Name: ________________________________

Directions: Select the best answer for each question. Write answer on answer sheet. (1 point each)

1. If a bar magnet is divided into two equal pieces,
   A) the north and south poles are separated.
   B) two magnets result.
   C) the magnet properties are destroyed.
   D) an electric field is created.

2. A horizontal wire carries a current straight toward you. From your point of view, the magnetic field caused by this current
   A) points directly away from you.
   B) points to the left.
   C) circles the wire in a clockwise direction.
   D) circles the wire in a counterclockwise direction.

3. An electron moving along the +x axis enters a region where there is a uniform magnetic field in the +y direction. What is the direction of the magnetic force on the electron? (+x to right, +y up, and +z out of the page.)
   A) +z direction
   B) –z direction
   C) –y direction
   D) –x direction

4. A long straight wire carries current toward the east. A proton moves toward the east alongside and just south of the wire. What is the direction of the force on the proton?
   A) north
   B) south
   C) up
   D) down

5. A circular coil lies flat on a horizontal table. A bar magnet is held above its center with its north pole pointing down, and released. As it approaches the coil, the falling magnet induces (when viewed from above)
   A) no current in the coil.
   B) a clockwise current in the coil.
   C) a counterclockwise current in the coil.
   D) a current whose direction cannot be determined from the information provided.

6. A long straight wire lies on a horizontal table and carries an ever-increasing current northward. Two coils of wire lie flat on the table, one on either side of the wire. When viewed from above, the induced current circles
   A) clockwise in both coils.
   B) counterclockwise in both coils.
   C) clockwise in the east coil and counterclockwise in the west coil.
   D) counterclockwise in the east coil and clockwise in the west coil.

7. The flux through a coil changes from 4.0 x 10^{-5} T/m^2 to 5.0 x 10^{-5} T/m^2 in 0.10 s. What emf is induced in this coil?
   A) 5.0 x 10^{-4} V
   B) 4.0 x 10^{-4} V
   C) 1.0 x 10^{-4} V
   D) none of the given answers

8. A step-down transformer is needed to reduce the primary voltage from 120 V AC to 6.0 V AC. What turns ratio is required (N_s:N_p)?
A) 10:1  
B) 1:10  
C) 20:1  
D) 1:20

9. You are designing a generator with a maximum emf of 8.0 V. If the generator coil has 200 turns and a cross-sectional area of 0.030 m², what would be the frequency of the generator in a magnetic field of 0.030 T?  
   A) 7.1 Hz  
   B) 7.5 Hz  
   C) 8.0 Hz  
   D) 44 Hz

10. A current balance similar to one used in lab is balanced when a mass m rests on the top wire and a current I travels through both wires. If the mass resting on the top wire is increased to 2m, what current is required to keep the two wires balanced?  
   A) 2I  
   B) \( \frac{1}{2} I \)  
   C) 4I  
   D) \( \sqrt{2} I \)

**Long Answer:** Write out a solution for each problem. Be sure to show all your work.  
(10 points each)

11. In a mass spectrometer a particle of mass m and charge q is accelerated through a potential difference V and allowed to enter a magnetic field B, where it is deflected in a semi-circular path of radius R. The magnetic field is uniform and oriented perpendicular to the velocity of the particle. Derive an expression for the mass of the particle in terms of B, q, V, and R.

12. Determine the current through each resistor.