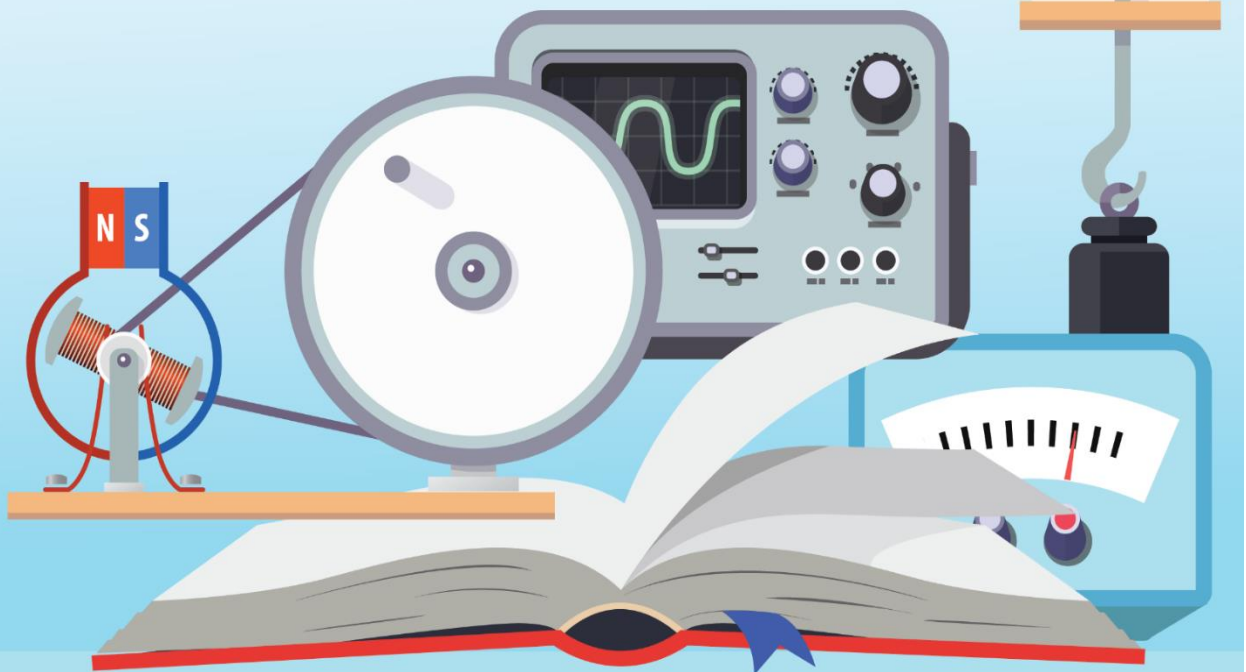


Science - Grade 11

Competency 3.0 - Utilizes various forms of energy, their interaction with the matter & energy transformation by maintaining efficiency and effectiveness at optimum level.

Competency levels: 3.6, 3.7, 3.8

Lessons –Electronics, Electromagnetism and Electromagnetic Induction



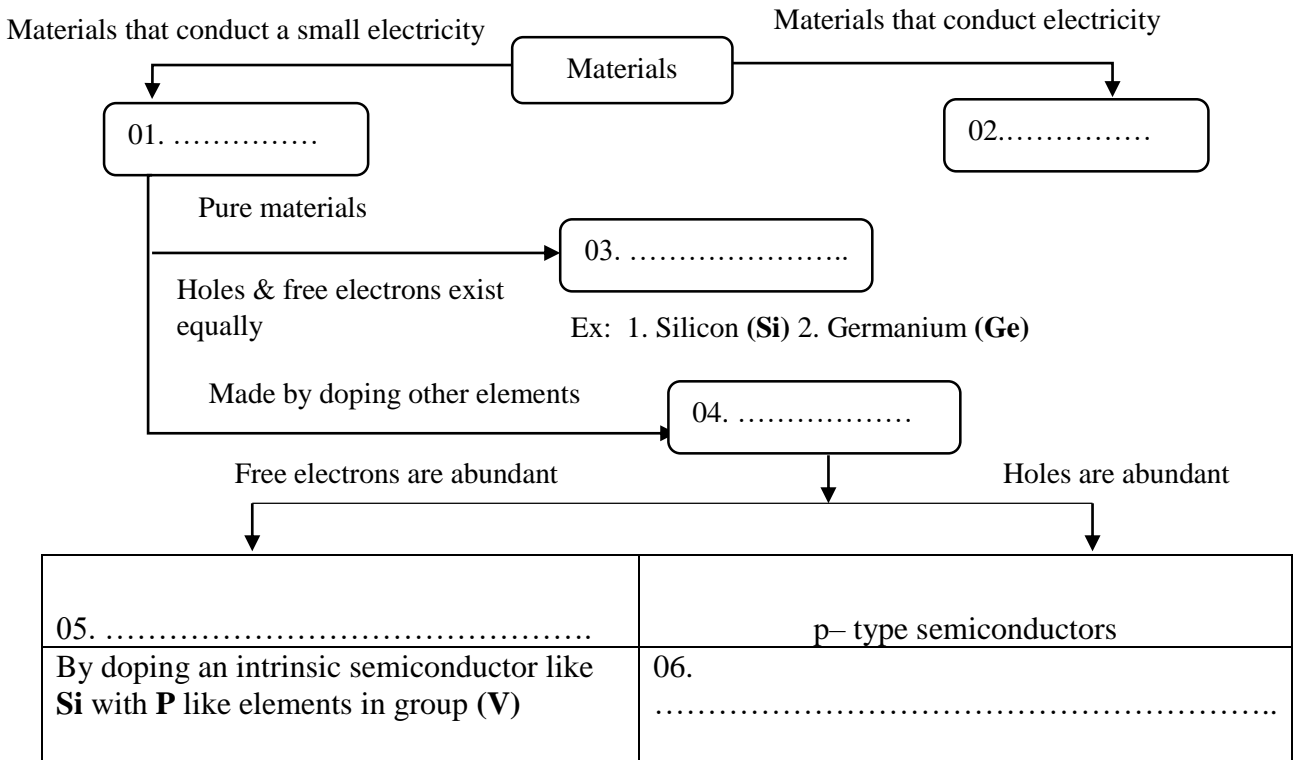
Content – Semiconductors, Junction diodes, Transistors, Magnetism, Magnetic effect of a current, Electromagnetic induction

