Chemistry

Academic Year: 2013-2014 Marks: 70
Date: October 2013

Question 1: Select and write the most appropriate answers from the given alternatives for each sub-question: **[7]**

Question 1.1: **[1]**

The Arrhenius equation is_____ .
(a) $k = Ae^{R\frac{T}{E_a}}$
(b) $A = ke^{-\frac{E_a}{RT}}$
(c) $k = Ae^{-\frac{RT}{E_a}}$
(d) $k = Ae^{-\frac{E_a}{RT}}$

Solution: $k = Ae^{-\frac{E_a}{RT}}$

Question 1.2: If the enthalpy of vaporisation of water at 100°C is 186.5 J.mol^{-1}, the entropy of vaporization will be_____. **[1]**

(a) 4.0 J . K^{-1}. mol^{-1}
(b) 3.0 J . K^{-l}. mol^{-1}
(c) 1.5 J - K^{-1}. mol^{-1}
(d) 0.5 J . K^{-l}. mol^{-1}

Solution: 0.5 J . K^{-l}. mol^{-1}

Question 1.3: The atomicity of sulphur in orthorhombic sulphur is_____. **[1]**

(a) 8
(b) 6
(c) 4
(d) 2

Solution: 8

Question 1.4: The major binding force in diamond is_____. **[1]**

(a) Covalent bond
(b) Ionic bond
(c) Metallic bond
(d) Co-ordinate covalent bond

Solution: Covalent bond

Question 1.5: The boiling point of water at high altitude is low. Because _____.[1]

(a) the temperature is low.
(b) the atmospheric pressure is low.
(c) the temperature is high.
(d) the atmospheric pressure is high

Solution: the atmospheric pressure is low.

Question 1.6: The molar conductivity of cation and anion of salt BA are 180 and 220 mhos respectively. The molar conductivity of salt BA at infinite dilution is_____. [1]

(a) 90 mhos.cm^2
(b) 110 mhos.cm^2.mol^{-1}
(c) 200 mhos.cm^2.mol^{-1}
(d) 400 mhos.cm^2.mol^{-1}

Solution:

400 mhos.cm^2.mol^{-1}

Solution :-

$$\Delta^{\circ}_{BA} = \lambda^{\circ}_{B^+} + \lambda^{\circ}_{A^-}$$

= 180 + 220

= 400 mhos cm^2 mol^{-1}

Question 1.7: What is the process in which concentrated ore is reduced to the corresponding metal by heating at high temperature with a reducing agent? [1]

(a) Polling
(b) Pyrometallurgy
(c) Hydrometallurgy
(d) Calcination

Solution: (B) Pyrometallurgy

Question 2: Answer any THREE of the following [9]

Question 2.1: Describe anomalous behaviour of oxygen as compared with other elements of group 16 with reference to - [3]
(a) Magnetic property
(b) Oxidation state
(c) Hydrides

Solution: a. Magnetic property : Molecular oxygen (O2) is paramagnetic while other members of group 16 are diamagnetic.
b. Oxidation state : In most of compounds, oxygen shows −2 oxidation state. It also shows −1 in some compounds. It cannot exhibit higher oxidation state due to absence of vacant d-orbitals. The other group 16 elements show −2, +2, +4 and +6 oxidation states.
c. Hydrides : Water is liquid at room temperature whereas hydrides of other group 16 elements are gases.

Question 2.2: What is the value of for the following reaction at 298 K - **[3]**

$6CO_2 + 6H_20_{(l)} \rightarrow C6H_{12}0_{6(s)} + 60_{2(g)}$,
Given that: $\Delta G° = 2879$ kj mol^{-1}, AS = -210 JK^{-1} mol^{-1}.

Solution: Given:

$\Delta G° = 2879$ kJ/mol

$\Delta S° = -210$ J K^{-1} mol^{-1}
$= -0.210$ kJ $K^{-1}mol^{-1}$
T = 298 K

To find: ΔS_{surr}

Formula: $\Delta G° = \Delta H° - T\Delta S°$

Calculation: $\Delta G° = \Delta H° - T\Delta S°$

$2879 = \Delta H° - (298 \times -0.210)$
$2879 = \Delta H° - (-62.58)$
$2879 = \Delta H° + 62.58$

$\Delta H° = 2816.42$ kJ

$$\Delta S_{surr} = \frac{q_{surr}}{T}$$

$$= -\frac{\Delta H^{\circ}}{T}$$

$$= -\frac{2816.42}{298}$$

$= -9.45$ kJ/K

Question 2.3: Sucrose decomposes in acid solution to give glucose and fructose according to the first order rate law. The half-life of the reaction is 3 hours. Calculate fraction of sucrose which will remain after 8 hours. **[3]**

Solution:

For a first order reaction

$$k = \frac{2.303}{t}\log\left(\frac{[R]_0}{[R]}\right)$$

it is given that $t_{1/2}$ = 3 hours

therefore,

$$k = \frac{0.693}{t_{\frac{1}{2}}}$$

k = 0.693/3 h^{-1}

k = 0.231 h^{-1}

$$\therefore 0.231 = \frac{2.303}{8h}\log\left(\frac{[R]_0}{[R]}\right)$$

$$\therefore \log\left(\frac{[R]_0}{[R]}\right) = \frac{0.231h^{-1} \times 8h}{2.303}$$

$$\therefore \frac{[R]_0}{[R]} = anti\log(0.8024)$$

$$\therefore \frac{[R]_0}{[R]} = 6.3445$$

$$\therefore \frac{[R]}{[R]_0} \approx 0.1576$$

$$\therefore \frac{[R]}{[R]_0} = 0.158$$

Hence the fraction of the sample of sucrose that remains after 8 hours is 0.158.

