Downloaded from https:// www.studiestoday.com

2 Carbon

Carbon is a very important element. It is present in every living being. The food we eat has compounds of carbon.

Carbon has many uses. Coal and hydrocarbons are widely used as fuels. Carbon compounds are also used in medicines. The clothes we wear have compounds of carbon. In the form of diamond, carbon is used as a gemstone.

In one form or the other, carbon forms a significant part of the mineral world.

Occurrence

In the free or in the combined state, carbon is widely distributed on earth.

In the Free State

Carbon exists in the free state in coal, diamond and graphite.

1. Coal

As you know, coal is a decomposition product of plants buried millions of years ago due to some natural phenomena. Plants contain carbon compounds, and their buried remains were slowly converted into carbon. We will discuss the formation of coal in greater detail in the next chapter.

> The conversion of a carbon compound into carbon is called carbonisation.

2. Diamond and graphite

Diamond and graphite are the crystalline forms of carbon found in nature. Graphite is more abundant than diamond.

In the Combined State

Carbon is widely distributed in the combined state.

1. Carbon dioxide

Air contains about 0.03% carbon dioxide (CO_2).

2. Living organisms

All living organisms—plants and animals—have carbon compounds. Hence, everything we eat, which is derived from plants and animals, contains carbon compounds. The essential ingredients of food—carbohydrates, proteins, fats and vitamins—are compounds of carbon.

3. Minerals

All carbonate minerals contain carbon. For example, limestone, calcite and marble are calcium carbonate ($CaCO_3$), and dolomite is a mixed carbonate of magnesium and calcium ($MgCO_3 \cdot CaCO_3$).

4. Natural gas and petroleum

Natural gas and petroleum contain mainly hydrocarbons, i.e., compounds which have only carbon and hydrogen. Natural gas is mostly methane (CH_4), and petroleum is a mixture of various hydrocarbons containing a large number of carbon atoms.

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

Table 2.1 **Some common compounds which have carbon**

Inorganic compounds		Organic compounds	
Name	**Formula**	**Name**	**Formula**
Carbon monoxide	CO	*Hydrocarbons*	
		Methane	CH_4
Carbon dioxide	CO_2	Butane	C_4H_{10}
Sodium carbonate	Na_2CO_3	Acetylene	C_2H_2
		Benzene	C_6H_6
Sodium hydrogencarbonate (sodium bicarbonate)	$NaHCO_3$	*Alcohols*	
		Methyl alcohol	CH_3OH
		Ethyl alcohol	C_2H_5OH
Calcium carbonate	$CaCO_3$	*Sugars*	
Magnesium carbonate	$MgCO_3$	Glucose	$C_6H_{12}O_6$
		Sucrose (cane sugar)	$C_{12}H_{22}O_{11}$
Zinc carbonate	$ZnCO_3$	*Acids*	
Copper carbonate	$CuCO_3$	Acetic acid	$C_2H_4O_2$
		Oxalic acid	$H_2C_2O_4$
		Citric acid	$C_6H_8O_7$
		Tartaric acid	$C_4H_6O_6$
		Ascorbic acid (vitamin C)	$C_6H_8O_6$

Common Compounds which Have Carbon

You have learnt that all carbon-containing compounds, except carbon monoxide, carbon dioxide, carbonates and hydrogencarbonates, are called organic compounds. And all noncarbon compounds, along with carbon monoxide, carbon dioxide, carbonates and hydrogencarbonates, are called inorganic compounds. Some examples of organic and inorganic compounds are given in Table 2.1.

Allotropy

Before we take up allotropy, let us learn about crystalline and amorphous solids.

Crystalline and Amorphous Solids

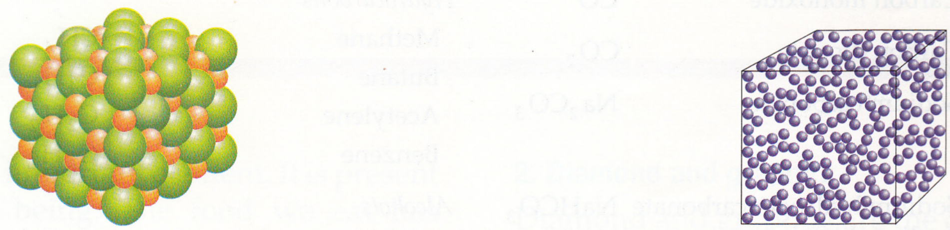
Solids are divided into two classes—crystalline or true solids, and amorphous solids or pseudosolids.