Prepared by – Provincial Department of Education, North Western Province

Competency level : 3.6 Use the knowledge of electronics in day-to-day activities and scientific works

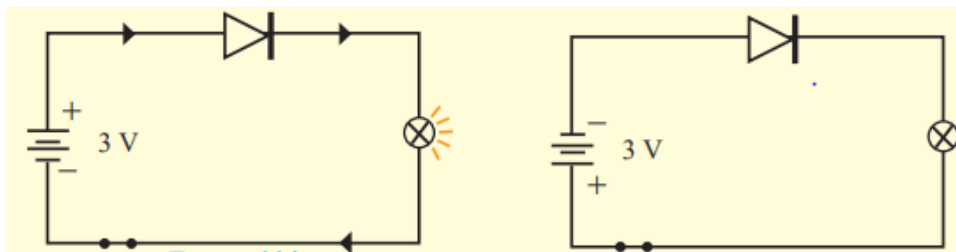
Lesson : Electronics

01. Complete the following mind map.



Activity : Identification of action of a diode

Materials :1N 4001 Diode, 2.5 V torch bulb, two 1.5V dry cells, connecting wires



1st Instance

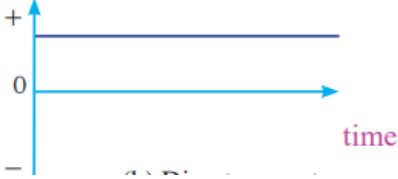
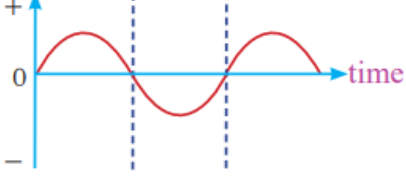
2nd Instance

01. Write down the observations of the above activity.

- 1st instance :
- 2nd instance :

02. Mark the anode and the cathode of the diagrams given above.

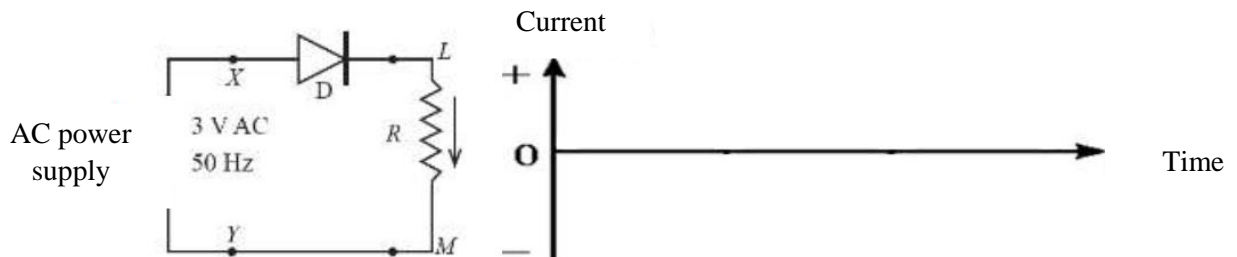
❖ Let's recall...

