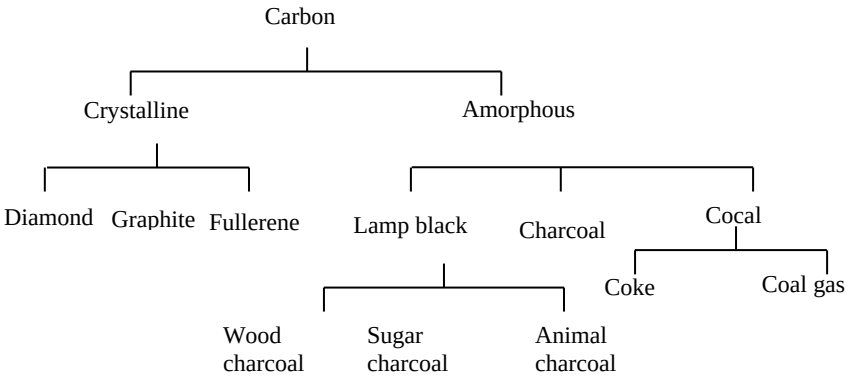
Carbon

Introduction:

Carbon is the most important and widely distributed element the earth. It is present in the bodies of all living organisms, plants and animals and also in several non-living things (e.g. limestone, marble, chalk etc.) It is present in air as CO_2. It forms the larges number of compounds. Compounds of carbon are studies as a separate branch of chemistry known as organic chemistry. It exists in free as well as in combined form. Diamond, graphite and coal are the free forms of carbon. Marble, paper, cloth and sugar are the combined forms or compounds or carbon.

Allotropes

Allotropes is the property by the virtue of which an element exists in more than one form and each form has different physical properties, but identical chemical properties. These different forms are called allotropes. Carbon, Phosphorus and Sulphur exhibit the property of allotropy.

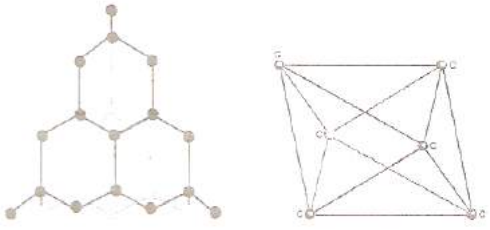


Crystalline Forms of Carbon

Crystalline forms are those forms in which the carbon atoms are arranged in a definite order due to which they assume a definite shape or form crystals.
Carbon has three crystalline forms.
(a) Diamond (b) Graphite (c) Fullerenes

(a) Diamond

(i) Structure of diamond: Diamond crystals found in nature are generally octahedral (eight faced). In the structure of diamond, each carbon is linked to four other carbon atoms forming a regular and tetrahedral arrangement.



Three dimensional tetrahedral structure

(ii) Properties of diamond:

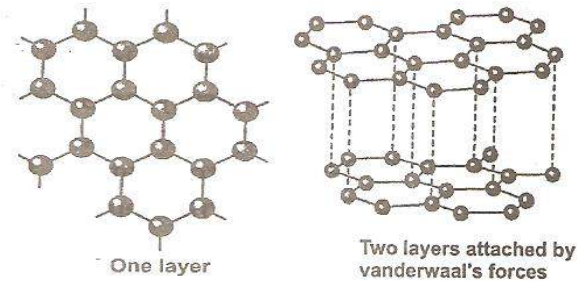
- It occurs naturally in Free State and has octahedral shape.
- It is the hardest known natural substance.
- It has high specific gravity (about 3.52)
- It is transparent, colourless and brittle solid.
- It has high refractive index (about 2.4).
- It is non-conductor of electricity.
- It does not react with any chemical. However, when heated to 800_oC in the presence of oxygen it gives carbon dioxide.

