Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT : CHEMISTRY

CLASS X

Week : 1 February to 6 February 2021

CHAPTER 1 : CHEMICAL REACTIONS AND EQUATIONS

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link is given below :

https://youtu.be/wjSUm8kmf0o

https://youtu.be/bP46IMf6XUo

https://youtu.be/bP46IMf6XUo

Learning outcomes

Each student will be able to :

- Students will able to learn about chemical reaction
- They get knowledge of different types of chemical reaction

Sub topics :

- Chemical reaction
- Physical and chemical change
- Observation during chemical reactions
- Types of chemical reaction

LESSON DEVLOPMENT

Chemical Reactions and Equations

Any process that involves the rearrangement of structure of the substance or conversion of reactants into products is defined as **Chemical Reaction**.

For a Chemical Reaction to occur, the change can be observed in the form of -

- **Change in State**: Melting of ice into water.
- **Change in Colour**: Iron rusting which has colour change from silver to reddish brown.

$$\underset{\text{Iron}}{4Fe} + \underset{\text{oxygen}}{2O_2} \xrightarrow{xH_2O\ (\text{moisture})} \underset{\text{Hydrated iron [III]oxide (Rust)}}{2Fe_2O_3.xH_2O}$$

- **Change in Temperature**: There are two types of reaction i.e Exothermic and Endothermic Reaction.

Exothermic Reactions: Those reactions in which energy is released in the form of heat are called **Exothermic Reactions**.

Examples -

(1) All combustion reactions e.g.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + \text{Heat}$$

(2) Thermite reactions e.g.

$$2A_1 + Fe_2O_3 \longrightarrow 2Fe + Al_2O_3 + \text{Heat}$$

Combinations are generally exothermic in nature. The decomposition of organic matters into compost is an example of exothermic reaction.

Endothermic Reactions: Those reactions in which energy is absorbed are called **Endothermic Reactions**.

Examples -

$$CaCO_3 \xrightarrow{\text{Heat}} CaO + CO_2$$

also, the reaction of photosynthesis -

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

- **Evolution of any gas: When Zinc reacts with sulphuric acid it gives hydrogen gas.**

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$

Formation of Precipitate: When a soluble carbonate reacts with Barium, Barium Carbonate precipitate can be observed.

Change in State

Some chemical reactions are characterized by a change in state.

- When wax is burned (in the form of wax candle,) then water and carbon dioxide are formed.
- Now, wax is a liquid whereas carbon dioxide is a gas. This means that during the combustion reaction of wax, the physical state changes from solid to liquid and gas.

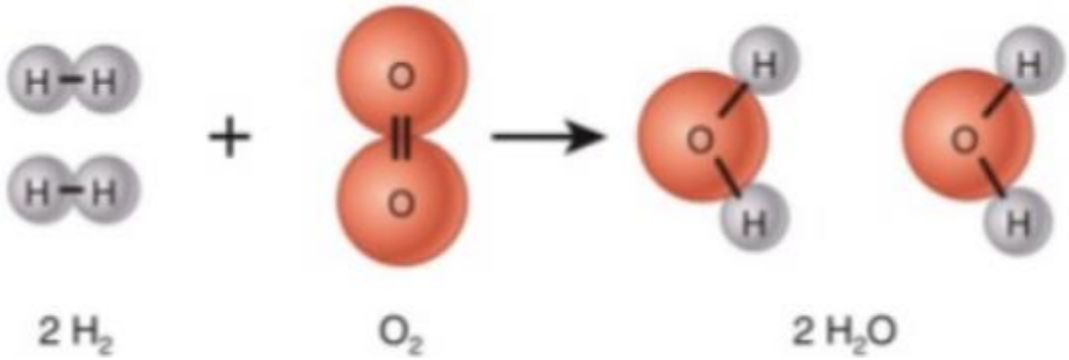
Physical Change

- In this change identity of the substance remains same.

- For Example, Melting, Boiling etc.

Chemical Change

- The identity of the substances change
- Reactants are converted into substance due to formation or broken down of older bonds



Chemical Equation

The symbolic representation of chemical reaction using symbols and formulae is known as **Chemical Equation**. For this, reactants are written in left hand side whereas products are written on the right.

Balanced Chemical Equation

A balanced chemical equation is the one where the number of atoms involved in reactants side is equal to number of atoms on product side.

$$3Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)$$

Eq.1. Example of Balanced Chemical Equation

Steps to form Balanced Equation

To show how to balance the equation, the following equation is used-

$$\mathbf{Fe + H_2O \rightarrow Fe_3O_4 + H_2}$$

Step 1: First of all, draw the boxes around each formula as shown below-

$$\boxed{Fe} + \boxed{H_2O} \rightarrow \boxed{Fe_3O_4} + \boxed{H_2}$$

Step 2: Find out the number of atoms of each element. **For Example**, on reactant side, 1 for Fe, 2 H, and 1 O and on product side we have, 3 for Fe, 4 for O and 2 for H.

Step 3: Start to balance the equation with the compound having maximum number of atoms. While balancing does not alter the formula of the compound.

Step 4: One by one balance each element on reactant and product side.

$$\boxed{Fe} + 4\boxed{H_2O} \rightarrow \boxed{Fe_3O_4} + 4\boxed{H_2}$$

Step 5: After balancing number of atoms on both the side of the equation, finally check the correctness of the balanced equation.

$$3\boxed{Fe} + 4\boxed{H_2O} \rightarrow \boxed{Fe_3O_4} + 4\boxed{H_2}$$

Step 6: then write the symbols of the physical state of reactants and products as shown below-

$$\mathbf{3Fe(s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)}$$

This above equation represents the balanced equation.

Balancing a Redox Reaction

The basic ionic form of the equation is-

$$Fe^{2+} + Cr_2O_7^{2-} \rightarrow Fe^{3+} + Cr^{3+}$$

Oxidation half reaction is-

$$\overset{+2}{Fe^{2+}}(aq) \longrightarrow \overset{+3}{Fe^{3+}}(aq)$$

Oxidation Half

Reduction half reaction is-

$$\overset{+6\ -2}{Cr_2O_7^{2-}}(aq) \longrightarrow \overset{+3}{Cr^{3+}}(aq)$$

Reduction Half

Use the reduction half method to balance the equation. Balance the atoms in each half of the reaction except H and O atoms.

$$Cr_2O_7^{2-}(aq) \rightarrow 2\ Cr^{3+}(aq)$$

Add water molecules as the reaction is taking place in acidic solution. This is to balance the O atoms and hydrogen ions.

$$Cr_2O_7^{2-}(aq) + 14\ H^+(aq) \rightarrow 2\ Cr^{3+}(aq) + 7H_2O\ (l)$$

Then balance the charges in both half reactions.

$$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$$
$$Cr_2O_7^{2-}(aq) + 14\ H^+ + 6e^- \rightarrow 2\ Cr^{3+} + 7H_2O$$
$$6\ Fe^{2+}(aq) \rightarrow 6\ Fe^{3+}(aq) + 6e^-$$

Two half of the equations are added to get the overall reaction

$$6Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) + 14H^+(aq) \rightarrow 6Fe^{3+}(aq) + 2Cr^{3+}(aq) + 7H_2O\ (l)$$

Types of Chemical Reaction

- **Combination Reaction** is reaction when single product is formed from the combination of two or more reactants. **For Example**-

$$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (aq)$$

Eq.2. Example of Combination Reaction

Reactions can be exothermic as well as endothermic. Exothermic reaction release heats and raises the temperature of the surroundings. **For Example**, Respiration is an example of exothermic reaction.

$$C_6H_{12}O_6\ (aq) + 6O_2\ (aq) \rightarrow 6CO_2 + 6H_2O\ (l) + energy$$

Eq.3. Example of Exothermic Reaction

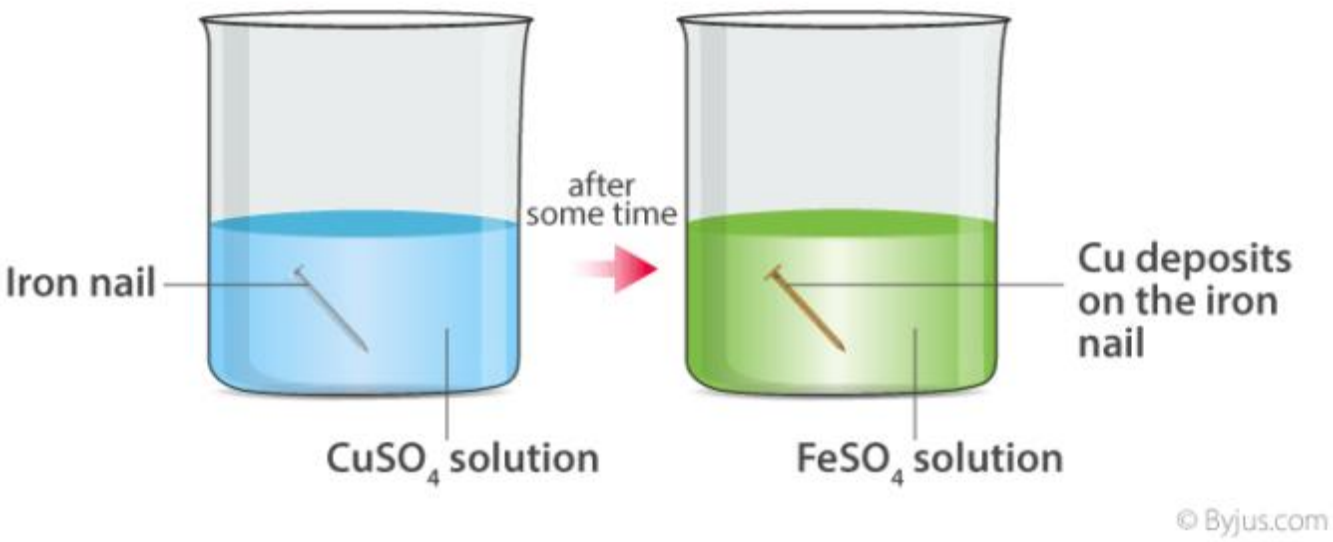
Endothermic reaction involved the absorption of the heat and thus it cools the surrounding. The decomposition of dead organic material is an endothermic reaction.

