Yoga, meditation and some physical exercise. Mr. Angad followed his friend's advice and after few days he started feeling better. After reading the above passage answer the following : [4]

(i) What are the values (at least two) displayed by Mr. Deepak?**

(ii) Why is it not advisable to take sleeping pills without consulting doctor?

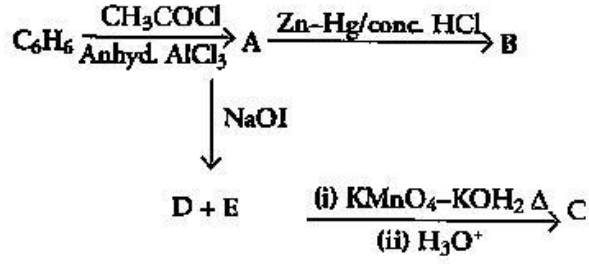
(iii) What are tranquilizers ? Give two examples.

Answer :

(ii) Sleeping pills are tranquilizers and may cause harmful side effects as they slow down the working of the brain and nervous system. Hence a doctor must be consulted to regularise the doses of such drugs.

(iii) Tranquilizers are a class of drugs or chemicals which are used to treat stress and mental disease. Example : Iproniazid and Equanil.

24. (a) Write the structures of A, B, C, D and E in the following reactions : [5]



OR

(a) Write the chemical equation for the reaction involved in Cannizzaro reaction.

(b) Draw the structure of the semicarbazone of ethanal.

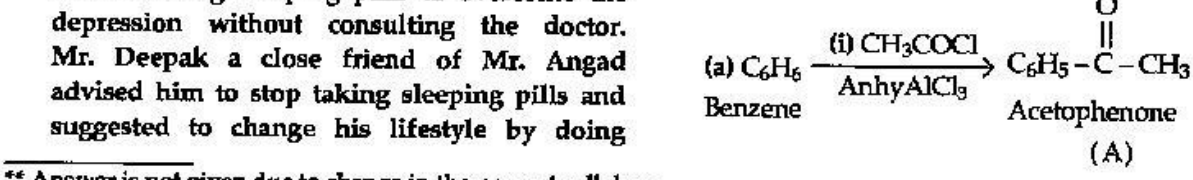
(c) Why pKa of $F–CH_2–COOH$ is lower than that of $Cl–CH_2–COOH$?

(d) Write the product in the following reaction;

$$CH_3-CH=CH-CH_2CN \xrightarrow[(ii)\ H_2O]{(i)\ DIBAL-H}$$

(e) How can you distinguish between propanal and proanone ?

Answer :



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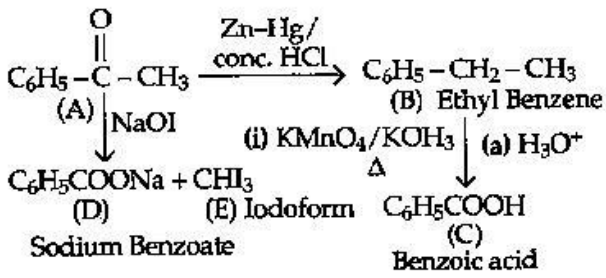


OR

(a) For aldehydes which do not have α-hydrogen atom self oxidation and reduction takes place in presence of concentrated alkali. This produces one mole of alcohol and one mole of salt of carboxylic acid. This is called Cannizzaro's reaction.

$$\underset{\text{formaldehyde}}{HCHO} + \underset{\text{Sodium hydroxide}}{HCHO + \text{conc. NaOH}} \longrightarrow \underset{\text{Methylalcohol}}{CH_3OH} + \underset{\text{(Sodium formate)}}{HCOO^-Na^+}$$

(b) $CH_3CHO + H_2N-NH-\overset{\overset{O}{\|}}{C}-NH_2 \longrightarrow$

Ethanal, Semicarbazide

$$CH_3-CH=N-NH-\overset{\overset{O}{\|}}{C}-NH_2$$

Ethanal Semicarbozone

(c) pKa of $F-CH_2-COOH$ is lower than that of pKa of $Cl-CH_2-COOH$ as $F-CH_2-COOH$ is a stronger acid. This is because of higher electronegativity of F atom than Cl atom.

(d) $CH_3-CH=CH-CH_2CN \xrightarrow[\text{(ii) H2O}]{\text{(i) DIBAL–H}}$

Nitrile

$CH_3-CH=CHCH_2CHO$

aldehyde

(e) Tollen's reagent will give a positive test of silver mirror formation with propanal, while propane does not gives this test since aldehydes can oxidise Tollens' reagent to metallic silver but ketones cannot.

$$\underset{\text{Tollen's reagent}}{R-CHO + 2[Ag(NH_3)_2]^+ + 3OH^-} \longrightarrow \underset{\text{Silver colour deposit}}{2Ag\downarrow} + R-COO^- + H_2O$$

25. (a) Calculate the freezing point of solution when 1.9 g (of $MgCl_2$ (M = 95 g/mol) was dissolved in 50 g of water, assuming $MgCl_2$ undergoes complete ionization. [5]

(K_f for water = 1.86 K kg mol^{-1})

(b) (i) Out of 1 M glucose and 2 M glucose, which one has a higher boilling point and why ?

