UNIT 3

Electromagnetic Induction

05/08/2020 – Class 15

Activity 1

Imagine that power supply is gone in our home. What are the difficulties we are facing due to this power failure.

- All the bulbs are gone off.
- Fan doesn't works.
- Pump cannot be operated.
- Refrigerator, TV, Mixi, Iron box, etc. doesn't work.

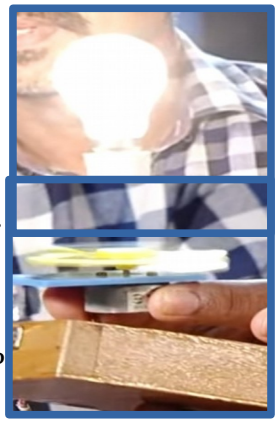
Inference

Electrical energy is the most important form of energy that we used in our daily life. In this modern world, we cannot live without electricity.

In the previous chapter we learned that electrical energy can be converted into many other forms of energy.

Activity 2.a

Glows an electric bulb.



Discussion

- What is the energy change take place when an electric bulb is glowing? **Electrical energy is converted to light energy.**

Activity 2.b

A fan is connected to the shaft of an electric motor. Switch on the circuit.

Observation

Fan is rotating.

Discussion

- What is the energy change take place when an electric motor is working? **Electrical energy is converted to mechanical energy.**

Activity 2.c

Take some water in a beaker and measure its temperature using a thermometer. Dip an immersion heater in to the beaker and switch on the circuit. After some time measure its temperature again.

Observation

- Initial temperature of the water = **22^0 C**
- Temperature of the water after heating = **60^0 C**

Discussion

- Why does the temperature of water rises? **Receives heat energy**
- From where, water receives heat energy? **From the immersion heater.**
- What is the energy change taking place when an immersion heater works? **Electrical energy is converted to heat energy.**

Activity 2.d

An electromagnet is connected to the power supply. Bring a blade near to its end.

Observation

When electricity is passed through the electromagnet it attracts the blade. When the circuit is turned off, the blade is fell down.

Discussion

- Why the electromagnet attracts the blade? **When electricity is passed, it becomes a magnet.**

- Why the blade fell down, when switch is turned off? **Electromagnet is a temporary magnet. It has magnetic property only when electricity is passes through it.**
- What is the energy change taking place when an electromagnet works? **Electrical energy is converted to magnetic energy.**

Inference	
Device	**Energy change**
Electric bulb	Electrical energy to light energy
Electric motor	Electrical energy to mechanical energy
Immersion heater	Electrical energy to heat energy
Electromagnet	Electrical energy to magnetic energy

Activity 3.a

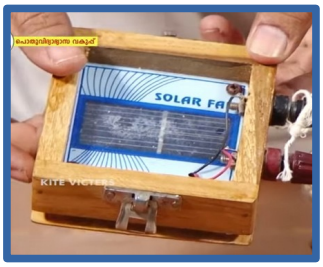
Which are the forms of energy that can be converted into electrical energy?

Observe a torch cell.

Discussion

- If a torch cell is connected to a bulb, what are the energy changes taking place there? **Chemical energy stored in the cell is converted to electrical energy and then it is converted to light energy.**

Activity 3.b



A solar cell is connected to a galvanometer.

Observation

When the solar cell is connected to the galvanometer, its needle deflected.

Discussion

- Why galvanometer needle deflected, when solar cell is connected? **Electricity is passed through the galvanometer.**
- What is the energy change take place, when a solar cell is used in the circuit? **Solar energy (light energy) is converted to electrical energy.**

Activity 4.a

Can we convert magnetic energy to electrical energy?

Experiment

Materials required – Bar magnet, Solenoid, Galvanometer, Connecting wire.

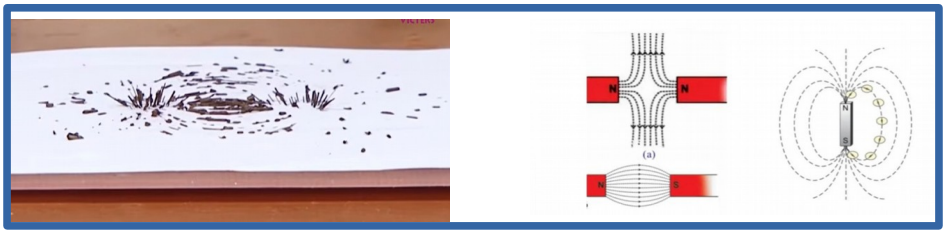
Observe a bar magnet.

Discussion

- Which are the poles of a magnet? **North pole and south pole.**
- How can identify the poles of a magnet? **A white dot indicates the north pole.**
- What you mean by magnetic field? **The region around a magnet where the influence is felt is the magnetic field.**

Activity4.b

A card board is placed above a bar magnet. Spread some iron filings on the card board and gently tap on it.



