9

FIRE (ENERGY)

Dear student, in the last lesson you read about air conservation of air in the Vedas. In this lesson you will read about Fire (energy). Fire (energy) is also one of the great five elements. The heat of fire is present in the form of energy in the whole universe.

Have you ever felt what it feels like if you don't eat food someday? Weary, the desire not to do any work, it seems to be the same. Can a car work if we do not put diesel or petrol in it? No. Because the engine cannot run until it gets fuel. Food also acts as a fuel for us, which gives us strength. Whether it is food or fuel, all these provide such power to us or the engine, etc., by which work can be done.The ability of any object to function is called energy.

The ox needs energy to run the plow in the field, the children to play and the engine to drive the car. There are many such examples, in which it will be seen that no work is being done, but they are also using energy, such as in a ignited bulb or in running water, they also have energy.

Actually, energy has become such a necessity in our daily life that without it, it seems that everything will stop. There are many forms of energy and energy comes from different sources.

Let us read about the need for energy, its various sources and forms in this lesson. In this lesson we will also read about the uses and conservation of energy.

OBJECTIVES

After reading this lesson you will be able -

- know the different forms of energy;
- get to know about various sources of energy;
- Knowing energy saving measures; and
- understand nuclear energy and its utility.

9.1 FATIGUE AND ENGERGY

As you read 'no work is possible without energy'. You too must have said such a thing many times, which also means the same thing as mentioned above. For example - after running for a long distance you would have said that 'I am tired, cannot run longer. Similarly, when you stop playing after playing for hours, you have said, 'Now, I cannot play much, I am feeling tired'. What is this tiredness? How do you know you are tired? Why do you feel tired when you work too much or work too long?

Tiredness means a condition after which you are not in a position to do anymore work. This means that all your energy is spent

working. Therefore, tiredness depends on your physical energy. The weak man feels tired after doing a little hard work. A powerful man can carry a heavy weight far enough, but a weak man can carry that same weight for barely half the distance. This makes it clear that the weak man does not have the ability to carry the weight much further.

Fig. 9.1 (a) Use of energy while playing hockey. (a) while working,

We often use two words to explain the above example - work and energy. We will say that carrying weight is a task and the amount of work done will depend on the strength or energy of his body and when the entire energy of his body is spent, he feels tired. In this way, we can define energy as the ability to work. This means that there is a close relationship between energy and work.

Unit of energy

If an object is displaced by a meter distance by applying a Newton force, the energy spent in doing so is one joule of energy. Hence the unit of energy is joule.

INTEXT QUESTIONS 1.1

1. Why do we feel tired when doing more work?
2. Why can't a weak man do more work?
3. What does one joule energy mean?

9.2 ENERGY FORMS

There are many forms of energy. And one type of energy can also be converted into another type of energy. The various forms of energy are of the following types:

(a) Mechanical energy

The energy present in an object due to its state or motion is called mechanical energy, such as a keyed clock coil has mechanical energy. Similarly, there is also mechanical energy in flowing water or in a moving car.

Fig. 9.2 Mechanical energy objects

(b) Chemical Energy

As you know, all substances are made up of molecules. Compounds are formed when molecules of different substances combine. Some energy is hidden in these molecules and compounds. When a chemical change occurs, this hidden energy, called chemical energy, is produced in many forms. For example, before burning a matchstick, it contains chemical energy, but after burning it turns into thermal and light energy.

(C) Sound energy

Sound is another form of energy. It will be difficult to see that an object can be moved by sound, but you know that when the sound waves produce vibrations on the screen of our ears, then only we are able to hear.

When there is a big explosion with a loud sound, you must have noticed that the doors and windows of the houses start rattling. Since sound can rattle windows and doors, it is also a form of energy.

(D) Thermal energy

Have you ever made tea at home or have you ever seen your mother or elder sister making tea? When the water starts boiling in the steel vessel, you must have noticed that the lid placed on it starts rising upwards due to steam. At normal temperature, the water cannot lift the lid but when heated to boiling, it becomes hot vapor ie steam and now it has thermal energy and it can lift the lid. Hence heat is a form of energy.

(E) Optical energy

Since light is a weak form of energy, it is not able to produce motion in heavy objects. However, it can affect the photographic film. This can cause displacement in light dust particles. The light emitted from a bulb or tube light is optical energy.

