3 SOURCES OF ENERGY

3.1 INTRODUCTION

Energy comes in different forms – heat (thermal), light (radiant), mechanical, electrical, chemical and nuclear energy. These sources of energy are divided into two groups – renewable (an energy source that can be replenished in a short period of time) and nonrenewable (an energy source that we are using up and cannot recreate in a short period of time).

Renewable energy sources include solar energy, which comes from the sun and can be turned into electricity and heat. Wind, geothermal energy from inside the earth, biomass from plants, and hydropower and ocean energy from water are also renewable energy sources.

However, we get most of our energy from non-renewable energy sources, which include the fossil fuels – oil, natural gas, and coal. They're called fossil fuels because they were formed over millions and millions of year by the action of heat from the Earth's core and pressure from rock and soil on the remains (or "fossils") of dead plants and animals. Another non-renewable energy source is the element uranium, whose atoms we split (through a process called nuclear fission) to create heat and ultimately electricity.

Question based on basic knowledge required to understand this chapter

1. Which of the following is renewable source of energy?
   (A) Coal (B) Natural gas (C) Sun light
   (D) Uranium
2. The source of energy in a hydro power station is:
   (A) Coal (B) Water (C) Sunlight
   (D) Dissel
3. The radiations that are responsible for the heating effect of solar raditions are:
   (A) Visible radiations (B) X-rays
   (C) Ultra-violet radiations (D) Infra-red-radiations

4. A renewable source of energy is
   (A) exhaustible (B) non-replenishable (C) limited (D) inexhaustible
5. Which one of the following is not used as a cooking fuel:
   (A) Compressed natural gas (B) Biogas
   (C) Liquified petroleum gas (D) Coal
6. Biogas is made mainly of _____ gas.
   (A) CH_4 (B) CO_2 (C) H_2SO_4 (D) N_2
7. Which of the following is a by product of a biogas plant.
   (A) Fertiliser (B) Nutritious food (C) Cleaning detergent (D) Poisonous gas
8. Which of the following is not an example of a biomass energy source:
   (A) Wood (B) Gobar gas (C) Nuclear energy (D) Coal
9. Most of the sources of energy use us by respresent stored solar energy. Which of the following is not ultimately derived from the Sun's energy:
   (A) geothermal energy (B) wind energy
   (C) nuclear energy (D) biomass
10. Which of the following materials is used to make a photovoltaic solar cell:
    (A) Silicon (B) Carbon (C) Lead (D) Aluminium

3.2 SOURCE OF ENERGY

Anything which supplies useful energy to us to carry out the various acitivites like cooking, heating, lighting, operating transport and machines etc. is known as **source of energy.**

3.2.1 Meaning of useful Energy

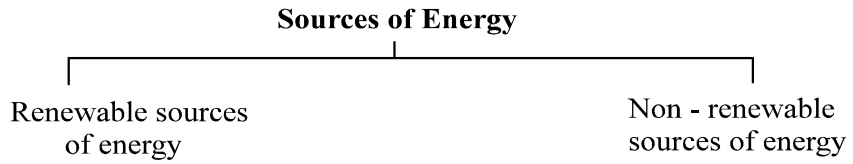
Before getting useful energy from a source of energy, we have to supply some energy to it, which is known as input. After receiving the input, the source of energy gives output. The difference between the output and the input is known as useful energy.

3.2.2 Characteristics of a Source of Energy

The source of energy should have the following characteristics : –

(a) It should supply enough amount of useful energy (b) can beeasily stored (c) can be easily transported (d) should occupy less space for storage (e) should supply useful energy in a controlled manner.

3.2.3 Renewable and Non - Renewable Sources of Energy



3.2.4 Non-Renewable Sources of Energy:

The sources of energy which are exhaustible (i.e. which can be finished) and have been formed in nature long ago are known as non-renewable sources of energy.

For example : – (i) Coal (ii) Petroleum (iii) Natural Gas (iv) Fissionable materials like Uranium.

