Half Yearly Portion Study Materials

11th Standard

Chemistry

Multiple Choice Questions

1) 1 g of an impure sample of magnesium carbonate (containing no thermally decomposable impurities) on complete thermal decomposition gave 0.44 g of carbon dioxide gas. The percentage of impurity in the sample is _____
(a) 0%(b) 4.4%**(c) 16%**(d) 8.4%

2) 7.5 g of a gas occupies a volume of 5.6 litres at 0° C and 1 atm pressure. The gas is
(a) NO(b) N_2O(c) CO(d) CO_2

3) Which of the following contain same number of carbon atoms as in 6 g of carbon-12.
(a) 7.5 g ethane(b) 8 g methane**(c) both (a) and (b)**(d) none of these

4) Maximum oxidation state is present in the central metal atom of which compound
(a) CrO_2Cl_2(b) MnO_2(c) $[Fe(CN)_6]^{3-}$(d) MnO

5) The volume occupied by any gas at S.T.P. is_____
(a) 22.4litres(b) 2.24litres(c) 224 litres(d) 0.224 litres

6) Two elements X and Y (atomic mass of X = 75; Y = 16) combine to give a compound having 76% of X. The formula of the compound is?
(a) XY(b) X_2Y(c) X_2Y_2**(d) X_2Y_3**

7) How many equivalents of sodium sulphate is formed when sulphuric acid is completely neutralized by a base NaOH:
(a) 0.2**(b) 2**(c) 0.1(d) 1

8) How many molecules of hydrogen is required to produce 4 moles of ammonia?
(a) 15 moles(b) 20 moles**(c) 6 moles**(d) 4 moles

9) According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon?
(a) n = 6 to n = 1(b) n = S to n = 4(c) n = S to n = 3**(d) n = 6 to n = S**

10) Electron density in the yz plane of $3d_{x^y-y^2}$ orbital is
(a) zero(b) 0.50(c) 0.75(d) 0.90

11) Which one of the following arrangements represent the correct order of least negative to most negative electron gain enthalpy
(a) Al < O < C < Ca < F(b) Al < Ca < O < C < F(c) C < F < O < Al < Ca **(d) Ca < Al < C < O < F**

12) Assertion: Permanent hardness of water is removed by treatment with washing soda.
Reason: Washing soda reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates

(a) Both assertion and reason are true and reason is the correct explanation of assertion. (b) Both assertion and reason are true but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false (d) Both assertion and reason are false

13) Assertion Generally alkali and alkaline earth metals form superoxides
Reason There is a single bond between O and 0 in superoxides
(a) both assertion and reason are true and reason the correct explanation of assertion (b) both assertion and reason are true but reason is not the correct explanation of assertion (c) assertion is true but reason is false **(d) both assertion and reason are false**

14) Rate of diffusion of a gas is
(a) directly proportional to its density (b) directly proportional to its molecular weight (c) directly proportional to its square root of its molecular weight **(d) inversely proportional to the square root of its molecular weight**

15) When 15.68 litres of a gas mixture of methane and propane are fully combusted at 0° C and 1 atmosphere, 32 litres of oxygen at the same temperature and pressure are consumed. The amount of heat of released from this combustion in KJ is (ΔH_c (CH_4) = - 890 KJ mol^{-1} and ΔH_c (C_3H_8 = - 2220 KJ mol^{-1})
(a) - 889 $K.Jmol^{-1}$ (b) - 1390 $K.Jmol^{-1}$ (c) - 3180 $K.Jmol^{-1}$ **(d) - 635.47 $K.Jmol^{-1}$**

16) In the equilibrium,
$2A(g) \rightleftharpoons 2B(g) + C2(g)$
the equilibrium concentrations of A, B and C_2 at 400 K are 1×10^{-4} M, 2.0×10^{-3} M, 1.5×10^{-4} M respectively. The value of K_C for the equilibrium at 400 K is
(a) 0.06 **(b) 0.09** (c) 0.62 (d) 3 x 10^{-2}

17) The partial pressure of nitrogen in air is 0.76 atm and its Henry's law constant is 7.6×10^4 atm at 300K. What is the mole fraction of nitrogen gas in the solution obtained when air is bubbled through water at 300K?
(a) 1 x 10^{-4} (b) 1 x 10^{-6} (c) 2 x 10^{-5} **(d) 1 x 10^{-5}**

18) The IUPAC name of the compound $CH_3 - CH = CH - C \equiv CH$ is
(a) Pent - 4 - yn-2-ene **(b) Pent -3-en-l-yne** (c) pent – 2– en – 4 – yne (d) Pent – 1 – yn –3 – ene

19) What is the colour formed in Lassaigne's test of an organic compound containing N and S?
(a) Prussian blue colour **(b) Blood red colour** (c) Purple colour (d) Canary yellow colour

20) The geometrical shape of carbocation is
(a) Linear (b) tetrahedral **(c) Planar** (d) Pyramidal

21) In $-NO_2$, $-NH_2$,$-SO_3H$, the decreasing order of I II III -I effect is
(a) I > II > III **(b) I > III > II** (c) III > II > I (d) III > I > II

22) Which one of the following is correct order of the stability of carbanions?
(a) $-C(CH_3)_3 > {}^-CH(CH_3)_2 > {}^-CH_2{}^-CH_3 > {}^-CH(CH_3)_2 > {}^-$ (b) ${}^-CH_3 > {}^-CH_2{}^-CH_3$ **(c) $^-CH(CH_3)_2 > {}^-H_3 > {}^-CH_2{}^-CH_3 > {}^-$** (d) ${}^-CH_2{}^-CH_3 > {}^-CH(CH^3)_2 > {}^-CH_3 > {}^-$

> $^{-}CH_3$ $(CH_3)_3$ **$(CH_3)_3$** $(CH_3)_3$

23) $CH_2(Br) - CH_2(Br) \xrightarrow{(A)} CH \equiv CH$, where A is,

(a) Zn (b) Conc H_2SO_4 **(c) alc. KOH** (d) dil H_2SO_4

24) In which of the following geometrical isomerism is possible?

(a) $CH_3CH = C(CH_3)_2$ **(b) $C_6H_5N = NC_6H_5$** (c) $CH_3CH = CH_2$ (d) All of these

25) Which one of the following shows three possible isomeric structures?

(a) C_4H_{10} **(b) C_5H_{12}** (c) C_6H_{12} (d) C_3H_4

26) Which of the following is less reactive than benzene towards electrophilic substitution reactions?

(a) Nitrobenzene (b) Aniline (c) Bromobenzene (d) Chlorobenzene

27) Chloroform reacts with nitric acid to produce

(a) nitro toluene (b) nitro glycerine **(c) chloropicrin** (d) chloropicric acid

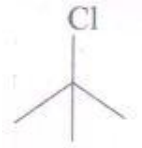
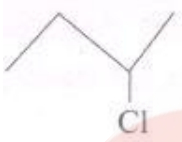
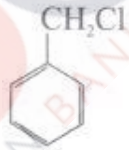
28) For reacting with HCI, the alcohol which does not require $ZnCI_2$ is

(a) PCl_3 (b) PCl_5 **(c) $SOCl_2$** (d) None of the above

29) Which of the following pair functional groups represents ambident nucleophiles?