Hidden-bell is a device that works on optical energy. Light energy is incident on an optical cell(photo cell) and the bell starts ringing. When a thief enters the house, this photo stops the light imported from the cell and starts ringing.

(F) Electrical energy

As you all know, electric energy is one of the most used energy in our daily life.

Fig. 9.4 Use of electrical energy (a) Bulb, (b) Fan, (c) Computer

We switch on the bulb and light is generated due to the current flowing in the bulb. Similarly, electric energy is used in the fan; tube well, air conditioning, fridge, mixer and many other household appliances.

(G) Magnetic energy

You all know that a magnet can attract (pull) iron shavings or pins. In many factories, cranes will be found to separate the iron from the pile of waste. Very large electromagnets are used in these.

Fig. 9.5 Magnetic energy

Energy Conversion

Different types of energy can be converted into each other, for example in the thermal power house, the chemical energy of coal is first converted into thermal energy of hot steam, then it is converted into mechanical energy of turbine. This energy is converted into electrical energy by the generator, which flows into electrical wires and reaches various places - houses, factories, etc., where it is again converted into heat, light, sound or mechanical energy.

Fig. 9.6 Thermal Power Plant

INTEXT QUESTIONS 9.2

1. Explain with the help of an example that sound is also a form of energy.
2. What are the energies before and after burning in matchsticks?
3. State three uses of electrical energy.

9.3 SOURCES OF ENERGY

Everything from which we receive energy is called a source of energy. By the way, there are many types of sources of energy, the major sources of which are given below.

Non-renewable sources of energy

So far coal, petrol, natural gas and diesel have been major sources of energy. These energy sources are limited in quantity and are likely exhaustible. They cannot be used again and again. Hence they are called non-renewable energy sources. If we look at our current energy requirement and rapid development in the future, it is expected that our oil and natural gas reserves will end in the next few years.The coal reserves will also not be able to run much. Therefore, we should use our non-renewable sources of energy wisely and avoid misuse of energy as much as possible.

Residual (fossil) fuel

Sources of energy are found in many forms. Residual fuels are the most popular sources, such as coal, wood, petrol, diesel, kerosene, and natural gas.

Coal is formed thousands of years after the plants are buried in

the ground. There is a limited stock of coal found in the coal mines. There will also be a time when all the coal will be used completely and we will have to find other sources of energy. Coal contains chemical energy. When coal burns, this chemical energy is converted into heat. Coal is also used to generate electricity in thermal power planets. Wood obtained from trees is also used as coal. When wood burns, chemical energy is converted into heat and light. Trees have to be harvested for this source. Therefore, a large number of trees are required to be planted daily to maintain the natural balance.

Other than this, petrol and diesel are used in cars, scooters, trucks, airplanes and other vehicles. Kerosene (kerosene) is used in lamps to obtain light and in stoves for thermal energy. Natural gas is used in gas stoves for cooking. Petrol, diesel, kerosene and natural gas are obtained from petroleum, which is found at very deep depths inside the earth. It is formed as a result of thousands of years of water plants and animals being buried in the ground. They contain chemical energy, which on burning is converted into thermal and light energy. But there is a limited stock of petroleum and once it is exhausted, it will take thousands of years to become fresh petroleum.

Renewable sources of energy

Water, air, sunlight and biomass etc. are called renewable sources of energy. The reason for this is that they can be used again and again. Also, they are available in sufficient quantities, are free and do not pollute the environment. Therefore, efforts are being

made to make maximum use of the energy available in them. The following is a brief description of the major renewable sources of energy.

(1) Food energy

All living beings get energy from the food they eat. Trees and plants (flora) are the main source of food for all living beings including humans.

Trees and plants make their own food by the method of photosynthesis and food is present as chemical energy in plants.

(2) Solar Energy

Sun has been providing us with uninterrupted heat and light for billions of years and it is expected that it will continue to provide energy to us for the next billion years. All plants get their energy from the sun and animals get their energy mainly from plants. Therefore, it can be concluded that the sun is the source of energy of animals. Even the energy stored in butter, milk and eggs come from the sun. Why do we say? In fact, the sun is the ultimate source of energy for all living beings. Life on earth is possible only due to solar energy.

(3) Wind Energy

You must have seen the spinning wheel. This is called the wind cycle. What happens when you blow on the petals of a spinning wheel? It starts rotating. Therefore, wind provides energy. Wind power is available for free. It is clean and does not pollute the environment and is reliable.