These sources of energy are also known as **conventional sources of energy.**

We mainly depend upon the **conventional sources** of energy (or non- renewable source) like coal, petroleum, near future. This is because of their continuous and rapid use. Thus, a stage is bound to come when these sources of energy will be out of stock. This would create an **energy crisis** on the earth.

3.2.5 Renewable Sources of Energy

The sources of energy which are inexhaustible (i.e. which can never be finished) and are being continuously supplied by nature are known as **renewable sources of energy.**

For example :

(i) Wind (ii) Flowing water (iii) The sun (iv) Ocean Tidals Energy (v) Interior of the Earth

These sources of energy are also known as **non -conventional sources of energy**.

3.3 CONVENTIONAL SOURCES OF ENERGY

3.3.1 Fossil Fuels

Fossils are the remains of the pre-historic animals or plants, buried under the earth, millions of year ago. Coal, petroleum and natural gas are known as fossil fuels becauses they were formed by the decomposition of the remains of the pre-historic plants and animals (fossils) buried under the earth.

Sun is the Ultimate Source of Fossil Fuels

The green plants need sunlight energy to grow. They get this energy from sunlight, and store it in the form of carbon compounds. Thus fossil fuels are energy-rich compounds of carbon which were originally made by the plants with the help of sun's energy (solar energy). Without sun-light, there could have been no coal, petrolum, natural gas, wood or any other fuel in this world. Today when we burn coal, petroleum or **natural gas, we are** actually making use of the sunlight energy that was stored by the plants millions of years ago.

3.3.2 Coal

Coal is a complex mixture of compounds of carbon, hydrogen and oxygen, and some free carbon. Small amounts of nitrogen and sulphur compound are also present in coal. It is found in deep coal mines under the surface of earth.

Different Types of Coal

The main constituent of coal is carbon (in the form of carbon compounds as well as free carbon). The percentage of carbon in a sample of coal varies from place to place. There are four varieties of coal on the basis of their carbon content. These are given below:

Type of Coal	Carbon Content
1. Peat	60% carbon
2. Lignite (Soft coal)	70% carbon

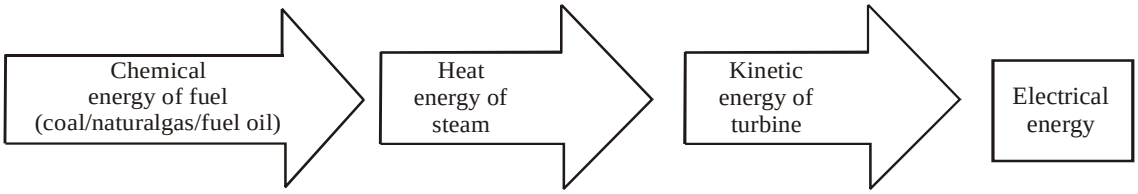
3. Bituminous (Household coal) 80% carbon
4. Anthracite (Hard coal) 90% carbon

Uses of coal

1. Coal is used as a fuel for heating purposes in homes and in industry.
2. Coal is used as a fuel in thermal power plants for generating electricity.
3. Coal is used to make coke. And this coke is then used as a reducing agent in the extraction of metals.
4. Coal is used in the manufacture of fuel gases like coal gas.
5. Coal is used in the manufacture of petrol and synthetic natural gas.

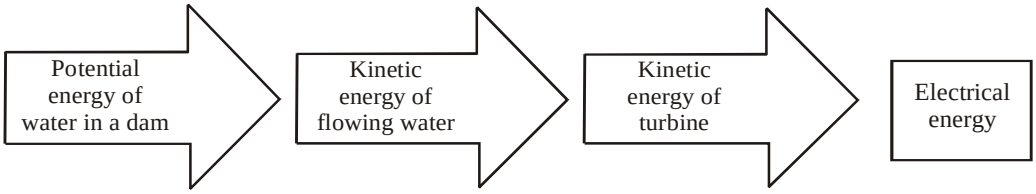
3.4 THERMAL POWER PLANT

The Coal or natural gas based electricity - generating units are called **thermal power plants.**
In a thermal power plant, coal/natural gas/ fuel oil is burnt to produce superheated steam. This steam is used in running a turbine to generate electricity. Thus, in a thermal power plant, chemical energy of coal/ natural gas/fuel oil is converted into electrical energy through the following steps.



