

# Some Basic Concepts of Chemistry

## A Quick Recapitulation of the Chapter

1. Anything that occupies space and has mass is called **matter**. On physical basis, it is classified into solid, liquid and gases, while on the basis of chemical composition, it is classified as mixture and pure substance.
2. Units of length, mass, time, electric current, temperature, amount of substance and luminous intensity are called **fundamental or basic units**.
3. The mass is the amount of matter present in a substance and is measured very accurately in the laboratory by using an analytical balance.
4. The **weight** of a substance is the force exerted by gravity on an object.
5. **Density** of a substance is its amount of mass per unit volume.
6. A **measurement** is the quantity, dimensions or extent of something, usually in comparison to a specific unit.
7. Scientific notation is the exponential notation in which any number can be represented in the form of  $N \times 10^n$ , where  $n$  is an exponent having positive or negative values and  $N$  can vary between 1 to 10.
8. **Precision** refers to the closeness of various measurements for the same quantity while accuracy is the agreement of a particular value to the true value for the result.
9. All non-zero digits or zero present between two non-zero digits are **significant**. Zero of the left side of a number are never significant, while that of right side, if present after a number and also a decimal point, are significant.
10. **Laws of chemical combinations** Compounds are formed from elements and their formation is governed by the following five basic laws:
  - (i) **Law of conservation of mass** It states that in a chemical change, mass is neither created nor destroyed in any chemical reaction.  
Total mass of reactant = Total mass of product
  - (ii) **Law of definite proportions** The reaction of the masses of elements in any compound is constant regardless of its source or its preparation, i.e. a given compound always contains exactly the same proportion of elements by weight.
  - (iii) **Law of multiple proportions** If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in the ratio of small whole numbers.
  - (iv) **Law of gaseous volume** It is proposed by Gay-Lussac, which states that gases react with each other in simple ratio of their volume and if product is also in gaseous state, its volume also bears a simple ratio with the volume of gaseous reactants under similar conditions of temperature and pressure.
  - (v) **Avogadro's law** Equal volumes of gases at the same temperature and pressure should contain equal number of molecules.

## 11. Dalton's atomic theory

- (i) Matter consists of indivisible atoms.
- (ii) All the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass.
- (iii) Compounds are formed when atoms of different elements combine in a fixed ratio.
- (iv) Chemical reactions involve reorganisation of atoms. These are neither created nor destroyed in a chemical reaction.

12. Atomic and molecular weights are expressed with respect to carbon-12 as reference in amu (or u).

$$1 \text{ u} = 1.66 \times 10^{-24} \text{ g}$$

13. A **mole** is defined as the number of atoms in 12.0 g of C-12 which is equal to  $6.023 \times 10^{23}$ . This number is called **Avogadro's number**.

14. The mass of one mole of a substance in gram is called its **molar mass**, which is numerically equal to atomic/molecular formula mass expressed as 'u'.

15. For determining the % composition of each element in a compound.

Mass % of an element

$$= \frac{\text{Mass of that element in a compound}}{\text{Molar mass of the compound}} \times 100$$

## [Objective Questions Based on NCERT Text]

### Topic 1

### Importance of Chemistry and Nature of Matter

16. **Empirical formula** represents the simplest relative whole number ratio of atoms, while molecular formula represents the actual number of atoms of each element in one molecule of a substance.

17. **Stoichiometry** deals with the calculation of masses of the reactants and products involved in a chemical reactions.

18. **Limiting reagent**, i.e. the reactant which is present in less quantity or which is consumed first, controls the amount of product obtained.

19. Concentration of solution can be expressed in following ways:

$$(i) \text{ Mass per cent} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

(ii) Mole fraction of solute

$$= \frac{\text{No. of moles of solute}}{\text{No. of moles of solute} + \text{No. of moles of solution}}$$

$$(iii) \text{ Normality (N)} = \frac{\text{Gram-equivalent of solute}}{\text{Volume of solution (in L)}}$$

$$(iv) \text{ Molarity (M)} = \frac{\text{No. of moles of solute}}{\text{Volume of solution (in L)}}$$

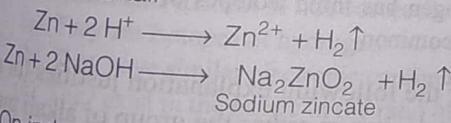
$$(v) \text{ Molality (m)} = \frac{\text{No. of moles of solute}}{\text{Mass of solvent (in kg)}}$$