(iii) Uses of diamond:

- They are used in jewellery because of their ability to reflect and refract light.
- Black diamonds called carbonado are used in cutting glass and drilling rocks.
- Diamond has extraordinary sensitivity to heat rays and due to this reason, it is used for making high precision thermometers.
- Diamond has the ability to cut out harmful radiations and due to this reason it is used for making protective windows for space probes.
- Diamond dies are used for drawing thin wires. Very thin tungsten wires of diameter less than one –sixth of the diameter of human hair have been drawn using diamond dies.
- It is used as bearing in the watches.
- Diamonds are used as needles for long playing record player.
- Surgeons use diamond knives for performing delicate operations.

(b) Graphite:

(i) Structure of graphite: It has two dimensional hexagonal layer structure.



(ii) Properties of graphite:

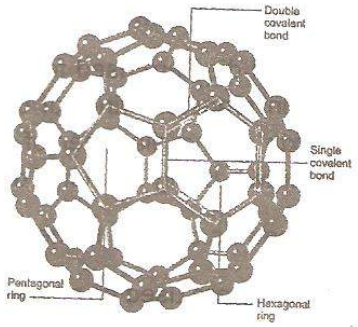
- It is greyish black and opaque.
- It is soft and greasy in touch.
- Its specific gravity is 2.5
- It occurs in hexagonal layers.
- It is a good conductor of heat and electricity.
- It is stable and has high melting point

• When heated to 700°C in presence of oxygen it gives carbon dioxide and heated in the absence of air melts at 3675°c

(iii)Uses of graphite:

- It is used for making pencil lead, printer's ink, black paint etc.
- It is used as dry lubricant for heavy machinery
- It is used in making crucibles for melting substances.
- It is used as an electricity in batteries and electric furnaces
- It is used in nuclear reactors as moderator to regular nuclear reactions
- It is also used in making artificial diamond.

(C) Fullerenes: Fullerene is naturally occurring allotrope of carbon in which 60 carbon atoms are linked to from a stable structure previously, only two forms of carbon (diamond and graphite) were known This third allotrope of carbon, called fullerene, was discovered in 1985 by Robert Curl, Herald Krota and Richard Smalley.



Structure of Fullerene

They correctly suggested the cage structure as shown in the figure and named the molecule Buckminster fullerene after the architect Buckminster Fuller, the inventor of the Geodesic dome, which resembles the molecular structure of C_{60}. Molecules of C_{60} have a highly symmetrical structure in which 60 carbon atoms are arranged in a closed net with 20 hexagonal faces and 12 pentagonal faces.

(i) Uses of fullerenes:

It is hoped fullerenes or their compounds may find uses as-

- Superconductors
- Semiconductors
- Lubricants
- Catalysts
- Highly tensile fibres for construction industry.
- Inhibiting agent in the activity of AIDS virus.

DIFFERENCE BETWEEN PROSPERITIES OF DIAMOND AND GRAPHITE

Property	Diamond	Graphite
Hardness	Hardest natural substance	Very Soft
Density	3.5/cm^3	2.25 g/cm_3
Tendency to conduct electric current	Bad conductor	Good conductor
Colour	Pure diamond is colourless	Black
Transparency	Transparent	Opaque
Occurrence	Rare	Abundant
Structure	Tetrahedral	Hexagonal layer

Amorphous Forms of Carbon

The important varieties of amorphous carbon are:

(a) Charcoal:

Charcoal can be obtained from a variety of sources. Ti is produced by heating a source material in the absence of air. Such a process is called destructive distillation. Charcoal is normally named after the source from which it is obtained.

Charcoal is classified into three types based on its source material-

(i) Wood charcoal: It is derived from wood by heating it in the absence of air. This process is called destructive distillation of wood. In this process a dark coloured liquid is obtained. It is wood tar and, the clear liquid formed above the dark liquid, is known as pyroligneous acid. It turns blue litmus red. A black mass is also obtained it is called wood charcoal, i.e. The residue of sawdust.

