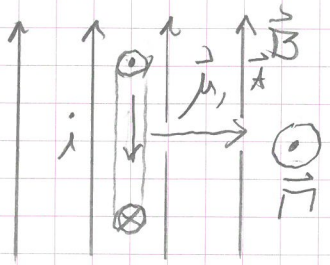
9.9) FOR A 1-CM RADIUS LOOP WITH $i = 0.4A$, FIND

a) $\vec{\mu}$

b) THE TORQUE WHEN $\vec{\mu}$ IS $\perp$ TO $\vec{B} = 1.5T\,\hat{j}$, AND

c) THE ENERGY DIFFERENCE BETWEEN $\vec{\mu}$ BEING PARALLEL AND BEING ANTIPARALLEL.

FOR A LOOP WITH THE AREA $\perp$ TO $\vec{B}$



a) $\vec{\mu} = iA$ WITH DIRECTION BY R.H.R.

$\vec{\mu} = (0.4)\left[\pi(0.01)^2\right] = 1.26\times10^{-4}\ A\cdot m^2$ RIGHT

b) TZD II (9.7) GIVES

$\vec{\tau} = \vec{\mu}\times\vec{B} = \mu B \sin\theta$ DIR BY RHR

FOR $\vec{\mu} \perp$ TO $\vec{B}$, $\theta = 90^\circ$

$\Rightarrow \tau_\perp = \mu B = (1.26\times10^{-4})(1.5)$ $\qquad (A\cdot m^2)\left(\frac{N}{A\cdot m}\right) \sim N\cdot m$

$|\tau_\perp| = 1.88\times10^{-4}\ N\cdot m$, OUT OF PAGE IN DIAGRAM

c) FIND ΔU BETWEEN PARALLEL & ANTIPARALLEL $\vec{\mu}$ & $\vec{B}$

FOR A LOOP, $U = -\vec{\mu}\cdot\vec{B} = -\mu B\cos\theta$ (9.10)

$\Rightarrow$ PARALLEL: $\theta = 0 \Rightarrow U_{\parallel} = -\mu B$

ANTIPARALLEL: $\theta = 180^\circ \Rightarrow U_{A\parallel} = +\mu B$

THUS THE DIFFERENCE IS

$\Delta U = U_{A\parallel} - U_{\parallel} = 2\mu B = 2(1.88\times10^{-4})$

$\boxed{\Delta U_{\parallel, A\parallel} = 3.77\times10^{-4}\ J} = 37.7\ \mu J$

Σ NOT INSIGNIFICANT, BUT FAIRLY SMALL.