- **Decomposition Reaction** is type of reaction which involves breakdown of single reactant into simpler products. Decomposition of silver chloride into silver and chlorine in presence of sunlight is an example of decomposition reaction.

$$2AgCl \xrightarrow{\text{Sunlight}} 2Ag + Cl_2$$

Eq.4. Example of Decomposition Reaction

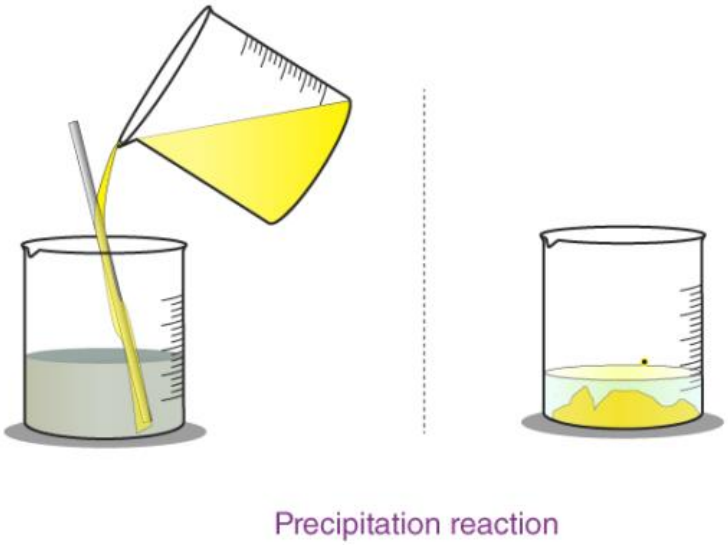
- **Displacement Reaction** is a reaction in which more reactive element will displaces the less reactive element.



$$Fe\ (s) + CuSO_4\ (aq) \rightarrow FeSO_4\ (g) + Cu\ (s)$$

Eq. 5. Example of Displacement Reaction

- **Double Displacement Reaction** is a type of reaction in which cations and anions in the reactants switch the places to form new products.



- $$Na_2(SO)_4\ (aq) + BaCl_2\ (aq) \rightarrow BaSO_4\ (s) + NaCl\ (aq)$$

Eq. 6. Example of Double Displacement Reaction

- **Redox Reaction** is also known as **Oxidation-reduction Reaction**. In this type of reaction transfer of electrons occurs between the two species. Oxidation is defined as addition of oxygen or removal of hydrogen. Reduction is defined as removal of oxygen or addition of hydrogen. Oxidizing agent is the one which gains the electrons and is reduced in a chemical reaction. Reducing agent is oxidized in a chemical

reaction and it loses the electrons. Fluorine is the strongest oxidizing agent. Formic acid is a reducing agent

$$CuO + H_2 \xrightarrow{\Delta} Cu + H_2O$$

Eq.7. Example of Redox Reaction

ASSIGNMENT

1. Consider the following chemical reaction (CBSE 2015)
   X + Barium chloride———–> Y + Sodium chloride
   (White ppt)
   (a) Identify 'X' and 'Y'
   (b) The type of reaction
2. Name the reducing agent in the following reaction:
   $3MnO_2 + 4Al$———— > $3Mn + 2Al_2O_3$
   State which is more reactive, Mn or A1 and why? (CBSE 2015)
3. Name the type of chemical reaction represented by the following equation: (CBSE 2015)
   (i) $CaO + H_2O \longrightarrow Ca(OH)_2$
   (ii) $3BaCl_2 + Al_2(SO_4)_3 \longrightarrow 3BaSO_4 + 2AlCl_3$
   (iii) $2FeSO_4 \xrightarrow{heat} Fe_2O_3 + SO_2 + SO_3$
4. Write the chemical equation of the reaction in which the following changes have taken place with an example of each:
   (i) Change in colour
   (ii) Change in temperature
   (iii) Formation of precipitate (CBSE 2015)
5. State the type of chemical reactions and chemical equations that take place in the following:
   (i) Magnesium wire is burnt in air.
   (ii) Electric current is passed through water.
   (iii) Ammonia and hydrogen chloride gases'are mixed. (CBSE 2015)
6. (a) Write the essential condition for the following reaction to take place:
   2AgBr—-> $2Ag + Br_2$
   Write one application of this reaction.
   (b) Complete the following chemical equation of a chemical reaction 2FeS04 —
   $2FeSO_4 \xrightarrow{heat} Fe_2O_3 + ... + ...$
   (c) What happens when water is added to quick line. Write chemical equation. (CBSE 2015)
7. 2g of ferrous sulphate crystals are heated in a dry boiling tube.
   (i) List any two observations.
   (ii) Name the type of chemical reaction taking place.
   (iii) 'Write the chemical equation for the reaction. (CBSE 2015)
8. Write chemical equation reactions taking place when carried out with the help of
   (a) Iron reacts with steam
   (b) Magnesium reacts with dil HCl
   (c) Copper is heated in air. (CBSE 2015)
9. Write balanced equation for the reaction between magnesium and hydrochloric acid. Name the product obtained, identify the type of reaction. (CBSE 2019)
10. The following diagram displays a chemical reaction. Observe carefully and answer the following questions

   (a) Identify the type of chemical reaction that will take place and define it. How will the colour of the salt change?

Write the chemical equation of the reaction that takes place.
(c) Mention one commercial use of this salt. (CBSE 2018)

11. A white salt on heating decomposes to give brown fumes and a residue is left behind.
    (i) Name the salt.
    (ii) Write the equation for the decom-position reaction.(CBSE 2016)
12. When a solution of potassium iodide is added to a solution of lead nitrate in a test tube, a reaction takes place.
    (a) What type of reaction is this?
    (b) Write a balanced chemical equation to represent the above reaction.(CBSE 2017)
13. .You might have noted that when copper powder is heated in a china dish, the surface of copper powder becomes coated with a black colour substance.
    (i) How has this black coloured substance formed?
    (ii) What is that black substance?
    (iii) Write the chemical equation of the reaction that takes place(CBSE 2020,2018)
14. When you have mixed the solutions of lead(II) nitrate and potassium iodide,
    (i) what was the colour of the precipitate formed and can you name the precipitate?
    (ii) write the balanced chemical equation for this reaction.
    (iii) is this also a double displacement reaction? (CBSE 2010, 2012)
15. What happens when an aqueous solution of sodium sulphate reacts with an aqueous solution of barium chloride? State the physical conditions of reactants in which the reaction between them will not take place. Write the balanced chemical equation for the reaction and name the type of reaction (CBSE 2010)

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SUBJECT : CHEMISTRY

CLASS X

Week : 1 February to 8 February 2021

CHAPTER 2 : ACID BASES AND SALTS

Guidelines

- Refer to the content given below and view the links
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Instructional Aids / Resources

NCERT Link is given below :

https://youtu.be/dRITmCbJ1sM

https://youtu.be/dRITmCbJ1sM

https://youtu.be/LOJxH0rxZuc

Learning outcomes

Each student will be able to :

- Students will able to learn about acids bases and salts
- They get knowledge of acids , bases and salts and reactions
- Indicators
- Some common salts

Sub topics :

- Acids
- Bases
- Indicators
- Natural and synthetic indicators
- Some common salts

LESSON DEVELOPMENT

Acids, Bases and Salts

The taste of the food is due to presence of acids and bases in them.

Acids

- Acids is defined as the one which produces hydrogen ions in water. **For Example**, Sulphuric Acid, Hydrochloric Acid etc.
- They give sour taste.
- Acids turn blue litmus to red. This is used as confirmation test for the presence of acid.
- When acids react with metals, gases are evolved.

Reactions with Acids

1. Reaction of Acid with Metal

$$\text{Acid + Metal} \rightarrow \text{Salt + Hydrogen gas}$$

$$Mg + H_2SO_4 \rightarrow H_2 + MgSO_4$$

2. Reaction of Acid with Carbonates

$$Na_2CO_3\,(s) + 2\,HCl\,(aq) \rightarrow 2NaCl\,(aq) + H_2O(l) + CO_2(g)$$

3. Reaction of Acid with Bicarbonates

$$NaHCO_3\,(s) + HCl\,(aq) \rightarrow NaCl(aq) + H_2O\,(l) + CO_2\,(g)$$

Similarity between Acids and Bases

- Both acids and base react with water. They produce ions in water
- Both acids and bases acts as electrolytes, so are good conductors of electricity.
- Both of them changes the colour of the litmus paper.

Classification of Acids

Acids are classified as **Organic Acids and Mineral Acids**. Acids which are derived from plants and animals, they are known as **Organic Acids**. **For Example**, Citric Acid from fruit. Mineral acids are inorganic acids such as **Sulphuric Acid**. They are dangerous to be used, so need more precautions.

Acids are also classified as **Strong Acids or Weak Acids**. Strong acid is an acid, that completely dissociates into ions in aqueous solutions. **For Example**, Sulphuric Acid, Hydrochloric Acid.

$$\underset{\text{acid}}{\text{HCl}} + H_2O = H_3O^+ + Cl^-$$

Weak acid is the one which does not dissociate completely into ions in aqueous solutions. **For Example**, **Acetic Acid**.

$$CH_3COOH + H_2O \rightleftarrows CH_3COO^- + H^+$$

Acids can also be as **Dilute Acid and Concentrated Acids**. The one which has low concentration of acids in aqueous solution, they are known as **Dilute Acids** whereas the one which has high concentration of acids in aqueous solution, are known as **Concentrated Acids**.

It is advisable to add acid to water and not vice versa because large amount of heat is released if water is added to acid. This released heat is large enough to cause harm.

Acids can also be classified based on **number of hydrogen ions**. **Monoprotic acid** is the one which gives one mole of hydrogen ions per mole of acid, such as HCl. **Diprotic Acid** is the one which produces two mole of hydrogen ions per mole of acid. **For Example**, H_2SO_4.

Bases

- Bases are the one which produces hydroxide ions in aqueous solutions. Bases which are water soluble they are known as **Alkalis**.

- They turn red litmus to blue.
- They have a bitter taste.
- They also produced carbon-dioxide when reacted with carbonates.
- They also evolved hydrogen gas when bases react with metals.

Reactions of Bases

1. Reaction with Metals

Base reacts with metals and produce hydrogen gas.

$$2NaOH + Zn \rightarrow Na_2 \rightarrow Na_2ZnO_2 + H_2$$

2. Reaction with Acids

Base reacts with acids to form salts. **For Example**,

$$KOH + HCl \rightarrow KCl + H_2O$$

3. Reaction with Non-metallic Oxides

Base reacts with non-metallic oxides to form salt and water.

$$2NaOH + CO_2 \rightarrow CO_2 \rightarrow Na_2CO_3 + H_2O$$

Classification of Bases

Bases are classified as **Strong Base** and **Weak Base**. Strong base is the one which dissociates completely into its ions in aqueous solution. **For Example**, **NaOH**.