# CHAPTER 09

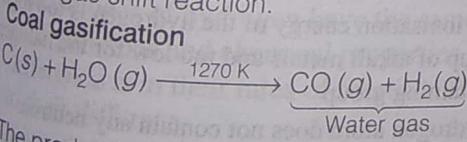
## Hydrogen

### A Quick Recapitulation of the Chapter

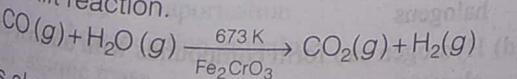
1. **Hydrogen** is the first element in the periodic table. Its position is not certain because it has a capacity of gaining as well as losing an electron.
2. **Dihydrogen** is the most abundant element in the universe and is also the main element present in the atmosphere of sun.
3. Hydrogen has **three isotopes**, namely protium ( ${}^1\text{H}$ ), deuterium (D or  ${}^2\text{H}$ ) and tritium (T or  ${}^3\text{H}$ ). Tritium is radioactive in nature and emits low energy  $\beta$ -particles.
4. In laboratory dihydrogen is usually prepared by the reaction of granulated zinc with dilute hydrochloric acid or by the reaction of zinc with aqueous alkali



5. On industrial scale dihydrogen is prepared by the water gas shift reaction.



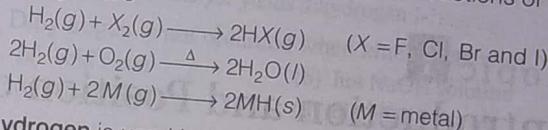
The production of  $\text{H}_2$  can be increased by water gas shift reaction.



It is also obtained as a by-product by the electrolysis of brine.

6. The H—H bond enthalpy of dihydrogen is highest ( $435.88 \text{ kJ mol}^{-1}$ ) for a single bond between two atoms of any elements. Due to the high H—H bond enthalpy, it is relatively inert at room temperature.

7. **Dihydrogen** is a colourless, odourless, tasteless and combustible gas. The important chemical reactions of dihydrogen are



8. **Dihydrogen** is used in the synthesis of ammonia which is used in the manufacture of nitric acid and nitrogenous fertilizers. It is used in the manufacture of vanaspati ghee by the hydrogenation of polyunsaturated vegetable oils.
9. It combines with almost all the elements to form hydrides. Hydrides can be classified into three categories. Ionic or saline hydrides, covalent or molecular hydrides, metallic or non-stoichiometric hydrides. Metallic hydrides are useful for ultrapurification of dihydrogen and as dihydrogen storage media.
10. **Water** is the oxide of hydrogen while heavy water is the oxide of deuterium. It is used as moderator and coolant in nuclear reactors.
11. Water molecule is highly polar in nature due to its bent structure. This property leads to hydrogen bonding which is maximum in ice and least in water vapours. Density of ice is less than that of water.
12. Water forming lather with soap is called **soft water** and that does not do so is called **hard water**. The hardness of water may be of two types:
  - (i) **Temporary hardness** It is due to the presence of calcium and magnesium bicarbonates.
  - (ii) **Permanent hardness** It is due to the presence of chlorides and sulphates of calcium and magnesium.

13. **Temporary hardness** of water is removed by just boiling, while **permanent hardness** is removed by sodalime method, Calgon method, ion exchange method or by synthetic resin method.
14. **Degree of hardness** of water is measured in ppm by weight of  $\text{CaCO}_3$  irrespective of its presence and is estimated by simple titration of EDTA solution.
15. **Hydrogen peroxide** acts as oxidising, reducing and bleaching agent. Oxidation of  $\text{H}_2\text{O}_2$  is slow in acidic medium but rapid in alkaline medium.
16. Hydrogen peroxide is manufactured by the electrolysis of 50%  $\text{H}_2\text{SO}_4$  or by the auto-oxidation of 2-alkyl anthraquinols. 30% solution of  $\text{H}_2\text{O}_2$  is called **perhydrol** and is used as germicide and antiseptic.
17. '20 volume  $\text{H}_2\text{O}_2$ ' means 1 mL of this solution on decomposition liberates 20 mL of oxygen at NTP.
18. In **structure of  $\text{H}_2\text{O}_2$** , two O—H bonds are in different planes due to repulsion between bonding and antibonding orbitals. Bond angle H—O—O is 94.5°.
19.  $\text{H}_2\text{O}_2$  decomposes slowly on exposure to light. In presence of metal surface or traces of alkali, its decomposition reaction is catalysed. Therefore, it is stored in a wax-lined glass or plastic vessel in dark.
20. **Hydrogen economy** involves the safe transportation and storage of energy in the form of liquid or gaseous dihydrogen.  
The main advantage is that here energy is transported in the form of dihydrogen and not as electric energy.

# CHAPTER 10

# s-Block Elements

## A Quick Recapitulation of the Chapter

1. Li, Na, K, Rb, Cs and Fr belong to IA group (**alkali metals**) and have a general electronic configuration as, [inert gas] $ns^1$ .
2. **General trends in atomic and physical properties** of alkali metals (down the group).
 

