DRILL

CHAPTER 13 PRACTICE QUESTIONS

- **Directions:** Complete the following problems as specified by each question, and then check your work using the solutions that follow. For extended, step-by-step solutions, access your Student Tools online.
- 1. A 3 C charge of mass 10 g is in the presence of a uniform magnetic field $\vec{B} = (0.05 \text{ T})i$. If the charge is moving with an initial velocity of $\vec{v} = (2.5 \text{ m/s})j$, what is the radius of the circular motion the charge undergoes? What is the frequency? After 5 s, how much work was done on the charge?
- 2. A 4 C charge moves with an initial velocity of $\vec{v} = (1 \text{ m/s})\hat{i} - (2 \text{ m/s})\hat{j}$ in the presence of a uniform magnetic field $\vec{B} = -(2 \text{ T})\hat{i} + (4 \text{ T})\hat{j}$. What is the magnetic force on the charge?
- **3.** A 10 C charge moves with a velocity $\vec{v} = (5 \text{ m/s})\hat{i} + (2 \text{ m/s})\hat{k}$. What is the magnetic field at a position $\vec{r} = (2 \text{ m})\hat{i} + (4 \text{ m})\hat{j}$ if the charge is at the origin? What is the magnetic force on the charge?
- 4. A charge passes through the center of a loop carrying a 2 A current. If the loop is of radius 2 cm, what is the magnetic field the charge experiences?

- 5. A 10 cm solenoid has 20 loops of current. If the current in the solenoid is decreasing at a constant rate of 2 A/s, what is the rate at which the magnetic flux through a loop placed directly in front of the solenoid changes? Consider the loop to have a 5 cm radius.
- 6. A conducting loop of radius 10 cm with a resistance of 10 Ω is in the presence of a changing magnetic field. If the magnetic field passes at an angle of 30° to the normal of the loop and is changing at a rate of 1 × 10⁻⁴ T/s, what is the induced current on the resistor?
- A loop experiences a magnetic field directed upward through its center. If the magnetic field is increasing in magnitude, in which direction does the magnetic field the loop induces point?
- 8. A charge is initially moving with a velocity of 20 m/s in the positive *x*-direction. If it enters a region of uniform electric field $\vec{E} = (100 \text{ N/C})\hat{i}$ and uniform magnetic field $\vec{B} = (0.5 \text{ T})\hat{j}$, it undergoes a non-uniform rotational motion about some guiding center. How far does the guiding center move in 10 s? In which direction is the guiding center moving?