(a) -SH & - OH **(b) CN & -NO_2** (c) -Br & -Cl (d) -O- &-CHO

30) Which one of the following will undergo SNI reaction faster?

(a)  (b)  (c)  (d) 

2 Marks

31) Calculate the average atomic mass of naturally occurring magnesium using the following data

Isotope	Istopic atomic mass	Abundance(%)
Mg^{24}	23.99	78.99
Mg^{26}	24.99	10.00
Mg^{25}	25.98	11.01

Answer : Average atomic mass

$= \frac{(78.99\times23.99)+(10\times24.99)+(11.01\times25.98)}{100}$

$= \frac{2430.9}{100}$

= 24.31u

32) Explain the term limiting reagent.

Answer : When a reaction is carried out using non-stoichiometric quantities of the reactants, the product yield will be determined by the reactant that is completely consumed. This reagent is called as the limiting reagent.

33) An atom of an element contains 35 electrons and 45 neutrons. Deduce

(i) the number of protons

(ii) the electronic configuration for the element

(iii) All the four quantum numbers for the last electron

Answer : no. of electrons: 35 (given)
no. of protons : 35
Electronic configuration
$1s^2\ 2S^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

↓↑	↑↓	↑
$4P_x$	$4P_y$	$4p_z$

last electron present in $4P_y$ orbital y
n = 41 = 1 m1 = either + 1 or -1 and s = -1/2

34) Calculate the total number of angular nodes and radial nodes present in 4p and 4d orbitals.

Answer : For 4p orbital: Number of angular nodes = l
For 4p orbital l = 1
∴. Number of angular nodes = 1
Number of radial nodes = n - l - 1
= 4-1-1
= 2
∴.Total number of nodes = n -1 = 4 - 1 = 3
1 angular node and 2 radial nodes.
For 4d orbital: Number of angular nodes = 1
For 4d orbital 1= 2
∴. Number of angular nodes = 2,
Number of radial nodes = n - l- 1
=4-2-1
= 1
∴. Total number of nodes = n - 1 = 4 - 1 = 3
1 radial nodes and 2 angular node.

35) Would you expect the first ionization enthalpies of two isotopes of the same element to be the same or different? Justify your answer.

Answer : Ionization enthalpy, among other things, depends upon the electronic configuration (number of electrons) and nuclear charge (number of protons). Since isotopes of an element have the same electronic configuration and same nuclear charge, they have same ionization enthalpy.

36) An the cube at 0° C is placed in some liquid water at 0^0C, the ice cube sinks - Why? What will happen to ice at 0^0C placed in liquid water at 0^0C?

Answer : NOTE
At any condition ice cube does not sink in water.
At 0^0C, ice and liquid water will be in equilibrium and will coexist. Hence no freezing or melting will occur.

37) Mention the uses of sodium hydroxide.

Answer : (i) Sodium hydroxide is used as a laboratory reagent.
(ii) It is also used in the purification of bauxite and petroleum refining.
(iii) It is used in the textile industries for mercerising cotton fabrics.
(iv) It is used in the manufacture of soap, paper, artificial silk and a number of chemicals.

38) Write a note about physical appearance of gypsum.

Answer : (i) Gypsum is usually white, colourless or grey in colour.
(ii) It can also be found in the shades of pink, yellow, brown and light green, mainly due to the presence of impurities.
(iii) Gypsum crystals are found to occur in a form that resembles the petals of a flower. This type of formation is referred to as 'desert rose', as they mostly occur in arid areas or desert terrains

39) Give reason why sodium bicarbonate is used in bakeries.

Answer : Sodium bicarbonate is called as baking soda. Because it decomposes on heating to generate bubbles of carbon dioxide, leaving holes in cakes or pastries and making them light and fluffy

40) Distinguish between diffusion and effusion.

Answer : Distinguish between diffusion and effusion:
Diffusion is the process by which molecules move and travel from one place to another without requiring bulk motion. Diffusion results in molecules mewing or mixing by only using kinetic energy.
Effusion is the process by which molecules travel through a pinhole from a place of high concentration to low concentration. The process describes the ability of gas to travel through a small hole without collisions between molecules.

41) For the reaction, $2A(g) + B(g) \longrightarrow 2D(g)$ $\Delta U^0 = -10.5$ kJ and $\Delta S^0 = -44.1\ JK^{-1}$. Calculate ΔG^0 for the reaction and predict whether the reaction is spontaneous or not.

Answer : $\Delta H^0 = \Delta U^0 + RT(\Delta n)$
$= -10.5 + 8.314 \times 10^{-3} \times 298 \times (-1)$
$= -12.978$ kJ
We know, $\Delta G^0 = \Delta H^0 - T\Delta S^0$
$= -12.978 - 298\ (-44.1 \times 10^{-3})$
$= 0.164$ kJ
Hence, the reaction is non spontaneous.

42) For a given reaction at a particular temperature, the equilibrium constant has constant value. Is the value of Q also constant? Explain.

Answer : No. The value of Q is determined by the concentration of product and reactants that are not necessarily equilibrium concentration. Thus its value is not a constant. At equilibrium $K_c = Q$.

43) (i)State Le-charteriers principle.
(ii)Write the complete thermochemical equation for the formation of NH_3 and mention which is endothermic & exothermic.

Answer : (i) It states that "If a system at equilibrium is disturbed, then the system shifts itself in a direction that nullifies the effect of that disturbance. "
(ii) Let us consider the formation of ammonia

$$N_2(g) + 3H_2(g) \underset{endothermoic}{\overset{exothermic}{\rightleftharpoons}} 2NH_3(g)\ \Delta H = 92.2KJ$$

In this equilibrium, the forward reaction is exothermic (i.e.) the heat is liberated while the reverse reaction is endothermic (i.e.) the heat isabsorbed.

44) How many moles of solute particles are present in one litre of 10^{-4} M potassium sulphate?

Answer : In 10^{-4}M K_2SO_4 solution, there are 10^{-4} moles of potassium sulphate. K_2SO_4 molecule contains 3 ions ($2K^+$ and $1So_4^{2-}$)
1 mole of K_2SO_4 contains 3 × 6.023 x 1023 ions 10^{-4} mole of K_2SO_4 contains 3 x 6.023 x 1023 x 10^{-4} ions
= 18.069×10^{19}.

45) What is the relationship between the solubility of eerie sulphate with temperature?

Answer : The dissolution of eerie sulphate is exothermic and the solubility decreases with the increase in temperature.

46) 0.30 g of a substance gives 0.88 g of carbon dioxide and 0.54 g of water calculate the percentage of carbon and hydrogen in it.