Direct current	Alternating current
Current flows in one direction only.	Direction of current changes periodically.
<p>Voltage or current</p> 	<p>Voltage or current</p> 

- ✓ Converting an alternating current into a direct current that flows only in one direction is known as “rectification.”

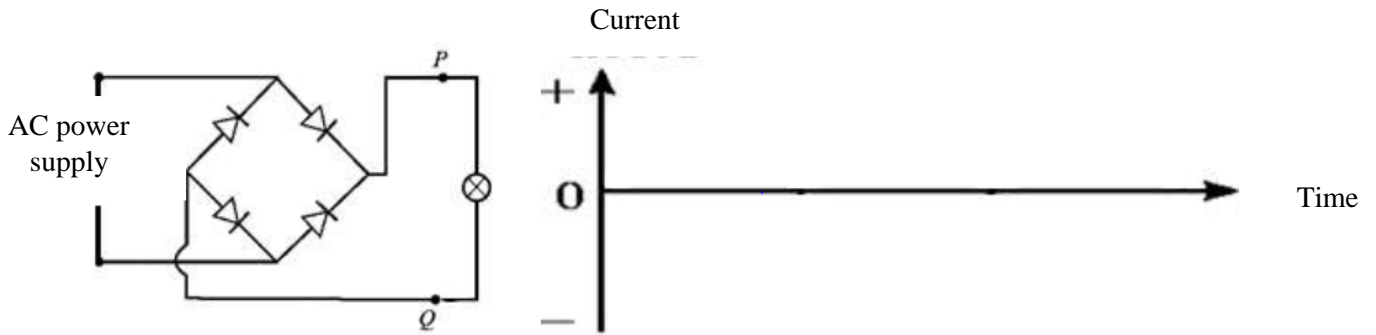
Half-wave Rectification

04. Plot the current obtained through **R** when an alternating current is passed through a rectified diode as shown in the below diagram.



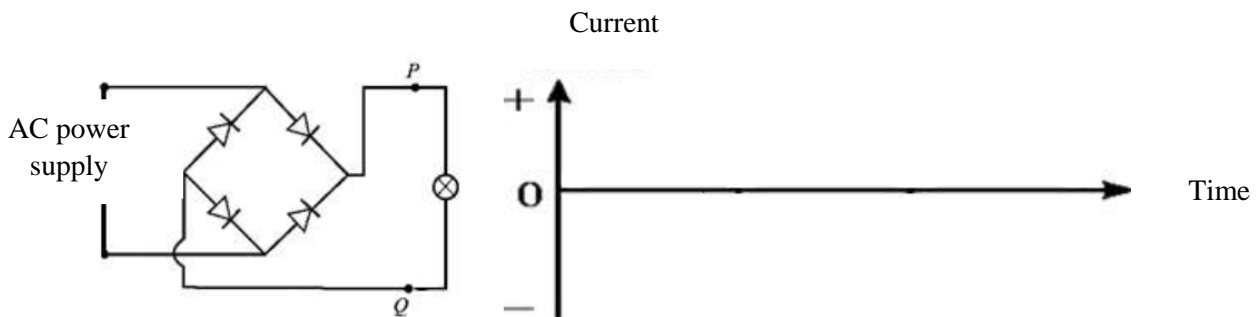
Full-wave Rectification

05. Plot the graphical representation of the current obtained through the bulb, when an alternating current is passed through the following circuit bridge.



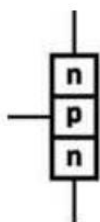
06. Draw the direction of current flow in the above circuit using a different colours.

07. Mark the order in which a capacitor could be connected to the above diagram to make the variation in the rectified current smoother. Plot the graphical representation of the current obtained.



Transistors

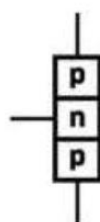
01. Structure and circuit diagram of npn and pnp transistors are shown below. Mark the base, collector and emitter of them as b, c and e respectively.



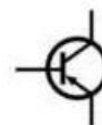
Structure



Circuit diagram
npn Transistors



Structure

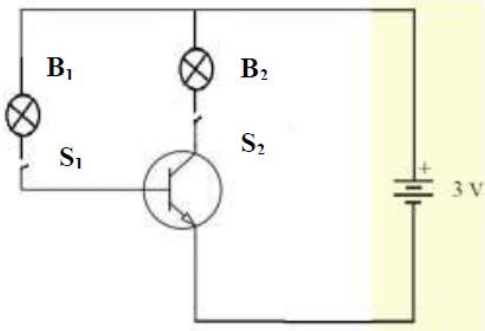


Circuit diagram
pnp Transistors

Activity : Let's identify the action of transistor as a switch

Materials : D 400 transistor, two 2.5V torch bulbs, two 1.5V dry cells, two switches, connecting wires

01. Construct the below circuit. Switch off and on the S1 and S2 switches and record observations on lighting up (light up/not) of the bulbs B1 and B2.

