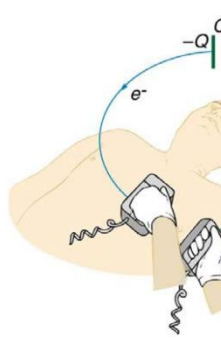1. Electric current is defined to be the rate at which _____ flows.

2. Write the equation for electric current.

3. The unit for electric current is _____.

4. 1 ampere = 1 _____ /second.

5. Example:

    A. What is the current involved when a truck battery sets in motion 720 C of charge in 4.00 s while starting an engine? Show your work.

    B. How long does it take 1.00 C of charge to flow through a handheld calculator if a 0.300-mA current is flowing? Show your work.

6. Label the terms and components in this circuit.
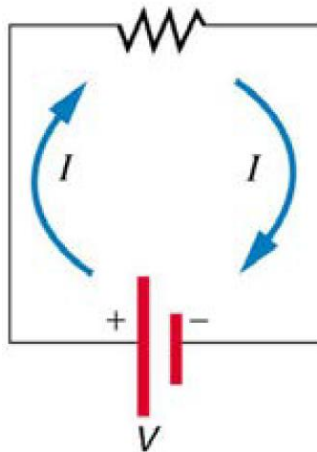
7. By convention, the direction of current flow is from _____ to _____. The direction of conventional current is the direction that _____ charge *would* flow.

8. In metal wires, current is carried by _____. So it is _____ charges that are moving, and they are moving oppositely to conventional current.

9. The fact that conventional current is taken to be in the direction that positive charge would flow can be traced back to American politician and scientist _____. He named the type of charge associated with electrons negative, long before they were known to carry current in so many situations. Franklin, in fact, was totally unaware of the small-scale structure of electricity.

10. It is important to realize that there is an _____in conductors that is responsible for producing the current, unlike static electricity situations, where a conductor in equilibrium cannot have an electric field in it. Conductors carrying a current have an electric field and are not in static equilibrium. An electric field is needed to supply energy to move the charges.

11. If the 0.300-mA current through a wire is carried by electrons, how many electrons per second pass through it? Show your work.

12. Electrical signals are known to move very rapidly. Most electrical signals carried by currents travel at speeds on the order of _____ m/s, a significant fraction of the speed of light. However, the actual electrons move much more slowly on average, typically drifting at speeds on the order of _____ m/s. Another example of sending messages quickly through a slowly-moving medium is provided by _____

_____

13. Show the direction of the drift velocity v_d, electric field E and the current I.
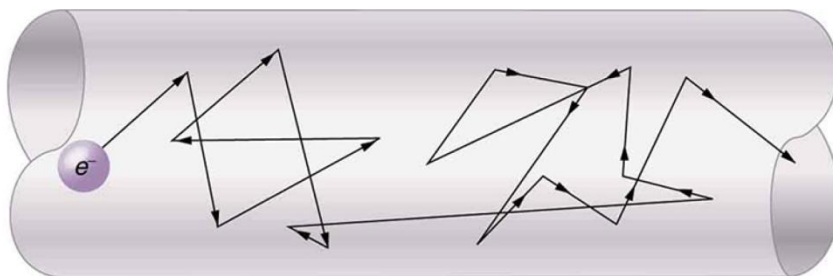
Practice – 20.1 Current

1. Car batteries are rated in ampere-hours (A · h). To what physical quantity do ampere-hours correspond (voltage? Charge? Energy? . . .)?

5. What is the current in milliamperes produced by the solar cells of a pocket calculator through which 4.00 C of charge passes in 4.00 h?

6. What is the current when a typical static charge of 0.250 µC moves from your finger to a metal doorknob in 1.00 µs?

7. A large lightning bolt had a 20,000-A current and moved 30.0 C of charge. What was its duration?

8. A defibrillator passes 12.0 A of current through the torso of a person for 0.0100 s. How much charge moves?

9. A clock battery wears out after moving 10,000 C of charge through the clock at a rate of 0.500 mA.
    A. How long did the clock run?

    B. How many electrons per second flowed?

Solutions:
1. charge   5. 0.278 mA   6. 0.250 A   7. 1.50 x 10⁻³ s   8. 0.120 C
9. A. 2.00 x 10⁷ s   B. 3.13 x 10¹⁵ e⁻/s