

## Suggested problems

### Chapter 28

The quiz questions will be same or very similar to the following text-book problems.

Refer to the course website for the latest version of this document.

You are encouraged to seek the help of your instructor during his office hours.

6. A proton moves through a uniform magnetic field given by  $\vec{B} = (10\hat{i} - 20\hat{j} + 30\hat{k})$  mT. At time  $t_1$ , the proton has a velocity given by  $\vec{v} = (v_x\hat{i} + v_y\hat{j} + 2.0\hat{k})$  km/s and the magnetic force on the proton is  $\vec{F}_B = (4.0 \times 10^{-17} \text{ N})\hat{i} + (2.0 \times 10^{-17} \text{ N})\hat{j}$ . At that instant, what are (a)  $v_x$  and (b)  $v_y$ ?

**Answer:** (a)  $-3.5 \times 10^3 \text{ m/s} = -3.5 \text{ km/s}$ ; (b)  $7.0 \times 10^3 \text{ m/s} = 7.0 \text{ km/s}$ .

10. A proton travels through uniform magnetic and electric fields. The magnetic field  $\vec{B} = -2.50\hat{i}$  mT. At one instant the velocity of the proton is  $\vec{v} = 2000\hat{j}$  m/s. At that instant and in unit-vector notation, what is the net force acting on the proton if the electric field is (a)  $4.00\hat{k}$  V/m (b)  $-4.00\hat{k}$  V/m, and (c)  $4.00\hat{i}$  V/m?

**Answer:**  $(6.41\hat{i} + 8.01\hat{j}) \times 10^{-19} \text{ N}$

24. An electron is accelerated from rest by a potential difference of 350 V. It then enters a uniform magnetic field of magnitude 200 mT with its velocity perpendicular to the field. Calculate (a) the speed of the electron and (b) the radius of its path in the magnetic field.?

**Answer:** (a)  $1.11 \times 10^7 \text{ m/s}$ ; (b)  $3.16 \times 10^{-4} \text{ m} = 0.316 \text{ mm}$ .

41. A 13.0 g wire of length  $L = 62.0$  cm is suspended by a pair of flexible leads in a uniform magnetic field of magnitude 0.440 T (Fig. 28-40). What are the (a) magnitude and (b) direction (left or right) of the current required to remove the tension in the supporting leads?

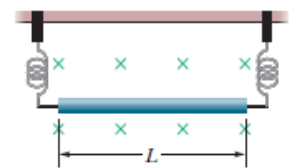


Fig. 28-40 Problem 41.

**Answer:** (a) 0.467 A = 467 mA; (b) From left to right

49. Figure 28-44 shows a rectangular 20-turn coil of wire, of dimensions 10 cm by 5.0 cm. It carries a current of 0.10 A and is hinged along one long side. It is mounted in the  $xy$  plane, at angle  $\theta = 30^\circ$  to the direction of a uniform magnetic field of magnitude 0.50 T. In unit-vector notation, what is the torque acting on the coil about the hinge line?

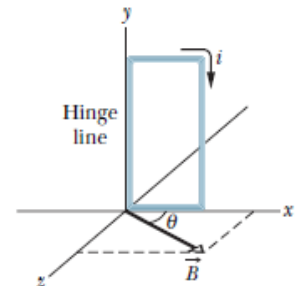


Fig. 28-44 Problem 49.

**Answer:**  $4.33 \times 10^{-3} \hat{j} \text{ N}\cdot\text{m}$ .

57. A circular coil of 160 turns has a radius of 1.90 cm. (a) Calculate the current that results in a magnetic dipole moment of magnitude  $2.30 \text{ A}\cdot\text{m}^2$ . (b) Find the maximum magnitude of the torque that the coil, carrying this current, can experience in a uniform 35.0 mT magnetic field.

**Answer:** (a) 12.7 A; (b)  $8.05 \times 10^{-2} \text{ N}\cdot\text{m}$ .