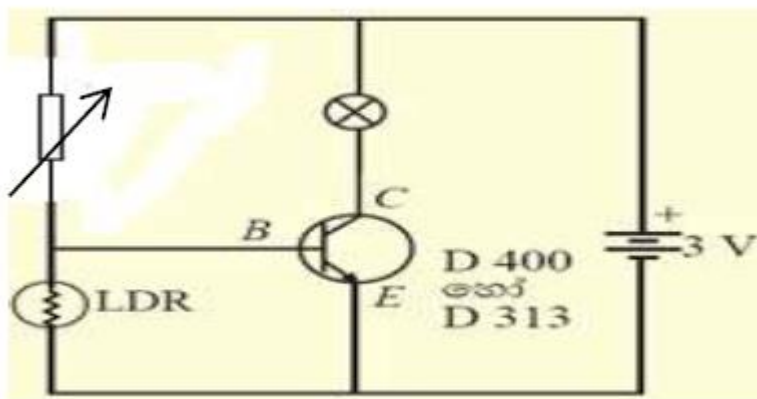


S1 switch	S2 switch	B1 bulb	B2 bulb
Open	Open		
Close	Open		
Open	Close		
Close	Close		

02. What is the minimum voltage between base and the emitter if the transistor to be forward biased?

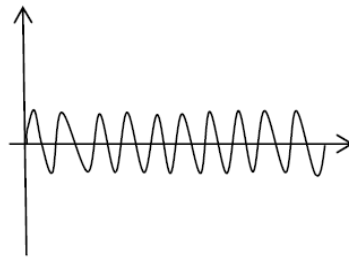
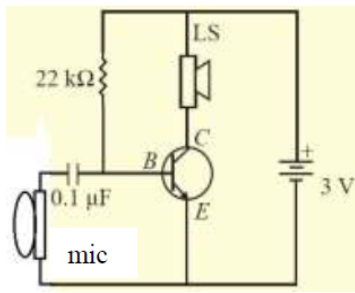
.....

02. When covering (from light) the LDR, the base and the emitter will be forward biased and the bulb will light up. Redraw the following circuit to operate a motor instead of the bulb when the light is incident on the LDR.



Activity : Let us identify the amplifier mode of a transistor.

Materials : D 400 transistor, two 1.5V dry cells, 22kΩ variable resistor, a small microphone, 8 Ω speaker, 0.1μF capacitor, connecting wires



Signal given to the microphone



Output from the speaker

03. Plot a rough sketch of the graphical representation of the output waves from the speaker, if you are able to hear an amplified sound from the speaker when a small sound is made at the microphone.

❖ Let's recall....

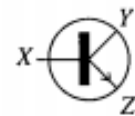
- ✓ Increase of amplitude of an electronic signal given to a transistor is the amplifier action of a transistor.

Exercise

1. (2011 - 1)

25. Which of the following is true about the transistor shown in the figure?

- (1) It belongs to PNP type.
- (2) A positive (+) potential should be applied to the terminal Y.
- (3) In the internal circuit, base is connected to an N-type semiconductor.
- (4) Y is the emitter.



2. (2012 - 1)

26. Which of the following is the true statement about the transistor shown in the diagram and its action?

- (1) It is a npn transistor and the current flows from the collector to the emitter.
- (2) It is a npn transistor and the current flows from the emitter to the collector.
- (3) It is a pnp transistor and the current flows from the collector to the emitter.
- (4) It is a pnp transistor and the current flows from the emitter to the collector.

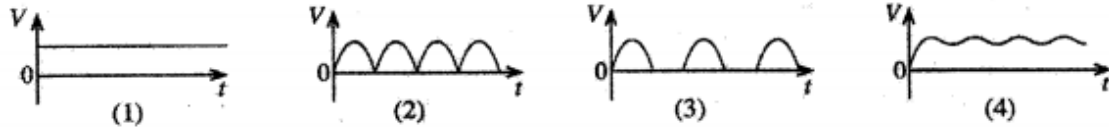


3. (2018 - 1)

4. Of the following statements, which is **false** about a silicon npn junction transistor?

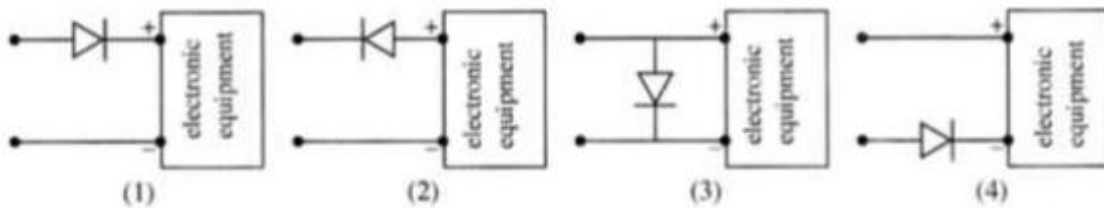
- (1) It can be used to amplify signals.
- (2) It can be used as a switch.
- (3) It can be used as a current amplifier.
- (4) It can be used to rectify alternating voltages.

