
Effects of Electric Current

Grade 10

Effects of Electric current...

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Current flowing through a conductor

<https://phet.colorado.edu/en/simulation/circuit-construction-kit-dc>

https://phet.colorado.edu/sims/html/ohms-law/latest/ohms-law_en.html

Magnetic field in current carrying conductor and Maxwell's rule

<https://cdac.olabs.edu.in/?sub=74&brch=9&sim=90&cnt=4>

Force on current carrying conductor and Fleming's Left hand rule.

Some important questions

How does the short circuit form? What is its effect?

Answer

Short circuit occurs when naked live and neutral wires touch each other.

In such situations, the resistance of the circuit becomes very less. Now, according to Ohm's law, current is inversely proportional to resistance.

Thus, the decrease in value of resistance of the circuit raises the current to a significant amount.

As a result, the wires become hot and sparks are caused by Joule's heating effect of current.

Give scientific reasons.

1. Tungsten metal is used to make a solenoid type coil in an electric bulb.

Answer

Tungsten metal is used to make a solenoid type coil in an electric bulb because its melting point is very high. Thus, when a high amount of current is passed through it, it becomes red hot and emit lights without getting burnt.

2. For electric power transmission, copper or aluminium wire is used.

Answer

For electric power transmission, Copper or Aluminium wire is used because they provide low resistance path to the flow of current. Thus, the power loss in the low resistance transmission wire will be less.

3. In the electric equipment producing heat e.g. iron, electric heater, boiler, toaster etc, an alloy such as Nichrome is used, not pure metals.

Answer

In the electric equipment producing heat, such as iron, electric heater, boiler, toaster etc., an alloy such as Nichrome is used, not pure metals because of the following reasons:

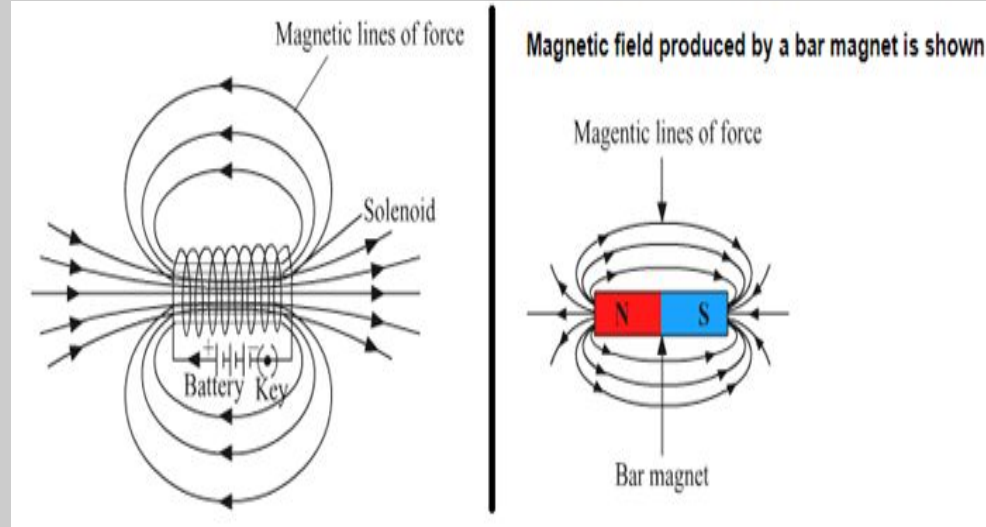
- (i) Resistivity of Nichrome is more compared to pure metal.
- (ii) Melting point of Nichrome is high as compared to pure metal.
- (iii) Nichrome does not get oxidised when heated in air whereas metal does.

What is a solenoid? Compare the magnetic field produced by a solenoid with the magnetic field of a bar magnet. Draw neat figures and name various components.

A solenoid is a long straight insulated wire, such as a copper coil, often wrapped around a cylinder-shaped body. The diameter of the solenoid is lesser than its length. It produces a magnetic field when electric current is passed through it.

