

Force on a current-carrying conductor placed in a magnetic field.

When a current-carrying conductor is placed in a uniform magnetic field, a force acts on the conductor and it moves. The magnitude of the force can be increased by

- Increasing the strength of current
- Increasing the strength of magnetic field of the magnet
- Increasing the length of the conductor inside the magnetic field.

The direction of force reverses if,

- The direction of current reverses
- The direction of magnetic field reverses

The force is maximum, when the direction of current is at right angles to the direction of magnetic field.

FLEMING'S LEFT HAND RULE

This rule gives the direction of force acting on a current-carrying conductor placed in a magnetic field.

Statement:- Hold the thumb, fore finger and centre finger of your left hand, in such a way that they are perpendicular to each other. If the forefinger represents the direction of field and the centre finger represents the direction of current, then the thumb gives the direction of motion or force acting on the conductor.

ELECTRIC MOTOR

An electric motor is a device that converts electrical energy to mechanical energy.

Qn. What is a commutator?

A commutator is an important part of an electric motor. A device that reverses the direction of flow of current through a circuit is called a commutator. In electric motors, the split ring acts as a commutator.

Qn. What is an armature?

An armature is the part of an electric motor that consists of a soft iron core and insulated copper wires wound around the core.

ELECTROMAGNETIC INDUCTION

The phenomenon of inducing an e.m.f in a conductor placed in a magnetic field when there is a relative motion between the conductor and the magnet is called electromagnetic induction. The emf produced is called induced emf and the current is called induced current. *The induced current is maximum,*

The direction of induced current reverses if the direction of field reverses *or* if the direction of motion of the coil is right angles to the magnetic field.

Fleming's Right Hand Rule.

It gives the direction of induced current. **Statement:-** Stretch the thumb, forefinger and centre finger of your right hand so that they are perpendicular to each other. If the forefinger indicates the direction of the magnetic field and the thumb shows the motion of the conductor, then the centre finger will show the direction of the induced current.

ELECTRIC GENERATOR

It is a device that converts mechanical energy to electrical energy.

Principle

When a conductor is moved in a magnetic field, a current is induced in the conductor.

Domestic Electric Circuits.

In our houses, we get AC electric power with a potential difference 220V and frequency 50Hz. There are three wires used in the circuits:- Live, Neutral and Earth wires. [refer page 239]

Qn. What is short-circuiting?

It is the situation that occurs when the live wire and neutral wires come into direct contact. This happens when the insulation of wires is damaged or when there is a fault in the appliance. In such a situation the current in the circuit suddenly increases. This is called short-circuiting.

Qn. What is overloading?

Overloading can occur in a domestic circuit in the following situations:

- When too many appliances are connected to a single socket.
- When there is an accidental hike in the supply voltage.

In such a situation, the current in the circuit suddenly increases.

Qn. How are the devices and circuit prevented from possible damage due ^{to} 'overloading'?

The use of a fuse wire in series with the appliance in the live wire prevents the damage of appliances. Due to overloading or short-circuiting if the current through the circuit increases, suddenly the fuse wire gets heated and melts. So the circuit breaks, keeping the appliance safe.

Qn. What is the function of an earth wire? Why is it necessary to earth metallic devices?

The earth wire that is connected to the outer metallic part of a device is a safety measure. The other end of the earth wire is connected to a metal plate deep in the near the house. Due to any fault in the circuit if the outer metallic body of the device becomes live (i.e., current passes to it). The current will flow to the earth and the user may not get severe electric shock.

If the device is not earthed, somehow if the current passes to the outer metallic part of the appliance, the user may get a severe electric shock. To avoid this, it is necessary to earth the metallic devices.

CHAPTER 14 - SOURCES OF ENERGY

1. *What is meant by a good source of energy?*

A good source of energy is the one,

- which gives a large amount of work per unit volume or mass.
- is easily available,
- is easy to store and transport
- is economical.

2. *What is a good fuel?*

A good fuel is the one which,

- releases large amount of heat energy,
- is easily available,
- does not produce a lot of smoke.

3. *Name the conventional source of energy.*

Fossil fuels, electricity from thermal power plant, electricity from hydroelectric power plant, energy from biomass, wind energy...

FOSSIL FUELS

4. *What are the advantages and disadvantages of using fossil fuels as the source of energy?*

Advantages:- It is economical and it gives a large amount of heat per unit mass.

Disadvantages:- Burning fossil fuels cause air pollution. On burning fossil fuels, oxides of carbon, nitrogen and sulphur are released. This leads to acid rain which affects our water and soil resources.

During the burning of fossil fuels, CO₂ is released causing green house effect and it leads to global 'warming.'