3.5 HYDRO POWER PLANT

Electricity porduced by making use of the kinetic energy of the flowing water is termed **hydroelectricity** or **hydroelectric power**.
In a hydropower station, the potential energy of water stored in a dam is converted into kinetic energy of the turbine which finally gets coverted into electrical energy.



The whole set - up involved in the production of hydroelectricity is commonly called **hydroelectric power station.**
Fast flowing big rivers are not found everywhere. Quite often, many small rivers are located at higher altitudes in the mountainous region. Water from these small rivers can be collected in large reservoirs at higher altitude by constructing dams. The water stored in a dam has large potential energy (due to its height above the ground). When this water is released through tunnels, its potential energy gets converted into kinetic energy and the water comes out of the tunnels at a very high speed. This fast flowing water rotates the blades of a turbine. The rotating turbine rotates the alternator of the generator, producing electrical energy.

Illustration 1

Mention any two advantages and two disadvantages of producing hydro electricity by building dams on rivers.

Solution

Advantages

(i) Production of cheap electricity without producing pollution.

(ii) Dams are used for irrigation and flood control.

Disadvantages

(i) Large land area gets submerged.

(ii) It adversely affects the ecosystem of adjoining as well as areas downsteam.

Try yourself

1. List out the properties of a good source of energy?
2. Why most of the thermal power plants are set near coal or oil mines?

3.6 BIO MASS

The fuels obtained from plants and animals porducts are said to be bio - mass.

3.6.1 BIO - GAS

Biogas is a mixture of various gases formed when the animal dung mixed with water is allowed to ferment in the absence of air (or oxygen).

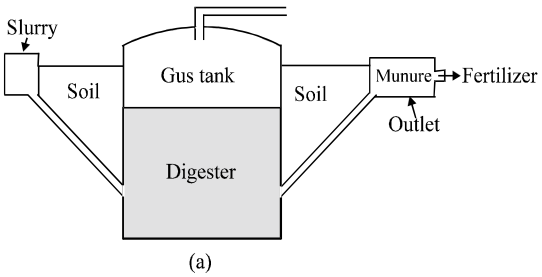
The animals and plants wastes contain large quantity of carbon compounds like carbohydrates, fats, proteins etc. The bacteria or anaerobic micro-organisms present in animal dung decompose these compounds into single compounds like methane (CH_4) in the presence of water.

Consituents of Bio -gas

Biogas is a mixture of various gases such as methane (CH_4), carbon-dioxide (CO_2), hydrogen (H_2) and hydrogen sulphide (H_2S). The chief constituent of biogas is methane gas which is about 75% by volume.

3.6.2 Biogas Plant

Working : Animals-dung is mixed with water to make slurry in the mixing tank. This slurry enters the digester through the inlet chamber. The digester is a sealed chamber in which there is no oxygen. Anaerobic micro - organisms that compounds of the cow - dung slurry. It takes a few days for the decomposition process to be complete and generate gases like methane, carbon dioxide, hydrogen, and hydrogen sulphide. The bio - gas is sotred in the gas tank above the digester from which they are drawn through pipes for use.



(a)

Once the biogas plant starts functioning, more and more slurry may be fed into the digester to get the continuous supply of biogas. The used slurry collected in the overflow tank is rich in nitrogen and phosphorous which are essential for the growth of crops and plants. Hence this used slurry can be used as manure.

Advantage of using biogas

Biogas is used for cooking food and heating water.

It is a good source of energy because

(i) biogas does not produce smoke during burning and hence there in no air pollution.

(ii) it is a cheaper source of energy.

3.7 WIND ENERGY

Air in motion is called **wind.** As a moving object possesses kintic energy, so wind has also kinetic energy. The kinetic energy of the wind is also known as wind energy.