Question 2.4: A solution containing 0.73 g of camphor (molar mass 152 g . mol^{-1}) in 36.8 g of acetone (boiling point 56.3°C) boils at 56.55°C. A solution of 0.564 g of unknown compound in the same weight of acetone boils at 56.46°C. Calculate the molar mass of the unknown compound. **[3]**

Solution: Calculation for K_b of camphor:

Here, mass of solvent, W_A = 36.8g

mass of solute, W_B = 0.73g

molecular mass of solute, $M_B = 152$

elevation in boiling point,

$\Delta T_b = 56.55 - 56.30 = 0.25°C$

Now,

$\Delta T_b = K_b \times (W_B \times 1000)/(W_A \times M_B)$

$K_b = (\Delta T_b \times W_A \times M_B)/(W_B \times 1000)$

$K_b = (0.25 \times 36.8 \times 152)/(0.73 \times 1000)$

$K_b = 1.9156\ °C\ kgmol^{-1}$

Calculation of molecular mass of unknown solute

Here, mass of solvent, $W_A = 36.8g$

mass of solute, $W_B = 0.564g$

elevation in boiling point,

$\Delta T_b = 56.46 - 56.30 = 0.16°C$

Now,

$M_b = (K_b \times W_B \times 1000)/(W_A \times \Delta T_b)$

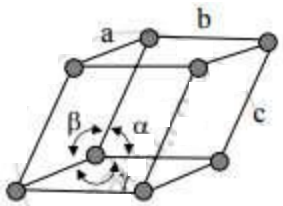
$M_b = (1.9156 \times 0.564 \times 1000)/(36.8 \times 0.16)$

$M_b = 183.4\ g$

Question 3: Answer any SIX of the following : **[12]**

Question 3.1: Describe triclinic crystal lattice with the help of a diagram. **[2]**

Solution: Triclinic lattice:
The three edges (sides) are of unequal lengths and all angles are different but none is perpendicular to any of the others ($a \neq b \neq c$, $\alpha \neq \beta \neq \gamma \neq 90°$).



TRICLINIC

$a \neq b \neq c$

$\alpha \neq \beta \neq \gamma \neq 90°$

Question 3.2: Write any four applications of electrochemical series **[2]**

Solution: applications of electrochemical series :

1. Oxidizing and Reducing Strengths.
2. Comparison of Reactivities of Metals
3. Calculation of the EMF of the Cell
4. Predicting the Liberation of Hydrogen Gas from Acids by Metals
5. Predicting Feasibility of a Redox Reaction

Question 3.3: State and explain Hess's law of constant heat summation. **[2]**

Solution: It states that, "The amount of heat evolved or absorbed in a chemical change is the same whether the process takes place in one step or in several steps". (i.e. it follows 1st Law of Thermodynamics)

For example, carbon can be oxidised to CO_2 either directly or in two different steps as given below:

I st method $C(s)+O_2(g) \rightarrow CO_2(g) \Delta H=-94.3kcal$

II methode $C(s)+(1/2)O_2(g) \rightarrow CO(g) \Delta H_1=-26.0kcal$

$CO(g)+(1/2)O_2(g) \Delta H_2=-68.3kcal$

According to Hess's law ΔH must be equal to $\Delta H_1+\Delta H_2$ which is true

Question 3.4: Distinguish between : Order and Molecularity of reaction **[2]**

Solution:

ORDER OF A REACTION	**MOLECULARITY OF A REACTION**
It is sum of the concentration terms on which the rate of reaction actually depends or it is the sum of the exponents of the concentrations in the rate law equation.	It is the number of atoms, ions or molecules that must collide with one another simultaneously so as to result into a chemical reaction.

It need not be a whole number i.e. it can be fractional as well as zero.	It is always a whole number.
It can be determined experimentally only and cannot be calculated.	It can be calculated by simply adding the molecules of the slowest step.
It is for the overall reaction and no separate steps are written to obtain it.	The overall molecularity of a complex reaction has no significance. It is only slowest step whose molecularity has significance for the overall reaction.
Even the order of a simple reaction may not be equal to the number of molecules of the reactants as seen from the unbalance equation.	For simple reactions, the molecularity can usually be obtained from the Stoichiometry of the equation.
It may be an integer, fraction or zero	It is always an integer and never a fraction or zero

Question 3.5: With the help of the equation $\Delta G° = - nFE°_{cell}$. Explain that cell potential is an intensive property. **[2]**

Solution: Gibbs energy depends on the amount of substance. Hence it is an extensive property. However the electrical potential is independent of the amount of substance and thus, it is an intensive property.
eg. Consider a situation when the amount of substance is doubled. This can be done by multiplying the stoichiometric equation of redox reaction by 2. Hence, the amounts of substances oxidized and reduced are doubled. Also ΔG° and the number of electrons transferred are doubled. So, the ratio

$$E^{o} = -\frac{\Delta G^{o}}{nF}$$, becomes

$$E^{o} = -\frac{2\Delta G^{o}}{2nF} = -\frac{\Delta G^{o}}{nF}$$

Thus, E° remains constant.
Hence, electrical potential is an intensive property.

