WS – 10.1 *Ch*-10. s-Block Elements **Topic- 10.1 Alkali Metals**

FILL IN THE BLANKS:

1. The *s*-block elements of the Periodic Table are those in which the last electron enters the outermost _____ -orbital.
2. Group 1 of the Periodic Table consists of the elements: _____, _____, _____ , _____ & _____ ; they are collectively known as the _____metals.
3. The general electronic configuration of *s*-block elements is _____ for alkali metals and _____ for alkaline earth metals.
4. Lithium shows similarities to magnesium and beryllium to aluminium in many of their properties. This type of diagonal similarity is commonly referred to as _____ _____ .
5. The alkali metal atoms have the _____ sizes in a particular period of the periodic table.
6. The monovalent ions (M^+) are _____ than the parent atom.
7. The atomic and ionic radii of alkali metals _____ on moving down the group.
8. The ionization enthalpies of the alkali metals are considerably _____ and _____ down the group from Li to Cs.
9. The hydration enthalpies of alkali metal ions _____ with increase in ionic sizes.
10. Because of the large size, alkali metals have _____ density which _____ down the group from Li to Cs.
11. Lithium forms _____, sodium forms _____, the other metals form superoxides.
12. In all the oxides the oxidation state of the alkali metal is _____ .
13. The alkali metals react with water to form hydroxide and _____.
14. All the alkali metal hydrides are _____ solids with _____ melting points.
15. The alkali metals dissolve in liquid ammonia giving deep _____ solutions which are _____ in nature.
16. Among halides, lithium iodide is the most _____ in nature.
17. The melting and boiling points always follow the trend: fluoride __ chloride ___ bromide ___ iodide.
18. _____ is also used as an excellent absorbent of carbon dioxide.
19. Liquid _____ metal is used as a coolant in fast breeder nuclear reactors.
20. _____ _____ react with proton donors such as alcohol, gaseous ammonia and alkynes.

Solved Examples 10.1 to 10.3 of NCERT +
NCERT Exercise Questions No. 10.1, 10.3 ,10.4, 10.7, 10.10, 10.18 & 10.23.

Solved Examples 10.1 to 10.3 of NCERT

Problem 10.1 What is the oxidation state of K in KO_2?

Problem 10.2 The E^0 for Cl_2/Cl^- is +1.36V, for I_2/I^- is + 0.53V, for Ag^+ /Ag is +0.79V, Na^+ /Na is –2.71V and for Li^+ /Li is – 3.04V. Arrange the following ionic species in decreasing order of reducing strength: I^-, Ag, Cl^-, Li, Na.

Problem 10.3 Why is KO_2 paramagnetic ?

+ NCERT Exercise Questions No. 10.1, 10.3 ,10.4, 10.7, 10.10, 10.18 & 10.23.

10.1 What are the common physical and chemical features of alkali metals ?
10.3 Why are alkali metals not found in nature ?
10.4 Find out the oxidation state of sodium in Na_2O_2.
10.7 In what ways lithium shows similarities to magnesium in its chemical behaviour?
10.10 When an alkali metal dissolves in liquid ammonia the solution can acquire different colours. Explain the reasons for this type of colour change.
10.18 Describe two important uses of each of the following : (i) caustic soda (ii) sodium carbonate (iii) quicklime.
10.23 Why is LiF almost insoluble in water whereas LiCl soluble not only in water but also in acetone ?

HA – 10.1 *Ch*-10. s-Block Elements **Topic- 10.1 Alkali Metals**

NCERT Exercise Questions No. 10.6, 10.8, 10.9 , 10.12, 10.13, 10.16, 10.25 to 10.28.

10.6 Compare the alkali metals and alkaline earth metals with respect to (i) ionisation enthalpy (ii) basicity of oxides and (iii) solubility of hydroxides.
10.8 Explain why can alkali and alkaline earth metals not be obtained by chemical reduction methods?
10.9 Why are potassium and caesium, rather than lithium used in photoelectric cells?
10.12 Discuss the various reactions that occur in the Solvay process.
10.13 Potassium carbonate cannot be prepared by Solvay process. Why ?
10.16 Starting with sodium chloride how would you proceed to prepare:
(i) sodium metal;
(ii) sodium hydroxide;
(iii) sodium peroxide &
(iv) sodium carbonate ?
10.25 What happens when
(i) sodium metal is dropped in water ?
(ii) sodium metal is heated in free supply of air ?
(iii) sodium peroxide dissolves in water ?
10.26 Comment on each of the following observations:
(a) The mobilities of the alkali metal ions in aqueous solution are $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$
(b) Lithium is the only alkali metal to form a nitride directly.
(c) E^0 for M^{2+} (aq) + $2e^- \rightarrow$ M(s) (where M = Ca, Sr or Ba) is nearly constant.
10.27 State as to why
(a) a solution of Na_2CO_3 is alkaline ?
(b) alkali metals are prepared by electrolysis of their fused chlorides ?
(c) sodium is found to be more useful than potassium ?
10.28 Write balanced equations for reactions between
(a) Na_2O_2 and water ; (b) KO_2 and water ; (c) Na_2O and CO_2.

FILL IN THE BLANKS :

1. Alkaline Earth Metals are so called because their oxides and hydroxides are _____ in nature and these metal oxides are found in the _____ _____.
2. Of the alkaline earth metals calcium and magnesium rank _____ and _____ in abundance respectively in the earth's crust.
3. The group 2 elements comprise _____, _____, _____ ,_____, _____ and _____.
4. The first element beryllium differs from the rest of the members and shows diagonal relationship to _____.
5. The atomic and ionic radii of the alkaline earth metals are _____ than those of the corresponding alkali metals in the same periods.
6. The first ionisation enthalpies of the alkaline earth metals are_____ than those of the corresponding Group 1 metals.
7. Second ionisation enthalpies of the alkaline earth metals are _____ than those of the corresponding alkali metals.
8. Like alkali metal ions, the hydration enthalpies of alkaline earth metal ions _____ with increase in ionic size down the group.
9. The melting and boiling points of _____ _____ metals are higher than the corresponding alkali metals due to _____ sizes.
10. The hydration enthalpies of alkaline earth metal ions are _____ than those of alkali metal ions.
11. Calcium, strontium and barium impart characteristic _____, _____ and _____ colours respectively to the flame.
12. Beryllium and magnesium are kinetically inert to oxygen and water because of the formation of a /an _____ film on their surface.
13. A suspension of magnesium hydroxide in water , called _____ of magnesia, is used as antacid in medicine.
14. _____ salts are used in radiotherapy, for example, in the treatment of cancer.
15. Carbonates of alkaline earth metals are _____ in water .
16. Sulphates of the alkaline earth metals are all _____ solids and _____ to heat.
17. Like aluminium, beryllium is not readily attacked by acids because of the presence of an oxide film on the surface of the metal.
18. The chlorides of both _____ and _____ have Cl^- bridged chloride structure in vapour phase.
19. _____ is used as a building material in the form of marble and in the manufacture of quick lime.
20. _____is used for immoblising the affected part of organ where there is a bone fracture or sprain.

CA – 10.2 *Ch*-10. s-Block Elements **Topic- 10.2 Alkaline Earth Metals**

Solved Examples 10.4 & 10.5 of NCERT + NCERT Exercise Questions No. 10.2, 10.11 & 10.32.

Solved Examples 10.4 & 10.5 of NCERT:

Problem 10.4 Why does the solubility of alkaline earth metal hydroxides in water increase down the group?

Problem 10.5 Why does the solubility of alkaline earth metal carbonates and sulphates in water decrease down the group?

NCERT Exercise Questions No. 10.2, 10.11 & 10.32.

10.2 Discuss the general characteristics and gradation in properties of alkaline earth metals.

10.11 Beryllium and magnesium do not give colour to flame whereas other alkaline earth metals do so. Why ?

10.32 Which one of the alkaline earth metal carbonates is thermally the most stable ?
(a) $MgCO_3$ (b) $CaCO_3$ (c) $SrCO_3$ (d) $BaCO_3$

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Class XI Chemistry *Unit -10. The s-Block Elements*

HA – 10.2 *Ch*-10. s-Block Elements **Topic- 10.2 Alkaline Earth Metals**

NCERT Exercise Questions No. 10.17, 10.21 , 10.22 & 10.29.

10.17 What happens when (i) magnesium is burnt in air (ii) quick lime is heated with silica (iii) chlorine reacts with slaked lime (iv) calcium nitrate is heated?

10.21 Describe the importance of the following :
(i) limestone (ii) cement (iii) plaster of paris.

10.22 Why are lithium salts commonly hydrated and those of the other alkali ions usually anhydrous?

10.29 How would you explain the following observations?
(i) BeO is almost insoluble but $BeSO_4$ in soluble in water,
(ii) BaO is soluble but $BaSO_4$ is insoluble in water,
(iii) LiI is more soluble than KI in ethanol.

WS – 11.1 *Ch- 11.* Some p-Block Elements **Topic- 11.1 Group -13 Elements**

FILL IN THE BLANKS:

1. The maximum oxidation state shown by a p-block element is equal to the total number of valence electrons, i.e., the sum of the ____ and _____-electrons .
2. The non-metallic character of elements _____ down the group.
3. Non-metals have _____ ionization enthalpies and _____ electro-negativities than the metals.
4. The compounds formed by highly reactive non-metals with highly reactive metals are generally _____ because of large differences in their electronegativities.
5. Compounds formed between non-metals themselves are largely _____ in character.
6. The non-metal oxides are _____ or _____ whereas metal oxides are _____ in nature.
7. The first member of a group differs from the heavier members in its ability to form _____ - _____ multiple bonds to itself.
8. Boron is a typical _____ , aluminium is a _____.
9. _____ is the most abundant metal and the third most abundant element in the earth's crust.
10. The two isotopic forms of boron are_____ (19%) and _____(81%).

11. The outer electronic configuration of _____ elements is ns^2np^1.

12. Atomic radius of Ga is _____ than that of Al.

13. _____ with unusually low melting point (303K), could exist in liquid state during summer.
14. Density of the elements _____ down the group from boron to thallium.

15. High boiling point (2676 K) makes_____ , a useful material for measuring high temperatures.
16. The relative stability of +1 oxidation state progressively _____ for heavier elements.
17. Compounds in +1 oxidation state, as expected from energy considerations, are more _____ than those in +3 oxidation state.
18. BCl_3 easily _____ a lone pair of electrons from ammonia to form $BCl_3.NH_3$.

19. Aluminium forms a very thin _____ layer on the surface which protects the metal from further attack.
20. Aluminium dissolves in mineral acids and aqueous alkalies and thus shows _____ character.

CA – 11.1 *Ch- 11.* Some p-Block Elements **Topic- 11.1 Group -13 Elements**

Solved Examples 11.1 to 11.4 of NCERT + NCERT Exercise Questions No. 11.1 to 11.7.

Solved Examples 11.1 to 11.4 of NCERT

Problem 11.1 Standard electrode potential values, E^0 for Al^{3+}/Al is –1.66 V and that of Tl^{3+}/Tl is +1.26 V. Predict about the formation of M^{3+} ion in solution and compare the electropositive character of the two metals.

Problem 11.2 White fumes appear around the bottle of anhydrous aluminium chloride. Give reason.

Problem 11.3 Boron is unable to form BF_6^{3-} ion. Explain.

Problem 11.4 Why is boric acid considered as a weak acid?

+ NCERT Exercise Questions No. 11.1 to 11.7.

