## Chemistry [ 14 Parts ]

## Prepared From Samacheer Books As Per Tnpsc Syllabus

### 1. Chemistry in Daily Life

1. Name some chemical substances that we use in our daily life?
   Shampoo that we use for washing our hair, soap that we use for bathing, the ink used in our pen and chalk piece used by our teachers are also chemical substances.
2. Which plays a major role in manufacturing useful things that we need?
   Chemistry .
3. Which is used in used in the construction of buildings?
   Cement
4. Who synthesised cement and what was the name given by him to cement?
   In 1824 Joseph Aspidin, a mason in England synthesised cement. As this cement resembled the limestone found in Portland, he named the cement as Portland cement.
5. What is cement?
   Cement is a mixture of limestone, clay and gypsum in definite proportion. This mixture is heated, cooled and powdered to get the chemical substance called cement.
6. What are the uses of cement?
   Cement is used in different forms like mortar, concrete and reinforced cement concrete.
7. How is mortar obtained?
   Mortar is obtained in the form of thick paste by mixing cement, sand and water. This paste is used in flooring, constructing and plastering the walls of the houses.
8. What is concrete?
   Concrete is a mixture of cement, sand, gravel and water. It is used in the construction of buildings, bridges, dams or reservoirs.
9. What is reinforced cement concrete?

When concrete is filled in and around a steel wire netting or skeleton of iron rods and allowed to set we get reinforced cement concrete. This RCC is very strong and durable. This type of concrete is used in the construction of dams, bridges, pillars and roofs of the buildings. It is also used in making pipes, constructing water tanks, and laying sewage and drainage canals.

10. What is Thermo Plastics?

Plastic pipe and plastic bottle melt and become soft on heating. On cooling, they become hard. These types of plastics are known as 'Thermo Plastics'. Polythene bags, PET bottles, PVC(Polyvinyl chloride) pipes, buckets, mugs, combs, toys etc. are made of thermo plastics.

11. What is non conductor of heat and electricity?

Bakelite is a non conductor of heat and electricity.

12. What is Melamine?

Melamine is a non-inflammable substance

13. What are the effects of plastics?

- Plastics do not get degraded.
- They do not allow rainwater to seep through the soil
- They affect the growth of the plants.
- Water gets stagnant in these disposed plastic pieces. It becomes the breeding place for mosquitoes, which in turn spread contagious diseases.
- They arrest the flow of water.
- When food contaminated with plastic material is consumed, it leads to the death of living organisms.
- When Plastics/Polythene bags are burnt, they emit toxic gases.
- These gases mix in air and cause respiratory problems.

14. What is glass made of?

Glass is made of chemical substances like silica(sand), calcium carbonate(limestone) and sodium carbonate.

15. What is annealing?

When molten glass is cooled rapidly it becomes brittle. When the molten glass is cooled very slowly, it will not allow light to pass through. Therefore glass should not be cooled either very slowly or rapidly. It should be cooled gradually. This method of cooling is called annealing.

16. Where is the raw material used in soaps mentioned?

    In the wrapper.

17. Can we prepare soap at home?

Yes, we can prepare soap at home provided sodium hydroxide is available.

18. What are the types of fiber?

Fibres are classified into two types based on their source.

- Natural fibres
- synthetic fibres

19. What are natural fibers?

Fibres which are obtained from plants and animals are known as natural fibres. Jute is obtained from the stem of the jute plant. It is used to make bags, curtains, carpets, etc.

20. What are cellulous?

Cotton fibre consists a chemical substance called “cellulose”.

21. What are synthetic fibres?

The fibres which are synthesized from chemical substances using scientific technology are called synthetic fibres. Polyester, nylon, rayon are some of the examples of synthetic fibres.

22. Fact file:

- The first Government approved Indian cement factory was started in the year 1914 at Porbandar in Gujarat by India Cement Ltd.,
- Broken glass pieces found during the archeological survey. at Mesopotamia confirms that Mesopotamians were the first to use glass in the third century.

- Nowadays a new kind of plastics namely Bio-plastics are manufactured. This kind of plastics is Bio-degradable in nature.

## 2. Separation of Substance

1. Why should we need separation of substance?

- To remove unwanted substances
- To remove substances which are harmful to our body
- To obtain the substances which are useful to us in a pure state.

2. What are the Methods used to separate mixture of solids?

Solid mixtures can be separated using methods like hand picking, winnowing, sieving and magnetic separation.

3. What is Hand picking?

Hand picking method can be applied, when the quantity is small and are of reasonable size. The method of separating the substances based on size, colour and shape using hands is called hand picking

4. What is winnowing?

Farmers allow the mixture of grain and husk to fall from a height. Grains, being heavier fall down and form a heap. Husk, being lighter is carried away by wind and forms a separate heap. The method of separating lighter particles from heavier particles with the help of wind is called winnowing.

5. What is Sieving?

We can separate the impurities like bran, husk, stone, worms, stalk and tiny insects from flour by sieving. It allows the fine particles to pass through the pores, while the coarser particles remain in the sieve. Components of a mixture can be separated by the method of sieving only when they differ in their size.

6. Where is Magnetic separation used?

Magnetic separation is used to separate mixtures containing components, which are attracted by a magnet.

7. How can we separate insoluble solids from liquids?

We can separate insoluble solids from liquids by using the method of sedimentation, decantation and filtration.

8. What is sedimentation?

The mixture of insoluble solids and liquid is taken in a beaker and the solid substances are allowed to settle down as sediments. This is known as sedimentation. The clear liquid above the sediment is called supernatant liquid. e.g. a mixture of sand and water

9. What is decantation?

Transferring the clear liquid (supernatant liquid) into another container using a glass rod is called decantation.

10. What is filtration?

Filtering the impure particles using papers is called as filtration.

11. What is filtrate?

The liquid drains through pores of the filter paper. The clear liquid that is collected in the beaker is known as filtrate.

12. What is residue?

The dust particles that remain on the filter paper is called "residue".

13. What are the Methods of separation of solid substances dissolved in liquids?

Evaporation and condensation processes are used to separate solid substances dissolved in liquids

14. What is evaporation?

Evaporation is a process in which a liquid changes into vapour on heating. Evaporation method is used to separate dissolved solids from liquids.

15. What is condensation?

When the vapours of a substance get cooled, they condense into liquid. This process is known as condensation.

16. Name some products that undergo more than one method of separation?

More than one method of separation are used to extract metals like iron, gold, aluminium and copper in pure state, from their ores.

## 3. Changes Around Us

1. Who was the first Indian born American woman who travelled to space?

Kalpana Chawla was the first Indian born American woman who travelled to space in the space shuttle Columbia.

2. What is considered to be changes?

Changes in colour, temperature, place, shape and size of the substances are considered as changes

3. What are slow changes?

Changes that take place in a few hours, days, months or years are called slow changes.

4. What are fast changes?

The changes that take place in a short duration of time are called fast changes

5. Which turns into coal?

Trees which got buried under the earth nearly 30 crore years ago had undergone many changes and turned into coal.

6. What are reversible changes?

In some changes, the substance can be brought back to its original state. Such changes are called reversible change

7. What are irreversible changes?

The change in which the substance cannot be converted back into its original form is called irreversible change.

8. What are desirable changes?

Changes like raining, ripening of fruits, blooming of flowers, etc. are useful to us. Such useful changes are called desirable changes

9. What are undesirable changes?

Changes like spoiling of food, eruption of volcano, rusting of iron, breaking of glass are not liked by us, as they are harmful and not useful to us. Changes which are not useful to us are called undesirable changes.

10. What are periodic changes?

The changes that occur at regular intervals are called periodic changes.

11. What are non-periodic changes?

The changes that do not occur at regular intervals are called non-periodic changes.

12. What are the difference between periodic and non periodic changes?

- Occur at regular intervals. Can be predicted e.g. weather

- Do not occur at regular intervals. Cannot be predicted e.g. earthquake

13. What are exothermic changes?

Changes in which heat is liberated are called exothermic changes. E.g .burning of a matchstick, dissolution of detergent or washing soda in water.

14. What are endothermic changes?

Changes in which heat is absorbed are called endothermic changes. E.g. Dissolution of glucose or ammonium chloride in water.

15. Who invented Velcro?

Invention of Velcro by George Mestral in the year 1948 is a right example for this.

George Mestral used to go for a walk with his pet dog daily. One day he found that some seeds were hooked on his clothes and on the fur of his dog. He observed these seeds under a microscope and found some hook like structures on them. Based on this he tried to create a new thing.

## 4. Matter in our Surrounding

1. What is mass?

In the World of Science, matter is anything that has mass and occupies space.

2. How is atom measured?

The size of the atoms and molecules of matter is very small, almost beyond our imagination. It is measured in nanometres (1nm = 10-9m).

3. What is matter made of?

Matter is made up of tiny particles known as atoms and molecules. Molecules are made up of atoms. Molecules and atoms are the building blocks of matter

4. What are the characteristics of molecules?

- There exists a space between the molecules in matter
- The molecules of matter continuously move and mix with each other
- Molecules of matter have force of attraction between them.

5. What are the physical states of matter?

Matter can exist in three physical states, i.e., solid, liquid and gas.

6. What are solids?

Solids are characterized by definite shape, size and volume. In solids, the molecules are very closely arranged because the force of attraction between the molecules is very strong. They are incompressible.

7. What are fourth and fifth state of matter?

Matter exists in two more states.

- Fourth State of Matter -Plasma- super heated gaseous State.
- Fifth State of Matter - 'Bose-Einstein condensate' – super cooled Solids.

8. What is liquid?

Liquids occupy definite volume but have no definite shape. It takes the shape of the container.

9. What is gas?

The atoms or molecules of matter that always occupies the whole of the space in which they are contained is called a gas

10. Name some compressed gas?

The Liquefied Petroleum Gas (LPG) cylinder that we get in our home for cooking and the oxygen supplied to hospitals in cylinders are compressed gases. These days Compressed Natural Gas (CNG) too, is used as fuel in vehicles.

11. Why does the smell of hot cooked food spread out easily?

Here the particles of the aroma of food mix with the particles of air in the kitchen and spread out from the kitchen very easily. This is due to

(i) The free particles or molecules of gas in aroma and air.

(ii) The high speed of the gaseous particles or molecules.

(iii) The large space between them.

So gases diffuse much faster than solids and liquids.

12. What are the properties of solid?

- Have definite shape and volume
- Cannot flow
- Intermolecular space is minimum
- Intermolecular forces are maximum
- They are incompressible

13. What are the properties of liquid?

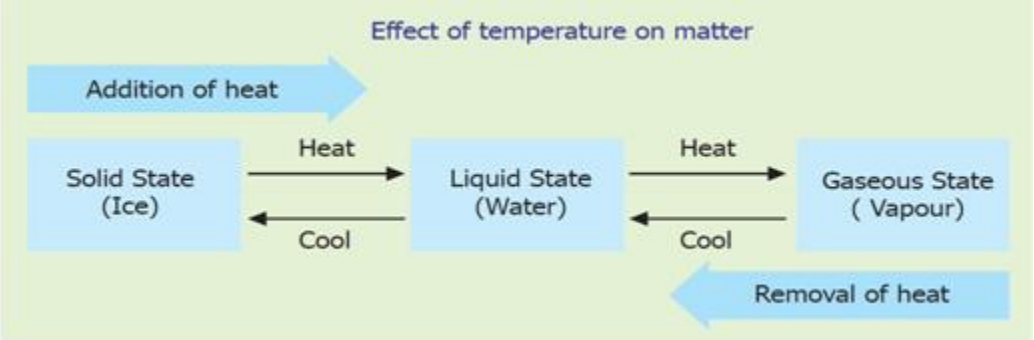
- Have definite volume but no definite shape
- Can flow from higher level to lower level
- Intermolecular space is moderate
- Intermolecular forces are less than solid
- They are compressible to an extent

14. What are the properties of gas?

- Have neither definite shape nor definite volume
- Can flow very easily and quickly in all directions
- Intermolecular space is maximum
- Intermolecular forces are negligible

- They are easily compressible

15. What is the effect of temperature on matter?




16. What is various state of matter of water?

Water can exist as three states of matter.

• Solid, as ice.

• Liquid, as water

• Gas, as water vapour

17. What is melting point?

The temperature at which a solid melts to become a liquid is called its melting point. The melting point of ice is $0^{o}$ C

18. What is boiling point?

The temperature at which a liquid starts boiling is known as its boiling point. The boiling point of water is $100^{o}$ C.

## 5. Matter and its Nature

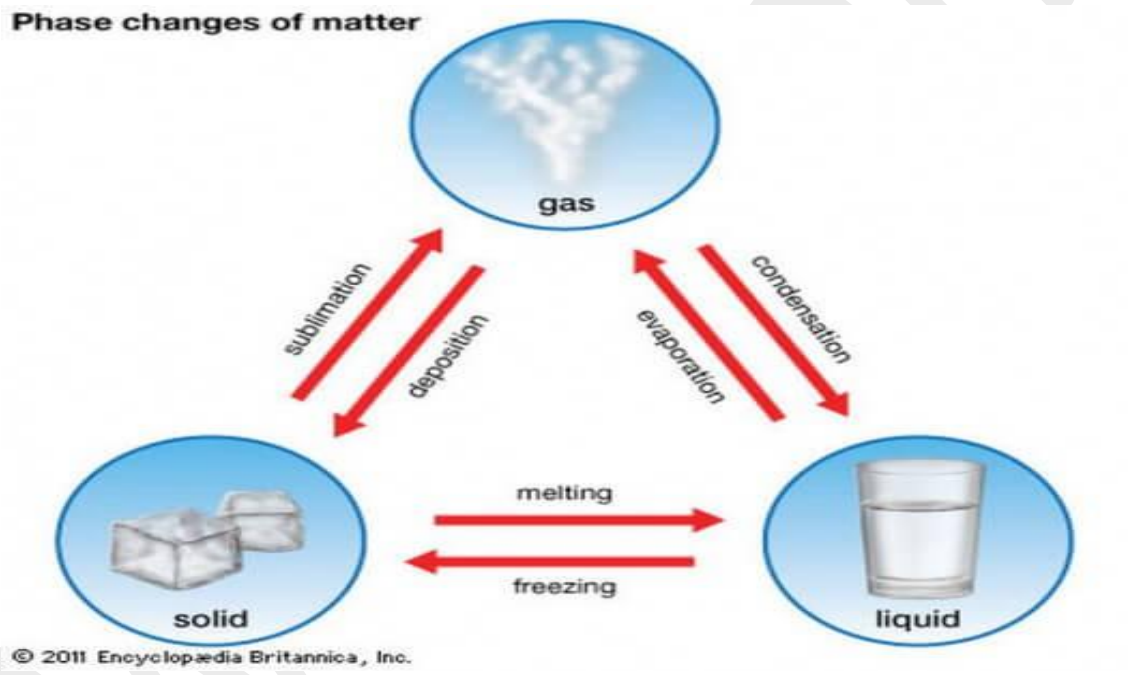
1. What is crystallization?

The copper sulphate in crystals that is dissolved in water have turned into crystals again. Therefore, dissolution of copper sulphate is a physical change. We also observe that the newly formed crystals have definite geometrical shape and size. Thus crystals of pure substance can be obtained from their solution. This process of crystal formation is known as crystallization.

2. What is sublimation?

The process of converting a solid directly into its gaseous state is known as sublimation.

3. What are the changes of water?




4. What is melting?

Solids change into liquids on heating. This process is called melting.

5. What is evaporation?

Liquids change to gas on heating. This process is called evaporation.

6. What is condensation?

The vapour, when allowed to cool, condenses into its liquid state. This process is called condensation.

7. What is freezing?

Water, when cooled to zero degrees, changes into ice. This process is called freezing.

8. What is physical change?

A physical change occurs when the substance changes its physical state but does not change its chemical composition. A change in which a substance undergoes changes only in its physical properties is called a physical change. A physical change is generally reversible and no new substance is formed.

9. What is rusting?

If you leave an iron object such as bolt or iron rod in the open air or in the rain, a reddish brown layer is deposited on its surface. The layer thus formed is called rust and the process is called rusting.

10. What is rust?

In the presence of moisture, iron reacts with oxygen present in air to form hydrated 'iron oxide' known as rust.

11. For which we can give Burning of a candle as best example?

Burning of a candle is an example of a chemical change. Wax molecule is converted into carbon dioxide and water molecules.

12. Which is responsible for bright colours, aroma and flavour of many fruits and vegetables?

Phenolic compounds are responsible for the bright colours, aroma and flavour of many fruits and vegetables. They reduce the risk of heart disease and certain types of cancer.

13. What is melanin?

Vegetables and fruits turn brown on cutting. It is due to the reaction between the phenolic compound in fruits and the oxygen in air. Phenolic compound and oxygen react to form a brown pigment known as melanin.

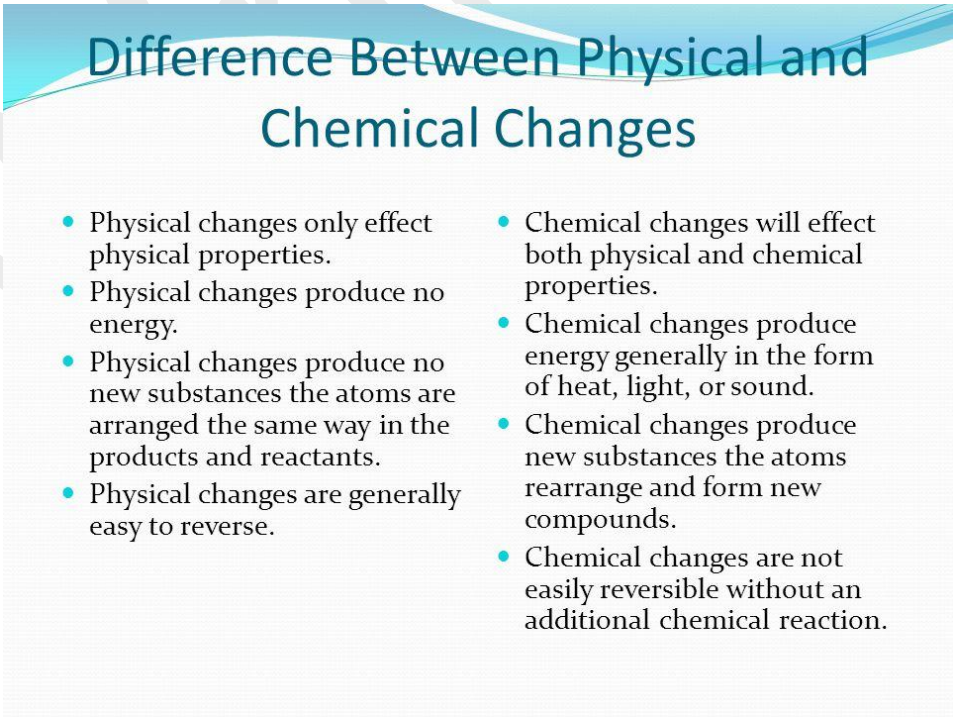
14. What is chemical change?

Any change that results in the formation of one or more new substances is called a chemical change. A complete and permanent change in the properties of the substance is produced in the process. A chemical change is also referred to as a chemical reaction

15. Why did iron pillar become famous?

In New Delhi, near Qutub Minar, stands an iron pillar which is more than 7 meters tall and weighs more than 6000 kg. It was built 1,600 years ago. Strangely, even after such a long period of time, it has not rusted. Scientists from all over the world have examined its quality of rust resistance. It shows the advancement India had made in metallurgy technology as far back as 1600 years ago.