Question 3.6: Describe the laboratory method of preparation of ammonia **[2]**

Solution: On a small scale, ammonia is prepared by decomposition of ammonium salts when treated with slaked lime. Moist ammonia is dried by passing over quick lime (CaO).

$$2NH_4Cl + Ca(OH)_2 \xrightarrow{\Delta} 2NH_3 + CaCl_2 + 2H_2O$$

Ammonium chloride Slaked lime Ammonia Calcium chloride

Question 3.7: Define van't Hoff factor. **[2]**

Solution: The van't Hoff factor is defined as the ratio of observed colligative property produced by a given concentration of electrolyte solution to the property observed for the same concentration of non-electrolyte solution.

Van't Hoff factor :
To account for the extent of dissociation or association, van't Hoff introduced a factor i , known as the van't Hoff factor.

$$i = \frac{\text{Observed colligative property of electrolyte solution}}{\text{Observed colligative property of non-electrolyte solution of same concentration}}$$

It is related to the degree of dissociation as,

$$a = \frac{i - 1}{n' - 1}$$

Value of i :
For association, i < 1
For dissociation, i > 1
No association or dissociation, i = 1

Question 3.8: Write chemical formulae of the following ores : **[2]**

(a) Calamine
(b) Haematite
(c) Magnetite
(d) Corundum

Solution: Calamine $ZnCO_3$

Haematite Fe_2O_3

Magnetite Fe_3O_4

Corundum Al_2O_3

Question 4: Answer any ONE of the following: **[7]**

Question 4.1.i: Write the reactions involved in extraction of silver from its ore by leaching process. **[7]**

Solution:

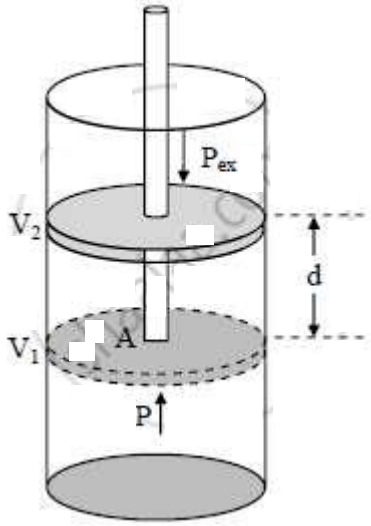
$$\underset{\text{Native silver ore}}{4Ag_{(s)}} + 8CN^-_{(aq)} + O_{2(g)} + 2H_2O_{(l)} \longrightarrow \underset{\text{Sodium dicyanoargentate (I) (Soluble complex)}}{4[Ag(CN)_2]^-_{(aq)}} + 4OH^-_{(aq)}$$

$$\underset{\text{Sodium dicyanoargentate (I) (Soluble complex)}}{2[Ag(CN)_2]^-_{(aq)}} + Zn_{(s)} \longrightarrow 2Ag_{(s)} + \underset{\text{Sodium tetracyanozincate (II) (Soluble complex)}}{[Zn(CN)_4]^{-2}}$$

Question 4.1.ii:

Derive the equation : $W = - P_{ext}AV$

Solution:



1. The work W, that is done due to the expansion or compression of a gas against an external opposing pressure P is called pressure-volume work.

2. Consider a certain amount of gas at pressure P, volume V_1 and temperature T enclosed in a cylinder fitted with frictionless, rigid, movable piston of area A as shown in the figure.
3. As the gas expands, it pushes the piston upward through a distance d against an external opposing force f. The work done by the gas during the process is given by,
   W = opposing force × distance = -f.d ....(1)

4. The negative sign signifies that when the piston moves against an opposing force, the internal energy of the system doing the work will decrease. The force opposing the expansion is the constant external pressure, pex multiplied by the area A of the piston.
   $f = p_{ex} . A$ ....(2)
   From equations (1) and (2),
   $W = -p_{ex} \times A \times d$

5. The product A.d is the volume of the cylinder covered by the piston during its motion that is the change in volume during expansion. Thus
   $A \times d = \Delta V = V_2 - V_1$
   where, V_2 is the final volume of the gas.
   $W = -p_{ex} \cdot \Delta V = -p_{ex} (V_2 - V_1)$

Question 4.1.iii:

A unit cell of iron crystal has edge length 288 pm and density 7.86 $g.cm^{-3}$. Find the number of atoms per unit cell and type of the crystal lattice.
Given : Molar mass of iron = 56 $g.mol^{-1}$; Avogadro's number $N_A = 6.022 \times 10^{23}$.

Solution: Edge length of unit cell (a) = 288pm

volume of unit cell = $(a)^3$

$=(288)^3 = 2.389 \times 10^{-23}\ cm^3$

density of iron = $\rho = 7.86 g.cm^3$

Mass of iron unit cell (M) = Density × Volume

$= 7.86 \times 2.389 \times 10^{-23}$

$= 18.778 \times 10^{-23}\ g$

molar mass of iron = $56\ g.mol^{-1}$

moles of iron in a unit cell = mass of iron in unit cell / molar mass of iron

$= 18.778 \times 10^{-23} / 56$

$= 3.353 \times 10^{-24}\ mol$

number of atoms per unit cell = moles of iron in a unit cell × Avogadro's number

$= 3.353 \times 10^{-24} \times 6.022 \times 10^{23}$

= 2.0191

≈ 2 atoms per unit cell

In a body centered cubic structure (bcc), the total number of atoms equals 2.

Question 4.2.i: Define : Cryoscopic constant. **[7]**

Solution: Cryoscopic constant or the Molal depression constant is defined as the depression in freezing point when one mole of non-volaitile solute is dissolved in one kilogram of solvent. Its unit is $K.Kg.mol^{-1}$

Question 4.2.ii:

What is the action of hot/concentrated nitric acid on – Arsenic

Solution: Arsenic form oxyacids on treatment with hot concentrated nitric acid.

