

47. (a) The magnitude of the magnetic dipole moment is given by $\mu = NiA$, where N is the number of turns, i is the current in each turn, and A is the area of a loop. In this case the loops are circular, so $A = \pi r^2$, where r is the radius of a turn. Thus

$$i = \frac{\mu}{N\pi r^2} = \frac{2.30 \text{ A} \cdot \text{m}^2}{(160)(\pi)(0.0190 \text{ m})^2} = 12.7 \text{ A}.$$

(b) The maximum torque occurs when the dipole moment is perpendicular to the field (or the plane of the loop is parallel to the field). It is given by

$$\tau_{\text{max}} = \mu B = (2.30 \text{ A} \cdot \text{m}^2)(35.0 \times 10^{-3} \text{ T}) = 8.05 \times 10^{-2} \text{ N} \cdot \text{m}.$$