



Sources of Energy

We already know that energy is the 'capacity of a body to do work'. In earlier classes, we have learnt about different forms of energy: mechanical, heat, chemical, electrical, light, sound, nuclear and so on. These are interconvertible but cannot be created or destroyed.

All forms of energy that we use everyday are stored in different ways in the energy sources.

We need energy for all our activities; from baking our favourite cakes or cookies, to sending astronauts into space.

We already know that ~~(~~ The substances which produce heat on burning in air are called **fuels.**)

CLASSIFICATION OF SOURCES OF ENERGY

I. On the basis of occurrence

- 1. Natural Sources:** Natural resources are those which are taken up by us from the nature like solar energy, wind energy, energy from water, i.e. hydro energy, etc.

2. **Synthetic Sources:** Man-made materials used as sources of energy like chemical energy stored in the form of batteries that are used in calculators, remotes, etc.

II. On the basis of physical state

1. **Solid:** Firewood, charcoal, coal fall under the category of solid fuels.
2. **Liquid:** A very commonly used fuel in our homes is kerosene. Other familiar liquid fuels are petrol and diesel.
3. **Gas:** Petroleum gas commonly known as LPG (Liquified Petroleum Gas) and natural gas used as CNG (Compressed Natural Gas) are two of the best known gaseous fuels.

III. On the basis of availability

1. **Renewable:** A renewable source of energy is the one which can be used over and over again. Wind, sun, biomass from plants and hydropower from water are all renewable sources of energy. These are **inexhaustible** natural resources.
2. **Non-renewable:** Energy source, which gets used up and cannot be recreated in a short period of time is called a **non-renewable** source of energy. These are also called **exhaustible** natural resources, and include fossil fuels like petroleum, natural gas and coal.

DO YOU KNOW ?

A reasonably good estimate of the quality of a fuel can be attained through what is known as its calorific value. The **calorific value** of a fuel is the amount of the heat obtained from it when a unit mass of this fuel is completely burnt out under ideal conditions.

For example, the calorific value of coal is 30,000 kJ/kg and that of wood is 20,000 kJ/kg.

The above values indicate that coal is a better fuel than wood.

WOOD AS A FUEL

Wood is a major renewable natural resource. The burning of wood is currently the largest source of energy derived from solid fuel biomass. Wood can be used for cooking, heating and occasionally for steam engines and steam turbines that generate electricity.

Burning wood produces heat which is useful but it also produces other gases which are undesirable, irritating or dangerous like CO_2 (carbon dioxide) and CO (carbon monoxide).

DO YOU KNOW ?

The excessive removal of wood from forests can cause habitat destruction and soil erosion. Wood burning does not release more carbon dioxide than its bio-degradation (rotting).

COAL

Coal is a readily combustible black rock or brownish black sedimentary rock. Coal is one of the fuels used for cooking food. However, it produces a lot of smoke and foul-smelling gases, which cause air pollution.

Coal, a fossil fuel, is the largest source of energy for the generation of electricity worldwide.

DO YOU KNOW ?

Coal is one of the largest worldwide source of CO_2 emissions.



Anthracite coal

Occurrence of Coal

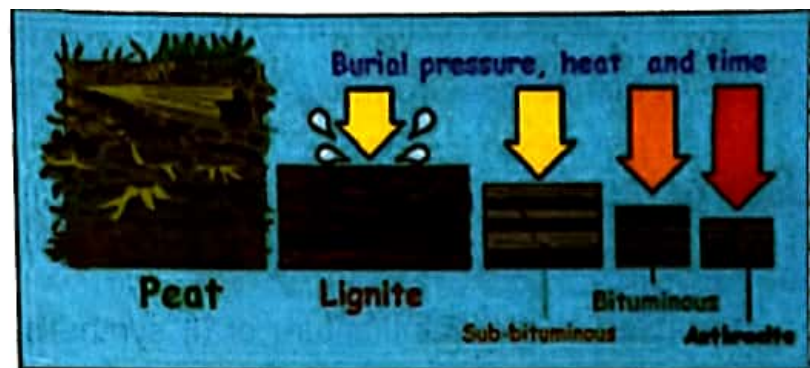
Coal is found deep under the surface of the earth. The major coal mines in India are located in Jharkhand, Madhya Pradesh, Orissa and West Bengal. The largest coal mines are at Bokaro and Jharia in Jharkhand and Raniganj in West Bengal.