$As_4 + 20HNO_3 \rightarrow 4H_3AsO_4 + 20NO_2 + 4H_2O$

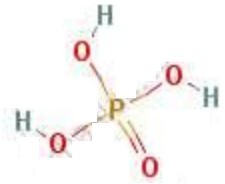
Arsenic Nitric acid (hot conc.) Arsenic acid

Question 4.2.iii:

Draw the structure of: Orthophosphoric acid

Solution: Molecular Formula: H_3O_4P or H_3PO_4

Structure:



Question 4.2.iv:

How much electricity in terms of Faraday is required to produce :
(a) 20 g of Ca from molten $CaCl_2$
(b) 40 g of Al from molten Al_20_3
(Given : Molar mass of Calcium and Aluminium are 40 $g.mol^{-1}$ and 27 $g.mol^{-1}$ respectively.)

Solution: a)

$$Ca^{2+} + 2e^{-1} \longrightarrow \underset{40\ g}{Ca}$$

Electricity required to produce 40g of calcium = 2F

Therefore, electricity required to produce 20 g of calcium

$$= \frac{2 \times 20}{40} F$$

= 1 F

b)

$$Al^{3+} + 3e^{-} \longrightarrow \underset{27\ g}{Al}$$

Electricity required to produce 27g of Al = 3 F

Therefore, electricity required to produce 40 g of Al

$$= \frac{3 \times 40}{27} F$$

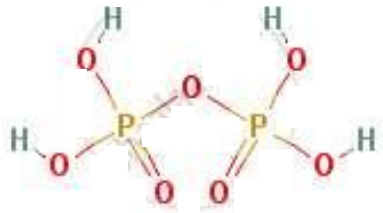
= 4.44 F

Question 4.2.v:

Draw the structure of: Pyrophosphoric acid

Solution: Molecular Formula: $H_4O_7P_2$

Structure :



Question 4.2.vi:

What is the action of hot/concentrated nitric acid on - Antimony.

Solution: Antimony reacts with hot concentrated nitric acid to form antimony oxide.

$4Sb + 20HNO_3 \rightarrow Sb_4O_{10} + 20NO_2 + 10H_2O$

Antimony Nitric acid (hot conc.) Antimony oxide

Question 5: Select and write the most appropriate answers from the given alternatives for each sub-question **[7]**

Question 5.1: Which of the followings is a trihydric alcohol ? **[1]**

(a) n-propyl alcohol
(b) Glycerol
(c) Glycol
(d) Glycine

Solution: (b) Glycerol

Question 5.2: Alkyl halides are - **[1]**

(a) Mono halogen derivatives of alkanes
(b) Di halogen derivatives of alkanes
(c) Tri halogen derivatives of alkanes

(d) Tetra halogen derivatives of alkanes

Solution: Mono halogen derivatives of alkanes

Question 5.3: Mohr's Salt is - **[1]**

(a) Ferrous ammonium sulphate
(b) Ferrous sulphate
(c) Ammonium sulphate
(d) Ferric sulphate

Solution: (a) Ferrous ammonium sulphate

Question 5.4: Which of the following is polyamide ? **[1]**

(a) Teflon
(b) Nylon 6,6
(c) Terylene
(d) Bakelite

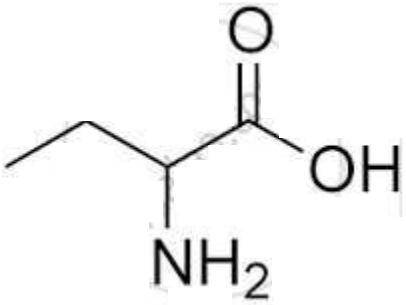
Solution: Nylon 6,6

Question 5.5: Vitamin 'C' belongs to the class of— **[1]**

(a) Vitamins of aliphatic series
(b) Vitamins of aromatic series
(c) Vitamins of alicyclic series
(d) Vitamins of heterocyclic series

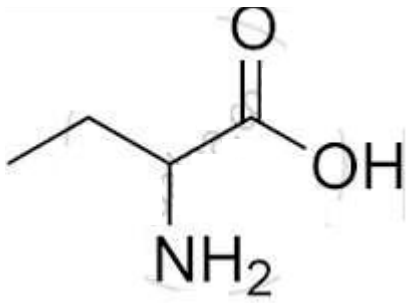
Solution: (a) Vitamins of aliphatic series

Question 5.6: What is the IUPAC name of **[1]**



α - Amino butanoic acid
2 - Amino butyric acid
α - Aminobutyric acid
2 - Amino butanoic acid

Solution:



What is the IUPAC name of **α - Aminobutyric acid.**

Question 5.7: Which among the following molecular formulae represents urotropine? **[1]**

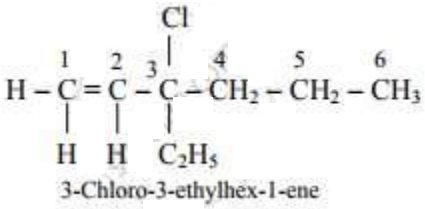
(a) $C_6H_{12}N_4$
(b) $C_6H_{24}H_4$
(c) $C_6H_{12}N_4O_2$
(d) $C_6H_24N_4O_2$