Crystalline solids	Amorphous solids or pseudosolids
Solids which have definite geometrical forms are called crystalline or true solids.	Solids which do not have definite geometrical forms are called amorphous solids or pseudosolids.
Examples	*Examples*
1. Rock salt and common salt (cubic form)	1. Glass
2. Alum	2. Pitch
3. Sugar	3. Plastic

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

Characteristics of crystalline solids	Characteristics of amorphous solids
1. The particles constituting a crystalline solid are arranged in an ordered manner in three dimensions (Figure 2.1a).	1. The particles constituting an amorphous solid are not arranged in an ordered manner (Figure 2.1b).



(a) (b)

Fig. 2.1 Arrangement of particles in (a) crystalline (ordered), and (b) amorphous (disordered) solids

Characteristics of crystalline solids	Characteristics of amorphous solids
2. When crystalline solids are broken or cut with a sharp knife, we get pieces with sharp edges and plane faces (Figure 2.2a). Such breaking is known as crystalline fracture.	2. When amorphous solids are broken or cut with a sharp knife, we get pieces with curved faces. Such breaking is called conchoidal fracture (Figure 2.2b).

(a) (b)

Fig. 2.2 (a) Crystalline fracture in rock salt, and (b) conchoidal fracture in glass

Characteristics of crystalline solids	Characteristics of amorphous solids
3. A crystalline solid melts sharply at a definite temperature called its melting point.	3. Amorphous solids do not melt sharply at definite temperatures; rather they soften over a range of temperature when heated.

What is Allotropy?

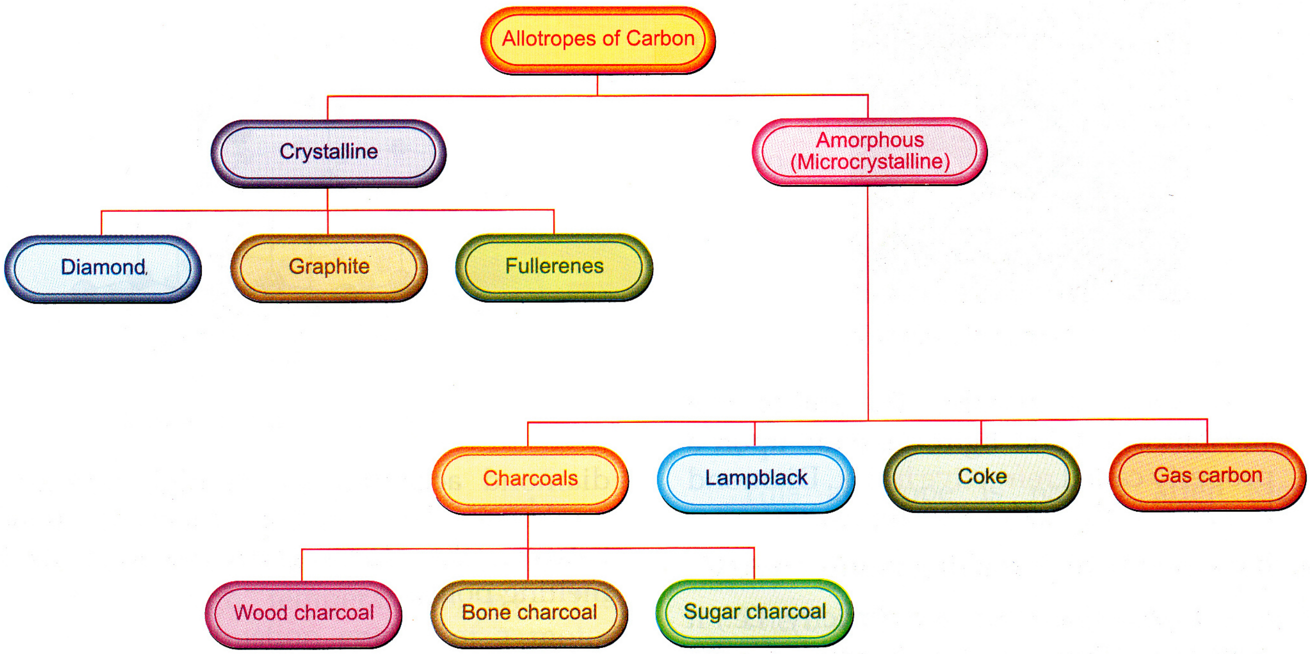
> The phenomenon of some elements existing in different forms which vary in physical and chemical properties is called allotropy.

