Electric Current

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Printed: August 4, 2016

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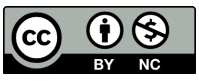

CHAPTER 1 Electric Current

- Describe electric current.
- Explain why electric current occurs.
- Define voltage.

Emily's dad is giving his car battery a "jump" because the battery "died" overnight. He's attaching cables to the terminals of the car battery. Then he will connect the other ends of the cables to the terminals of a "live" battery. The cables will carry electric current to the dead battery, providing the energy needed for the car to start.

Flowing Charges

Electric current is a continuous flow of electric charges (electrons). Current is measured as the amount of charge that flows past a given point in a certain amount of time. The SI unit for electric current is the ampere (A), or amp. Electric current may flow in just one direction (direct current), or it may keep reversing direction (alternating current).

Q: Why do you think charges flow in an electric current?

A: Electric charges flow when they have electric potential energy. Potential energy is stored energy that an object has due to its position or shape.

Electric Potential Energy

Electric potential energy comes from the position of a charged particle in an electric field. For example, when two negative charges are close together, they have potential energy because they repel each other and have the potential to push apart. If the charges actually move apart, their potential energy decreases. Electric charges always move spontaneously from a position where they have higher potential energy to a position where they have lower potential energy. This is like water falling over a dam from an area of higher to lower potential energy due to gravity.

Voltage

For an electric charge to move from one position to another, there must be a difference in electric potential energy between the two positions. A difference in electric potential energy is called **voltage**. The SI unit for voltage is the volt (V). Look at the **Figure** 1.1. It shows a simple circuit. The source of voltage in the circuit is a 1.5-volt battery. The difference of 1.5 volts between the two battery terminals results in a spontaneous flow of charges, or electric current, between them. Notice that the current flows from the negative terminal to the positive terminal, because electric current is a flow of electrons.

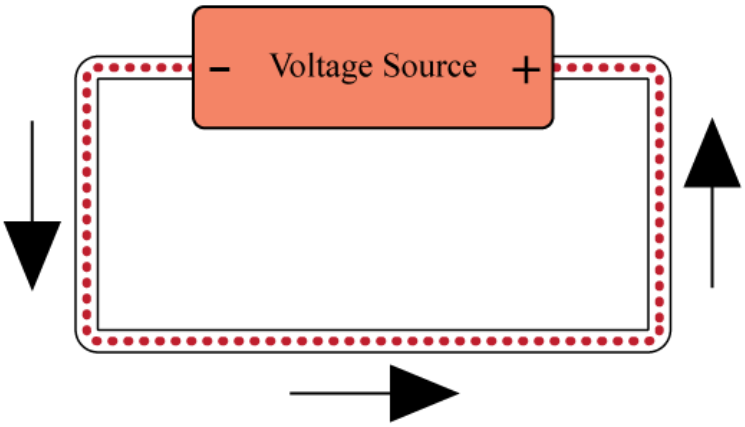

FIGURE 1.1

Q: You might put a 1.5-volt battery in a TV remote. The battery in a car is a 12-volt battery. How do you think the current of a 12-volt battery compares to the current of a 1.5-volt battery?

A: Greater voltage means a greater difference in potential energy, so the 12-volt battery can produce more current than the 1.5-volt battery.

Summary

- Electric current is a continuous flow of electric charges. The SI unit for electric current is the ampere (A).
- An electric charge flows when it has electric potential energy due to its position in an electric field. An electric charge always moves spontaneously from a position of higher to lower potential energy.
- For an electric charge to move from one position to another, there must be a difference in electric potential energy between the two positions. This difference is called voltage. The SI unit for voltage is the volt (V).

Review

1. What is electric current? Name the SI unit for electric current.
2. Explain what gives a charge electric potential energy. Describe an example.
3. How is electric potential energy related to the direction an electric charge spontaneously moves?
4. What is voltage, and why is it needed for charges to flow in an electric current?

References

1. Zachary Wilson. Flow of electrons in a circuit . CC BY-NC 3.0