16. What are the difference between physical change and chemical change?



17. What is acid?

Curd, lemon juice, orange juice and vinegar taste sour. These substances taste sour because they contain acids. The chemical nature of such substances is acidic. The word ‘acid’ comes from the Latin word ‘acidus’ which means sour.

18. How are acid classified?

Acids can be classified into two categories namely organic acids and mineral acids or inorganic acids.

19. What is organic acid?

Acids which are obtained from animal and plant materials are called organic acids. Many such acids are found in nature. Lemon and orange contain citric acid.

20. What are mineral acid?

Acids that are obtained from minerals are called mineral acids or inorganic acids. For example, Hydrochloric acid, Nitric acid, Sulphuric acid

21. What are bases?

Bases are oxides or hydroxides of metals. They are chemically opposite to acids. Some bases like caustic soda [Sodium hydroxide] and caustic potash [Potassium hydroxide] are very corrosive.

22. What are alkalies?

Bases which are soluble in water are called Alkalies. The hydroxides of Sodium and Potassium are examples of alkalies. They are water soluble bases. All alkalies are bases, but not all bases are alkalies. The word ‘alkali’ is derived from the Arabic word ‘alquili’ which means plant ashes. Ashes of plants are composed mainly of sodium and potassium carbonates.

23. Name the other names for the following?

- Quicklime Calcium oxide

- Potassium hydroxide Caustic potash
- Calcium hydroxide Slaked lime
- Sodium hydroxide Caustic soda
- Magnesium hydroxide Milk of magnesia

24. Name the base and state where it is found?

- Calcium hydroxide Lime water
- Ammonium hydroxide Window cleaner
- Sodium hydroxide/ Potassium hydroxide Soap
- Magnesium hydroxide Antacid

25. Name some indicator and its colour in acid and colour in base

| Indicator | Colour in Acid | Colour in base |
|---|---|---|
| Litmus | Red | Blue |
| Phenolphthalein | Colourless | Pink |
| Turmeric powder | Yellow | Brick red |
| Beetroot juice | Pink | Pale yellow |
| Red cabbage juice | Pink/Red | Green |

26. What is litmus?

The most commonly used natural indicator is litmus. It is extracted from lichens and it has a purple colour when put in distilled water. When added to an acidic solution, it turns red and

when added to a basic solution, it turns blue. It is available in the form of solution or in the form of strips of paper known as litmus paper. Generally, it is available as red and blue litmus paper.

27. What are the properties of acid?

- They have a sour taste.
- Strong acids are corrosive in nature.
- Hydrogen is the common element present in all acids. However, all compounds containing hydrogen are not acids. For instance, ammonia, methane and glucose are not acids.
- They react with metals and produce hydrogen.
- Metal + Acid Salt + Hydrogen gas
- Acids turn blue litmus in to red.
- The indicator phenolphthalein is colourless in acids.
- The indicator methyl orange is red in acids.
- They are good conductors of electricity.

28. What are uses of inorganic acid?

- Chemical laboratories as reagents.
- Industries for manufacturing dyes, drugs, paints, perfumes, fertilizers and explosives.
- The extraction of glue from bones and metals from their ores.
- Preparation of gases like Carbon dioxide, Hydrogen sulphide, Hydrogen, Sulphurdioxide etc.
- Refining petroleum.

29. What are the uses of organic acid?

- As food preservatives.
- As a source of Vitamin C.
- For preparation of baking soda.
- To add flavour to foodstuffs and drinks.

30. What are the properties of bases?

- Bases are bitter in taste.
- Strong bases are highly corrosive in nature.
- Generally, they are good conductors of electricity.
- Basic solutions are soapy to touch.
- Bases turn red litmus paper into blue.
- Bases are compounds that contain hydroxide ions

31. What are the uses of bases?

- in chemical laboratories, as a reagent
- in industries, for manufacturing soap, textile and plastic.
- for the refining of petroleum.
- for manufacturing paper, pulp and medicine.
- to remove grease and stains from clothes.

32. What is neutralization?

Neutralisation can be defined as a chemical reaction that takes place between an acid and a base. In this process, salt and water are produced with the evolution of heat

33. Which is called as king of chemicals?

Sulphuric acid (H2SO4) is called the king of chemicals, because of its industrial importance. The amount of sulphuric acid that a country uses indicates the economy of country. Fluorosulphuric acid (HFSO3) is one of the strongest acids.

34. What is salt?

Salt is a substance formed by the neutralisation of an acid with a base.

Sodium hydroxide + Hydrochloric acid ----------→Sodium chloride + Water + Heat (Base) (Acid) (Salt)

35. Name of acid and how salt is formed?

- HCl Chloride __Sodium chloride, ___Copper chloride, ___Ferric chloride
- HNO3 Nitrate__ Sodium nitrate, ____Copper nitrate, ___Ferric nitrate

36. Name of salt and its uses?

For the human body

Calcium phosphate, Calcium lactate, Ferrous sulphate, Sodium chloride etc.

Uses: For the proper functioning of the human body.

For domestic purposes

Sodium chloride, Sodium bicarbonate, Hydrated potassium, aluminium sulphate

Uses: Used as a preservative/ To add taste to our food In baking/ in effervescent drinks. In purification of water

37. What is indigestion?

Our stomach contains hydrochloric acid. It helps us digest the food we eat. Secretion of excess acid in the stomach will cause stomach upset or indigestion. Sometimes indigestion becomes painful. We take an antacid such as milk of magnesia to neutralize the excess acid.

38. What is ant bite?

When an ant bites, it injects acidic liquid (Formic acid) into the skin. The effect of the acid can be neutralized by rubbing the bitten area with moist baking soda or calamine solution (Zinc Carbonate).

39. What are factory waste?

The wastes of many factories contain acids. If they are allowed to flow into the water bodies, the acids will kill the fish and other organisms. The factory wastes are therefore, neutralised by adding basic substances.

40. What is soil treatment?

Excess use of chemical fertilizers makes the soil acidic. When the soil is acidic, plants do not grow well. So it is treated with bases. If the soil is basic, the organic matter releases acids, which neutralises the basic nature of soil.

## 6. Combustion and Flame

1. How did people live before invention of fire?

In the Stone Age, people never knew the use of fire. They ate raw food. Accidently they discovered that by rubbing two stones together, they could produce fire. Later they used fire for cooking, getting light and for safeguarding their lives from animals.

2. How is fire obtained?

Fire is obtained by the rapid oxidation of a substances in the chemical process of combustion, releasing heat, light and various other products.

3. What is combustion?

Combustion is the burning of substances in air or oxygen to release heat and light.

4. What is fuel?

The substance that undergoes combustion is called fuel.

5. How are fuel classified?

There are many substances that can burn. They can be classified depending on their state state as solid, liquid and gas. Cowung, coal and firewood are solid fuels. Kerosene and petrol are liquid fuels. LPG, coal gas, natural gas and bio-gas are gaseous fuels.

6. What is combustible substances?

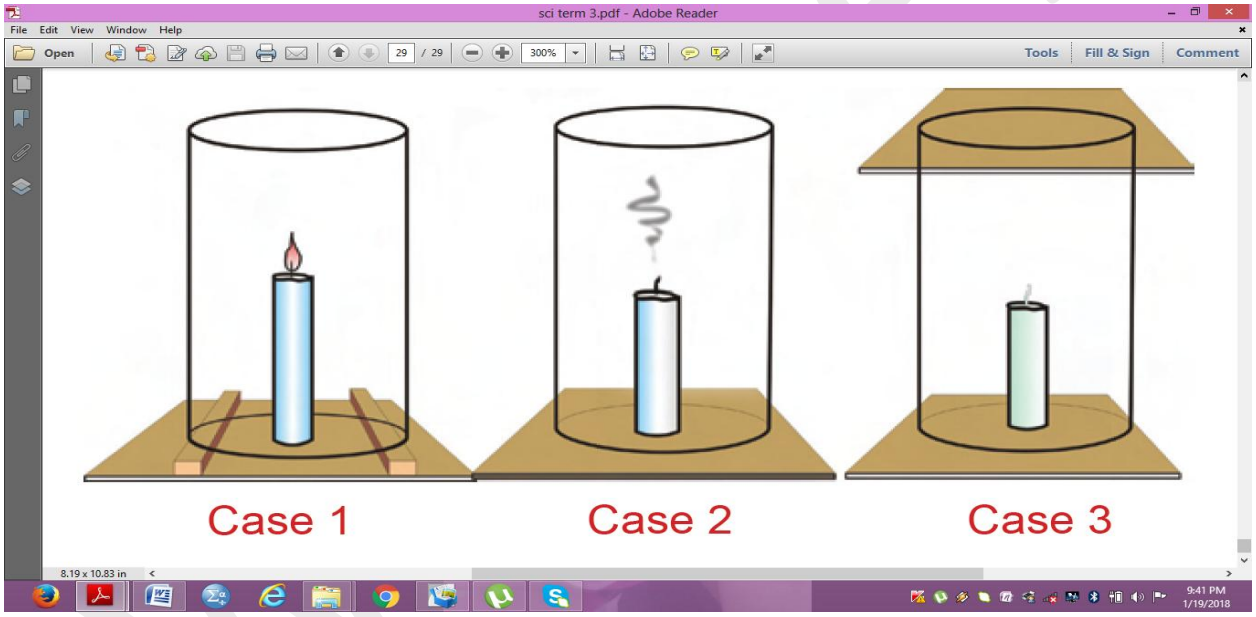
The substances that undergoes combustion are called combustible substances.

7. What is non-combustible substances?

Substances like paper, straw, wood, matchsticks, etc. are combustible substances. Substances like stone, glass, iron nails, etc. do not burn on being exposed to flame. Such substances are called non-combustible substances.

8. Give a proof for air is essential for burning?

The candle burns freely in case 1 when air can enter the chimney from the bottom. In case 2, when air does not enter the chimney from the bottom, the flame flickers and produces smoke. In case 3 the flame finally goes off, because the air is not available. Therefore you can easily understand that air is necessary for combustion.




9. What is ignition temperature?

A fuel has to be heated to a certain minimum temperature before it can catch fire. This temperature is different for different fuels. Some substances catch fire immediately, while some take a longer time. The lowest temperature at which a fuel catches fire is called its ignition temperature.

10. What are the different types of combustion?

Combustion can be of different types. It can be spontaneous, rapid, slow and incomplete.

11. What is spontaneous combustion?

Some combustion reactions take place without the application of heat energy. When white phosphorus is exposed to air at room temperature, it catches fire immediately; even without being lit by a match stick. This type of combustion reaction that occurs without the help of any external heat source is called spontaneous combustion.

12. What is rapid combustion?

The gas burns rapidly. Such combustion is known as rapid combustion. Bursting of fire crackers, burning of camphor, magnesium ribbon in air, gas in a burner and kerosene in a stove are good examples of rapid combustion.

13. What is slow combustion?

Combustion that takes place at a very slow rate is called slow combustion. During this type of combustion low heat and light are produced. Food oxidized in our body to release energy is an example of slow combustion.

Carbohydrates + Oxygen ----------→Carbon dioxide + water + heat energy

14. What is incomplete combustion?

Combustion takes place in the presence of oxygen. If the supply of oxygen is insufficient, then combustion will be incomplete. This is called incomplete combustion. Carbon forms carbon monoxide when it undergoes incomplete combustion.

Carbon + Oxygen --------→carbon monoxide

15. How does rusting of iron takes place?

Rusting of iron is another good example of slow combustion. During rusting, iron is oxidized and energy is released, but the process is very slow. So we cannot see how it happens.

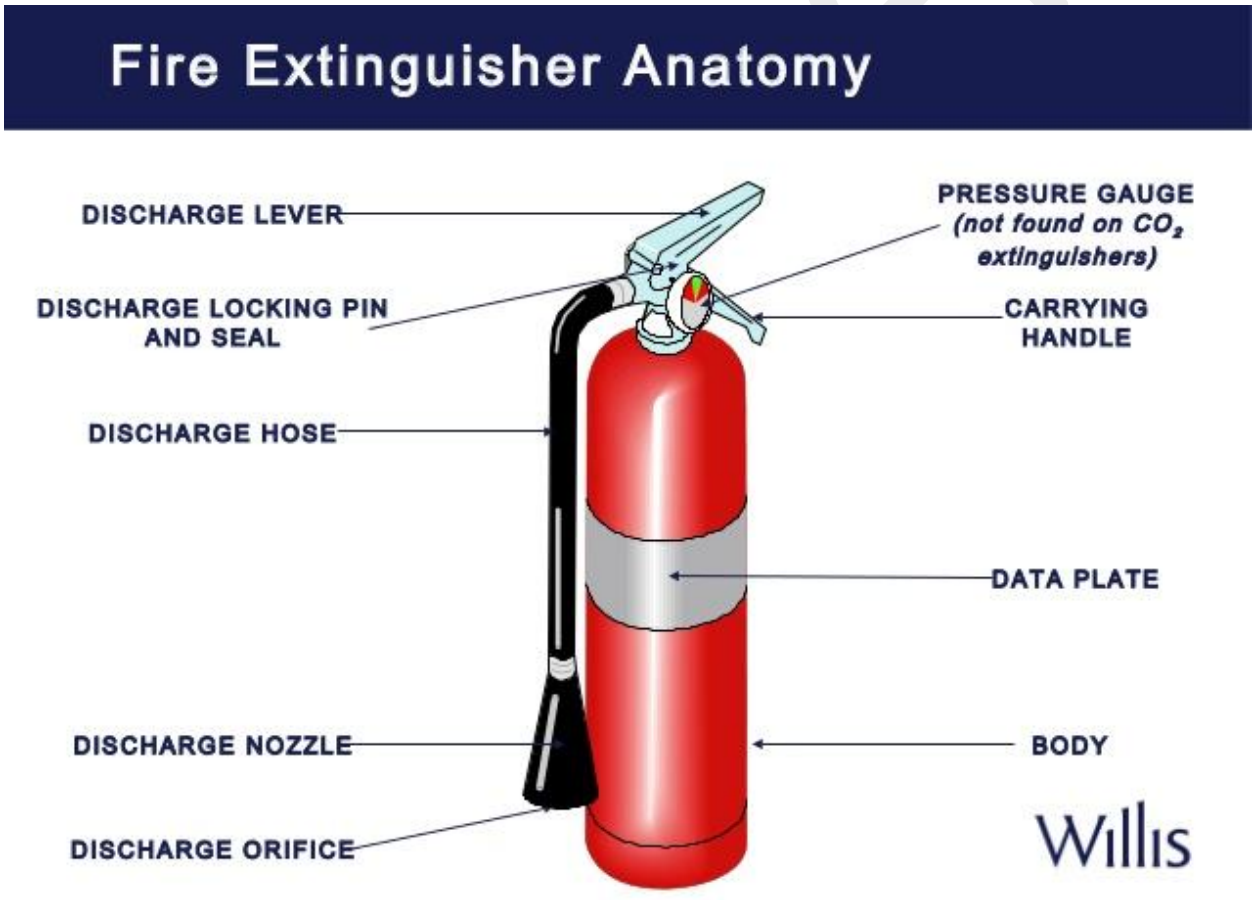
16. How to stop fire?

- removing any combustible substances near the region of fire;
- cutting off the supply of air by using sand or blanket;
- bringing down the ignition temperature by using water;

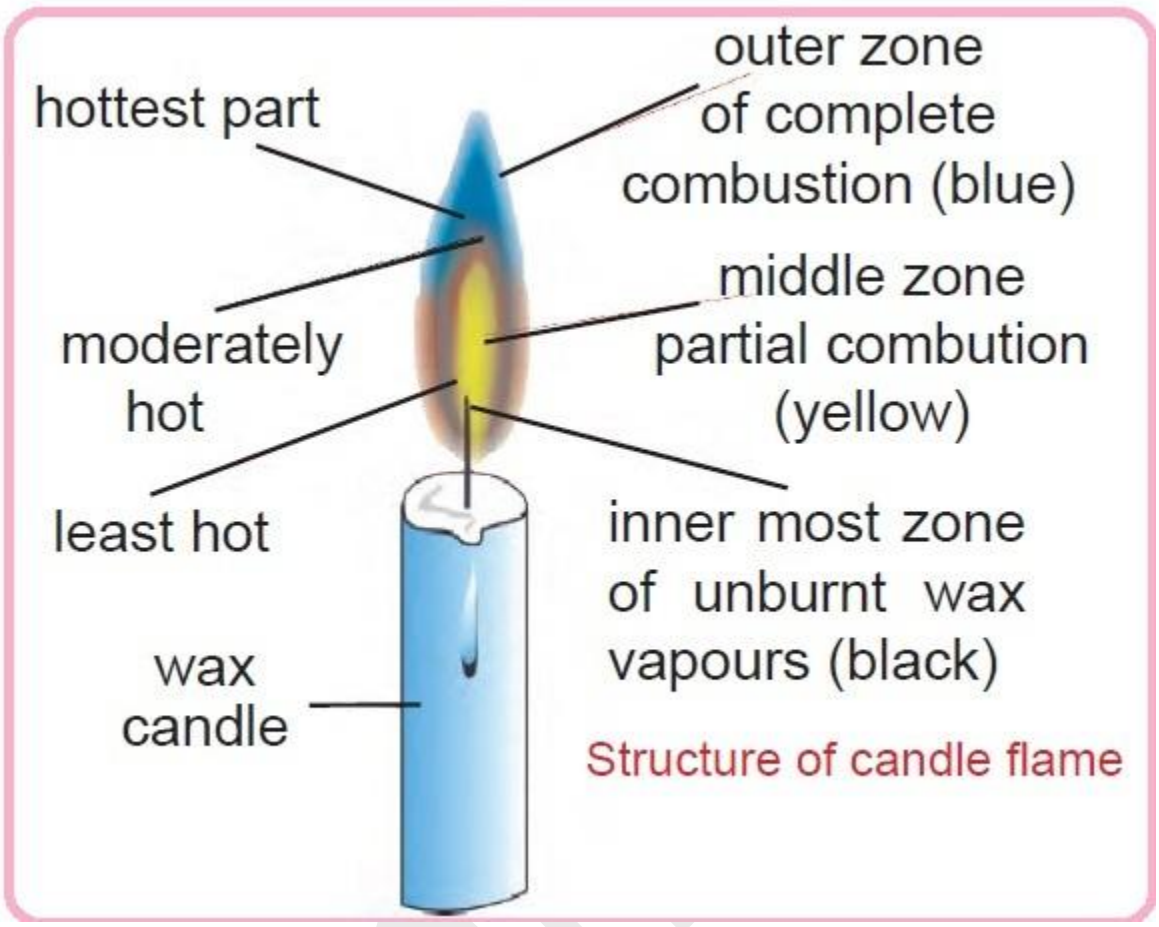
17. Can we use water for oil fire?

Usually sand and water are thrown on burning substances to extinguish fire. Sand reduces the supply of air and cools it. Water should not be used for oil fire. Oil being lighter, floats, spreads and causes severe damage. So, oil fire should be extinguished by using substances like foamite.

18. Mark parts of fire extinguisher




19. Mark parts of candle.




20. What are the various zone in candle?

Zone of non-combustion: This is the dark zone that lies around the wick. It contains unburnt gas particles. No combustion takes place here as no oxygen is available.

Zone of partial combustion: In this zone, the hydrocarbons present in the oil gas from wax decompose into free carbon and hydrogen. The unburnt carbon particles impart a pale yellow colour to the flame. This is the luminous part of the flame.

Zone of complete combustion (blue) : This is the non-luminous thin zone of the flame. It is the outermost hottest region in the flame that is invisible. Here, carbon and hydrogen are completely oxidized to carbondioxide and water vapour.