11.1 Discuss the pattern of variation in the oxidation states of ;(i) B to Tl and (ii) C to Pb.

11.2 How can you explain higher stability of BCl_3 as compared to $TlCl_3$?

11.3 Why does boron triflouride behave as a Lewis acid ?

11.4 Consider the compounds, BCl_3 and CCl_4. How will they behave with water ? Justify.

11.5 Is boric acid a protic acid ? Explain.

11.6 Explain what happens when boric acid is heated .

11.7 Describe the shapes of BF_3 and BH_4^-. Assign the hybridisation of boron in these species.

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Class XI Chemistry ***Unit -11.*** **Some p-Block Elements**

HA – 11.1 *Ch- 11.* Some p-Block Elements

NCERT Exercise Questions No. 11.20, 11.22, 11.28 & 11.31.

11.20 What happens when:

(a) Borax is heated strongly,

(b) Boric acid is added to water,

(c) Aluminium is treated with dilute NaOH,

(d) BF_3 is reacted with ammonia?

11.22 Give reasons :

(i) Conc. HNO_3 can be transported in aluminium container.

(ii) A mixture of dilute NaOH and aluminium pieces is used to open drain.

(iii) Graphite is used as lubricant.

(iv) Diamond is used as an abrasive.

(v) Aluminium alloys are used to make aircraft body.

(vi) Aluminium utensils should not be kept in water overnight.

(vii) Aluminium wire is used to make transmission cables.

11.28 When metal X is treated with sodium hydroxide, a white precipitate (A) is obtained, which is soluble in excess of NaOH to give soluble complex (B). Compound (A) is soluble in dilute HCl to form compound (C). The compound (A) when heated strongly gives (D), which is used to extract metal. Identify (X), (A), (B), (C) and (D). Write suitable equations to support their identities.

11.31 Write balanced equations for:

(i) $BF_3 + LiH \rightarrow$ (ii) $B_2H_6 + H_2O \rightarrow$

(iii) $NaH + B_2H_6 \rightarrow$ (iv) $H_3BO_3 + \Delta \rightarrow$

(v) $Al + NaOH \rightarrow$ (vi) $B_2H_6 + NH_3 \rightarrow$

WS – 11.2 *Ch- 11.* Some p-Block Elements **Topic- 11.2 Group -14 Elements**

FILL IN THE BLANKS:

1. Carbon (C), silicon (Si), germanium (Ge), tin (Sn) and _____ (__) are the members of group _____ .
2. Naturally occurring carbon contains two stable isotopes i.e._____ and _____ .
3. _____ is the second (27.7 % by mass) most abundant element on the earth's crust.
4. _____ is a very important component of ceramics, glass and cement.
5. Tin occurs mainly as _____, SnO_2 and lead as _____ , PbS.
6. Ultra pure form of _____ and _____ are used to make transistors and semiconductor devices.
7. The first ionization enthalpy of group 14 members is _____ than the corresponding members of group 13.
8. The valence shell electronic configuration of _____ elements is ns^2np^2.
9. Due to small size, the elements of this group are slightly _____ electronegative than group 13 elements.
10. Silicon is _____, germanium is a _____, whereas tin and lead are soft _____ .
11. Melting points and boiling points of group 14 elements are much _____ than those of corresponding elements of group 13.
12. The dioxides — CO_2, SiO_2 and GeO_2 are _____ , whereas SnO_2 and PbO_2 are _____ in nature.
13. Carbon atoms have the tendency to link with one another through covalent bonds to form chains and rings. This property is called _____ .
14. If aluminium atoms replace few silicon atoms in three-dimensional network of silicon dioxide, overall structure known as _____ .
15. ZSM-5 (A type of zeolite) used to convert alcohols directly into _____ .
16. Two important man-made silicates are _____ and _____ .
17. Quartz, cristobalite and tridymite are some of the crystalline forms of _____ .
18. 95% of the earth's crust is made up of _____ and _____.
19. In CO_2 molecule carbon atom undergoes _____ hybridization.
20. The highly poisonous nature of CO arises because of its ability to form a complex with _____ .

Solved Examples 11.5 & 11.8 of NCERT +
NCERT Exercise Questions No. 11.10 to 11.12, 11.17 to 11.19 & 11.38.

Solved Examples 11.5 & 11.8 of NCERT:

Problem 11.5. Select the member(s) of group 14 that (i) forms the most acidic dioxide, (ii) is commonly found in +2 oxidation state, (iii) used as semiconductor.
Problem 11.6. $[SiF_6]^{2-}$ is known whereas $[SiCl_6]^{2-}$ not. Give possible reasons.
Problem 11.7. Diamond is covalent, yet it has high melting point. Why?
Problem: 11.8. What are silicones?

NCERT Exercise Questions No. 11.10 to 11.12, 11.17 to 11.19 & 11.38.

11.10 Write the resonance structures of CO_3^{2-} and HCO_3^- .
11.11 What is the state of hybridisation of carbon in (a) CO_3^{2-} (b) diamond (c) graphite?
11.12 Explain the difference in properties of diamond and graphite on the basis of their structures.
11.17 Suggest a reason as to why CO is poisonous.
11.18 How is excessive content of CO_2 responsible for global warming?
11.19 Explain structures of diborane and boric acid.
11.38 If the starting material for the manufacture of silicones is $RSiCl_3$, write the structure of the product formed.

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Class XI Chemistry *Unit -11.* **Some p-Block Elements**

HA– 11.2 ***Ch- 11.*** **Some p-Block Elements** **Topic- 11.2 Group -14 Elements**

NCERT Exercise Questions No. 11.21, 11.25 , 11 .29 & 11.30 .

11.21 Explain the following reactions
(a) Silicon is heated with methyl chloride at high temperature in the presence of copper;
(b) Silicon dioxide is treated with hydrogen fluoride;
(c) CO is heated with ZnO;
(d) Hydrated alumina is treated with aqueous NaOH solution.

11.25 What are allotropes? Sketch the structure of two allotropes of carbon namely diamond and graphite. What is the impact of structure on physical properties of two allotropes?

11.29 What do you understand by (a) inert pair effect (b) allotropy and (c) catenation?

11.30 A certain salt X, gives the following results.
(i) Its aqueous solution is alkaline to litmus.
(ii) It swells up to a glassy material Y on strong heating.
(iii) When conc. H_2SO_4 is added to a hot solution of X, white crystal of an acid Z separates out. Write equations for all the above reactions and identify X, Y and Z.

ORIGIN OF ORGANIC CHEMISTRY

In the earlier period of development of chemistry, compounds were classified into two types: organic and inorganic. While the former were taken to be derived from 'living matter' the latter were taken to come from non-living matter. There was the mistaken notion that a 'vital force' was essential for the synthesis of organic compounds. The preparation of urea (present in urine) from the inorganic compound ammonium cyanate by Wöhler in 1828 effectively destroyed the myth of organic compounds being associated with a 'vital force'.

$$\underset{\text{Ammonium cyanate}}{NH_4CNO} \xrightarrow{\text{heat}} \underset{\text{Urea}}{NH_2CONH_2}$$

Soon afterwards Herman Kolbé accomplished the synthesis of acetic acid which had been previously obtained from the biological materials. The pioneering work of Lavoisier, Kolbé, Kekulé and Berthelot showed conclusively that organic compounds are essential compounds formed by carbon with itself and other elements and that they can be synthesized in a laboratory as easily as other 'inorganic compounds'. The development of electronic theory of covalent bonding ushered organic chemistry into its modern shape.

The determination of structure of an organic compound involves the following steps:

(i) Purification of the compound,
(ii) Qualitative analysis for determining the elements present,
(iii) Quantitative analysis of elements detected under (ii),
(iv) Determination of Molecular mass, and
(v) Determination of structural formula by physicochemical and spectroscopic methods.

The common techniques used for purification are as follows;

(i) Filtration, (ii) Recrystallization, (iii) Sublimation, (iv) Distillation,
(v) Differential extraction, and (vi) Chromatography.

(1) FILTRATION :

Filtration is used to separate an insoluble solid component of the mixture from the soluble component in a given solvent. For example, a mixture containing naphthalene and urea can be separated by this technique.

Urea dissolves in water while naphthalene remains insoluble. Urea is recovered from the filtrate by evaporating water.

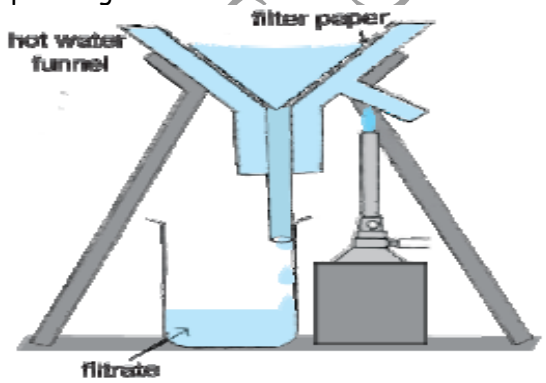


Fig. 16.1 Filtration of hot mixture. The funnel is kept hot by hot water

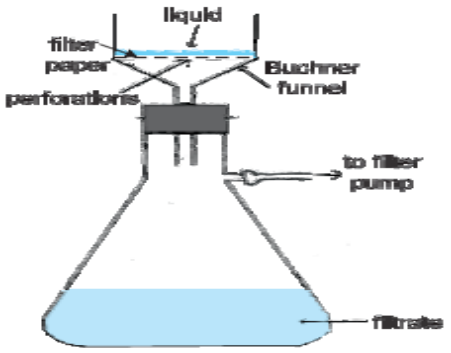


Fig. 16.2 Filtration under reduced pressure. The pressure in filtration flask is reduced with water pump/vacuum pump.

(2) CRYSTALLIZATION :

This is one of the most commonly used techniques of purification of solid organic substances. It is based on the difference in the solubilities of the compound and the impurities in a suitable solvent. The impure compound is dissolved in a solvent in which it is sparingly soluble at room temperature but appreciably soluble at higher temperature. The solution is concentrated to get nearly a saturated solution.

On cooling, the pure substance crystallizes out and is removed by filtration. The filtrate (mother liquor) contains impurities and small quantity of the compound. If the substance is highly soluble in one solvent and too little soluble in another solvent, then crystallization can be satisfactorily carried out in a mixture of these solvents taken in an appropriate proportions.

(3) Sublimation :

On heating, some solid substances change from solid to vapour state without passing through liquid state. Such substances are known as sublimable. Sublimation is used to separate sublimable compounds from non-sublimable impurities. The impure compound is heated in a porcelain dish covered with a filter paper which is perforated with a number of small holes. A funnel with its stem plugged with cotton is inverted over the porcelain dish. The vapours of the pure compound get deposited on the inner side of the funnel. Compounds like camphor and naphthalene can be purified by this method.

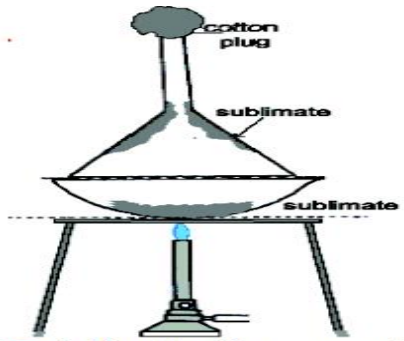


Fig. 16.3 Sublimation. The vapours of the volatile component are deposited over the inner surface of funnel.