(A) Properties of wood charcoal: The properties of wood charcoal are as follows-

- It is a black, porous and brittle solid.
- It is heavier than water (specific gravity 1.5)
- If floats on water as it has the capacity to hold air in its pores.
- It a good adsorbent.
- It is a bad conductor of electricity

(B) Uses of wood charcoal: The uses of wood charcoal are as follows:-

- It is used as a fuel.
- It is an important constituent of gunpowder.
- It is used in gas masks or respirators as it adsorbs harmful gases.
- It forms a component of cigarette filters as it adsorbs the poisonous vapours of nicotine.
- It helps in decolorizing sugar syrup, and refining oils and fats by removing coloured impurities.
- It is used as a disinfectant.

(ii) Animal charcoal: It is also known as bone charcoal. This type of charcoal is obtained by the destructive distillation of bones in the absence of air. Bone oil and pyridine are obtained as by products. The chief ingredient of animal charcoal is calcium phosphate with the carbon content limited to 10-12 percent only.

(a) Properties and uses of animal charcoal:

Animal charcoal has the following properties and uses-

- It has the property of extracting coloured materials from solutions.
- It is easily wetted by liquids and is extensively used to decolorize sugar solutions.
- It is used in the manufacture of phosphorus and its compounds.

(iii) Sugar charcoal: Sugar charcoal is the purest from of amorphous carbon. It is prepared by heating cane sugar or glucose in the absence of air.

$$\underset{Glucose}{C_6H_{12}O_6} \xrightarrow{Heat} \underset{Carbon}{6C} + \underset{Water}{6H_2O}$$

$$\underset{Glucose}{C_{12}H_{22}O_{11}} \xrightarrow{Heat} \underset{Carbon}{12C} + \underset{Water}{11H_2O}$$

It can also be prepared by the dehydration of cane sugar or glucose in the presence of concentrated sulphuric acid. The acid absorbs the water to leave behind carbon.

(b) Coal:

Coal is a mixture of compounds of carbon, hydrogen, oxygen and some free carbon. Coal is formed a the result of high temperature and pressure on the logs of wood and the remains of animals which got buried under the earth due to earthquakes and volcanoes millions of years ago. The different varieties of coal are obtained as a result of slow chemical conversion of wood into coal called carbonization. The approximate percentage of carbon present in different varieties of coal is-

Types of coal	Percentage of carbon
Peat	60%
Lignite (soft coal)	67%
Bituminous (household coal)	88%
Anthracite (hard coal)	96%

Peat is the most inferior and anthracite is the most superior quality of coal. Coal is mainly used as fuel and to make coke. Coke is the purest form of coal. Coal is also used as a source of large number of organic compounds. These organic compounds are used in the manufacture or drugs, explosives etc.

(c) Coke: It is a grayish-black, hard solid. It is prepared by the destructive distillation of coal. In 1709, Abraham Darby, an iron maker, used coke instead of charcoal to extract iron from its ore. Coke was prepared by him by roasting coal until only the carbon skeleton was left.

Uses of Coke:

- Coke is used as a fuel.
- It is used for making gaseous fuels.
- It is used for reducing iron ore to iron in blast furnace.
- It is used for making electrodes.
- It is used in the manufacture of graphite, water gas etc.

(d) Lamp Black:

Lamp black contains 99 percent carbon. It is prepared by heating carbon rich substances like petroleum, kerosene, turpentine oil etc., in a limited supply of air. The soot is collected over damp blankets in chambers and is obtained from them by jerking.

Uses of lamp black:

(i) Lamp black is used in making black printing ink.
(ii) It is used as a filler in tyres to increase their durability.
(iii) It is used in shoe polish and kajal.

Compounds of Carbon

Carbon has a great capacity of combine with elements like oxygen, hydrogen, nitrogen and sulphur to form substances such as hydrocarbons, carbohydrates, fats and proteins.

Compounds of carbon with oxygen are called oxides of carbon.

(a) Carbon Dioxide (CO_2)

Carbon dioxide was first prepared by Van Helmost (1630) by burning wood. Joseph Black (1776) obtained it from chalk ($CaCO_3$). Properties of carbon dioxide were studies in detail by Lavoisier (1783)

(ii) Occurrence: Carbon dioxide occurs in air. Air contains about 0.03% carbon dioxide. It is produced by the oxidation of organic matter during burning and decay. It is also produced during respiratory process of plants and animals.