Methods to reduce the pollution

(i) By increasing the efficiency of the combustion process,

(ii) by using various techniques to reduce the escape of harmful gases and ashes.

5. *State the energy conversion in thermal power plants.*

In thermal power plants, heat energy is converted into electrical energy.

Hydropower plants

State the energy conversion in hydro power plants.

In hydro power plants, potential energy of water is converted into electrical energy.

Advantages:

It is a renewable form of energy. It does not cause that much pollution.

Disadvantages:

During the construction of dams, large areas of agricultural land and human habitation are to be sacrificed. Large ecosystems are destroyed. The vegetation that is submerged, rots under anaerobic conditions and produces methane that causes green house effect.

What do you mean by renewable and non-renewable source of energy?

Renewable source of energy

The sources of energy that can be replaced within the life span of human life.

E.g., hydroelectrical, wind...

Non- Renewable source of energy

The sources of energy that cannot be replaced within the life span of human life.

E.g., fossil fuels

Improvements in the technology, for using conventional sources of energy.

Biomass as a fuel.

The fuels that are the products of plants and animals are called biomass fuels. E.g., wood, cow dung cakes..

Advantage: It is a renewable source of energy.

Disadvantages: (i) Does not produce much heat on burning.

(ii) Lot of smoke is given out.

How do you get charcoal from wood?

When wood is burnt in the limited supply of oxygen, water and volatile materials present in it get removed and charcoal is left behind as the residue.

Charcoal is preferred as a fuel compared to wood. Why?

Charcoal burns without flames, is comparatively smokeless and has high heat generation efficiency.

What is biogas?

The waste materials formed from plants such as residue after harvesting the crops, vegetable waste and sewage are decomposed in the absence of oxygen to give biogas. It is also known as gobar gas.

With the help of a diagram, explain the working of a biogas plant.

In a biogas plant, all the vegetable waste along with water is fed.

It consists of a dome-like structure built with bricks. Slurry of cow dung and water is made in the mixing tank from where it is fed into the digester. The digester is a sealed chamber in which there is no oxygen. Anaerobic micro-organisms that do not require oxygen break down complete compound of the cow dung slurry. It takes a few days to complete the decomposition process and to generate gases like methane, carbon dioxide etc., hydrogen and hydrogen sulphide. This biogas collected above the digester is drawn through pipes for use. [for diagram ref: pg 237]

Biogas is an excellent fuel, as it contains 75% methane. It burns without smoke, leaves no residue like ash in wood. The slurry left behind is removed periodically and is used as a very good manure.

Advantages biogas

- It is an excellent fuel.
- It burns without smoke and leaves no residue like ash.
- It is a renewable source of energy.
- It gives a safe and efficient method of waste disposal.

WIND ENERGY

The kinetic energy of wind can be converted into electrical energy, with the help of wind mills.

Advantages:

- It is an environment-friendly source of energy.
- It is a renewable source of energy.

Disadvantages:

- Wind energy farms can be established only at those places where wind blows for the greater part of the year.
- The wind speed should be higher than 15km/hr.
- There should be provision for storing energy for the period when there is no wind.
- Establishment of wind energy farms require large area of land.
- The initial cost of establishment of a wind energy farm is high
- It needs a high level of maintenance.

NON-CONVENTIONAL SOURCES OF ENERGY

Solar energy:- Solar energy can be used to heat water in solar water heaters and it can be used to cook food in solar cooker.

Qn. Draw the diagram of a solar cooker.

[Refer page 249]

Solar Cells

Solar cells are the devices that convert solar energy into electrical energy. A typical solar cell can produce a voltage of 0.5 – 1 V and can produce about 0.7W of electricity when exposed to Sun. A large number of solar cells that are combined in an arrangement is called a *solar cell panel*.

Advantages:

- Solar energy is a renewable source of energy.
- They require little maintenance
- They can be placed in any remote places.
- They can be used in artificial satellites and space probes.

Disadvantage:

- The maintenance of a solar cell is expensive.

Energy from the sea.

There are three major ways to harness the energy from the sea:- Wave energy, Tidal energy and Ocean Thermal Energy.

Explain the working of OTEC plants

Ocean Thermal Energy Conversion plants make use of the difference in temperature of the different layers of ocean water. The warm surface water is used to boil a volatile liquid like ammonia. These vapours are used to run a turbine of a generator. The cold water from the depth of the ocean is pumped up and condense vapour again to liquid.

Geothermal energy:- It is the energy due to the difference in the temperature between the different layers of the earth. This energy can be used to produce electricity by using suitable conversion devices.

Advantages:

- Available all the time
- It is clean
- It is environment-friendly
- It is cost effective when converted into electricity.