Chapter 29 Even Answers

2. (a) West (b) zero deflection

(c) up (d) down

4. (a) 8.67×10^{-14} N (b) 5.19×10^{13} m / s^2

6. (a) 7.90×10^{-12} N (b) zero

8. $\mathbf{F}_B\left(1.00 \times 10^{-6}\text{ N}\right)\text{ vertical} + \left(0.990 \times 10^{-6}\text{ N}\right)\text{ horizontal}$

10. Can determine that $B_z = 0$ and $B_y = -2.62$ mT. Cannot determine B_x.

12. $\left(8.29 \times 10^{-14}\ \mathbf{k}\right)$ N

14. $\left(-2.88\ \mathbf{j}\right)$ N

16. 0.109 A to the right

18. ab: 0, bc: $\left(-40.0\ \mathbf{i}\right)$ mN, cd: $\left(-40.0\ \mathbf{k}\right)$ mN, da: $\left(40.0\ \mathbf{i} + 40.0\ \mathbf{k}\right)$ mN

20. $\sqrt{\dfrac{4IdBL}{3m}}$

22. 2.98 μN west

24. 18.4 mA · m^2

26. (a) 3.97° (b) 3.39 mN · m

30. (a) 118 μN · m (b) $-118\ \mu\text{J} \le U \le 118\ \mu\text{J}$

32. 1.98 cm

34. 6.56×10^{-2} T

36. (a) 5.00 cm (b) 8.78×10^{6} m / s

38. $m'/m = 8$

40. $m = 2.99$ u, either ${}^{3}_{1}\text{H}^{+}$ or ${}^{3}_{2}\text{He}^{+}$

42. (a) 8.28 cm (b) 8.23 cm; ratio is independent of both ΔV and B

44. 0.162 m

46. 3.00 T

48. (a) 7.44×10^{28} m^{-3} (b) 1.79 T

50. 1.28×10^{29} m^{-3}, 1.52

52. (a) 37.7 mT (b) 4.29×10^{25} m^{-3}

54. 39.2 mT

56. (a) -8.00×10^{-21} kg · m / s (b) 8.90°

58. 0.128 T pointing north at 78.7° below the horizontal.

60. $r = 3.13 \times 10^{4}$ m; the proton will not hit the Earth.

62. $B \sim 10^{-1}$ T, $\tau \sim 10^{-1}$ N · m, $I \sim 10^{0}$ A, $A \sim 10^{-3}$ m^{2}, $N \sim 10^{3}$ turns

64. $\frac{\mu g}{I} \tan\theta$

66. (a) 1.04×10^{-4} m (b) 1.89×10^{-4} m

68. 3.82×10^{-25} kg

70. (a) $\Delta V_H = \left(1.00 \times 10^{-4} \ \frac{\text{V}}{\text{T}}\right)B$ (b) 0.125 mm

72. (a) $v = qBh / m$. The particle moves in a semicircle of radius h, leaving the field at the point $(2h, 0, 0)$ with velocity $-v\,\mathbf{j}$.

(b) The particle moves in a semicircle of radius $r = mv / qB < h$, leaving the field at the point $(2r, 0, 0)$ with velocity $-v\,\mathbf{j}$.

(c) The particle moves in a circular arc of radius $r = mv / qB > h$, centered at $(r, 0, 0)$. The arc subtends an angle $\theta = \sin^{-1}(h / r)$. The particle leaves the field at the point $[r(1 - \cos\theta), h, 0]$ with velocity $\mathbf{v}_f = v\sin\theta\,\mathbf{i} + v\cos\theta\,\mathbf{j}$.