(ii) Preparation of Carbon dioxide:

(A) When materials (like wood, charcoal, coal or clothes) are burnt in the presence of excess of air or oxygen, carbon dioxide gas is obtained.

$$\underset{\text{Carbon}}{C(s)} + \underset{\text{Oxygen}}{O_2(g)} \xrightarrow{\text{Burning}} \underset{\text{Carbon dioxide}}{CO_2(g)}$$

$$\underset{\text{Methane}}{CH_4(g)} + 2\underset{\text{Oxygen}}{O_2(g)} \xrightarrow{\text{Burning}} \underset{\text{Carbon dioxide}}{CO_2(g)} + 2\underset{\text{Water}}{H_2O(\ell)}$$

(B) By heating metallic carbonates and bicarbonates-

$$\underset{\text{Calcium carbonate}}{CaCO_3(s)} \xrightarrow{\text{Burning}} \underset{\text{Calcium oxide}}{CaO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

$$2\underset{\text{Sodium bicarbonate}}{NaHCO_3(s)} \xrightarrow{\text{Heat}} \underset{\text{Sodium carbonate}}{Na_2CO_3(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Water}}{H_2O(\ell)}$$

(C) By the action f acids on carbonates and bicarbonates:

$$\underset{\text{Calcium carbonate}}{CaCO_3(s)} + 2\underset{\text{Hydrochloric acid}}{HCl(dil)} \longrightarrow \underset{\text{Calcium chloride}}{CaCl_2(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Water}}{H_2O(\ell)}$$

$$\underset{\text{Sodium bicarbonate}}{NaHCO_3(s)} + \underset{\text{Hydrochloric acid}}{HCl(dil)} \longrightarrow \underset{\text{Sodium chloride}}{NaCl(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Water}}{H_2O(\ell)}$$

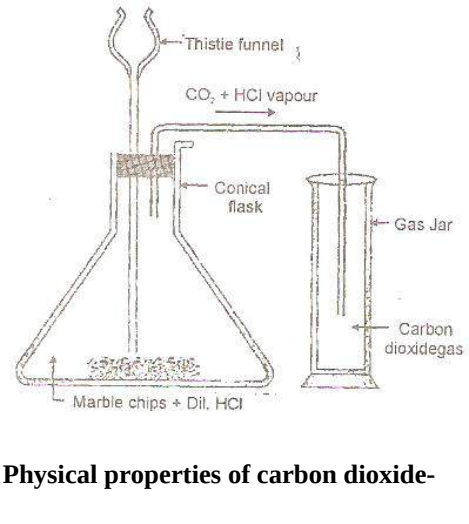
(D) Laboratory method of preparation carbon dioxide:

In the laboratory, it is prepared by the action dilute HCl on marble chips or limestone.

$$\underset{\text{Marble}}{CaCO_3(s)} + 2\underset{\text{Hydrochloric acid}}{HCl(dil)} \longrightarrow \underset{\text{Calcium chloride}}{CaCl_2(aq)} + \underset{\text{Water}}{H_2O(g)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

If sulphuric acid is used to react with marble chips, the reaction will stop soon, because the calcium sulphate formed is insoluble and forms a coating over the marble chips.

$$\underset{\text{Marble}}{CaCO_3(s)} + \underset{\text{Sulphuric acid}}{H_2SO_4(dil)} \longrightarrow \underset{\text{Calcium sulphate (Insoluble)}}{CaSO_4(s)} + \underset{\text{Water}}{H_2O(\ell)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$



(iii) Physical properties of carbon dioxide-

- It is colourless and odourless gas.
- It is acidic in nature (its aqueous solution turns blue litmus red).
- It is heavier than air and can be poured from one jar to another.
- It is sparingly soluble in water. But the solubility in water increases with increasing pressure.
- CO_2 when compressed to high pressure and subsequently cooled, condenses into liquid CO_2 (-78°C). On increasing the pressure, liquid CO_2 solidifies into dry ice.