Hydrocarbon + Oxygen --------→Carbondioxide (blue flame) + Water (vapour)

21. What is the free call number for ambulance?

108

22. What is fuel?

Any substance that can be burnt or otherwise consumed to produce heat energy is called a fuel. Wood, natural gas, petrol, kerosene, diesel, coal, and LPG are commonly used as fuels.

23. What are the characteristics of good fuel?

- It should be cheap and readily available.
- It should be easy to store, transport and handle.
- It should not produce toxic fumes or smoke or other harmful products on combustion.
- The amount of soot or ash left behind should be minimum.
- It should have a high calorific value.
- It should have a low ignition temperature.

24. What is Calorific Value?

The main constituents of fuels are hydrocarbons. During combustion, these hydrocarbons get oxidized to form carbon dioxide and water. Heat is evolved in this process (exothermic process).

Hydrocarbon + Oxygen-----→ Carbon dioxide + Water + Heat energy

25. What are the types of fuel?

There are three types of fuels. They are solid, liquid, and gaseous fuels.

26. What is solid fuel?

Coal, wood, charcoal, coke, and paraffin wax are some commonly used solid fuels. The drawbacks of solid fuels are as follows:

- They have a high ignition temperature.
- They produce a large amount of residue (soot, ash) after combustion.

- Their calorific value is low.

27. What is liquid fuel?

Petrol, kerosene, and diesel are some commonly used liquid fuels which are obtained from petroleum (an oily mixture of hydrocarbons in its crude form). Ethyl alcohol is also a liquid fuel. Locomotives, buses, and lorries use diesel as fuel.

28. What are gaseous fuel?

Gases such as methane, carbon monoxide and hydrogen are combustible. Natural gas, producer gas, coal gas, water gas, LPG (Liquefied Petroleum Gas), and biogas (gobar gas) are other examples of gaseous fuels. Gaseous fuels are

preferred over solid and liquid fuels because of the following advantages:

- They have a low ignition temperature.
- They burn completely (complete combustion) and leave no residue (soot, ash, smoke).
- They are easy and safe to handle, transport, and store.
- They have a high calorific value.
- They are cheap.

29. What is natural gas?

Natural gas is obtained from petroleum wells. It contains a mixture of hydrocarbons (methane and ethane). It is one of the cheapest available gaseous fuels.

30. What is LPG?

LPG (Liquefied Petroleum Gas): It is the most widely used gaseous fuel for cooking. LPG is a mixture of propane (15%) and butane (85%) liquefied under pressure. It has a high calorific value. A small amount of ethyl mercaptan, an inert gas with a characteristic odour, is added to LPG to detect any leakage.

31. What is biogas?

Gobar gas contains a mixture of methane and ethane and is a very cheap form of gaseous fuel. Gobar gas is becoming increasingly popular in villages, where cattle can be maintained in large numbers. It is also comparatively less expensive.

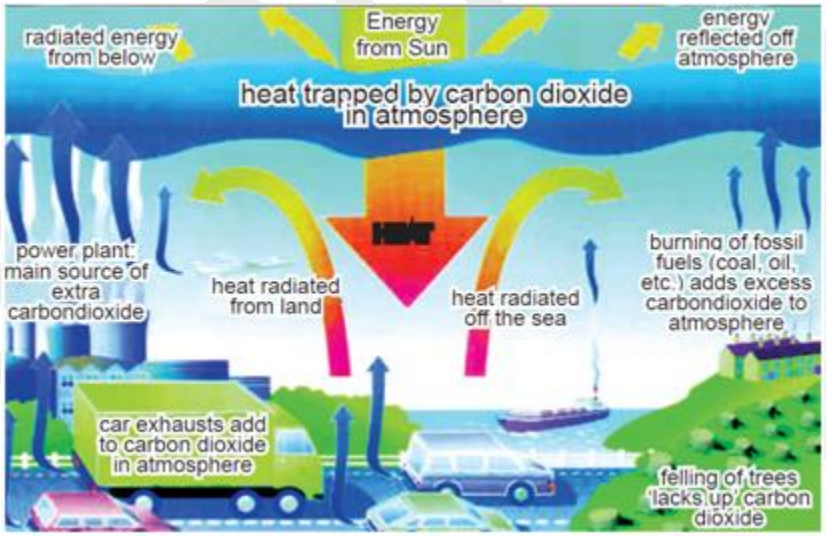
32. What is acid rain?

Burning of coal and diesel releases sulphur dioxide. It is an extremely suffocating and corrosive gas. Moreover, petrol engines give off gaseous oxides of nitrogen. Oxides of sulphur and nitrogen dissolve in rain water and form acids. Such rain is called Acid Rain. It is very harmful for crops, buildings and soil.

33. What is global warming?

It is the rise in temperature of the atmosphere of the earth. This results, in the melting of polar glaciers, which leads to a rise in the sea level, causing floods in the coastal areas. Low lying coastal areas may even be permanently submerged.

34. Mark global warming process




## 7. Elements and Compounds around Us

1. What is pure substance?

A pure substance has fixed composition and fixed properties which cannot be easily separated by physical methods. For example, pure water boils at 100°C at one atmospheric pressure and ice freezes at 0°C. These are the properties of all samples of pure water, regardless of their origin. Pure water contains only two hydrogen atoms and an oxygen atom which cannot be separated by physical methods.

2. What are elements?

The unscrambled words such as iron, copper, gold, oxygen and carbon that we come across in our daily life are said to be elements

3. What is atom and molecule?

An atom is the smallest particle of an element. A molecule is made up of the same kind of atoms or different kinds of atoms

4. What are the different views of elements by scientist?

● An element is a pure substance that cannot be split into anything simple by physical or chemical methods. (BOYLE)

● An element is the basic form of matter that cannot be broken into a simpler substance. (LAVOISIER)

● An element is made of same kind of atoms. (Modern atomic theory)

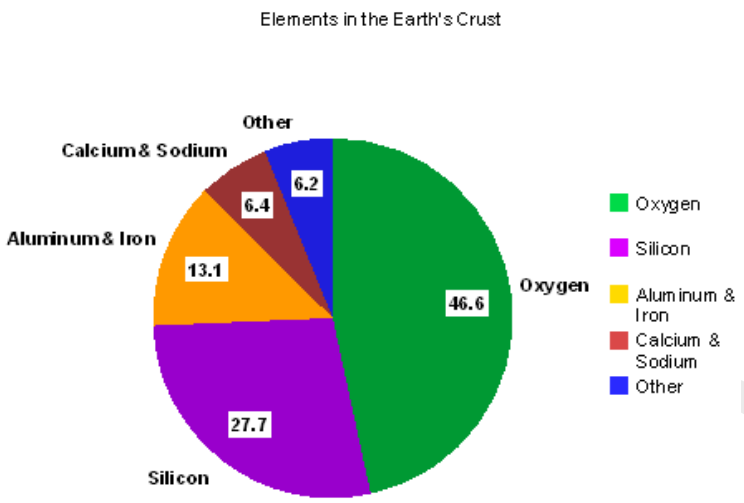
5. What is the equation for mercuric acid?

Mercuric oxide → Mercury + Oxygen (element) (element)

6. How is sliver chloride obtained?

Silver(white elemet) Sunlight --------→Silver (grey element) + Chlorine chloride( Greenish Yellow element)

7. What are the percentage of elements in earth?

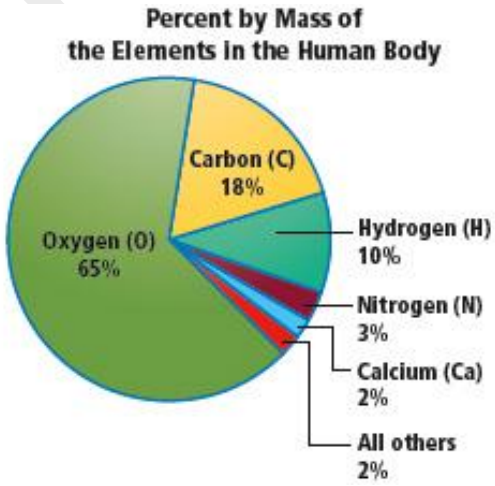



8. **Do you know how many elements exist in nature?**

There are **118** elements known at present, out of which **92** elements occur in nature and the remaining **26** have been prepared in laboratory by artificial methods. However, only 112 elements have been authenticated by IUPAC (International Union of Pure and Applied Chemistry), and are allotted symbols.

9. What are the elements found in body?

About 99% of the mass of human body is made up of six elements (oxygen, carbon, hydrogen, nitrogen, calcium and phosphorus) and the rest 1% by other elements.



Oxygen (65%), Carbon (18%), Hydrogen (10%), Nitrogen (3%), Calcium (2%) along with some other elements.

10. How are elements classified?

The elements are classified on the basis of their state of subdivision as solids, liquids and gases.

**Liquids:** Mercury, bromine, (at room temperature) cesium and gallium can exist in liquids around 30° C.

**Gases:** Hydrogen, nitrogen, oxygen, chlorine, fluorine, helium, neon, argon, krypton, radon and xenon.

**Solids:** Remaining elements are solids. e.g. Carbon, silicon, copper, gold etc.

11. How are elements classified based on properties?

The known elements are classified on the basis of their properties as **metals, non-metals** and **metalloids.**

**Metals:** Of the 92 natural elements 70 elements are metals. Metals are hard lustrous (shining in appearance), malleable( can be beaten into very thin sheet) ductile(drawn into wire), good conductors of heat and electricity, and sonorous (producing sound) e.g. Copper, gold, silver, iron etc,.

**Non-metals:** Only about 16-17 elements are soft, non lustrous, non-malleable, non-ductile, bad conductors of heat and electricity, and non-sonorous. e.g. Hydrogen, oxygen, sulphur, carbon etc,.

**Metalloids:** Very few semi-metals are known as metalloids which shows properties of metals as well as non metals. e.g. Boron, silicon, germanium etc.

12. Why do we use symbol?

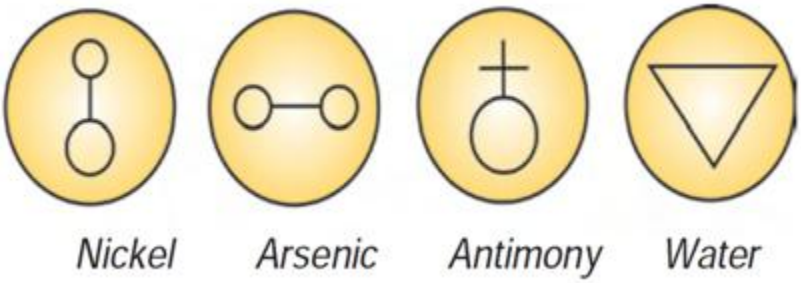
Every chemical change can be conveniently represented in the form of chemical equation. This is because describing a chemical change with the names of substances becomes difficult. So, we need symbol for an element.

13. What is symbol?

A symbol is a shortened form of the name of an element.

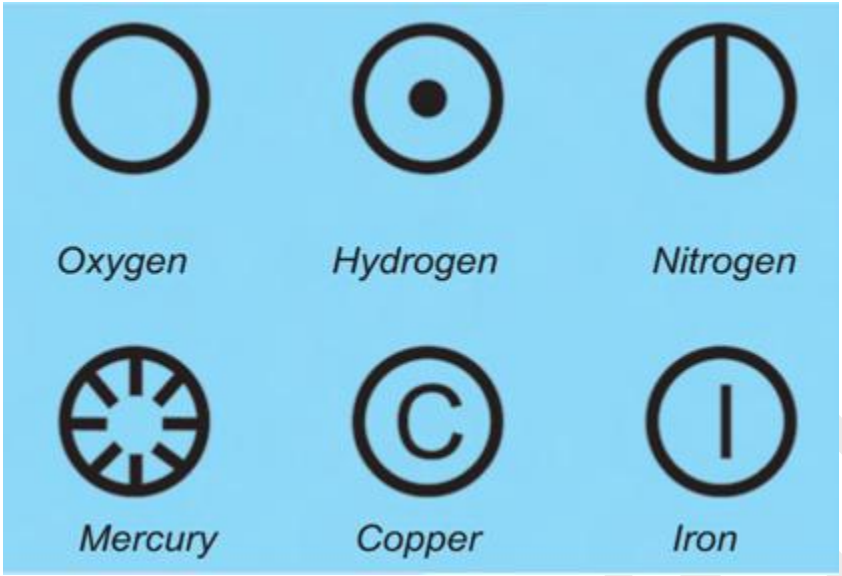
14. Name some Alchemist symbols?

In the days of alchemists, the different materials that they used were represented by pictorial symbols. The work of trying to change less valuable metal into gold was called **alchemy,** and the men who did this work were **alchemists.**




15. What is Dalton's symbol?

In 1808, **John Dalton**, English scientist tried to name the various elements based on these pictorial symbols.




The uses of the above symbols are difficult to draw and inconvenient to use. Hence, Dalton, symbols are not used; it is only of historical importance.

16. What is Berzelius symbols?

In 1813, **Jon Jakob Berzelius,** Swedish chemist devised a system using letters of alphabet. He argued that letters should be used because they could be written more easily than other signs. The modified version of Berzelius system follows under the heading 'System for Determining Symbols of the Elements'

17. Name some elements and symbols.

| Chemical Elements Number Name Symbol Chart 1 - nicholasacademy.com | | |
|---|---|---|
| 1 - Hydrogen H | 21 - Scandium Sc | 41 - Niobium Nb |
| 2 - Helium He | 22 - Titanium Ti | 42 - Molybdenum Mo |
| 3 - Lithium Li | 23 - Vanadium V | 43 - Technetium Tc |
| 4 - Beryllium Be | 24 - Chromium Cr | 44 - Ruthenium Ru |
| 5 - Boron B | 25 - Manganese Mn | 45 - Rhodium Rh |
| 6 - Carbon C | 26 - Iron (Ferrum) Fe | 46 - Palladium Pd |
| 7 - Nitrogen N | 27 - Cobalt Co | 47 - Silver (Argentum) Ag |
| 8 - Oxygen O | 28 - Nickel Ni | 48 - Cadmium Cd |
| 9 - Fluorine F | 29 - Copper (Cuprum) Cu | 49 - Indium In |
| 10 - Neon Ne | 30 - Zinc Zn | 50 - Tin (Stannum) Sn |
| 11 - Sodium (Natrium) Na | 31 - Gallium Ga | 51 - Antimony (Stibium) Sb |
| 12 - Magnesium Mg | 32 - Germanium Ge | 52 - Tellurium Te |
| 13 - Aluminium (Aluminum) Al | 33 - Arsenic As | 53 - Iodine I |
| 14 - Silicon Si | 34 - Selenium Se | 54 - Xenon Xe |
| 15 - Phosphorus P | 35 - Bromine Br | 55 - Caesium (Cesium) Cs |
| 16 - Sulfur S | 36 - Krypton Kr | 56 - Barium Ba |
| 17 - Chlorine Cl | 37 - Rubidium Rb | 57 - Lanthanum La |
| 18 - Argon Ar | 38 - Strontium Sr | 58 - Cerium Ce |
| 19 - Potassium (Kalium) K | 39 - Yttrium Y | 59 - Praseodymium Pr |
| 20 - Calcium Ca | 40 - Zirconium Zr | 60 - Neodymium Nd |

18. Name some elements name derived from countries name

| Name | Symbol | Name derived from |
|---|---|---|
| Americium | Am | America (Country) |
| Europium | Eu | Europe(Country) |
| Nobelium | No | Alfred Nobel(scientist) |
| Iodine | I | Violet (colour, greek) |
| Mercury | Hg | God mercury (mythologic character) |
| Plutonium | Pu | Pluto (planet) |
| Neptunium | Np | Neptune (planet) |
| Uranium | U | Uranus (planet) |

19. How to write symbols?

While writing a symbol for an element, one has to follow the method given below.

1. If the element has a single English letter as a symbol, it should be written in capital letter.

2. For elements having two letter symbols, the first letter should be in capital followed by small letter.

20. What are the significance of symbol?

Symbol of an element signifies

● Name of the element

● One atom of the element

For example,

● The symbol N stands for the element of nitrogen

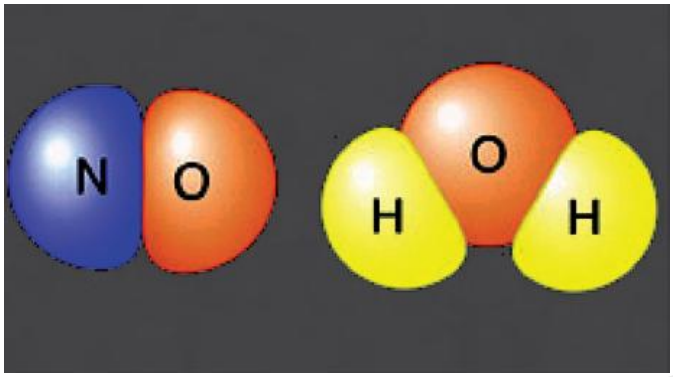
● One atom of nitrogen

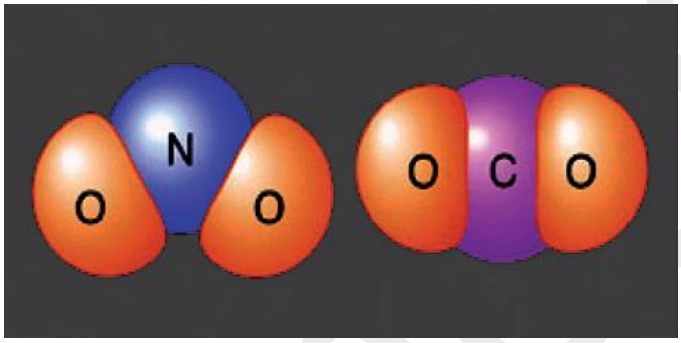
21. What is molecule of element?

The molecule of an element contains two or more similar atoms. For example, a molecule of chlorine contains two atoms of chlorine; it is therefore written as Cl2 (Chlorine). Similarly, a molecule of nitrogen contains two atoms of nitrogen; it is therefore written as N2 (Nitrogen). Molecules like chlorine and nitrogen which consist of two atoms of the same kind, are called diatomic molecules. A molecule of ozone consists of three atoms of oxygen and is represented as O3. Similarly, some molecules, like phosphorus (P4) and sulphur (S8), consists of more than two similar atoms.

22. What is compound?

We have learnt that there is limited number of elements (<120), but number of compounds is unlimited.




When two or more elements combine in a fixed ratio by mass, they form compound. For example, water is a compound made of two hydrogen atoms and one oxygen atom in the ratio 2 :1 by volume or 1 : 8 by mass. A compound is a pure substance composed of two or more elements combined together chemically in a fixed ratio by mass.

23. What is aluminium iodide?

The greyish black compound formed is aluminium iodide.

