

Chapter 8 HW Answers

Review Questions:

9. The electric force changes as the inverse square of the distance.

$$F = \frac{kq_1q_2}{(2d)^2} = \frac{kq_1q_2}{4d^2} = \frac{1}{4} \frac{kq_1q_2}{d^2} \quad 2d \rightarrow 1/4 F$$

$$F = \frac{kq_1q_2}{(3d)^2} = \frac{kq_1q_2}{9d^2} = \frac{1}{9} \frac{kq_1q_2}{d^2} \quad 3d \rightarrow 1/9 F$$

10. An electrically polarized object has no net charge; it is neutral. A charged object has a net charge, has a different number of electrons than protons.

16. Each Coulomb of charge must acquire **6 Joules** of energy to pass through a 6 volt battery.

20. A thin wire has a greater resistance than a thick wire.

Exercises:

1. The comb gains a negative charge and the hair is left with a net positive charge. The comb has gained electrons and the hair has lost electrons.

2. Electrons are on the outside of the atom, so it is easier for them to move from one object to another.

4. The nuclear force holds the neutrons and protons together in the penny, and the electric force holds the protons and electrons together in the penny.

5. The same electric force is felt by each charge.

8. Electrons are relatively free to move in materials that are good conductors. The free movement of electrons allows more collisions per second.

23. Automobile headlights must be wired in **parallel**. When one headlight goes the other headlight remains lit, so there must be multiple paths.

30. When the distant switch is turned on, an electric field is established immediately allowing electrons to flow immediately.

32. The electroscope leaves gain the same net charge and like charges repel, so the leaves move apart.

34. The penny is more massive if it has a **negative charge**. A negative charge indicates electrons have been added which means mass has been added.

36. The electric force on the proton will be slightly greater than the electric force on the electron; the difference is due to the difference in mass. The proton and electron will be accelerated at different rates because of the difference in force, and the two particles will be accelerated in opposite directions because of the difference in charge.

43. a) The brightness of bulb C is greater than the brightness of bulb A or B.
b) Bulb C draws the most current.

$$V = IR \quad \rightarrow \quad I = V/R$$

Twice the resistance (2 bulbs) results in 1/2 the current.

- c) If bulb A is unscrewed, B will go out, but C will remain lit.
d) If bulb C is unscrewed, A and B will be unaffected and will remain lit.

45. The first circuit is actually 3 series circuits. The other two circuits are wired in parallel.

Problems:

10. $P = IV$ $I = \frac{P}{V} = \frac{1200 \text{ Watts}}{120 \text{ volts}} = \mathbf{10 \text{ Amps}}$

$V = IR$ $R = \frac{V}{I} = \frac{120 \text{ V}}{10 \text{ A}} = \mathbf{12 \Omega}$

12. $V = 12 \text{ volts}$ rating = 60 amp-hrs

There are two headlights, so there are 6 amps total being drawn.

$I = 2(3 \text{ Amps}) = 6 \text{ Amps}$

Now we need to use the information to get hours.

$\frac{60 \text{ amp-hrs}}{6 \text{ amps}} = \mathbf{10 \text{ hrs}}$

Additional:

A. Potential difference between the high voltage source and a low voltage source will produce a shock.

B. No. An electric field is set up and electrons move back and forth within the wire, but there is no net charge in the wire.

C. a) You will first need to add the total power:

$$P = 1\text{kW} + 250\text{ W} + 2(40\text{ W}) = 1000\text{ W} + 250\text{ W} + 80\text{ W} = 1330\text{ W}$$

$$P = IV$$

Rearrange the equation.

$$I = \frac{P}{V} = \frac{1330\text{ Watts}}{110\text{ volts}} = \mathbf{12\text{ Amps}}$$

No, it does not exceed the limit for the circuit.

C. b) Need kWh: $1330\text{ W} = 1.33\text{ kW}$

$$1.33\text{ kW} \times 3\text{ h} = 3.99\text{ kWh}$$

$$\text{Then, need } \phi: 3.99\text{ kWh} \times \frac{22\text{ } \phi}{\text{kWh}} = \mathbf{87.78\text{ } \phi}$$