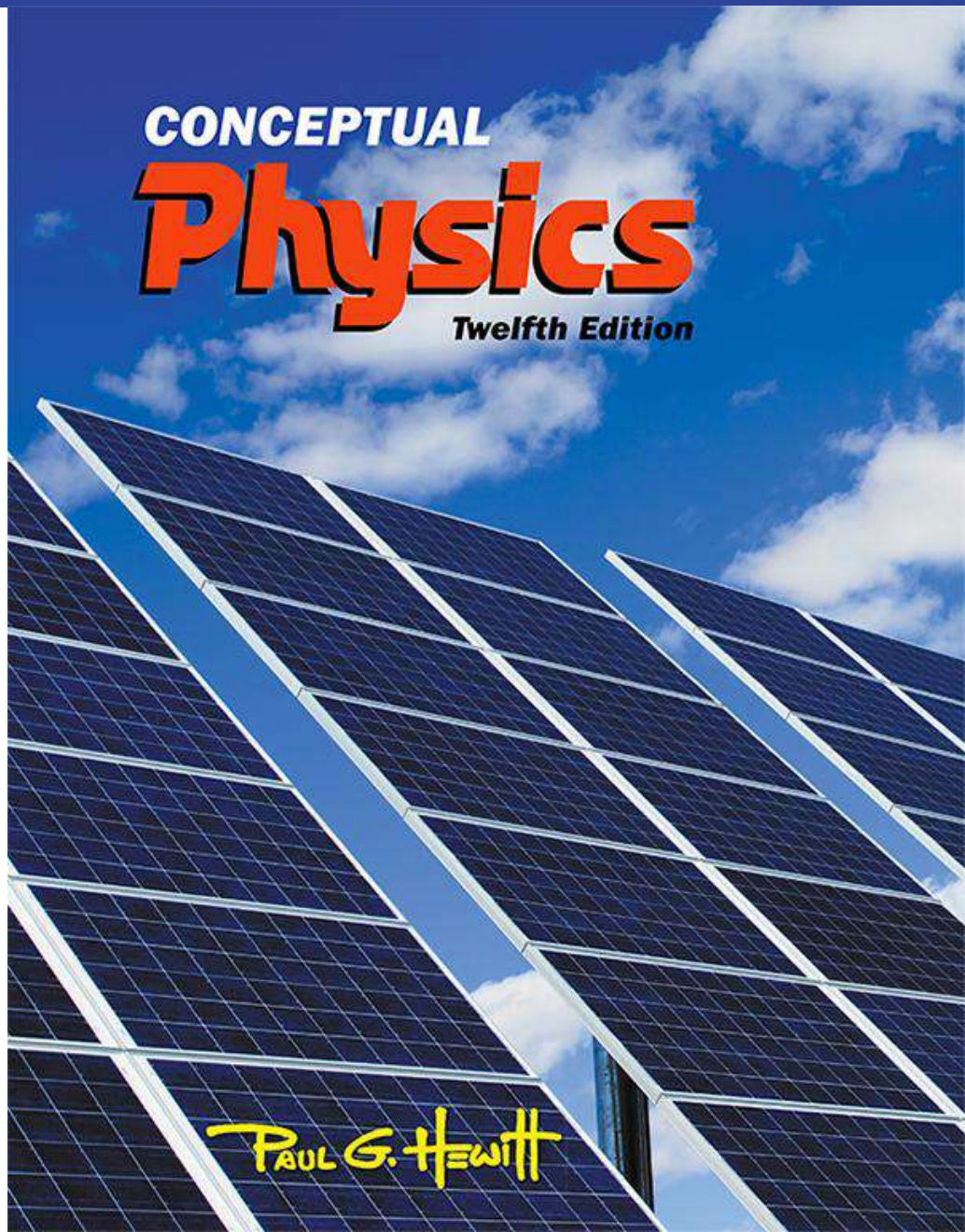
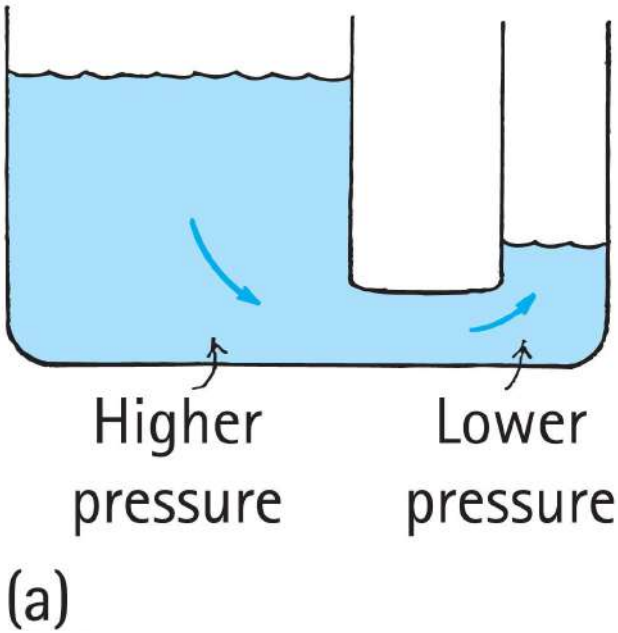
# Lecture Outline