2Al (element) +3I2(element) → 2AlI3 (compound)

24. What are the characteristic of compound?

- Iron sulphide contains iron and sulphur in the ratio 7 : 4. by mass. Hence, we can say that a chemical compound is formed by the **chemical reaction between two or more elements in a fixed proportion by mass.**
- Iron in iron sulphide cannot be pulled away by using a magnet. Similarly sulphur present in iron sulphide cannot be separated by dissolving it in carbon disulphide because sulphur

present in it does not dissolve in carbon disulphide. Hence we can conclude that the **components of the compound cannot be separated by simple physical methods.**

- When a mixture of iron powder and sulphur is heated it glows red hot, and the glow stays for a while even when bunsen flame is removed. This shows that heat is given out. This reveals that **formation of a compound is associated with evolution or absorption of heat.**
- Pure iron sulphide melts at a definite temperature. Hence a **compound has a fixed melting and boiling point.**
- Iron sulphide is not attracted by magnet. When dilute sulphuric acid is added to iron sulphide, a colourless gas with rotten egg smell is produced due to hydrogen sulphide but not hydrogen. Thus iron present in the compound does not show its property. When carbon disulphide is added to Iron sulphide, it does not dissolve in it. This shows that sulphur is also not able to show its characteristic property. Hence we can say **the properties of a compound are different from those of its component elements.**
- When a sample of iron sulphide is viewed by magnifying lens, it is found to be homogenous throughout its mass. No individual particle of iron and sulphur can be seen in iron sulphide. Hence **compound is homogenous.**

25. What are the classification of compound?

**1. Inorganic compounds:** Compounds obtained from non living sources such as rock, minerals, etc., are called inorganic compounds. eg. Chalk, marble, baking powder, etc.

**2. Organic compounds:** Compounds obtained from living sources such as plants, animals etc., are called organic compound. eg.Protein,waxes,oil, carbohydrates, etc.

26. Name some compounds and their daily use in normal life?

| COMMON NAME | CHEMICAL NAME | COMPONENTS | USES |
|---|---|---|---|
| Water | Hydrogen Oxide | Hydrogen and oxygen | For drinking and as solvent |
| Table salt | Sodium chloride | Sodium and chlorine | Essential component of our daily diet, preservative for meat and fish. |
| Sugar | Sucrose | Carbon, hydrogen and oxygen | Preparation of sweets, toffees and fruit juices. |
| Baking soda | Sodium bicarbonate | Sodium, hydrogen , carbon and oxygen | Fire extinguisher, preparation of baking powder and preparation of cakes and bread. |
| Washing soda | Sodium carbonate | Sodium,carbon and oxygen | As cleaning agent in soap and softening of hard water. |
| Bleaching powder | Calcium oxy chloride | Calcium, oxygen and chlorine | As bleaching agent, disinfectant and sterilisation of drinking water. |
| Quick lime | Calcium oxide | Calcium and oxygen | Manufacture of cement and glass. |

27. What are the molecule of compounds?

The molecule of a compound contains two or more different types of atoms. For example, the molecule of hydrogen chloride contains one atom of hydrogen and one atom of chlorine. Similarly, one molecule of water contains two hydrogen atoms and one atom of oxygen.

28. What is formula?

The formula represents the number of atoms of each element in the molecule. For example H2 represents one molecule of hydrogen formed when two atoms of hydrogen combine.

29. What is valency?

Valency can be defined as the combining capacity of an element.

## 8. Is Matter Around Us Pure?

1. What is matter?

The entire world that we see, touch and feel around us is made up of matter. The fragrant fresh air that we breathe, the beautiful flowers and trees around us, the tasty fruits that we eat, the pets that we love, the roof and walls of our houses, the ground that we walk on and why, even our own bodies are all made up of matter. Matter occupies space. In other words matter has volume. Some are large and some are small.

2. How is matter characterized?

The quantity of matter contained in any object is referred to as mass. Hence, each and every matter is characterized by mass and volume.

3. What are the classification of matter?

- According to physical state as solid, liquid and gas.
- According to its composition as element, compound and mixture.

4. What are the physical state of matter?

- **Solid:** Solids have a definite shape and a definite volume. They take a lot of energy to change the shape. They are rigid and not compressed appreciably even at high pressures. They usually have high densities and expand only very slightly, when heated. In a solid, the molecules are held tightly together in definite arrangements.
- **Liquid:** Liquids have no definite shape and they take the shape of the container. They have a definite volume. They are not appreciably compressed by moderate pressures. They expand more than solids on heating and change into the gaseous state. They have lower densities than solids.
- **Gas:** Gases have no definite shape. They take the shape of the containing vessel. Gases have no definite volume. They have the property to occupy the entire space available to them. They are easily compressed by even small pressures and also expand more than liquids on heating. They have low densities.

5. What is purity of matter?

Substances rarely exist in a pure form in nature. They are often mixed with many other substances or materials. Their physical properties and chemical properties are either altered or not clearly visible because of the presence of other substances. A pure substance is a distinct type of matter that has the same properties (physical and chemical) throughout the sample.

6. How is matter classified based on its composition?

According to its composition, matter can be classified as an element, a compound and a mixture.

Elements

An element is the simplest substance that cannot be broken down chemically.

Compounds

Compounds are substances resulting from the chemical combination of two or more elements in fixed proportions

**MIXTURES**

When two or more substances are mixed together and the substances retain their individual original identities, the combination is called a mixture

7. What are the characteristics of mixtures?

- Mixtures may consist of substances in the same or different physical states. For example, bronze is an alloy consisting of the two solid metals, copper and tin; both are in the solid state.
- Most common solutions are mixtures of a solid in a liquid. For example, salt dissolved in water.
- Mixtures are not pure substances, since they are neither a single type of distinct matter nor do they display a single set of physical and chemical properties throughout the whole sample.
- In mixtures, elements are physically mixed in any ratio and no new compound is formed.

8. What is The Law of Constant Composition?

A pure compound always contains the same elements combined together in the same definite proportions by weight, irrespective of its method of preparation.

9. Is water a mixture or a compound?

- Water is a compound because of the following reasons.
- It is homogeneous.
- It has definite physical constants such as boiling point, freezing point, density, etc.
- The properties of water are entirely different from those of its constituents, i.e, hydrogen and oxygen.
- Water has a definite composition by mass. The ratio of H:O by mass is 1:8.

10. Is air a mixture or a compound?

- Air is a mixture because of the following reasons.
- Air does not have a fixed composition.
- The composition of air varies from place to place.
- Artificial air can be made by mixing the various components of air in the same proportions in which they occur at a place, and when this is done, no energy changes are noticed
- The components of air can be separated by a physical method such as fractional distillation of liquid air.
- Liquid air does not have a definite boiling point. It boils over a range of temperature between -196ºC and -183ºC.
- If air is a compound, the composition of air expelled from humans should not be different from the composition of air around us.
- But it is known that during respiration, the exhaled air has lower percentage of oxygen than the ordinary air.

11. What is the composition of air inhaled and exhaled?

Composition of inhaled air and exhaled air during respiration.

| Inhaled Air | Exhaled Air |
|---|---|
| Contains 78% nitrogen. | Contains 78% nitrogen. |
| Contains 20% oxygen. | Contains 16% oxygen. |
| Contains 0.03% Carbon dioxide. | Contains 4% Carbon dioxide. |
| Contains very little moisture. | Contains appreciable amount of moisture. |

12. What is the composition of air?

Composition of air

| Gas | in mass % |
|---|---|
| Nitrogen | 75.50% |
| Oxygen | 23.20% |
| Argon | 1.0% |
| Carbon dioxide | 0.046% |
| Neon | Negligible |
| Helium | Negligible |

13. What are the difference between mixture and compound?

### 3.2.1. Differences between mixture and compound

| Mixture | Compound |
|---|---|
| Elements are physically mixed in any ratio and no new compound is formed. | Elements are chemically combined in a fixed ratio to form a new compound. |
| They have no sharp or definite melting point, boiling point, density etc. | They have definite melting point, boiling point, density etc. |
| A mixture exhibits the properties of its constituent or component elements. | Property of a compound is different from its constituent or component elements. |
| They are either homogeneous or heterogeneous in nature. | They are always homogeneous in nature. |
| Constituents of a mixture can be separated by physical methods like filtration, magnetic separation etc. | Constituents of a compound cannot be separated by physical methods. |

14. What are the types of mixture?

There are two types of mixtures. They are:

- Homogeneous mixture
- Heterogeneous mixture

15. What is homogeneous mixture?

Homogeneous mixtures consist of a uniform distribution of the substances throughout the mixture

16. What are the types of homogeneous mixture?

There are three types of homogeneous mixtures.

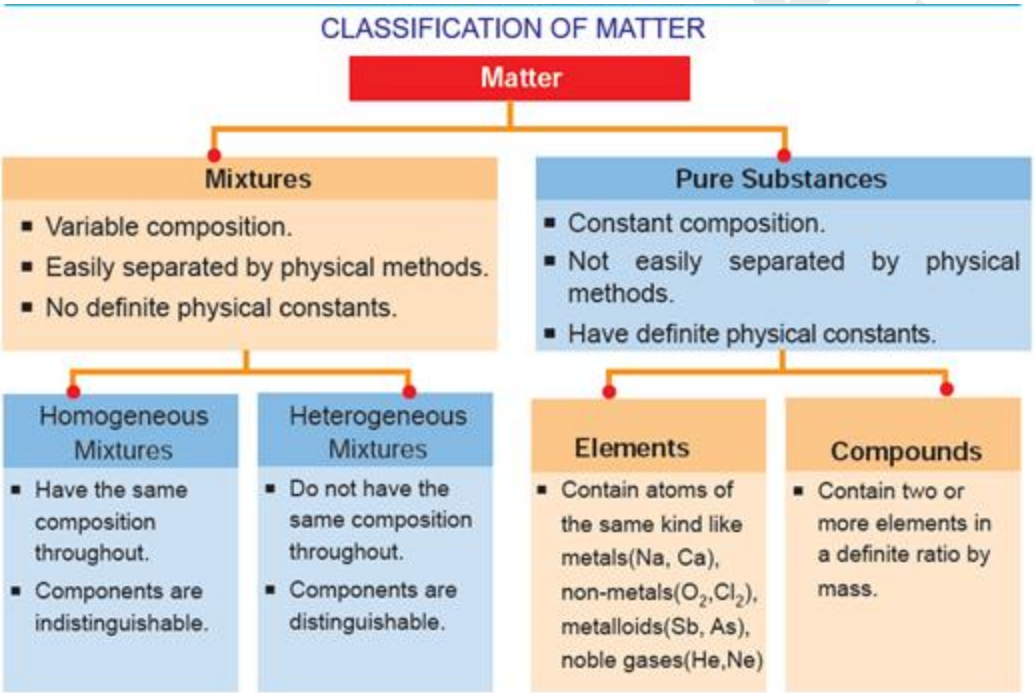
- Solid homogeneous mixture - e.g. Alloys
- Liquid homogeneous mixture - e.g. Alcohol in water
- Gaseous homogeneous mixture - e.g. Air

17. What is heterogeneous mixture?

Heterogeneous mixtures do not have a uniform composition. For example, if you take dilute buttermilk in a vessel and leave it undisturbed for some time, the particles will settle at the bottom and the water will remain on the top. The composition is not uniform. The ingredients of a heterogeneous mixture need not necessarily be in the same state - gas, liquid or solid.

- Solid - solid heterogeneous mixture - mixture of sugar and salt
- Solid - liquid heterogeneous mixture - chalk powder in water.
- Gas - gas heterogeneous mixture - smoke in air.
- Liquid - liquid heterogeneous mixture - kerosene in water.

18. What are the classification of matter?




19. What is Separation of heterogeneous mixture?

- Decantation: Used to separate a liquid from a solid (present as large particles) that does not dissolve in it.
- Filtration: Used to separate a liquid from a solid (present as very small particles) which does not dissolve in the liquid.

- Sublimation: Used to separate a volatile solid substance from a mixture containing a non-volatile solid substance.
- Separating funnel: Used to separate two completely immiscible liquids

20. What is Sublimation?

Sublimation is defined as a process, in which a substance in solid state is directly converted into vapour state.

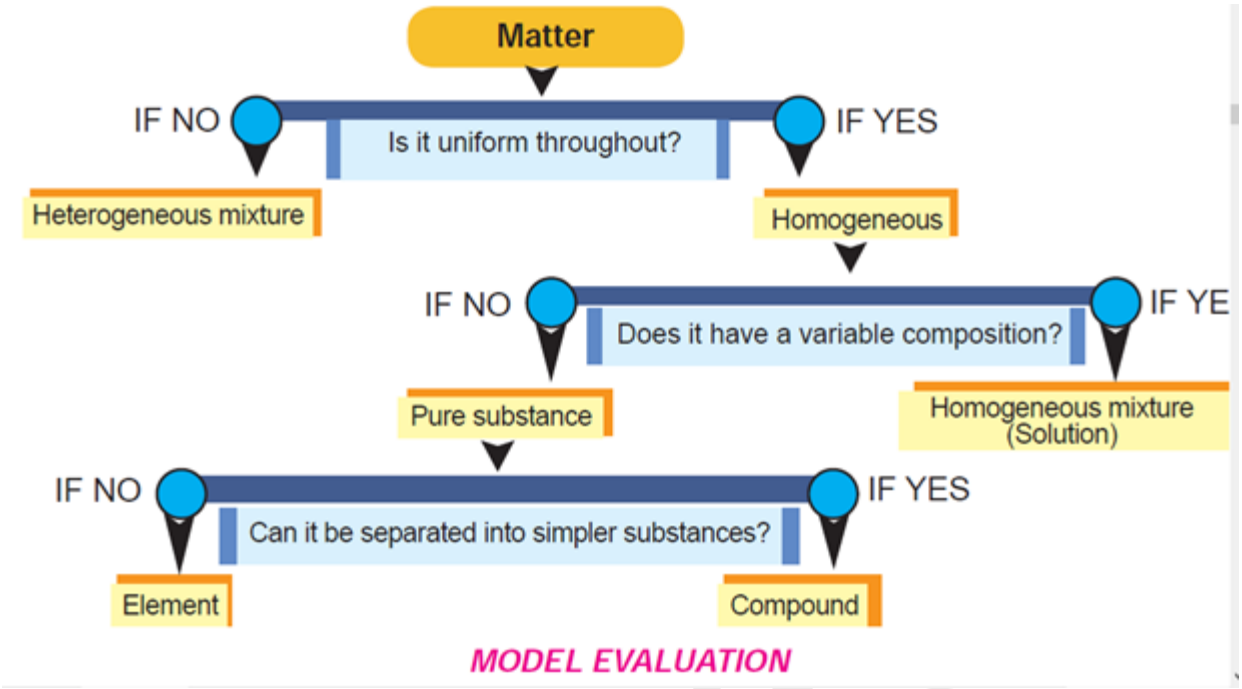
21. How does separation of homogeneous mixture?

- Distillation: Used to separate a nonvolatile solid and a volatile liquid mixed together in a solution.
- Fractional distillation: Used for separating a mixture containing two or more liquids with an appreciable difference in their boiling points.
- Chromatography: Separation of two or more dissolved solids can be carried out by chromatography. It can be used to separate samples as small as a pictogram (10-12 g) and as large as several ions. It involves the distribution of solutes between a moving phase and a nonmoving or stationary phase.

22. What is **filtration processes adopted in various fields?**

- Carbon filter: Powdered charcoal can be formed in such a way as to be full of tiny holes, which serves as a filter. As air is drawn through the holes, the charcoal traps gases and chemicals . Such carbon filters are put in the gas masks used by soldiers and firefighters.
- Air-Conditioning filter: It circulates the air with fans and removes dust from air.
- Automobile filter: Filters in the fuel line clean the fuel but they can block the flow of fuel, when they get clogged with dirt.
- Water filter: Particles of matter suspended in water are removed by the use of chemicals like chlorine, potash alum and powdered carbon and filtered through beds of sand or porous separation.

23. How can we identify element, compound and mixture?




## 9. Periodic Classification of Elements

1. What is periodic table?

In the early days, when elements were being discovered, scientists tried to classify elements based on their nature, and then according to their atomic mass.

This classification of elements is called 'periodic table'.

2. What is Lavoisier's Classification of Elements?

In 1789, Lavoisier first attempted to classify the elements into two divisions, namely Metals and Non-metals. However, this classification was not satisfactory as there were many exceptions in each category.

3. What is Dobereiner's Classification of Elements?

In 1817, Johann Wolfgang Dobereiner grouped three elements together into what he termed triads. For example, elements like lithium, sodium and potassium were grouped together into a triad as shown below. The atomic mass is shown in brackets Li (7)Na (23)K (39).

4. What was the limitation of the Dobereiner's Classification of Elements?

After the discovery of elements many of them could not be grouped this way.

5. What was the Newland's Classification of Elements?

In 1863, John Newland arranged the elements in the increasing order of Atomic Mass. He observed that there appeared to be a repetition of similar properties in every eighth element like that of eighth note in an octave of music. Therefore, he placed seven elements in each group. Then he classified the 49 elements known at that time into seven groups of seven each. Newland referred to this arrangement as the Law of Octaves.

| Note | 1 (Sa) | 2 (re) | 3 (ga) | 4 (ma) | 5 (pa) | 6 (dha) | 7 (ni) |
|---|---|---|---|---|---|---|---|
| Element | Li | Be | B | C | N | O | F |
| | Na | Mg | Al | Si | P | S | Cl |
| | K | Ca | Cr | Ti | Mn | Fe | - |

6. What are the Limitations of Newland's Classification?

Inert gases were discovered at a later stage. With the inclusion of inert gas,

'Neon' between 'Fluorine' and 'Sodium', the 9th element became similar to the first one. Similarly, the inclusion of inert gas 'Argon' between 'Chlorine' and 'Potassium' made the 9th element similar to the first one.

7. What is Lothar Meyer's Classification of Elements?

In 1864, Lothar Meyer plotted the atomic weight against the atomic volume of various elements. He found out that the elements with similar properties and valency fell under one another. However, this also could not give a better understanding the sequences.

8. Who is Mendeleev?

Dimitri Ivanovich Mendeleev, a Russian chemist, suggested that the chemical elements can be sorted out based on certain similarities in their properties. The arrangement he proposed is called

the Periodic Table. His table proved to be a unifying principle in chemistry and led to the discovery of many new chemical elements.

9. What is periodicity?

Periodicity is the recurrence of similar physical and chemical properties of elements, when they are arranged in a particular order.

10. Give the Mendeleevs periodic table?

4.2. MENDELEEV'S PERIODIC TABLE

| Groups | 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 6.941 | 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 26.98 | Si 28.09 | P 30.97 | S 32.06 | Cl 35.453 | | | |
| 4 First Series | K 39.10 | Ca 40.08 | -- | Ti 47.90 | V 50.94 | Cr 52.20 | Mn 54.94 | Fe 55.85 | Co 58.93 | Ni 58.69 |
| Second series | Cu 63.55 | Zn 65.39 | -- | -- | As 74.92 | Se 78.96 | Br 79.90 | | | |
| 5 First series | Rb 85.47 | Sr 87.62 | Y 88.91 | Zr 91.22 | Nb 92.91 | Mo 95.94 | Tc 98 | Ru 101.07 | Rh 102.9 | Pd 106.4 |
| Second series | Ag 107.87 | Cd 112.41 | In 114.82 | Sn 118.71 | Sb 121.76 | Te 127.90 | I 126.90 | | | |
| 6. First series | Cs 132.90 | Ba 137.34 | La 138.91 | Hf 178.49 | Ta 180.95 | W 183.84 | -- | Os 190.2 | Ir 192.2 | Pt 195.2 |
| Second series | Au 196.97 | Hg 200.59 | Tl 204.38 | Pb 207.2 | Bi 208.98 | | | | | |

11. How did Mendeleev`s has classified elements?

Mendeleev's periodic table is based on a law called Mendeleev's periodic law which states that : "The physical and chemical properties of elements are the periodic functions of their atomic masses"

12. What are the Characteristics of Mendeleev's Periodic Table?

- Mendeleev felt that similar properties occurred after periods (horizontal rows) of varying length.
- He created a table with eight columns.