(iv) Chemical properties of carbon dioxide:

- Carbon dioxide turns lime water milky.

$$\underset{\substack{\text{Calcium hydroxide}\\(\text{Lime water})}}{Ca(OH)_2(aq)} + \underset{\text{Carbondioxide}}{CO_2(g)} \longrightarrow \underset{\substack{\text{Calcium carbonate}\\(\text{white ppt.})}}{CaCO_3} + \underset{\text{Water}}{H_2O(\ell)}$$

CO_2 gas is passed in excess, the insoluble calcium carbonate is charged into soluble calcium bicarbonate and the milkiness disappears.

$$\underset{\substack{\text{Calcium carbonate}\\(\text{Insolube})}}{CaCO_3(s)} + \underset{\text{Water}}{H_2O(\ell)} + \underset{\substack{\text{Carbon dioxide}\\(\text{In excess})}}{Co_2(g)} \longrightarrow \underset{\substack{\text{Calcium bicarbonate}\\(\text{Soluble})}}{Ca(HCO_3)_2(aq)}$$

- CO_2 neutralises alkalies to form carbonates:

$$\underset{\text{Carbon dioxide}}{Ca_2(g)} + 2\underset{\text{Sodium hydroxide}}{NaOH(aq)} \longrightarrow \underset{\text{Sodium carbonate}}{Na_2CO_3} + \underset{\text{Water}}{H_2O(\ell)}$$

- Carbon dioxide dissolves in water of form carbonic acid-

$$\underset{\text{Water}}{H_2O(\ell)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow \underset{\text{Carbonic acid}}{H_2CO_3(aq)}$$

Carbon dioxide reacts with calcium and magnesium oxides to form calcium and magnesium carbonate respectively-

$$\underset{\text{Calcium oxide}}{CaO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow \underset{\text{Calcium Carbonic}}{CaCO_3(s)}$$

CO_2 reacts with water in the presence of sunlight and chlorophyll to form glucose, water and oxygen. This reaction is known as photosynthesis

$$\underset{\text{Carbon dioxide}}{6CO_2(g)} + \underset{\text{Water}}{12H_2O(\ell)} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \underset{\text{Clucose}}{C_6H_{12}O_6(s)} + \underset{\text{Oxygen}}{6O_2(g}$$

(V) Uses of carbon dioxide:

- It is used in fire extinguishers. It does not support combustion.

- It is used for making aerated drinks like cocacola.
- Dry ice (solid CO_2) is used fro refrigeration.
- It is used in making washing soda ($Na_2CO_3.10H_2O$).
- It is used by plants to make food during photosynthesis.
- It is used in making bread.
- It is used for preserving food.
- A mixture of 95% oxygen and 5% CO_2 is used for artificial respiration. The mixture is sold under the name carbogen.
- Carbon dioxide is used in the manufacture of urea and other fertilizers.
- It is used in atomic reactors as a coolant.

(b) Carbon Monoxide (CO):

Carbon monoxide was first prepared by Lassone in 1776 by heating zinc oxide with charcoal.

$$\underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Charcoal}}{C(s)} \longrightarrow \underset{\text{Zinc}}{Zn(s)} + \underset{\text{Carbon monoxide}}{CO(g)}$$

(i) Preparation of carbon monoxide-

$$\underset{\text{Carbon}}{2C(s)} + \underset{\text{Oxygen (Limited supply)}}{O_2(g)} \longrightarrow \underset{\text{Carbon monoxide}}{2CO(g)}$$

(ii) Physical properties of carbon monoxide-

(A) It is odourless and colourless gas.
(B) It is insoluble in water
(C) It is neutral towards litmus paper
(D) It is slightly lighter than air.