The different forms of an element are known as allotropes or allotropic modifications. The allotropes of an element differ from each other in atomicity, structure or both.

Carbon, oxygen, phosphorus and sulphur are some common elements that show allotropy. Diamond, graphite and the fullerenes are allotropes of carbon. Dioxygen (O_2) and ozone (O_3) are allotropes of oxygen. You will learn about the allotropy of other elements in higher classes.

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com



Allotropy of Carbon

Carbon exists in crystalline as well as amorphous forms.

Diamond, graphite and the fullerenes are the crystalline forms. And charcoals, lampblack, coke and gas carbon are the amorphous forms. In fact, the amorphous forms of carbon are found to contain extremely small crystals of graphite, and hence they are also called microcrystalline forms.

The Crystalline Forms of Carbon

In its crystalline forms, a carbon atom is bonded to three or four other carbon atoms. These atoms, in turn, are bonded to other carbon atoms. In the different crystalline forms of carbon such as diamond and graphite the atoms are arranged in a different manner.

Diamond

Diamond is the costliest gemstone and the hardest natural substance known. It is so hard that it can only be cut by another diamond.

Diamonds are formed at the high temperature and pressure that exist over 100 km below the earth's surface. They are brought to the surface along with the carrier rock—kimberlite—by volcanic action. They form only one part in over 15,000,000 parts of the rock. Diamonds are found mainly in Australia, Botswana and South Africa.

Diamond is artificially produced by heating graphite at a high temperature (say, 5000°C) and pressure (say, 100,000 atmospheres).

Diamond is generally colourless. However, the coloured varieties—yellow, brown, red, green, blue, grey or even black—are also found in nature. The colour arises due to metallic impurities. The less costly varieties—grey and black—have no use as gemstones, and are used for cutting glass and drilling rocks.

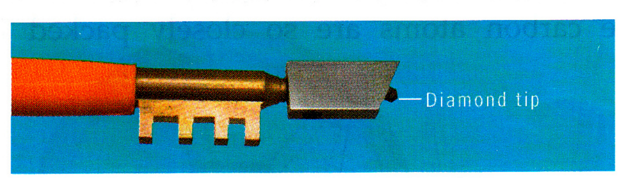


Fig. 2.3 A diamond-tipped glass cutter

Properties

1. Diamond is the hardest solid known.
2. It has a density of 3.51 g/cm^3.
3. A properly cut diamond bends back a great percentage of the light falling on it.

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

Fig. 2.4 Cut and polished diamonds

That is why it sparkles. The ability of a substance to bend light depends upon a property called refractive index. Diamond has a very high refractive index.

4. It has a very high melting point—3930°C.
5. It is a bad conductor of electricity, i.e., it does not allow electric current to pass through it.
6. When ignited, it burns in air at 900°C and in oxygen at 700°C to give carbon dioxide.

$$C + O_2 \xrightarrow{\text{ignition}} CO_2$$

Structure In diamond, each carbon atom is bonded to four other carbon atoms. As shown in Figure 2.5, the central carbon atom is bonded to four carbon atoms placed at the vertices of a tetrahedron. The other carbon atoms, in turn, are also tetrahedrally bonded to four carbon atoms each (Figure 2.6).

This kind of bonding results in the formation of a giant molecule, in which the carbon atoms are packed closely. The fact that the carbon atoms are so closely packed in

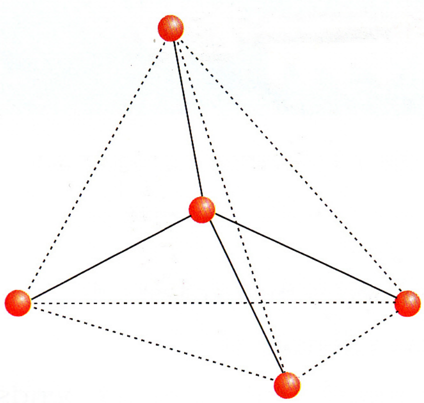


Fig. 2.5 Tetrahedral arrangement of carbon atoms

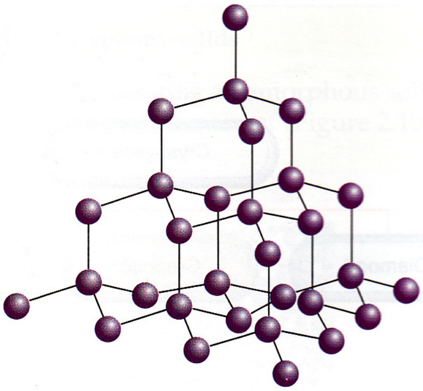


Fig. 2.6 Structure of diamond

diamond accounts for its high density and hardness. The strong chemical bonding between the atoms gives diamond its high melting point.