- He left a few cells empty so that all the elements with similar properties could be grouped in the same column.
- Mendeleev inferred that there must be other elements that had not yet been discovered.
- He predicted the properties and atomic masses of several elements that were not discovered at that time. Later on, when these elements were discovered, their properties remarkably agreed with his prediction.
- Similarly, Scandium for 'eka-boron' and Gallium for 'eka-aluminium' were later discovered.
- Eight out of ten vacant spaces left by Mendeleev were filled by the discovery of new elements.
- Incorrect atomic masses of some of the already arranged elements were corrected. For example, the atomic mass of Beryllium was corrected as 9 from 13.

13. What are the Characteristics of modified Mendeleev's Periodic Table?

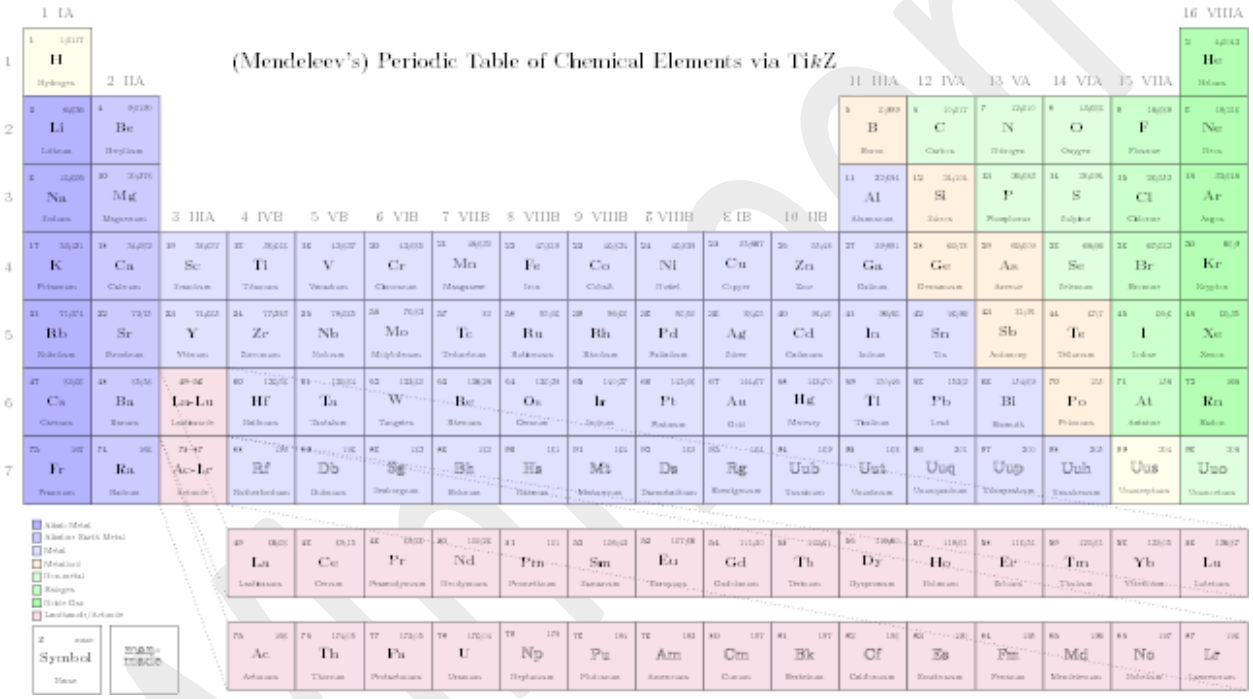
- Elements are arranged in the increasing order of their atomic masses.
- Vertical columns are called 'groups' and horizontal rows are called 'periods'.
- There are 'nine groups' numbered from I to VIII and 0.
- Groups I to VII are subdivided into subgroups A and B.
- There are 'seven periods'.
- The first three periods contain 2, 8, 8 elements respectively. They are called 'short periods'.
- The fourth, fifth and sixth periods have 18, 18 and 32 elements respectively.
- The seventh period is an incomplete period.
- Blank spaces are left for elements yet to be discovered.
- The series of 'fourteen elements'following lanthanum is called'Lanthanide series'.
- The series of 'fourteen elements' following actinium is called 'Actinide series'.
- Lanthanides and actinides are placed at the bottom of the periodic table.

14. How do we define the modern periodic law?

The inadequacy in the Mendeleev's periodic table has been overcome by the introduction of the Modern periodic table. It is also known as Long form of periodic table. In this table, the

properties of elements are dependent on their electronic configurations (distributions). Hence, the modern periodic law is defined as: "the properties of elements are the periodic function of their atomic numbers " .

15. Give the Modified Mendeleev's Periodic Table.




16. What are the Limitations of modified Mendeleev's Periodic Table?

- A few elements that have a higher atomic mass were placed before those having a lower atomic mass. Example: Argon (39.9) was placed before Potassium (39.1)
- Cobalt (58.9) was placed before Nickel (58.6). Tellurium (127.9) was placed before Iodine (126.9).
- There were no provisions for placing Isotopes.
- Hydrogen was placed in group IA although its properties resembled elements in group IA as well as group VIIA.

- Chemically dissimilar elements were placed in the same group. For example, alkali metals like sodium and potassium were placed along with coinage metals like copper, silver and gold.

17. How are periodic table classified?

All the elements in the periodic table are broadly divided into three categories.

- Metals
- Non-metals
- Metalloid (semi-metals)

18. What are metals?

Metals are a group of elements which have similar properties. Most of the known elements are metals and they occupy a large area in the periodic table. The left side of the periodic table contains metals.

19. How are metals classified?

- Alkali metals e.g. sodium and potassium
- Alkaline earth metals e.g. calcium and magnesium
- Transition metals e.g. iron and nickel
- Other metals e.g. aluminium, tin.

20. What are non-metal?

Elements that do not exhibit the properties of metals are called non-metals. Non-metals occupy the left side of the periodic table. e.g. Carbon, Iodine.

21. What are metalloids?

Elements which have the properties of both metals and nonmetals are called metalloids. They are very good semi-conductors e.g. Silicon, Germanium.

22. Name the highest, lightest and heaviest metal?

- Tungsten has the highest melting point of over 3300oC.
- Lithium is the lightest metal. It weighs about half as much as water.
- Osmium is the heaviest metal. It is about 22½ times heavier than water and nearly 3 times heavier than iron.

23. What are the physical properties of metal and non-metals?

| S. No. | Properties | Metals | Non-metals |
|---|---|---|---|
| 1. | Appearance | Have a lustre, known as metallic lustre. The surface is polishable.  Platinum  Gold  Silver | Have no lustre and look dull. Surface cannot be polished. (Exceptions: Graphite and iodine are lustrous).  Yellow - Sulphur, White - Phosphorous, Red - Bromine, Black-Carbon |
| 2. | Physical state | In general, they are hard crystalline solids.(Exception: Mercury is a liquid). | They exist as soft solids or gases. (Exceptions: Diamond is a hard solid and bromine is a liquid). |
| 3. | Density | They have a high density. (Exceptions: Sodium and Potassium). | They have a low density. |
| 4. | Melting and boiling points | Usually they have high melting and boiling points. (Exceptions: Sodium and Potassium). | They have low melting and boiling points. (Exceptions: Diamond and graphite). |

| | | | |
|---|---|---|---|
| 5. | Malleability and ductility | They are malleable and ductile. | Solid non-metals are brittle. |
| 6. | Heat conductivity | They are good conductors | They are bad conductors. (Exception: Diamond). |
| 7. | Electrical conductivity | They are good conductors | They are bad conductors. (Exception: Graphite) |
| 8. | Sonority (phenomenon of producing a characteristic sound when a material is struck) | They are sonorous. | They are non-sonorous. (Exception: Iodine crystals produce a soft metallic clink when they are shaken in a bottle). |
| 9. | Alloy formation | Metals form alloys with each other and also with some non-metals | Non-metals usually do not form alloys. (Exceptions: B, C, Si and P form alloys with metals). |

24. What are the chemical properties of non-metal?

1. Electropositivity:

Metals are electropositive. They lose

electrons and form cations.

$Na \rightarrow Na^+ + e^-$

$Mg \rightarrow Mg^{2+} + 2e^-$

2. Reaction with Oxygen:

Metals combine with oxygen to form metallic oxides.

i. Magnesium burns in oxygen to form magnesium oxide. $2Mg + O_2$ $2MgO$

ii. Aluminium combines with oxygen to form a layer of aluminium oxide. $4Al + 3O_2$ $2Al_2O_3$

iii. Iron wool (thread) burns in oxygen to form iron oxide along with the release of thermal energy and light energy.

$4Fe + 3O_2$ $2Fe_2O_3$

3. Action of water

(i) Metals like sodium and potassium react with cold water vigorously and

liberate hydrogen gas. $2Na + 2H_2O \rightarrow 2NaOH + H_2\uparrow$

$2K + 2H_2O \rightarrow 2KOH + H_2\uparrow$

(ii) Magnesium and Iron react with steam to form magnesium oxide and iron oxide respectively. Hydrogen gas is liberated. $Mg + H_2O \rightarrow MgO + H_2\uparrow$

$3Fe + 4\ H_2O \rightarrow Fe_3O_4 + 4\ H_2\uparrow$

(iii) Aluminium reacts slowly with steam to form aluminium hydroxide and hydrogen.

$2Al + 6\ H_2O \rightarrow 2Al\ (OH)_3 + 3\ H_2\uparrow$

Other metals like copper, nickel, silver and gold do not react with water.

4. Action of acids on metals

Metals such as sodium, magnesium and aluminium react with dilute hydrochloric acid to give the respective salts. Hydrogen gas is liberated.

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

$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2\uparrow$

5. Action of halogens

Metals react with halogens to form ionic halides.

$2Na + Cl_2 \rightarrow 2NaCl$

$2Al + 3\ Br_2 \rightarrow 2AlBr_3$

6. Reducing property:

When a reactant gains electrons during the reaction, it is said to be reduced.

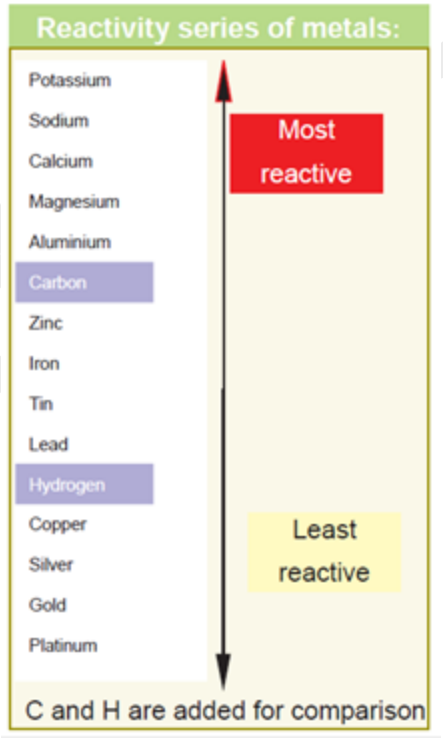
In a chemical reaction between a metal and a non-metal, the metal loses one or more electrons, which are accepted by the non-metal. So the metal is oxidized and the non-metal is reduced. The metal acts as a reducing agent.

$6Na + Al_2O_3 \xrightarrow{heat} 3Na_2O + 2Al$

$2Mg + CO_2 \xrightarrow{heat} 2MgO + C$

25. What is reactivity series?

The reactivity series or activity series is the arrangement of some common metals according to their reactivity. The reactivity of the metals decreases as we go down. The two non-metals, hydrogen and carbon, are included in the series to compare the reactivity of the metals above and below them in specific reactions.




26. What are the uses of reactivity series of metals?

- Highly reactive metals occupy the top portion of the series. They readily react with other chemical compounds. Most of the reactions are exothermic.

- The electropositive nature of metals decreases as the reactivity decreases. So the reducing nature of metals decreases too.
- The metals above hydrogen in the reactivity series displace hydrogen from water.
- The metals above hydrogen in the reactivity series react with dilute acids and liberate hydrogen gas. Lead is an exception.
- A more reactive metal can displace a less reactive metal from its salt solution. Example: $Fe(s) + CuSO4\ (aq) \rightarrow FeSO4(aq) + Cu(s)$
- The reactive metals are susceptible to corrosion.
- Metals above carbon cannot be extracted from their carbon ores.

27. What is alloy?

An alloy is a homogeneous mixture consisting of two or more metals fused together in the molten state in a fixed ratio.

28. What are the Composition of Alloys?

There are two types of alloys. They are,

(i) Substitutional alloys

(ii) Interstitial alloys

29. What are substitutional alloys?

In substitutional alloys, atoms of one metal randomly take the place of atoms of another metal

30. What is interstitial alloy?

In interstitial alloys, small non-metallic atoms such as H(Hydrogen), B(Boron), C(Carbon) and N(Nitrogen) occupy the holes in the crystal structure of the metal.

31. What are the uses of alloy?

| Name of the alloy | Metals present in it | Uses |
|---|---|---|
| Brass | Copper, Zinc | To make screws, windows and door fittings |
| Bronze | Copper, Tin | To mould statues, machine parts |
| Solder | Tin, Lead | In electrical and plumbing industries, to join metal surfaces without melting them. |
| Steel | Iron, Carbon, Chromium, Nickel, Tungsten | In construction of bridges, buildings, household products, cooking utensils |
| Duralumin | Aluminium, Copper, Manganese, Magnesium | To manufacture aircraft parts, cars, ships and nails. |

32. What are the characteristics of alloys?

- An alloy is harder than the metals in it.
- An alloy enhances the tensile strength of the base metal.
- An alloy improves corrosion resistance.
- The density and melting point of the individual metal is different from the density and melting point of the alloy.
- An alloy enables better castability.

## 10. Solutions

1. What is solution?

A solution is a homogeneous mixture of two or more substances.

2. What is binary solution?

All solutions exist in homogeneous form. The term Homogeneous refers to the state in which two or more substances are uniformly present in a given mixture. If a solution contains two components, then it is called as a Binary Solution.

3. What is solute and solvent?

In a solution, the component present in lesser amount by weight is called solute and the component present in a larger amount by weight is called solvent. Generally a solvent is a dissolving medium. It surrounds the particles of solute to form a solution.

In short, a solution can be represented, as follows:

(Solute + Solvent → Solution)

4. What are the types of solution?

Based on the particle size of the substance, the solutions are divided into three types.

- True Solution: It is a homogeneous mixture that contains small solute particles that are dissolved throughout the solvent eg. sugar in water.
- Colloidal Solution: It is a heterogeneous mixture made up of two phases namely, dispersed phase and dispersion medium. The substance distributed as particles is called dispersed phase. The continuous phase in which the colloidal particles are dispersed is called dispersion medium.
- (Dispersed phase + Dispersion medium → Colloidal solution)
- Suspension: It is a heterogeneous mixture of small insoluble particles in a solvent. In a suspension, the solid particles stay in clusters that are large enough to be seen. (e.g. chalk powder in water).

5. What is Tyndall Effect?

The phenomenon by which colloidal particles scatter light is called Tyndall Effect. If a beam of light is allowed to pass through a true solution, some of the light will be absorbed and some will be transmitted. The particles in true solution are not large enough to scatter light. However, if light is passed through a colloid, the light is scattered by the larger colloidal particles and the beam becomes visible. This effect is called TYNDALL EFFECT

6. What is Brownian movement?

The phenomenon by which the colloidal particles are in continuous random motion is called Brownian movement. Brownian motion is named after ROBERT BROWN, a biologist. He observed the motion of the particles in suspension of pollen grains in water.

7. What is the Comparison of the Properties of True Solution, Colloidal Solution and suspension?

| Property | True Solution | Colloidal Solution | Suspension |
|---|---|---|---|
| Particle size in Å ($1Å = 10^{-10}m$) |  1Å to 10 Å |  10Å to 2000 Å |  More than 2000 Å |
| Appearance | Transparent | Translucent | Opaque |
| Visibility of particles | Not visible even under ultra microscope | Visible under ultra microscope | Visible to the naked eye |
| Nature | Homogeneous | Heterogeneous | Heterogeneous |
| Diffusion of particles | Diffuses rapidly | Diffuses slowly | Diffusion does not occur |
| Scattering effect | Does not scatter light | Scatters light | Does not scatter light |

8. Based on the type of solvent, how are solutions classified?

1. Aqueous Solution: The solution in which water acts as a solvent, is called aqueous solution. (e.g. sugar solution).

2. Non-aqueous Solution: The solution in which any liquid other than water acts as a solvent is called non-aqueous solution. Solution of sulphur in carbon disulphide is a suitable example for non-aqueous solution. (Benzene, ether, carbon disulphide (CS2) acetone are a few examples for non-aqueous solvents to dissolve organic compounds.)

9. How are solutions classified based on the amount of solute in given solution?

Based on the amount of solute in the given amount of solvent, solutions are classified into the following types.

- Unsaturated solution
- Saturated solution
- Super saturated solution

10. What are the nine types of physical state of solution, solvent and solute?

| Solute | Solvent | Examples |
|---|---|---|
| Solid | Solid | Alloys |
| Solid | Liquid | Sugar solution |
| Solid | Gas | Smoke |
| Liquid | Solid | Cheese |
| Liquid | Liquid | Milk |
| Liquid | Gas | Cloud |
| Gas | Solid | Cork |
| Gas | Liquid | Soda water |
| Gas | Gas | Helium-oxygen mixture (for deep-sea diving ) |

11. What are Dilute and Concentrated Solutions?

Concentration of a solution is the amount of solute dissolved in a given amount of solvent.

A solution containing less amount of solute is known as a dilute solution, whereas a solution containing a large amount of solute is known as a concentrated solution. It may be noted that dilute and concentrated are relative terms and they have only quantitative meaning.

12. What are the factors affecting soluability?

1. Temperature

2. Nature of solute and solvent

3. Pressure

- Effect of Temperature: In endothermic process, solubility increases with increase in temperature. e.g. Solubility of KNO3 increases with the increase in temperature. In exothermic process, solubility decreases with increase in temperature. e.g. Solubility of CaO decreases with increase in temperature. Solubility of oxygen is more in cold water.
- Nature of Solute and Solvent: Solubility of a solute in a solvent depends on the nature of both solute and solvent. A polar compound dissolves in a polar solvent. e.g. Common salt dissolves in water. A polar compound is less soluble (or) insoluble in a non-polar solvent.
- Effect of Pressure: Effect of pressure is observed only in the case of gases in liquids. An increase in pressure increases the solubility of a gas in a liquid. For e.g. CO2 gas is filled in soft drinks using the effect of pressure.

13. What is Henry's Law?

Increase in pressure increases the solubility of gases. At a given temperature, the mass of gas dissolved in a fixed volume of liquid is directly proportional to the pressure of the gas on the surface of the liquid. This is called Henry's Law.

## 11. Chemical Reaction

1. How are changes classified?

Any change can be classified as physical change or chemical change.

2. What is chemical reaction?

During chemical changes, New substances are formed and it is difficult to regenerate the original substances. Chemical changes are more permanent than physical changes. All chemical changes are accompanied by chemical reactions.

3. Why do the white colour of the silver anklet slowly changes into slightly black colour?

It is due to the formation of silver sulphide (Ag2S), as a result of the reaction between silver and hydrogen sulphide in the air.

4. How is slaked lime produced?

Calcium oxide reacts with water to produce slaked lime (calcium hydroxide). This reaction is exothermic and is accompanied by a hissing sound and formation of bubbles, leading to the release of considerable amount of heat.

5. What are reactants and products?

The substances taking part in the reaction are known as reactants and those formed as a result of the reaction are called products.