15. An alternating voltage was subjected to full wave rectification followed by smoothing by a capacitor. Which of the following graphs illustrates the variation of the output voltage (V) with time (t)?



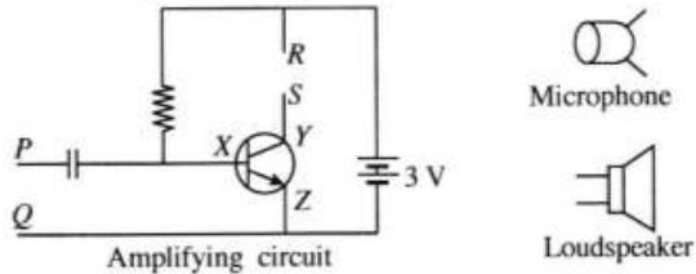
4. (2019 - 1)

20. When supplying electricity to an electronic equipment, it may get damaged if the source of electricity is connected to it with the terminals reversed. Which diagram illustrates correctly how a diode should be connected to it to protect the equipment from such a damage?



05 . 2019 (Essay – Part B)

(B) Parts of a public address system are given below.



- (i) What type of transistor is connected to the amplifying circuit?
- (ii) Name the terminals marked X, Y and Z in the transistor.
- (iii) To which terminals of the amplifying circuit should the microphone be connected?
- (iv) Name the phenomenon which converts the sound waves received by the microphone to an electrical signal.
- (v) To which points of the amplifying circuit should the loudspeaker be connected?
- (vi) What physical quantity connected with the signal given by the microphone is amplified by the amplifying circuit?
- (vii) Briefly explain how sound is produced by the loudspeaker when the amplified signal is given to the loudspeaker.

(Total marks 20)

Magnetic effect of electric current

1. Name three metals that are attracted by magnets.

i----- ii----- iii-----

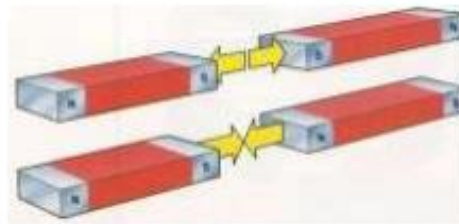
3. Name three metals that aren't attracted by magnets.

i----- ii----- iii-----

4. Name three non-metals that aren't attracted by magnets.

i----- ii----- iii-----

5. Indicate the properties of the magnets shown in the figure.



i-----

-ii-----

iii-----

Around any magnet, there is a region within which the magnet has an influence.

This region is known as the magnetic field.

When an electric current flows through an electric conductor, a magnetic field is created in the vicinity of the conductor.

8. A straight conductor is shown in the figure. Mention the observations of the compass movement in each of the cases given below. (Text book 2, page 117)

(1) The compass is above the AB wire

When the switch is closed. -----

When the switch is ON. -----

(2) The compass is under the AB wire,

When the switch ON. -----

When the switch is closed. -----

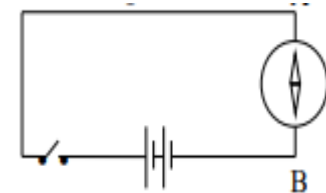
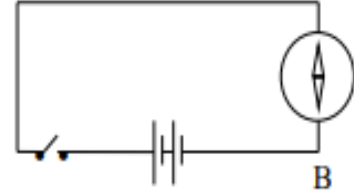
(3) Changing the direction of the current and the compass is above the AB wire, When the switch ON.

When the switch is closed. -----

(4) Changing the direction of the current and the compass is under the AB wire,

When the switch ON. -----

When the switch is closed. -----



Direction of the Magnetic Field due to a Current through a Straight Conductor

There are two laws that can be used to find the direction of the magnetic field around a conductor when a current flow along a straight conductor. (Text book 2, page 118-119)

Maxwell's corkscrew rule

When a corkscrew is rotated in such a way that its tip moves in the direction of current flow, then the magnetic field lines produced by the current are in the direction of rotation of the corkscrew

Right hand grip rule

If the conductor is held with the right hand in such a way that the thumb is directed towards the direction of current flow, then the direction of the other four fingers around the conductor indicates the direction of the magnetic field.

Force Acting on a Current Carrying Conductor Placed in a Magnetic Field

When a current is flowing through a conductor placed in a magnetic field, the conductor moves because a force is acting on it.