Weak base is the one which does not dissociate completely into its ions in aqueous solutions. **For Example**, **Ammonium Hydroxide**, **NH_4OH**

Bases are also classified as **Dilute Base** and **Concentrated Base**. The solution which has low concentration of base in aqueous solution is defined as **Dilute Base** whereas the one which has high concentration of base in aqueous solution is known as **Concentrated Base**.

Strength of Acid or Base Solutions

The dissociation constant of weak acid or weak base can be represented as-

$$CH_3COOH + H_2O \rightleftharpoons CH_2COO^- + H_3O^+$$

$$NH_3 + H_2O \rightleftharpoons NH_4 + (aq) + OH^-(aq)$$

Strength of an acid or base can be determined using a pH scale. It is a scale to measure the hydrogen ion concentration in a solution. The p stands for 'potenz', it is a German word which means power.

- If pH is equal to 7, means the solution is neutral.
- If pH is greater then 7 means alkaline solution.
- If pH is less then 7 means the solution is acidic.

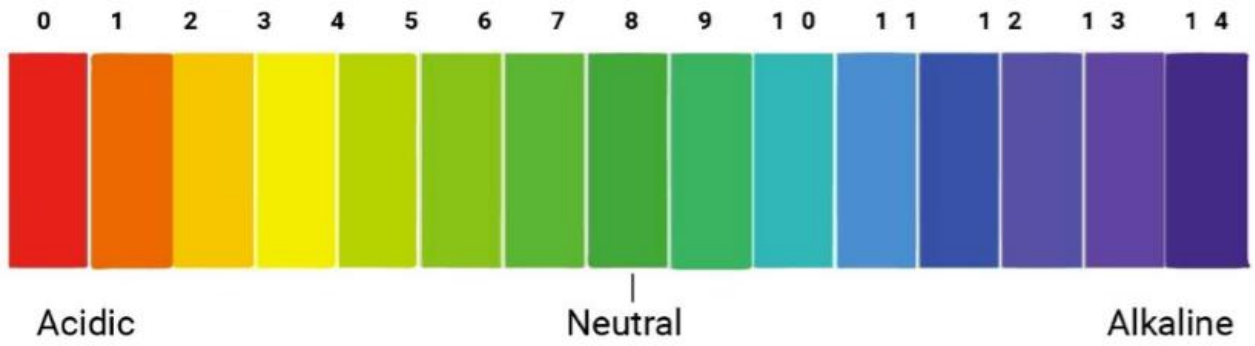

Fig.1. pH scale

Importance of pH

- Human body works at a pH of about 7.4.
- Stomach has a pH of about 2 due to presence of hydrochloric acid in it. It is needed for the activation of pepsin protein required for protein digestion.
- When we eat food containing sugar, then the bacteria present in our mouth break down the sugar to form acids. This acid lowers the pH in the mouth. Tooth decay starts when the pH of acid formed in the mouth falls below 5.5. This is because then the acid becomes strong enough to attack the enamel of our teeth and corrode it. This sets in tooth decay. The best way to prevent tooth decay is to clean the mouth thoroughly after eating food.
- Many animals and plants protect themselves from enemies by injecting painful and irritating acids and bases into their skin.
  - When honey bee stings a person, it injects an acidic liquid into the skin. Rubbing with mild base like baking soda solution on the stung area of the skin gives relief.
  - When a wasp stings, it injects an alkaline liquid into the skin. Then rubbing with a mild acid like vinegar on the stung area of the skin gives relief.
- Soil pH and plant growth: Most of the plants grow best when the pH of the soil is close to 7. If the soil is too acidic or basic, the plants grow badly or do not grow at all. The soil pH is also affected by the use of chemical fertilisers in the field. Chemicals can be added to soil to adjust its pH and make it suitable for growing plants. If the soil is too acidic then it is treated with materials like quicklime or slaked lime. If the soil is too alkaline then alkalinity can be reduced by adding decaying organic matter.

Salts

When acid and base neutralize, salts are formed. Strong acid and strong base combines to form neutral salt.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Eq.1. Formation of Neutral Salt

Strong acid and weak base combine to form acidic salt. **For Example**, Hydrochloric Acid and ammonium hydroxide combine to form ammonium chloride. Other examples, sodium hydrogen carbonate, sodium hydrogen sulphate etc.

$$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$$

Eq.2. Formation of Acidic Salt

Similarly, weak acid and strong base combine to form basic salt. **For Example**, Acetic Acid and sodium hydroxide combine to form sodium acetate. Other examples are calcium carbonate, potassium cyanide etc.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

Eq.3. Formation of Basic Salt

The most common salt is table salt or sodium chloride (NaCl).

Indicators

They are the substances that which indicate acidic or basic nature of the solution using colour change. **For Example**, litmus solution, methyl orange, phenolphthalein, methyl red etc. Acids convert blue litmus paper red in colour. Bases turn red litmus blue. Phenolphthalein remains colourless in presence of acids but turn pink in presence of bases.

Some Important Chemical Compounds and their uses

	Preparation	Uses
Common Salt (NaCl) (Sodium Chloride)	1. $NaOH + HCl \rightarrow NaCl + H_2O$ 2. From sea water by evaporation 3. From underground deposit {Large crystals of common salt found in underground deposit which is brown due to presence of impurities in it. It is mined from underground deposit like coal.}	1. Raw material for making large number of useful chemicals in industry. Eg: NaOH (caustic soda), Na_2CO_3 (washing soda), $NaHCO_3$ (baking soda). 2. Preservative in pickle and curing meat and fish. 3. To melt ice and clear roads in winters in cold countries. 4. Used in manufacturing of soap.
Caustic Soda (NaOH) (Sodium Hydroxide)	Passing electricity through concentrated solution of NaCl (called '**brine**') $2NaCl\ (Brine) + 2H_2O \xrightarrow[\text{(electrolysis)}]{\text{electricity}}$ 2NaCl (Brine) + $2H_2O$2NaOH (Caustic Soda) + $Cl_2 + H_2$ <u>At anode</u> (+ve electrode): Cl_2 is produced <u>At cathode</u> (-ve electrode): H_2 is produced It is called chloro-alkali process because products formed are chlorine (Chloro) and NaOH (alkali).	**<u>Uses of H_2</u>** 1. Hydrogenation of oil to get vegetable ghee (margarine) 2. To make ammonia for fertilizers 3. In fuel for rockets. **<u>Uses of Cl_2</u>** 1. In water treatment 2. To clean water in swimming pools 3. To make plastic, e.g. PVC 4. To make CFCs, chloroform, dyes etc. **<u>Uses of NaOH</u>** 1. Used in making soap and detergent. 2. Used in manufacturing of paper 3. De-greasing metals 4. Refining oil 5. Making dyes and bleaches **<u>Uses of HCl</u>** 1. Cleaning steel 2. Preparation of chloride, e.g. NH_4Cl 3. In making medicines and cosmetics 4. In making plastics, PVC etc.
Baking Soda ($NaHCO_3$) (Sodium Hydrogencarbonate)	$NaCl + NH_3 + H_2O + CO_2 \rightarrow NaHCO_3 + NH_4Cl$ **<u>Properties</u>** <u>Action of Heat:</u>	1. <u>Used as antacid</u> in medicine to remove acidity of the stomach

	$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$	2. <u>Used in making baking powder</u> (Basic soda + tartaric acid) $NaHCO_3 + H^{\oplus}$ (from mild acid) → $Na^{\oplus}$ (sodium salt of acid) + CO_2 + H_2O The CO_2 produced during the process gets trapped in wet dough and bubbles out slowly to make cake 'rise' so that it becomes soft and spongy. Tartaric acid neutralizes it, and so it has pleasant taste. 3. Used in soda-acid fire extinguisher
Washing Soda ($Na_2CO_3.10H_2O$) (Sodium Carbonate)	**Na_2CO_3** + 10 H_2O → $Na_2CO_3.10H_2O$ Preparation of **Na_2CO_3** {$NaCl + NH_3 + H_2O + CO_2$ $NaHCO_3 + NH_4Cl$ $NaHCO_3$ → **Na_2CO_3** + CO_2 + H_2O}	1. Used in glass, soap and paper industries 2. Used in manufacturing of sodium compounds such as Borax 3. Cleaning agent for domestic purpose 4. Remove permanent hardness of water
Bleaching Powder ($CaOCl_2$) Calcium Oxychloride	$Ca(OH)_2 + Cl_2$ → $CaOCl_2 + H_2O$ Slaked Lime Calcium Oxychloride <u>Properties</u> $CaOCl_2 + H_2SO_4$ → $CaSO_4 + Cl_2 + H_2O$ The Cl_2 produced by action of dilute acid acts as bleaching agent.	1. For bleaching cotton and linen in textile industry, for bleaching wood pulp in paper factories, for bleaching washed clothes in laundry 2. Oxidizing agent in chemical industries 3. Disinfecting drinking water
Plaster of Paris (P.O.P) ($CaSO_4.1/2\ H_2O$) (Calcium Sulphate Hemihydrate)	$CaSO_4.2H_2O(Gypsum) \xrightarrow{Heat\ to\ 100°C}$ $CaSO_4.H_2O$ (Plaster of Paris) +3/2 H_2O * Heating of gypsum should not be done above 100°C as above that temperature, water of crystallization will eliminate and anhydrous $CaSO_4$ will be obtained. This anhydrous $CaSO_4$ is known as **Dead Burnt Plaster**. * $CaSO_4.1/2\ H_2O$ means that two molecules of $CaSO_4$ share one molecule of water. <u>Properties</u> Has remarkable property of setting into a hard mass on wetting with water, as gypsum is formed. $CaSO_4.1/2\ H_2O$ (P.O.P) + 1/2 H_2O → $CaSO_4.2H_2O$ (Gypsum set as hard mass)	1. Used in hospital for setting fractured bones in the right position to ensure correct healing. 2. Making toys, decorative materials, cheap ornaments, and casts of statues. 3. Used as fire-proofing material 4. Used in chemistry labs for setting air gaps in apparatus. 5. Making smooth surfaces, such as For making ornamental designs on

	Hence, P.O.P should be stored in moisture-proof container as moisture can cause slow setting of P.O.P by hydrating it.	ceilings of houses and other buildings

