

Chapter 22, Homework Solution

$$2. \quad v = \frac{F}{eB} = \frac{8.9 \times 10^{-15} \text{ N}}{(1.6 \times 10^{-19} \text{ C})(0.12 \text{ T})} = \boxed{4.6 \times 10^5 \text{ m/s}}$$

$$12. \quad r = \frac{mv}{eB} = \frac{(9.11 \times 10^{-31} \text{ kg})(6.27 \times 10^5 \frac{\text{m}}{\text{s}})}{(1.6 \times 10^{-19} \text{ C})(0.55 \text{ T})} = \boxed{6.5 \times 10^{-6} \text{ m}}$$

$$14. \quad v = \frac{E}{B} = \frac{450 \frac{\text{N}}{\text{C}}}{0.12 \text{ T}} = \boxed{3.8 \text{ km/s}}$$

$$24. \quad F = ILB \sin \theta = (2.8 \text{ A})(2.25 \text{ m})(0.88 \text{ T}) \sin 36.0^\circ = \boxed{3.3 \text{ N}}$$

$$28.(a) \quad \frac{F}{L} = IB \sin \theta$$

$$B = \frac{\frac{F}{L}}{I \sin \theta} = \frac{0.033 \frac{\text{N}}{\text{m}}}{(6.2 \text{ A}) \sin 7.5^\circ} = \boxed{41 \text{ mT}}$$

$$(b) \quad \theta = \sin^{-1} \frac{\frac{F}{L}}{IB} = \sin^{-1} \frac{0.015 \frac{\text{N}}{\text{m}}}{(6.2 \text{ A})(0.04078 \text{ T})} = \boxed{3.4^\circ}$$

$$32. \quad I = \frac{\tau}{NAB \sin \theta} = \frac{23 \text{ N} \cdot \text{m}}{(200)(0.22 \text{ m})(0.16 \text{ m})(0.45 \text{ T})(1)} = \boxed{7.3 \text{ A}}$$

$$34. \quad \tau = \frac{\tau_{\max}}{2} = \frac{1}{2} IAB = IAB \sin \theta$$

$$\theta = \sin^{-1} \left(\frac{1}{2} \right) = 30^\circ$$

The angle the plane of the loop makes with the field is $90^\circ - 30^\circ = \boxed{60^\circ}$.

$$38. \quad B = \frac{\mu_0 I}{2\pi r} = \frac{\left(4\pi \times 10^{-7} \frac{\text{T}\cdot\text{m}}{\text{A}}\right)(6.81 \text{ A})}{2\pi(0.0525 \text{ m})} = \boxed{2.59 \times 10^{-5} \text{ T}}$$

$$46.(a) \quad \frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi d} = \frac{\left(4\pi \times 10^{-7} \frac{\text{T}\cdot\text{m}}{\text{A}}\right)(4.33 \text{ A})(2.75 \text{ A})}{2\pi(0.322 \text{ m})} = \boxed{7.40 \times 10^{-6} \text{ N/m}}$$

(b) The force exerted on a meter of the 4.33-A wire is the same as the force exerted on a meter of the 2.75-A wire because these forces form an action-reaction pair.

$$50. \quad B = \mu_0 n I = \left(4\pi \times 10^{-7} \frac{\text{T}\cdot\text{m}}{\text{A}}\right)(3250 \text{ m}^{-1})(3.75 \times 10^3 \text{ A}) = \boxed{15.3 \text{ T}}$$