1. Write down three factors that affect the magnitude of the force exerted here.

Loudspeaker

A loud speaker generates a sound when a current that varies according to the wave form of the sound is allowed to pass through the coil in the loud speaker.

2. Mention the three main parts, present in loudspeaker

Direct Current Motor (DC Motor)

3. What are the main parts of a direct current motor?

4. Let us simply examine how a direct current motor rotates when supplied with electricity.(Text book 2, page 128-130)

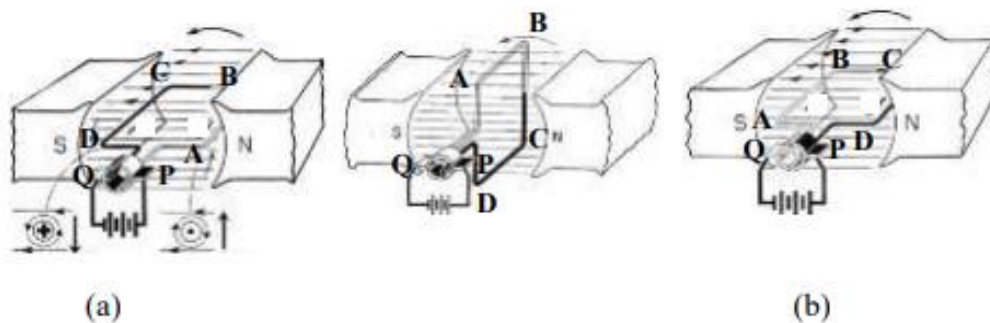


Figure (a)

- When power is supplied to the PQ brushes of a direct current motor, the standard current flows from the positive terminal through P, -----, -----, -----, ----- , -----, reaches the negative terminal of the cell.
- The direction of magnetic field from.....(N/S) to (N/S).
- According to Fleming's left-hand law, the force act..... (upwards/ downwards) on part AB and(upwards/downward) on part CD.
- Therefore, the coil rotates(anticlockwise / clockwise) due to the couple of forces.

Figure (b)

- Due to the couple of forces, the coil returns to the position of the (b) image.
- When the power is supplied to the PQ brushes of direct current motor, the standard current flows from the positive terminal through P, -----, -----, -----, ----- , -----, reaches the negative terminal of the cell.
- The direction of magnetic field from.....(N/S) to (N/S).
- According to Fleming's left-hand law, the force act (upwards/ downwards) on part AB and(upwards/downward) on part CD.
- Therefore, the coil rotates(anticlockwise / clockwise) due to couple of forces.
- The coil again return to the position of the figure (a).

Competency level: 3.8:

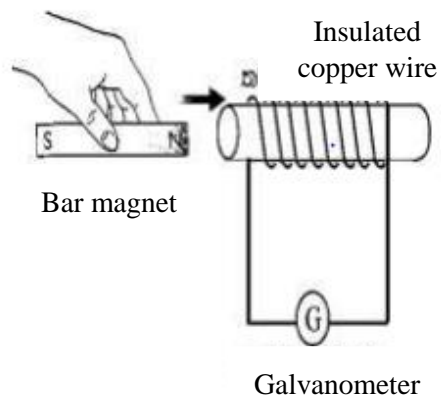
Investigate the phenomenon of electromagnetic induction and uses of it.

Lesson: Electromagnetic Induction

Activity: Demonstrating the electromagnetic induction

Materials: A bar magnet, About 1m length of gauge 28 insulated copper wire, A center zero galvanometer

01. Make a set up as shown in the below diagram. Record the observations in the center zero galvanometer when the bar magnet is moved relative to the insulated copper wire.



Instance	Observations in the galvanometer
Moving the bar magnet towards the coil	Indicator deflects to a certain direction & again to zero
Keeping the bar magnet stationary inside the coil	
Moving the bar magnet away from the coil	
Moving the coil towards the bar magnet	
Moving the bar magnet away from the coil	

02. Explain the phenomenon of electromagnetic based on the observations of above experiment.

.....

03. Write down the factors that affect the magnitude of induced voltage according to electromagnetic induction phenomenon.

.....

04. What is the rule that is used to identify the direction of induced current flow in a straight conductor which is moved perpendicular to the magnetic field?

.....

Fleming's right hand rule

When the first three fingers of the right hand are oriented perpendicular to one another and the thumb is pointed in the direction of motion of the conductor and the index finger along the direction of the magnetic field that intersects the conductor, the middle finger shows the direction of the current flowing through the conductor.