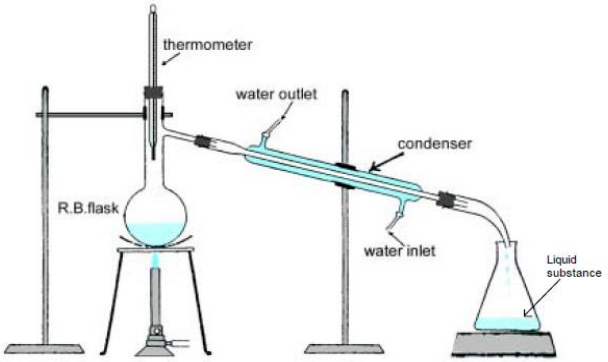


Fig.16.4 Simple distillation. The vapours of a substance formed are condensed and the liquid is collected in conical flask.

(4) Distillation:

This important method is used to separate (i) volatile liquids from non-volatile impurities and (ii) liquids having sufficient difference in their boiling points. Liquids having different boiling points vaporize at different temperatures. The vapours are cooled and the liquids so formed are collected separately.

Fractional Distillation: If the difference in boiling points of two liquids is not much, simple distillation cannot be used to separate them. The vapours of such liquids are formed within the same temperature range and are condensed simultaneously. The technique of fractional distillation is used in such cases. In this technique, the vapours of a liquid mixture are passed through a fractionating column fitted over the mouth of the round bottom flask

One of the technological applications of fractional distillation is to separate different fractions of ***crude oil in petroleum industry***.

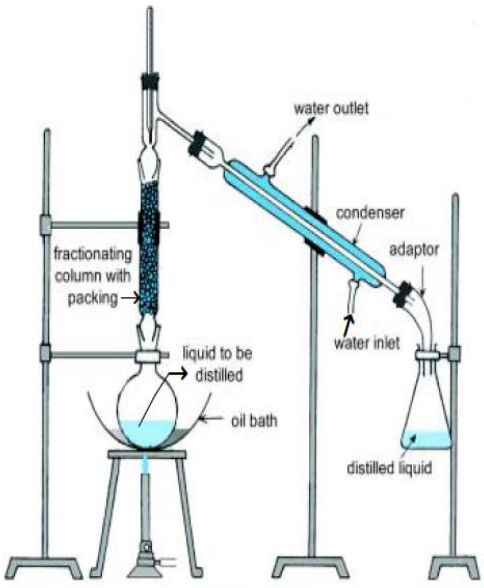


Fig.16.5 Fractional distillation. The vapours of lower boiling fraction reach the top of the column first followed by vapours of higher boiling fractions.

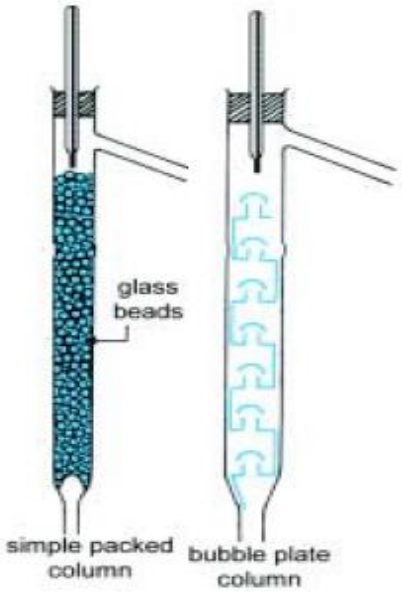


Fig. 16.6 Different types of fractionating columns

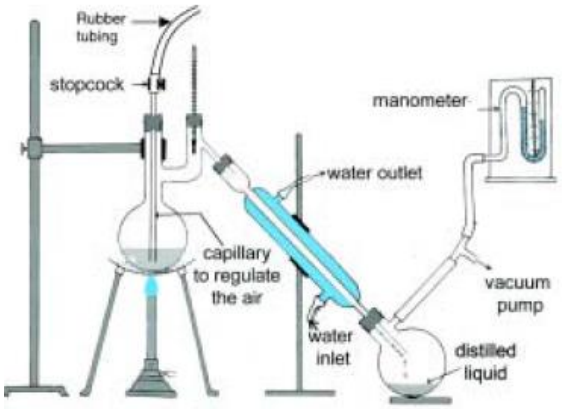


Fig. 16.7 Distillation under reduced pressure. A liquid boils at a temperature below its vapour pressure by reducing the pressure.

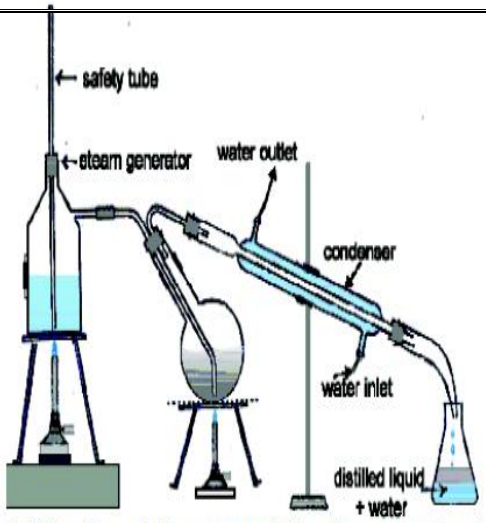


Fig. 16.8 Steam distillation. Steam volatile component volatilizes, the vapours condense in the condenser and the liquid collects in conical flask.

DISTILLATION UNDER REDUCED PRESSURE: This method is used to purify liquids having very high boiling points and those, which decompose at or below their boiling points. Such liquids are made to boil at a temperature lower than their normal boiling points by reducing the pressure on their surface. A liquid boils at a temperature at which its vapour pressure is equal to the external pressure. The pressure is reduced with the help of a water pump or vacuum pump. Glycerol can be separated from *spent-lye in soap industry* by using this technique.

STEAM DISTILLATION: This technique is applied to separate substances which are steam volatile and are immiscible with water. In steam distillation, steam from a steam generator is passed through a heated flask containing the liquid to be distilled. The mixture of steam and the volatile organic compound is condensed and collected.

In steam distillation, the liquid boils when the sum of vapour pressures due to the organic liquid (p_1) and that due to water (p_2) becomes equal to the atmospheric pressure (p), i.e. $p = p_1 + p_2$. Since p_1 is lower than p, the organic liquid vaporizes at lower temperature than its boiling point.

(5) DIFFERENTIAL EXTRACTION:

When an organic compound is present in an aqueous medium, it is separated by shaking it with an organic solvent in which it is more soluble than in water. The organic solvent and the aqueous solution should be immiscible with each other so that they form two distinct layers which can be separated by separating funnel. The organic solvent is later removed by distillation or by evaporation to get back the compound. Differential extraction is carried out in a separating funnel.

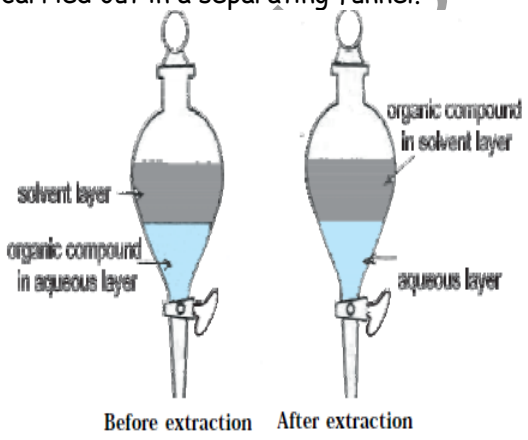


Fig. 16.9 (a) Differential extraction. Extraction of compound takes place based on difference in solubility

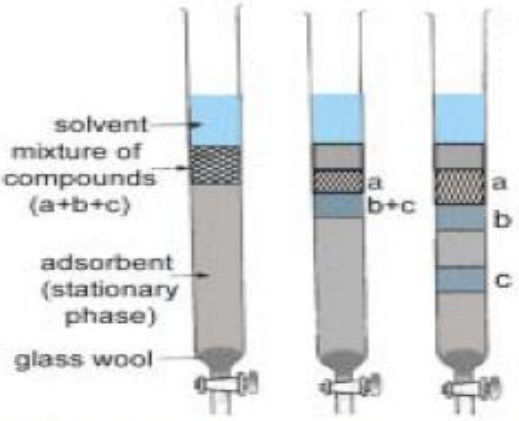


Fig. 16.10 Column chromatography. Different stages of separation of components of a mixture.

(6) CHROMATOGRAPHY:

Chromatography is an important technique extensively used to separate mixtures into its components, purify compounds and also to test the purity of compounds. The name chromatography is based on the greek word *chroma*, for colour since the method was first used for the separation of coloured substances found in

plants. In this technique, the mixture of substances is applied onto a stationary phase, which may be a solid or a liquid.

Based on the principle involved, chromatography is classified into different categories. Two of these are: (i) Adsorption chromatography and (ii) Partition chromatography.

Following are two main types of chromatographic techniques based on the principle of differential adsorption.

(i) Column chromatography and (ii) Thin layer chromatography

Column Chromatography : Column chromatography involves separation of a mixture over a column, of adsorbent (stationary phase) packed in a glass tube. The column is fitted with a stopcock at its lower end. The mixture adsorbed on adsorbent is placed on the top of the adsorbent in the column. An appropriate elutent which is a liquid or a mixture of liquids is allowed to flow down the column slowly. Depending upon the degree to which the compounds are adsorbed, complete separation takes place. The most readily adsorbed substances are retained near the top and others come down to various distances in the column.

***Thin layer Chromatography*:** Thin layer chromatography (TLC) is another type of adsorption chromatography, which involves separation of substances of a mixture over a thin layer of an adsorbent coated on glass plate. A thin layer (about 0.2mm thick) of an adsorbent (silica gel or alumina) is spread over a glass plate of suitable size. The plate is known as *thin layer chromatography plate*. The solution of the mixture to be separated is applied as a small spot about 2 cm above one end of the TLC plate. The glass plate is then placed in a closed jar containing the elutent. As the elutent rises up the plate, the components of the mixture move up along with the elutent to different distances depending on their degree of adsorption and separation takes place. The relative adsorption of each component of the mixture is expressed in terms of its **retardation factor** i.e. **Rf value**

$$R_f = \frac{\text{Distance moved by the substance from base line (x)}}{\text{Distance moved by the solvent from base line (y)}}$$

***Partition Chromatography*:** Partition chromatography is based on continuous differential partitioning of components of a mixture between stationary and mobile phases. Paper chromatography is a type of partition chromatography. In paper chromatography, a special quality paper known as chromatography paper is used. Chromatography paper contains water trapped in it, which acts as the stationary phase.

QUALITATIVE ANALYSIS

The elements present in organic compounds are carbon and hydrogen. In addition to these, they may also contain oxygen, nitrogen, sulphur, halogens and phosphorus.

a) Detection of Carbon and Hydrogen :Carbon and hydrogen are detected by heating the compound with copper (II) oxide. Carbon present in the compound is oxidized to carbon dioxide (tested with limewater) and hydrogen to water (tested with anhydrous copper sulphate, which turns blue).

$$C + 2CuO \longrightarrow 2Cu + CO_2$$
$$2H + CuO \longrightarrow Cu + H_2O$$
$$CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$$
$$4\,H_2O + CuSO_4.\,H_2O \longrightarrow CuSO_4.5H_2O$$
White **Blue**

b) Detection of other Elements

Nitrogen, sulphur, halogens and phosphorus present in an organic compound are detected by "***Lassaigne's test***". The elements present in the compound are converted from covalent form into the ionic form by fusing the compound with sodium metal. Following reactions take place:

$Na + C + N \longrightarrow NaCN$
$2Na + S \longrightarrow Na_2S$
$Na + X \longrightarrow Na\,X$ (X = Cl, Br or I) C, N, S and X come from organic compound.

