

Electric Conductors and Insulators

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CHAPTER

1

Electric Conductors and Insulators

- Relate electric current to matter.
- Define electric conductor, and give examples of conductors.
- Describe electric insulators, and identify materials that are insulators.



Do you see the wires and peaks on top of this old house? They are lightning rods, and their purpose is to protect the building in the event of a lightning strike. Each lightning rod is connected to a wire that goes down the side of the house and into the ground. If lightning strikes the building, it will target the rod and be conducted by the rod and wire into the ground. There the electricity can be safely absorbed. Lightning rods may differ in style, but to work they must be good at conducting electricity.

Electric Current and Matter

Electrical energy is transmitted by moving electrons in an electric current. In order to travel, electric current needs matter. It cannot pass through empty space. However, matter resists the flow of electric current. That's because flowing electrons in current collide with particles of matter, which absorb their energy. Some types of matter offer more or less resistance to electric current than others.

Electric Conductors

Materials that have low resistance to electric current are called **electric conductors**. Many metals—including copper, aluminum, and steel—are good conductors of electricity. The outer electrons of metal atoms are loosely bound and free to move, allowing electric current to flow. Water that has even a tiny amount of impurities is an electric conductor as well.

Q: What do you think lightning rods are made of?

A: Lightning rods are made of metal, usually copper or aluminum, both of which are excellent conductors of electricity.

Electric Insulators

Materials that have high resistance to electric current are called **electric insulators**. Examples include most non-metallic solids, such as wood, rubber, and plastic. Their atoms hold onto their electrons tightly, so electric current cannot flow freely through them. Dry air is also an electric insulator.

Q: You may have heard that rubber-soled shoes will protect you if you are struck by lightning. Do you think this is true? Why or why not?

A: It isn't true. Rubber is an electric insulator, but a half-inch layer on the bottom of a pair of shoes is insignificant when it comes to lightning. The average lightning bolt has 100 million volts and can burn through any insulator, even the insulators on high-voltage power lines.

The Path of Least Resistance

Look at the electric wires in the **Figure 1.1**. They are made of copper and coated with plastic. Copper is very good conductor, and plastic is a very good insulator. When more than one material is available for electric current to flow through, the current always travels through the material with the least resistance. That's why all the current passes through the copper wire and none flows through its plastic coating.

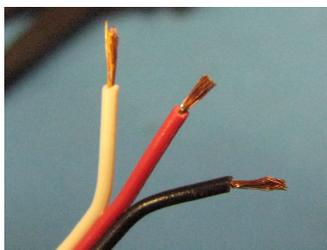


FIGURE 1.1

Summary

- Electricity must travel through matter. All matter offers some resistance to the flow of electrons in an electric current. Some materials resist current more or less than others.
- Materials that have low resistance to electric current are called electric conductors. Many metals are good electric conductors.
- Materials that have high resistance to electric current are called electric insulators. Wood, rubber, and plastic are good electric insulators.
- When more than one material is available for electric current to flow through, the current always travels through the material with the least resistance.

Review

1. What is an electric conductor? Give examples of good electric conductors.
2. Explain why electric current doesn't flow through rubber.
3. Jon can see the conductor of the power cord for an electric lamp. Should he use the lamp? Why or why not?

References

1. Flickr:solarbotics. [Closeup of copper wires](#) . CC BY 2.0