Formation of Coal

(Coal was formed from plant remains buried under the earth's crust. Over the period of time, the chemical and physical properties of the remains were changed by geological action to create a solid material.) 5

Different types of coal are **peat**, **lignite**, **bituminous** and **anthracite**.

Various types of coal differ from each other in the content of volatile material and the percentage of carbon, moisture and other elements present.



Processing of Coal

All varieties of coal contain volatile compounds of carbon which are very useful for industrial application. These compounds are lost if the coal is straightway burnt. However, if coal is heated strongly in the absence of air, these compounds can be recovered and used for various purposes. (Strong heating of coal in absence of air is called **destructive distillation**.) Let us study about the products that are obtained by the destructive distillation of coal.

Uses of Coke

1. It is used as domestic as well as an industrial fuel in stoves and furnaces. It gives little or no smoke.
2. It is used for extraction of metals.
3. It can be used to make fuel gases like water gas ($\text{CO} + \text{H}_2$).

Uses of Coal Tar

It is a black liquid of high viscosity.

It is used in the manufacture of (i) synthetic dyes (ii) drugs (iii) explosives (iv) perfumes (v) plaster (vi) paints (vii) photographic materials (viii) roofing materials.

Uses of Coal Gas

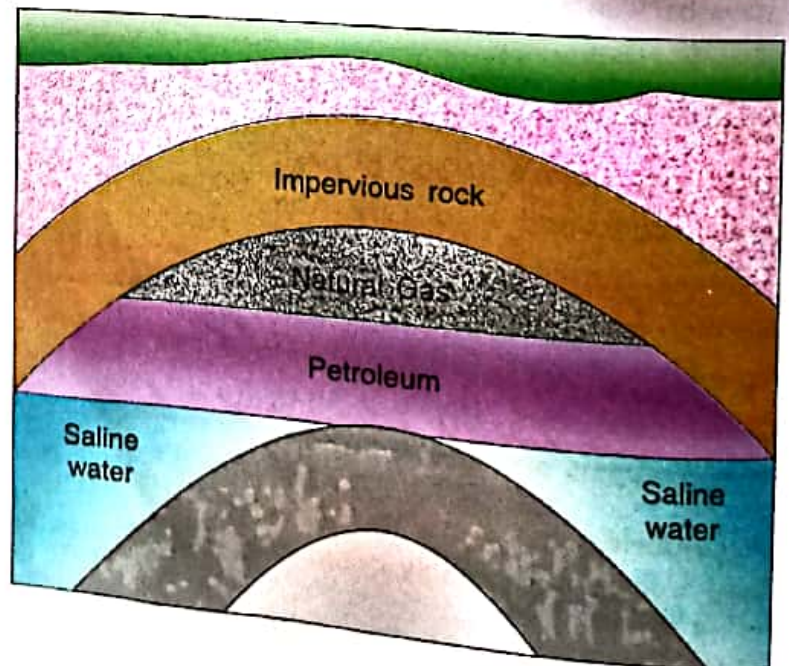
1. It is used as a domestic fuel.
2. It is used as an industrial fuel for those industries which are located near the coal processing units.

PETROLEUM

Petroleum is a fossil fuel. It is a dark coloured, viscous and foul-smelling liquid commonly called **crude oil**. It is found in rock formations in the earth. Its name is derived from the Latin word *petra* (meaning 'rock') and *oleum* (meaning 'oil'). It literally means **rock oil**.

Occurrence of Petroleum

3 (Petroleum is found at a moderate depth (500 m to 2,000 m) between the two layers of impervious rocks. The petroleum deposits are usually found mixed with salt water.) The petroleum is lighter than salt water, and hence, floats over it. (Natural gas is found above petroleum, trapped between the rock cap and petroleum layer.)