Increase ↓	I. Atomic and ionic radii II. Metallic character III. Electropositive nature IV. Density, mp and bp	Decrease ↓	I. Ionisation energy II. Hydration enthalpy
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3. As higher the hydration enthalpy, lower is the ionic mobility, the **order of mobility of alkali metals ions** in aqueous solution is
 
$$Li^+ < Na^+ < K^+ < Rb^+ < Cs^+ < Fr^+$$
4. In Bunsen flame, all alkali metals impart characteristic colour.
5. The stability of peroxides and superoxides increases down the group.  
Order of stability:  
Normal oxides > peroxides > superoxides
6. Alkali metal hydroxides are strongest known bases.
7. All metal chlorides of group-I elements are ionic except LiCl, which is covalent in nature.  
The order of stability of metal halides is
 
$$MF > MCl > MBr > MI.$$
8. **Alkali metals** are good reductant and Li because of its most negative  $E^\circ$ , is most powerful reductant among them but Na is least powerful.
9. The solution of alkali metals in liquid ammonia is blue, paramagnetic and has high reducing capacity. This is because of the presence of solvated electrons.  

$$M + (x+y)NH_3 \longrightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$$
  
 Solvated electrons
10. As the electropositive character increases down the group, the stability of the alkali metal carbonates and hydrogen carbonates increases.
11. Lithium, due to its smaller size and high charge density exhibits properties that are quite different from other members of group-I. It shows resemblance in its properties with Mg, placed diagonally opposite to it.
12.  $Na_2CO_3 \cdot 10H_2O$  is called **washing soda** or **salt soda** and prepared by Solvay process or Le-Blanc process. On heating it gives soda ash ( $Na_2CO_3$ ).
13. An aqueous solution of NaCl is called brine. NaCl melts at 1081 K. It has a solubility of 36.0 g in 100 g of water at 273 K.
14. **Sodium hydroxide** (NaOH) is also called caustic soda and prepared by Castner-Kellner cell. Crystals of NaOH are deliquescent. The NaOH solution at the surface reacts with the  $CO_2$  of the atmosphere to form  $Na_2CO_3$ .
15.  $NaHCO_3$  is also called **baking soda**. On heating it gives  $Na_2CO_3$  and is used as fire extinguisher.
16. Na and K play an important role in nerve signal transmission.
17. Be, Mg, Ca, Sr, Ba and Ra belong to group II (**alkaline earth metals**) and have [inert gas] $ns^2$  general electronic configuration.
18. **Trends in atomic and physical properties** of alkaline earth metals (down the group).
 

Increase ↓	I. Atomic and ionic radii II. Ionisation enthalpy	Decrease ↓	I. Ionisation enthalpy II. Hydration enthalpy
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19. The melting point, boiling point and density of alkaline earth metals do not show a regular trend.

20. In **Bunsen flame**, all alkaline earth metals (except Be and Mg) give coloured flame.
21. All alkaline earth metals form **halides** of the type  $MX_2$ . All halides of Be are covalent and electron deficient.
22. **Oxides and hydroxides** of all the alkaline earth metals are basic except Be and  $Be(OH)_2$  which are amphoteric in nature.
23. Solubility of carbonates and sulphates of alkaline earth metals decreases on moving down the group.
24. Anomalous properties of Be ; due to small size, high ionisation energy and absence of *d*-orbital, it shows such properties and resemble with Al. e.g. its compounds are covalent.
25. **Plaster of Paris** ( $CaSO_4 \cdot \frac{1}{2} H_2O$ ) is obtained by heating gypsum ( $CaSO_4 \cdot 2H_2O$ ) at  $120^\circ C$ . However, gypsum on heating at  $200^\circ C$  gives dead burnt plaster ( $CaSO_4$ ) and at  $400^\circ C$  it gives  $CaO$ ,  $SO_2$  and  $O_2$ .
26. The general composition of **Portland cement** is 70%  $CaO$ , 20%  $SiO_2$ , 5%  $Al_2O_3$ , 3%  $Fe_2O_3$  and 2%  $MgO$ .
27. Some gypsum is added to cement to slow down its setting process.
28. Mg : Required for enzymatic reaction, acts as a co-factor and present in chlorophyll.
29. Ca : Forms bones and teeth, play important role of blood clotting.

# CHAPTER 11

# **p-Block Elements**

## A Quick Recapitulation of the Chapter

1. p-block of the periodic table is unique in terms of having all types of elements-metals, non-metals and metalloids.
2. There are six groups of p-block elements in the periodic table numbering from 13 to 18. Their valence shell electronic configuration is  $ns^2 np^{1-6}$  (except for He).
3. Differences in the inner core of their electronic configuration greatly influence their physical and chemical properties.
4. The combined effect of size and availability of d-orbitals considerably influences the ability of these elements to form  $\pi$ -bonds.
5. **Group-13** of the periodic table contains five elements, viz, B, Al, Ga, In, Tl and is collectively called **boron family**.
6. Their electronic configuration is [inert gas]  $ns^2 np^1$ .

### Physical properties

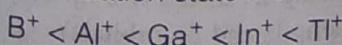
Increase   (Down the group)	I. Atomic and ionic radii
	II. Metallic character
	III. Density, mp and bp

Their ionisation enthalpy and electronegativity do not show a regular trend.

8. **Halides of this group** being electron deficient can accept electrons, so they act as **Lewis acids**.