Cause of Wind

The air from polar regions rushes towards the equatorial region to fill the gap. This causes the air to move Moreover, local weather conditions also contribute to the movement of air. If the speed of air is small, then the wind is known as breeze. On the other hand, if the speed of air is very large, then the wind is knonw as storm or tornado.

The large kinetic energy of the storm uproots the trees, blows the roofs of houses and causes huge loss of the property and life.

Use of Wind Energy

The kinetic energy of the wind can be used to

(i) move the sail boats in lakes, rivers and seas.

(ii) operate water pumps to draw undergound water.

(iii) run the flour mills to grind the grains (i.e. maize, wheat, corns, etc.).

(iv) produce electricity.

WIND MILL

A device used to convert wind energy into the mechanical energy of the machine is called wind mill.

Uses: Wind mill is used for operating water pumps, griders and is also used to produce electicity.

Sequence in which energy is transformed : K.E. of wind is converted into K.E. of rotation of wheel. K.E. of rotation of wheel is converted to K.E. of the piston. Then K.E. of the piston is converted into P.E. of raised water.

Advantages of Wind energy:

(i) Wind energy produces no smoke and no harmful gases.So this form of energy is pollution free.

(ii) Wind energy is free of cost and hence devices operated by wind energy are economical.

(iii) This source of energy is inexhaustible i.e. it is limitless and is available for all times to come under favourable conditions.

Limitations of Energy

(i) We cnannot depend upon wind energy as it is available only when air is in motion. The appliances or machines operating with wind energy stop working as soon as wind stops. The minimum speed of wind to operate generator to produce electricity is about 15 km/h. As soon as the speed of wind become less than 15 km/h, the generator stops working.

(ii) There are certain regions where wind is not available, so the use of wind energy is limited to certain places where wind is in plenty and blows most of the time.

(iii) Wind energy is not sufficient to operate very heavy machines.

(iv) Wind energy cannot be used to operate all types of machines.

3.8 ALTERNATIVE OR NON-CONVENTIONAL SOURCES OF ENERGY

3.8.1 Solar Energy

The energy emitted by the sun in the form of heat and light (i.e. radiations) is known as solar energy. The Sun contains mainly light elements like hydrogen and helium. When the atoms of these elements fuse together due to exteremely high temperature in the interior of the Sun, a large amount of energy is radiated continuously by the Sun. This process is known as Nuclear fusion. All the planets of the solar system receives this energy emitted by the Sun. The energy is emitted by the Sun in the form of radiations. These radiations are visible rays, infra-red rays(i.e., heat radiation), Ultraviolet radiation and gamma rays. It may be noted that only some fraction of the total energy emitted by the Sun reach the surface of the earth.

Uses of Solar Energy

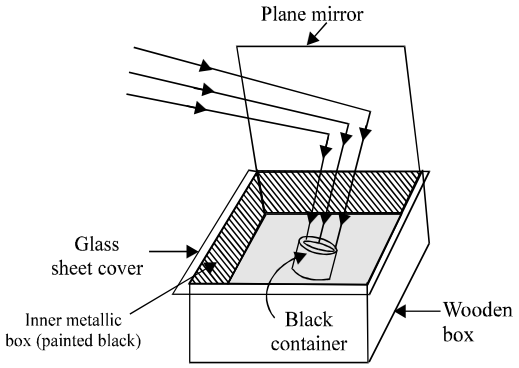
(i) for cooking food using solar cookers (ii) for heating water using solar water heaters (iii) for producing steam by heating water to produce electricity (iv) by green plants to make their food (v) to produce electricity using solar cells (vi) to melt metals using solar furnaces (vii) for drying clothes and food grains (viii) Solar energy is the ultimate source of all types of energy. Hydrogen is combustible but it does not support combustion.

3.8.2 Solar Cookers

Construction

It consists of a wooden box (rectangular in shape) in which a metallic box painted black is fitted. The space between wooden box and metallic box is filled with an insulating material like thermocol. The insulating minimizes the heat lose by conduction and radiation.