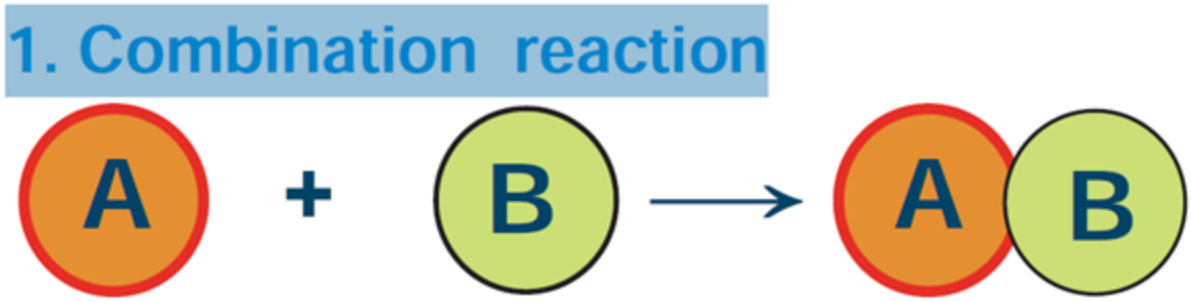
6. How is slaked lime used for white washing?

Calcium hydroxide reacts slowly with carbon dioxide in air to form a thin layer of calcium carbonate on the walls. Calcium carbonate is formed after two to three days of white-washing and gives a shiny finish to the walls. It is interesting to note that the chemical formula for marble is also CaCO3.

7. What are the types of chemical reaction?

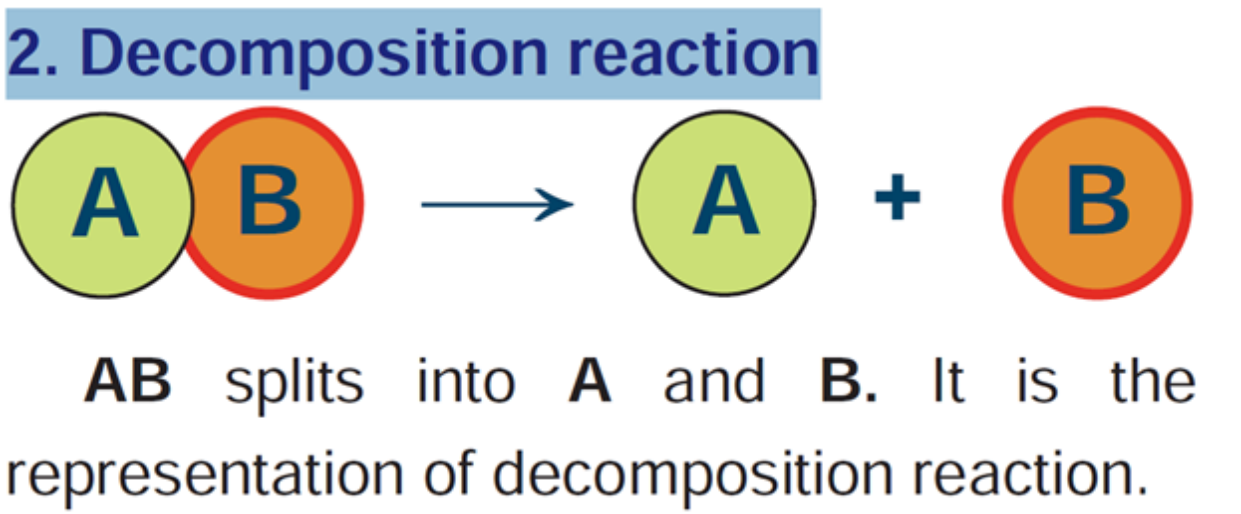
Since there are numerous chemical reactions, the study of these reactions can be made easier by classifying them. All the chemical reactions are classified under six broad categories depending on how the product is formed. Let us see the different types of classifications of chemical reactions.

1. Combination reaction




A combines with B to form a new product AB. It is the simple representation of combination reaction. A reaction in which a single product is formed from two or more reactants is known as combination reaction.

2. Decomposition reaction




A single compound breaks down to produce two or more substances. Such type of reaction is called decomposition reaction.

A few more examples for decomposition

reaction are:

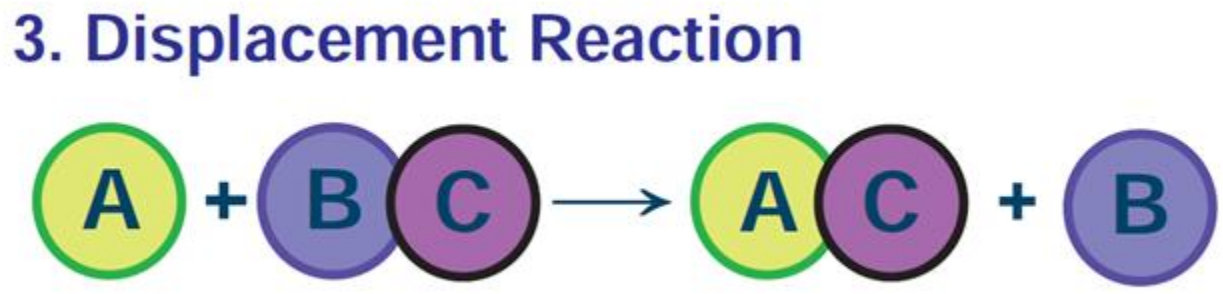
- Decomposition of lime stone

$CaCO_3 \rightarrow CaO + CO_2 \Delta \uparrow$

- Decomposition of ammonium dichromate

$(NH_4)_2Cr_2O_7 \rightarrow Cr_2O_3 \uparrow + N_2 \uparrow + 4H_2O \uparrow$

3. Displacement Reaction




In the reaction between A and BC, A displaces B from BC to form AC. The reaction, in which, a more reactive element displaces a less reactive element from its compound is called displacement reaction.

4.Double Decomposition Reaction (Double Displacement Reaction)

# 4. Double Decomposition Reaction (Double Displacement Reaction)


In the reaction between **AB** and **CD**, both the reactants decompose to form **AD** and **CB** through the rearrangement of ions.

In the reaction between AB and CD, both the reactants decompose to form AD and CB through the rearrangement of ions. Double Decomposition Reaction is the reaction in which exchange of ions between two reactants occurs, leading to the formation of two different products. Other example : $CuSO_4 + H_2S \rightarrow CuS\downarrow + H_2SO_4$

4. Oxidation and reduction

Oxidation:

A chemical reaction which involves addition of oxygen or removal of hydrogen or loss of electron(s) is called Oxidation.

$2Mg + O_2 \rightarrow 2MgO$ (addition of oxygen)

$H_2S + Br_2 \rightarrow 2HBr + S$ (removal of hydrogen)

$Fe^{2+} \rightarrow Fe^{3+} + e^-$ (loss of electron)

Reduction:

A chemical reaction which involves addition of hydrogen or removal of oxygen or gain of electron(s) is called Reduction.

$2Na + H_2 \rightarrow 2NaH$ (addition of hydrogen)

$CuO + H_2 \rightarrow Cu + H_2O$(removal of oxygen)

$Fe^{3+} + e^- \rightarrow Fe^{2+}$ (gain of electron)

Redox Reaction:

Redox reaction is a chemical reaction in which oxidation and reduction take place simultaneously.

5. Exothermic and endothermic reactions

The chemical reactions which take place with the evolution of heat energy are called exothermic reactions. $N_2 + 3H_2 \rightarrow 2NH_3 + Heat$

The chemical reactions which take place with the absorption of heat energy are called endothermic reactions. $2NH_3 + Heat \rightarrow N_2 + 3H_2$

8. What is redox reaction?

Oxidation and reduction always takes place together, so the reaction is called redox reaction.

9. What is Nature of the reactants?

Magnesium ribbon reacts with both hydrochloric acid and acetic acid but reaction is faster in hydrochloric acid than in acetic acid. Hydrochloric acid is more reactive than acetic acid. It shows that the nature of the reactant influences the rate of the reaction.

10. What is Concentration of the Reactants?

Granulated zinc reacts with both 1M hydrochloric acid and 2M hydrochloric acid. The rate of evolution of hydrogen gas is more in test tube B than in test tube A. This is because 2M

hydrochloric acid is more concentrated than 1M hydrochloric acid. That is, the greater the concentration of the reactant, the greater will be the rate of the reaction.

11. What is Surface Area of the Reactants?

Powdered calcium carbonate reacts more quickly with hydrochloric acid than marble chips. Powdered calcium carbonate offers large surface area for the reaction to occur at a faster rate. This shows that the greater the surface area, the greater is the rate of the reaction.

12. What is Catalyst?

When potassium chlorate is heated, oxygen is evolved very slowly, whereas after the addition of manganese dioxide to the reactant, oxygen is liberated at a faster rate. This shows that manganese dioxide acts as a catalyst and influences the rate of the reaction. A substance which alters the rate of reaction without undergoing any change in mass and composition is known as catalyst.

13. What are acid?

Acid is a substance which furnishes H+ ions or H3O+ ions when dissolved in water. Acids have one or more replaceable hydrogen atoms. The word 'acid' is derived from the Latin name ‘acidus’ which means sour taste. Substances with ‘sour taste’ are acids. Lemon juice, vinegar and grape juice have sour taste, so they are acidic.

14. How are acid classified based on their sources?

- Based on their sources : Acids are classified into two types, namely, organic acids and inorganic acids.
- Organic Acids:- Acids present in plants and animals (living things) are organic acids e.g. HCOOH, CH3COOH (Weak acids).
- Inorganic Acids:- Acids in rocks and minerals are inorganic acids or mineral acids e.g. HCl, HNO3, H2SO4 (Strong acids).

15. How are acid classified based on their basicity?

Monobasic Acid: - It is an acid which gives one hydrogen ion per molecule of the acid in solution, e.g. HCl, HNO3.

Dibasic Acid:- It is an acid which gives two hydrogen ions per molecule of the acid in solution, e.g. H2SO4, H2CO3.

Tribasic Acid:- It is an acid which gives three hydrogen ions per molecule of the acid in solution, e.g. H3PO4

16. How are acid classified based on Ionisation?

Acids are classified into two types based on ionisation.

Strong Acids:- These are acids which ionise completely in water, e.g.HCl.

Weak Acids:-These are acids which ionise partially in water, e.g. CH3COOH.

17. How are acid classified based on Concentration?

Based on the percentage or amount of acid dissolved in water, acids are classified into concentrated acids and dilute acids.

Concentrated Acid:- It is an acid having a relatively high percentage of acid in its aqueous solution.

Dilute Acid:- It is an acid having a relatively low percentage of acid in its aqueous solution

18. How does metals react with acid?

Reaction of Metals with Acid: Note that zinc reacts with dilute hydrochloric acid to form zinc chloride and hydrogen gas. $Zn + 2HCl \rightarrow ZnCl2 + H2\uparrow$.

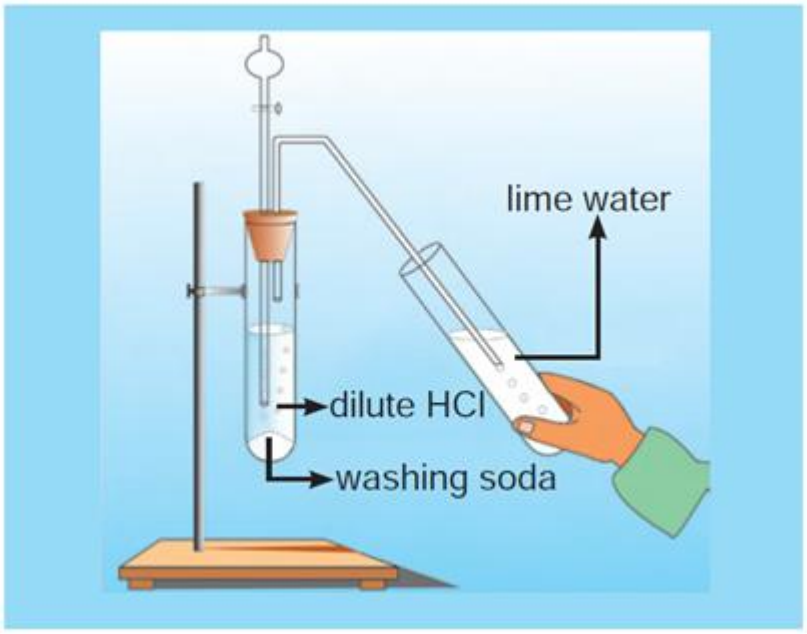
When a burning candle is brought near a bubble containing hydrogen gas, the flame goes off with a 'popping' sound. This confirms that metal displaces hydrogen from the dilute acid. (Hydrogen gas burns with a 'popping' sound)

Metal + Acid → Salt + Hydrogen

Another example:

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

19. What are the Reaction of Metal carbonate and Metal bicarbonate with Acids?




Test tube I

$Na_2CO_3 + 2\ HCl \rightarrow 2\ NaCl + H_2O + CO_2\uparrow$

Test tube II

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2\uparrow$

When carbon dioxide is passed through lime water, it turns milky.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3$ (milky) $+ H_2O$

Metal carbonate or metal bicarbonate + acid → salt + water + carbon dioxide.

Some other examples:

$MgCO_3 + 2\ HCl \rightarrow MgCl_2 + H_2O + CO_2\uparrow$

$Mg(HCO3)\ 2 + 2\ HCl \rightarrow MgCl2 + 2H2O + 2CO2\uparrow$

20. What is the action of acid with water?

An acid produces hydrogen ions in water.

$HCl + H2O \rightarrow H3O+ + Cl-$

Hydrogen ions cannot exist alone, but they exist in the form of hydronium (H3O+) ions. When water is absent, the separation of hydrogen ions from an acid does not occur.

21. What are the uses of acid?

- Sulphuric acid (King of chemicals) is used in car batteries and in the preparation of many other compounds.
- Nitric acid is used in the production of ammonium nitrate which is used as a fertilizer in agriculture.
- Hydrochloric acid is used as a cleansing agent in toilets.
- Tartaric acid is a constituent of baking powder.
- Salt of benzoic acid (sodium benzoate) is used in food preservation.
- Carbonic acid is used in aerated drinks.

22. What is base?

Base is a substance which releases hydroxide ions(OH-) when dissolved in water. It is bitter in taste and soapy to touch (e.g. washing soda, caustic soda and caustic potash). They change red litmus to blue. They are pink with phenolphthalein and yellow with methyl orange.

23. How are base classified based on Ionisation?

Strong Bases:- These are bases which ionise completely in aqueous solution e.g.NaOH, KOH.

Weak Bases:- These are bases which ionise partially in aqueous solution. e.g. NH4OH, Ca(OH)2.

24. How are base classified based on acidity?

Monoacidic Base:- It is a base which ionises in water to give one hydroxide ion per molecule. e.g.NaOH, KOH.

Diacidic Base:- It is a base which ionizes in water to give two hydroxide ions per molecule. e.g. Ca(OH)2, Mg(OH)2.

Triacidic Base:- It is a base which ionizes in water to give three hydroxide ions per molecule. e.g. Al(OH)3, Fe(OH)3.

25. How are base classified based on concentration?

Depending on the percentage or amount of base dissolved in water, bases are classified as concentrated alkali and dilute alkali.

Concentrated Alkali:- It is an alkali having a relatively high percentage of alkali in its aqueous solution.

Dilute Alkali:- It is an alkali having a relatively low percentage of alkali in its aqueous solution.

26. What are alkalies?

Bases which dissolve in water are called alkalies. All alkalies are bases, but not all bases are alkalis. NaOH and KOH are alkalies, whereas Al(OH)3 and Zn(OH)2 are bases.

27. What is the reaction of base with metals?

Zinc reacts with sodium hydroxide to form sodium zincate with the liberation of hydrogen gas.

$Zn + 2\ NaOH \rightarrow Na2\ ZnO2 + H2\uparrow$

Metal + Base → Salt + Hydrogen

28. What is the Reaction of Non-metallic oxides with Bases?

Sodium hydroxide reacts with carbon dioxide and gives sodium carbonate and water.

$2NaOH + CO2 \rightarrow Na2CO3 + H2O$

The above reaction indicates that

Non metallic oxide + Base → Salt + Water

Another example is

Ca(OH)2 + CO2 → CaCO3 + H2O

29. What is the reaction of base with water?

Bases generate hydroxide (OH-) ions when dissolved in water.

NaOH → Na+ + OH-

30. What is the reaction of acid with base?

Acid + Base → Salt + Water

31. What are the uses of base?

1. Sodium hydroxide is used in the manufacture of soap.

2. Calcium hydroxide is used in whitewashing buildings.

3. Magnesium hydroxide is used as a medicine for stomach disorder.

4. Ammonium hydroxide is used to remove grease stains from clothes.

32. What is PH SCALE?

pH stands for the power of hydrogen ion concentration in a solution. pH values decide whether a solution is acidic or basic or neutral. pH scale was introduced by S.P.L. Sorenson. It is mathematically expressed as

pH = -log10 [ H+ ]

33. What is the importance of $P_H$ on human body?

(i) Using pH factor, the general health condition of our body can be examined. At pH level 6.9, the body becomes prone to viral infections like cold, cough and flu. Cancer cells thrive inside the body at a pH of 5.5.

(ii) The pH of a normal, healthy human skin is 4.5 to 6. Proper skin pH is essential for a healthy complexion.

(iii) pH of stomach fluid is approximately 2.0. This fluid is essential for the digestion of food.

(iv) Human blood pH range is 7.35 to 7.45. Any increase or decrease in this value, leads to diseases. The ideal pH for blood is 7.4.

(v) pH of saliva normally ranges between 6.5 to 7.5.

(vi) White enamel coating of our teeth is calcium phosphate, the hardest substance in our body. It does not dissolve in water. If pH of mouth falls below 5.5, the enamel gets corroded.

Toothpastes which are generally basic and used for cleaning the teeth can neutralize the excess acid and prevent tooth decay.

34. What is the importance of pH on soil?

In agriculture, the pH of soil is very important. Citrus fruits require slightly alkaline soil, while rice requires acidic soil and sugarcane requires neutral soil.

35. What is the need of pH of Rain Water?

pH of rain water is approximately 7 showing the high level of its purity and neutrality. If rain water is polluted by $SO_2$ and $NO_2$, acid rain occurs, bringing the pH value less than 7.

36. What is salt?

Salts are the products of the reaction between acids and bases. Salts produce positive ions and negative ions when dissolved in water.

37. What are the classification of salt?

- Normal Salts: A normal salt is obtained by complete neutralization of an acid by a base. NaOH + HCl → NaCl + H2O
- Acid Salts: Acid salts are derived from the partial replacement of hydrogen ions of an acid by a metal. When a calculated amount of a base is added to a polybasic acid, acid salt is obtained, as follows: NaOH + H2SO4 → NaHSO4 + H2O
- Basic Salts: Basic salts are formed by the partial replacement of hydroxide ions of a diacidic or triacidic base with an acid radical. Pb(OH)2 + HCl → Pb(OH)Cl + H2O
- (Diacidic base) Basic salt A basic salt may further react with an acid to give a normal salt.
- Double Salts: Double salts are formed by the combination of the saturated solution of two simple salts in equimolar ratio followed by crystallization. e.g. potash alum

38. What are the uses of salt?

Common Salt (NaCl): It is used in our daily food and also as a preservative.

Washing Soda (Na2CO3):

- It is used in softening hard water.
- It is used as a cleaning agent for
- domestic purposes.

Baking Soda (NaHCO3)

1. It is used in making of baking powder, which is a mixture of baking soda and tartaric acid. Baking powder is used to make cakes and bread, soft and spongy

2. It is an ingredient in antacid. Being alkaline, it neutralises excess of acidity in the stomach.

Bleaching Powder (CaOCl2)

1. It is used for disinfecting drinking water to make it free from micro-organisms.

2. It is used for bleaching cotton and linen in the textile industry.

Plaster of Paris (CaSO4. ½H2O)

It is used for plastering fractured bones and in making casts for statues.