9. The **order of acidity** is  $BCl_3 > AlCl_3 > GaCl_3 > InCl_3$ .

10. Due to inert pair effect, on moving down the group stability of lower oxidation state increases.



B due to its small size, high charge density and non-availability of d-electrons, shows anomalous behaviour, i.e. it has high mp and bp, forms covalent compounds, shows allotropism and behaves as a typical non-metal.

11.  $B_2H_6$  is electron deficient molecule. It forms 3-centre-2-electron ( $3c - 2e$ ) bond.  $B_3N_3H_6$  is called **borazole** or **inorganic benzene**.

12. Borax is  $Na_2B_4O_7 \cdot 10 H_2O$  and its important application is **borax bead test**.

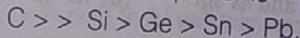
13. **Group-14** includes C, Si, Ge, Sn, Pb. The general electronic configuration is [inert gas]  $ns^2 np^2$ .

14. Physical properties

Decreases   (Down the group)	I. Ionisation enthalpy II. Electronegativity III. mp and bp	Increases   (Down the group)	I. Atomic and ionic radii II. Metallic character
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15. **Carbon** is a typical non-metal forming covalent bonds employing all its four valence electrons. It shows the property of catenation.

The order of catenation power is



16. Three important allotropes of carbon are diamond, graphite and fullerenes.

17. **Diamond** is the hardest substance known and is a insulator of electricity, but a conductor of heat.

18. **Graphite** is soft, has sheet like structure and weak van der Waals' forces, thus, shows lubricating properties. It is a good conductor of electricity so used in making electrodes.

19. **Buckminsterfullerene** contains 60 carbon atoms with  $sp^2$ -hybridisation.

20. **Carbon monoxide** reduces metal oxides into metal except that of alkali and alkaline earth metal.

The mixture of  $CO + H_2$  and  $CO + N_2$  is known as **water gas** or **synthesis gas** and **producer gas** respectively.

21. **Carbon dioxide** can be obtained as a solid in the form of dry ice by allowing the liquefied  $\text{CO}_2$  to expand rapidly.
22. **Silicon dioxide** ( $\text{SiO}_2$ ) is also called **silica** and found in the form of quartz, cristobalite and tridymite. It has three-dimensional network solid structure.
23. Silicones are the organosilicon polymers having  $-\text{R}_2\text{SiO}$  - monomer and  $-\text{O}-\text{Si}-\text{O}-$  linkage. Silicones are chemically inert and posses insulating properties.

24. **Silicates** are the minerals of silicon having  $\text{SiO}_4^{4-}$  basic repeating unit.
25. Main types of silicates are orthosilicates, pyrosilicates, sheet and 3-dimensional silicates.
26. **Zeolites** are prepared by substituting S-atoms in 3-dimensional network of  $\text{SO}_2$  by Al.
27. ZSM-5, a type of zeolite, is used to convert alcohols directly into gasoline.
28. Hydrate zeolite are used as an ion exchanger in softening of "hard water".

**11.**

**12.**

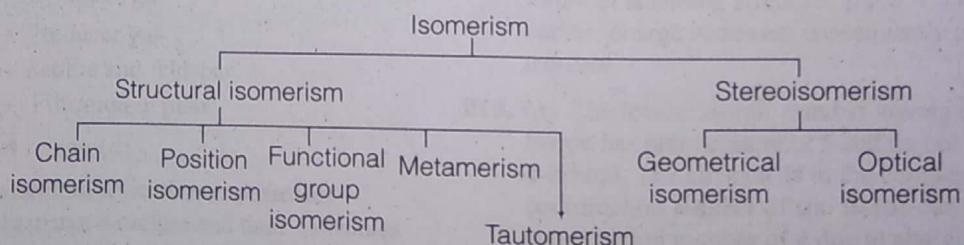
CHAPTER

# 12

# Some Basic Principles and Techniques

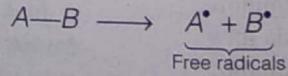
## A Quick Recapitulation of the Chapter

- Organic compounds** are the compounds of carbon with the exception of cyanides, carbonates etc and formed by sharing of electrons, i.e. involve covalent bonding.
- The naming of the organic compounds is carried out by following a set of rules laid down by the IUPAC.  
The general formula for writing name of an organic compound is position of substituent + substituent name + root word + primary suffix + secondary suffix (with its location).
- In **IUPAC nomenclature**, the names are correlated with the structure in such a way that the reader can deduce the structure from the name.
- The compounds which have same molecular formula, but differ in their chemical and physical properties are called **isomers** and the phenomenon is called **Isomerism**.

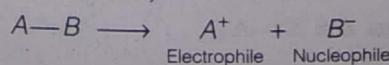


- The organic reaction begins with the breakage of covalent bond and this breakage or fission are of two types:

(i) **Homolytic fission** produces free radicals.



(ii) **Heterolytic fission** produces ions (i.e. anion and cation).



- Attacking reagents** These are of three types:

- Electrophiles are positively charged atom or the species containing an electron deficient atom.
- Nucleophiles are negatively charged or electron rich atom.
- Ambiphiles have both electrophile and nucleophile sites hence, have dual (amphoteric) nature.