05. What are the Applications of Electromagnetic Induction?

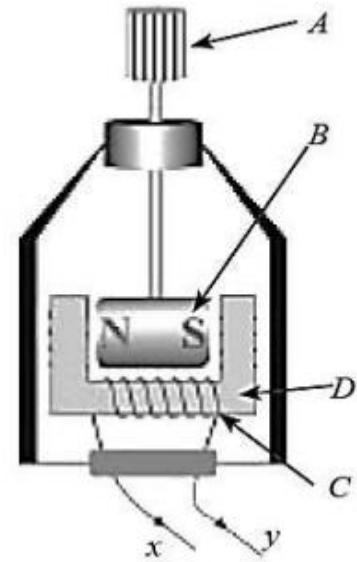
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06. Following figure shows the internal components of a bicycle dynamo.

- i. Name the parts A, B, C and D.
- ii. What is the principle behind the working of dynamo?
- iii. Explain the action of bicycle dynamo.
- iv. The current obtained from bicycle dynamo is AC or DC?
- v. Draw a graph (rough sketch) to show the variation of electromotive force with the time.
- vi. The brightness of the bicycle lamp varies with the speed of the bicycle. Explain how it happens.
- vii. Write the energy transformation that take place when bicycle lamp is lighted by the bicycle dynamo.

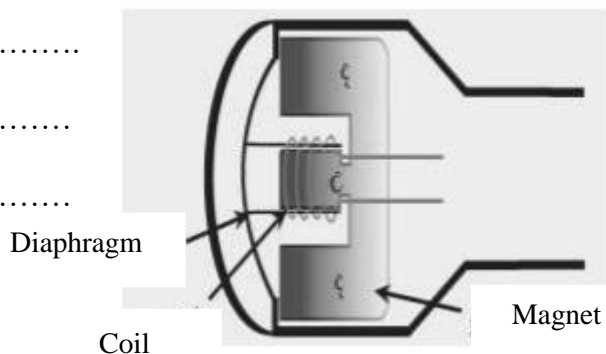


07. Following is a diagram of moving coil magnetic microphone. Explain the action of it using electromagnetic induction principle.

.....

.....

.....

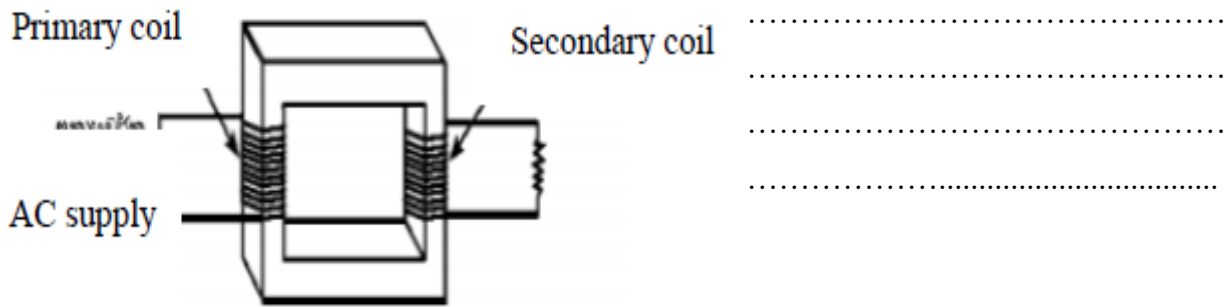


Competency level: 3.8:

Investigate the phenomenon of electromagnetic induction and uses of it.

Lesson: Transformers

01. Following is a diagram of a transformer. Explain the operation of it using the electromagnetic induction principle.



02. Name the two types of transformers and write down the uses and instances of using each of them.

.....

.....

.....

.....

❖ Let's recall....

✓ If the efficiency of a transformer is 100%, $\frac{V_s}{V_p} = \frac{N_s}{N_p}$ $V_p I_p = V_s I_s$

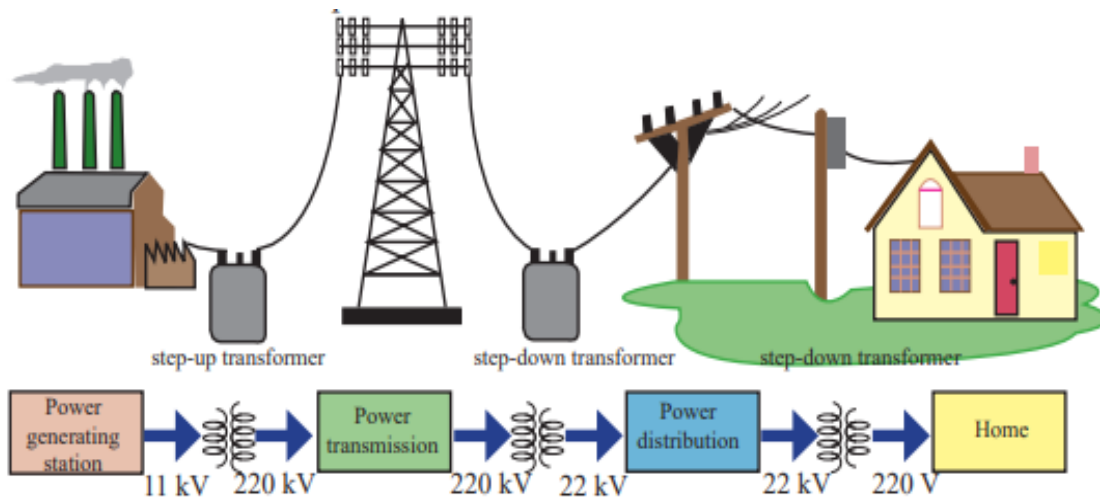
03. Calculate the induced current and the voltage in the secondary coil, if there are 250 turns in its primary coil and 5000 turns in its secondary coil and a current of 10A and a voltage of 12 V is supplied to it. (Consider the efficiency of the transformer as 100%)