Answer : Weight of organic compound = 0.30g
Weight of carbon dioxide = O.88g
Weight of water = O.54g
Percentage of carbon:
44 g if carbondioxide contains, carbon = 12g
0.88 g of carbon dioxide contains,
carbon = $\frac{12\times0.88}{44}g$
0.30 g substance contams, carbon = $\frac{12\times0.88}{44}g$
100g substance contains
$\frac{12\times0.88}{44} \times \frac{100}{0.30} = 80$ g of carbon
Percentage of carbon = 80
Percentage of hydrogen:
18 g of water contains, hydrogen = 2g
0.54 g of water contains, hydrogen= $\frac{2\times0.54}{18}g$
0.30 g of substance contains hydrogen= $\frac{2\times0.54}{18\times0.30}g$
100g of substance contam. s = $\frac{2\times0.54}{18\times0.30} \times 100g$
= 20g of hydrogen
Percentage of hydrogen = 20

47) Write the IUPAC names of the following compounds.

(i) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{CH_2-Ch_2}{|}}{CH} - CH_2 - CH_3$

(ii) $CH_3 - \underset{\underset{CHO}{|}}{C}H - CH_2 - CH_3$

Answer : (i) 3-ethyl-2-methyl pentane
(ii) 2-methylbutanal

48) Write the possible isomers for the formula CSH)O with their name and type of isomerism present in it.

Answer : CsHIO: (i) CH_3-CH_2-CH_2-CH = CH_2 (Pent-l-ene)
(ii) CH_3-CH_2-CH = CH-CH_3 (Pent-2-ene)
The type of isomerism present above is position isomerism.

49) What are free radical initiators?

Answer : The types of reagents that promote homolytic cleavage in substrate are called as free radical initiators. They are short lived and are highly reactive.

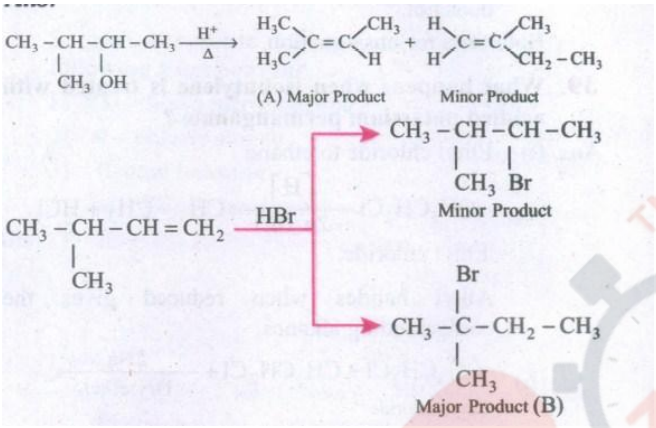
50) $CH_3 - CH(CH_3) - CH(OH) - CH_3$

$\downarrow$ H^+/heat

(A) major product $\xrightarrow{HBr}$ (B) major product

Identify A and B.

Answer :



51) What happens when water is treated with ethyne and propyne?

Answer : Alkynes undergo hydration on warming with mercuric sulphate and dilute H_2SO_4 at 333K to form carbonyl compounds.

$CH \equiv CH + HOH \xrightarrow[333K]{Hg^{2+}/H^+} CH_3 = \underset{OH}{C} - H \xrightarrow{Isomerisation} CH_3CHO$

Ethene Acetaldehyde

$CH_3 - C \equiv CH + HOH \xrightarrow[333K]{Hg^{2+}/H^+} CH_3 - \underset{OH}{C} = CH_2 \xrightarrow{Isomerisation} CH_3 - \underset{O}{\overset{\|}{C}} - CH_3$

Propyne Propan-2-one

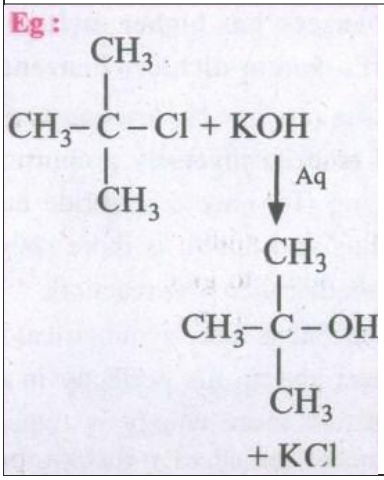
52) Why chlorination of methane is not possible in dark?

Answer : Methane does not react with chlorine in dark. Reaction of methane with chlorine proceeds by free radical mechanism. The initiation step in the free radical chain reaction is $Cl_2 \rightarrow 2Cl$. This step requires more energy. The excess energy is provided by heat or light.

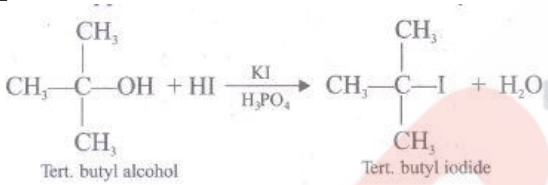
53) Compare S_N1 and S_N2 reaction mechanisms.

Answer :

S_N1 Reaction	S_N2 product
It is unimolecular reaction	It is a bimolecular reaction.
Its mechanism occurs in two steps	It is a one step process
It involves the formation of an intermediate (Carbocation)	It involves the formation of transition sate.
Rate = k[Alkyl halide]	Rate = k[Alkyl halide] [Nuclophile]
Products have both retained and inverted configuration	Products have inverted configuration.

Carbocation rearrangement occurs.	No carbocation rearrangement occurs.
Reactirity : Methyl < 1 ° < 2° < 3°	IReactirity : Methyl > 1° > 2° > 3°
Eg : 	Eg: $CH_3Cl + KOH \xrightarrow{Aq} CH_3OH + KCl$

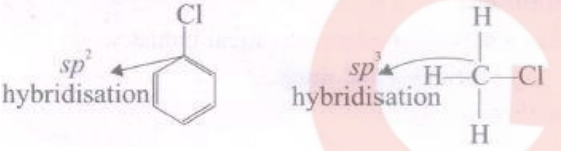
54) What happens when HI reacts with tert. butyl alcohol?

Answer : 

55) Compare the bond length C-X in haloarenes and C-X in haloalkanes

Answer : (i) Due to this double bond character of C-X bond in haloarenes, the C-X bond length is shorter length and stronger than in haloalkanes.

(ii) Example:



3 Marks

56) Why is anode called oxidation electrode, whereas the cathode is called reduction electrode?

Answer : At the anode, loss of electron takes place (ie.,) oxidation occurs. Hence called as oxidation electrode.

At the cathode, the gain of electrons takes place (ie.,) reduction occurs. Hence called as reduction electrode.

57) Calculate the oxidation number of underlined atoms of the following:

$K_2\underline{Cr}O_4$

Answer : $K_2\underline{Cr}O_4$

2(1)+x+4(-2) = 0

2+x-8 = 0

x-6 = 0

x = +6

Oxidation number of Cr in K_2CrO_4 is +6

58) Calculate the molar volume of the following 5 moles of methane

Answer : Molar mass of methane= 16 g

Molar volume of 16g (1 mole) of methna= $2.24 \times 10\text{-}^{2}\ m^3$
volume of 5 moles(80g) of methane = $\frac{2.24\times10^{-2}\times80}{16}$
= $11.2 \times 10^{-2}\ m^3$

59) Calculate the mass of the following atoms in a.m.u (unified atomic mass).