Graphite

Graphite is a black, opaque solid, found in large deposits in many countries like China, South Korea and India.

It is artificially prepared by strongly heating coke with silica in an electric furnace.

$$\underset{\text{coke}}{3C} + \underset{\text{silica}}{SiO_2} \xrightarrow{\text{heat}} \underset{\text{silicon carbide}}{SiC} + \underset{\text{carbon monoxide}}{2CO}$$

$$SiC \xrightarrow{\text{heat}} Si + \underset{\text{graphite}}{C}$$

Properties

1. Graphite has a density of 2.2 g/cm^3.
2. Unlike diamond, it is very soft.
3. Graphite melts at 3700°C.
4. It is a good conductor of heat and electricity.
5. It burns in air at 700°C to give carbon dioxide.

Structure Graphite contains layers of hexagonal rings of carbon atoms, joined together. Each carbon atom is shared by three rings. These rings occur in different planes, arranged parallel to each other. Each layer is held by the adjacent layer with weak forces. So, the adjacent carbon layers can slide over one another.

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

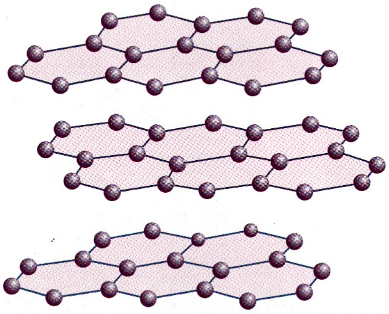


Fig. 2.7 Structure of graphite

Uses

1. Graphite electrodes are widely used.
2. It is used as a lubricant for machines that work at high temperatures, e.g., the internal combustion engine of a motor vehicle.
3. Graphite leaves a mark on paper. In fact, the 'lead' of a pencil is graphite mixed with clay. Being very soft, graphite has to be mixed with clay. The greater the proportion of graphite, the softer the pencil. The term graphite is derived from the Greek word *grapho*, meaning 'I write'.
4. It is used for making crucibles for casting metals.
5. A mixture of graphite and linseed oil is used for painting things made of iron.
6. It is used in nuclear reactors.

Fullerenes

Fullerenes are a crystalline form of carbon. Unlike diamond and graphite, they have discrete molecules containing large numbers of carbon atoms, e.g., C_{32}, C_{50}, C_{60}, C_{70}, C_{76}, C_{84}, and so on.

The first fullerene—buckminsterfullerene (C_{60})—was artificially prepared in 1985. The C_{60} molecule is spherical in shape. It consists of 20 hexagons and 12 pentagons of carbon atoms. Each carbon atom is shared by two hexagons and one pentagon. The design looks like that of a football. So, it is also called the buckyball.

This allotrope is named after Richard Buckminster Fuller, who was an American architect famous for designing spherical domes.

The buckyball is a yellow solid, also found in soot. It is chemically more active than diamond and graphite.

The Amorphous Forms of Carbon

Unlike the crystalline form, the amorphous form of a substance contains loosely held particles. These particles easily separate and make available a large surface area.

When a piece of a substance breaks into two, two new surfaces are created (Figure 2.9). If the pieces keep on breaking, newer surfaces appear. So, the more powdery a substance, the larger the surface area.

Because of its larger surface area, the amorphous form of a substance is generally more active than the crystalline form.