Fig. 9.7 Windmill

In many areas of our country, where strong winds blow for most of the year, wind cycles are used to draw water from wells and generate electricity. Wind energy is used to rotate wind cycles.

(4) Water Energy

Like flowing air (wind), flowing water is also a source of energy. It is also free and does not pollute the environment. The energy of the running water is used to move large wooden logs and plants from one place to another. The energy of flowing water in hydropower plants (hydro power houses) is used to generate electricity. The flowing water rotates the wheel of a turbine, which helps in generating electricity.

(5) Energy from biomass

Biomass means dead parts of living things and waste material. This includes garbage, industrial waste, crop waste and sewage.

We can use biomass as an energy source in two ways -

- By directly burning dry biomass to generate heat and steam.
- By creating biogas by decomposition of biomass in the absence of air. Like liquid petroleum gas, this gas can be used for cooking and lighting.

The remaining of the biomass can be used as fertilizer in a biomass plant.

INTEXT QUESTIONS 9.3

1. Explain the difference between renewable and non-renewable energy sources.
2. What is biomass? How can biomass be used as a source of energy?
3. Explain by example that the last source of energy for living beings is the sun.

9.4 MEASURES OF SAVING ENERGY

In our country and all over the world, a small number of large oil fields have been detected in the past years, even after running programs of oil explorations. Our oil and gas demand will certainly exceed the available supply in the early twenty-first century. This type of situation is called energy crisis. In times of energy crisis there is high demand and limited supply of energy.

As you know that fossil fuels are limited in quantity, so to conserve energy sources we should use them as little as possible.

We all must put serious effort to save energy. For this, we can start from our home.

(a) When not needed, we can switch off the bulbs and fans; and other electrical devices.

(b) Do not leave water tanks open because energy is also used to supply water.

(c) Keep the vessel covered while cooking lentils, rice, etc. and does not use more water than necessary to cook them.

(d) Soak the pulses in water for a while before setting them on for cooking.

There are some ways to comply by which we can save a lot of energy. Outside the house, if we have to go a little bit far, we can go on foot or go by bicycle and save energy by not going by vehicle. To save fuel, you can travel by public vehicles rather than using a private vehicle.

Another way to save energy is to use more efficient applications. For example, fluorescence tubes (tube lights) of the same power rate give more light than bulbs. Fuel burns more efficiently in good stoves and they give relatively higher heat for the result of energy per unit. More energy efficient vehicles should be used and their engines should properly be taken care of.

Conservation of Energy

We use energy every moment. We eat food and use the energy stored in food to do our work and maintain body temperature.

When work is there, energy is transformed from one form to another. In the period of every physical, chemical or biological change, energy is transformed from one form to another. But at the time of all these energy conversions, the total quantity of energy remains unchanged. Energy can neither be generated, nor can it be destroyed. It only changes from one form to another, and the sum total of all the energies of the body remains fixed.

INTEXT QUESTIONS 9.4

1. What do you mean by the energy crisis?

2. Describe four ways for energy saving in homes.

3. What is the principle of energy conservation?

9.5 ENERGY FROM ATOMS

As the name suggests, chemical energy is related to the type of chemical conversion in which each atom of a reagent retains its identity and there is no change in its behavior and nature. But there are also some energy conversion processes in which the nuclei of some atoms remain unchanged. This type of energy-conversion processes yields large amounts of energy. Since the nuclei of atoms participate in these processes, the energy obtained is called nuclear energy.

Nuclear Energy

The energy stored in the nucleus of an atom is called nuclear energy. This energy stored in the nucleus of an atom can be

released by breaking (disintegrating) it into two lighter nuclei than a heavy nucleus such as uranium.

Nuclear Fission is the breaking of the nucleus of an atom into two equal mass segments in which such energy is released.

When an independent neutron collides with a uranium nucleus at the right speed, it is absorbed into it. After absorption of the neutron, the uranium nucleus becomes very unstable and breaks into the nucleus of the small atom and in this process energy is released to a great extent. In this process, some neutrons are also released. These neutrons fragment other uranium nuclei. Running this sequence rapidly releases energy and is called chain reaction. This reaction produces extremely high quantities of heat, which are used in many ways.