ASSIGNMENT

1. Name the acid present in the following:
   (i) Tomato (ii) Vinegar (iii) Tamarind
2. A white coloured powder is used by doctors for supporting fractured bones.
   (a) Write chemical name and formula of the powder.
   (b) When this white powder is mixed with water a hard solid mass is obtained. Write balanced chemical equation for the change.
3. Explain the action of dilute hydrochloric acid on the following with chemical equation:
   (i) Magnesium ribbon (ii) Sodium hydroxide (iii) Crushed egg shells
4. (a) State the chemical properties on which the following uses of baking soda are based:
   (i) as an antacid
   (ii) as a soda acid fire extiguisher
   (iii) to make bread and cake soft and spongy.
5. Name the natural source of each of the following acid
   (i) Citric acid. (ii)Oxalic acid.
   (iii)Lactic acid. (iv)Tartaric acid.
6. (a) Write the name given to bases that are highly soluble in water. Give an example.
   (b) How is tooth decay related to pH? How can it be prevented?
   (c) Why does bee sting cause pain and irritation? Rubbing of baking soda on the sting area gives relief. How?
7. A white powder is added while baking breads and cakes to make them soft and fluffy. Write the name of the powder. Name its main ingredients. Explain the function of each ingredient. Write the chemical reaction taking place when the powder is heated during baking.
8. (a) Identify the acid and the base whose combination forms the common salt that you use in your food. Write its formula and chemical name of this salt. Name the source from where it is obtained.
   (b) What is rock salt? Mention its colour and the reason due to which it has this colour.
   (c) What happens when electricity is passed through brine? Write the chemical equation for it.
9. Dry pellets of a base ‘X’ when kept in bpen absorbs moisture and turns sticky. The compound is also formed by chlor-alkali process. Write chemical name and formula of X. Describe chlor-alkali process with balanced chemical equation. Name the type of reaction occurs when X is treated with dilute hydrochloric acid. Write the chemical equation. (ii) While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?
10. A student dropped few pieces of marble in dilute hydrochloric acid, contained in a test-tube. The evolved gas was then passed through lime water. What change would be observed in lime water? What will happen if excess of gas is passed through lime water? With the help of balanced chemical equations for all the changes explain the observations.
11. (a) Crystals of a substance changed their colour on heating in a closed test tube but regained it after sometime when they were allowed to cool down. Name the substance and write its formula and explain the phenomenon involved.

(b) Name the compound whose one formula unit is associated with 10 water molecules. How is it prepared? Give equations of related reactions. Give two uses of the compound.

12. Explain the following **chemical properties of acids** with the help of balanced chemical equations only.
    (i) When an acid reacts with a metal carbonate.
    (ii)When an acid reacts with a metal bicarbonate.
    (iii) When an acid reacts with a metal oxide.
    (b) You are given three solutions A, B and C with pH values 2, 10 and 13 respectively. Write which solution has more hydrogen ion concentration among the three and state the nature 'acidic or basic' of each solution.
13. What is the colour of $FeSO_4.7H_2O$ crystals? How does this colour change upon heating? Give balanced chemical equation for the changes.
14. A gas 'X' reacts with lime water and forms a compound 'Y' which is used as a bleaching agent in chemical industry. Identify 'X' and 'Y Give the chemical equation of the reactions involved.
15. What would be the colour of red litmus in a solution of sodium carbonate?

Mount Abu Public School

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SUBJECT : CHEMISTRY

CLASS X

Week : 8 February to 13 February 2021

CHAPTER 3 : METAL AND NON METAL

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for ch 3 is given below :

https://youtu.be/Bi4DtKpF6T0

https://youtu.be/d7RVnlA2XZY

https://youtu.be/Yesf31dK4f8

Learning outcomes

Each student will be able to :

- Students will able to learn about physical properties of metal and non metal
- They get knowledge of chemical properties of metal and non metal
- Reactivity series
- Ionic compound

Sub topics :

- Difference between metal and non metal
- Chemical properties of metal and non metal
- Ionic compound
- Properties of ionic compound

LESSON DEVELOPMENT

Metals and Non-metals

Elements are classified as metals and non-metals based on different properties. The properties of metals and non-metals are given in the form of table below-

Metals	Non-metals
Metals are lustrous, that is, they have a property to shine.	They are not lustrous, that is, they do not have shining surface. except, graphite and iodine
All metals exist as solids except mercury which is liquid at room temperature.	They are generally soft, except diamond.
They can be drawn into wires, this is known as **Ductility**.	They are non-ductile.
Metals can be converted into sheets, this is known as **Malleability**, except mercury	They are non-malleable
They are good conductors of electricity and heat. Except Lead and mercury.	They are poor conductors of electricity and heat. Exception-graphite is good conductor of electricity
They have high density and high melting point. Exception-sodium and potassium have low melting points	They have low density compared to metals and low melting point except Diamond which has high melting point

Chemical Properties of Metals

- Metals react with air or oxygen to form metal oxide.

For Example, Copper reacts with oxygen to form copper oxide.

$$\textbf{Metal} + O_2 \rightarrow \textbf{Metal oxide}$$

$$2Cu + O_2 \rightarrow 2CuO$$

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

- Oxides of metals can react with both acids and bases to produce salt and water. Such oxides are known as **Amphoteric Oxides**.

$$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + H_2O$$

$$\underset{\text{Aluminium oxide}}{Al_2O_3} + \underset{\text{(Conc.)}}{2NaOH(aq.)} \rightarrow \underset{\text{Sodium aluminate}}{2NaAlO_2} + H_2O$$

- Metals also reacts with water to form metal oxide. Metal oxide in turn can react with water to form metal hydroxide. **For Example**

$$2Na + 2H_2O \rightarrow 2NaOH + 1H_2$$

$$2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2$$

- Metals also reacts with dilute acids to form salt and hydrogen. **For example**, magnesium reacts with dilute hydrochloric acid to form magnesium chloride and hydrogen.

$$\textbf{Metal} + \textbf{Acid} \rightarrow \textbf{Metal Salt} + \textbf{Hydrogen}$$

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Chemical Properties of Non-metals

- Non-metals reacts with oxygen to form non-metal oxide.

Non-metal + Oxygen → Non-metal oxide

$$C + O_2 \rightarrow CO_2$$

- Non-metals do not react with water and acids to evolve hydrogen gas.
- Non-metals can react with salt solution; more reactive element will displace the less reactive non-metal.

$$2\ NaBr\ (aq) + Cl_2(aq) \rightarrow 2NaCl\ (aq) + Br_2\ (aq)$$

- Non-metals can also react with hydrogen to form hydrides.

$$H_2(g) + S(l) \rightarrow H_2S(g)$$

Reactivity Series

The series in which metals are arranged in the decreasing order of reactivity, it is known as **Reactivity Series**.

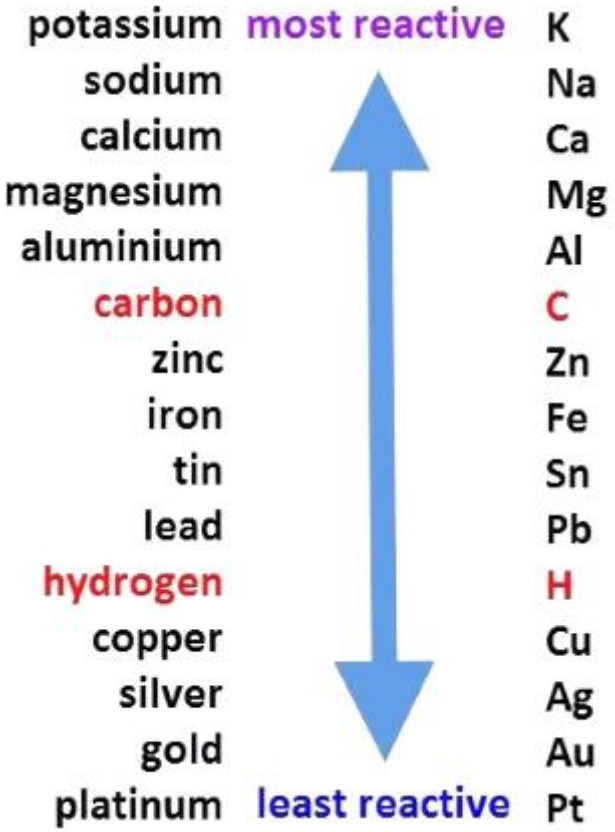
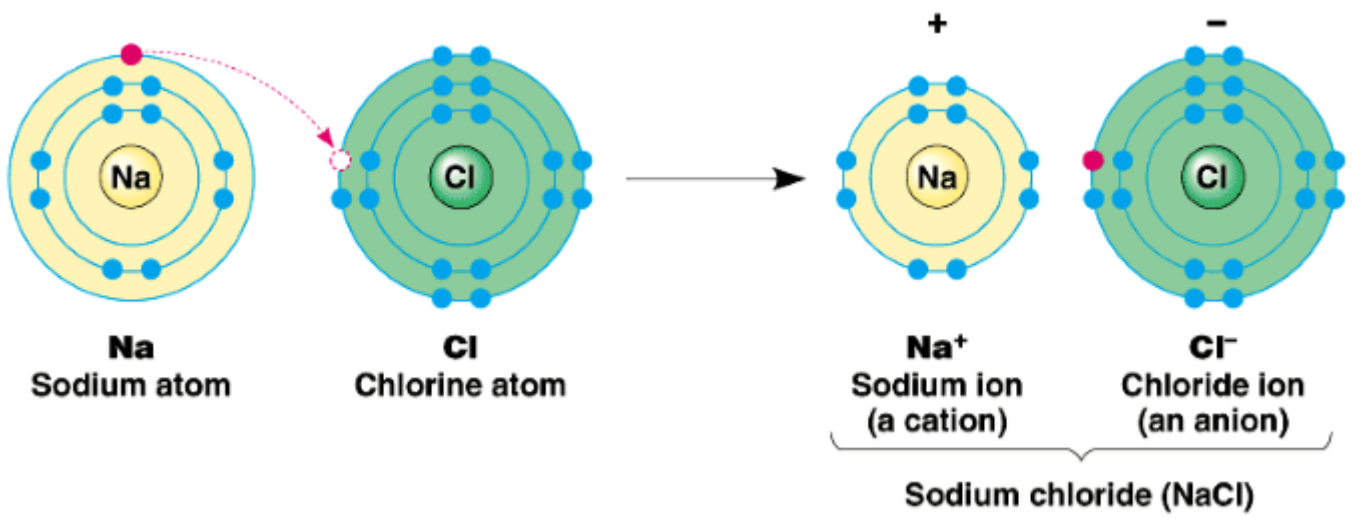


Fig.1. Reactivity Series

Ionic Compounds

Compounds formed due to the transfer of electrons from a metal to a non-metal are known as **Ionic Compounds**.