Cyanide, sulphide and halide of sodium so formed in sodium fusion are extracted from the fused mass by boiling it with distilled water. This extract is known as ***sodium fusion extract***.

(i) Test for Nitrogen

The sodium fusion extract is boiled with iron (II) sulphate and then acidified with conc. Sulphuric acid. The formation of Prussian blue colour confirms the presence of nitrogen. Sodium cyanide first reacts with iron (II) sulphate and forms sodium hexacyanoferrate (II). On heating with conc. sulphuric acid some iron (II) ions are oxidised to ferric ions which react with sodium hexacyanoferrate (II) to produce iron (III) hexacyanoferrate (II) (ferriferrocyanide) which is Prussian blue in colour.

$$6CN^- + Fe^{2+} \longrightarrow [Fe(CN)_6]^{4-}$$

$$3[Fe(CN)_6]^{4-} + 4Fe^{3+} \longrightarrow Fe_4[Fe(CN)_6]_3$$

Prussian blue

(ii) Test for Sulphur

(a) The *sodium fusion extract* is acidified with acetic acid and lead acetate is added to it. A black precipitate of lead sulphide indicates the presence of sulphur.

$$S^{2-} + Pb^{2+} \longrightarrow PbS$$

(b) On treating sodium fusion extract with sodium nitroprusside, a violet colour further indicates the presence of sulphur.

$$S^{2-} + [Fe(CN)_5NO]^{2-} \longrightarrow [Fe(CN)_5NOS]^{4-}$$

Violet

In case, nitrogen and sulphur both are present in an organic compound, sodium thiocyanate is formed. It gives blood red colour and no Prussian blue since there are no free cyanide ions.

$$Na + C + N + S \longrightarrow NaSCN$$

$$Fe^{3+} + SCN^- \longrightarrow [Fe(SCN)]^{2+}$$

If sodium fusion is carried out with excess of sodium, the thiocyanate decomposes to yield cyanide and sulphide. These ions give their usual tests.

$$NaSCN + 2Na \longrightarrow NaCN + Na_2S$$

(iii) Tests for Halogens

The sodium fusion extract is acidified with nitric acid and then treated with silver nitrate. A white precipitate, soluble in ammonium hydroxide shows the presence of chlorine, a yellowish precipitate, sparingly soluble in ammonia shows the presence of bromine and a yellow precipitate, insoluble in ammonium hydroxide shows the presence of iodine.

$$X^- + Ag^+ \longrightarrow AgX$$

X represents a halogen – Cl, Br or I.

If nitrogen or sulphur is also present in the compound, the sodium fusion extract is first boiled with conc. nitric acid to decompose cyanide or sulphide of sodium formed during *Lassaigne's test*. These ions would otherwise interfere with silver nitrate test for halogens.

(iv) *Test for Phosphorus*

The compound is heated with an oxidising agent(sodium peroxide). The phosphorus present in the compound is oxidised to phosphate. The solution is boiled with nitric acid and then treated with ammonium molybdate. A yellow colouration or precipitate indicates the presence of phosphorus.

$$Na_3PO_4 + 3HNO_3 \longrightarrow H_3PO_4 + 3NaNO_3$$

$$H_3PO_4 + 12(NH_4)_2MoO_4 + 21HNO_3 \longrightarrow$$

Ammonium molybdate

$$(NH_4)_3PO_4 \cdot 12MoO_3 + 21NH_4NO_3 + 12H_2O$$

Ammonium phosphomolybdate

QUANTITATIVE ANALYSIS:

a) Estimation of Carbon & Hydrogen:

$$C_xH_y + (x+y/4)\ O_2 \longrightarrow x\ CO_2 + (y/2)\ H_2O$$

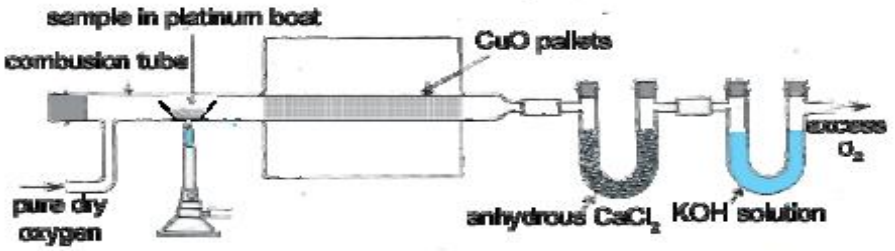


Fig. 16.13 *Estimation of carbon and hydrogen. Water and carbon dioxide formed on oxidation of substance are absorbed in anhydrous calcium chloride and potassium hydroxide solutions respectively contained in U tubes.*

m_1 and m_2 g respectively.

$$\text{Percentage of carbon} = \frac{12 \times m_2 \times 100}{44 \times m}$$

$$\text{Percentage of hydrogen} = \frac{2 \times m_1 \times 100}{18 \times m}$$

b) Estimation Of Nitrogen:

a) Duma's Method:

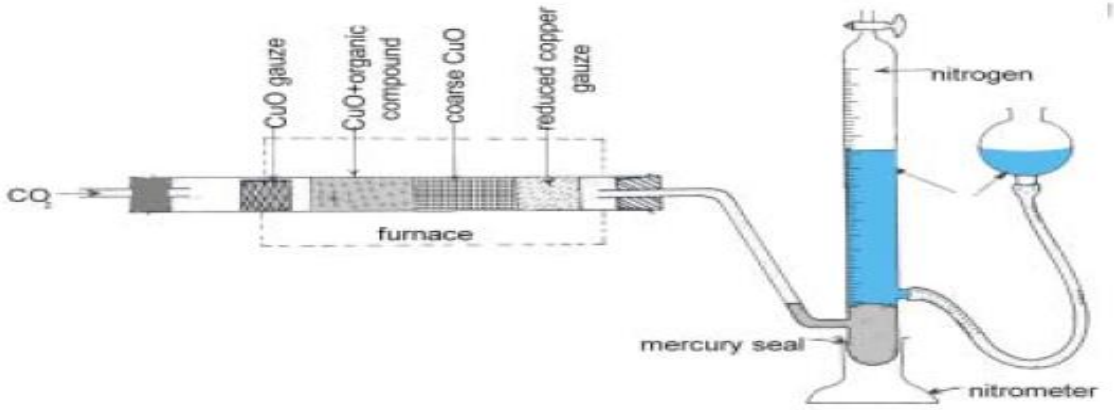


Fig. 16.14 *Dumas method. The organic compound yields nitrogen gas on heating it with copper (II) oxide in presence of CO_2 gas, the mixture of gases is collected over potassium hydroxide solution in which CO_2 is absorbed and volume of nitrogen gas is determined.*

$$C_xH_yN_z + (2x+y/2)\ CuO \longrightarrow x\ CO_2 + y/2\ H_2O + z/2\ N_2 + (2x+y/2)\ Cu$$

Let the mass of organic compound = m g

Volume of nitrogen collected = V_1 mL

Room temperature = T_1 K

$$\text{Volume of nitrogen at STP} = \frac{P_1V_1 \times 273}{760 \times T_1}$$

(Let it be V mL)

Where P_1 and V_1 are the pressure and volume of nitrogen, P_1 is different from the atmospheric pressure at which nitrogen gas is collected. The value of P_1 is obtained by the relation;

P_1 = Atmospheric pressure – Aqueous tension

22400 mL N_2 at STP weighs 28 g.

$$V \text{ mL } N_2 \text{ at STP weighs} = \frac{28 \times V}{22400} \text{ g}$$

$$\text{Percentage of nitrogen} = \frac{28 \times V \times 100}{22400 \times m}$$

b) kjehldah's method:

$$\text{Organic compound} + H_2SO_4 \longrightarrow (NH_4)_2SO_4$$

$$\xrightarrow{2\,NaOH} Na_2SO_4 + 2NH_3 + 2H_2O$$

$$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$$

Let the mass of organic compound taken = m g

Volume of H_2SO_4 of molarity, M, taken = V mL
Volume of NaOH of molarity, M, used for titration of excess of H_2SO_4 = V_1 mL
V_1 mL of NaOH of molarity M
= $V_1/2$ mL of H_2SO_4 of molarity M
Volume of H_2SO_4 of molarity M unused
= $(V - V_1/2)$ mL
$(V - V_1/2)$ mL of H_2SO_4 of molarity M
= $2(V-V_1/2)$ mL of NH_3 solution of molarity M.
1000 mL of 1 M NH_3 solution contains 17g NH_3 or 14 g N
$2(V-V_1/2)$ mL of NH_3 solution of molarity M contains

$$\frac{14 \times M \times 2(V - V_1/2)}{1000} \text{ g N}$$

$$\text{Percentage of N} = \frac{14 \times M \times 2(V - V_1/2)}{1000} \times \frac{100}{m}$$

$$= \frac{1.4 \times M \times 2(V - V_1/2)}{m}$$

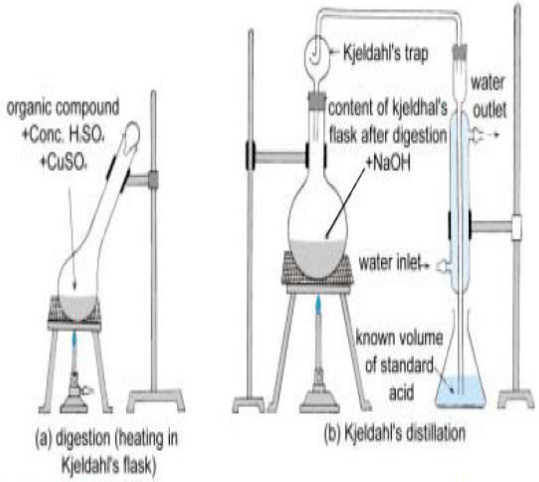


Fig.16.15 Kjeldahl method. Nitrogen-containing compound is treated with concentrated. H_2SO_4 to get ammonium sulphate which liberates ammonia by treating it with NaOH, ammonia is absorbed in known volume of standard acid.

c) Estimation Of halogen by Carius Method:

Let the mass of organic compound taken = m g
Mass of AgX formed = m_1 g
1 mole of AgX contains 1 mole of X
Mass of halogen in m_1 g of AgX

$$= \frac{\text{atomic mass of X} \times m_1 \text{g}}{\text{molecular mass of AgX}}$$

Percentage of halogen

$$= \frac{\text{atomic mass of X} \times m_1 \times 100}{\text{molecular mass of AgX} \times m}$$

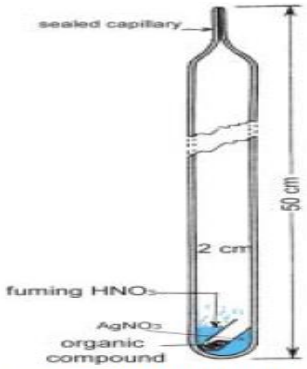


***Fig. 16.16** Carius method. Halogen containing organic compound is heated with fuming nitric acid in presence of silver nitrate.*

d) Estimation of sulphur:

Let the mass of organic compound taken = m g
and the mass of barium sulphate formed = m_1 g
1 mol of $BaSO_4$ = 233 g $BaSO_4$ = 32 g sulphur

m_1 g $BaSO_4$ contains $\frac{32 \times m_1}{233}$ g sulphur

$$\text{Percentage of sulphur} = \frac{32 \times m_1 \times 100}{233 \times m}$$

e) Estimation of Phosphorous:

Let the mass of organic compound taken = m g and mass of ammonium phospho molydate = m_1 g

Molar mass of $(NH_4)_3PO_4\ 12MoO_3 = 1877$ g

$$\text{Percentage of phosphorus} = \frac{31 \times m_1 \times 100}{1877 \times m}\ \%$$

If phosphorus is estimated as $Mg_2P_2O_7$,

$$\text{Percentage of phosphorus} = \frac{62 \times m_1 \times 100}{222 \times m}\ \%$$

ELECTRON DISPLACEMENT EFFECTS:

'INDUCTIVE EFFECT' is an experimentally observable effect of the transmission of charge through a chain of atoms in a molecule. The net polar effect exerted by a substituent is a combination of this inductive effect and the mesomeric effect.

