SCIENCE FORM 1

CHAPTER 6 The Various Forms and Sources of Energy

Energy

1. Things have energy if they can do work.Energy is the ability to do work.
2. The unit of energy is joule (J)
3. All living things need energy to do work. Energy makes things grow, keeps us warm and sustains life. Without energy, all living things would not survive.
4. Energy is also needed for machines to do our work. Without energy supplies, all our machines would stop working and we would be able to do very little work.

Various forms of energy

1. Energy can exist in many different forms.
2. Working energy is the form of energy that involves work being done. The effects of energy changes can be seen.
3. Stored energy is the form of energy which is less obvious. It is stored and can be released by a conversion process.

Kinetic Energy

1. Kinetic energy is the energy of an object due to its motion.
2. All moving objects possess kinetic energy.
3. The faster an object moves, the greater its kinetic energy.
4. All stationary (not moving) objects have zero kinetic energy.

Potential Energy

1. Potential energy is the energy stored by an object due to its position or its condition.
2. All objects above the ground have gravitational potential energy because of their raised position.
3. The gravitational potential energy of an object depends on

(i) the mass of the objects,

(ii) the height or position of the object above the ground, and

(iii) the strength of the gravitational pull on the object.

4. The bigger the mass, the greater the potential energy.
5. The higher the position of an object from the ground, the more potential energy it has.
6. Potential energy is also stored in objects which are compressed, stretched or bent.
7. All elastic substances when stretched or compressed prossess elastic potential energy because of their stretched or compressed condition.

Chemical Energy

1. Chemical energy is the energy stored in substances such as food and fuels.
2. The stored chemical energy is released and converted to other forms of energy when the substances undergo chemical reactions.

Sound Energy

1. Sound energy is produced by vibrating objects.
2. Sound energy can be transferred from one place to another in the form of waves through a medium such as air, water or solid.
3. Sound energy cannot pass through a vacuum as there are no molecules in a vacuum to transfer the energy.

Heat Energy

1. Heat energy is the energy found in hot objects.
2. The hotter the object, the more energy it can give out.
3. Heat energy can increase he temperature of an object.
4. Heat energy is also known as thermal energy. The heat energy that is stored in a hot body depends on its temperature and volume. The higher the temperature, the higher the amount of heat energy that can be stored in the body.
5. The Sun is our main source of heat energy.

Light Energy

1. Light energy is the energy radiated (spread out) by luminous objects (objects that give out light).
2.Light energy enables us to see things around us.

Electrical Energy

1. Electrical energy consists of electric charges, which travel through electrical conductors or wires.
2. Electrical energy is supplied in the form of electrical power by generators, batteries, dry cells and solar cells.
3. Electrical energy is widely used because it can be easily generated, transported and changed to other forms of energy.

Nuclear Energy

1. Nuclear energy is the energy stored in the nucleus of an atom.
2. All radioactive materials store nuclear energy. When radioactive materials decay, energy is released because of the changes in the nuclei of the atoms.
3.Nuclear energy is also released when a particle penetrates a large nucleus and causes it to split into many smaller nuclei. This process is called nuclear reaction.
4. A nuclear reactor is used to control the nuclear reaction and the energy released. The nuclear energy is then converted to heat energy and the steam produced is used to generate electricity in a power station.
5. The nuclear energy generated from a nuclear reactor also provides direct mechanical power to operate a ship or a submarine.
6. During the production of nuclear energy, various types of radioactive waste are produced. This waste is dangerous and can cause harm to people and the environment coming into contact with it.

Energy Sources For Daily Uses

Sun

Type of energy:

- Solar energy
- Heat energy

Daily uses:

- Solar cells convert solar energy into electrical energy.
- Solar panels of a solar furnace absorb solar energy as heat for heating purposes.

Wind

Type of energy:

- Mechanical energy

Daily uses:

- Windmills use wind power to pump water and generate electricity.

Water

Type of energy:

- Hydroelectric energy

Daily uses:

- Fast flowing water can be used to generate electric energy for electrical equipment.

Wave

Type of energy:

- Mechanical kinetic energy

Daily uses:

- Movement of sea waves run generators and provide electricity.

Tide

Type of energy:

- Gravitational potential energy

Daily uses:

- Tidal barrage generates electricity.

Geothermal

Type of energy:

- Heat energy inside the Earth

Daily uses:

▪Local heating
▪Steam is used to turn turbines and generate electricity.

Biomass (Plant and animal wastes)

Type of energy:
▪Biomass energy

Daily uses:
▪Food, plants, fuels for local heating.
▪Operate machines and engines.

Fossil

Type of energy:
▪Fossil fuels or chemical energy

Daily uses:
▪ Thermal power station to generate electricity.
▪Petroleum is used as the main fuel for vehicles and machines.