7. The inductive, resonance, electromeric and hyperconjugation effects may help in polarisation of a bond making certain carbon atom or other atoms as places of low or high electron densities.

### 8. Types of organic reactions and mechanisms

Organic reactions can be classified into the following categories:

- (i) Substitution reactions
- (ii) Addition reactions
- (iii) Elimination reactions
- (iv) Rearrangement reactions

### 9. Methods of purification of organic compounds

The common techniques used for purification are as follows:

- (i) **Sublimation** used to separate sublimable compounds from non-sublimable impurities.
- (ii) **Distillation** used to separate volatile liquids from non-volatile impurities and the liquids having sufficient difference in their boiling points. There are various types of distillation;
  - (a) **Fractional distillation** used to separate those compounds that have nearly equal boiling points.
  - (b) **Steam distillation** used to separate those compounds that are steam volatile and are immiscible with water.
  - (c) **Distillation under reduced pressure** used to purify the substances which decompose at their boiling point.
- (iii) **Crystallisation** used for the purification of solid compounds.
- (iv) **Differential extraction** extraction of compound takes place based on difference in solubility.
- (v) **Chromatography** used for separation, isolation, purification and identification of the constituents of a mixture. It is the latest technique to be followed. Various types of chromatographies are adsorption chromatography, column chromatography, thin layer chromatography, partition chromatography.

### 10. In the qualitative analysis of organic compounds, nitrogen, sulphur, halogens and phosphorus are detected by Lassaigne's test.

11. Carbon and hydrogen are estimated by determining the amounts of carbon dioxide and water produced.
12. Nitrogen is estimated by **Dumas** or **Kjeldahl's method** and halogens by **Carius method**.
13. Sulphur and phosphorus are estimated by oxidising them to sulphuric and phosphoric acids respectively.
14. The percentage of oxygen is usually determined by difference between the total percentage (%) and the sum of percentages of all other elements present.

### 15. Determination of the percentage composition of elements in the compounds.

$$(i) \% \text{ of C} = \frac{12}{44} \times \frac{\text{weight of CO}_2}{w} \times 100$$

where,  $w$  = weight of the compound

$$(ii) \% \text{ of H} = \frac{2}{18} \times \frac{\text{weight of H}_2\text{O}}{w} \times 100$$

$$(iii) \% \text{ of Cl} = \frac{35.5}{143.5} \times \frac{\text{weight of AgCl}}{w} \times 100$$

$$(iv) \% \text{ of Br} = \frac{80}{188} \times \frac{\text{weight of AgBr}}{w} \times 100$$

$$(v) \% \text{ of I} = \frac{127}{235} \times \frac{\text{weight of AgI}}{w} \times 100$$

$$(vi) \% \text{ of S} = \frac{32}{233} \times \frac{\text{weight of BaSO}_4}{w} \times 100$$

$$(vii) \% \text{ of N} = \frac{28}{22400} \times \frac{\text{volume of N}_2 \text{ at NTP}}{w} \times 100$$

(Duma's method)

$$(viii) \% \text{ of N} = \frac{14M \times 2(V - V/2)}{w} \quad (\text{Kjeldahl's method})$$

(ix) Molecular formula =  $nx$

where,  $n = \frac{\text{molecular mass}}{\text{empirical formula mass}}$

$x$  = empirical formula

(x) % of O = 100 - (% of rest of the elements)

$$(xi) \% \text{ of P} = \frac{62}{222} \times \frac{\text{mass of Mg}_2\text{P}_2\text{O}_7 \text{ formed}}{\text{mass of substance taken}} \times 100$$

## 13

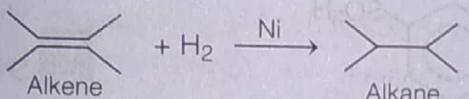
# Hydrocarbons

## A Quick Recapitulation of the Chapter

1. **Hydrocarbons** are the compounds of carbon and hydrogen. They are obtained from coal and petroleum.

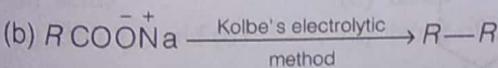
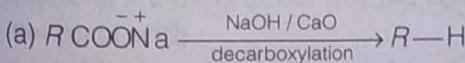
### 2. Preparation of Alkanes

(i) By the hydrogenation of unsaturated hydrocarbons in the presence of Pt or Pd or Ni.



