

Ch. 11 Prob. 89

$$r = 10 \text{ cm}$$

$$I = 5.0 \text{ A}$$

a) Find the magnetic dipole moment of the loop

$$\mu = I \cdot A = I \pi r^2 = (5.0 \text{ A}) \pi (0.10 \text{ m})^2 = 0.157 \text{ Am}^2$$

b)

$\mu$  +  $B$  are  $30^\circ$  from each other

Find the torque on the loop

$$B = 0.20 \text{ T}$$



Since  $\vec{\tau} = \vec{\mu} \times \vec{B}$

The magnitude is

$$\tau = \mu B \sin \theta$$

$$= (0.157 \text{ Am}^2)(0.20 \text{ T}) \sin(30^\circ)$$

$$\tau = 0.0157 \text{ N}\cdot\text{m}$$

c) Find the ~~energy~~ potential energy of the dipole

$$U = -\vec{\mu} \cdot \vec{B} = -\mu B \cos \theta$$

$$U = -(0.157 \text{ Am}^2)(0.20 \text{ T}) \cos 30$$

$$U = -0.0272 \text{ J}$$