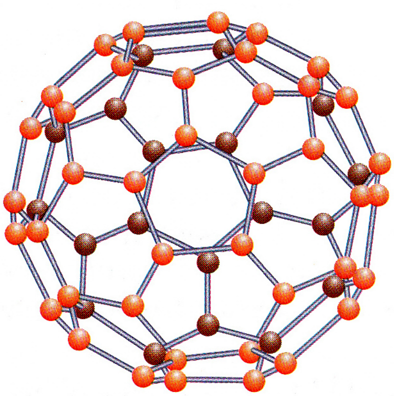


Fig. 2.8 The structure of buckminsterfullerene and the ball it resembles

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

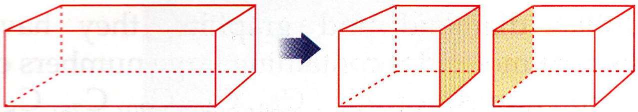


Fig. 2.9 The surface area of a solid increases on breaking. The shaded surfaces, not present in the original body, have appeared.

The charcoals

Charcoals are prepared by a process known as destructive distillation or pyrolysis.

In destructive distillation, a substance is heated in the absence of air with a view to breaking bigger molecules into smaller ones. During the process, certain substances distil out, and may be collected.

Wood charcoal Wood charcoal is prepared by the destructive distillation of wood. A mixture of gases and vapours evolves, and charcoal is left as a residue.

The mixture of gases (CO_2, CO, CH_4 and H_2) is combustible, and is known as wood gas. On being condensed, the vapours separate into a tar and a liquid. The liquid, called pyroligneous acid, contains some organic compounds.

The destructive distillation of wood can be carried out on a small scale in the laboratory, as shown in Figure 2.10.

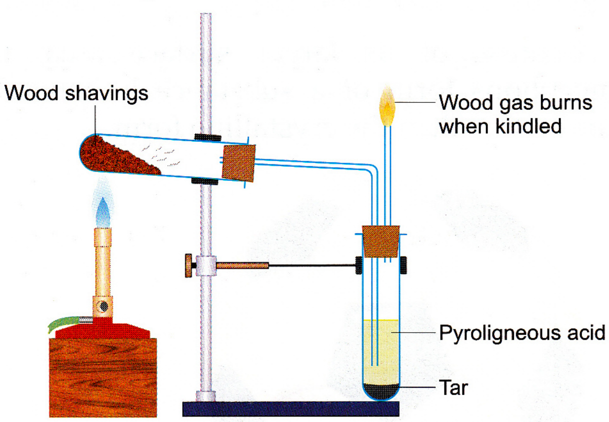


Fig. 2.10 The destructive distillation of wood

Activity You can make wood charcoal at home too. Put some wood shavings in a can, and cover it with a lid. Make a hole in the lid, and heat the can on a stove. Hold a lighted match to the mixture of gases emerging from the hole. It should burn with a steady flame (Fig. 2.11). Place a can full of ice near the hole. Substances in the mixture that have a low melting point will condense around this can. Turn off the stove when the gases stop evolving. Examine the cans after they have cooled. The wood shavings would have converted to charcoal. And there will be tar on the surface of the second can as well as on the inside surfaces of the first.

Fig. 2.11 Making wood charcoal at home

Being a form of carbon, wood charcoal shows the general properties of carbon, which we will study soon.

Activated charcoal Activated charcoal is prepared by heating wood charcoal at 900°C in a limited supply of air or steam. Any tar in the wood charcoal is removed, and the surface area of the charcoal increases greatly. 1 kg of activated charcoal in powder form has a surface area of 1 km^2. Hence, activated charcoal is much more active than simple wood charcoal.

Bone, or animal, charcoal Animal bones are first boiled with water to remove fatty substances and then subjected to destructive distillation in a retort. The solid product in the retort is washed thoroughly with hydrochloric acid. The residual substance is bone charcoal.

Sugar charcoal Sugar charcoal is the purest form of carbon. It is prepared by the destructive distillation of cane sugar or by the dehydration of sugar with concentrated sulphuric acid.

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

$$C_{12}H_{22}O_{11} \rightarrow 12C + 11H_2O$$

Lampblack (soot) When substances like oil and wax burn, soot is given out.

Activity You can prepare lampblack at home by burning mustard oil with the help of a wick and collecting the soot on a dish. The soot is used for preparing *kajal* and printer's ink.

