Chapter 8 Test Solutions

1 Multiple Choice

1. A. $F_m = Bqv\sin(\theta)$ and $\sin(0) = 0$.

2. D. Substitute the numbers into the formula $F_m = Bqv\sin(\theta)$.

$$F_m = (500)(175)(\frac{1000}{3600})\sin(90°)$$

$$F_m = 2.43 \times 10^4$$

3. D. Use the formula $F = IlB\sin(\theta)$

$$1 = I(0.025)(1)$$

$$I = 40$$

4. A. $B = \mu_0(\frac{NI}{L})$

$$\mu_0(\frac{15(I)}{0.15}) = 2.4 \times 10^{-2}$$
$$I = 179$$

5. D. By $B = \mu_0(\frac{I}{2\pi r})$, we see only A and B are true.

2 Full Solution

2.1 Question 1

A particle with mass m and charge e is launched out of a device with a velocity of v m/s into deep space. After a while, the particle enters a magnetic field with a strength of B [into page] at an angle of 45° above the horizontal.

(a) (1 point) Using the variables given above, what is the $\vec{F_m}$ experienced by the particle?

$$\vec{F_m} = q(\vec{B} \times \vec{v})$$

$$|F_m| = Bev\sin(45°)$$

$$\vec{F_m} = Bev\frac{\sqrt{2}}{2}[\rightarrow]$$

(b) (2 points) Describe the path the particle follows after a lengthy period of time causes the particle to settle into a determinable path.

1. Top-down view will be circular

2. Rising spiral

One point for each of the above.

(c) (1 point) After a period of time, the particle settles into a path discussed in the previous part. Determine the radius of this orbit.

$$F_c = F_m$$

$$\frac{mv^2}{r} = Bev\frac{\sqrt{2}}{2}$$

$$r = \frac{\sqrt{2}mv^2}{Bev}$$

(d) (2 points) If the mass was halved to $\frac{m}{2}$ and the magnetic field was reversed to be [out of page], describe the new path the particle follows.

1. Half radius
2. Direction of orbit reversed

One point for each of the above.