The metallic box is covered by a thick glass sheet. A plane mirror relfector is used to reflect the sun rays is attached to the box. The un-cooked food placed in the black container is put inside the box.



Working

The plane mirror reflector is adjusted in such a way that maximum sun light falls on it. The light reflected

by the plane mirror falls on the thick glass sheet cover. The heat radiations (i.e. infra -red rays) pass through the glass sheet and are absorbed by the black container or any other object placed in the box and black surface of the box . The heat radiations entered in the box are not able to come out of the box through the glass sheet. Thus, the heat radiations are trapped in the box. (The effect is known as green house effect). **The temperature inside the box increases from 100°C to 140°C.** Thus, the food in the container is cooked.

Advantages of Box Type Solar Cooker

1. Economical : The cost of cooking food in the solar cooker is very small as money is only spent to purches the solar cooker.

2. Pollution : No pollution is caused as there is no burning of fuel.

3. Nutrition value of food is preserved as the food is cooked at low temperature.

4. It can cook two or three dishes at a time.

5. It saves the costly fuel like wood, gas, kerosene oil etc.

Disadvantages of Solar Cooker

(i) Food cannot be cooked at night. (ii) Food cannot be cooked on cloudy day. (iii) Food cannot be cooked quickly as solar cooker takes 4 to 5 hours to cook it. (iv) Large quantity of food cannot be cooked with the solar cooker. (v) Chapti's cannot be made with this cooker. (vi) Food cannot be fired. (vii) The position of the reflecting plane mirror has to be changed again and again so that it always face the sun.

Advantages of Solar Devices

(i) These devices save the costly fuel like wood, gas, kerosene, diesel etc.

(ii) These devices cause no pollution and hence they are environment-friendly.

(iii) The repair and maintanance is very cheap.

Limitations of Solar devices

(i) They cannot work during night

(ii) They cannot work on cloudy and rainy days.

(iii) They are less effective during winter season.

(iv) They are not effective in polar regions.

(v) They cannot be used to operate automobiles like buses, cars, ships and aeroplanes.

(vi) They cannot be used to operate heavy machinery.

(vii) Their initial cost is high.

3.8.3 Solar Cell

A device which converts sunlight into electrical energy is known as solar cell.

History of Solar cell

It was discovered more than 100 years ago that sunlight falling on a thin layer of selenium element can be converted into electric energy. But, the efficiency was too low (about 0.7%), so no efforts were made to develop the solar cells.

Semiconductors and Solar cells

A substance whose conductivity lies between those of a conductor and an insulator is known as semiconductor.

Examples: Silicon, Gallium, Sallium and Germanium are Semiconductors.

Question: How to make Solar Cell?

A solar cell made of semiconductor (Germanium or Silicon having Gallium as impurity) has an efficiency about 10 -15%.

Use of Solar Cells

1. They are used in wrist watches and calculators.
2. They are used to generate electricity needed in artificial satellites (i.e. man made satellites).
3. They are used to operate electric bulbs and tubes in remote areas where hydroelectricity is not available.
4. They are used to operate radio sets in remote corners.

3.8.4 Solar Panel

A group of solar cells connected to each other in a certain pattern forms a solar panel.

A solar panel converts sunlight into electrical energy. The efficiency of solar panel is very large.

Solar panels have limited uses. They can not be used to meet our domestic needs of electricity. This is because of the following reasons:

1. The solar cells used in a solar panel are made of pure silicon. The production of pure silicon is very costly affair. These solar cells in a solar panel are joined to each other with a best conductor silver to reduce the resistance of the solar panel to get maximum electricity. But silver metal is also costly. Thus, we find that the cost of fabricating a solar panel is very high.

2. The storage battery connected to a solar panel can supply direct current (D.C.). So only those electric applicances can operate with the solar panel which require direct current. However, the electric appliances which require alternating current (A.C.) can be operated with the solar panel.

3. Solar ponel can supply the electricity continuously only if the sun shines during day time.

Uses of Solar Panels

(i) They are used to operate electric bulbs and tubes in the remote villages and areas.