The electron cloud in a σ-bond between two unlike atoms is not uniform and is slightly displaced towards the more electronegative of the two atoms. This causes a permanent state of bond polarization, where the more electronegative atom has a slight negative charge (δ−) and the other atom has a slight positive charge (δ+).

If the electronegative atom is then joined to a chain of atoms, usually carbon, the positive charge is relayed to the other atoms in the chain. This is the electron-withdrawing inductive effect, also known as the effect.

Some groups, such as the alkyl group are less electron-withdrawing than hydrogen and are therefore considered as electron-releasing. This is electron releasing character and is indicated by the effect. In short alkyl groups are tending to give electrons leading to induction effect.

As the induced change in polarity is less than the original polarity, the inductive effect rapidly dies out, and is significant only over a short distance. The inductive effect is permanent but feeble, as it involves the shift of strongly held σ-bond electrons, and other stronger factors may overshadow this effect.

The inductive effect may be caused by some molecules also. Relative inductive effects have been experimentally measured with reference to hydrogen:

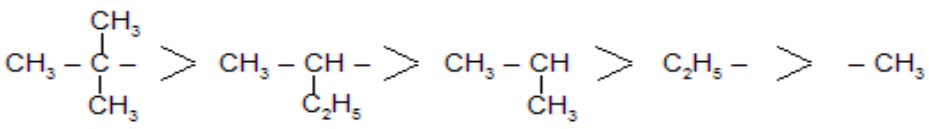
(Decreasing order of - I effect or increasing order of + I effect)

$-NR_3 > -NO_2 > -SO_2R > -CN > -COOH > -F > -Cl > -Br > -I > -OR > -COR > -OH > -C_6H_5 > -CH{=}CH_2 > -H$

Also the inductive effect is dependent on the distance between the substituent group and the main group that react. That is, as the distance of the substituent group increases the Inductive effect weakens or decreases.

Inductive effects can be measured through the **Hammett equation**.

+I	HYDROGEN	−I
Groups which attract electrons less strongly than hydrogen, electron donating groups, all alkyl groups. Strength of inductive effect (+I)	ZERO I effect	Groups which attract electrons more strongly than hydrogen electron attracting groups with high electronegativity example $-NO_2$, − COOH



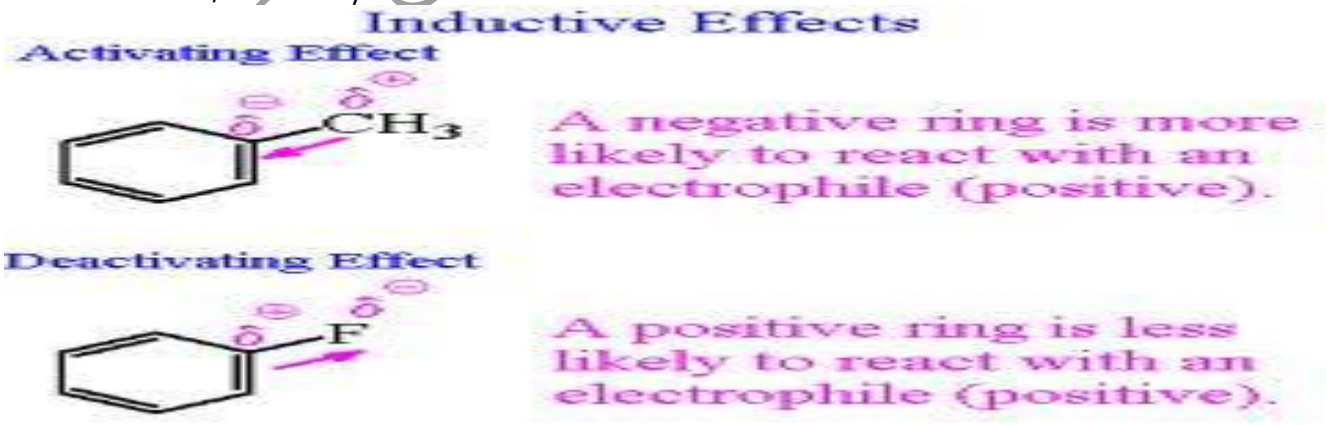
Strength of inductive effect (–I) in decreasing order

$\overset{\oplus}{N}R_3 > -CF_3 > -CCl_3 > -NO_2 > -COOH > -CHO > -SO_3H > F > Cl > Br > I >$ Phenyl ($-C_6H_5$)

-I (electron withdrawing)		+I (electron donating)
$-\overset{+}{N}H_3$, $-\overset{+}{N}R_3$	$-F$	$-CH_3$
$-NO_2$	$-Cl$	$-CH_2R$
$-C\equiv N$	$-Br$	$-CHR_2$
$-\overset{O}{\overset{\|}{C}}-OH$, $-\overset{O}{\overset{\|}{C}}-NH_2$	$-I$	$-CR_3$
$-\overset{O}{\overset{\|}{C}}-OR$, $-\overset{O}{\overset{\|}{C}}-X$		$-\overset{O}{\overset{\|}{C}}-O^-$
$-\overset{O}{\overset{\|}{C}}-H$, $-\overset{O}{\overset{\|}{C}}-R$		
$-OH$, $-OR$		
$-SH$, $-SR$		
$-C=C$, $-C\equiv C$		

Note:-The inductive effect can also be used to determine whether a molecule is stable or unstable depending on the charge present on the atom under consideration and the type of groups bonded to it. For example, if an atom has a positive charge and is attached to a –I group its charge becomes 'amplified' and the molecule becomes more unstable than if I-effect was not taken into consideration. Similarly, if an atom has a negative charge and is attached to a +I group its charge becomes 'amplified' and the molecule becomes more unstable than if I-effect was not taken into consideration. But, contrary to the above two cases, if an atom has a negative charge and is attached to a –I group its charge becomes 'de-amplified' and the molecule becomes more stable than if I-effect was not taken into consideration. Similarly, if an atom has a positive charge and is attached to a +I group its charge becomes 'de-amplified' and the molecule becomes more stable than if I-effect was not taken into consideration. The explanation for the above is given by the fact that more charge on an atom decreases stability and less charge on an atom increases stability.

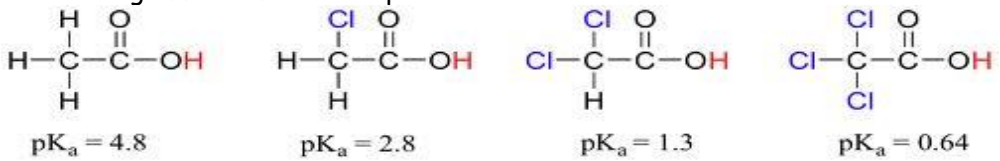
The inductive effect also plays a vital role in deciding the acidity and basicity of a molecule. Groups having +I effect attached to a molecule increases the overall electron density on the molecule and the molecule is able to donate electrons, making it basic. Similarly groups having -I effect attached to a molecule decreases the overall electron density on the molecule making it electron deficient which results in its acidity. As the number of -I groups attached to a molecule increases, its acidity increases; as the number of +I groups on a molecule increases, its basicity increases.



Applications of Inductive effects:

Aliphatic carboxylic acids. The strength of a carboxylic acid depends on the extent of its ionization: the more ionized it is, the stronger it is. As an acid becomes stronger, the numerical value of its pKa drops. In aliphatic acids, the electron-releasing inductive effect of the methyl group increases the electron density on oxygen and thus hinders the breaking of the O-H bond, which consequently reduces the ionization. Greater ionization in formic acid when compared to acetic acid makes formic acid (pKa=3.75) stronger than acetic acid

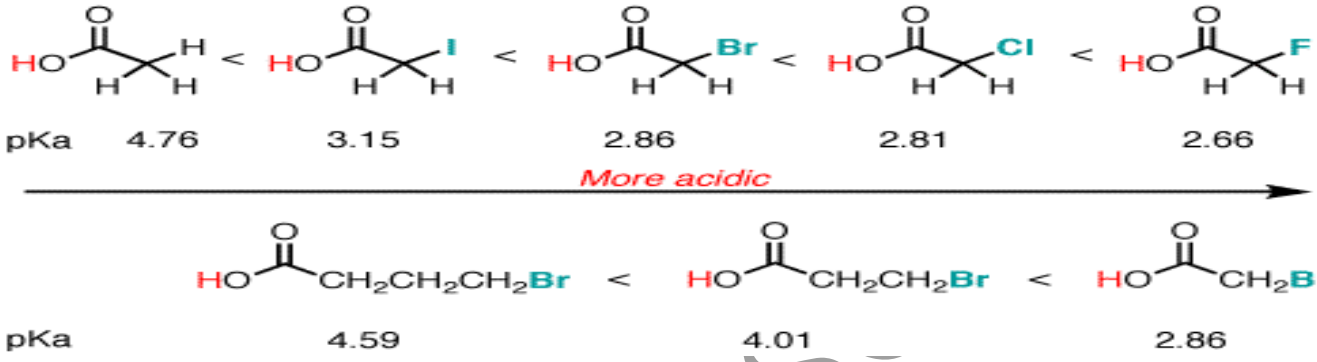
(pKa=4.76). Monochloroacetic acid (pKa=2.82), though, is stronger than formic acid, since the electron-withdrawing effect of chlorine promotes ionization.



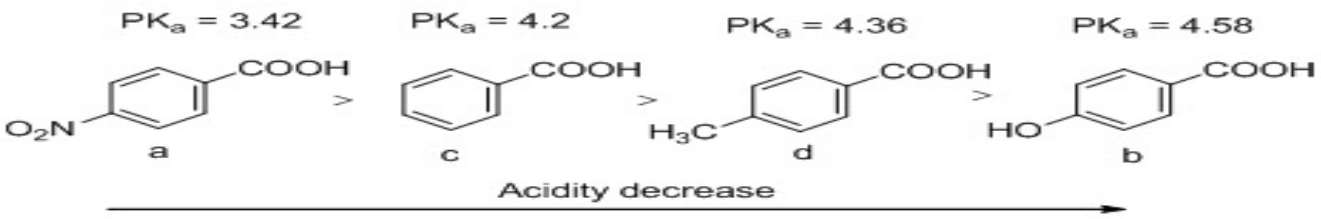
4. Electronegativity and inductive effects:

Two principles - electron-withdrawing substituents can increase acidity of a nearby atom, which increases with electronegativity and decreases with increasing distance to the atom.