Properties of Ionic Compounds

- They are generally hard and solid.
- They have a high melting and boiling point.
- They are soluble in water but insoluble in inorganic solvents such as ether etc.
- They are conductors of electricity in molten and solution state.

ASSIGNMENT

1. **Which one of the given metals does not react with cold as well as hot water?**
   A. Na
   B. Ca
   C. Mg
   D. Fe
2. **Which of the given oxide(s) of iron would be obtained on prolonged reaction of iron with steam?**
   A. FeO
   B. Fe_2O_3
   C. Fe_3O_4
   D. Fe_2O_3 and Fe_3O_4
3. **What happens when calcium is treated with water?**
   (a) It does not react with water
   (b) It reacts violently with water
   (c) It reacts less violently with water
   (d) Bubbles of hydrogen gas formed stick to the surface of calcium
   A. (A) & (D)
   B. (B) & (C)
   C. (A) & (B)
   D. (C) & (D)
4. **The composition of aqua-regia is**
   A. Dil.HCl : Conc. HNO_3 = 3 : 1
   B. Conc.HCl : Dil. HNO_3 = 3 : 1
   C. Conc.HCl : Conc. HNO_3 = 3 : 1
   D. Dil.HCl : Dil. HNO_3 = 3 : 1
5. **Which of the following metals exists in its native state in nature?**
   (a) Cu
   (b) Au
   (c) Zn
   (d) Ag
   A. (A) & (B)
   B. (B) & (C)
   C. (B) & (D)
   D. (C) & (D)
6. **An element A is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element**
   A. Mg
   B. Na
   C. P
   D. Ca
7. **Reaction between X and Y, forms compound Z. X loses electron and Y gains electron. Which of the given properties is not shown by Z?**
   A. Has high melting point
   B. Has low melting point
   C. Conducts electricity in molten state
   D. Occurs as solid

In the following questions a statement of Assertion is followed by a statement of Reason. Mark the correct choice as
(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason ·is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If Reason is true but Assertion is false.
(e) If both Assertion and Reason are false.

8. **ASSERTION :**metal are sonorous
   REASON : They are generally brittle in the solid state , they break into pieces when hammered
9. **ASSERTION :**sodium react with water , producing hissing sound
   REASON :sodium react with water produce hydrogen gas
10. **ASSERTION :**when soft iron nail are dipped in $CuSO_4$ solution greenish solution formed
    REASON :iron replaces copper from copper sulphate solution forming iron sulphate

Short questions :

11. **(a) Write electron dot diagram for chlorine (At No. 17) and calcium (At No. 20).**
    Show the formation of calcium chloride by transfer of electrons.
    (b) Identify the nature of above compound'and explain three physical properties of such compound.
12. **a) Define activity series of metals. Arrange the metals gold, copper, iron and magnesium in order of their increase in reactivity.**
    (b) What will you observe when:
    (i) Some zinc pieces are put in copper sulphate solution.
    (ii) Some silver pieces are put into green coloured ferrous sulphate solution.
13. **Name the following:**
    (a) A metal, which is preserved in kerosene.
    (b) A lustrous coloured non-metal.
    (c) A metal, which can melt while kept on palm.
    (d) A metal, which is a poor conductor of heat.
14. **Explain why calcium metal after reacting with water starts floating on its * surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some time when immersed in water.**
15. **Give reason for the following:**
    (a) Aluminium oxide is considered as an amphoteric oxide.
    (b) Ionic compounds conduct electricity in molten state.

CHAPTER 4 : CARBON AND ITS COMPUND

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/7nKMLYw2MN4
https://youtu.be/12W81VGYPMw
https://youtu.be/7nKMLYw2MN4

Learning outcomes

Each student will be able to :

1. Learn about covalent bond
2. Versatile nature of covalent bond
3. Functional group
4. Homologous series

Sub topics :

- Covalent compound
- Structure of covalent compound
- Electron dot structure
- Physical properties
- Versatile nature of covalent compound
- Allotropes
- Homologous series

LESSON DEVELOPMENT

Bonding in Carbon: The Covalent bond, Electron dot structure, Physical properties of organic compounds, Allotropes of Carbon.

Covalent Bond: The atomic number of carbon is 6. Its electronic configuration is 2, 4. It requires, 4 electrons to achieve the inert gas electronic configuration. But carbon cannot form an ionic bond

It could gain four electrons forming C^{4-} cation. But it would be difficult for the nucleus with six protons to hold on to ten electrons.

It could lose four electrons forming C^{4+} cations. But it requires a large amount of energy to remove four electrons.

Thus, carbon overcomes this problem by sharing of its valence electrons with other carbon atoms or with atoms of other elements.

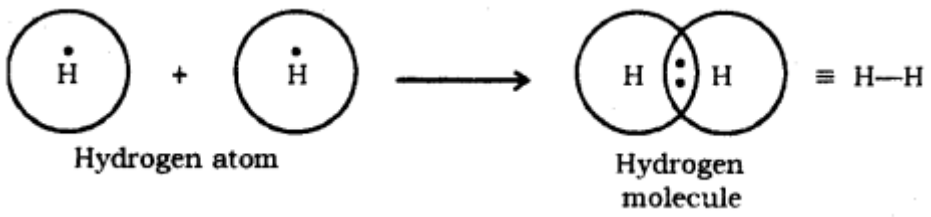
The bond formed by mutual sharing of electron pairs between two atoms in a molecule is known as Covalent Bond.

Types of Covalent Bond:

- Single Covalent Bond: When a single pair of electrons are shared between two atoms in a molecule. For example; F_2, Cl_2, H_2 etc.
- Double Covalent Bond: When two pairs of electrons are shared between two atoms in a molecule. For example; O_2, CO_2 etc.
- Triple Covalent Bond: When three pairs of electrons are shared between two atoms in a molecule. For example; N_2 etc.

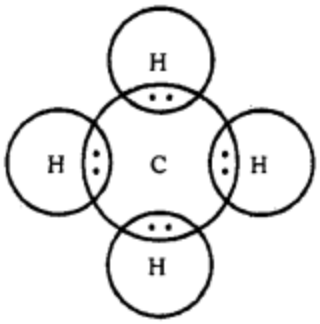
Electron Dot Structure: The electron dot structures provides a picture of bonding in molecules in terms of the shared pairs of electrons and octet rule.

Formation of Hydrogen Molecule
Atomic number of Hydrogen = 1
Number of valence electrons = 1

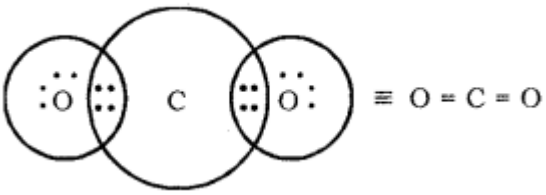


Formation of CH_4 Molecule
Atomic number of Carbon = 6 [2, 4]
Number of valence electrons = 4
Atomic number of Hydrogen = 1

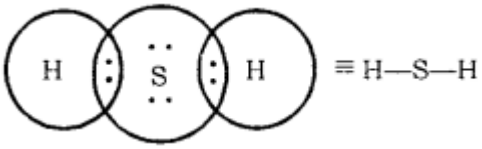
Number of valence electrons = 1



Formation of CO_2 Molecule
Atomic number of Carbon = 6 [2, 4]
Number of valence electrons = 4
Atomic number of Oxygen = 8 [2, 6]
Number of valence electrons = 6



Formation of H_2S Molecule
Atomic number of Sulphur = 16 [2, 8, 6]
Number of valence electrons = 6



Physical Properties of Organic Compounds
Most of the organic compounds have low boiling and melting point, due to the weak force of attraction (i.e., the inter-molecular force of attraction) between these molecules.
Most carbon compounds are poor conductors of electricity, due to the absence of free electrons and free ions.

Allotropes of Carbon
Allotropy: The phenomenon in which the element exists in two or more different physical states with similar chemical properties are called Allotropy.

Carbon has Three Main Allotropes

- **Diamond:** In this, carbon, an atom is bonded to four other atoms of carbon forming three-dimensional structures. It is the hardest substance and an insulator. It is used for drilling rocks and cutting. It is also used for making jewellery.
- **Graphite:** In this, each carbon atom is bonded to three other carbon atoms. It is a good conductor of electricity and used as a lubricant.
- **Buckminster Fullerene:** It is an allotrope of the carbon-containing cluster of 60 carbon atoms joined together to form spherical molecules. It is dark solid at room temperature.

Versatile nature of Carbon, Hydrocarbons, Isomerism, Homologous series, Functional groups, Nomenclature of functional groups.

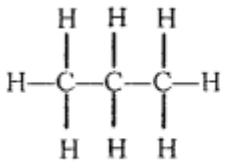
Versatile Nature of Carbon: The existence of such a large number of organic compounds is due to the following nature of carbon,

- Catenation
- Tetravalent nature.

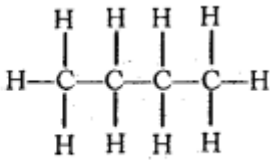
(i) Catenation: The self linking property of an element mainly carbon atom through covalent bonds to form long straight, branched and rings of different sizes are called Catenation.
This property is due to

- The small size of the carbon atom.
- The great strength of the carbon-carbon bond.