Answer : (i) Oxygen: (average mass of oxygen atom = 2.656 x $1O^{-23}$g
1 a.m.u = 1.6605 x $1O^{-27}$kgor 1.6605 x $1O^{-24}$gram)
(ii) Mass of an oxygen atom = 2.656 x $1O^{-23}$g
The mass of oxygen atom In a.m.u = $\frac{Average\ mass\ of\ oxygen\ atom\ in\ gram}{1.6605\times10^{-24}}$

$= \frac{2.656\times10^{-23}g}{1.6605\times10^{-24}g}$
=1.599x10
=15.99a.m.u

60) Calculate the amount of water produced by the combustion of 32 g of methane.

Answer : $CH_{4(g)} + 2O_2 \rightarrow CO_2 + 2H_2O$
16g (2x18)g
As per stoichiometric equation,
16 g of methane produces 36 g of H_2O
$\therefore$ 32 g of methane will produce = $\frac{36}{16} \times 32 = 72$ g of water.

61) Discuss the similarities and differences between 1s and 2s-orbitals.

Answer : The similarities in 1s and 2s-orbitals are as follows :
(i) Both have the spherical shape
(ii) Both have the same angular momentum.
The difference in between them are as follows :
(i) Size of 2s-orbital is larger than that of 1s-orbital.
(ii) Energy of 2s-orbital is greater than that of 1s-orbital.
(iii) 2s-orbital has one node while 1s-orbital has no node.

62) Write a note about principal quantum number.

Answer : (i) The principal quantum number represents the energy level in which electron revolves around the nucleus and is denoted by the symbol 'n'.
(ii) The 'n' can have the values 1,2,3, ... n = 1 represents K shell; n=2 represents L shell and n = 3, 4, 5 represent the M, N, O shells, respectively.
(iii) The maximum number of electrons that can be accommodated in a given shell is $2n^2$.
(iv) 'n' gives the energy of the electron,
$E_n = \frac{(-1312.8)Z^2}{n^2}\ kJ\ mol^{-1}$ and the distance of the electron from the nucleus is given by $r_n = \frac{(0.529)n^2}{Z} A$

63) Define metallic radius.

Answer : Metallic radius is defined as one half of the distance between two adjacent metal atoms in the closely packed metallic crystal lattice.

64) How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

Answer : Electronic configuration of Na and Mg are

$Na = Is^2\ 2s^2 2p^6\ 3s^1$

$Mg = Is^2\ 2s^2 2p^6\ 3s^2$

First electron in both cases has to be removed from 3s-orbital but the nuclear charge of Na (+ 11) is lower than that of Mg (+12) therefore first ionization energy of sodium is lower than that of magnesium.

After the loss of first electron, the electronic configuration of

$Na^+ = Is^2\ 2s^2\ 2p^6$

$Mg^+ = Is^2\ 2s^2 2p^6\ 3s^1$

Here electron is to be removed from inert(neon) gas configuration which is very stable and hence removal of second requires more energy when compared to Mg. Therefore, second ionization enthalpy of sodium is higher of magnesium.

65) Give the uses of sodium bicarbonate

Answer : (i) Sodium hydrogen carbonate is used as an ingredient in baking.

(ii) It is a mild antiseptic for skin infections.

(iii) It is also used in fire extinguishers

66) Write a note about the structure of beryllium chloride.

Answer : (i) $BeCl_2$ has a chain structure in the solid state.

(ii) In the vapour phase $BeCl_2$ tends to form a chloro-bridged dimer.

(iii) At high temperatures of the order of 1200K it gives linear monomer

67) Give reason for the following statements. U is an extensive property

Answer : 'U' is an extensive property because its magnitude depends on the quantity of material in the system.

68) For the oxidation of iron: $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

The entropy change is -549.4 $Jk^{-1}mol^{-1}$ at 298K. Inspiteof negative entropy change of this' reaction, why this reaction is spontaneous?

Answer : $\triangle H^0$ for this reaction is -1648×10^3 j mol^{-1}

$\triangle s^0$ (system) = -549.4 $jk^{-1}mol^{-1}$

$\triangle H^0$ (reaction) = -1648×10^3 j mol^{-1}

T = 298 K (as standard state)

$\triangle S(total) = \triangle S(system) + \triangle S(surronding)$

$\triangle S(total) > 0$ for spontaneous process

$$\triangle S(surrrounding) = \frac{\Delta H(surronding)}{T}$$

$$= \frac{+1648 \times 10^3}{298} = 5530\ K^{-1}mol^{-1}$$

$\triangle S(total)$ = -549.4 + 5530

= 4960.6 J k^{-1} mol^{-1}

= Positive

Hence, the reaction is spontaneous

69) Give three examples for solid vapour equilibrium.

Answer : $I_2(S) \leftrightharpoons I_2(g)$

Camphor (s) ⇌Camphor (g)

$NH_4Cl(s) \rightleftharpoons NH_4Cl(g)$

70) The following concentration were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at 500 K.

N_2 (g)] = 1.5 x 10^{-2} M

$[H_2$ (g)] = 3.0 x 10^{-2} M

$[NH_3]$ = 1.2 x 10^{-2} M.

Calculate equilibrium constant

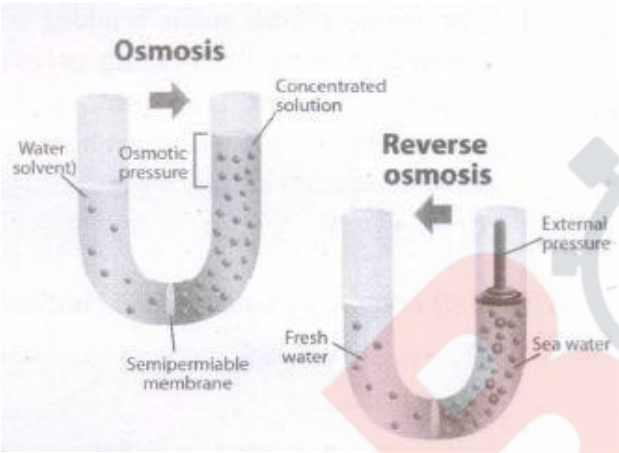
Answer : $N_2(g) + 3H_2(g)) \rightleftharpoons 2NH_3(g)$

$$K_C = \frac{[NH_3]^2}{[N_2][H_2]} = \frac{\left[1.2 \times 10^{-2} M\right]^2}{\left[1.5 \times 10^{-2} M\right]\left[3.0 \times 10^{-2} M\right]^{-3}}$$

=3.55X10^2 M

71) Explain about the application of reverse osmosis in water purification.

Answer :



(i) Reverse osmosis is used in the desalination of sea water and also in the purification of drinking water.

(ii) When a pressure higher than the osmotic Water pressure is applied on the solution side solvent) (sea water) the water molecules moves from solution side to the solvent side through semi permeable membrane (opposite to osmotic flow). The pure water can be collected.

(iii) Cellulose acetate (or) polyamide membranes are commonly used in commercial system.

72) Write a brief note on sublimation.

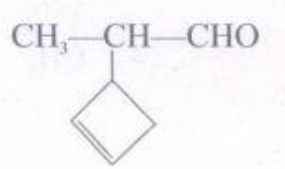
Answer : Few substances like benzoic acid, naphthalene and camphor when heated pass directly from solid to vapor without melting (ie liquid). On cooling the vapours will give back solids. Such phenomenon is called sublimation. It is a useful technique to separate volatile and non-volatile solid. It has limited application because only a few substance will sublime.