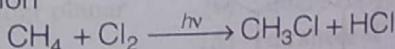
(ii) From alkyl halides,  $\text{RX} \xrightarrow[\text{Na, dry ether}]{\text{Zn + dil. HCl}} \text{R-H}$   
 Wurtz reaction  
 $\xrightarrow{\quad} \text{R-R}$

(iii) From sodium salts of carboxylic acids

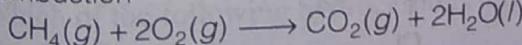


### 3. Chemical Reactions of Alkanes

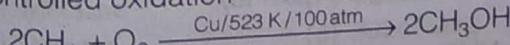
(i) Halogenation



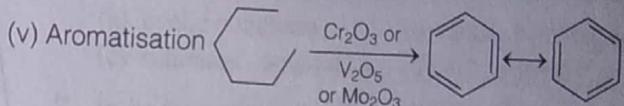
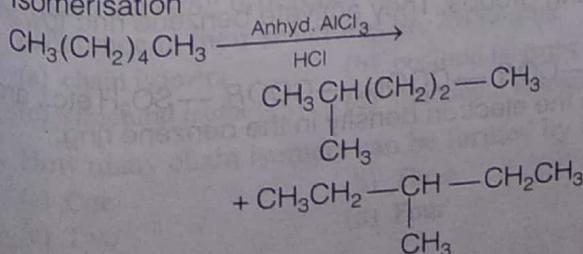
(ii) Combustion



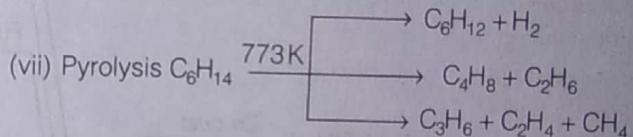
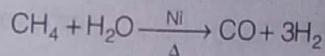
(iii) Controlled oxidation



(iv) Isomerisation



(vi) Reaction with steam

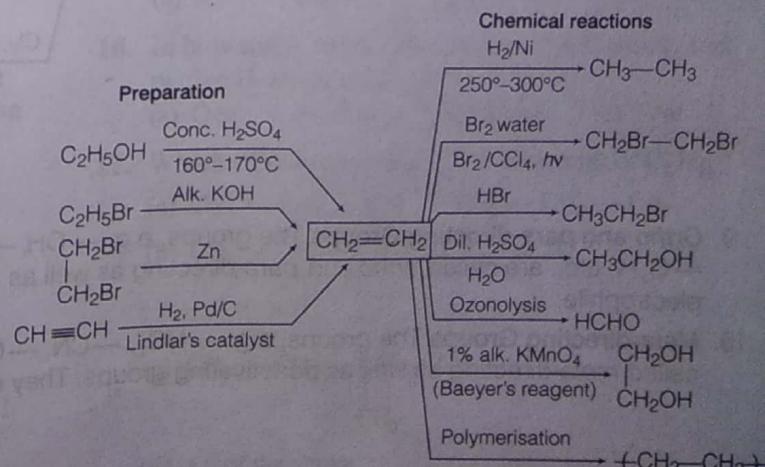


4. Alkanes show conformational isomerism due to free rotation along C—C σ-bonds.

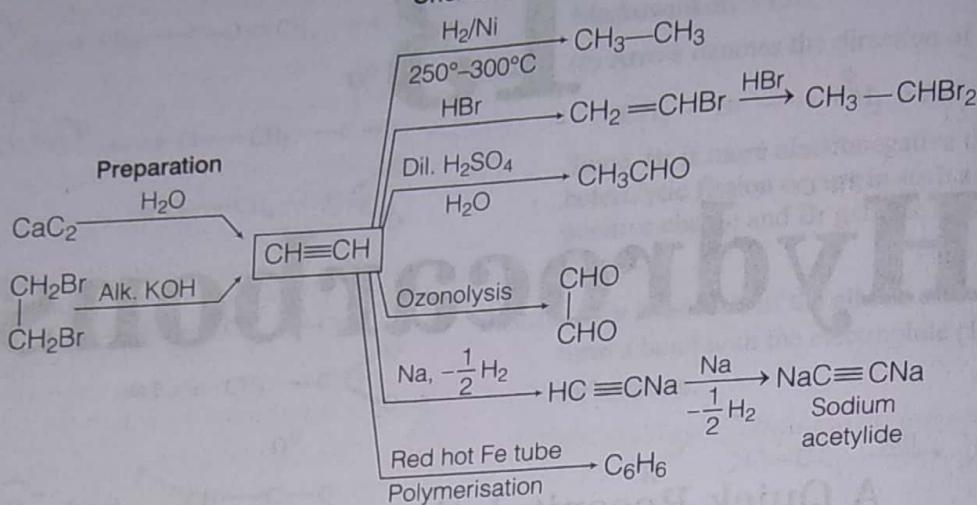
Out of staggered and eclipsed conformations of ethane, staggered conformation is more stable as H-atoms are farthest apart.