Neutrons released in a fission reaction to produce electric current are absorbed by controlled sticks made of cadmium. Nuclear fission reactions are controlled and routinely generated in nuclear reactors. The energy gathered in nuclear reactors is used to heat water to create steam and it drives the steam generator, which generates electricity. Great scientists like Homi Jahangir Bhabha and APJ Abdul Kalam have a huge hand in strengthening and advancing our country in the field of nuclear energy. In our country nuclear reactors are being used for power generation in Narora, Tarapur, Kalpakkam and Kota.

The uses of nuclear energy

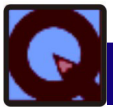
The following are the uses of nuclear energy:

- The heat generated in the nuclear reactor is used to heat water by steam. It is used to rotate the turbine due to which the electric generator starts working and electricity is generated.
- Nowadays nuclear energy is being used to operate submarines and ships. Nuclear-powered ships and submarines can be operated for long distances without refueling.
- The nuclear energy of bombs (atomic bombs and hydrogen bombs) is used to protect the country.
- Radioisotopes are made by nuclear energy, which are used in agriculture, research and hospitals.

Nuclear energy hazards

Nuclear radiation is also employed when nuclear reactors generate nuclear energy that can pierce the human body and cause so much damage to cells that it is not possible to be treated. Nuclear reactors are covered with very thick radiation absorbing materials such as lead, to protect them from degradation of these severe and deadly nuclear radiations. But if there is a slight error in the structure of the reactor or if any natural untoward incident occurs with a completely safe reactor, then this type of very harmful radiation can be employed in the environment, due to which the people living around that area pose a permanent threat to animals. Many such substances are produced at each stage of the nuclear

cycle. These harmful nuclear materials are collectively called nuclear waste. We have not yet been able to discover the procedures for safe disposal of nuclear wastes.



INTEXT QUESTIONS 9.5

1. Write two uses of radioisotopes.
2. What could be the contribution of nuclear energy to avoid an energy crisis?
3. Explain one use of nuclear fission.

WHAT HAVE YOU LEARNT

- require energy for all processes occurring on Earth. The ability to work is called energy.
- Energy comes in many forms; it can be converted from one form to another.
- The Sun is considered the ultimate source of energy for life on Earth. We All use the sun's energy, which is called solar energy, indirectly or indirectly.
- Energy sources are either renewable or non-renewable, but non-renewable sources are ending.
- Coal and petroleum are fossil fuels. We must use renewable sources of energy to conserve fossil fuels.
- Energy can neither be generated nor destroyed. In any energy conversion, the sum total of all energies remains fixed.

- In nuclear power plants, the fission reaction is carried out in a controlled manner. A large amount of nuclear energy is released in this process.
- Nuclear energy is used in many peaceful works.

TERMINAL QUESTIONS

1. Write the definition of energy and its unit.
2. What are the different forms of energy? Give one example each.
3. Write the names of different sources of energy.
4. "The ultimate source of energy for all living beings is the sun." Confirm this statement.
5. How can energy be obtained from biomass? Which of these Is the best and why?
6. What is the major difference between renewable and non-renewable sources of energy?
7. What is meant by the energy crisis? What steps should we take to face it?
8. What can we do to save energy?
9. Make a list of energy conversions on a thermal power plant.
10. List some uses of nuclear energy.
11. Explain the nuclear chain reaction.
12. What are the risks in generating nuclear energy?

ANSWERS TO INTEXT QUESTIONS

9.1

1. Because energy is spent.
2. A weak man does not have enough energy.
3. A Joule energy means the work done to displace an object by a meter distance by applying a Newton force.

9.2

1. Rattling of glass of windows with a loud bang.
2. Chemical energy before burning and then optical and Thermal energy.
3. For light to run a fan, for ironing, and in the form of energy.

9.3

1.

Renewable sources	**non-renewable sources**
(1) There are never ending sources.	(1) One day it will end.
(2) can be born again.	(2) Takes thousands of years in rebirth.
(3) They do not pollute the environment.	(3) They pollute the environment.

2. Dead parts and waste materials of living things.
3. Trees need sunlight to make food and we get our food from trees, which is our main source of energy.

9.4

1. Spending more than supply is an energy crisis.
2. Please refer to 9.4.
3. Energy is never destroyed nor can it be produced but Can be converted from one form to another.

9.5

1. In the field of agriculture, in the field of medicine and in the treatment of cancer.
2. A large amount of energy can be obtained from nuclear energy without pollution.
3. To make energy from nuclear reactors.