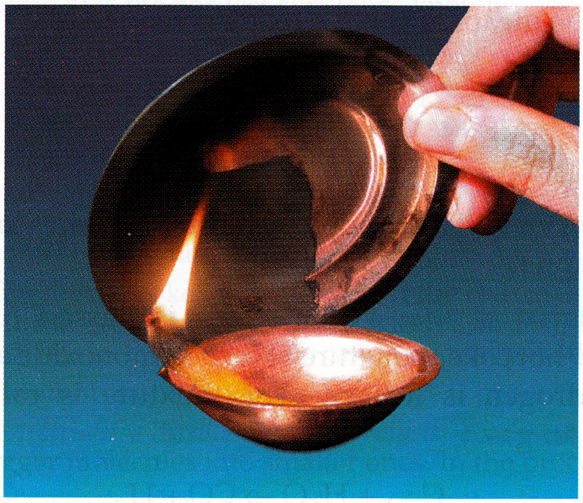


Fig. 2.12 Making lampblack

Coke Coke is obtained when coal is heated strongly in the absence of air. Coke is more porous, and therefore, more active than coal.

Gas carbon Gas carbon deposits on the walls of a retort when a hydrocarbon is heated in it in the absence of air. Gas carbon is a good conductor of electricity and is, therefore, used as an electrode.

Some Useful Properties of Carbon

We have already discussed some properties and uses of the different forms of carbon. Let us talk about a few more of its properties and uses.

Adsorption—A Physical Property

Adsorption is a phenomenon in which a thin layer of a solid, liquid or gas is formed on the surface of a solid or a liquid.

A substance on the surface of which adsorption takes place is called an adsorbent.

Adsorption is a surface phenomenon and should not be confused with absorption. In absorption, the concentration of the absorbed substance is the same throughout the bulk of the absorbent. For example, hydrogen chloride, ammonia or carbon dioxide is absorbed by water to form a solution. But in adsorption, a thin layer of the adsorbed substance is formed *only at the surface of the adsorbent*. For example, moisture is adsorbed at any solid surface that is exposed to moist air. The formation of a thin film of oil over the surface of water is another example of adsorption.

Being a surface phenomenon, adsorption is dependent on surface area. It is found that the larger the surface area of the adsorbent, the greater the adsorption.

Adsorption by charcoals

As charcoals have a large surface area in powder form, they are good adsorbents. The following uses of charcoals are based on this property.

1. Wood charcoal is a good adsorbent of gases. It is, therefore, used in gas masks to remove poisonous gases. An active form of charcoal prepared from coconut shells is especially suitable for gas masks.
2. Bone charcoal (or animal charcoal) is used to remove the brown impurities from unrefined sugar.
3. Many impurities of water are removed by filtration through charcoal. This is done in municipal water-treatment plants as well as in domestic UV purifiers.
4. Activated coconut charcoal is used for separating a mixture of noble gases (helium, neon, argon, krypton and xenon). The different noble gases are adsorbed by the charcoal at different temperatures.
5. Activated charcoal facilitates certain chemical reactions and is, therefore, used as a catalyst. For example, chlorine

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

adsorbed on activated charcoal readily combines with hydrogen in the dark. The reaction between chlorine and hydrogen in the dark is otherwise extremely slow.

Chemical Properties and Their Uses

1. Reaction with oxygen or air

On being lit, carbon burns in an excess of oxygen or air to form carbon dioxide.

$$C + O_2 \rightarrow CO_2 + \text{heat}$$

In an insufficient supply of air, carbon monoxide is formed.

$$2C + O_2 \rightarrow 2CO + \text{heat}$$

Carbon monoxide also burns in air to form carbon dioxide.

$$2CO + O_2 \rightarrow 2CO_2 + \text{heat}$$

The heat produced in these reactions makes carbon a good fuel.

2. Reducing properties

Carbon has a great affinity for oxygen. So, it combines with the oxygen present in many compounds, and thus, acts as a reducing agent.

Reduction of metal oxides When heated with coke or charcoal, the oxides of metals below aluminium in the activity series are reduced to the corresponding metals.

Activity series
K
Na
Ca
Mg
Al
Zn
Fe
Sn
Pb
H
Cu
Hg
Ag
Au

$$\underset{\text{zinc(II) oxide}}{ZnO} + C \xrightarrow{\text{heat}} \underset{\text{zinc}}{Zn} + CO$$

$$\underset{\text{iron(III) oxide}}{Fe_2O_3} + 3C \xrightarrow{\text{heat}} \underset{\text{iron}}{2Fe} + 3CO$$

$$\underset{\text{tin(IV) oxide}}{SnO_2} + 2C \xrightarrow{\text{heat}} \underset{\text{tin}}{Sn} + 2CO$$

$$\underset{\text{lead(II) oxide}}{PbO} + C \xrightarrow{\text{heat}} \underset{\text{lead}}{Pb} + CO$$

This kind of reduction, called carbon reduction, is of great importance in metallurgy, i.e., the science of extracting metals from their ores and modifying them for use.