.....

.....

.....

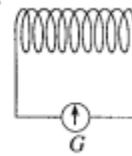
Applications of transformers



Exercise

2. 2011 – 1

33. A coil and a sensitive centre-zero galvanometer are connected as shown in the diagram. The galvanometer **does not** show a deflection when
- (1) a strong bar magnet is kept motionless at the centre of the coil.
 - (2) the south pole of a bar magnet is taken away from the coil.
 - (3) the north pole of a bar magnet is brought closer to the coil.
 - (4) a bar magnet is kept motionless and the coil is moved closer to it.



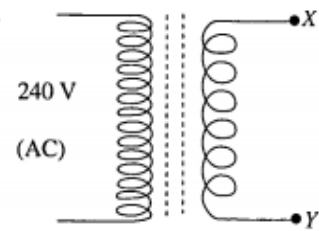
3. 2012 – 1

27. As illustrated by the diagram, an insulated copper wire is wound around a plastic tube and a current I is passed through it. The magnetic effect created by the coil **cannot** be increased by,
- (1) increasing the number of turns of the coil.
 - (2) inserting a core of soft iron wires into the coil.
 - (3) increasing the current flowing through the coil.
 - (4) using a nichrome wire coil in place of the copper wire.



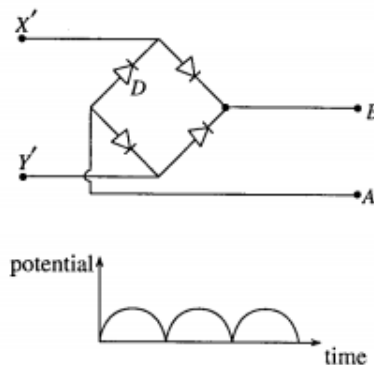
4. 2012 – Essay – Part B

10. (A) Given in the diagram is a transformer used in power packs for the purpose of obtaining a potential difference of 6 V from a 240 V alternating current (AC) supply.



- (i) To what type does this transformer belong?
- (ii) On what principle of physics is the transformer made?
- (iii) In a transformer the 'turns ratio' $\left(\frac{N_p}{N_s}\right)$ is equal to the potential difference ratio $\left(\frac{V_p}{V_s}\right)$. In the above transformer, if the number of turns in the coil to which 240 V are supplied is 1200, calculate the number of turns there should be in the secondary coil.
- (iv) (a) When transmitting energy from power houses to the national grid, step up transformers are used. What change is effected by this when transmitting the current generated in a power house?
(b) What is the advantage brought about by this?
- (v) In some power packs resistors are used in place of the transformer. State one **disadvantage** of such a usage.

- (B) A direct current power supply is made by connecting the terminals X' and Y' of a diode bridge circuit to the X and Y terminals of the above transformer.



- (i) What is the advantage of using a four diode bridge instead of a single diode for rectification?
- (ii) In this, a voltmeter is connected across A and B to measure the output voltage. Of the terminals A and B, to which end should the positive terminal of the voltmeter be connected?
- (iii) The graph shows how the output voltage of the circuit changes with time. Indicate by a graph, how the direct current voltage obtained from a battery varies against time.
- (iv) In order to minimise the variation of the output voltage given by the rectifier circuit, **what** equipment should be connected to the power supply circuit and **how** should it be connected?

11. 2018 – 1

8. Which of the following equipments is based on the phenomenon of electromagnetic induction?
- | | |
|--------------------------|-------------------------------------|
| (1) Direct current motor | (2) Loudspeaker |
| (3) Electric bell | (4) Moving coil magnetic microphone |

8. 2019 – 1

28. What is the equipment that works using the force exerted on a current carrying conductor placed in a magnetic field?
- | | |
|----------------------------|--------------------------|
| (1) moving coil microphone | (2) electric bell |
| (3) transformer | (4) direct current motor |