Carbon can also form stable multiple bonds (double or triple) with itself and with the atoms of other elements.
Straight Chain

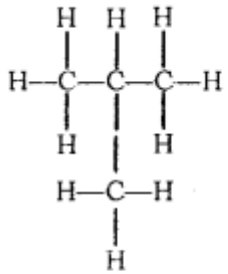


Propane

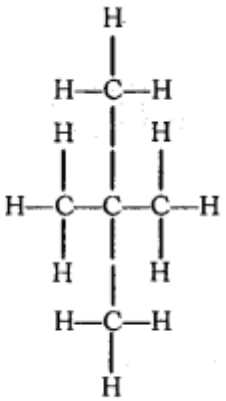


Butane

Branched Chain

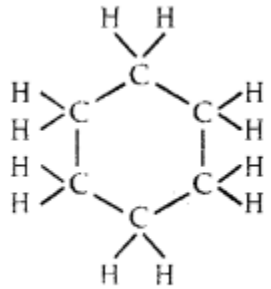


2-Methylpropane

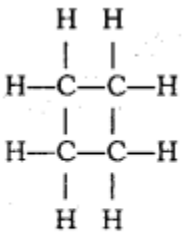


2, 2– Dimethylpropane

Rings

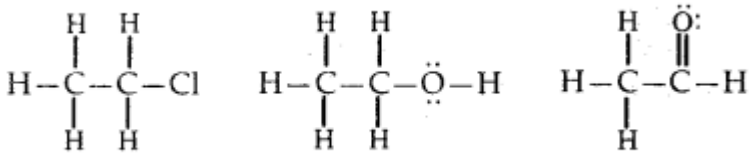


Cyclohexane



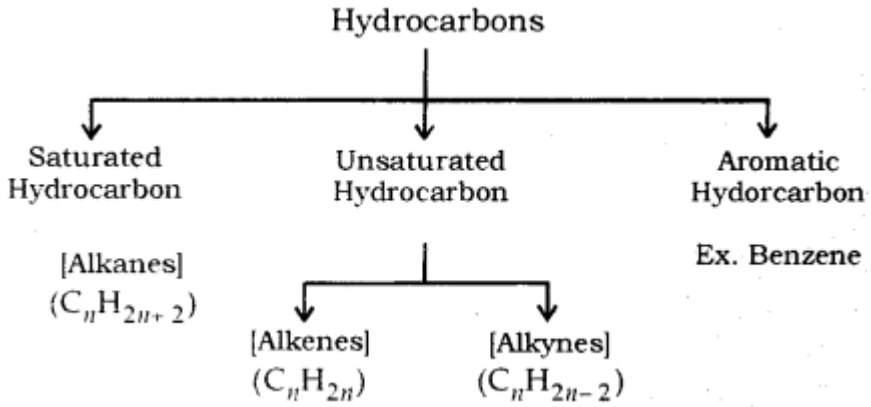
Cyclobutane

(ii) Tetravalent Nature: Carbon has valency of four. It is capable of bonding with four other atoms of carbon or some other heteroatoms with single covalent bond as well as double or triple bond.

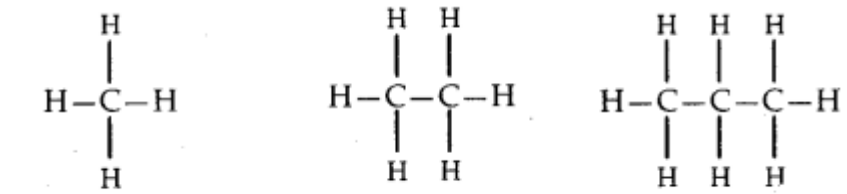


Chloroethane Ethanol Ethanal

Hydrocarbons: Compounds of carbon and hydrogen are known as hydrocarbons.
For example; Methane (CH_4), Ethane (C_2H_6), Ethene (C_2H_4), Ethyne (C_2H_2) etc.

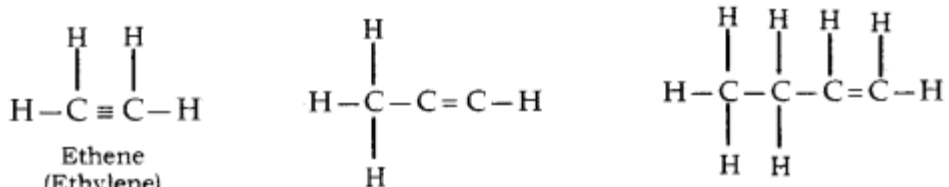


Saturated Hydrocarbon (Alkanes): General formula is C_nH_{2n+2}.
n = number of carbon atoms.
In this, the carbon atoms are connected by only a single bond.
For example; Methane (CH_4), Ethane (C_2H_6) etc.



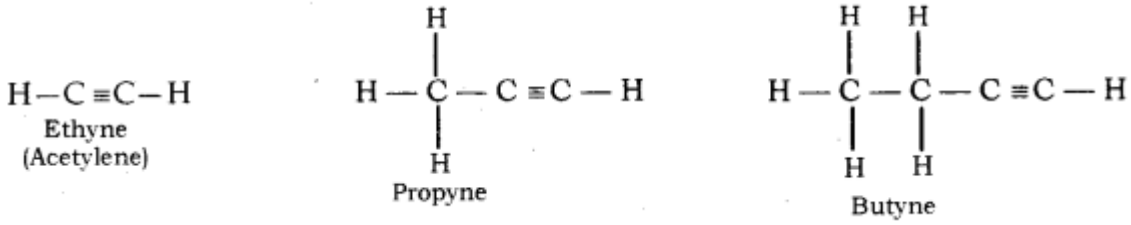
Methane (n = 1) Ethane (n = 1) Propane (n = 3)

Unsaturated Hydrocarbons
Alkenes: General formula is C_nH_{2n}, where n = number of carbon atoms.
In this, the two carbon atoms are connected by double bond.

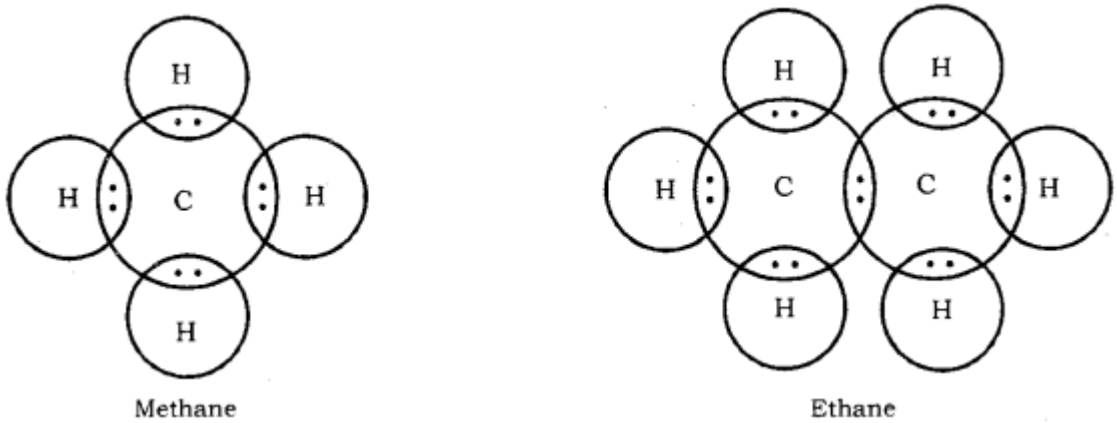


Ethene (Ethylene) Propane Butene

Alkynes: General formula is C_nH_{2n-2}, where n = number of carbon atoms. In this, the two carbon atoms are connected by triple bond.



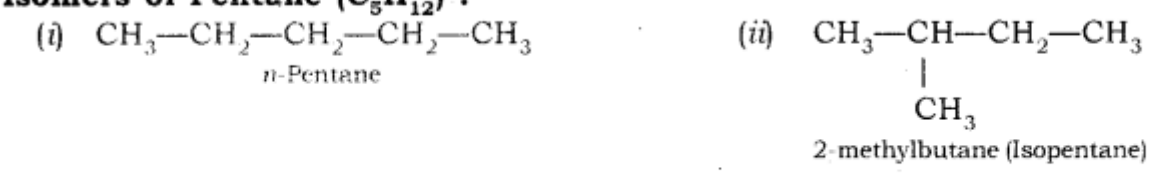
Electron Dot Structure of Hydrocarbons



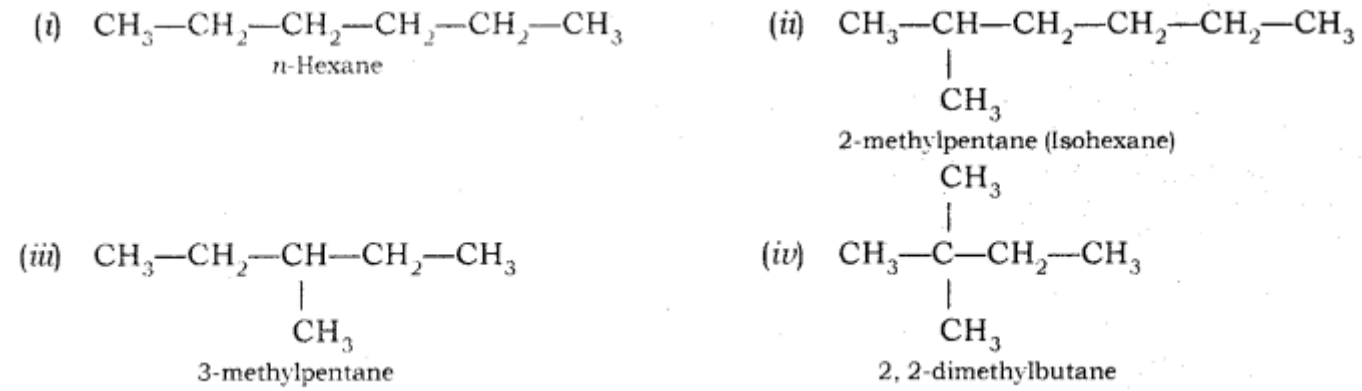
Isomerism: Compounds having the same molecular formula but different structural formula and properties are known as Isomers and this phenomenon is known as Isomerism.

Structural Isomerism: Compounds having the same molecular formula but different structures are called Structural isomers. Example: Isomers of butane (C_4H_{10})

Isomers of Pentane (C_5H_{12}) :



Isomers of Hexane (C_6H_{14}) :



Homologous Series: Series of organic compounds having the same functional group and chemical properties and successive members differ by a CH_2 unit or 14 mass units are known as Homologous series.

Homologous series of Alkanes, Alkenes and Alkynes

Alkanes : Methane (CH_4)
Ethane ($CH_3—CH_3$)
Propane ($CH_3—CH_2—CH_3$)

Alkenes : Ethene ($CH_2 = CH_2$)
Propene ($CH_3—CH = CH_2$)

Alkynes : Ethyne ($CH \equiv CH$)
Propyne ($CH_3—C \equiv CH$)

Characteristic of Homologous Series

- The successive members in homologous series differ by CH_2 unit or 14 mass unit.
- Members of given homologous series have the same functional group.
- All the members of homologous series shows similar chemical properties.

Functional Group: An atom or group of atoms present in a molecule which largely determines its chemical properties are called Functional Group.