5. Alkenes exhibit **geometrical (cis-trans) isomerism** due to restricted rotation around the C—C double bond.

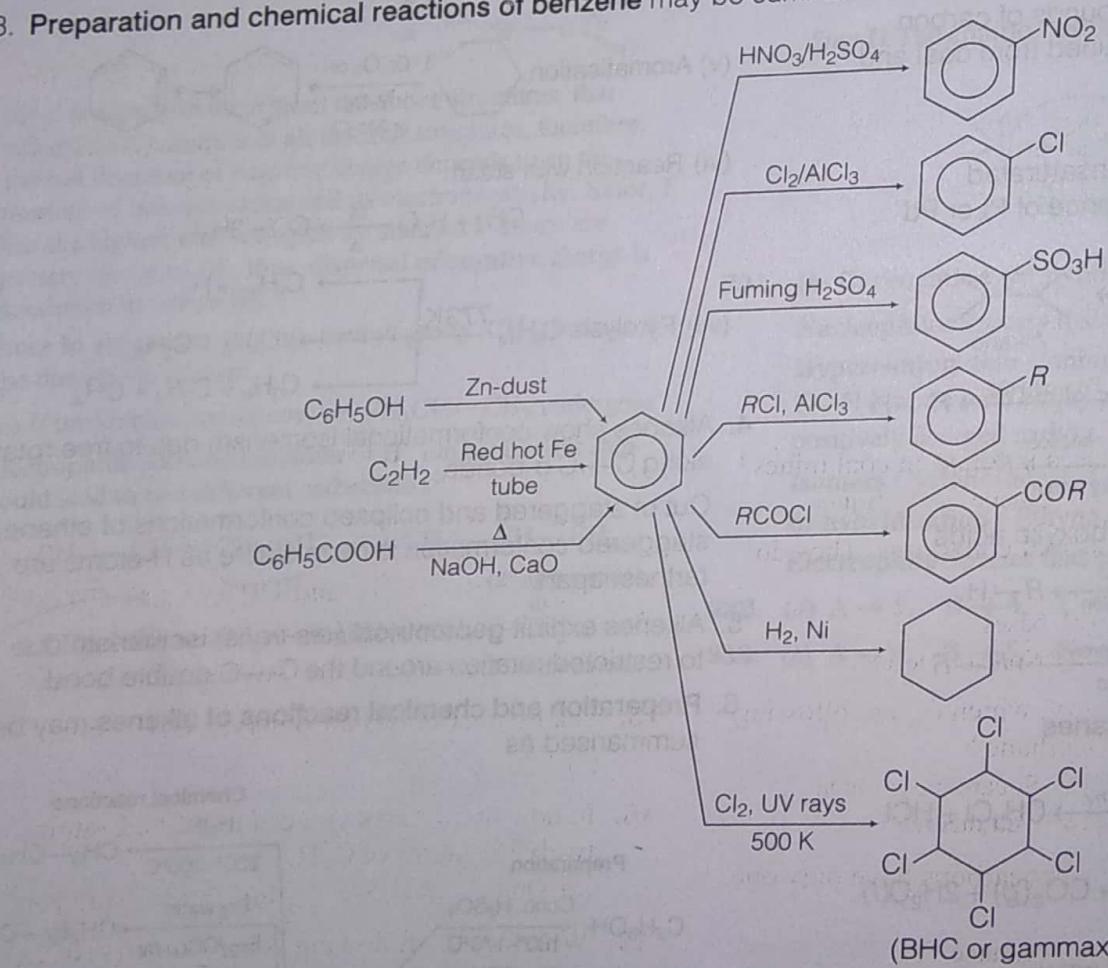
6. **Preparation and chemical reactions of alkenes** may be summarised as



7. Preparation and chemical reactions of alkynes may be summarised as



8. Preparation and chemical reactions of benzene may be summarised as



9. **Ortho and para-directing Groups** The groups, e.g.  $-\text{OH}$ ,  $-\text{NH}_2$ ,  $-\text{NHR}$ ,  $-\text{NHCOCH}_3$ ,  $-\text{OCH}_3$ ,  $-\text{CH}_3$ ,  $-\text{C}_2\text{H}_5$  etc., are called *ortho* and *para*-directing as well as activating groups. They activate benzene ring towards electrophile.

10. **Meta-directing Groups** The groups, e.g.  $-\text{NO}_2$ ,  $-\text{CN}$ ,  $-\text{CHO}$ ,  $-\text{COR}$ ,  $-\text{COOH}$ ,  $-\text{COOR}$ ,  $-\text{SO}_3\text{H}$  etc., are called *meta*-directing as well as deactivating groups. They reduce the electron density in the benzene ring.