Observations

Iron filings formed a pattern on the card board.

Discussion

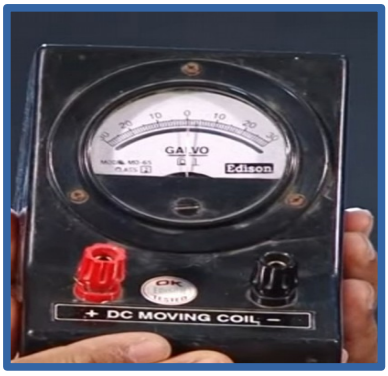
- Why the iron filings are arranged like this? **Due to the influence of magnetic field lines.**
- From where did the magnetic field lines starts? **North pole**
- From where did it ends? **South pole**
- What is magnetic flux? **It is the number of magnetic field lines passing through a given area.**

Inference

- The region around a magnet where the influence is felt is the magnetic field.
- Magnetic flux is the number of magnetic field lines passing through a given area.

Activity 4.c

Observe a galvanometer.

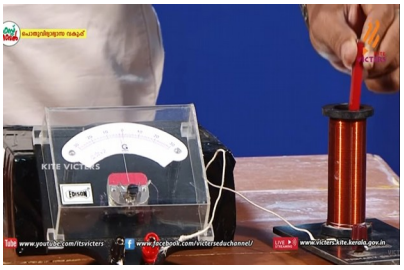


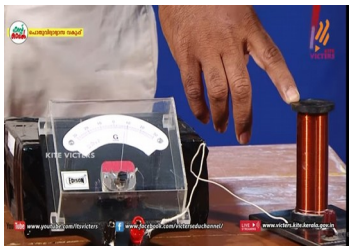
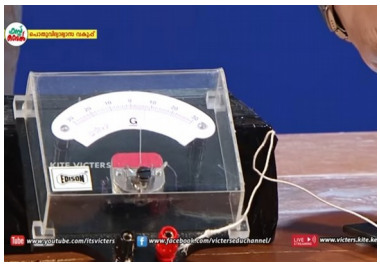
Discussion

- What is the use of galvanometer in a circuit? **Galvanometer is used to identify the presence of a feeble current and find the direction of current in a circuit.**
- Where is the position of the galvanometer needle, when there is no current flows in the circuit? **At the centre. (zero)**
- How we detect the presence of electric current by using a galvanometer? **Deflection of galvanometer needle on either sides from the centre indicates the presence of current.**
- How we find the direction of current using a galvanometer? **The needle will deflect to the right or left depending on the direction of current.**

Activity 5

Connect the solenoid to the galvanometer and following activities are done.

Activity	Observation	Inference
North pole of the magnet is kept stationary near the solenoid. 	Galvanometer needle does not deflects.	Current does not produce in the solenoid.
North pole of the magnet is moved into the solenoid. 	Galvanometer needle deflects to the left.	Current is produced in the solenoid.

The magnet is stationary inside the solenoid. 	Galvanometer needle does not deflects.	Current does not produce in the solenoid.
North pole of the magnet is moved out of the solenoid. 	Galvanometer needle deflects to the right.	Current is produced in the solenoid in opposite direction.
South pole of the magnet is moved into the solenoid. 	Galvanometer needle deflects to the right.	Current is produced in the solenoid. Direction of current is opposite to the current produced by the motion of north pole into the solenoid.
Magnet and solenoid are moved in the same direction at the same speed. 	Galvanometer needle dose not deflects.	Current dose not produce in the solenoid.
The solenoid is moved keeping the magnet stationary. 	Galvanometer needle deflects.	Current is flowing through the solenoid.

Discussion

- Why did the galvanometer needle deflect in the experiment? **Current is flowing through the solenoid.**
- Which were the instances in which there was a flow of current through the solenoid? **Whenever there is a relative motion between the magnet and solenoid.**
- Due to the relative motion between the magnet and solenoid, what happens to the magnetic flux linked with the solenoid? **Magnetic flux changes.**

Inference

Whenever there is a change in the magnetic flux linked with a coil, an emf is induced in the coil. This phenomenon is electro-magnetic induction.

Assignment

Complete the table.

Sl. No.	Experimental procedure	Observation (Galvanometer needle)	
		Deflects/ does not deflect	Direction to the left/ to the right
1	The magnet is stationary near the solenoid		
2	North pole of the magnet is moved into the solenoid		
3	The magnet is stationary inside the solenoid		
4	The magnet is moved out of the solenoid.		
5	The south pole of the magnet is moved into the solenoid		
6	Magnet and solenoid are moved in the same direction at the same speed		
7	The solenoid is moved keeping the magnet stationary		