(iii) Chemical properties of carbon monoxide-

(A) It is a good redacting agent. It reduces iron oxide to iron.

$$\underset{\text{Iron(III)}}{Fe_2O_3(s)} + 3\underset{\text{Carbon oxide}}{CO(g)} \longrightarrow 2\underset{\text{Iron}}{Fe(s)} + 3\underset{\text{Carbon dioxide}}{CO_2(g)}$$

(B) It burns with blue flame forming CO_2 gas which turns lime water milky.

$$2\underset{\text{Carbon monoxide}}{CO(g)} + \underset{\text{Oxygen}}{O_2(g)} \longrightarrow 2\underset{\text{Carbon dioxide}}{CO_2(g)}$$

(iv) Uses of carbon monoxide

(A) Mixture of carbon monoxide and other gases are used as fuel.
(B) It is used as a reducing agent in the extraction of metals (e.g. during metallurgy of iron)
(C) It is used in the production of synthetic petrol, phosgene gas and methanol.

(v) Harmful effect of carbon monoxide-

(A) Carbon monoxide is a highly poisonous gas. When inhaled in small quantity, it causes headache, giddiness and unconsciounsnes.
(B) Excess breathing of the gas causes death because it readily combines with haemoglobin in the blood, thereby preventing it from carrying oxygen to all parts of the body.

Carbonates and Bicarbonates of Carbon:

Carbonates and bicarbonates are the salts of carbonic acid. The tow important compounds formed by carbon are Na_2COs and $NaHCO_3$.

(a) Sodium Carbonate (Na_2CO_3):

It is commonly known as soda ash. Its compound $Na_2CO_3.10H_2O$ is also known as washing soda. It is manufactured by the Solvay process. In this process, carbon dioxide and ammonia are passed into brine solution (salt water) to form sodium bicarbonate. Sodium bicarbonate on heating gives sodium carbonate.

$$\underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Ammonia}}{NH_3(g)} + \underset{\text{Sodium chloride}}{NaCl(aq)} + \underset{\text{Water}}{H_2O(\ell)} \longrightarrow \underset{\text{Sodium bicarbonate}}{NaHCO_3(s)} + \underset{\text{Ammonium chloride}}{NH_4Cl(aq)}$$

$$2NaHCO_3(s) \xrightarrow{Heat} Na_2CO_3(s) + H_2O(\ell) + CO_2(g)$$

(i) Properties of sodium carbonate-

(A) It is a white solid
(B) It is soluble in water
(C) Its solution turns red litmus paper blue

(ii) Uses of sodium carbonate-

(A) It is used for the manufacture of glass, caustic soda (NaOH) etc.
(B) It is used in laundry works (for washing purpose)
(C) It is used in paper and paint industry
(D) It is also used for softening hard water

(b) Sodium Bicarbonate ($NaHCO_3$):

(i) Properties of sodium bicarbonate-

(A) It is a white solid
(B) It is insoluble in water
(C) It s solution turns red litmus solution blue

It is common name is baking soda. Baking soda is prepared bypassing CO_2 gas into cold saturated solution of sodium carbonate.

$$\underset{\text{Sodium carbonate}}{Na_2CO_3(s)} + \underset{\text{Water}}{H_2O(\ell)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow 2\underset{\text{Sodium bicarbonate}}{NaHCO_3(s)}$$

(ii) Uses of sodium bicarbonate-

(A) It is used for making baking power which is actually a mixture of $NaHCO_3$ with tartaric acid or citric acid.

(B) It is used in medicine as mild antiseptic

(C) It is also used as antacid (to neutralize stomach acidity)

(D) It is used in soda acid fire extinguishers

The Unique Properties of Carbon

Carbon is unique in the variety of molecules it can form. The chemistry of these molecules form a separate branch of the subject known as organic chemistry. Carbon is a non-metal in group 14 of the periodic table. It forms covalent compounds. The uniqueness of carbon lies in the versatility of the bonding.

There are three special features of covalent bonding involving carbon-

(i) Carbon atoms can join to each other to form long chains. Atoms of other elements can then attach to the chain.

(ii) The carbon atoms in a chain can be linked by single, double or triple covalent bonds.

(iii) Carbon atoms can also arrange themselves in rings.

Hydrocarbons

The compounds which are formed by the combination of hydrogen and carbon, are called hydrocarbon. Hydrocarbon are of two types.