Solution: $C_6H_{12}N_4$

Question 6: Answer any THREE of the following **[9]**

Question 6.1.i: Write the structures of - 3-chloro-3-ethylhex-1-ene **[3]**

Solution:



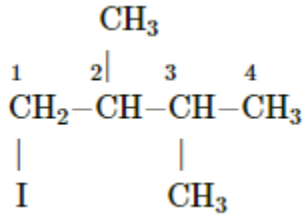
3-Chloro-3-ethylhex-1-ene

Question 6.1.ii:

Write the structures of -1-Iodo-2, 3-dimethylbutane

Solution: 1-Iodo-2,3-dimethyl butane

Structure:

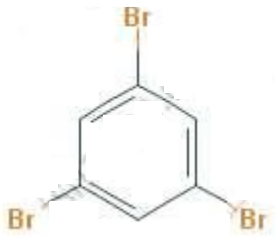


Question 6.1.iii:

Write the structures of - 1, 3, 5 – tribromobenzene

Solution: Molecular Formula: $C_6H_3Br_3$

Structure :



Question 6.2.i: What is the action of acidified potassium dichromate on - SO_2 **[3]**

Solution: Action of acidified potassium dichromate on SO2:
Sulphur dioxide gas is oxidized to sulphuric acid when passed through acidified potassium dichromate solution. The colour of the solution changes from orange to green because potassium dichromate is reduced to chromic sulphate.

$$\underset{\text{Potassium dichromate}}{K_2Cr_2O_7} + \underset{\text{Sulphur dioxide}}{3SO_2} + \underset{\text{Sulphuric acid}}{H_2SO_4} \longrightarrow \underset{\text{Potassium sulphate}}{K_2SO_4} + \underset{\text{Chromic sulphate}}{Cr_2(SO_4)_3} + \underset{\text{Water}}{H_2O}$$

Question 6.2.ii:

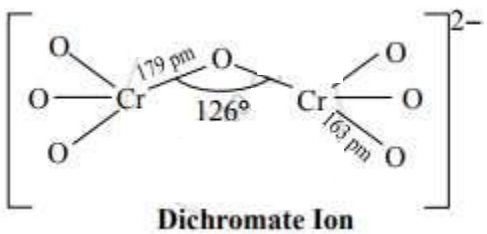
What is the action of acidified potassium dichromate on – KI

Solution 1: Action of acidified potassium dichromate on KI:

Potassium iodide is oxidized to iodine by acidified potassium dichromate. Colour of the solution changes to brown due to the liberated iodine

$$\underset{\text{Potassium dichromate}}{K_2Cr_2O_7} + \underset{\text{Potassium iodide}}{6KI} + \underset{\text{Sulphuric acid}}{7H_2SO_4} \longrightarrow \underset{\text{Potassium sulphate}}{4K_2SO_4} + \underset{\text{Chromic sulphate}}{Cr_2(SO_4)_3} + \underset{\text{Water}}{7H_2O} + \underset{\text{Iodine}}{3I_2}$$

Structure of dichromate ion:



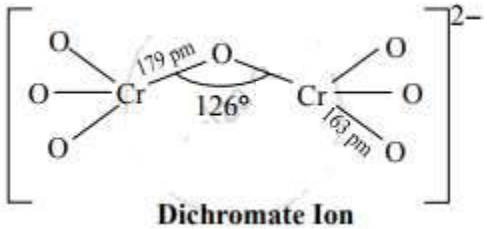
Dichromate Ion

Solution 2: Action of acidified potassium dichromate on KI:

Potassium iodide is oxidized to iodine by acidified potassium dichromate. Colour of the solution changes to brown due to the liberated iodine

$$\underset{\text{Potassium dichromate}}{K_2Cr_2O_7} + \underset{\text{Potassium iodide}}{6KI} + \underset{\text{Sulphuric acid}}{7H_2SO_4} \longrightarrow \underset{\text{Potassium sulphate}}{4K_2SO_4} + \underset{\text{Chromic sulphate}}{Cr_2(SO_4)_3} + \underset{\text{Water}}{7H_2O} + \underset{\text{Iodine}}{3I_2}$$

Structure of dichromate ion:



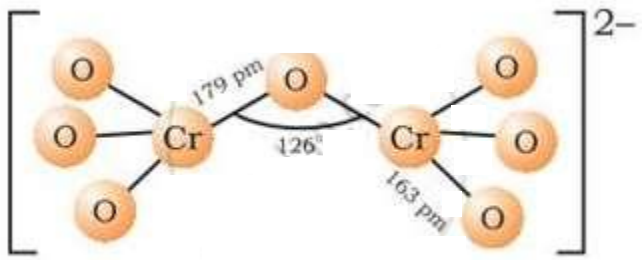
Dichromate Ion

Question 6.2.iii:

Draw structure of dichromate ion

Solution: Dichromate salts contain the dichromate anion, $Cr_2O_7^{2-}$
They are oxoanions of chromium in the oxidation state +6.
They are moderately strong oxidizing agents.
In an aqueous solution, dichromate ions can be interconvertible.

structure of dichromate ion $Cr_2O_7^{2-}$:



Dichromate ion

Question 6.3.i: Describe laboratory method for preparation of glucose. [3]

Solution: Preparation of glucose

Glucose can be prepared in the laboratory by boiling sucrose (cane sugar) with dilute hydrochloric acid or sulphuric acid for about two hours. This hydrolyzes sucrose to glucose and fructose. In order to separate glucose from fructose, alcohol is added during cooling. Glucose is almost insoluble in alcohol. It crystallizes out first, while fructose is more soluble. It remains in the solution. The solution is filtered to obtain the crystals of glucose.