Electronegativity increases in the order F > Cl > Br > I :



Aromatic carboxylic acids. In benzoic acid, the carbon atoms which are present in the ring are sp2 hybridised. As a result, benzoic acid(pKa=4.20) is a stronger acid than cyclohexane carboxylic acid(pKa=4.87). Also, electron-withdrawing groups substituted at the ortho and para positions, enhance the acid strength.



Dioic acids. Since the carboxyl group is itself an electron-withdrawing group, the dioic acids are, in general, stronger than their monocarboxyl analogues.

ELECTROMERIC EFFECT refers to a molecular polarizability effect occurring by an intramolecular electron displacement (sometimes called the 'conjugative mechanism' and, previously, the 'tautomeric mechanism') characterized by the substitution of one electron pair for another within the same atomic octet of electrons. However, this term is now considered and this effect is considered along with the inductive effect.

+E and -E groups

Electromeric effect can be classified into +E and -E effects based on the direction of transfer of the electron pair.

When the electron pair moves towards the attacking reagent, it is termed as the +E effect. The addition of acids to alkenes is an example of the +E effect. After the transfer takes place, the reagent gets attached to the atom where the electrons have been transferred to.

The -E effect can be found in reactions such as addition of cyanide ion to carbonyl compounds. In these reactions, the electron pair moves away from the attacking reagent.

As another example, consider the carbonyl group, >C=O, present in electrometric effect aldehydes and ketones. When a negatively charged reagent approaches the molecule seeking positive site, it causes instantaneous shift of the bond electron pair of the C=O bond in carbonyl group to oxygen (which is more electronegative than carbon). The carbon then acquires positive charge. In the meanwhile oxygen takes complete control of the electron pair and becomes negatively charged. Therefore, in the presence of attacking reagent, one bond is lost and this negatively charged attacking reagent links to the carbon having positive

charge. It is temporary in nature because the molecule acquires its original electronic condition upon removal of the attacking reagent.

For example, consider the carbonyl group, >C=O, present in aldehydes and ketones. When a negatively charged reagent say approaches the molecule seeking positive site, it causes instantaneous shift of electron pair of carbonyl group to oxygen (more electronegative than carbon). The carbon thus becomes deprived of its share in this transferred-pair of electrons and acquires positive charge. In the meanwhile oxygen takes complete control of the electron pair and becomes negatively charged. Therefore, in the presence of attacking reagent, one bond is lost and this negatively charged attacking reagent links to the carbon having positive charge.

CONCLUSION: This phenomenon of movement of electrons from one atom to another at the demand of attacking reagent in multibonded atoms is called electromeric effect, denoted as E effect. The electromeric shift of electrons takes place only at the moment of reaction. Like the inductive effect, the electromeric effect is also classified as +E and E.

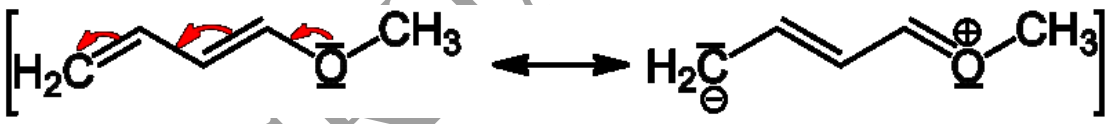
Nowadays electromeric effect is often considered along with inductive effect as electron displacement.

THE MESOMERIC EFFECT OR RESONANCE EFFECT in chemistry is a property of substituents or functional groups in a chemical compound. The effect is used in a qualitative way and describes the electron withdrawing or releasing properties of substituents based on relevant resonance structures and is symbolized by the letter M. The mesomeric effect is negative (-M) when the substituent is an electron-withdrawing group and the effect is positive (+M) when based on resonance and the substituent is an electron releasing group.

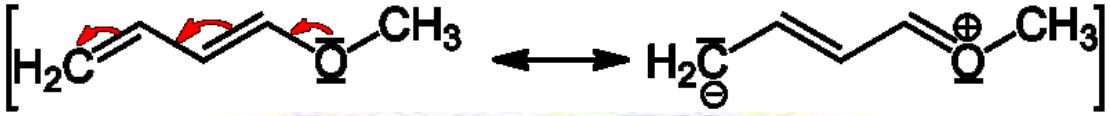
Examples of -M substituents: acetyl (IUPAC ethanoyl) - nitrile - nitro

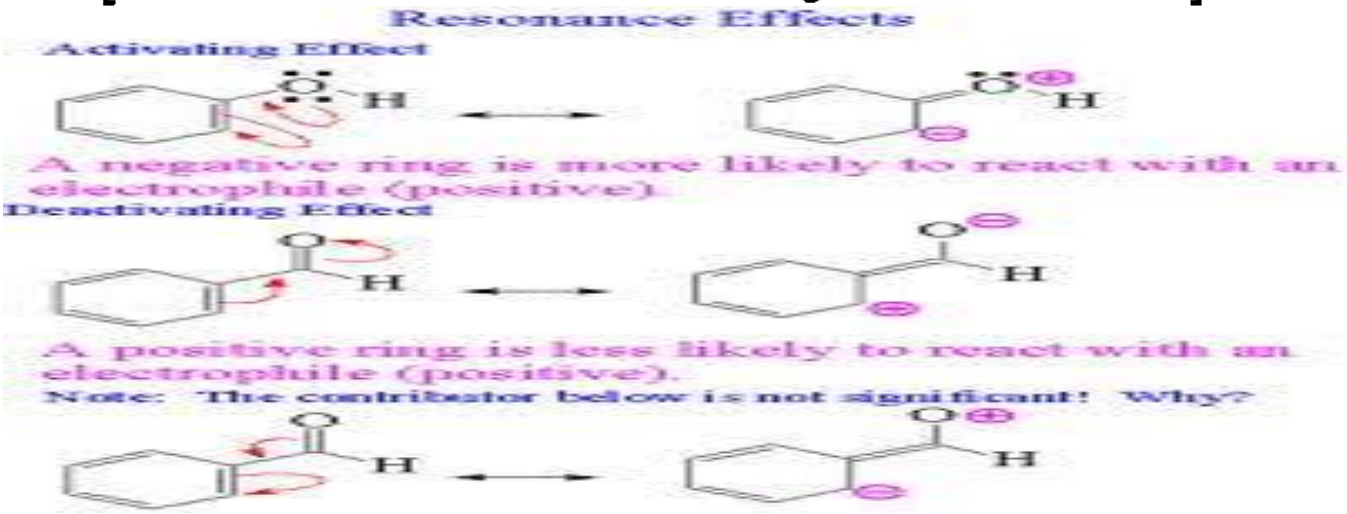
Examples of +M substituents: alcohol - amine-benzene

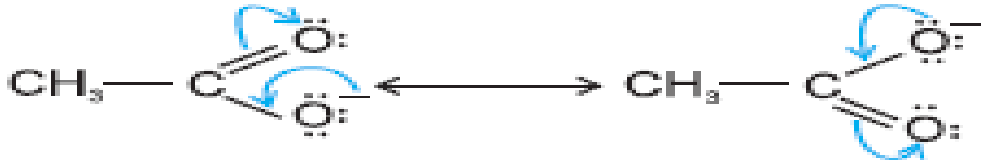
The net electron flow from or to the substituent is determined also by the inductive effect. The mesomeric effect as a result of p-orbital overlap (resonance) has absolutely no effect on this inductive effect, as the inductive effect is purely to do with the electronegativity of the atoms and their topology in the molecule (which atoms are connected to which).



The concepts of mesomeric effect, mesomerism and mesomer were introduced by Ingold in 1938 as an alternative to the Pauling's synonymous concept of resonance.[1] "Mesomerism" in this context is often encountered in German and French literature but in English literature the term "resonance" dominates.





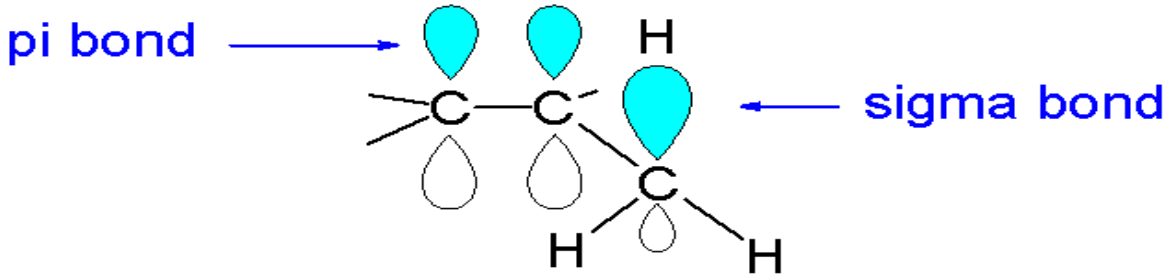


(a)

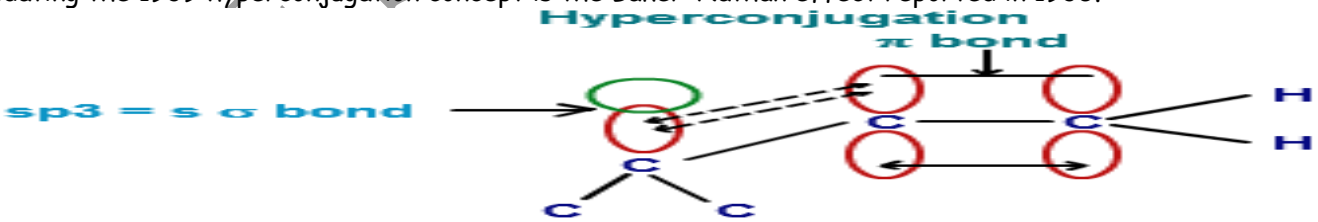
(b)

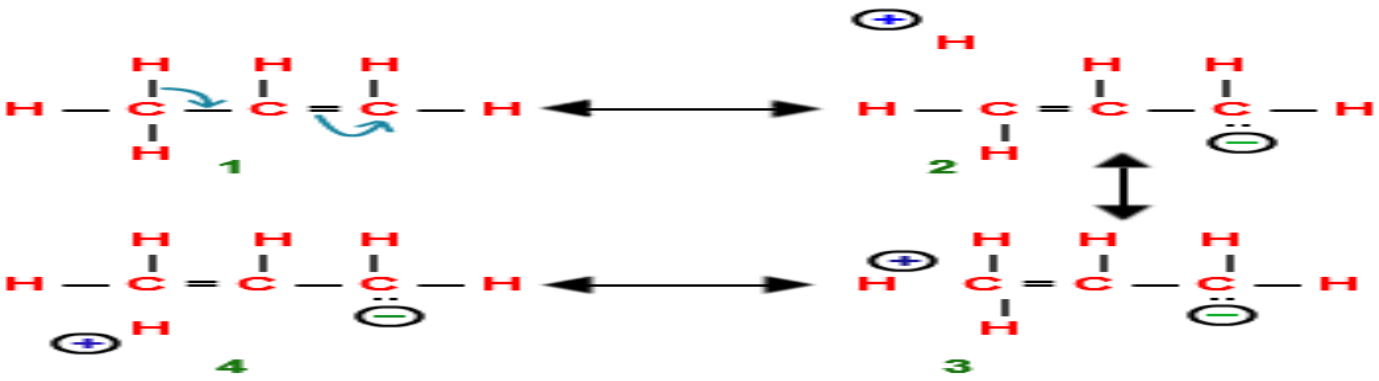
HYPERCONJUGATION:

In organic chemistry, hyperconjugation is the interaction of the electrons in a sigma bond (usually C–H or C–C) with an adjacent empty (or partially filled) non-bonding p-orbital, antibonding π orbital, or filled π orbital, to give an extended molecular orbital that increases the stability of the system. Only electrons in bonds that are β to the positively charged carbon can stabilize a carbocation by hyperconjugation.



