SCS 139 Applied Physic II Semester 2/2011

Practice Questions for "Magnetic Forces and Fields (I)"

1. (a) What is the minimum magnetic field needed to exert a 5.4×10^{-15} N force on an electron moving at 2.1×10^{7} m/s? (b) What magnetic field strength would be required if the field were 45° to the electron's velocity?
   Ans: (a) 1.6 mT; (b) 2.27 mT
2. What is the magnitude of the magnetic force on a proton moving at 2.5×10^{5} m/s (a) at right angle; (b) at 30°; (c) parallel to a magnetic field of 0.50 T?
   Ans: (a) 2×10^{-14} N; (b) 1×10^{-14} N; (c) 0 N
3. A magnetic field of 0.10 T points in the positive *x* direction. A charged particle carrying 1.0 μC enters the field region moving at 20 m/s. What are the magnitude and direction of the force on the particle when it first enters the field if it does so moving (a) in the positive *x* direction; (b) in the positive *y* direction; (c) in the positive *z* direction; (d) at 45° to both positive x and positive y axes?
   Ans: (a) 0 N; (b) 2×10^{-6} N, -z; (c) 2×10^{-6} N, +y; (d) 1.4×10^{-6} N, -z
4. Moving in the x direction, a particle carrying 1.0 μC experiences no force. Moving with speed *v* at 30° to the x axis, the particle experiences a magnetic force of 2.0 N. What magnetic force would it experience if it moved along the y axis with speed v?
   Ans: 4 N
5. A beam of electrons moving in the positive *x* direction at 8.7×10^{6} m/s enters a region where a uniform magnetic field of 180 G points in the positive *y* direction.
   The mass of an electron is 9.10×10^{-31} kg.
   How far into the field region does the beam penetrate?
   Ans: 2.75 mm
6. How long does it take an electron to complete a circular orbit at right angles to a 1.0 G magnetic field? The mass of an electron is 9.10×10^{-31} kg.
   Ans: 3.57×10^{-7} s
7. What is the magnitude of the force on a 50 cm long wire carrying 15 A at right angles to a 500 G magnetic field?
   Ans: 0.375 N
8. In a high-magnetic field experiment, a conducting bar carrying 7.5 kA passes through a 30 cm long region containing a 22 T magnetic field. If the bar makes a 60° angle with the field direction, what force is necessary to hold it in place?
   Ans: 4.29×10^{4} N
9. A piece of wire with mass per unit length 75 g/m runs horizontally at right angles to a horizontal magnetic field. A 6.2 A current in the wire results in its being suspended against gravity. What is the magnetic field strength?
   Ans: 0.119 T

Additional Questions for "Magnetic Forces and Fields (I)"

1. [Halliday, Resnick, and Walker, 9E, P28.18]

•18 In Fig. 28-35, a particle moves along a circle in a region of uniform magnetic field of magnitude $B = 4.00$ mT. The particle is either a proton or an electron (you must decide which). It experiences a magnetic force of magnitude 3.20×10^{-15} N. What are (a) the particle's speed, (b) the radius of the circle, and (c) the period of the motion?

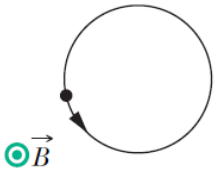

Fig. 28-35 Problem 18.

Ans: (a) 4.99×10^{6} m/s; (b) 0.00710 m; (c) 8.93×10^{-9} s

2. [Halliday, Resnick, and Walker, 9E, P28.24]

•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.

Ans: (a) 1.11×10^{7} m/s; (b) 3.16×10^{-4} m.

3. [Halliday, Resnick, and Walker, 9E, P28.42]

•42 The bent wire shown in Fig. 28-41 lies in a uniform magnetic field. Each straight section is 2.0 m long and makes an angle of $\theta = 60°$ with the x axis, and the wire carries a current of 2.0 A. What is the net magnetic force on the wire in unit-vector notation if the magnetic field is given by (a) $4.0\hat{k}$ T and (b) $4.0\hat{i}$ T?

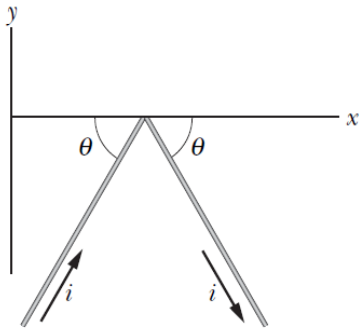

Fig. 28-41 Problem 42.

Ans: (a) $-16\hat{j}$ N; (b) 0

4. [Halliday, Resnick, and Walker, 9E, P28.43]

•43 A single-turn current loop, carrying a current of 4.00 A, is in the shape of a right triangle with sides 50.0, 120, and 130 cm. The loop is in a uniform magnetic field of magnitude 75.0 mT whose direction is parallel to the current in the 130 cm side of the loop. What is the magnitude of the magnetic force on (a) the 130 cm side, (b) the 50.0 cm side, and (c) the 120 cm side? (d) What is the magnitude of the net force on the loop?

Ans: (a) 0; (b) 0.138 N; (c) 0.138 N; (d) 0