CHAPTER

08

COAL AND PETROLEUM

In this chapter, we will discuss carbon, its various forms, its compounds, fuels and petroleum and their types.

In this chapter, we will study about some exhaustible natural resource, like coal, petroleum and natural gas. These are also called non-renewable sources of energy. This is because when all the coal, petroleum and natural gas present under the earth will get used up, no more supply of these will be available in the near future.

Natural Resources

The various resources which are obtained from the nature are called natural resources, e.g. air, water, soil, etc. On the other hand, paints, synthetic fibres, plastics explosives are man-made materials.

Natural resources can be broadly classified into two kinds:

1. Inexhaustible Natural Resources

The natural resources which are present in an unlimited quantity in nature and are not likely to be exhausted (used up) by human activities, are called inexhaustible natural resources, e.g. sunlight, air. There are never ending supply of inexhaustible resources in nature. They can be used again and again.

2. Exhaustible Natural Resources

The natural resources which are present in a limited quantity in nature and can be exhausted (used up) by human activities, are called exhaustible natural resources, e.g. coal, petroleum, natural gas, minerals, forests, wildlife, etc.

Coal

Coal is the most impure form of carbon. It is obtained from mines. In India, it is found in Raniganj in West Bengal, Jharia in Jharkhand, etc.

Depending upon carbon contents, coal is of the following types

1. Peat (60% carbon)
2. Lignite (70% carbon)
3. Bituminous (78% to 83% carbon)
4. Anthracite (90% carbon)

Bituminous is the common variety of coal and anthracite is the purest form of coal.

Products Obtained from Coal

When coal is heated strongly in the absence of air in closed retorts, various useful products are obtained. The strong heating of coal in the absence of air is called destructive distillation of coal. These are coke, coal tar and coal gas.

1. Coke

It is a tough, porous and black solid substance. It is almost the pure form of carbon. It contains 98 per cent carbon. When coal is heated in the absence of air, then coal gas and coal tar are eliminated and coke is left behind as a black residue.

Uses of Coke

Coke is used

(i) Coke is used as a reducing agent in the extraction of metals such as iron, zinc, etc.

(ii) Coke is used in the manufacture of steel.

(iii) Coke is used as a fuel.

2. Coal Tar

It is a thick, black liquid having an unpleasant smell. It is a mixture of about 200 substances.

Uses of Coal Tar

- The useful carbon compounds present in coal tar include benzene, toluene, naphthalene, phenol, aniline and anthracene.
- The various compounds obtained from coal tar are used as starting materials for manufacturing a large number of substances used in everyday life and in industry like synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, etc.

Note Coal tor has been used for metalling the roads. But, these days bitumen (a petroleum product) is being used increasingly for metalling the roads.

3. Coal Gas

It is a gaseous fuel. It is obtained during the processing of coal to get coke. It is mainly a mixture of methane and hydrogen with some carbon monoxide.

Uses of Coal Gas

- It is used as a fuel in many industries situated near the coal processing plants.
- It has also been used for lighting purposes.
- These days, it is used as a source of heat rather than light.

Petroleum

Petroleum is the dark oily liquid form of fossil fuel.

It is also called crude oil. It is a complex mixture of hydrocarbons.

It is formed from the remains of microorganisms due to action of high pressure, heat and certain catalytic actions over a period of millions of years.

Refining of Petroleum

- Petroleum is a dark oily liquid having an unpleasant odour.
- It is a mixture of solid, liquid and gaseous hydrocarbons such as petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc.
- Before the use of petroleum for specific purposes, it has to be refined (or purified).
- The process of separating the various useful constituents (fractions) of petroleum is known as refining.

- Refining of petroleum is carried out in a petroleum refinery. Petroleum is separated into different fractions by the process of fractional distillation, which is the process of separation in which fractions of petroleum having different boiling point ranges are collected separately.

Various Constituents of Petroleum and their Uses

Constituents of Petroleum	Uses
Petroleum gas in liquid form (LPG)	Fuel for home and industry
Petrol	Motor fuel, aviation fuel, solvent for dry cleaning
Kerosene	Fuel for stoves, lamps and for jet aircrafts
Diesel	Fuel for heavy motor vehicles, electric generators
Lubricating oil	Lubrication
Paraffin wax	Ointments, candles, vaseline, etc.
Bitumen	Paints, road surfacing

Liquefied Petroleum Gas (LPG)

The petroleum gas which has been liquefied under pressure is known as **Liquefied Petroleum Gas (LPG).**

It is the most important fuel used in homes.

It mainly consists of butane.

LPG is a good fuel because of its following advantages

(i) It burns easily.

(ii) It has a high calorific value (about 50,000 kJ/kg)

(iii) It burns with a smokeless flame, so it does not cause air pollution.

(iv) It does not produce any harmful gases

(v) It does not leave behind any solid residue after burning.

(vi) It is easy to handle and convenient to store

Natural Gas

Natural gas mainly consists of methane (95%). Other constituents are ethane and propane. It occurs deep under the earth's crust either alone or along with oil above the petroleum.

Natural gas is used as a starting material for the manufacture of a number of chemicals (petrochemicals) and fertilisers as it is a source of hydrogen gas needed to manufacture the fertilisers.

In India, natural gas has been found in Tripura, Rajasthan, Maharashtra and in the Krishna Godavari delta.

Natural gas is a very important fossil fuel as it is easy to transport through pipes. When it is compressed by applying pressure, it is called Compressed Natural Gas (CNG). CNG is used for power generation. It is now being used as a fuel for transport vehicles as it is a clean fuel and burns without producing any smoke and thus does not cause air pollution.