(ii) They are used to supply electricity in artificial satellites.

Illustration 2

What are the environmental benefits of a biogas plant?

Solution

Following are the environmental benefits of a biogas plant.

(i) It reduces deforestation as it avoids the cutting of trees for firewood.

(ii) It helps in rural sanitation.

(iii) It helps in maintaing the ecological balance.

Illustration 3

List some uses of a solar cell.

Solution

(i) To supply power to calculators, artificial satellites and wireless transmission system installed in remote areas.

(ii) To operate traffic lights, road lights.

Try Yourself:

3. With a neat diagram of a bio-gas plant write its construction and working?
4. What is the role of a glass sheet and black coated surface of a box type solar cooker?

3.9 ENERGY FROM THE SEA (HYDRO WATER)

The energy obtained from the water is known as hydro-energy.

The sun heats the water in the oceans. As the specific heat capacity of water (4200 J kg^{-1} $°C^{1}$) is very high, so the water in oceans in a store house of heat energy.

The energy from ocean water is available in the following forms:

(i) Energy of sea waves (ii) Tidal energy (iii) Ocean thermal energy

(iv) Energy of sea vegetation (v) Energy of salinity gradient

3.9.1 Energy of Sea Waves

Coastal regions are high wind regions. These winds produce huge waves on the surface of water in the sea or ocean. Thus, the water in the sea moves. The kinetic energy of this moving water rotates the turbine of a generator. Hence elecrticity is produced.

3.10 TIDAL ENERGY

The alternate rise and fall of waters of the ocean twice in nearly 24 hours is know as tides. The tides are caused due to the gravitational force of attraction exerted by the moon and to some extent by the sun on the waters of the ocean. At the time of new and full moon, when the sun and the moon are in a straight line, tides are very high.When the sun and the moon are at right angle from the earth, tides are low. The kinetic energy of the water during tides is used to produce electricity. Tidal power plants are constructed near narrow Bays. During tides the gates of the dam are opened. The rising water is allowed to fall on the turbine of generator which produces electricity. Thus kinetic energy of the water is converted into electricity energy.

3.11 OCEAN THERMAL ENERGY

The heat energy due to the temperature difference between the different layers of water in the ocean is knonw as ocean thermal energy (OTE). The difference in temperature between warm surface waters heated by the sun and colder waters found at ocean depths is another form in which solar energy becomes available from the oceans. This is known as ocean thermal energy.

3.11.1 Ocean Thermal Energy Conversion (OTEC) Power Plants

A device used to obtain ocean thermal energy is known as **Ocean Thermal Energy Conversion (OTEC) Power plant.** For operating OTEC power plant, temperature difference of 20°C (293 k) or more between the surface water of ocean and water deep into the ocean is required. The warm surface water of ocean is used to boil liquid like ammonia or chlorofluoro carbon (CFC). The vapours of this liquid at high pressure are used to rotate the turbine of the generator to produce electricity. The un-used vapours (known as dead steam) are again converted into liquid by the cold water pumped up from the deep ocean. This process is repeated time and again to convert thermal energy into electric energy (i.e. electricity). The main advantage of OTEC power plant is that it can be operated for 24 hours throughout the year.

3.12 GEO-THERMAL (GEO-THERMAL MEANS EARTH-HEAT)

The regions in the crust where the hot magma rises up and is collected in hot spots. The heat energy stored in the hot spots of the earth's crust is called **geo-thermal energy.** This energy heats the underground water. The hot underground water comes automatically out of the earth's surface in certain regions where crust is weak in the form of fountains known as hot water springs or geysers.

The steam of underground water is usually taken out by sinking pipes through holes drilled in the earth's crust. This steam under high pressure is used to rotate the turbine of the generator to produce electicity.

Advantages of Geo-thermal energy:

1. Geo-thermal energy can be converted continuously into electricity for 24 hours throughout the year.
2. Geo-thermal energy causes no pollution, so it is enviroment friendly.
3. The cost of converting geo-thermal energy into electricity is very less.