## 12. Coal and Petroleum

1. What is fuel?

"Substances that burn in air to give heat energy are called fuels"

2. How are fossil fuels formed?

Fossil fuels are formed from the buried remains of decayed plants and animals over millions of years, under the influence of heat and pressure in the absence of air. Coal, petroleum and natural gas are called fossil fuels.

3. What is the Occurence of coal?

Coal mining was started in India in 1774. India now ranks third among the coal producing countries in the world. USA and China have ⅔ of the world's coal reserve.

4. What is carbonization?

As coal contains mainly carbon, the slow process of conversion of dead vegetation into coal is called carbonization

5. What are the composition of coal?

Coal is a natural black mineral, which is a mixture of free carbon and compounds of carbon containing hydrogen, oxygen, nitrogen and sulphur.

6. What are the types of coal?

- 1.PEAT : Peat is the first stage of coal. It is the most inferior variety of coal which contains 10-15% of carbon. When it is burnt, it produces a lot of smoke.
- 2.LIGNITE: Lignite is brown in colour. It contains 25-35% of carbon. Like peat it also produces a lot of smoke on being ignited. It can be used for power generation.

- 3.BITUMINOUS COAL: It is also called soft coal. It contains 45-86% of carbon. It is used as a common household fuel and industrial fuel.

7. What is destructive distillation of coal?

Heating coal in the absence of air is called destructive distillation of coal.

8. Name some product of coal and their uses?

- Coal Gas -----As a fuel in cooking food
- LiquorAmmonia -------To make fertilizers
- Coal Tar----- To make plastics, paints, dyes, naphthalene balls and explosives
- Coke---- As a fuel and as a reducing agent in steel manufacturing

9. What is the consumption of coal?

The coal that we consume in one day is what the earth took 1000 years to form. The amount of coal we consume is greater than the amount that we produce.

10. What does 1000 kg of coal gives?

• 700 kg of coke

• 100 litres of ammonia

• 50 litres of coal tar

• 400 m3 of coal gas

11. Where was world`s first petroleum found?

•The world's first petroleum well was drilled in Pennsylvania, USA(1859.)

•Eight years later in 1867,oil was struck at Makum in Assam

12. How did petroleum form?

Millions of years ago, dead plants and animals were buried at the bottom of the sea. They got covered with layers of sand and clay. Due to high pressure and temperature, they transformed into petroleum.

13. Name places where petroleum is present?

The chief petroleum producing countries are U.S.A Kuwait, Iraq, Iran, Russia and Mexico. In India, petroleum is found in Assam, Gujarat, Maharashtra(Mumbai), Andhra Pradesh (Godavari and Krishna basin) and Tamil Nadu (Cauveri Basins). Petroleum is obtained by drilling through the earth. The crude oil is pumped out from the well as a black liquid.

14. What is refining of petroleum?

Petroleum is a mixture of various constitutents such as petroleum gas, petrol, diesel, kerosene, lubricating oil, paraffin wax, etc. The process of separation of the various constitutents or fractions of petroleum by fractional distillation in fractionating columns is known as refining of petroleum.

15. Name some fraction and their uses?

- Petroleum Gas- Fuel for home (LPG)
- Petrol -Motor fuel
- Kerosene- Fuel for stove and jet aircrafts
- Diesel- Fuel for heavy motor vehicles
- Lubricating oil - Lubrication
- Fuel Oil- Fuel for Power Stations and Ship
- Paraffin wax- Candles, Vaseline,
- Bitumen - Paints, Road surfacing

16. Why is petroel called as black gold?

Many useful substances are obtained from petroleum and natural gas. These are termed ‘Petrochemicals. These are used in the manufacture of detergents, fibres, and other man-made

plastics like polythene. Hydrogen gas obtained from natural gas, is used in the production of fertilizers. Due to its great commercial importance, pertoleum is also called ‘black gold.

17. How are natural gas formed?

Natural gas is formed whenever vegetation decomposes in marshy areas and waste sewages. It also occurs in coal mines and petroleum wells. It mainly contains 90% methane.

18. Name some places where natural gas is present?

Naturalgas in Tripura, Rajasthan, Maharashtra, Andhra Pradesh (Krishna, Godavari Basins) and Tamilnadu (Cauveri Delta.)

19. What are the ways of using natural gas?

1. CNG (Compressed Natural Gas )

2. LNG ( Liquified Natural Gas )

CNG is stored at high pressure whereas LNG is in ultra cold liquid form. CNG can be produced at lower cost.

20. What are the advantages of CNG?

- It is a less pollutant fuel.
- It is directly used as fuel for burning at home and factories.
- It is the basic material for the manufacture of a number of chemicals and fertilizers.

21. Name some natural resources along with their lasting period?

Coal-------148 years

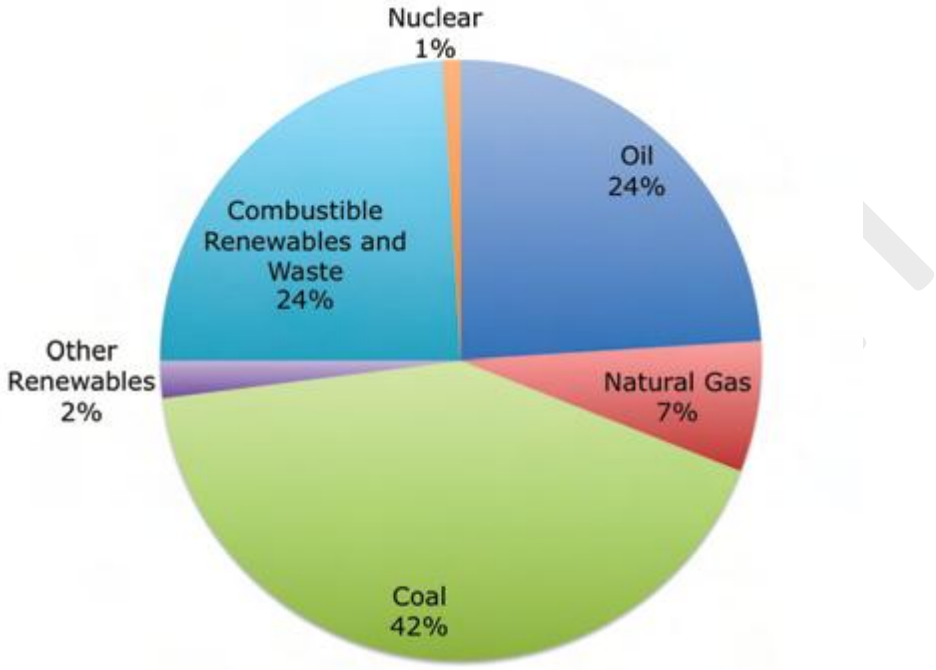
Petroleum--------40 years

Natural Gas--------61 years

22. What is bio-diesel?

Biodiesel is a fuel obtained from vegetable oils such as Soyabean oil, Jatropha oil, Cornoil, Sunflower Oil, Cotton seed oil, Rice bran oil and Rubber seed oil.

23. Name the energy sources in usage?




24. Name some places where we can find wind mills?

Wind mills are mostly located at Kayathar, Aralvaimozhi, Palladam and Kudimangalam in TamilNadu.

25. How are solar energy used?

Solar energy is harnessed using (i) solar cookers (ii) solar water heaters (iii) solar cells.

26. What is gobar gas?

Gobar gas is obtained by the fermentation of cow dung in the absence of air (anaerobic conditions). It mainly contains methane and a little ethane. It is widely used in rural areas for cooking and operating engines

27. Which is the future fuel?

Hydrogen

28. What is Cold Fusion Process?

Nuclear fusion is a process in which two or more lighter nuclei of atoms are combined to produce nuclear energy. This process requires very high temperature. If the nuclear fusion process is carried out at room temperature, it is called as cold fusion process.

29. How can we use Methane from sewage?

Sewage sludge can be decomposed by microorganisms to produce methane gas along with impurities like carbon dioxide and hydrogen sulphide. After removing these impurities, methane gas can be used as an efficient fuel.

## 13. Chemical Equation

1. What is photosynthesis?

Plants produce their food (carbohydrate) by a chemical reaction called photosynthesis. The process of photosynthesis requires: (i) carbon dioxide (ii) water (iii) sunlight (iv) chlorophyll. This can be represented by the equation:

Carbon dioxide + Water-sunlight/chlorophyll---- Carbohydrate + Oxygen

2. How are atom made of?

Atoms are made up of particles called protons, neutrons and electrons. Protons are positively charged, while electrons are negatively charged. An atom has no net charge. It is said to be electrically neutral, since it has an equal number of protons and electrons.

3. What is ion?

In chemical reactions, the number of protons in an atom remains unchanged, whereas the number of electrons may increase or decrease. This leads to a difference in the number of protons and electrons giving a net electrical charge to the atom. When an atom acquires a net charge, it is called an ion. Ions are atoms or group of atoms that carry a net positive or negative charge.

4. What is cation?

If an atom, which is electrically neutral, loses one or more electrons, it becomes positively charged and is called a cation

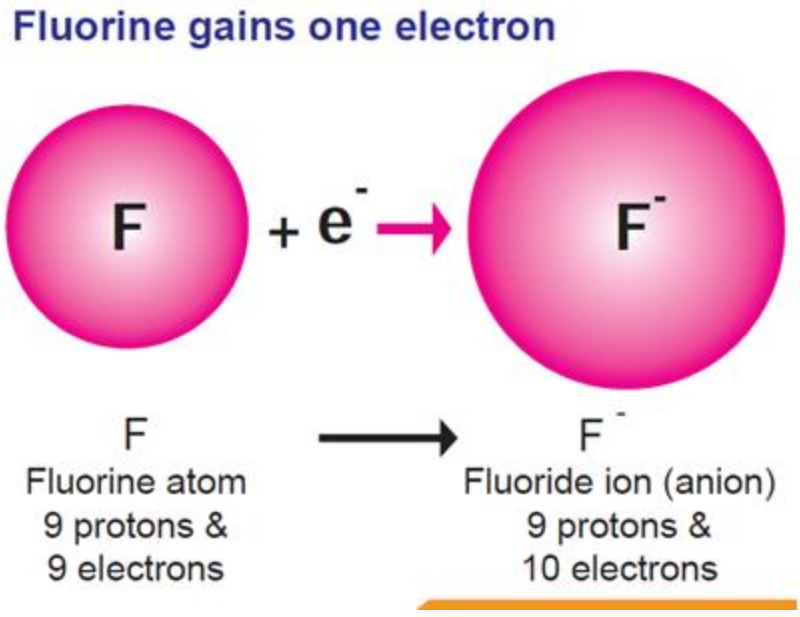
5. What are anions?

If an atom, which is electrically neutral, gains one or more electrons, it becomes negatively charged and is called an anion.

6. Why is caution smaller than atom?

This is because the nucleus pulls the electrons towards it, as the number of protons is more than the number of electrons.

7. How is Formation of fluoride ion from fluorine atom taking place?




8. What is Monoatomic ions?

A monoatomic ion is formed from a single atom. For example, Sodium ion Na+ is a monoatomic cation and Fluoride ion F- is a monoatomic anion.

9. What is Polyatomic ions?

An ion can also be formed from one or more atoms of different elements. This is called a polyatomic ion. A polyatomic ion exists and behaves as a single unit. It may carry either a positive or a negative charge. Example: NH4 + is Ammonium ion (polyatomic cation) OH- is Hydroxide ion (polyatomic anion)

10. What is dimer?

A molecule formed by the combination or association of two molecules is known as a dimer.

Hg2 2+ Mercurous ion exists as a dimer only.

11. What is valency?

The valency of an element is the net charge on the ion of that element. For a polyatomic ion, the net charge of the group is its valency.

| | Monoatomic ion | | Polyatomic ion | |
|---|---|---|---|---|
| | cation | anion | cation | anion |
| Monovalent | $Na^+$ | $F^-$ | $NH_4^+$ | $OH^-$ |
| Divalent | $Ca^{2+}$ | $S^{2-}$ | | $SO_4^{2-}$ |
| Trivalent | $Fe^{3+}$ | $N^{3-}$ | | $PO_4^{3-}$ |

12. What are monovalent polyatomic ions and bivalent polytomic ions?

**Monovalent polyatomic ions**

| Name | Formula |
|---|---|
| Bisulphate ion | $HSO_4^-$ |
| Bisulphite ion | $HSO_3^-$ |
| Chlorate ion | $ClO_3^-$ |
| Chlorite ion | $ClO_2^-$ |
| Cyanide ion | $CN^-$ |
| Hydroxide ion | $OH^-$ |
| Hypochlorite ion | $ClO^-$ |
| Nitrate ion | $NO_3^-$ |
| Nitrite ion | $NO_2^-$ |
| Perchlorate ion | $ClO_4^-$ |
| Permanganate ion | $MnO_4^-$ |

**Bivalent polyatomic ions**

| Name | Formula |
|---|---|
| Carbonate ion | $CO_3^{2-}$ |
| Chromate ion | $CrO_4^{2-}$ |
| Dichromate ion | $Cr_2O_7^{2-}$ |
| Manganate ion | $MnO_4^{2-}$ |
| Peroxide ion | $O_2^{2-}$ |
| Sulphate ion | $SO_4^{2-}$ |
| Sulphite ion | $SO_3^{2-}$ |
| Thiosulphate ion | $S_2O_3^{2-}$ |

Trivalent polyatomic ions

13. What are Multivalent cations or polyvalent cations?

**Multivalent cations or polyvalent cations**

| Formula | Name | Formula | Name |
|---|---|---|---|
| $Au^+$ | Gold (I) or Aurous | $Au^{3+}$ | Gold (III) or Auric |
| $Ce^{3+}$ | Cerium (III) or Cerous | $Ce^{4+}$ | Cerium (IV) or Ceric |
| $Co^{2+}$ | Cobalt (II) or Cobaltous | $Co^{3+}$ | Cobalt (III) or Cobaltic |
| $Cr^{2+}$ | Chromium (II) or Chromous | $Cr^{3+}$ | Chromium (III) or Chromic |
| $Cu^+$ | Copper (I) or Cuprous | $Cu^{2+}$ | Copper (II) or Cupric |
| $Fe^{2+}$ | Iron (II) or Ferrous | $Fe^{3+}$ | Iron (III) or Ferric |
| $Mn^{2+}$ | Manganese (II) or Manganous | $Mn^{3+}$ | Manganese (III) or Manganic |
| $Pb^{2+}$ | Lead (II) or Plumbous | $Pb^{4+}$ | Lead (IV) or Plumbic |
| $Sn^{2+}$ | Tin (II) or Stannous | $Sn^{4+}$ | Tin (IV) or Stannic |

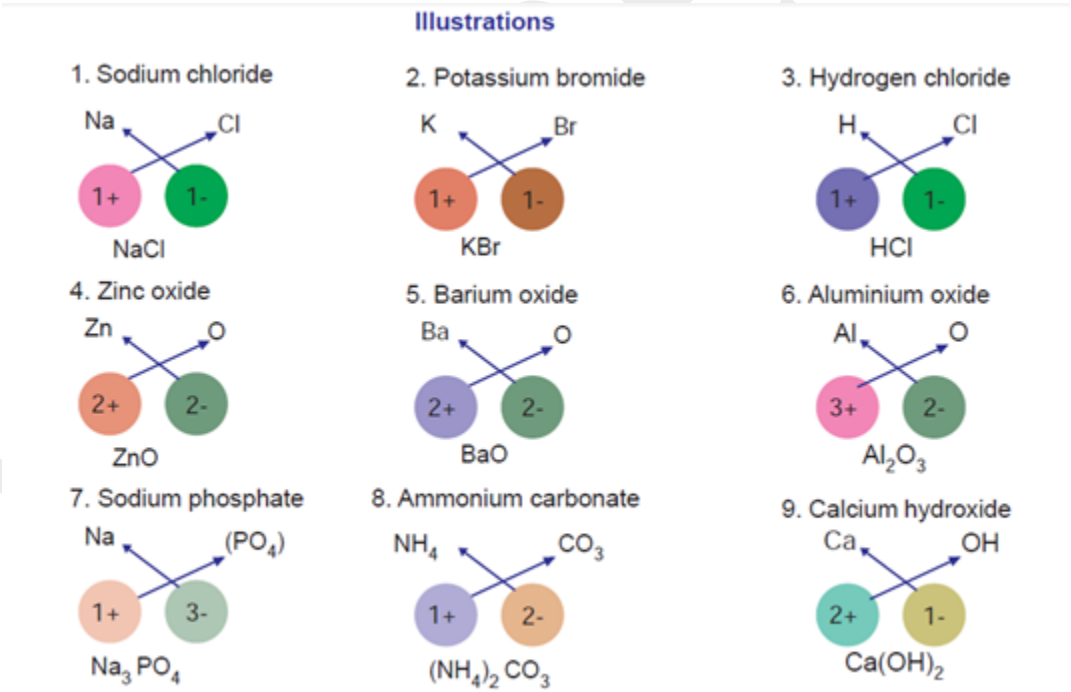
14. What is chemical formula?

A Chemical formula is a symbolic way to represent a compound. To write the chemical formula of a compound, symbols and valencies of constituent elements must be known.

15. What are the methods used for writing chemical formula?

- The symbols or formulae of the components are written side by side.
- Positive ions are written on the left and negative ions on the right.
- The valencies of ions are written below the respective symbols.
- The criss-cross method is applied to exchange the numerical value of valency of each ion. It is written as subscript of the other ion.
- For a polyatomic ion, the ion is enclosed within brackets and the subscript is placed outside the lower right corner.
- The common factor is removed.
- If the subscript of the ion is one, it is omitted.

16. Give some illustration for writing formulas?




17. What is chemical equation?

The symbolic expression of a chemical reaction, using symbols of reactants and products, is called a chemical equation.

18. What is the nature of reactants and products?

The physical state of a substance can be indicated using the following symbols as a subscript:

| Physical state | Symbol | Example |
|---|---|---|
| solid state | (s) | $NaCl_{(s)}$ |
| liquid state | (l) | $H_2O_{(l)}$ |
| gaseous state | (g) | $O_{2(g)}$ |
| solution in water | (aq) | $NH_{3(aq)}$ |

The following arrows are used to show the nature of the substances:

(↑) gas is released. Example: O2(g) ↑

(↓) precipitate is formed. Example: BaSO4↓

19. What are reaction condition?

Favourable conditions like temperature, pressure, presence of catalyst and light can be indicated above or below the arrow.

Example:

(iii) Heat changes:

Some reactions involve heat changes.

Example:

N2 + 3H2 2NH3 + heat

Heat is released. This is an exothermic reaction.

20. What is balancing chemical equation?

The "Law of conservation of mass" requires that the number of atoms present before the reaction (reactants) must be equal to the number of atoms present after the reaction (products). In other words, the equation must be "balanced".

21. What are the procedures for balancing an equation?

- Identify the reactants and the products and write the skeleton equation. For example:
- Reactant A + Reactant B---------→ Product C + Product D
- Count the number of atoms on either side. If they are not equal, balance them by adjusting the number of reactants or products.
- If the coefficients have a common divisor, simplify.