Substances to be purified is taken in a beaker. It is covered with a watch glass. The beaker is heated for a while and the resulting vapours condense on the bottom of the watch glass. Then the watch glass is removed and the crystals are collected. This method is applicable for organic substance which has high vapour pressure at temperature below their melting point. Substances like naphthalene, benzoic acid can be sublimed quickly. Substance which has very small vapour pressure will decompose upon heating are puried by sublimation under reduced pressure. This apparatus consists of large heating and large cooling surface with small distance in

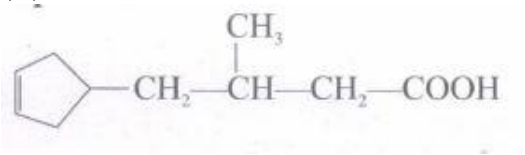
between because the amount of the substance in the vapour phase is much too small in case of a substance with low vapour pressure.

73) Give the IUPAC name of the following compounds:

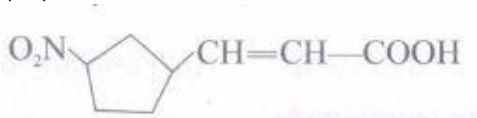
(i)



(ii)



(iii)



Answer : (i) 2-(cyc1o but-2-en-l-yl)-propanal

(ii) 4-(cyc1opent-3-en-l-yl)-3-methylbutanoic acid

(iii) 3-(3-nitro cyc1opentyl)-prop-2-enoic acid

74) Give the IUPAC name of

(i) $CH_3 - CH_2 - \underset{\displaystyle CH_2}{CH} - CH_2 - CH_2 - CN$

(ii) $CH_2 = \underset{\displaystyle CONH_3}{CH} - CH - CH_3$

(iii) $CH_3 - \underset{\displaystyle OH}{CH} - CH_2 - CH = CH - CH_3$

Answer : (i) 4-methyl/hexanenitrite

(ii) 2-methyl but-3-en-amide

(iii) Hex-4-en-2-o1

75) Draw the structural formula of the following compounds.

(i) N-ethyl-N-methylpropan-l-amine

(ii) N, N-dimethyl benzenamine

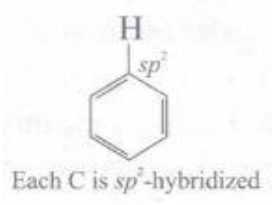
(i)

Answer : $CH_3 - CH_2 - CH_2 - \underset{\displaystyle CH_3}{N} - CH_2 - CH_3$

(ii)

76) Give the IUPAC names of the following compounds.

(a)

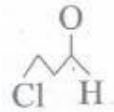


(b)

(c)

(d)

(e)

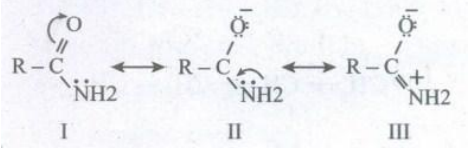


(f) Cl_2CHCH_2OH

Answer : (a) Propylbenzene
(b) Methylpentanenitrile
(c) 2, 5-Dimethylheptane
(d) 3-Bromo-3-chloroheptane
(e) 3-Chloropropanal
(f) 2,2-Dichloroethanol

77) Which of the following compounds will not exist as resonance hybrid? Give reason for your answer.
(i) CH_3 - OH
(ii) R-$CONH_2$
(iii) CH_3-CH = CH-CH_2NH_2

Answer : (i) CH_3-OH: Does not exist as resonance hybrid due to absence of π-electrons.
(ii) R-CO NH_2: Can exist as resonance hybrid due to the presence of non-bonding electrons on N and n-electrons on C=O bond.



(iii) CH_3-CH=CH-CH_2NH_2: Does not exist as resonance hybrid, because the lone pair on N-atom is not conjugated with n-electrons of the double bond

78) Explain the isomerism exhibited by alkenes.

Answer : Isomerism:
Presence of double bond in alkene provides the possibility of both structural and geometrical isomerism.

Structural Isomerism:

The first two member's ethene C_2H_4 and propene C_3H_6 do not have isomers because the carbon atoms in the molecules can be arranged only one distinct way.
However from the third member of alkene family butene C_4H_{10} structural isomerism exists.

(i) CH_3-CH = CH-CH_3 1-Butene

(ii) CH_2=CH-CH_2-CH_3 2-Butene

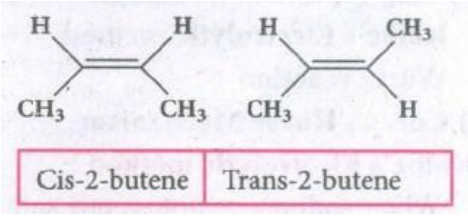
(iii) 2-Methyl-1-propene

$$CH_2 = \overset{CH_3}{\underset{|}{C}} - CH_3$$

structures (i) & (ii) are position isomers. structures (i) & (iii), (ii) & (iii) are chain isomers.

Geometrical isomerism:

It is a type of stereoisomerism and it is also called cis-trans isomerism. Such type of isomerism results due to the restricted rotation of doubly bounded carbon atoms.
if the similar groups lie on the same side, then the geometrical isomers are called C is-isomers. When the similar groups lie on the opposite side, it is called a Trans isomer.
for example: the geometrical isomers of 2-Butane is expressed as follow



79) Among ortho, meta and para substituted diahalobenzenes which has high melting point? Give reason with example.

Answer : The boiling points of isomeric dihalobenzene are pearly the same. The melting point of para isomer is generally higher than the melting points of ortho and meta isomers. The higher melting point of p-isomer is due to its symmetry which leads to more close packing of its molecules in the crystal lattice and consequently strong intermolecular attractive force which requires more energy for melting. p-Dihalobenzene > o-Dichlorobenzene > m-Dichloro benzene.

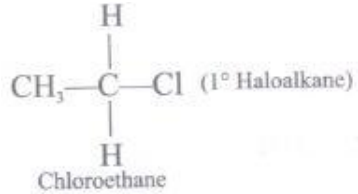
80) Give one example with structure and name for each of the following compounds

(a) Primary haloalkane

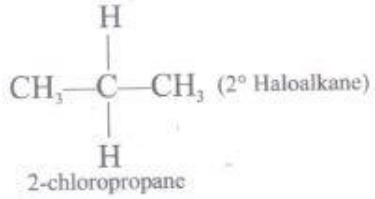
(b) Secondary haloalkane

(c) Tertiary haloalkane

Answer : (a) Primary haloalkane

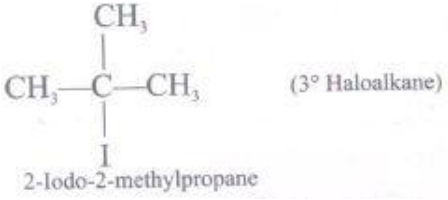


(b) Secondary haloalkane



2-chloropropane

(c) Tertiary haloalkane



2-Iodo-2-methylpropane

5 Marks

81) In a reaction, $A + B_2 \longrightarrow AB_2$, identify the limiting reagent if any in the following reaction mixtures

(i) 300 atoms of A + 200 molecules of B

(ii) 2 moles of A + 3 moles of B

(iii) 100 atoms of A + 100 molecules of B

(iv) 5 moles of A + 2.5 moles of B

(v) 2.5 moles of A + 5 moles of B

Answer : The given equation shows that 1 mole of A reacts with 1 mole of B_2 and I atom of A reacts with 1 molecule of B_2

(i) B is the limiting reagent because 200 molecules of B_2 will react with 200 atoms of A and 100 atoms of A will be left in excess.