Advantages of Using Compressed Natural Gas (CNG)

(i) It is a complete fuel and can be used directly in homes and industries.

(ii) It is a clean fuel as it does not leave behind any solid residue after burning.

(iii) It burns easily with a smokeless flame and thus does not cause air pollution.

(iv) It produces a lot of heat.

(v) A great advantage of CNG is that it can be supplied to homes and factories through a network of underground pipes, so additional storage and transport are not required for it. Such a network of pipelines exists in Vadodara (Gujarat), some parts of Delhi and some other places.

(vi) CNG is a good alternative to petrol and diesel in vehicles because it is a clean fuel and does not cause air pollution. It is filled in cylinders.

Note The fossil fuels such as coal, petroleum and natural gas cannot be prepared in the laboratory from dead organisms (plants and animals) because their formation is a very slow process and the conditions for their formation cannot be created in the laboratory.

Some Natural Resources are Limited

- Coal, petroleum and natural gas are the fossil fuels and their amounts in the earth are limited. Fossil fuels, forests and minerals, etc. are exhaustible natural resources.
- If consumed at a rate faster than the rate at which these are formed in nature, they will get exhausted very soon. Once the present stock of these gets exhausted, no new supplies of these fossil fuels will be available to us in the near future because it required millions of year to get converted the dead organisms into these fuels.
- As per present estimate, the known existing petroleum reserves will last at most a few hundred years This would lead to energy crises. Moreover, the burning of these fuels is a major cause of air pollution. Their uses also linked to global warming.

So, we should use these fuels only when absolutely necessary as .

(i) it will reduce air pollution and thus lead to better environment.

(ii) it will reduce the risk of global warming.

(iii) it will ensure their availability for a longer period of time.

Conservation of Coal and Petroleum

Petrol and diesel are the main fuels used for driving vehicles. So, we should make every effort to save these precious fuels. In India, the Petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving the vehicles.

The various tips to avoid wastage of these fuels while driving are as follows

(i) Drive at a constant and moderate speed as far as possible.

(ii) Switch off the engine of vehicle at traffic lights or at a place where you have to wait.

(iii) Ensure correct tyre pressure of the vehicle. Low tyre pressure consumes more fuel.

(iv) Ensure regular maintenance of the vehicle.

PRACTICE EXERCISE

1. Various materials which are obtained from nature are called natural resources. Which of the following is not a natural resource?
(a) Minerals (b) Water
(c) Soil (d) Plastic

2. Air is a natural resource and cannot be exhausted by human activities. It is known as inexhaustible natural resource. Which of the following is another inexhaustible natural resource?
(a) Coal
(b) Petroleum
(c) Sun-light
(d) Minerals

3. Which of the following is a pair of exhaustible natural resources?
(a) Coal and soil (b) Air and sunlight
(c) Water and petroleum
(d) Wildlife and minerals

4. Coal is processed in industries to get some useful products. Which of the following is not obtained from coal?
(a) Coke (b) Coal tar
(c) Coal gas (d) CNG

5. Exhaustible natural resources are:
(a) unlimited in quantity
(b) not dependent on nature
(c) limited in quantity
(d) not exhausted by human activities

6. Fossil fuels are obtained from
(a) remains of non-living materials
(b) dead remains of birds only
(c) dead remains of insects only
(d) dead remains of living organisms

7. Coal is formed from the remains of
(a) vegetation only
(b) animals only
(c) both vegetation and animals
(d) neither vegetation nor animals

8. Which one of the following forms of coal has the lowest percentage of carbon?
(a) Peat (b) Lignite
(c) Bituminous (d) Anthracite

9. Which of the following is the common variety of coal?
(a) Peat (b) Lignite
(c) Anthracite (d) Bituminous

10. The purest form of coal is
(a) anthracite (b) bituminous
(c) peat (d) lignite

11. The allotrope of carbon used to extract metals is
(a) gas carbon (b) coal
(c) coke (d) charcoal

12. Which substance is formed by the carbonisation of dead vegetation?
(a) Coal (b) Coke
(c) Coal gas (d) Coal tar

13. Naphthalene balls are obtained from coal tar and are used as
(a) mosquito repellant (b) honeybee repellant
(c) moth repellant (d) snake repellant

14. Which of the following is not a constituent of petroleum?
(a) Paraffin wax (b) Lubricating oil
(c) Petrol (d) Coke

15. Petroleum was formed from organisms
(a) living on the land
(b) living on the plants
(c) living in the sea
(d) living on the rocks

16. Petrochemical substances are obtained from
(a) LPG and coal
(b) natural gas and petroleum
(c) LPG and petroleum
(d) CNG and petroleum

17. Petrol is a mixture of ..... such as hexane, heptane and octane.
(a) natural gas (b) coal gas
(c) coal tar (d) coal

18. Paraffin oil or kerosene is obtained from petroleum by
(a) refining
(b) fractional distillation
(c) distillation
(d) centrifugation

19. The constituent of natural gas is
(a) ethane (b) methane
(c) butane (d) propane

20. Which of the following burns easily with a smokeless flame and thus does not cause air pollution?
(a) LPG (b) Coal
(c) Petroleum (d) CNG

Answers

1	*(d)*	2	*(c)*	3	*(d)*	4	*(d)*	5	*(c)*	6	*(d)*	7	*(a)*	8	*(a)*	9	*(d)*	10	*(a)*
11	*(c)*	12	*(a)*	13	*(c)*	14	*(d)*	15	*(c)*	16	*(b)*	17	*(b)*	18	*(b)*	19	*(b)*	20	*(d)*