Radioactive substances

Type of energy:
▪Nuclear energy from fission and fusion

Daily uses:
▪Nuclear power station to produce electricity

The Sun as the primary source of energy

1.Almost all the energy on the Earth comes originally from the Sun.
2.The Sun sends out energy as solar radiation. This solar radiation consists of light energy and heat energy.
3. Plants use solar radiation in a chemical reaction called photosynthesis to live and grow. Energy form the Sun is stored in plants as food in the form of chemical energy. This energy is then transferred from plants to animals and humans through food chains and food webs.
4. Over millions of years, chemical and physical processes charged decayed plants and animals to fossil fuels.
5.When we burn these fossil fuels, they release heat energy. We use the heat energy to generate electricity and drive machines that are essential for our daily activities.
6.The solar radiation that heats the Earth changes the weather systems. The heated air rising above the equator causes belts of moving air around the Earth. winds carry water vapour from oceans and bring rain. Winds can also cause sea water to move as waves.

Energy changes

1. Energy can be changed from one form into another but it cannot be created or destroyed. This is known as the law of conservation of energy.
2. when we use energy, we often convert it from one form to another.

(i) Rubbing two palms together
Observation—The palms feel hot and the sound of rubbing is heard.
Energy changes—Kinetic energy → heat energy + sound energy

(ii)Clapping
Observation—The sound of clapping is heard.
Energy changes—Kinetic energy → sound energy

(iii) Lighting a lamp
Observation—The lamp lights up and becomes hot.
Energy changes—Chemical energy→ electrical energy → light energy + heat energy

(iv)Releasing a stretched spring
Observation—The spring recoils.
Energy changes—Potential energy → kinetic energy

(v)Heating the joints of a copper and a zinc wire
Observation—The galvanometer needle is deflected.
Energy changes—Chemical energy→ heat energy → electrical energy→kinetic energy.

6.2 Renewable and Non-renewable Energy Sources

1. Energy resources can be divided into two main groups: renewable and non-renewable.
2.Renewable energy sources are energy source that can be replaced after being used. An example of renewable energy source is solar energy.
3. Non-renewable energy source are energy sources that cannot be replaced after being used. They will run out eventually. An example of non-renewable energy source is petrol.
4.We can group the various sources of energy into renewable and non-renewable sources.

Renewable energy sources

1. Wind energy

a) Wind power is used to turn the blades of large windmills or generators to produce electricity, or to pump water out of the ground. A high wind generators effectively.
b)Wind generated electricity does not cause air pollution. However, it costs more to produce than the electricity generated from coal.

2. Tidal/ Wave energy

a) The Earth movement is the source of tidal energy. A dam or barrage is built across a river mouth or estuary. Electricity is generated by the flows of water thorough turbines in the dam as the tides rise and full.

b) Waves are caused by the tides. The rapid up-and-down movement of waves on the surface of the sea can also drive turbines to produce electricity.
c)Although tidal and wave energies do not produce pollution, they can cause other environmental problem.

3. Biomass energy

a) Biomass is plant and animal waste materials that can be used for generating energy. This includes using fuel made from sugar cane, biomass of rotting waste and manure of livestock.
b) Methane gas from biomass is used to generate electricity, or is burnt for light and hearing purposes.
c)Converting biomass energy into usable energy has many environmental benefits. It uses waste materials that are usually dumped and uses up methane (a greenhouse gas).
d)Fuels such as alcohol can be made from biomass and used as an alternative to petrol to power motor cars.
e)There are a number of renewable energy projects using biomass. Many of these use waste products from agriculture. So, they solve the problem of waste disposal and at the same time create energy for use in homes, farms and factories.

4. Water power –hydroelectric energy

a)Hydroelectric is produced from the kinetic energy of water. The movement of the water spins turbines which generate electricity.
b) Locations with high rainfall and steep mountains are ideal for hydroelectricity. The hydroelectric power plant in Kenyir. Lake is one of the largest in Malaysia.
c)Most hydroelectricity projects require the building of large dams across rivers, which can be very expensive.
d)The use of hydroelectric energy does not cause pollution but the building of the large dams affects the ecosystems of the surrounding area. Many cultural sites may be flooded and sometimes people need to be resettled elsewhere. There are also impacts on fish breeding loss of wildlife habitat and changes in the flow of rivers.

5. Geothermal energy

a)Geothermal energy uses heat energy from beneath the surface of the Earth.
b) Some of this heat finds its way to the surface in the form of hot springs or geysers. Other schemes tap the heat energy by pumping water through hot dry rocks several kilometres beneath the Earth's surface.

c) Geothermal energy is used for generating electricity and for heating up buildings and water in some countries.
d)Geothermal energy is a good source of energy because it is clean and can be extracted without burning fossil fuels such as coal, gas or oil.

Non-renewable energy sources

1.Fossil fuels

a)There are three major forms of fossil fuels, namely coal, petroleum and natural gas.

b) They are called fossil fuels because they are formed over millions of years from the fossil for remains of dead animals and plants. The fossil are buried under dirt and rock. Heat from the Earth and pressure from dirt and rock changes these fossils into oil, natural gas and coal.

c)As it takes millions of years to make or renew more fossil fuels, we call them 'non-renewable fuels'.

d)Coal

(i) Coal is our most abundant fossil fuel resource. It is a hard , black, rock-like substance.