The term was introduced in 1939 by Robert S. Mulliken in the course of his work on UV spectroscopy of conjugated molecules. Mulliken observed that on adding alkyl groups to alkenes the spectra shifted to longer wavelengths. This bathochromic shift is well known in regular conjugated compounds such as butadiene. He was also the first to attribute the lower heat of hydrogenation for these substituted compounds (compared to those without substitution) to hyperconjugation. An effect predating the 1939 hyperconjugation concept is the Baker–Nathan effect reported in 1935.





APPLICATIONS:

Hyperconjugation can be used for rationalizing a variety of other chemical phenomena, including the anomeric effect, the gauche effect, the rotational barrier of ethane, the beta-silicon effect, the vibrational frequency of exocyclic carbonyl groups, and the relative stability of substituted carbocations and substituted carbon centred radicals. Hyperconjugation is proposed by quantum mechanical modeling to be the correct explanation for the preference of the staggered conformation rather than the old textbook notion of steric hindrance.

EFFECT ON CHEMICAL PROPERTIES

Bond length: Hyperconjugation is suggested as a key factor in shortening of sigma bonds (σ bonds). For example, the single C–C bonds in 1,3-butadiene and methylacetylene are approximately 1.46 angstrom in length, much less than the value of around 1.54 Å found in saturated hydrocarbons. For butadiene, this can be explained as normal conjugation of the two alkenyl parts. But for methylacetylene, hyperconjugation between the alkyl and alkynyl parts.

Dipole moments: The large increase in dipole moment of 1,1,1-trichloroethane as compared with chloroform can be attributed to hyperconjugated structures.

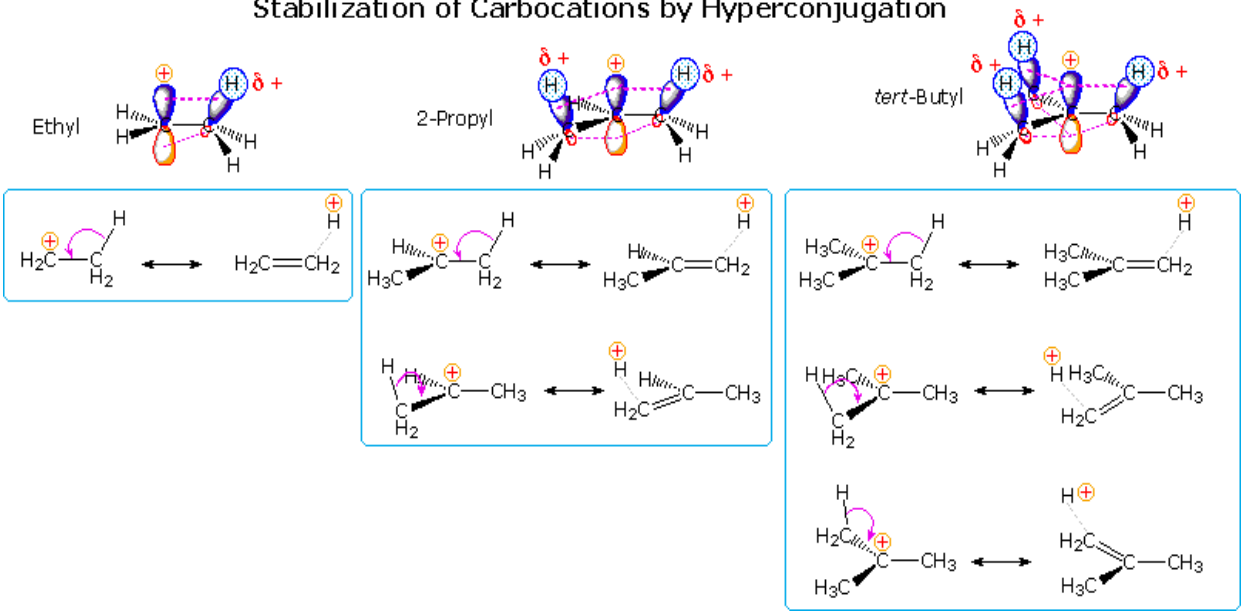
The heat of formation of molecules with hyperconjugation is greater than sum of their bond energies and the heats of hydrogenation per double bond are less than the heat of hydrogenation of ethylene.

Stability of carbocations:

$(CH_3)_3C^+ > (CH_3)_2CH^+ > (CH_3)CH_2^+ > CH_3^+$

The C–C σ bond adjacent to the cation is free to rotate, and, as it does so, the three C–H σ bonds of the methyl group in turn undergoes the stabilization interaction. The more adjacent C-H bonds are the larger hyperconjugation stabilization is.

Stabilization of Carbocations by Hyperconjugation



ISOMERISM:

Structural Isomerism

Compounds having the same molecular formula but different structures (manners of linking the atoms) are classified as structural isomers.

(i) Chain isomerism: When two or more compounds have similar molecular formula but different carbon skeletons, these are referred to as chain isomers and the phenomenon is termed as chain isomerism.

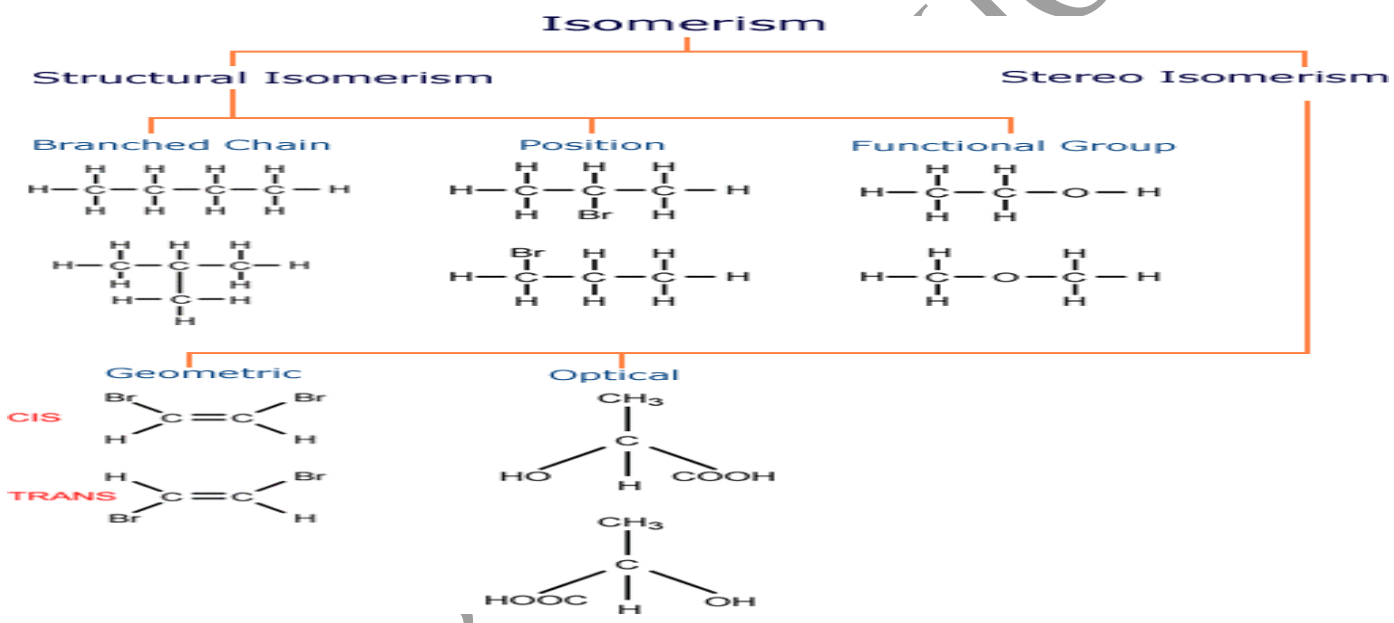
***(ii) Position isomerism*:** When two or more compounds differ in the position of substitutent atom or group on the carbon skeleton, they are called position isomers and this phenomenon is termed as position isomerism.

***(iii) Functional group isomerism*:** Two or more compounds having the same molecular formula but different functional groups are called functional isomers and this phenomenon is termed functional group isomerism.

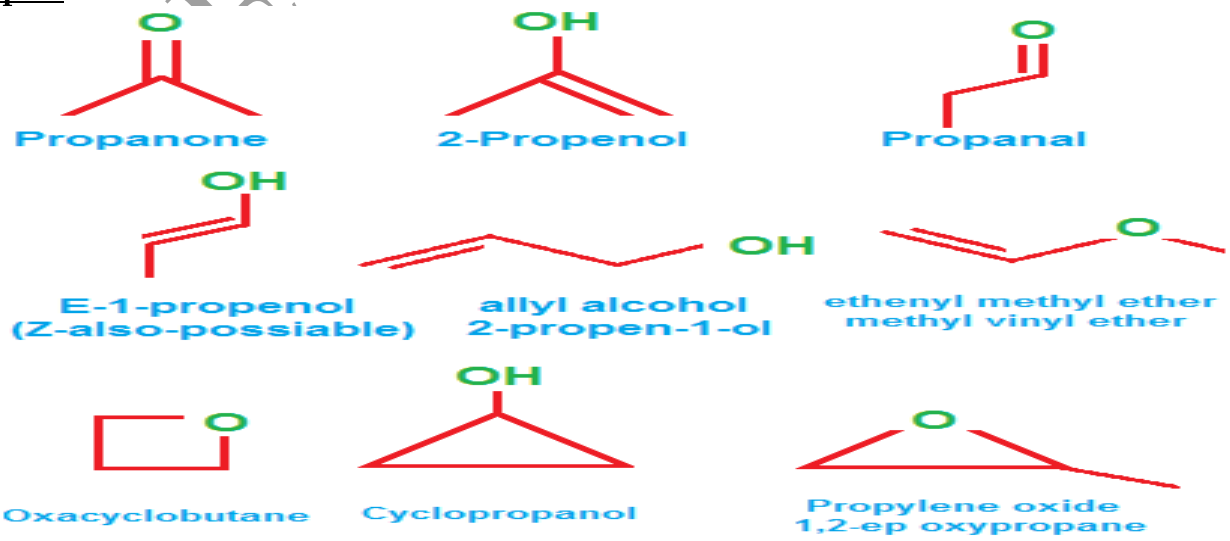
***(iv) Metamerism*:** It arises due to different alkyl chains on either side of the functional group in the molecule. For example, $C_4H_{10}O$ represents methoxypropane ($CH_3OC_3H_7$) and ethoxyethane ($C_2H_5OC_2H_5$).

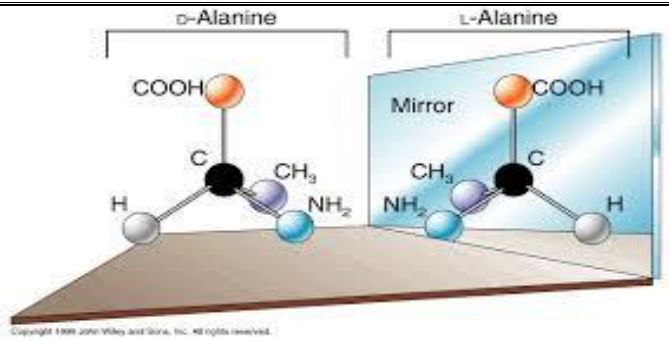
Stereoisomers

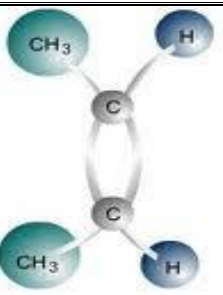
Stereoisomers are compounds that have the same constitution and sequence of covalent bonds but differ in the relative positions of their atoms or groups in space.



