Chapter 9 HW Answers

<u>Review Questions:</u>

12. Perpendicular – charge experiences maximum deflection force
Parallel -- charge experiences zero deflection force

28. Alternating Current

29. Changing Magnetic Field

<u>Exercises:</u>

4. Stationary charge → electric field
Moving charge → electric field and magnetic field

17. No, an electron at rest in a magnetic field will not be set into motion; however, a *changing* magnetic field would set the electron into motion. Yes, if the electron was at rest and experienced an electric field, then the electron would be set into motion.

35. A rapidly alternating (changing) magnetic field can induce electric current in the ring, and the electric energy can then be transformed into heat energy.

40. The alternating voltage induces the <u>changing</u> magnetic field necessary to induce voltage in the second coil. A direct current would produce a magnetic field, but not a changing magnetic field, and a changing magnetic field is required to induce current.

49. The magnet that is dropped through the copper pipe interacts with the pipe and the magnetic force between the magnet and the pipe causes the magnet to slow down. This does not happen with a plastic pipe.

<u>Problems:</u>

1. secondary voltage = 12 V secondary turns = ?
primary voltage = 120 V primary turns = 500

The equation we need to use is…

$$\frac{V_p}{T_p} = \frac{V_s}{T_s}$$

Rearranged it becomes…

$$T_s = \frac{V_s T_p}{V_p} = \frac{(12)(500)}{120} = \mathbf{50}$$

2. secondary voltage = 6 V secondary turns = ?
primary voltage = 120 V primary turns = 240

The equation we need to use is…

$$\frac{V_p}{T_p} = \frac{V_s}{T_s}$$

Rearranged it becomes…

$$T_s = \frac{V_s T_p}{V_p} = \frac{(6)(240)}{120} = \mathbf{12}$$

3. primary voltage = 120 V
secondary voltage = 24 V

The equation we need to use is…

$$\frac{V_p}{T_p} = \frac{V_s}{T_s}$$

Rearranged it becomes…

$$\frac{T_p}{T_s} = \frac{V_p}{V_s} = \frac{120}{24} = \frac{\mathbf{5}}{\mathbf{1}}$$

7. primary voltage = 120 V
secondary voltage = 12,000 V

The equation we need to use is…

$$\frac{V_p}{T_p} = \frac{V_s}{T_s}$$

Rearranged it becomes…

$$\frac{T_s}{T_p} = \frac{V_s}{V_p} = \frac{12{,}000}{120} = \frac{\mathbf{100}}{\mathbf{1}}$$

Additional:

A. 1. Magnetic domains are aligned within a material
2. Electric current runs through a wire
3. Motions within a planet generate a magnetic field
4. A metal object is placed near a magnet

B. The more loops of wire in the coil and the faster the coil is turned, the greater the voltage is that the generator can produce.

C. Faraday's law says the more loops, the more voltage can be produced; thus, the two coils in a transformer must have different numbers of loops to change the amount of voltage. Maxwell's law states that alternating current produces a changing magnetic field. The primary coil has alternating current to produce a changing magnetic field.

D. F = qvB

a. F = (2)(50)(100) = **10,000 N**

b. F = (200)(500)(1000) = **1 x 10^8 N**

c. F = 0

d. F = 0

e. v = 0.75(50 m/s) = 37.5 m/s F = (2)(37.5)(100) = **7,500 N**

f. v = 0.75(500 m/s) = 375 m/s F = (200)(375)(1000) = **7.5 x 10^7 N**

g. A large amount of charge, with a high velocity perpendicular to a strong magnetic field, results in the greatest amount of magnetic force.