(ii) A is limiting reagent because 2 moles of A will react with 2 moles of B and 1 mole of B will be left in excess.

(iii) Both will react completely because it is a stoichiometric mixture. No limiting reagent.

(iv) 2.5 moles of B will react with 2.5 moles of A. Hence B is the limiting reagent.

(v) 2.5 moles of A will react with 2.5 moles of B. Hence A is the. limiting reagent.

82) Write the steps to be followed while balancing redox equation by oxidation number method.

Answer : Oxidation number method:

This method is based on the fact that

Number of electrons lost by atoms = Number of electrons gained by atoms

Steps to be followed while balancing Redox reactions by Oxidation Number method:

1. Write skeleton equation representing redox reaction
2. Write the oxidation number of atoms undergoing oxidation and reduction.
3. Calculate the increase or decrease in oxidation numbers per atom.
4, Make increase in oxidation number equal to decrease in oxidation number by multiplying the formula of oxidant and reductant by suitable numbers.
5. Balance the equation atomically on both sides except O and H atoms.
6. Balance oxygen atoms by adding required number of water molecules to the side deficient in oxygen atoms.
7. Add required number of H^+ ions to the side deficient in hydrogen atom if the

reaction is in acidic medium.

8. For reactions in basic medium, add H_2O molecules to the side deficient in hydrogen atoms and simultaneously add equal number of OH^- ions on the other side of the equation.

9. Finally, balance the equation by cancelling common species present on both sides of the equation.

83) What is the de Broglie wave length of an electron, which is accelerated from the rest, through a potential difference of 100V?

Answer : Potential difference = 100V

= 100 x 1.6 x 10^{-19}J

$$\lambda = \frac{h}{\sqrt{2mev}}$$

$$= \frac{6.626\times10^{-34}Kgm^2s^{-1}}{\sqrt{2\times9.1\times10^{-31}Kg\times100\times1.6\times10^{-19}J}}$$

$$\lambda = 1.22\times10^{-10}m$$

84) Complete the table given below

S.No	Symbol	Mass No.	Atomic No	Proton	Neutron	Electrons
1.	Zn^{2+}	64	30	-	-	-
2.	Cl^-	35	-	-	18	18
3.	Ar	-	-	18	22	1

Answer : (i) $^{64}_{30}Zn^{2+}$

No. of protons = 30

No. of electrons = 30-2 = 28

No. of neutrons = 64-30 = 34

(ii) $^{35}Cl^-$

Atomic number = Mass number - No. of neutrons

=·35-18=17

Atomic number = No. of protons = 17

(iii) Ar

Mass number = No. of protons + No. of neutrons

= 18+ 22 = 40

Atomic number = No. of protons = 18

No. of electrons = No. of protons = 18.

85) Explain about the factors that influence the ionization enthalpy.

Answer : Factors influencing ionization enthalpy:

(i) Size of the atom:

If the size of an atom is larger, the outermost electron shell from the nucleus is also larger and hence the outermost electrons experience lesser force of attraction. Hence it would be more easy to remove an electron from the outermost shell. Thus, ionization energy decreases with increasing atomic sizes.

Ionization enthalpy $\propto \frac{1}{Atomic\ size}$

(ii) Magnitude of nuclear charge:

As the nuclear charge increases, the force of attraction between the nucleus and valence electrons also increases. So, more energy is required to remove a valence

electron. Hence I.E increases with increase in nuclear charge.
Ionization enthalpy α *nuclear charge*

(iii) Screening or shielding effect of the inner electrons:

The electrons of inner shells form a cloud of negative charge and this shields the outer electron from the nucleus. This screen reduces the coulombic attraction between the positive nucleus and the negative outer electrons. If screening effect increases, ionization energy decreases.
Ionization enthalpy $\propto \frac{1}{Screening\ effects}$

(iv) Penetrating power of subshells s, p, d, and f:

The s-orbital penetrate more closely to the nucleus as compared to p-orbitals. Thus, electrons in s-orbitals are more tightly held by the nucleus than electrons in p-orbitals. Due to this, more energy is required to remove a electron from an s-orbital as compared to a p-orbital. For the same value of 'n', the penetration power decreases in a given shell in the order.
s > p > d > f.

(v) Electronic configuration:

If the atoms of elements have either completely filled or exactly half filled electronic configuration, then the ionization energy increases.

86) An element occupies group number 1 and period number 3. This element when exposed to air gives compound (A). The element with water forms compound (B). Which is a strong base and (A) with ammonia gives compound (C) which is used as a reducing agent in organic chemistry? The element reacts with a halogen and forms cooking salt (D). Identify A, B, C and D

Answer : (i) An element belonging to group number 1 and period number 3 is **Sodium**

(ii) Sodium When exposed air gives **Sodium Peroxide (A)**

$4Na + O_2 \longrightarrow 2Na_2O_2$ ....A

(iii) With water sodium forms **Sodium hydroxide (B)**

$2Na + 2H_20 \longrightarrow 2NaOH + H_2$ .....B

(iv) With ammonia, Sodium gives **Sodamide (C)**

$2Na + 2NH_3 \overset{570-670k}{\longrightarrow} 2NaNH_2 + H_2$

(vi) Sodium on reaction with halogen (cl_2) forms Sodium chloride (D)

$2Na + Cl_2 \longrightarrow 2NaCl$

A	Na_2O_2	Sodium peroxide
B	NaOH	Sodium hydroxide
C	$NaNH_2$	Sodamide
D	NaCl	Sodium chloride

87) A sample of solid $KClO_3$ (potassium chlorate) was heated in a test tube to obtain O_2 according to the reaction $2KClO_3 \longrightarrow 2KCl + 3O_2$
The oxygen gas was collected by downward displacement of water at 295 K. The total pressure of the mixture is 772mm of Hg. The vapour pressure of water is 26.7 mm of Hg at 300K. What is the partial pressure of the oxygen gas?

Answer : $2KClO_{(s)} \longrightarrow 2KCl_{(s)} + 3O_{2(g)}$

P_{total} = 772 mm Hg
P_{H_2O} = 26.7 mm Hg
$P_{total} = P_{O_2} + P_{H_2O}$
$\therefore P_{O_2} = P_{total} - P_{H_2O}$
P_1 = 26.7 mm Hg T_2 = 295 K
T_1 = 300 K P_2 = ?
$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
$\Rightarrow P_2 = \left(\frac{P_1}{T_1}\right) T_2 = \frac{26.7mm \quad Hg}{300K} \times 295K$
P_2 = 26.26 mm Hg
$\therefore P_{O_2}$ = 772 - 26.26 = 745.74 mm Hg.