3.13 HOW LONG WILL AN ENERGY SOURCE LAST US?[ENERGY CRISIS]

Fast depletion of the non renewable concentrated sources of energy (fuels) is known as energy crisis.

What are the factors causing energy crisis

The following factors lead to energy crisis;

(i) Increasing population

(ii) Excessive use of non- renewable (conventional) sources of energy.

(iii) Use of less fuel - efficient machines.

(iv) Affluent life - style of the people.

How can the energy cirsis be prevented

To prevent energy crisis we should

(i) slow down the use of conventional fuels

(ii) use renewable sources of energy like wind energy, solar energy, hydroenergy, geothermal energy and biomass energy.

(iii) use more fuel - efficient machines and electrical appliances.

(iv) save energy whenever and wherever possible.

Illustration 4

What are the limitations of the energy that can be obtained from the oceans?

Solution

(i) It is difficult to find suitable sites in and around the ocean for the construction of dams for electricity generation.

(ii) Tides come at a place at intervals of six hours. This also affects the continuous process.

(iii) The strength of the sea waves depends upon the speed of the air flow.

(iv) The temperature of the top surface layer of the ocean is not very high. Therefore, the only low boiling point fluids can be evaporated by using suitable devices to trap ocean thermal energy .

Try Yourself:

5. How is electricity generated from Ocean Thermal Energy?
6. What is Geo-thermal energy?

3.14 NUCLEAR ENERGY

Nuclear energy is the energy released during nuclear reactions. We have seen that much large amounts of energy are given out in a nuclear reaction than in a chemical reaction. Where does this energy come from?

When a nuclear reaction occurs, the mass of the products is generally less than the mass of the reactants. Some mass has vanished. This is known as mass defect. Albert Einstein showed that this disappearing mass is converted to energy. When a mass m disappears during a nuclear reaction, the energy E released due to this is given by the famous equation

$E = mc^2$

where c is the speed of light (3×10^8 ms^{-1}). As c is a very large number, a tiny loss of mass produces a huge amount of energy.

The two nuclear processes which are used to generate huge amounts of energy are as follows

(i) Nuclear fusion i.e. the joining together (or fusion) of two or more nuclei to form a heavier nucleus.

(ii) Nuclear fission i.e. the breaking up (or fission) of a heavy nucleus into two smaller nuclei.

3.15 HAZARDS OF NUCLEAR ENERGY

The major hazard of nuclear power generation is the storage and disposal of spent or used fuels–the uranium still decaying into harmful subatomic particles (radiations). Improper nuclear waste storage and disposal result in environmental contamination. Further, there is a risk of accidental leakage of nuclear radiation. The high cost of installation of a nuclear power plant, high risk of environmental contamination and limited availability of uranium makes large-scale use of nuclear energy prohibitive.

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EXERCISE-I

1. What kind of gases are released while burning fossil fuels?
2. List out the different power plants from which we get electrical energy?
3. What is the major source of energy for the sun?
4. What nuclear reaction takes place in the sun?
5. Draw the schematic picture of a solar cooker?
6. What is the use of the plane mirror of a box type of solar cooker?
7. Which type of solar spectrum is trapped in the solar cooker?
8. What is a solar cell?
9. What are the uses of solar cells?
10. What are the different forms of energies available from the oceans?
11. What are hot spots?
12. What are the different type of nuclear reactions?
13. Define nuclear fission and fusion reactions.
14. List some renewable energies.

EXERCISE-II

1. What are main disadvantages of using fossil fuels and how can we minimize it?
2. What causes acid rain?
3. Write the working of a hydro power plant with heat diagram?
4. What are the limitations of constructing dams across rivers?
5. What is the composition of bio-gas and the matter rich in the slurry left behind in the bio-gas plant?
6. With a neat diagram of a wind mill write its construction and working?
7. Define solar constant and give its value on the upper atmosphere and on the lower atmosphere?
8. What are the advantages and disadvantages of a solar cell?
9. What are the limitations of using solar cell?
10. What factors make a solar cell very expensive?
11. What is ocean thermal energy and how is it harnessed?
12. What is OTEC?
13. What is the minimum requirement to operate the OTEC system?
14. What are the limitation of harnessing Geo-thermal energy?
15. What is the major hazard of nuclear power generation?