## CHAPTER

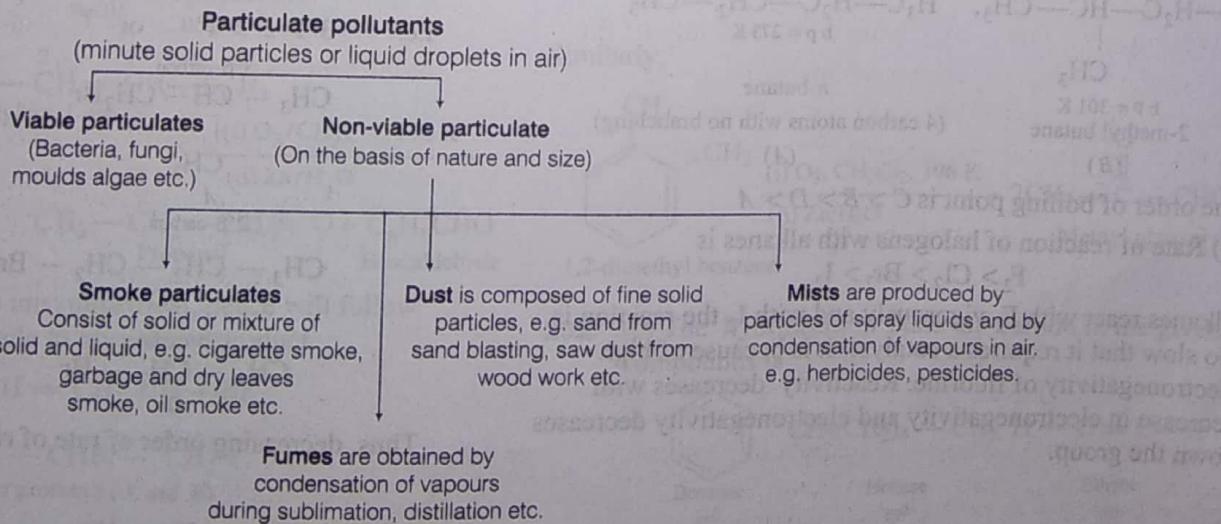
# 14

# Environmental Chemistry

## A Quick Recapitulation of the Chapter

- Environmental chemistry** deals with the sum of all social, economical, biological, physical and chemical interrelations with our surroundings.
- Environmental pollution** is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. The substance which causes pollution, is called **pollutant**.
- Atmosphere surrounds the earth and have concentric layers of our regions having different air densities. Atmospheric pollution is studied as **tropospheric** and **stratospheric pollution**.
- Tropospheric pollution occurs due to the presence of undesirable solid or gaseous particles in the air.
- Two types of pollutants are present in the troposphere: **Gaseous air pollutants** (oxides of sulphur, nitrogen and carbon; hydrogen sulphide, hydrocarbons, ozone and other oxidants) and **particulate pollutants** (dust, mist, fumes, smoke, smog etc.).
- Some gases such as  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{O}_3$ , CFCs and water vapour trapped heat in the earth's surface and keep the atmosphere warm. These gases are called **green house gases** and this phenomenon is called **green house effect**. Excess of any of the green house gas in the environment leads to excess heating of environment which is called **global warming**.
- When pH of the rain water drops below 5.6, it is called **acid rain**. It is due to the presence of oxides of nitrogen and sulphur in the atmosphere. These oxides dissolve in rain water making it acidic.

### Types of particulate pollutants



9. **Smog** is a harmful mixture of smoke and fog.
- (i) Reducing smog or London smog has  $\text{SO}_x$ , particulates such as soot,  $(\text{NH}_4)_2\text{SO}_4$  and humidity (from fog) as major components. It is reducing in nature.
- (ii) Photochemical smog or Los Angeles smog has inorganic gases ( $\text{NO}_x, \text{O}_3, \text{H}_2\text{O}_2, \text{CO}$ ) and organic hydroperoxides peroxyacetyl nitrate (PAN), peroxybenzoyl nitrate (PBN), peroxypropionyl nitrate (PPN), peracetic acid, acetyl peroxide, ethyl hydroperoxide, *n*-butyl hydroperoxide and *t*-butyl hydroperoxide. It is oxidising in nature.
10. In 1980s atmospheric scientists working in Antarctica reported about depletion of ozone layer, known as **ozone hole**. The effects of depletion of ozone layer are cataract, skin cancer, killing of phytoplanktons etc.
11. **Water pollution** originates from human activities. Easily identified source or place of water pollution is called point source, e.g. municipal and industrial discharge pipes. Non-point source of water pollution are those where source of pollution cannot be easily identified. e.g. agricultural run off, acid rain, storm water etc.
12. The oxygen dissolved in water is called **dissolved oxygen** (DO). If its concentration in water is below 6 ppm, the growth of fish gets inhibited.

13. **Causes of water pollution**
- (i) Pathogens (bacteria and other organisms that enter water from domestic sewage and animal excreta).
  - (ii) Organic wastes (organic matter such as leaves, grass, trash etc).
  - (iii) Chemical pollutants (Cd, Hg, Ni in water).
14. The amount of oxygen required by bacteria to break down the organic matter present in a certain volume of a sample of water, is called **Biochemical Oxygen Demand** (BOD).
15. **Eutrophication** is the process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving of oxygen and results in subsequent loss of biodiversity.
16. **International standards for drinking water**
- (i) The **concentration of fluorides** should be upto 1 ppm or  $1 \text{ mg dm}^{-3}$ . Above this limit, it causes brown mottling of teeth.
  - (ii) The **concentration of lead** should be  $< 50 \text{ ppb}$ .
  - (iii) The concentration of sulphate should be  $< 500 \text{ ppm}$ .
  - (iv) The concentration of nitrate should be  $< 50 \text{ ppm}$ .
17. **Soil pollution** is caused by high degree use of pesticides and herbicides.
18. **Green chemistry** is a production process that would bring about minimum pollution or deterioration to the environment.

## [Objective Questions Based on NCERT Text]