By boiling sucrose with dilute HCl or H_2SO_4 in alcoholic solution

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose Glucose Fructose

By boiling starch with dilute H_2SO_4, at 393 K, under pressure

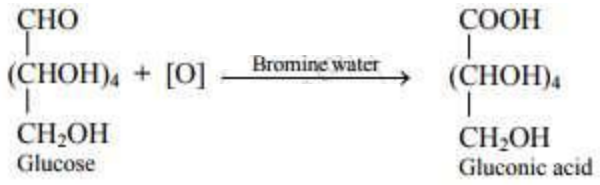
$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow[393k,2\text{-}3\ atoms]{H^+} nC_6H_{12}O_6$$

starch or cellulose Glucose

Question 6.3.ii:

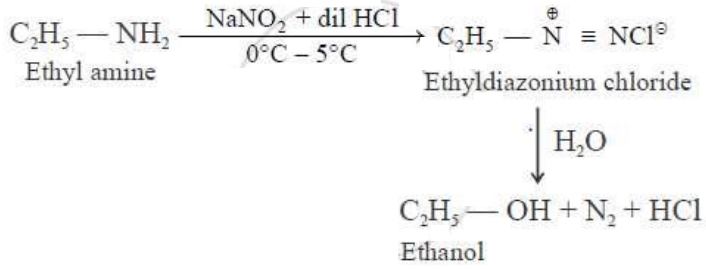
Write the reaction that indicates the presence of -CHO group in glucose

Solution: The oxidation of glucose with bromine water (which is a mild oxidizing agent) forms gluconic acid. This indicates presence of aldehyde group.



Question 6.4.i: What will be the action of the mixture of sodium nitrite and dilute hydrochloric acid on ethyl amine [3]

Solution:

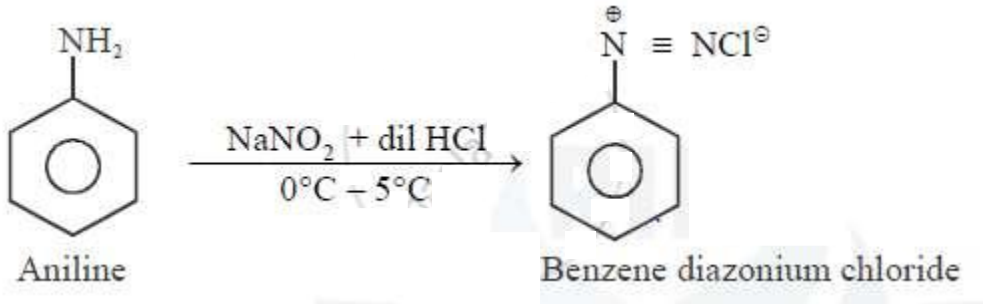


Ethyl amine reacts with $NaNO_2$ + dil HCl to give diazonium salt which decomposes and forms ethanol

Question 6.4.ii:

What will be the action of the mixture of sodium nitrite and dilute hydrochloric acid on aniline

Solution:

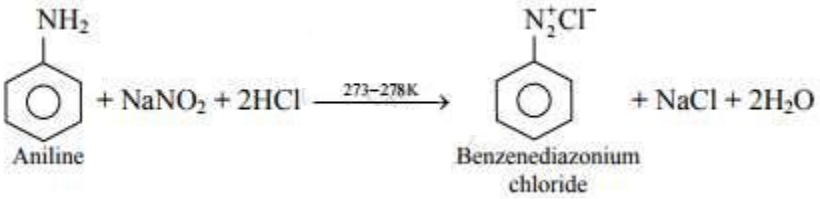


Aniline reacts with $NaNO_2$ + dil HCl to form diazonium salt.

Question 6.4.iii:

What will be the action of the mixture of sodium nitrite and dilute hydrochloric acid on triethyl amine

Solution: Aromatic primary amines react with nitrous acid in cold condition to give diazonium salts.



Question 7: Answer any SIX of the following : **[9]**

Question 7.1: What are chemical twins? Write 'two' examples. **[2]**

Solution: Chemical twins are those in which the properties of some elements are same. Atomic size of Zr and Hf , Nb and Ta are similar. This is due to Lanthanide contraction.
Example - Zr and Hf ; Nb and Ta

Question 7.2: Explain the term Antiseptics **[2]**

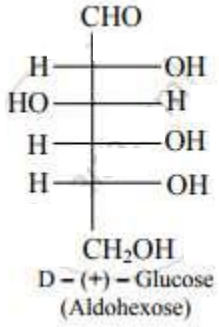
Solution 1: Antiseptic

- Chemicals which either kill or prevent the growth of microorganisms
- Antiseptics are applied to living tissues such as wounds, cuts, ulcers and diseased skin surfaces.
- Example:
- Furacine
- Soframicine
- Dettol (mixture of chloroxylenol and terpineol)

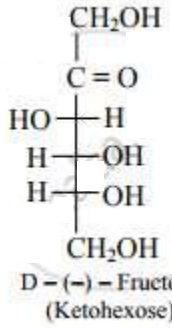
Solution 2: Anticeptic: Chemicals which either kill or prevent the growth of microorganismsn are called anticeptic drug. Antiseptics are applied to living tissues such as wounds, cuts, ulcers and diseased skin surfaces. For example: Soframicine, dettol etc.

