PREFLIGHTS **LESSON 9 – NEWTON'S 3RD LAW IN ELECTROMAGNETICS**

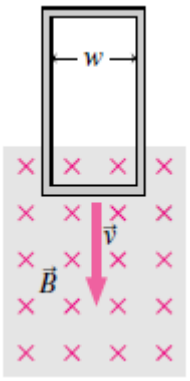
LEARNING OBJECTIVE:
Determine how Newton's 3rd law applies to situations where the electric and magnetic fields are changing.

1) On page 351, the book says, "The proof of conservation of momentum rests on the cancellation of internal forces, which follows from the third law." Describe briefly, in two or three sentences, how conservation of momentum follows from the third law.

2) Figures 8.2 and 8.3 are 3-D pictures, and it is a little difficult to determine the direction of some of the vectors from the pictures. What are the directions of $\boldsymbol{F}_e$, $\boldsymbol{F}_m$, and $\boldsymbol{B}$ on q_1 and q_2? Qualitative descriptions like "up and to the right" or "into the page" are fine. Also describe what laws or equations will give you the direction of the electric and magnetic forces on the charges.

3) The book states that the total electromagnetic forces on q_1 and q_2 do not obey Newton's 3rd law. But do the individual electric and magnetic forces obey Newton's 3rd law? *Hint: Look at Figure 8.2 and consider the case where both charges have the same charge but one is moving much much faster than the other.*

4) ***Note: This is a review question from Chapter 7.*** A rectangular conducting loop of resistance R, mass m, and width w falls into a uniform magnetic field $\boldsymbol{B}$, as shown in the picture. If the loop is long enough and the field region has a great enough vertical extent, the loop will reach a terminal speed. (a) Why? (b) Find an expression for the terminal speed. (c) What will the direction of the loop current be as the loop enters the field?



5) What did you find difficult or confusing in the pre-class work? If nothing was difficult or confusing, tell me what you found most interesting. Please be as specific as possible.

6) Document whatever help you received on the preclass work.