EXERCISE-III

SECTION-A

- **Fill in the blanks**

1. Hydro power plants convert the potential energy of falling water into _____.
2. The phenomena, in which, the nucleus of a heavy atom, when bombarded with low-energy neutrons, can be split apart into lighter nuclei, is called _____.

SECTION-B

- **Multiple choice question with one correct answers**

1. The word 'energy crisis' stands for
   (A) Energy destruction (B) Energy creation
   (C) Conversion of energy from usable form to less usable form (D) None of these
2. Device that converts the potential energy of flowing water into electricity is
   (A) Solar cooker (B) Thermal power plant
   (C) Hydro power plant (D) Bio-gas plant

SECTION-C

- **Assertion & Reason**

Instructions: In the following questions as Assertion (A) is given followed by a Reason (R). Mark your responses from the following options.

(A) Both Assertion and Reason are true and Reason is the correct explanation of 'Assertion'
(B) Both Assertion and Reason are true and Reason is not the correct explanation of 'Assertion'
(C) Assertion is true but Reason is false
(D) Assertion is false but Reason is true

1. **Assertion:** In nuclear fission, a tremendous amount of energy is released if the mass of the original nucleus is just a little more than the sum of the masses of the individual products.

   Reason: The difference in mass, Δm, between the original nucleus an the product nuclei gets converted to energy E according to equation

   $E = \Delta mC^2$

   where C is speed of light in vaccum.

SECTION-D

- **Match the following (one to one)**

Column-I and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. Only One entries of column-I may have the matching with the same entries of column-II and one entry of column-II Only one matching with entries of column-I

1.

Column-I ***(Device)***	**Column-II** ***(Limitation)***
(A) Hydro power plants	(P) Efficient commercial exploitation is difficult
(B) Wind mill	(Q) Special grade silicon is limited
(C) Solar cell	(R) Wind speed should higher than 15 km/h
(D) Ocean-thermal-energy conversion plants	(S) Large eco-systems are destroyed

EXERCISE-IV

SECTION-A

- **Multiple choice question with one correct answers**

1. The major source of energy in India is –
   (A) Nuclear (B) Petroleum (C) Hydro (D) Coal
2. Bio-gas is produced in a bio-gas plant, by decomposition of complex compounds of the cow-dung slurry. This process is done by : Micro-organism in the
   (A) Presence of Oxygen (B) Absence of Oxygen
   (C) Presence of N_2 (D) None of the these

SECTION-B

- **Multiple choice question with one or more than one correct answers**

1. Limitations in harnessing the kinetic energy of flowing water in hydro power plants is/are
   (A) The speed of flowing water should higher than 15 km/hr
   (B) The dam's can be constructed only in a limited number of places
   (C) Large ecosystems are destroyed when submerged under the water in dams
   (D) The dams need a high level of maintenance

SECTION-C

- **Comprehension**

Passage-1

The solar energy reaching unit area at outer edge of the earth's atmosphere exposed perpendicularly to the rays of the sun at the average distance between the sun and earth is known as the solar constant. It is estimated to be approximately 1.4 Kj per second per square metre or 1.4 Kw/m^2. A rocked is flying at the outer edge of earth's atmosphere. Sun rays are incident perpendicularly on the metal surface of rocket of area 10 m^2.

1. Solar energy incident on metal surface in 10 sec. is
   (A) 1.4 KJ (B) 14 KJ (C) 140 KJ (D) None of these
2. In how much time will metal surface receive 42 KJ of solar energy.
   (A) 3 sec (B) 30 sec (C) 300 sec (D) None of these
3. Solar energy received by unit area of metal surface in 10 sec. –
   (A) 1.4 KJ (B) 14 KJ (C) 140 KJ (D) None of these