5. What is the magnetic force on a 2.0-m length of (straight) wire carrying a current of 30 A in a region where a uniform magnetic field has a magnitude of 55 mT and is directed at an angle of 20° away from the wire?

a. 1.5 N
b. 1.3 N
c. 3.1 N
d. 1.7 N
e. 1.1 N

e

$$F = I \ell B \sin\theta$$
$$= (30A)(2m)(0.055T)\sin 20^\circ = 1.1N$$

6. A rectangular coil (0.20 m × 0.80 m) has 200 turns and is in a uniform magnetic field of 0.30 T. When the orientation of the coil is varied through all possible positions, the maximum torque on the coil by magnetic forces is 0.080 N · m. What is the current in the coil?

a. 8.3 mA
b. 1.7 A
c. 5.0 mA
d. 1.0 A
e. 42 mA

a

$$\tau_{max} = \mu B = NIAB$$
$$I = \frac{\tau_{max}}{NAB} = 0.0083\ A$$

7. A 500-eV electron and a 300-eV electron trapped in a uniform magnetic field move in circular paths in a plane perpendicular to the magnetic field. What is the ratio of the radii of their orbits?

a. 2.8
b. 1.3
c. 1.7
d. 4.0
e. 1.0

b

$$r_c = \frac{mv}{qB} \qquad v = \sqrt{\frac{2K}{m}} \leftarrow \text{kinetic energy}$$
$$\frac{r_{500}}{r_{300}} = \frac{mv_{500}}{qB}\frac{qB}{mv_{300}} = \frac{v_{500}}{v_{300}} = \sqrt{\frac{K_{500}}{K_{300}}} = \sqrt{\frac{500}{300}} = 1.3$$

8. A current I moves in the –y direction. The direction of the magnetic field at a point on the positive x axis is in the
a) +x direction b) – z direction c) –x direction d) +z direction

d

9. Two long parallel wires separated by 4.0 mm each carry a current of 24 A. These two currents are in the same direction. What is the magnitude of the magnetic field at a point that is between the two wires and 1.0 mm from one of the two wires?

a. 4.8 mT
b. 6.4 mT
c. 3.2 mT
d. 9.6 mT
e. 5.3 mT

c

10. If $a = 1.0$ cm, $b = 3.0$ cm, and $I = 30$ A, what is the magnitude of the magnetic field at point P? (answers on next page)

d