

Chapter 17

Introduction to Electricity

17-2

Electric Current and
Electric Energy

Essential Questions

- What is electric current?
- What is voltage and what is its relationship to electric current?
- What is resistance and what is its relationship to electric current?
- How does a cell generate electrical energy?
- How do thermocouples and photocells generate electrical energy?

Vocabulary


- Electric current – flow of charges
- Voltage – the potential difference between two points
- Resistance – tries to slow the flow of electric charge
- Cell – changes chemical or radiant energy into electric energy

Vocab. cont.

- Thermocouple – device that changes thermal energy into electrical energy
- Photocell – device that changes light energy into electrical energy


Electric Current

- Making Charges Move
 - Electric current is how fast charges are moving; higher current = faster
 - In an equation, the symbol for current is I
 - Expressed in units called amperes or amps; symbol is A
- Commanding Electrons to Move
 - Think of electrons standing in a line, when you flip the switch they all begin moving (bucket brigade)

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- AC and DC
 - Direct current (DC) – flows in one direction
 - Ex: batteries
 - Alternating Current (AC) – flow goes back and forth repeatedly
 - Ex: home outlets
 - US – AC changes direction 120/sec or has 60 cycles/second


Voltage

- Voltage and Energy
 - Voltage – work needed to move a charge
 - Higher voltage = more energy released
 - Voltage is expressed in volts (V)

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- Voltage and Electric Current
 - Size of current depends on voltage
 - more voltage = more current = more charges
 - Varying Nature of Voltage
 - Batteries have low voltage (DC)
 - Home outlets in US use 120 V (AC)

Resistance

- Resistance and Material
 - Resistance is “electrical friction”, slows down current
 - Measured in ohms (Ω); for equations:
R
 - Depends on material, thickness, length, & temperature
 - Good conductors have low resistance (copper); used to make wire



B. High resistance is also good (light bulb example)

B. Resistance, Thickness, and Length

1. Thick wire has less resistance because there is more space

2. Short wire has less resistance b/c current does not have to “work” as hard

C. Resistance and Temperature

1. Resistance also depends on Temperature

IV. Generating Electrical Energy

A. Parts of a cell

1. Cells change chemical or radiant (solar) energy into electrical energy (Ex: batteries)
2. Electrolytes – chemicals that allow charges to flow
3. Electrode – where charges enter or exit

B. Kinds of Cells

1. Wet cells – liquid electrolytes
 - a. Ex: car batteries use sulfuric acid
2. Dry cells – solid or plastic-like electrolytes
 - a. Ex: small batteries for flashlights



C. Thermocouples

1. Convert thermal energy (heat) into electric energy
2. Doesn't create much energy but is useful for monitoring temp. of large machines

D. Photocells

1. Converts light energy into electrical energy
2. Light gives enough energy for electrons to move between atoms, providing power
3. Sm. Ex: calculator; Lg. Ex: satellites