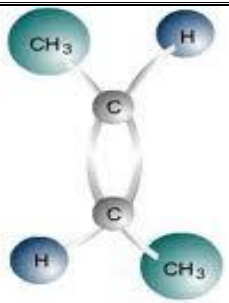
Examples:



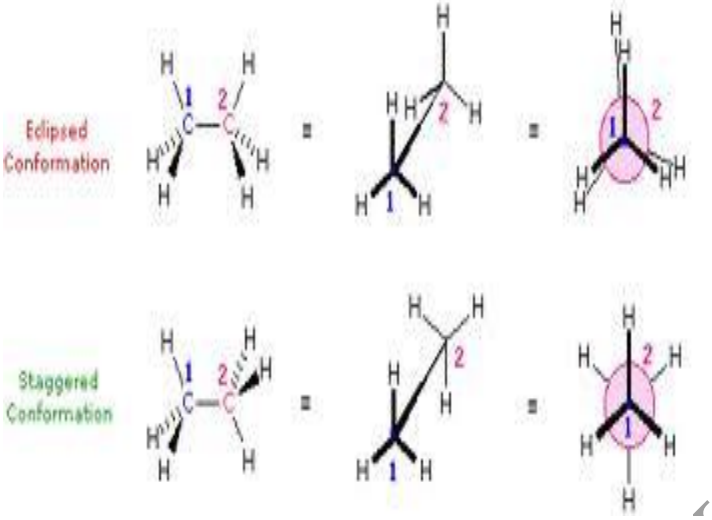


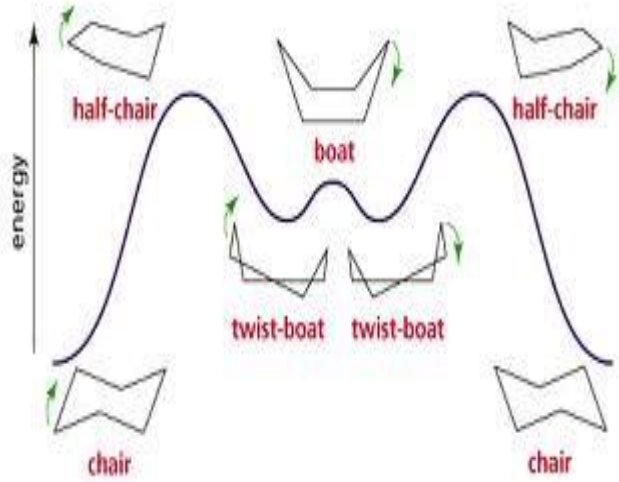


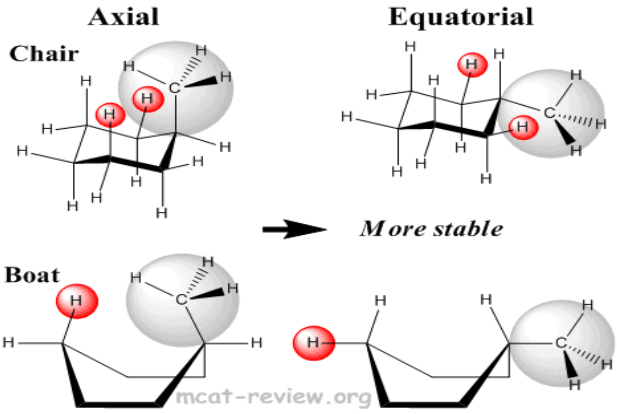
Cis-2-butene
B' pt 227k

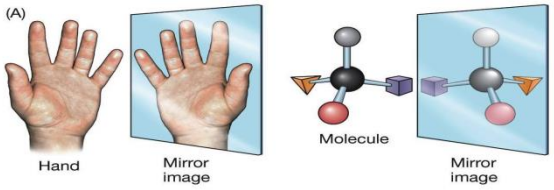


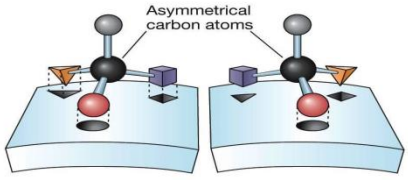
trans-2-butene
B' pt 274k



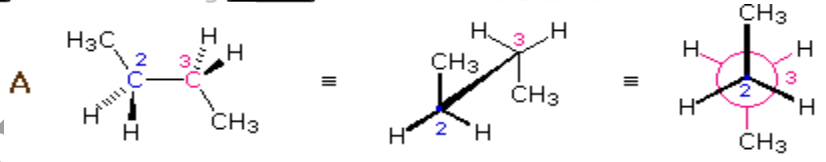


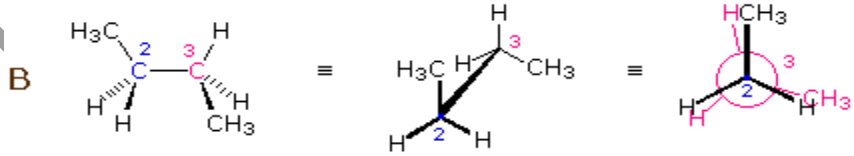


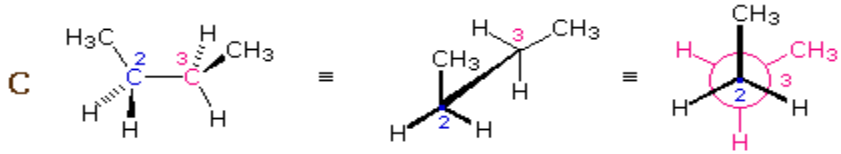


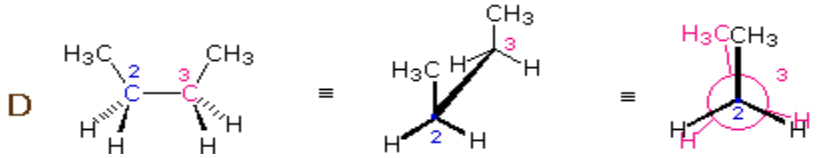


LIFE 8e, Figure 3.2









Worksheet (WS = 12.1) **Topic 12.1: - Structure, Naming & Isomerism**

Fill in the blanks:-

1. The sp hybrid orbital contains _____ s- character and hence it is closer to its nucleus and forms _____ and _____ bonds than sp^3 hybrid orbitals.
2. A carbon atom having an sp- hybrid orbital with _____ % S-character is _____ electronegative than that possessing sp^2 or sp^3 hybridized orbital.
3. In $CH_2 = CH_2$ molecule, all the atoms are in the _____ _____.
4. The electron charge cloud of the ∏-bond is located _____ & _____ the plane of bonding atoms.
5. The number of σ - & ∏ - bonds $HC\equiv CCH = CHCH_3$, are _____ & _____ respectively.
6. _____ compounds contain carbon atoms joined in the form of a ring (Homocyclic).
7. The active, reactive part of an organic compound responsible for its chemical properties is called _____ _____ .
8. A group or a series of organic compounds each containing a characteristic functional group forms a _____ series.
9. The full form of IUPAC is _____ _____ _____ _____ _____.
10. The name of $(CH_3)_2 CH (CH_2)_2 CH (CH_3) C_2H_5$ is not 3, 4, 7- Trimethyloctane because _____ rule is not followed.
11. The IUPAC name of the compound $CH_3 CH_2$-----C(=O)-----CH_2-----C(=O)-----CH_3 is –
12. Secondary suffix for –COOH group is _____ .
13. The general formula of an alcohol may be given as _____ .
14. Meta (m) is used to indicate _____ position of an aromatic compound.
15. For IUPAC naming – CN is given _____ priority than –OH group.
16. Total number of Structural isomers possible with molecular formula C_3H_8O are _____.
17. _____ arises due to different alkyl chains on either side of the functional group in the molecule.
18. The compounds that have the same constitution and sequence of covalent bonds but differ in relative and positions of their atoms or groups in space are called _____ .
19. Two or more compounds having the same molecular formula but different functional groups are called _____ _____ .
20. IUPAC name of functional isomer of acetic acid is _____ _____ .

CLASS ASSIGNMENT (CA – 12.1)

Solved Examples 12.1 to 12.10 of NCERT.

HOME ASSIGNMENT (HA – 12.1)

NCERT Exercise Questions No. – 12.4, 12.5, 12.6, 12.7 & 12.8.

Class XI Chemistry *Unit -12.* **Organic Chemistry-Some Basic Principles & Techniques**

Worksheet (WS = 12.2)

Topic 12.2: - Fundamentals Concepts, Purification, Qualitative & Quantitative Analysis

Fill in the blanks:-

1. A sequential account of each step, describing details of election movement, energetic during bond cleavage and bond formation, and the rates of transformation of reactants into products is referred to as _____ _____ .
2. A covalent bond can be cleaved either by _____ or _____ cleavage.
3. The observed order of carbocation stability is: CH_3^+ _____ $CH_3CH_2^+$ _____ $(CH_3)_2CH^+$ _____ $(CH_3)_3C^+$.
4. Hybridization in carbocation and carboanion are _____ & _____ respectively.
5. A reagent that brings an electron pair is called a _____ i.e. nucleus seeking.
6. OH^- , CN^- and CH_3^- are the examples of _____ (Nucleophiles / Electrophiles).
7. Polarisation of a σ - bond caused by the polarization of an adjacent σ - bond is because of _____ effect.
8. $-NO_2^-$, $-CN^-$, -COOH, -COOR, etc. are election _____ groups, and therefore will show _____ I effect.
9. The difference in energy between the actual structure and the lowest energy resonance structure is called the _____ _____ energy or simply the _____ energy.
10. –Cl, -OH, -OR, -OCOR, $-NH_2$, -NHR etc. groups show _____ (+R/-R) effect.
11. _____ _____ is a temporary effect, occurs in presence of attaching reagent only.
12. _____ is also known as no bond Resonance.
13. _____ is based on the difference in the solubilities of the compound and the impurities in a solvent.(A Separation Technique).
14. If the difference in the boiling points of two liquids is not much, the distillation technique is known as, _____ distillation.
15. _____ _____ Technique is applied to separate substances, which are steam volatile and are immiscible with water.
16. Based on the principle involved, chromatography is classified as _____ & _____ chromatography.
17. Nitrogen, Sulphur, halogens and Phosphorus present in an organic compound are detected by _____ test.
18. The sodium fusion extract is acidifies with nitric acid, and then treated with $AgNO_3$, to detect the presence of _____ .
19. Duma's & Kjeldahl's methods are used for analysis of _____ .
20. Sulphur and Phosphorus are estimated by oxidizing them to _____ & _____ acids respectively.

CLASS ASSIGNMENT (CA – 12.2)

Solved Examples: - 12.11 to 12.24 of NCERT.

HOME ASSIGNMENT (HA – 12.2)

NCERT Exercise Questions No: – 12.9, 12.17, 12.18, 12.21, 12.22, 12.25, 12.26, 12.28, 12.33 & 12.35