Drilling of Oil Wells

The prospective site of petroleum is located and mapped. With the help of giant rigs, a hole is drilled in the earth's crust. When the hole reaches the rock cap, the natural gas comes out first with a great pressure. After that, petroleum starts flowing out due to the pressure of natural gas. When the pressure falls further, the petroleum is pumped out by electric motors.



Pumping an oil well near Texas (US)

Refining of Petroleum

Petroleum is a mixture of various compounds that need to be separated for useful purposes. The process of separating various components of petroleum into their useful form is called **refining**.



A sample of crude oil

Petroleum Products and their Uses

1. **Residual Oil:** is further separated into following products:

- (i) **Asphalt:** It is a black and sticky solid. It is used for making roads and coating the underside of electric poles so as to prevent them from rusting.
- (ii) **Paraffin wax:** It is a white semi-solid, which is used as grease, for making vaseline, ointments and candles.
- (iii) **Lubricating oil:** It is a thick viscous oil used for lubricating machines.

2. **Fuel Oil:** It is used as a fuel in boilers.

3. **Diesel Oil:** It is used to run generators, heavy vehicles, such as buses, tractors, etc.

4. **Kerosene:** It is used as a domestic fuel. It is also used in lanterns.

5. **Gasoline or Petrol:** It is used as a fuel in cars, scooters, etc. It is also used for dry cleaning. Highly refined petrol is used as a fuel in aeroplanes (aviation fuel).

6. **Petroleum Gas:** It is liquified under pressure and is called **Liquified Petroleum Gas**. LPG is used as domestic fuel.

DO YOU KNOW ?

World's first oil refinery was opened at Ploiesti, Romania.

... burns easily to produce heat and light.

In India, gas fields have been discovered in Godavari-Krishna basin, Mumbai High and Tripura.

Assam in Digboi

Uses of Natural Gas

It burns readily, has high calorific value and so, is used as a fuel in homes and industries. It is also used as automobile fuel.



Mumbai high

CLEANER FUELS

Economic development and rapid growing population are putting a strain on the environment, infrastructure and the country's natural resources. Industrial pollution, soil erosion, deforestation, rapid industrialisation, urbanisation and land degradation are all worsening the problem. Burning of fossil fuels, such as coal and petroleum products, is a major source of pollution. Mining activities, use of fertilizers and pesticides also contribute to pollution.

Our strategy to address these environmental issues is to develop technology that uses renewable natural resources, such as biomass, water, wind and solar energy. India is blessed with an abundance of sunlight, water and biomass. Fuels like LPG, Compressed Natural Gas (CNG) and biogas are cleaner and better fuels. When burnt, biomass and LPG release carbon dioxide but in small amounts. When biomass crops are grown, an equivalent amount of carbon dioxide is consumed through photosynthesis. Natural gas is a cleaner fuel as it provides relatively low amounts of pollutants. It has fewer emissions than coal and petroleum products and has virtually no ash particles left after burning.



For energy needs, we must look for alternative sources, such as solar energy, tidal

Something to Know

A. Fill in the blanks:

1. _____ and _____ are non-renewable sources of energy.
2. An important liquid fuel used in our household is _____.
3. _____ is the process in which coal is strongly heated in the absence of air.
4. In oil wells, the _____ gas always collects above petroleum.
5. _____ is a foul-smelling liquid mined from earth.

B. State whether the following statements are true or false:

1. Asphalt is the residue obtained when petroleum is subjected to fractional distillation. _____
2. LPG is not a clean fuel. _____
3. Coke can be used to make fuel gases. _____
4. Petroleum is also called crude oil. _____
5. Burning of fossil fuels is a source of pollution. _____

C. Answer the following questions in brief:

1. Define fuel.
2. Name the places where petroleum deposits are located in India.
3. Define and give two examples of inexhaustible natural resources.
4. State two uses each of the following:
(a) asphalt (b) paraffin wax
5. Name the kind of fuel used in the following:
(a) scooters (b) tractors (c) lanterns
6. What are the advantages of using CNG and LPG as fuels?