

Notes

Sources of Energy

- **Sources of energy**

A source of energy is the one which can provide adequate amount of energy in a convenient form over a long period of time.

- **Renewable sources of energy**

Sources of energy which are being produced continuously in nature and are inexhaustible are called renewable sources of energy. The renewable sources of energy are: solar energy, wind energy, hydro energy, bio fuels (wood, biogas), hydrogen, energy from oceans and geothermal energy.

- **Non-renewable sources of energy**

Sources of energy which have been accumulated in nature over a very, very long period of time and cannot be quickly replaced when exhausted are called non-renewable sources of energy. Some important non-renewable sources of energy are fossil fuels, coal, petroleum and natural gas.

- **Fossil fuels**

Fuels that originated from the remains of dead plants and animals are called fossil fuels. Fossil fuels were formed from organic matter by complex processes over millions of years.

- **Coal**

The types of coal in the order of formation are peat → lignite → bituminous → anthracite. Coal is used primarily as a fuel, mainly in thermal power plants. The burning of coal produces gases like CO_2 , CO , SO_2 and NO_2 .

- **Petroleum**

Petroleum or crude oil is not used directly. It is utilised in the form of its products. The products obtained from fractional distillation are fuel oil, diesel, kerosene, petrol and petroleum gas. Asphalt, paraffin wax and lubricating oil are obtained by fractionating the residual oil. Pollution caused by burning petrol is more difficult to control than that by coal.

- **Natural gas**

Natural gas is the cleanest fossil fuel. It consists mainly of methane which gives CO_2 and water on burning. Natural gas is used for cooking and heating. It is also used as a fuel in thermal power plants. Compressed natural gas is used as a fuel in vehicles.

- **Alcohol as fuel**

Ethanol burns in air to produce heat, carbon dioxide and water. Ethane, for the purpose of being used as a fuel, is produced by the fermentation of plant sugars with the help of yeast. Although it has a low calorific value than petrol, it has many advantages.

- **Energy from biomass**

Biomass means any organic matter from which we can get energy on a renewable basis.

- **Solar energy**

The energy obtained from the sun is called solar energy.

Solar constant = 1.4 kilowatt per square metre

- **Energy from wind and tides**

Wind is caused by the uneven heating of the earth's surface by the sun and is an important source of energy. Waves are produced mainly due to winds and tides that have kinetic energy. This kinetic energy can be used to operate turbines and produce electricity by different methods.

- **Geothermal energy**

Interior of the earth is very hot with high pressure. Ground water absorbs this heat and produces steam. This steam helps to rotate the turbines and produce electricity.

- **Nuclear fission**

The breaking of a heavy nucleus into two or more fragments of comparable masses with the release of tremendous amount of energy is called nuclear fission. The released energy is used to produce steam and generate electricity.

- **Nuclear fusion**

The process in which two or more light nuclei are combined to form a single nucleus with the release of tremendous amount of energy is called a nuclear fusion.

- **Nuclear forces**

The protons and neutrons are held together by strong attractive forces (nuclear forces) inside the nucleus. Nuclear forces are of short-range. Its range is of the order 1 fm. It is much stronger than either electromagnetic or gravitational. Nuclear forces do not depend on charge. The force is small between any pair of nucleons.

- **Nuclear reactions**

A nuclear reaction should always satisfy the mass and energy conversion $Q = \Delta m \cdot 931 \text{ MeV}$. According to the law of conservation of mass, the total number of protons and neutrons should remain the same on both the sides of a nuclear reaction.

- **Mass defect and binding energy**

It is found that the mass of nucleus is always less than the mass of constituent (free) nucleons. This difference in mass is called mass defect and denoted by Δm

- **Nuclear bombs**

Bombs that are based on the fission of U-235 or Pu-239 are called fission bombs or atomic bombs or atom bombs.