Functional Group	Formula of Functional Group
1. Halo- Chloro- Bromo-	 —Cl —Br
2. Alcohol	—OH
3. Aldehyde	—CHO or $—\overset{\overset{\displaystyle O}{\|}}{C}—H$
4. Ketone	—CO— or $—\overset{\overset{\displaystyle O}{\|}}{C}—$
5. Carboxylic acid	—COOH or $—CO_2H$ or $—\overset{\overset{\displaystyle O}{\|}}{C}—O—H$

ASSIGNMENT

1. Ethane, with the molecular formula C_2H_6 has :
(a) 6 covalent bonds
(b) 7 covalent bonds
(c) 8 covalent bonds
(d) 9 covalent bond

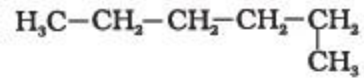
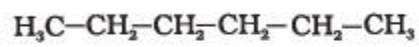
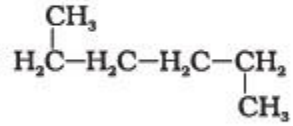
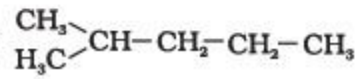
2. The chemical formulae of propane is :
(a) CH_4
(b) C_3H_8
(c) C_4H_{10}
(d) C_2H_6

3. The number of carbon atom present in the molecule of fifth member of the homologous series of alkynes is :
(a) four
(b) five
(c) six
(d) seven

4. Which of the following is homologous pair?
(a) CH_4 and C_2H_4
(b) CH_3OH and CH_3CHO
(c) HCHO and CH_3CHO
(d) C_3H_5OH and CH_3COCH_3.

5. The important feature of homologous series is :
(a) Difference in the chemical properties of compounds.
(b) Difference in the general formula of compounds
(c) Specific methods of formation of compounds
(d) Similarly in the functional group of compounds.

6. Reason of high number of organic compounds is :
(a) High activeness of carbon
(b) Changeable valency of carbon
(c) Ability ty of carbon to make covalent compound
(d) Abilito make series by connecting atoms together.

7. Which of the following is not a straight chain hydrocarbon?
(a) 
(b) 
(c) 
(d) 

8. Pentane has the molecular formula C_5H_{12}. It has
(a) 5 covalent bonds
(b) 12 covalent bonds
(c) 16 covalent bonds
(d) 17 covalent bonds

9. Identify the unsaturated compounds from the following
   (i) Propane
   (ii) Propene
   (iii) Propyne
   (iv) Chloropropane
   (a) (i) and (ii)
   (b) (ii) and (iv)
   (c) (iii) and (iv)
   (d) (ii) and (iii)

10. Buckminsterfullerene is an allotropic form of
    (a) phosphorus
    (b) sulphur
    (c) carbon
    (d) tin

11. Which of the following statements are usually correct for carbon compounds? These
    (i) are good conductors of electricity
    (ii) are poor conductors of electricity
    (iii) have strong forces of attraction between their molecules
    (iv) do not have strong forces of attraction between their molecules
    (a) (i) and (iii)
    (b) (ii) and (iii)
    (c) (i) and (iv)
    (d) (ii) and (iv)
12. **Give the names of the following functional groups:**
    (i) —OH (ii) —COOH
13. **(a) Why are covalent compounds generally poor conductors of electricity?**
14. **What is a homologous series? Which two of the following organic compounds belong to the same homologous?**
    CH_3 ,C_2H_6, C_2H_6O, $C_2H_6O_2$,CH_4O
15. **Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, C_4H_{10}**

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SUBJECT : CHEMISTRY

CLASS X

Week : 15 February to 20 February 2021

CHAPTER 5 PERIODIC CLASSIFICATION OF ELEMENTS

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for ch 5 is given below :

https://youtu.be/-yh66ax-wWw

https://youtu.be/vsrp9oA2x2k

https://youtu.be/Bi4DtKpF6T0

Learning outcomes

Each student will be able to :

1. Why do we classify elements
2. Classification of elements
3. Atomic size
4. Metallic and non metallic nature
5. Electronegativity

Sub topics :

- Classification of elements
- Dobereinertriad ,newland law of octaves
- Mendeleev periodic table
- Modern periodic table
- Physical properties

LESSON DEVELOPMENT

Periodic Classification of Elements

- Placing similar groups and species together is known as **Classification**. Classification is needed to easily understand the properties of different elements in a periodic table. Elements with similar properties are placed in one group to understand them easily.

- **Dobereiner's triad**

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

He try to arrange the elements with similar properties into group. He identified some groups having three element each so he called these groups triad.

- Elements are arranged in the order of increasing atomic mass
- He found that atomic mass of middle element was roughly the average of atomic mass of other two elements

  Limitation – he was failed to arrange all known element in the form of traid. And identify only 3 traid from the known element at that time.

Newland's Law of Octave

sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	—	—

- Arrange the element in order of increasing atomic mass, property of every 8 element is similar to the property of first element
- He compare these with the octaves found in music therefore he called it law of octaves

Limitation-

- newland law of Octave was applicable upto calcium only
- Newland assume that only 56 element exist in nature and no more element would be discovered in future but later several new animals were discovered in future whose properties did not fit into the table .
- In order to fit element into his table, newland put even two element Cobalt and Nickel together in one slot.
- Iron which resembles Copper and Nickel elements in properties was place for away from these element.

Mendeleev's Periodic Table

Table 5.4 Mendeléev's Periodic Table

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
3	Na 22.99	Mg 24.31	Al 29.98	Si 28.09	P 30.974	S 32.06	Cl 35.453	
4 First series: Second series:	K 39.102 Cu 63.54	Ca 40.08 Zn 65.37	Sc 44.96 Ga 69.72	Ti 47.90 Ge 72.59	V 50.94 As 74.92	Cr 50.20 Se 78.96	Mn 54.94 Br 79.909	Fe Co Ni 55.85 58.93 58.71
5 First series: Second series:	Rb 85.47 Ag 107.87	Sr 87.62 Cd 112.40	Y 88.91 In 114.82	Zr 91.22 Sn 118.69	Nb 92.91 Sb 121.75	Mo 95.94 Te 127.60	Tc 99 I 126.90	Ru Rh Pd 101.07 102.91 106.4
6 First series: Second series:	Cs 132.90 Au 196.97	Ba 137.34 Hg 200.59	La 138.91 Tl 204.37	Hf 178.49 Pb 207.19	Ta 180.95 Bi 208.98	W 183.85		Os Ir Pt 190.2 192.2 195.09

- According to Mendeleev periodic table the properties of elements are periodic function of their atomic masses
- It means that if elements were arrange in the order of increasing atomic masses then the properties of elements was repeated after regular interval.
- Among chemical properties, Mendeleev concentrated on the compound formed by hydrogen and oxygen as they are very reactive and formed compound with most of the elements **Achievements of Mendeleev periodic table**
- Mendeleev left proper gaps for some element that had no been discovered at that time. He name these as Eka to the name of preceding element .
- For Example Eka aluminium, Eka Boron , Eka silicon have similar property with Gallium , scandium and Germanium which discovered later
- Noble gases were discovered late because they are inert and have low concentration in the atmosphere . Mendeleev put noble gases in seperate group that did not disturbed the original mendeleevtable .
- Mendeleev place an element with a slightly greater atomic mass before an element with slightly low atomic mass
  Example Co appeared before nickel

Limitation of Mendeleev periodic table

- Position of isotopes could not explain

- No fixed position can be given to hydrogen in periodic table because properties of Hydrogen resembles with alkali metal as well as with halogens
- Atomic masses do not increase in regular manner in going from one element to another

Modern Periodic Table

Table 5.6 Modern Periodic Table

Metals | Metalloids | Non-metals

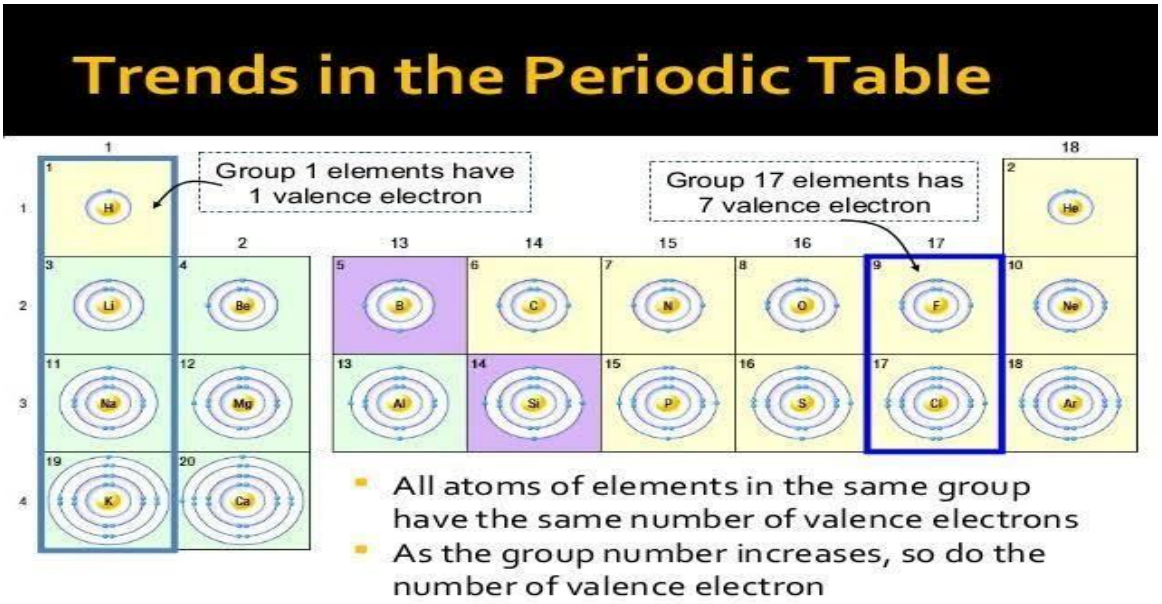
The zigzag line separates the metals from the non-metals.