On being separated from impurities, the oxide ores, e.g., haematite (Fe_2O_3) and tinstone (SnO_2), are reduced by coke (or charcoal) at high temperatures. In the case of a non-oxide ore, the oxide of the metal is first obtained by some means. Then the oxide is reduced.

$$\underset{\text{zinc blende}}{2ZnS} + \underset{\text{air}}{3O_2} \xrightarrow{\text{heat}} 2ZnO + 2SO_2$$

You will learn about these methods in a later chapter.

Reduction of water When steam is passed over red-hot coke, a mixture of carbon monoxide and hydrogen is formed. This mixture is called water gas.

$$\underset{\text{(red hot)}}{C} + \underset{\text{steam}}{H_2O} \rightarrow \underbrace{CO + H_2}_{\text{water gas}}$$

Water gas is of great industrial importance.

1. It is used in the synthesis of organic compounds like methane, methyl alcohol and acetic acid. And, starting from these, a large number of other organic compounds can be prepared.
2. After removing carbon monoxide, the hydrogen of water gas is used in the synthesis of ammonia (NH_3).
3. Both the components of water gas are combustible. So, it is used as an industrial fuel.

$$2CO + O_2 \xrightarrow{\text{burn}} 2CO_2 + \text{heat}$$

$$2H_2 + O_2 \xrightarrow{\text{burn}} 2H_2O + \text{heat}$$

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

Points to Remember

- Solids which have definite geometrical forms are called *crystalline* or *true solids*.
- Solids which do not have definite geometrical forms are called *amorphous solids* or *pseudosolids*.
- The phenomenon of some elements existing in different forms which vary in physical and chemical properties is called *allotropy*.
  The different forms of the element are known as *allotropes* or *allotropic modifications*.
- Diamond, graphite and the fullerenes are the crystalline forms of carbon.
- Diamond is a giant molecule containing carbon atoms, each tetrahedrally bonded to four other carbon atoms. It is the hardest substance known.
- Graphite consists of layers of hexagonal rings of carbon atoms. Each carbon atom is shared by three rings.
- Graphite is a good lubricant for machines working at high temperatures.
- The fullerenes are a crystalline form of carbon with discrete molecules containing large numbers of atoms—32, 50, 60, 70, 76, 84, and so on.
  Buckminsterfullerene (C_{60})—also called the buckyball—was the first fullerene (prepared in 1985). The buckyball molecule consists of 20 hexagons and 12 pentagons of carbon atoms, each carbon atom being shared by two hexagons and one pentagon.
- Lampblack, coke, gas carbon and the charcoals are the amorphous forms of carbon. What we commonly call the amorphous forms of carbon, in fact, consist of extremely small crystals of graphite. So, more accurately, they should be called microcrystalline forms of the element.
- The amorphous form of a substance is generally more active than the crystalline form.
- In *destructive distillation*, or *pyrolysis*, a substance is heated in the absence of air with a view to breaking bigger molecules into smaller ones. In the process, certain substances distil out, which may be collected.
  A charcoal is the residue obtained by the destructive distillation of wood, bone or sugar.
- *Adsorption* is a phenomenon in which a thin layer of a solid, liquid or gas is formed on the surface of a solid or a liquid.
  A substance on the surface of which adsorption takes place is called an *adsorbent*. Charcoals are very good absorbents.
- Carbon has a great affinity for oxygen. So it reduces many metal oxides (e.g., ZnO, Fe_2O_3, SnO_2 and PbO) to metals when heated with the oxides. This property of carbon is used in metallurgy.

Exercise

Short-Answer Questions

1. Name three sources of carbon in which it exists in the free state.
2. Name three inorganic compounds containing carbon. Name three organic compounds.
3. What are the following called?
   (i) Solids which have definite geometrical forms
   (ii) Solids which do not have definite geometrical forms
   Give two examples of each type.
4. Define allotropy. Name two elements which exhibit this phenomenon.
5. Show the allotropy of carbon with the help of a chart.
6. Which property of diamond makes it sparkle?
7. What does destructive distillation mean?