(i) Saturated hydrocarbons: Those hydrocarbons in which carbon-carbon are bonded with each other through the single covalent bond, are called saturated hydrocarbons. Hydrocarbon is C_nH_{2n+2}. Where n is an integer. Saturated hydrocarbons are also called alkane.

(ii) Unsaturated hydrocarbons: Those hydrocarbons in which double or triple bond is present, are called unsaturated hydrocarbons unsaturated hydrocarbons are of two type.

Alkene: The unsaturated hydrocarbons in which double bond is present, are called alkene. Their general formula is C_nH_{2n} where n is an integer.

Alkyne: The unsaturated hydrocarbons in which triple bond is present, are called alkyne. Their general formula is C_nH2_{n-2} where n is an integer.

Methane (CH_4)

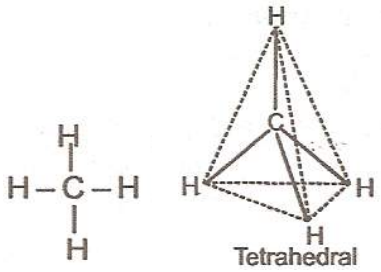
Methane is also called marsh gas as it is formed in marshy places due to the decomposition of vegetable matter under water.

Natural gas contains about 90% methane. It is formed in swampy areas by slow decomposition or organic matter in the absence of oxygen.

Methane gas is also formed in the intestine of rumination animals such as cows and buffaloes and in the bodies of termites.

(a) Structure of Methane:

Methane is tetrahedral molecule. In it, hydrogen atoms are arranged at the four corners of a regular tetrahedron. Bond angle in methane is $109_o28'$.



(b) Laboratory Preparation of Methane:

In the laboratory, methane can be prepared by heating a mixture of sodium acetate and soda lime (a mixture of sodium hydroxide an calcium oxide) in a boiling tube.

$$\underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Sodium hydroxide}}{NaOH} \xrightarrow{Heat} \underset{\text{Methane}}{CH_4} + \underset{\text{Sodium carbonate}}{Na_2CO_3}$$

(CaO)

(c) Physical Properties of Methane:

- It is odourless and colourless gas.
- It is insoluble in water but soluble in organic solvents like alcohol.
- It is lighter than air.
- It can be made liquid O^oC and 150 atmospheric pressure or at – 161.4^oC and normal pressure.

(d) Chemical Properties of Methane:

(i) Combustibility: On being ignited, it burns with a blue flame, forming carbon dioxide and water vapours.

$$\underset{\text{Methane}}{CH_4(g)} + 2\underset{\text{Oxygen}}{O_2(g)} \longrightarrow \underset{\text{dioxide}}{CO_2(g)} + \underset{\text{Carbon}}{2H_2O(\ell)} + \underset{\text{Water}}{Energy}$$

(ii) Action with chlorine

$$\underset{\text{Methane}}{CH_4} + \underset{\text{Chlorine}}{Cl_2} \xrightarrow{Sunlight} \underset{\text{Methyl chloride}}{CH_3Cl} + \underset{\text{Hydrochloric acid}}{HCl}$$

(iii) Pyrolysis: When methane is heated in the absence of air to 1000^oC, it decomposes to form

carbon and hydrogen. The process of decomposition of an organic compound into elements on heating called pyrolysis.

$$CH_4 \xrightarrow[\text{Vacuum}]{1000^\circ C} C + 2H_2$$

(e) Uses of Methane:

- Methane is an excellent fuel for cooking
- Methane is used to manufacture fertilizers, formaldehyde and methanol.
- Methane is used for preparing carbon black which is used in rubber and tyre industry.
- Methane is liquefied form is used as an automobile fuel.