(ii) Coal is mainly burned in power stations to generate electricity and as a source of heat for industry.

(iii) Burning of coal can produce a lot of carbon dioxide and some other toxic gases that can pollute the environment.

e) Petroleum

(i) Petroleum or crude oil is formed in a similar way as coal. But instead of becoming a rock, it becomes a liquid trapped between layers of rocks.

(ii) Petroleum can be made into gas, petrol, kerosene, diesel, oils and bitumen. These products are used in homes for heating and cooking, and in factories as a source of heat energy. They are also used in power stations to generate electricity and to provide fuel for transport.

(iii) Another common use for petroleum is in producing petrochemicals such as plastics.

(iv) However, the use of petrochemicals like petrol and diesel produces a lot of carbon dioxide. It also produces other poisonous gases that are harmful to the environment and health.

f) Natural gas

(i) Natural gas is formed in the same way as petroleum and is also trapped between layers of rock. It is usually found near petroleum.

(ii) Natural gas is tapped, compressed and piped into homes to be used in stoves and hot water systems.

(iii)LPG (Liquefied Petroleum Gas) is made from petroleum. It is used for cooking and heating at homes, factories and furnaces.

(iv)LPG can also be used as an alternative fuel to petrol.

2. Radioactive substances like uranium-235 is the main source of nuclear energy. When the nuclei of uranium-235 are split apart by nuclear reaction, a tremendous amount of energy is released. The energy is used for generation of electricity.

The Uses of Solar Energy

1. The Sun supplies solar energy which radiates as light energy and heat energy.

2. Solar energy is renewable and can be used continuously as long as the Sun exists.

3.Solar energy cannot be used directly but can be converters.

The need to conserve energy

1.It is important to save energy because most of the energy we use comes from fossil fuels. Fossil

fuels are non-renewable.

2.At present, we rely heavily on fossil fuels to sustain our daily activities. If we use up all of our fossil fuels, there will not be any left in the future. Our daily activities will be affected.

3. Increased consumption of fossil fuels can cause environmental damage, air pollution and global warming. Conserving energy can slow down or reduce all these negative effects.

4.So it is important for us to learn how to conserve energy. To conserve energy means to find out ways in which we can use less energy and not waste energy.

5. It is also important for us to learn how to manage the energy resources more efficiently.

Ways to increase efficient use of energy

1.Efficient use of energy means getting the most use of energy with minimum waste of energy.
2.The efficient use of energy is the most immediate way to reduce energy use and pollution.
3.The use of non-renewable energy sources like fossil fuels and nuclear fuels nust be planned and managed carefully so that we can get cheaper fuels.
4. We have to develop renewable energy sources like solar, wind, water and biomass energy. With the help of the latest technology, all these energy sources can be used more efficiently without causing much damage to our environment.
5.Some of the ways we can use energy efficiently are:
a) Using energy-saving electrical appliances.
b) Using fluorescent lamps which are more energy efficient. a compact fluorescent light uses 70% less energy and can last up to 10 times longer compared with a filament bulb.
c)In the kitchen, using pressure cooker and cooking utensils made of good conductors of heat can reduce cooking time and thus reduce the energy used.
d) In transportation, use public transport like buses and light rail transit (LRT) to go to work instead of using your own car if you are driving alone. Car pooling will also help to reduce the use of energy and traffic congestion.
e) Any new building should be designed to be more energy efficient. The building should be well ventilated, making use of solar technology and making maximum use of natural light.

6.3 The Importance of Conserving Energy Resources

1. As more and more people live on the Earth, the demand for energy increases. How far into the future will energy resources be available to supply our needs?
2.Without sufficient energy supply, our comfortable lifestyle in this modern society would be threatened.

3. All energy resources, whether renewable or non-renewable, must be conserved and used efficiently. This is to ensure that there is sufficient energy resources for ourselves and our children in the future.
4.If we do not conserve energy with the increasing demand for energy, our energy resources will be depleted even faster than expected. The cost of energy would rise to levels which would deprive poorer people of their essential needs.
5. It is important to conserve energy and use energy resources efficiently. IN this way, we can also reduce air pollution and slow down global warming.
6. With energy conservation, we can prolong the use of present energy resources so that we have enough time to seek out alternative energy sources for future needs.

The use and management of energy resources

1. In order to conserve energy resources and to sustain the use of energy, it is important to have proper planning and management of energy resources used in all sectors.
2. Fossil fuels are used in all forms of transport. We can save more fuel by making vehicles with smaller engine capacity and fuel-saving engines. Our cars can go a lot further per litre of petrol and more cars can travel on the road. More energy can be saved by having better public transport like buses and fast-moving trains.
3.Industrial development and telecommunication need huge amounts of energy. Most of it is supplied by electricity which comes from fuel-burning power stations. Fuel power stations need to be managed properly as the gas given out can pollute the air and cause global warming.
4. We need to develop and find alternative renewable energy sources to sustain the daily consumption of energy . The use of solar energy, wind and wave energy to generate electricity are good examples. We need to develop new technology to manage solar, wind and wave energy more economically so that they can replace non-renewable energy sources one day.