Question 7.3: Draw the simple Fisher projection formulae of D - (+) - glucose and D - (-) – fructose **[3]**

Solution:



D – (+) – Glucose
(Aldohexose)



D – (–) – Fructose
(Ketohexose)

Question 7.4: Classify the following ligands into monodentate and polydentate — **[2]**

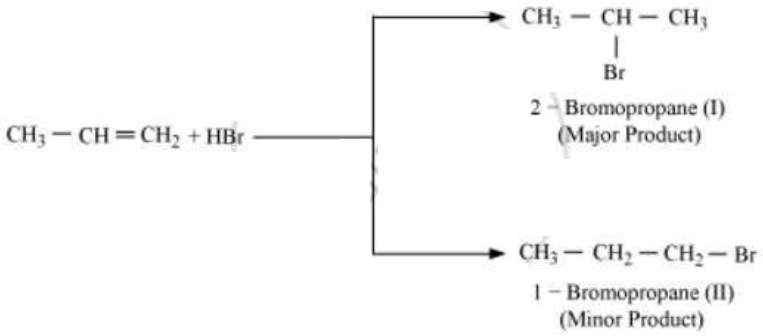
1. Ammonia
2. Carbon monoxide
3. Ethylene diamine
4. Ethylene diamine tetra acetate ion

Solution:

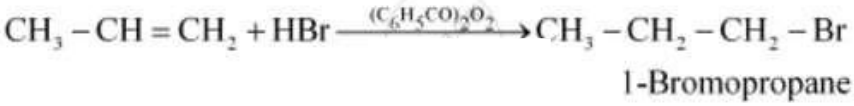
1. Ammonia - monodentate
2. Carbon monoxide - monodentate
3. Ethylene diamine - polydentate
4. Ethylene diamine tetra acetate ion - polydentate

Question 7.5: State and explain Markownikoff's rule with suitable example **[2]**

Solution: The Markovnikov's rule states that when to an unsymmetrical alkene a reagent is added then the negative part of the addendum (adding molecule) gets attached to that carbon atom which possesses lesser number of hydrogen atoms. For example

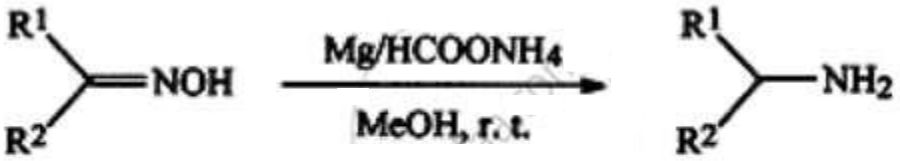


The anti- Markovnikov's rule is the reverse of the above and states that when to an unsymmetrical alkene a reagent is added then the negative part of the addendum (adding molecule) gets attached to that carbon atom which possesses more number of hydrogen atoms. It is normally followed when hydrogen and many other peroxide is added to a reaction system. Thus when the reaction system contains peroxides, anti- Markovnikov's rule will be followed. If any particular reagent has not been mentioned, then Markovnikov's rule will be followed. Example, in the following reaction anti-Markovnikov's rule is followed due to the presence of peroxide



Question 7.6: How are propan-1-amine and propan-2-amine prepared from oxime? **[2]**

Solution: The basic reaction to prepare amine from oxime is as follows:



R^1,R^2 = H or alkyl or phenyl or substituted phenyl group

If R_1 = H and R_2 = CH_3CH_2 then the product will be propane-1-amine.

If R_1 and R_2 both are CH_3 then the product will be propane-2-amine.

Question 7.7: **[2]**

Identify 'A' and 'B' in the following reaction :

$C_6H_5MgBr + CO_2 \rightarrow$ 'A' $\xrightarrow{PCl_5}$ 'B'

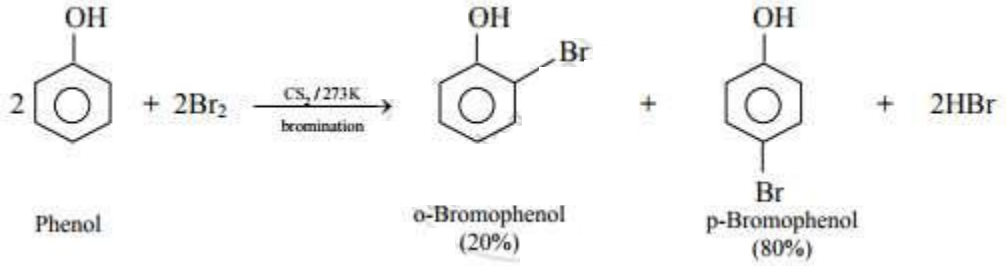
Solution:

$$C_6H_5MgBr + CO_2 \xrightarrow[H_2O]{\text{Dry ether}} C_6H_5COOH \xrightarrow{PCl} C_6H_5COCl$$

Phenyl Benzoic acid Benzoyl magnesium (A) chloride bromide (B)

Question 7.8.i: What is the action of the following reagents on phenol - Bromine in CS_2 at low temperature. **[2]**

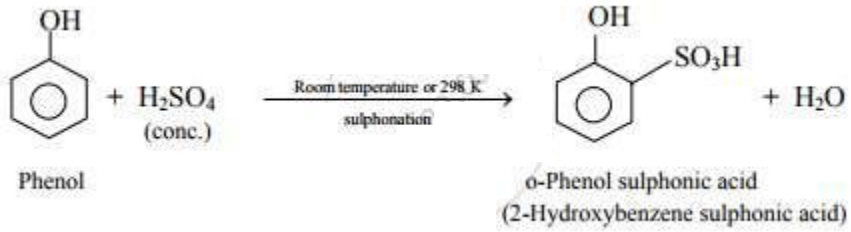
Solution: a. Action of bromine in CS2 at low temperature on phenol:
When phenol is treated with Br2 in non-polar solvent like CS_2 or CCl_4 or $CHCl_3$ at 273 K, it forms a mixture of ortho- and para-Bromophenol isomers.