88) Define the following terms
(a) isothermal process (b) adiabatic process
(c) isobaric process (d) isochoric process

Answer : (a) Isothermal process: An isothermal process is defined as one in which the temperature of the system remains constant, during the change from its initial to final state. The system exchanges heat with its surroundings and the temperature of the system remains constant.
For an isothermal process dT = 0
(b) Adiabatic process: An adiabatic process is defined as one in which there is no exchange of heat (q) between the system and surrounding during the process. For an adiabatic process q = 0
(c) Isobaric process: An isobaric process is defined as one in which the pressure of the system remains constant during its change from the initial to final state. For an isobaric process dP = 0 .
(d) Isochoric process: An isochoric process IS defined as the one in which the volume of system remains constant during its change from initial to final state. For an isochoric process, dV= 0.

89) State any five ways of enunciating the first law of thermodynamics.

Answer : (i) Whenever energy of a particular type disappears equivalent amount of another type must be produced.
(ii) Total energy of a system and, surroundings remains constant (or conserved)
(iii) "Energy can neither be created nor destroyed, but may be converted from one form to another".
(iv) "The change in the internal energy of a closed system is equal to the energy that passes through its boundary as heat or work".
(v) "Heat and work are two ways of changing a system's internal energy".

90) Derive the K_p and K_c for the following equilibrium reaction.
$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

Answer : Let us consider the formation of HI in which, 'a' moles of hydrogen and 'b' moles of iodine gas are allowed to react in a container of volume V. Let 'x' moles of each of H_2 and I_2react together to form 2x moles of HI.
$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

	H_2	I_2	HI

Initial number of moles	a	b	0
Number of moles reached	x	x	0
Number of moles at equilibrium	a-x	b-x	2x
Active mass or molar concentration at equilibrium	$\frac{a-x}{V}$	$\frac{b-x}{V}$	$\frac{2x}{V}$

Applying law of mass action,

$$K_C = \frac{[HI]^2}{[H]_2\,[I_2]}$$

$$= \frac{\left(\frac{2x}{V}\right)^2}{\left(\frac{a-x}{V}\right)\left(\frac{b-x}{v}\right)} = \frac{4x^2}{(a-x)\,(b-x)}$$

The equilibrium constant Kp can also be calcu•lated as follows:

We know }he \rer~tionship between the K_c and K_p

Here the Δn_g=n_p -n_r = 2 - 2 =0

Hence K = K ; $K_p = \frac{4x^2}{(a-x)\,(b-x)}$

c

91) Discuss the principle and procedure involved in estimating the amount of sulphur present in an organic compound.

Answer : Estimation of sulphur:

Carius method :A known mass of the organic substance is heated strongly with fuming $HN0_3$. C & H get oxidized to CO_2& H_2O while sulphur is oxidized to sulphuric acid as per the following reaction.

$$C \xrightarrow{fum.HNO_3} CO_2$$

$$2H \xrightarrow{fum.HNO_3} H_2O$$

$$S \longrightarrow SO_2 \xrightarrow{O+H_2O} H_2SO_4$$

'The resulting solution is treated with excess of $BaCI_2$ solution H_2SO_4 present in the solution in quantitatively converted into $BaSO_4$, from the mass of $BaSO_4$, the mass of sulphur and hence the percentage of sulphur in the compound can be calculated.

Procedure:

A known mass of the organic compound is taken in clean carius tube and added a few mL of fuming HNO_3. The tube is the sealed. It is then placed in an iron tube and heated for about 5 hours. The tube is allowed to cool to temperature and a small hole is made to allow gases produced inside to escape. The carius tube is broken and the content collected in a beaker. Excess of $BaCl_2$ is added to the beaker H2S04 acid formed as a result of the reaction is converted to BaS04. The precipitate of $BaSO_4$ is filtered, washed, dried and weighed. From the mass of $BaSO_4$, percentage of S is found.

Mass of the organic compound = w g

Mass of the $BaSO_4$ formed = x g

233g of $BaSO_4$ contains 32 g of sulphur

$\therefore$ x g of $BaSO_4$ contain $\left(\frac{32}{233} \times \frac{x}{w}\right)$

Percentage of sulphur = $\left(\frac{32}{233} \times \frac{x}{w} \times 100\right)$ %

92) An organic compound (A) of a molecular formula C_2H_4 which is a simple alkene. A reacts with dil H_2SO4 to give B. A again reacts with Cl_2 to give C. Identify A,B and C and write the equations.

Answer : (i) C_2H_4 is CH_2=CH_2 is a simple alkene. A is ethylene.

(ii) Ethylene (A) reacts with dil H_2SO4 to give ethanol (B)

$$\underset{\substack{Ethylene\\(A)}}{CH_2CH_2} \xrightarrow{dilH_2SO_4} \underset{\substack{ethanol\\(B)}}{CH_3-CH_2-OH}$$

(iii) Ethylene (A) reacts with Cl_2 to give 1,2 dichloro ethane (C)

$$\underset{\substack{(Ethylene)\\(A)}}{CH_2=CH_2} \xrightarrow{cl_2} \underset{(1,2-dicholoro\ ethene)}{\overset{Cl}{\overset{|}{CH_2}}-\overset{Cl}{\overset{|}{CH_2}}}$$

A	Ethylene	CH_2=CH_2
B	Ethanol	CH_3-CH_2-OH
C	1,2-dichloroethane	$\overset{Cl}{\overset{\vert}{CH_2}}-\overset{Cl}{\overset{\vert}{CH_2}}$

93) Explain various methods of preparation of alkane.

Answer : Preparation of al anes from catalytic reduction of unsaturated hydro-carbons.

When a mixture hydrogen gas with alkane or : alkyne gas is passed over a catalysts such as I platinum or palladium at room temperature, : an alkane is produced. is process of addition I of H2 to unsaturated compounds is known as I hydrogenatione above process can be catalysed : by nickel at 298K. is reaction is known as : Sabatier- Sendersens reaction.

Example :

$$\underset{Propene}{CH_3-CH=CH_2}+H_2 \xrightarrow{pt} CH_3-\underset{Propene}{CH_2}-CH_3$$

$$\underset{Propene}{CH_2=CH_2}+H_2 \xrightarrow[298K]{Ni} \underset{Ethane}{CH_3-CH_3}$$

2.Preparation of alkanes from carboxylic acids:

i) Decarboxylation of sodium salt of carboxylic acid

When a mixture of sodium salt of carboxylic acid and soda lime (sodium hydroxide + calcium oxide) is heated, alkane is formed. The alkane formed has one carbon atom less than carboxylic acid. This process of eliminating carboxylic group is known as decarboxylation.