22. Balance the reaction between Sodium and Chlorine.

Na + Cl2 ---→NaCl

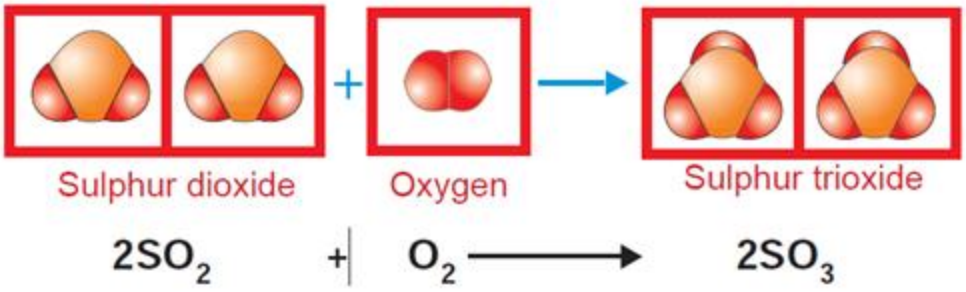
Balance Cl atom:

Na + Cl2 --→2NaCl

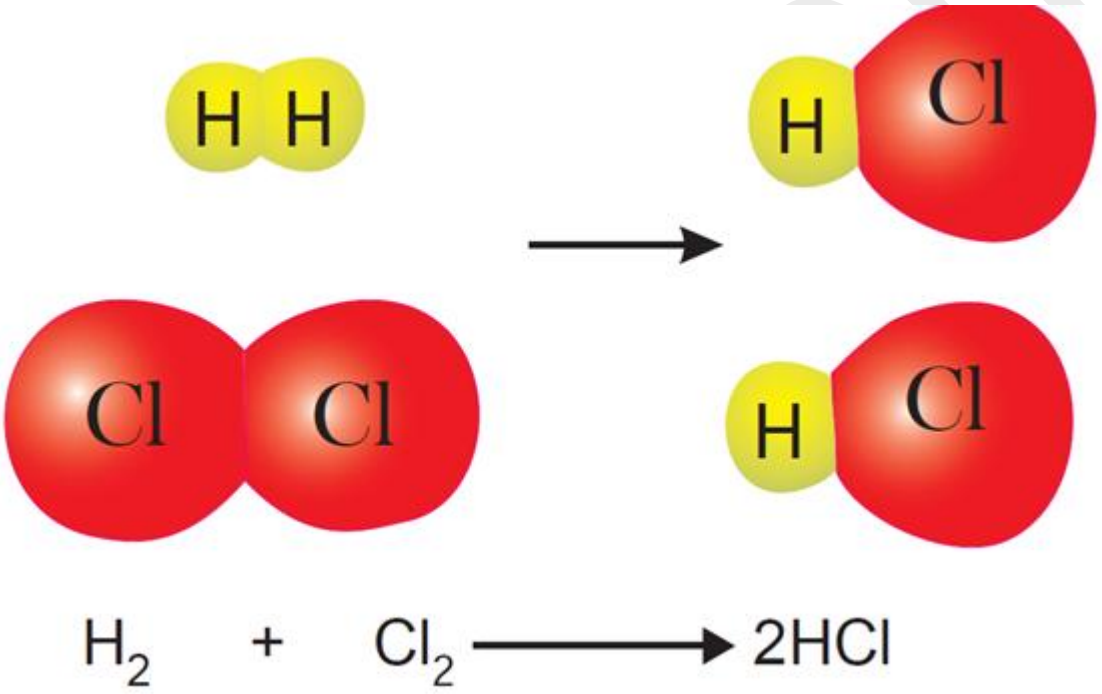
Balance Na atom:

2Na + Cl2 ---→2NaCl

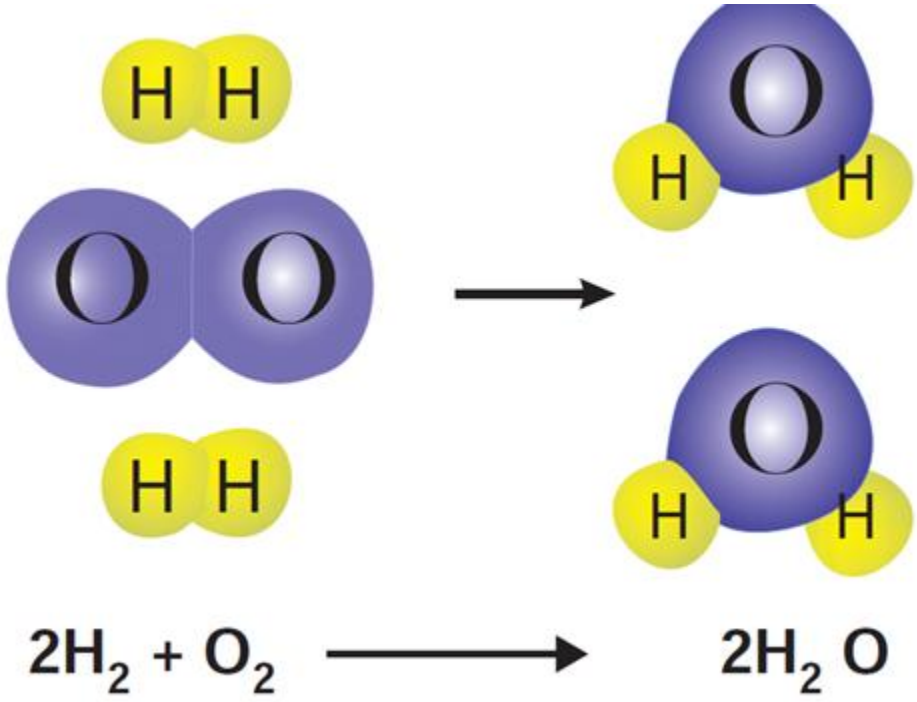
23. What is the reaction between Sulphur dioxide and Oxygen to form Sulphur trioxide?




24. What is the reaction between Hydrogen and Chlorine to form Hydrogen chloride?




25. What is the reaction between Hydrogen and Oxygen to form water?




26. How is acid rain produced?

Some chemical reactions take place naturally during lightning. Nitrogen in the atmosphere combine with oxygen to form nitrogen dioxide.

N2 + 2O2 -→ 2NO2

Oxygen present in the atmosphere is converted to ozone.

3O2------→ 2O3

This acidic oxide like nitrogen dioxide mixes with tiny droplets of water vapour to produce acid rain which is harmful to plants.

4NO2 + O2 + 2H2O --------→ 4HNO3

## 14. Carbon and its Compounds

1. What is the nature of carbon?

Without carbon, no living thing could survive. Human beings are made up of carbon compounds. Carbon is a non-metal. In nature, it occurs in its pure form as diamond and graphite. When fuels burn, the carbon in them reacts with oxygen to form carbon dioxide.

2. What is carbon cycle?

Carbon compounds hold the key to plant and animal life on the earth. Carbon circulates through air, plants, animals and soil by means of complex reactions. This is called carbon cycle.

3. What are the compounds of carbon?

In the beginning of the 19th century, scientists classified the compounds of carbon into two types, based on their source of occurence. They are:

i) Inorganic compounds (obtained from non living matter)

ii) Organic compounds (obtained from living matter, such as plant and animal sources)

4. What is living chemistry?

All living organisms are made of carbon atoms. This means that, carbon atoms form the building blocks of living organisms. These carbon atoms, in combination with other atoms decide life on earth. Hence carbon chemistry is also called as living chemistry.

5. Who is creator of revolution in ORGANIC CHEMISTRY?

FRIEDRICH WOHLER

6. What is organic chemistry?

The word ‘organic’ signifies life. The term organic chemistry was used by the Swedish chemist Berzelius. This refers to the chemistry of living things. However, the German chemist Wohler succeeded in the synthesis of an organic compound (urea) from an inorganic compound (ammonium cyanate) in his laboratory. This has dealt a severe blow to the Vital Force Theory (a theory of life process).

7. What is the definition of organic chemistry?

Organic Chemistry is defined as the branch of chemistry that deals with organic compounds which are made up of hydrocarbons and their derivatives. It gives a thorough insight into the nature of bonding, synthesis, characteristics and their usefulness in various fields.

8. What is KOHINOOR DIAMOND?

The most precious diamond is a crystalline allotrope of carbon. KOHINOOR DIAMOND is a 105 carat diamond (21.68g). It was seized by the EAST INDIA COMPANY and became the part of British Crown Jewels. May it be an ordinary coal or the most precious Kohinoor diamond, it is an allotropic modification of carbon indeed.

9. What are the bonding in carbon?

The atomic number of carbon is 6 and its ground state electronic configuration is 1s2 2s2 2p2. Since it has four electrons in its outermost shell, its valency is four. To achieve noble gas configuration, carbon atom has to lose or gain four electrons to form C4+ and C4- ions.

10. What is tetra valency of carbon?

Carbon overcomes this problem by sharing its valence electrons with other atoms of carbon or with atoms of other elements. This characteristic of carbon atom by virtue of which it forms four covalent bonds is generally referred to as tetra valency of carbon.

11. What is Allotropy?

Allotropy is defined as the property by which an element can exist in more than one form that are physically different but chemically similar.

12. What are the Allotropes of carbon?

• Carbon exists in three allotropic forms. They are: crystalline form (diamond and graphite), amorphous form (coke,charcoal) and fullerene. Graphite is a good conductor of electricity unlike other non-metals since it has free electrons in it.

• Fullerenes form another type of carbon allotropes. The first one was identified to contain 60 carbon atoms in the shape of a football. (C-60). Since this looks like the geodesic dome designed by the US architect Buck Minster Fuller, it is named as Buck Minster Fullerene.

• Diamond and graphite are crystalline allotropic forms. They differ in nature of the bond.

• In diamond, each carbon atom is bonded to four other carbon atoms in a tetrahedral fashion leading to a rigid three dimensional structure, accounting for its hardness and rigidity.

• In graphite, each carbon atom is bonded to three other carbon atoms in the same plane giving hexagonal layers held together by weak Vander Waals forces accounting for softness.

13. What is catenation.?

Carbon has the ability to form covalent bonds with other atoms of carbon giving rise to a large number of molecules through self linking property. This property is called catenation.

14. What is isomerism?

Carbon compounds show isomerism, the phenomenon by which two or more compounds have same molecular formula but different structural formula with difference in properties. i.e the formula C2H6O represents two different compounds namely ethyl alcohol (C2H5OH) and dimethyl ether (CH3OCH3).

15. What are the chemical properties of carbon?

- Carbon and its compounds burn in oxygen to give carbon dioxide along with heat and light. e.g.

  C + O2 → CO2 + heat + light

  CH4 + 2O2 → CO2 + 2H2O + heat + light

  C2H5OH + 3O2 → 2CO2 + 3H2O + heat + light
- Carbon compounds can be easily oxidized using suitable oxidizing agent like alkaline potassium permanganate to form carboxylic acids.
- CH3CH2OH (ethanol)____ KMnO4/ OH/2 (o) ___ CH3COOH+ H2O(ethanoic acid)

- Unsaturated carbon compounds undergo addition reactions with hydrogen in the presence of palladium or nickel catalyst.
- Saturated carbon compounds undergo substitution reactions in the presence of sunlight. e.g., methane undergoes substitution reaction to form different types of products.
- Carbon compounds such as alcohols react with sodium to liberate hydrogen gas. e.g. $2CH3CH2OH + 2Na \rightarrow 2CH3CH2ONa + H2 \uparrow$

16. What are homologous series?

A homologous series is a group or a class of organic compounds having same general molecular formula and similar chemical properties in which the successive members differ by a CH2 group.

17. What are the Characteristics of Homologous series?

• Each member of the series differs from the preceding or succeeding member by a common difference of CH2 and by a molecular mass of 14 amu ( amu = atomic mass unit).

• All members of each homologous series contain same elements and same functional groups.

• All members of each homologous series have same general molecular formula.

e.g. Alkane = CnH2n + 2

Alkene = CnH2n

Alkyne = CnH2n – 2

18. What are the importance of homologous series?

- It helps to predict the properties of the members of the series that are yet to be prepared.
- Knowledge of homologous series gives a systematic study of the members.
- The nature of any member of the family can be ascertained if the properties of the first member are known.

19. What are Hydrocarbons?

The organic compounds containing only carbon and hydrogen are called Hydrocarbons. These are regarded as the parent organic compounds and all other compounds are considered to be derived from them by the replacement of one or more hydrogen atoms by other atoms or groups of atoms.

20. What are the types of hydrocarbon?

Hydrocarbons are classified into two types: saturated and unsaturated hydrocarbons.

21. What are paraffins?

General formula = CnH2n+2Suffix : -ane

These are the organic compounds which contain carbon–carbon single bond. These were earlier named as paraffins (Latin : meaning little affinity) due to their least chemical reactivity. According to IUPAC system, these are named as alkanes (-ane is suffix with root word).

22. What are the formulas, common name and IUPAC names for the following?

| Formula | Common name | IUPAC name |
|---|---|---|
| $CH_4$ | Methane | Methane |
| $CH_3CH_3$ | Ethane | Ethane |
| $CH_3CH_2CH_3$ | Propane | Propane |
| $CH_3CH_2CH_2CH_3$ | n-Butane | Butane |

23. How are Unsaturated Hydrocarbons classified?

The hydrocarbon can classified into two types: alkenes and alkynes.

24. What is alkenes?

The hydrocarbons containing at least one carbon to carbon double bond are called alkenes. They have the general formula CnH2n .These were previously called olefins (Greek : olefiant – oil forming) because the lower gaseous members of the family form oily products when treated with chlorine.

25. Name the Alkene Common Name IUPAC Name for the following?

| Alkene | Common Name | IUPAC Name |
|---|---|---|
| $CH_2 = CH_2$ | Ethylene | Ethene |
| $CH_3CH = CH_2$ | Propylene | Propene |
| $CH_3CH_2–CH=CH_2$ | α-Butylene | But–1–ene |
| $CH_3CH = CHCH_3$ | β-Butylene | But–2–ene |

26. What is alkynes.?

Alkynes: General formula: CnH2n-2 Suffix : -yne

The hydrocarbons containing carbon to carbon triple bond are called alkynes. Alkynes are named in the same way as alkenes i.e., by replacing suffix -ane of alkane with -yne. In higher members, the position of triple bond is indicated by giving numbers 1, 2, 3, 4, ….to the carbon atom in the molecule.

27. Give the Alkyne Common Name IUPAC Name for the following?

| Alkyne | Common Name | IUPAC Name |
|---|---|---|
| $HC \equiv CH$ | Acetylene | Ethyne |
| $H_3C - C \equiv CH$ | Methyl acetylene | Propyne |
| $H_3C - C \equiv C - CH_3$ | Dimethyl acetylene | 2-Butyne |
| $H_3C - CH_2 - C \equiv CH$ | Ethyl acetylene | 1-Butyne |

28. What is Functional group?

Functional group may be defined as an atom or group of atoms or reactive part which is responsible for the characteristic properties of the compounds. The chemical properties of organic compounds are determined by the functional groups while their physical properties are determined by the remaining part of the molecule.

Example: -OH => Alcohol

C=O => Ketone

CHO => Aldehyde

COOH => Carboxylic acid

29. What is alcohol?

Alcohols are carbon compounds containing –OH group attached to alkyl group. The general formula of alcohol is R-OH where 'R' is an alkyl group and –OH is the functional group. The IUPAC name of alcohol is derived by replacing –e, in the word alkane, with the suffix –ol. Hence we get the name alkanol.

30. What are the Molecular Formula Common Name IUPAC Name for the following?

| Molecular Formula | Common Name | IUPAC Name |
|---|---|---|
| $CH_3OH$ | Methyl alcohol | Methanol |
| $CH_3$-$CH_2$-OH | Ethyl alcohol | Ethanol |
| $CH_3$- $CH_2$-$CH_2$-OH | n-Propyl alcohol | 1-Propanol |
| $CH_3$-CH(OH)-$CH_3$ | Isopropyl alcohol(or) secondary propyl alcohol | 2-Propanol |
| $CH_3$-$CH_2$-$CH_2$-$CH_2$-OH | n-Butyl alcohol | 1-Butanol |
| $CH_3$-CH($CH_3$)-$CH_2$-OH | Isobutyl alcohol | 2-Methyl-1-propanol |

31. What is Aldehydes?

Aldehydes are carbon compounds containing -CHO group attached to alkyl group or hydrogen atom. The general formula of aldehydes is R – CHO where 'R' is an alkyl group or hydrogen atom and – CHO is the functional group. The IUPAC name of aldehyde is derived by replacing – e, in the word alkane, with the suffix –al. Hence we get the name "alkanal".

32. Give the Molecular Formula Common Name IUPAC Name for the following?

| Molecular Formula | Common Name | IUPAC Name |
|---|---|---|
| HCHO | Formaldehyde | Methanal |
| $CH_3$- CHO | Acetaldehyde | Ethanal |
| $CH_3$- $CH_2$- CHO | Propionaldehyde | Propanal |
| $CH_3$- $CH_2$-$CH_2$- CHO | n-Butyraldehyde | Butanal |

33. What are Ketones?

Ketones are carbon compounds containing carbonyl – CO – group attached to two alkyl groups. The general formula of ketone is R-CO-R' where R and R' are alkyl groups and – CO – is the functional group. The IUPAC name of ketone is derived by replacing –e, in the word alkane, with the suffix -one. Hence we get the name "alkanone".

34. What are Carboxylic acids?

Carboxylic acids are carbon compounds containing –COOH group attached to a hydrogen atom or an alkyl group. The general formula of acid is R-COOH where 'R' is a hydrogen atom or an alkyl group and –COOH is the functional group. The IUPAC name of acid is derived by replacing – e, in the word alkane, with the suffix –oic acid. Hence we get the name "alkanoic acid".

35. What is Ethanol?

Ethanol or ethyl alcohol or simply alcohol is one of the most important members of the family of alcohols.

36. What is the Manufacture of Ethanol from Molasses?

(i) Dilution: Molasses is first diluted with water to bring down the concentration of sugar to about 8 to 10 percent.

(ii) Addition of Ammonium Salts: Molasses usually contains enough nitrogenous matter to act as food for yeast during fermentation. If the nitrogen content of the molasses is poor, it may be fortified by the addition of ammonium sulphate or ammonium phosphate.

(iii) Addition of Yeast: The solution from step (ii) is collected in large 'fermentation tanks' and yeast is added to it. The mixture is kept at about 303K for a few days. During this period, the enzymes invertase and zymase present in yeast, bring about the conversion of sucrose into ethanol. The fermented liquid is technically called wash.

(iv) Distillation of Wash: The fermented liquid containing 15 to 18 percent alcohol and the rest of the water, is now subjected to fractional distillation. The main fraction drawn, is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water. This is called rectified

spirit. This mixture is then heated under reflux over quicklime for about 5 to 6 hours and then allowed to stand for 12 hours. On distillation of this mixture, pure alcohol (100%) is obtained. This is called absolute alcohol.

37. What is fermentation?

The slow chemical change that takes place in complex organic compounds by the action of enzymes leading to the formation of simple molecules is called fermentation.

38. What are the uses of ethanol?

- as an anti-freeze in automobile radiators.
- as a preservative for biological specimen.
- as an antiseptic to sterilize wounds, in hospitals.
- as a solvent for drugs, oils, fats, perfumes, dyes, etc.
- in the preparation of methylated spirit (mixture of 95% of ethanol and 5% of methanol), rectified spirit (mixture of 95.5% of ethanol and 4.5% of water), power alcohol (mixture of petrol and ethanol) and denatured spirit (ethanol mixed with pyridine).
- in cough and digestive syrups.

39. What are the uses of Ethanoic acid?

- For making vinegar which is used as a preservative in food and fruit juices.
- As a laboratory reagent.
- For coagulating rubber from latex.
- In the preparation of dyes, perfumes and medicines.