GROUP NUMBER

PERIODS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H Hydrogen 1.0																	2 He Helium 4.0
2	3 Li Lithium 6.9	4 Be Beryllium 9.0											5 B Boron 10.8	6 C Carbon 12.0	7 N Nitrogen 14.0	8 O Oxygen 16.0	9 F Fluorine 19.0	10 Ne Neon 20.2
3	11 Na Sodium 23.0	12 Mg Magnesium 24.3											13 Al Aluminium 27.0	14 Si Silicon 28.1	15 P Phosphorus 31.0	16 S Sulphur 32.1	17 Cl Chlorine 35.5	18 Ar Argon 39.9
4	19 K Potassium 39.1	20 Ca Calcium 40.1	21 Sc Scandium 45.0	22 Ti Titanium 47.8	23 V Vanadium 50.9	24 Cr Chromium 52.0	25 Mn Manganese 54.9	26 Fe Iron 55.9	27 Co Cobalt 58.9	28 Ni Nickel 58.7	29 Cu Copper 63.5	30 Zn Zinc 65.4	31 Ga Gallium 69.7	32 Ge Germanium 72.6	33 As Arsenic 74.9	34 Se Selenium 79.0	35 Br Bromine 79.9	36 Kr Krypton 83.8
5	37 Rb Rubidium 85.5	38 Sr Strontium 87.6	39 Y Yttrium 88.9	40 Zr Zirconium 91.2	41 Nb Niobium 92.9	42 Mo Molybdenum 95.9	43 Tc Technetium (99)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.3	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3
6	55 Cs Caesium 132.9	56 Ba Barium 137.3	57 La* Lanthanum 138.9	72 Hf Hafnium 178.5	73 Ta Tantalum 181.0	74 W Tungsten 183.9	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Ti Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89 Ac** Actinium (227)	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo

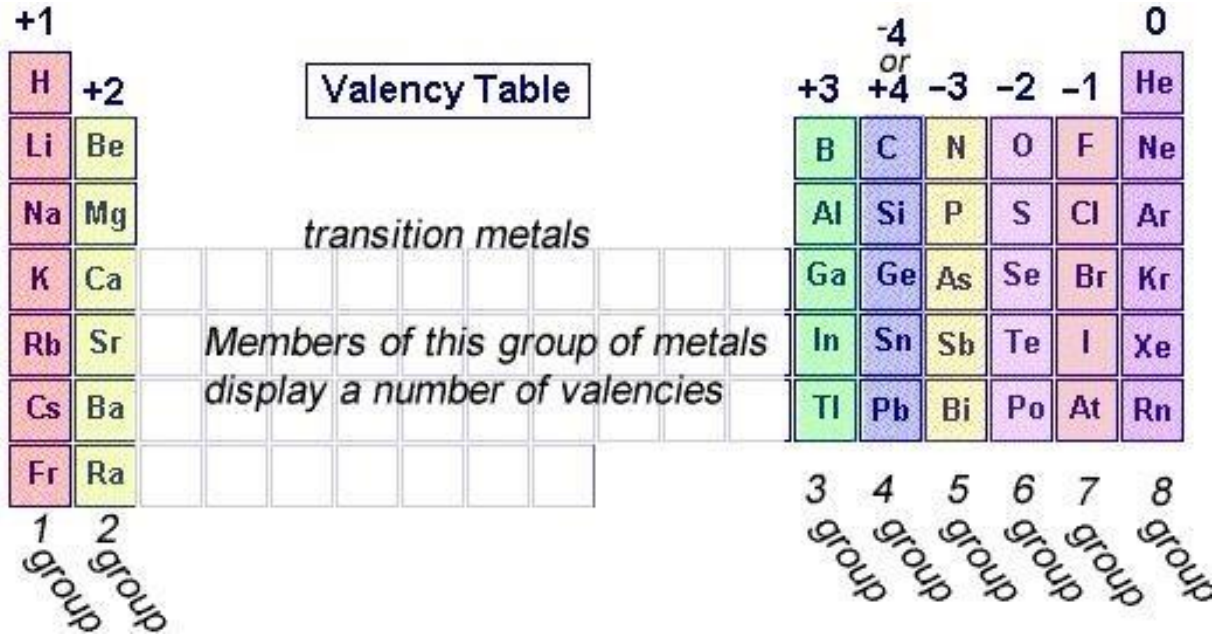
* Lanthanoides	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium 150.4	63 Eu Europium 152.0	64 Gd Gadolinium 157.3	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.5
** Actinoides	90 Th Thorium 232.0	91 Pa Protactinium (231)	92 U Uranium 238.1	93 Np Neptunium (237)	94 Pu Plutonium (242)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (245)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (253)	101 Md Mendelevium (256)	102 No Nobelium (254)	103 Lr Lawrencium (257)

- According to modern periodic table properties of element are periodic function of atomic number .
- Modern Periodic table has 18 vertical columns known as groups and 7 horizontal rows known as periods.
- Element present in any one group have same number of valence electron therefore show similar properties
- element present in one period do not have same number of valence electron but they contain same number of shell **Trends in Modern Periodic Table**
- **Valence Electrons**
- On moving from left to right in a period, the number of valence electron increase
- All the element of a group of periodic table have same number of valence electron

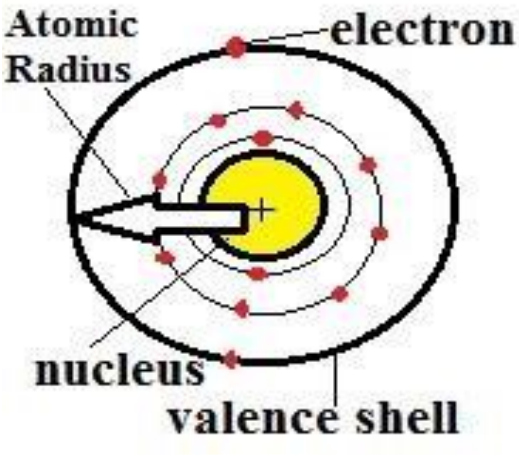


Valency

- On moving from left to right valency increase from 1 to 4 and then decrease to zero
- All elements in a group have same valency



Atomic Size –



- It refers to the radius of an atom atomic size is a distance between nucleus and outermost shell of an isolated atom
- Atomic size decreases left to right in a period as the nuclear charge increases due to large positive charges on the nucleus.
- Atomic size increases down the group due to addition of new shell this increases the distance between outermost electron and nucleus

- **Metallic Character** - Ability of atom to lose the electron is known as **MetallicCharacter**.
- Metallic character decreases from left to right in a period. This is due to increase in nuclear charge.
- And metallic character increases down the group as the size increases it can easily lose electron.
- But non-metallic character increases left to right in a period. And decrease down the group .
- **Electropositive Character** decreases from left to right in a periodic table and increases down the group. This is due to decrease in metallic character from left to right in a period.
- Non metals are **electronegative in nature .**

ASSIGNMENT

1. Upto which element, the Law of Octaves was found applicable?
(a) Oxygen
(b) Calcium
(c) Cobalt
(d) Potassium

2. In Mendeleev's Periodic Table, gaps were left for the elements to be discovered later. Which of the following elements found a place in the Periodic Table later?
(a) Chlorine
(b) Silicon
(c) Oxygen
(d) Germanium

3. An atom of an element has the electronic confi-guration 2,8,2. To which group does it belong?
(a) 4th group
(b) 6th group
(c) 3rd group
(d) 2nd group

4. Which of these belong to the same period?

Element	A	B	C
Atomic number	2	10	5

(a) A, B
(b) B, C
(c) C, A
(d) A, B and C

5. What is the atomic number of element of period 3 and group 17 of the Periodic Table?
(a) 10
(b) 4
(c) 17
(d) 21

6. An element X from group 2 of the Periodic Table reacts with Y from group 17 to form a compound. Give the formula of the compound.
(a) XY_2
(b) XY
(c) X_2Y
(d) $(XY)_2$

7. Consider the following elements
$_{20}Ca$, $_{8}Or$ $_{18}Ar$, $_{16}S$, $_{4}Be$, $_{2}He$
Which of the above elements would you expect to be in group 16 of the Periodic Table?
(a) $_{20}Ca$ and $_{16}S$
(b) $_{20}Ca$ and $_{8}O$
(c) $_{18}Ar$ and $_{16}S$
(d) $_{8}O$ and $_{16}S$

8. An element 'A' belongs to the third period and group 16 of the Periodic Table. Find out the valency of A.

(a) Valency = 6

(b) Valency = 2

(c) Valency = 1

(d) Valency = 3

9. Out of Mg and Al which has higher ionisation energy?

A) Mg

B) Al

C) Both have same

D) None

10. Out of F and Cl, which has higher electron affinity ?

A) Cl

B) F

C) Both have same

D) none

11. What relation do Ar and Ca have?

A) isotopes

B) isoelectronic

C) isobars

D) isotones

12. **The order of ionisation of alkali group follows which order?**

A) Li>Na>K>Rb>Cs

B) Li<Na>K<Rb>Cs

C) Li<Na<K<Rb<Cs

D) Li>Na<K>Rb<Cs

13. **Element X forms the chloride with the formula XCl2 ,which is a solid with a high melting point. X is most likely to be in the same group of periodic table as -**

A) Na

B) Mg

C) Al

D) Si

14. **Which of the following elements will form acidic oxide?**

A) with atomic number 7

B) with atomic number 3

C) with atomic number 12

D) with atomic number 19

15. **Two elements X and Y belong to group 1 and 2 respectively in the same period of periodic table. Compare them with respect to:**

periodic table from the left to the right and why?

(1) **the number of valence electrons in their atoms**

(2) **their valencies**

(3) **metallic character**

(4) **the sizes of their atom**

(5) **formulae of their oxides**

(6) **formulae of their chlorides**

16. **In the modern periodic table, the element Calcium (atomic number = 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these elements has physical and chemical properties resembling those of Calcium and why?**

17. **In the following table, six elements A, B, C, D, E and F (here letters are not the usual symbols of the elements) of the Modern Periodic Table with atomic numbers 3 to 18 are given:**

3	4	5	6	7	8	9	10
A					E		G
11	12	13	14	15	16	17	18
B	C		D			F	

(a) Which of these halogen ?is (i) a noble gas, (ii) a halogen
(b) If B combines with F, what would be the formula of the compound formed?
(c)Write the electronic configurations of C and E.

18. **Lithium, sodium and potassium form a Dobereiner's triad. The atomic masses of lithium and potassium are 7 and 39 respectively. Predict the atomic mass of sodium.**

19. **Table given below shows a part of the Periodic Table.**

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

(b) Atomic size of Mg is less than that of Na.
(c) Fluorine is more reactive than Chlorine.

20. **An element 'M' has atomic number 11.**
(a) Write its electronic configuration.
(b) State the group to which 'M' belongs.
(c) Is 'M' a metal or a non-metal?
(d) Write the formula of its chloride.