EXERCISE

1. The allotropic form of carbon, which is used as printers link is-
(A) charcoal (B) gas carbon
(C) carbon black (D) coke

2. Which one of the following substances does not contain carbon?
(A) sugar (B) limestone
(C) wood (D) sand

3. Which one is purest form of carbon?
(A) wood charcoal (B) anthracite
(C) graphite (D) soot

4. When solid carbon dioxide is allowed to evaporate rapidly it change into-
(A) carbon dioxide gas (B) carbon monoxide
(C) a snowy mass (D) dense white fumes

5. Which of the following can absorb colouring matter?
(A) Coke (B) Animal charcoal
(C) Lamp black (D) None of these

6. Which form of carbon is used to increase the durability of tyres?
(A) Coke (B) Paraffin oil
(C) Lamp black (D) Coaltar

7. Which of the following substances are crystalline allotropes of carbon?
(i) Diamond (ii) Charcoal
(iii) Graphite (iv) Lamp black
(v) Coal (vi) Fullerene
(A) (i) to (vi) all (B) (i), (ii) & (iv)
(C) (i), (iii) & (vi) (D) (iv), (ii), (v)

8. Which of the following substances is a good conductor of electricity?
(A) Diamond (B) Graphite
(C) Charcoal (D) Coal

9. Hardest substance is-
(A) graphite (B) silica
(C) diamond (D) fullerene

10. $C_{12}H_{22}O_{11} \xrightarrow{Con.H_2SO_4} 12C + 11H_2O$
The carbon obtained in this reaction is:
(A) animal charcoal (B) sugar charcoal
(C) coke (D) wood charcoal

11. In diamond, the bonding between carbon atom is-
(A) co-ordinate (B) ionic
(C) electrostatic (D) covalent

12. The general formula of alkyne is-
(A) C_nH_{2n+2} (B) C_nH_{2n}
(C) C_nH_{2n-2} (D) C_nH_{2n-n}

13. The general formula for saturated hydrocarbon is-
(A) C_nH_{2n+2} (B) C_nH_{2n}
(C) C_nH_{2n-2} (D) C_nH_{2n-n}

14. Compounds made up of carbon and hydrogen only are called-
(A) alkanes only (B) alkenes only
(C) alkynes only (D) hydrocarbons

15. The compound having a double bond is-
(A) C_3H_6 (B) C_3H_8
(C) CH_4 (D) C_2H_6

16. In the reaction $CH_3COONa + NaOH \xrightarrow[Heat]{CaO} X + Na_2CO_3$ product 'X' would be -

17. Final products of the oxidation of hydrocarbon is-
(A) acid (B) aldehyde
(C) dihydric alcohol (D) none of these

18. Ethyne is isoelectronic with-
(A) chlorine (B) oxygen
(C) nitrogen (D) CO_2

19. Which of the following is used to make aerated drink?
(a) carbon dioxide (b) nitrogen
(c) air (d) none of these

20. $N_2 + 3H_2 \longrightarrow X$
X is
(A) N_2H_4 (B) N_3H
(C) NH_3 (D) NH_2OH

21. The cooking gas is mainly a mixture of following two gases-

(NTSE-Stage-I/Raj/2007)

(A) Methane and Ethane
(B) Ethane and propane
(C) Propane and butane
(D) butane and pentane

22. Graphite is used as a lubricant because-

(NTSE-Stage-I/Raj/2007)

(A) It is conductor of electricity
(B) It is non-combustible
(C) It is soluble in organic solvent
(D) It's layers can slide one over the other

23. Now a days many to the automobiles are using CNG (Compressed Natural Gas) to minimize pollution. The CNG is mainly.

(NTSE-Stage-I/Raj/2007)

(A) methane (B) butane
(C) nitrogen (D) hydrogen

24. Which of the following forms of carbon is not a crystalline one? **(NTSE-Stage-I/Raj/2008)**

(A) diamond (B) charcoal
(C) graphite (D) fullerene

25. Graphite is used as a lubricant in machines because it has a very high melting point and also it-

(A) is crystalline
(B) has layer structure
(C) is a giant molecule
(D) is a liquid at room temperature

ANSWER – KEY

CARBON

Q.	1	2	3	4	5	6	7	8	9	10
A.	C	D	D	D	B	C	C	B	C	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	C	A	D	A	C	D	C	A	C
Q.	21	22	23	24	25					
A.	C	D	A	B	B					