## Electric Current
## Ch. 34.1 and 34.2



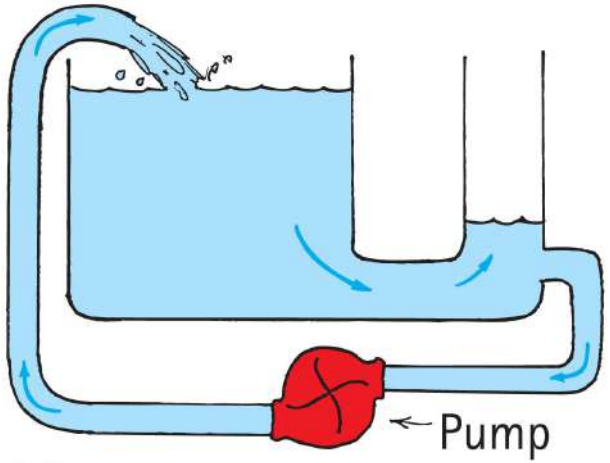
# Flow of Charge

- When the ends of an electrical conductor are at different electric potentials—when there is a **potential difference**—charge flows from one end to the other.
  - Analogous to water flowing from higher pressure to lower pressure



# Flow of Charge, Continued

- To attain a sustained flow of charge in a conductor, some arrangement must be provided to maintain a difference in potential while charge flows from one end to the other.
  - A continuous flow is possible if the difference in water levels—hence the difference in water pressures—is maintained with the use of a pump.



(b)

# Electric Current

- Electric current
  - Flow of charged particles
    - In metal wires
      - Conduction electrons are charge carriers that are free to move throughout atomic lattice.
      - Protons are bound within the nuclei of atoms.
    - In fluids
      - Positive ions and electrons constitute electric charge flow.

# Electric Current
# CHECK YOUR NEIGHBOR

Which of these statements is true?

A. Electric current is a flow of electric charge.
B. Electric current is stored in batteries.
C. Both A and B are true.
D. Neither A nor B are true.

# Electric Current
# CHECK YOUR ANSWER

Which of these statements is true?

**A. Electric current is a flow of electric charge.**

**Explanation:**

Voltage, not current, is stored in batteries. The voltage will produce a current in a connecting circuit. The battery moves electrons already in the wire, but not necessarily those in the battery.

# Electric Current, Continued

- Rate of electric flow
  - Measured in ampere (1 coulomb of charge per second).
  - Speed of electrons (drift speed) through a wire is slow because of continuous bumping of electrons in wire.
  - Charge flows *through* a circuit; voltage is established *across* a circuit.

# Electric Current, Continued-1

- Alternating current
  - Electrons oscillate to and fro around fixed positions.
  - Movement is produced by a generator or an alternator that switches the signs of charge periodically.
  - Commercial ac circuits are used in most residential circuits throughout the world and can be stepped up to high voltage for transmission over great distances with small heat losses, or stepped down where energy is consumed.

# Speed and Source of Electrons in a Circuit, Continued-1

- Misconceptions about electric current:
  - "Current is propagated through the conducting wires by electrons bumping into one another."
    - NOT true: Electrons that are free to move in a conductor are accelerated by the electric field impressed upon them.
    - True, they do bump into one another and other atoms, but this slows them down and offers resistance to their motion.
    - Electrons throughout the entire closed path of a circuit all react simultaneously to the electric field.