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

8. What is activated charcoal?
9. Define adsorption and give an example.
10. Which property of carbon makes it useful in metallurgy?

Long-Answer Questions

1. Describe three distinguishing characteristics of crystalline and amorphous solids.
2. Show how the destructive distillation of wood can be carried out on a small scale. What are the products formed?
3. Describe the preparations of lampblack, coke and gas carbon.

Objective Questions

Choose the correct option.

1. Which of the following is an amorphous or a microcrystalline form of carbon?
   (a) Graphite (b) Buckyball
   (c) Diamond (d) Coke
2. Which of the following conditions are required for the formation of diamond?
   (a) Very high temperature and pressure
   (b) Very high temperature, but a very low pressure
   (c) Very low temperature, but a very high pressure
   (d) Very low temperature and pressure
3. What is the 'lead' of a pencil made of?
   (a) Clay (b) Graphite
   (c) A mixture of clay and graphite (d) None of these
4. Which of the following will give carbon dioxide on being heated in an excess of oxygen?
   (a) Diamond (b) Graphite
   (c) Charcoal (d) All of these
5. Which among the following has the largest surface area?
   (a) Diamond (b) Wood charcoal
   (c) Graphite (d) Activated charcoal
6. Which of the following is water gas?
   (a) Air dissolved in water (b) Water vapour present in air
   (c) A mixture of CO and H_2 (d) A mixture of CO and H_2O (steam)

Fill in the blanks.

1. Charcoal is prepared by the _______ distillation of wood, bone or sugar. (fractional/destructive)
2. Gas carbon is a _______ conductor of electricity. (good/bad)
3. Charcoals are good _______ . (adsorbents/absorbents)
4. In the dark, chlorine adsorbed on charcoal reacts with hydrogen more _______ than chlorine ordinarily mixed with hydrogen. (readily/reluctantly)
5. Water gas is formed when _______ is passed over _______ coke. (water/steam/red-hot/cold)
6. Complete the following chemical equations and balance them.
   (a) $CO + O_2 \longrightarrow$ ____________
   (b) $ZnO + C \longrightarrow$ ____________ + ____________
   (c) Fe_2O_3 + ____________ $\longrightarrow$ ____________ + CO
   (d) SnO_2 + ____________ $\longrightarrow$ ____________ + CO

Downloaded from https:// www.studiestoday.com

Downloaded from https:// www.studiestoday.com

(e) $PbO + C \longrightarrow$ ________ + ________

(f) $ZnS + O_2 \longrightarrow ZnO$ + ________

Match the columns.

1. Match the items mentioned in column A with the information given in column B.

A	B
(a) Buckyball	(i) amorphous
(b) Diamond	(ii) layered, hexagonal rings
(c) Gas carbon	(iii) each carbon atom shared by two hexagons and one pentagon
(d) Graphite	(iv) each carbon atom tetrahedrally bonded to four others

2. Match the items mentioned in column A with the uses given in column B.

A	B
(a) Colourless diamond	(i) lubricant
(b) Black diamond	(ii) gas mask
(c) Graphite	(iii) rock drilling
(d) Wood charcoal	(iv) jewellery
(e) Bone charcoal	(v) printer's ink
(f) Lampblack	(vi) refining sugar

Indicate which of the following statements are true and which are false.

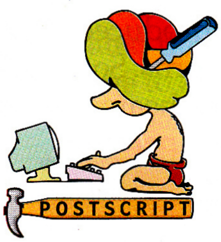
1. Carbon is not found in the free state in nature.

2. Diamond is the hardest substance known.

3. Being a nonmetal, graphite is a bad conductor of electricity.

4. Charcoal is used in the purification of water.

5. A component of water gas is used in the manufacture of ammonia.



Adsorption by Charcoal

You have learnt that charcoal becomes especially useful due to its property of adsorption. Apart from adsorbing gases, charcoal takes up many metal salts, organic compounds and colouring matter from solutions. This is why charcoal is used for rendering cane-juice syrup colourless in the manufacture of white sugar. You can verify for yourself that colouring matter is adsorbed by charcoal.

Take some water in a glass and add a few drops of ink. Add a small amount of finely powdered animal charcoal to the solution. Boil the contents of the glass for a couple of minutes, and filter. The filtrate will be colourless. The ink has been adsorbed by the charcoal.

❑

Downloaded from https:// www.studiestoday.com