(ii) What happens when the external pressure applied becomes more than the osmotic pressure of solution ?

OR

(a) When 2.56 g of sulphur was dissolved in 100 g of CS_2, the freezing point lowered by 0.383 K. Calculate the formula of sulphur (S_X).[5]

(K_f for CS_2 = 3.83 K kg $mole^{-1}$, Atomic mass of sulphur = 32 g/mol^{-1}).

(b) Blood cells are isotonic with 0.9% sodium chloride solution what happens if we place blood cells in a solution containing.

(i) 1.2% sodium chloride solution ?

(ii) 0.4% sodium chloride solution ?

Answer : (a) $MgCl_2$ on ionisation gives 3 ions each mole.

$$MgCl_2(s) \longrightarrow Mg^{2+}(aq) + 2Cl^-(q)$$

Hence Vant's Hoff factor, $i = 3$

$$\Delta T_f = T_{f(\text{water})} - T_{f(MgCl_2)} = i \times K_f \times m$$

$$m(\text{molality}) = \frac{1.9\text{g} \times 1000\text{g}}{95\text{g mol}^{-1} \times 50\text{g}} = 0.4 \text{ mole}$$

$\therefore$ $T_f(\text{water}) = 273$ K

Hence $\Delta T_f = 273\text{ K} - T_{f(MgCl_2)}$

$= 3 \times 1.86\text{ K.kg mol}^{-1} \times 0.4\text{ molkg}^{-1}$

$= 2.23$ K.

$T_{f(MgCl_2)} = (273 - 2.23)\text{ K} = 270.77$ K

(b) (i) 2M glucose will have higher boiling point because boiling point of a solution of a non-volatile liquid increases with increase in concentration

(ii) When the external pressure exerted on the solution is higher than the osmotic pressure, pure solvent starts flowing out of the solution through the semi permeable membrane. This process is known as reverse-osmosis.

OR

(a) Weight of sulphur (W_2) = 2.5 g, $W_1(CS_2)$ = 100 g,

ΔT_f = 0.383 K

M_2 = 32 g/mol

K_f = 3.83 K kg/ mol

Applying the formula

$$\Delta T_f = \frac{k_f \times W_2 \times 1000}{W_1 \times M}$$

$$0.383 = \frac{3.83 \times 2.56 \times 1000}{100 \times M}$$

$$M = 256 \text{ g/Mol}$$

Formula of Sulphur : One atom of S = 32 g mol^{-1} atoms of S in molecule

$$= \frac{256 \text{ gmol}^{-1}}{32 \text{ gmol}^{-1}} = 8.$$

Formula = S_8

(b) (i) 1.2 % Sodium chloride is hypertonic than blood cells, hence cells will shrink. Plasmolyis will take place.

(ii) 0.4% Sodium chloride solution is hypotonic than blood cell, so cells will swell. Endo osmosis will take place.

26. (a) Account for the following : [5]

(i) Ozone is thermodynamically unstable.

(ii) Solid PCl_5 is ionic in nature.**

(iii) Fluorine forms only one oxoacid HOF.

(b) Draw the structure of : (i) BrF_5, (ii) XeF_4

OR

(i) Compare the oxidising action of F_2 and Cl_2 by considering parameters such as bond dissociation enthalpy, electron gain enthalpy and hydration enthalpy.

(ii) Write the conditions to maximize the yield of H_2SO_4 by contact process.

(iii) Arrange the following in the increasing order of property mentioned.

(a) H_3PO_3, H_3PO_4, H_3PO_2 (Reducing Characters)**

(b) NH_3, PH_3, AsH_3, SbH_3, BiH_3 (Base strength)**

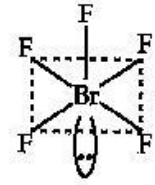
Answer : (a) (i) Ozone easily decompose to give nascent oxygen :

$$O_3 \rightarrow O_2 + [O]$$

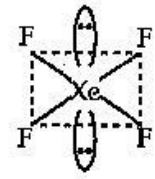
because the reaction is exothermic, (ΔH = negative). and results in the increases in entropy (ΔS = positive). Overall Gibb's energy change is quite high and negative.

(iii) Due to high electronegativity and small size fluorine forms only one oxoacid, HOF.

(b) (i) BrF_5



(ii) XeF_4



OR

(i) Fluorine is a much stronger oxidizing agent than chlorine. The oxidizing power depends on three factors.

(a) Bond dissociation energy.

(b) Electron gain enthalpy.

(c) Hydration enthalpy.

The electron gain enthalpy of chlorine is more negative than that of Fluorine. However, the bond dissociation energy of fluorine is much lesser than that of chlorine. Also, because of its small size, the hydration energy of fluorine is much higher than that of chlorine. Therefore, the latter two factors compensate more than for the less negative electron gain enthalpy of fluorine. Thus, fluorine is a much stronger oxidizing agent than chlorine.

(ii) The condition necessary to maximize the yield of H_2SO_4 by contact process are.

(a) A moderately low temperature of about 720 K and high pressure of about 2 bar yields maximum H_2SO_4 acid.

(b) Its an exothermic reaction and forward reaction causes decrease in pressure.

Note : All questions are same in outside Delhi Set II and III and Delhi Set-I, II and III

** Answer is not given due to change in present syllabus.

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