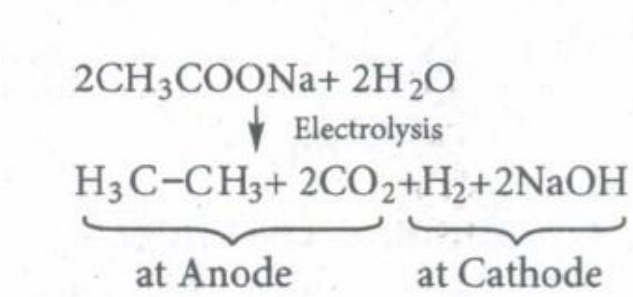
Example:

$$\underset{Sodium\ acetate}{CH_3COONa}+NaOH \xrightarrow[\triangle]{CaO} CH_4+\underset{Methane}{Na_2CO_3}$$

i) Kolbt's Electrolytic method:

When sodium or potassium salt of carboxylic acid is electrolyzed, a higher alkane is

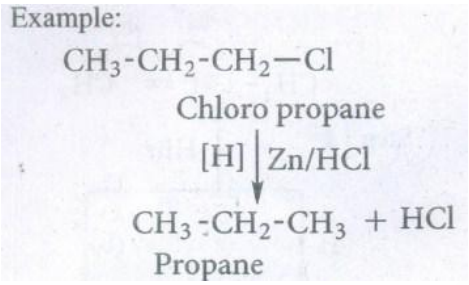
formed. The decarboxylative dimerization of two carboxylic acid occurs. This method is suitable for preparing symmetrical alkanes(R-R).



3. Preparation of alkanes using alkyl halides (or) halo alkanes:

i) By reduction with nascent hydrogen :

Except alkyl fluorides, other alkyl halides can be converted to alkanes by reduction with nascent hydrogen. The hydrogen for reduction may be obtained by using any of the following reducing agents: Zn+HCI, Zn+CH_3COOH, Zn-Cu couple in ethanol, $LiAlH_4$ etc.,



ii) Wurtz reaction:

When a solution of halo alkanes in dry ether is treated with sodium metal, higher alkanes are produced. is reaction is used to prepare higher alkanes with even number of carbon atoms.

Example :

$$\underset{Methyl\ bromide}{CH_3} - Br + 2Na + Br - CH_3 \xrightarrow[Ether]{dry} CH_3 - CH_3 + \underset{Ethane}{NaBr}$$

iii) Corey- House Mechanism :

An alkyl halide and lithium di alkyl cuprate are reacted to give higher alkane.

Example:

4) Preparation of Alkanes from Grignard reagents:

Halo alkanes reacts with magnesium in the pres~nce of dry ethers to give alkyl magnesium halide which is known as Grignard reagents. Here the alkyl group is directly attached to the magnesium metal make it to behave as carbanion. So, any compound with easily replaceable hydrogen reacts with Grignard reagent to.give corresponding alkanes.

Example:

$$\underset{Chloromethane}{CH_3} - Cl + Mg \xrightarrow{Dryether} \underset{Methyl\ magnesium\ bromide}{CH_3MgCl}$$

$$CH_3MgCl + H_2O \longrightarrow \underset{Methane}{CH_4} + Mg(OH)Cl$$

94) Explain the mechanism involved in bimolecular nucleophilic substitution reaction.

Answer : S_N2 Mechanism :

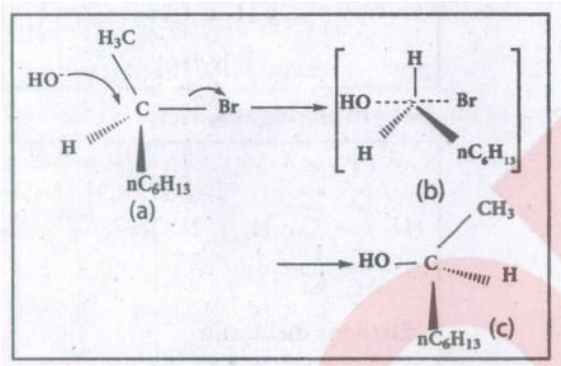
(i) The rate of SN2 reaction depends upon the . concentration of both alkyl halide and the nucleophile. (ii) Rate of reaction = Is [alkylhalide] [nucleophile]. It follows second order kinetics' and occurs in one step.

(iii) This reaction involves the formation of a transition state in which both the reactant molecules are partially bonded to each other. The attack of nucleophile occurs from the back side (i.e opposite to the side in which the halogen is attacked).

(iv) The carbon at which substitution occurs has inverted configuration during the course of reaction just as an umbrella has tendency to invert in a wind stonri. is inversion of configuration is called Walden inversion; after paul walden who rst discovered the inversion of configuration of a compound in $S_N2$reaction.

(v) $S_N2$reaction of an optically active haloalkane . is always accompanied by inversion of configuration at the asymmetric centre.

(vi) When 2 - Bromooctane is heated with sodium hydroxide, 2 - octanol is formed with invesion of configuration. (-) - 2 - Bromo octane is heated with sodium hydroxide (+) - 2 - Octanol is formed in which - OR group occupies a position opposite to what bromine had occupied,



(a) (-).2 - Bromo octane

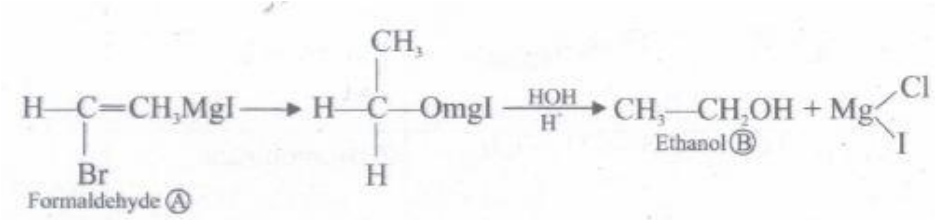
(b) Transition State

(c) (+) 2 - Octanol (product)

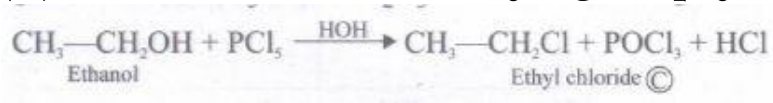
95) An organic compound Ⓐ of molecular formula CH_2O reacts with methyl magnesium iodide followed by acid hydrolysis to give Ⓑ of molecular formula C_2H_60. Ⓑ on reaction with PCIs gives ©. ©on reaction with alcoholic KOH gives Ⓓan alkene as the product. Identify Ⓐ, Ⓑ ©, Ⓓ and explain the reactions involved.

Answer : (i) Ⓐ of molecular formula CH_2O is identified as HCHO, formaldehyde.

(ii) Formaldehyde reacts with CH_3MgI followed by hydrolysis to give ethanol, CH_3-CH_2OH B as the product.



(iii) Ethanol Ⓑ, reacts with PCl_5 to give C_2H_5CI, Ethyl chloride © as the product.



(iv) CH_3-CH_2CI © on reaction with alcoholic KOH undergoes dehydrohalogenation to

give ethylene $CH_2 = CH_2$ © as the product.

$$CH_3 - CH_2Cl \xrightarrow[KOH]{alcoholic} \underset{Ethlene}{CH_2 = CH_2} + HCl$$

A	HCHO	Forrnaldehyde
B	CH_3 -CH_2OH	Ethanol
C	CH_3 -CH_2CI	Ethyl chloride
D	CH_2 -CH_2	Ethylene