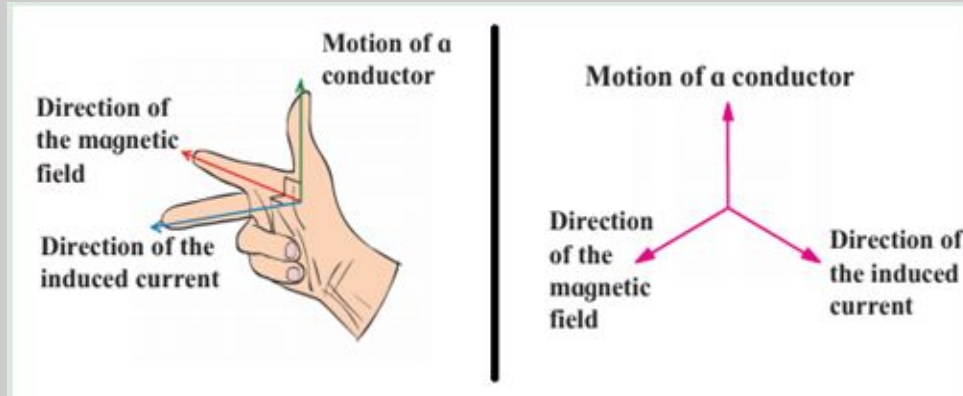
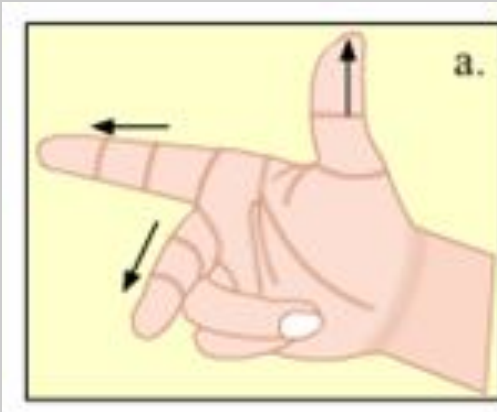
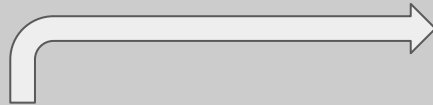
Magnetic field produced by a solenoid and by bar is shown below:

On comparing field lines produced by a solenoid with that produced by a bar magnet, we observe that they are very much identical. Thus, a solenoid acts as a bar magnet when current is passed through it.



Fleming's Right Hand Rule

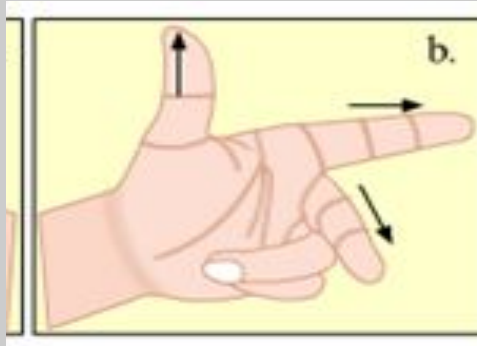
Name the following diagrams and explain the concept behind them.



a. It represents **Fleming's right hand rule** used for finding the direction of induced current with respect to the directions of the magnetic field and motion of the conductor.

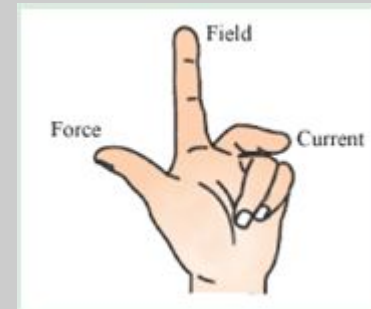
The direction of current induced in a conductor can be obtained by holding the thumb, the index finger, and the middle finger of your right hand mutually perpendicular to each other. In this situation, the thumb indicates the direction of the motion of the conductor, the index finger points along the magnetic field, and the middle finger points along the current induced in the conductor.

Fleming's Left Hand Rule



b. It represents **Fleming's left hand rule** used for finding the direction of magnetic force when a current carrying conductor is placed in a magnetic field.

This rule states that if you stretch the thumb, index finger, and middle finger of your left hand such that they are mutually perpendicular to each other, then your index finger represents the direction of the field, the middle finger represents the direction of the current, and the thumb represents the direction of the force experienced by the conductor.



Solve the following example.

1. Heat energy is being produced in a resistance in a circuit at the rate of 100 W. The current of 3 A is flowing in the circuit. What must be the value of the resistance?

Answer

Given:

Power, $P = 100$ W

Current, $I = 3$ A

Resistance, $R = ?$

We know, $P = I^2 R$

$$R = \frac{P}{I^2} = 100/9 = \text{nearly } 11 \Omega$$

