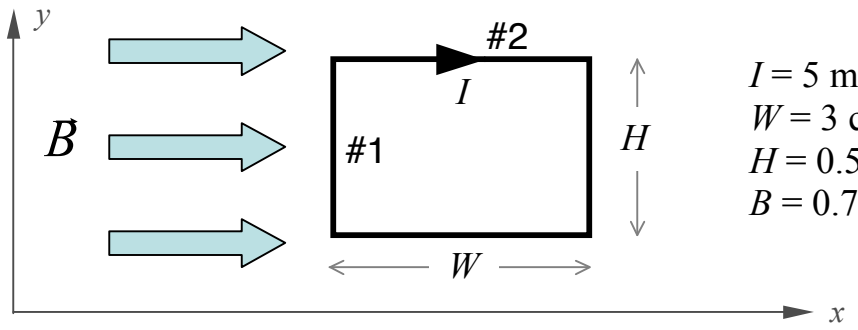
Name: _____ Sec. _____ **P212: Quiz 2 Week 8**

A rectangular wire loop with width *W* and height *H* has a clockwise current *I* running through it. The loop lies in the *xy* plane, in a constant magnetic field *B* that points in the +*x* direction.



$I = 5$ mA
$W = 3$ cm
$H = 0.5$ cm
$B = 0.75$ T

NOTE: Whenever you are asked for a **vector** quantity, give **both** its magnitude **and** direction.

1) Calculate the force $\boldsymbol{F_1}$ on the left segment of wire labeled #1. **[3]**

F is in –z direction (into page).
$F = IBH = 1.875\ 10^{-5}$ N

Rubric:
Correct problem setup (2)
Correct answer (1)

2) Calculate the force $\boldsymbol{F_2}$ on the top segment of wire labeled #2. **[3]**

$F_2 = 0$

Rubric:
Correct answer (3)

3) What is the torque $\boldsymbol{\tau}$ exerted on this loop by the magnetic field? **[6]**

$\tau = \mu \times B = IAB = IHWB = -5.625\ 10^{-7}$ Nm **y** (τ along – y direction)

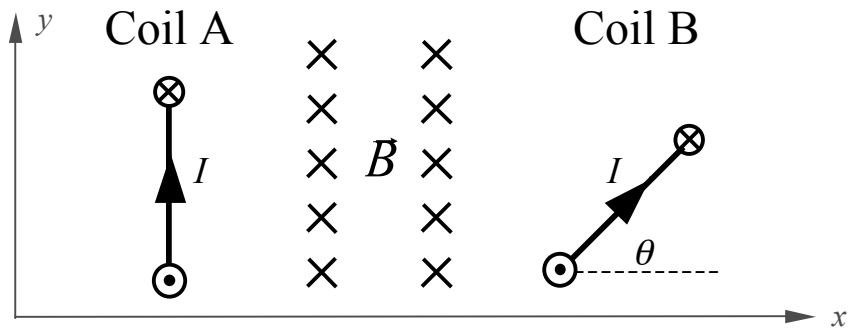
Rubric:
Correct problem setup (3)
Correct magnitude (2)
Correct direction (1)

4) In which direction would you point the magnetic field in order for the loop to be in stable equilibrium? **[4]**

Stable equilibrium at lowest U
U = - μB so minimum is when m is parallel to B → the loop is into the page

Rubric:
Use potential energy (2)
Correct answer (2)

5) Two square coils, **A** and **B**, each with side of length *a*, are situated in a region of constant magnetic field *B* directed along the negative *z*-axis as shown in the figure below. A current *I* flows in each coil in the direction shown. (The black arrows indicate the current direction on the side of the square nearest you.) The tilt angle of coil **B** is $\theta = 45°$. Compare the magnitudes $|\tau_A|$ and $|\tau_B|$ of the torques on coils **A** and **B**. **[4]**



a) $|\tau_A| < |\tau_B|$ **b) $|\tau_A| = |\tau_B|$** c) $|\tau_A| > |\tau_B|$

Rubric:
Correct answer (4)