Question 7.8.ii:

What is the action of the following reagents on phenol - H_2SO_4 at room temperature.

Solution: Action of conc. H2SO4 at room temperature on phenol:
At 298 K, phenol reacts with conc. H2SO4 forming o-phenol sulphonic acid as major product.



Question 8: Answer any ONE of the following: **[7]**

Question 8.1.i: Write the structure and IUPAC names of all the metamers represented by formula C_4H_{10} **[7]**

Solution: 1. Diethyl ether CH_3-CH_2-O-CH_2-CH_3

2. Methyl n-propyl ether CH_3-CH_2-CH_2-O-CH_3

Question 8.1.ii:

Write balanced chemical equations for action of ammonia on – formaldehyde

Solution: a. $6HCHO + 4NH_3 \rightarrow (CH_2)_6N_4 + 6H_2O$
Formaldehyde Urotropine

Question 8.1.iii:

Write balanced chemical equations for action of ammonia on – acetaldehyde

Solution:

b. $CH_3 - CHO + NH_3 \longrightarrow CH_3 - \underset{\displaystyle NH_2}{\overset{\displaystyle H}{\underset{|}{\overset{|}{C}}}} - OH$
Acetaldehyde — Acetaldehyde ammonia

Question 8.1.iv:

Write balanced chemical equations for action of ammonia on – acetone

Solution:

c. $CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}} = O + H_2 - CH - \overset{\displaystyle O}{\overset{||}{C}} - CH_3 \xrightarrow[-H_2O]{NH_3} CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}} = CH - \overset{\displaystyle O}{\overset{||}{C}} - CH_3$
Acetone — Mesityl oxide

$CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}} = CH - \overset{\displaystyle O}{\overset{||}{C}} - CH_3 + HNH_2 \longrightarrow CH_3 - \underset{\displaystyle NH_2}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}} - CH_2 - \overset{\displaystyle O}{\overset{||}{C}} - CH_3$
Mesityl oxide — Diacetoamine

Question 8.2.i: Write 'four' characteristics of co-ordinate complex ion. **[7]**

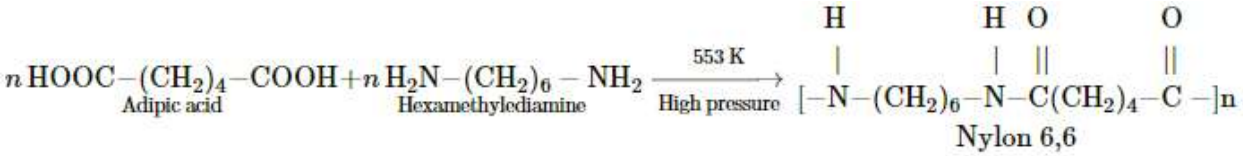
Solution: a. Generally a transition metal ion is the central metal ion in a complex.
b. An ion loses its individual properties and acquires the Properties of the complex ion, which it forms.
c. The complex ion can dissociate to a slight extent in the solution however it retains its identity. The strength of bond between the central metal and ligands determines the degree of dissociation.
d. The algebraic sum of the charges of the constituent ions is the net charge of the complex ion.

e. The stability of chelate complex is higher than those complexes which are similar but nonchelated.

Question 8.2.ii:

How is Nylon 6, 6 prepared?

Solution 1: Nylon-6,6 is prepared by the method of condensation polymerisation process. Hexamethylenediamine combines with adipic acid to give the macromolecule Nylon-6,6 with the elimination of water molecule.



Used in making sheets, bristles for brushes and in the textile industry.

Solution 2: Nylon -6,6 is synthesized by polycondensation of hexamethylenediamine and adipic acid. Equivalent amounts of hexamethylenediamine and adipic acid are combined with water in a reactor. This is crystallized to make nylon salt, an ammonium/carboxylate mixture. The nylon salt goes into a reaction vessel where polymerization process takes place either in batches or continuously.

$$n\ HOOC\text{-}(CH_2)_4\text{-}COOH + n\ H_2N\text{-}(CH_2)_6\text{-}NH_2 \rightarrow [\text{-}OC\text{-}(\ CH_2)_4\text{-}CO\text{-}NH\text{-}(CH_2)_6\text{-}NH\text{-}]_n + (2n\text{-}1)\ H_2O$$

Removing water drives the reaction toward polymerization through the formation of amide bonds from the acid and amine functions. Thus molten nylon 66 is formed. It can either be extruded and granulated at this point or directly spun into fibers by extrusion through a spinneret (a small metal plate with fine holes) and cooling to form filaments.

Question 8.2.iii:

Write any ‘two' uses of terylene.

Solution: Terelyne is used for making plastic bottles and clothing.

Question 8.2.iv:

Write ‘four’ physical methods of preserving food materials

Solution: Food preservatives

- Chemicals that prevent food from spoilage due to microbial growth
- Example: Table salt, vegetable oil, sodium benzoate (C_6H_5COONa), salts of propanoic acid
- Physical methods:
  a. By removal of heat

b. By addition of heat
c. By removal of water
d. By irradiation