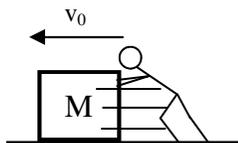
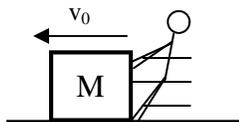


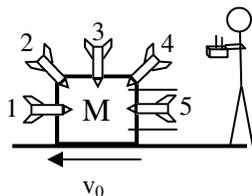
# PreAP Magnetism 7



1. A mass is moving to the left with a initial velocity of  $v_0$  (called “v-nought” [“nought” is a British word for zero] or  $v$  at time zero). Then Slim Jim pushes in the same direction (parallel) to the object’s motion. Does the object speed up, slow down, or keep the same speed?



2. This time Slim Jim acts on the mass with a force opposite of its motion (antiparallel). Does the object speed up, slow down, or keep the same speed?



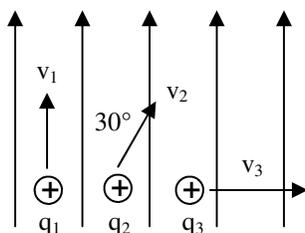
3. Slim Jim finally gets his act together and installs radio controlled rockets to the mass. With  $v_0$  again to the left and assuming no friction, which rocket should he turn on to make the following changes to the mass’s velocity?

- A. To speed it up fastest?
- B. \* To slow it down slowly?
- C. To slow it down fast?
- D. \* Which rocket will not change its velocity?

4. How horizontal is vertical?

5. So, why does a magnetic force NOT change the speed of a charged particle?

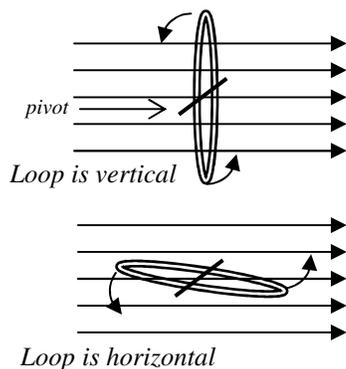
*Turns out that our equation for magnetic force is not complete, it should be:  $F_B = qvB\sin\theta$ , where  $\theta$  is between  $v$  and  $B$ .*



6. Just to simplify the math, let’s say there are three 1 C charges in a 1 T magnetic field moving 1 m/s. Notice the directions of the three charges.

- A. \* Which charge feels the greatest magnetic force?
- B. \* Which charge is crossing the most field lines per second?
- C. Which charge is not crossing any field lines?
- D. \* What is the magnetic force on  $q_2$ ?
- E. What is the magnetic force on  $q_1$ ?

*So, notice that the charge moving the most  $\perp$  to the field lines has the most force AND is crossing or “breaking” the most field lines.*



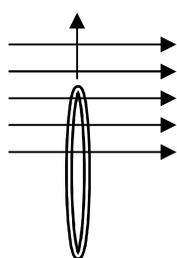
7. A loop is rotated counter-clockwise (CCW) about a diameter in a magnetic field.

- A. \* When the loop is vertical, is it breaking any magnetic field lines?
- B. So is there any  $I_{\text{induced}}$  when the loop is vertical?

*Or, by the right-hand rule, the top of the vertical loop is moving parallel to  $B$ , so there can’t be a RHR force ( $q$  and  $B$  can’t be parallel).*

- C. When the loop is horizontal, is it breaking any magnetic field lines?
- D. Is there any  $I_{\text{induced}}$  when the loop is horizontal?
- E. Using either Lenz’s Law or the RHR, determine the direction of  $I_{\text{induced}}$  in the horizontal loop, as viewed from above.

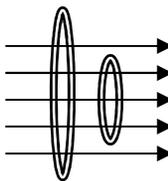
*Use Lenz’s Law or the RHR to figure out the direction of  $I$  induced in these next two examples.*



8. A. As the loop moves into the magnetic field, is  $B$  increasing or decreasing in the loop?

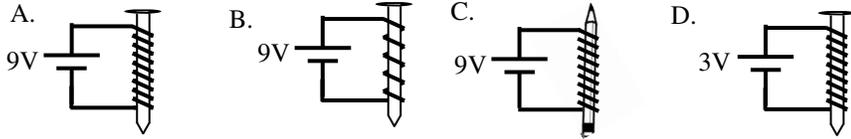
*So  $I_{\text{induced}}$  must oppose the change by making a north to the left.*

- B. As seen from the left, which direction must  $I_{\text{induced}}$  be flowing in the loop?



9. A. As the loop shrinks, does  $B$  (the magnetic field) inside the loop increase or decrease?
- B. So the  $I_{\text{induced}}$  opposes the change, making a magnetic field point left or right?
- C. As seen from the left, give the direction of the induced current in the loop.

PreAP Magnetism 6—p2



10. Which of the four electromagnets will be the strongest? (*You should be able to figure this out.*)

A generator “generates” electricity by wires being turned thru magnetic fields (or vice versa). Generators take mechanical energy from wind, moving steam (as in power plants), or a belt in your car and turn it into electrical energy. If hooked up in reverse (electricity in) a generator becomes a motor, which takes electrical energy and turns it into motion. A generator can be a motor. A motor can be a generator. Both contain magnets and wires.

11. Motor, Generator, or Both?

- |                                  |   |
|----------------------------------|---|
| A. ____ Creates electricity.     | F. ____ Can make electricity.               |
| B. ____ Has loops of wire in it. | G. ____ Used in a hydroelectric dam.        |
| C. ____ Creates motion.          | H. ____ Opens the windows in a car.         |
| D. ____ Is turned by a force.    | I. ____ Turns when electricity is applied . |
| E. ____ Device 1 (below).        | J. ____ Device 2 (below).                   |



- 3B) rocket 2, it is partially antiparallel
- 3D) rocket 3, it is completely vertical.
- 6A)  $q_3$ , since  $\sin 90^\circ = 1$ .
- 6B)  $q_3$
- 6D) 0.5 N
- 7A) No