PhyzLab Springboard: Right Hand Rule #2 X

• Purpose •
To determine the geometry of the directions of electric current, magnetic field, and magnetic force and develop a "handy" mnemonic device using your right hand

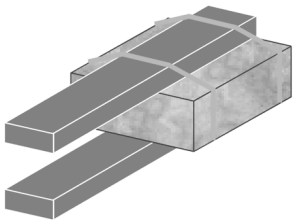
• Apparatus •
___DC source (battery or hand-crank generator)
___connecting wires
___"magnetic sandwich" (two antiparallel bar magnets sandwiching a wood block held together with rubber bands)

• Discussion •
As observed in the "Electric Magnetism" lab, an electric current passing through a magnetic field experiences a magnetic force. In this activity, you will determine the geometric relationship between the directions of current, field, and force. And you will determine an easy way to reconstruct those geometric relationships using your right hand.

• Procedure •
1. What are the six perpendicular directions in three-dimensional space?

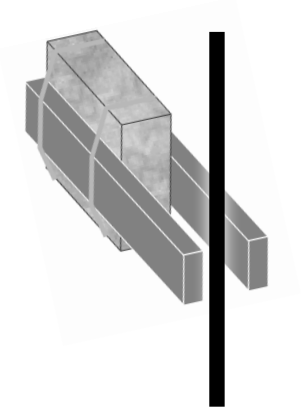
↑	↓	←	→	×	•
Up	Down	Left	Right	In	Out

2. Build the magnetic sandwich as shown to the right.



3. Create a simple circuit that will include a length of wire that can hang (dangle) vertically and be free to move. By switching connections to the battery (or switching the direction of cranking), you'll be able to make current move up or down in the wire.

4. Place the magnetic sandwich so that the dangling wire passes between its poles as shown below and to the right.

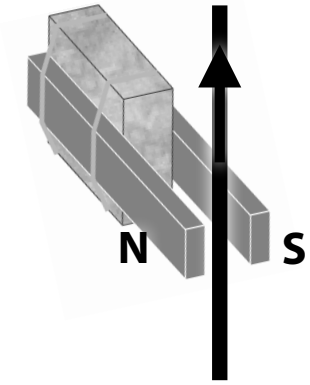


5. Experiment with the arrangement by running current up and down in the wire, noting the direction of magnetic force. Also reverse the direction of the magnetic field by flipping the sandwich.

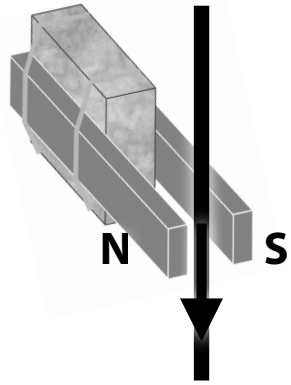
6. Recognize the **mutual perpendicularity** among the directions of electric current, magnetic field, and magnetic force. By the way, what is meant by "mutual perpendicularity"?

7. Now let's lock down the specific directions involved in four distinct geometric configurations. Complete the table in each distinct case. What does each symbol represent?

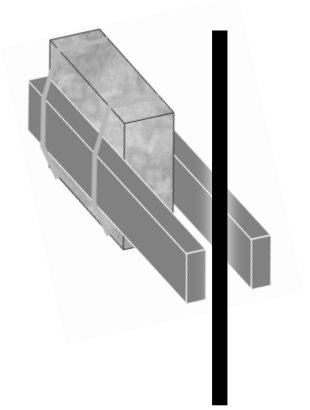
I:_____ B:_____ F:_____



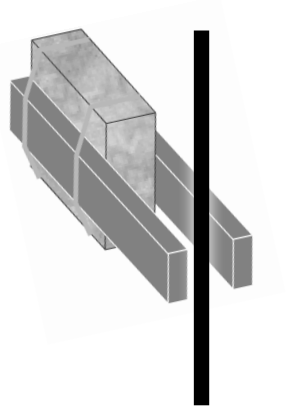
I	↑
B	→
F	



I	
B	
F	

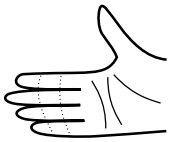


I	
B	
F	



I	
B	
F	

8. A rigid right hand (held flat) can be visualized as representing three mutually perpendicular directions. In the example illustration below, the fingers point to the left ←, the thumb points up ↑, and the palm points out • . What's going on in the other illustrations?



fingers	←
thumb	↑
palm	•

fingers	
thumb	
palm	

fingers	
thumb	
palm	

9. Each magnetic force on a current-carrying wire configuration has three directions: I, B, and F. The rigid, flat right hand has three directions: fingers, thumb, and palm. To represent the magnetic force geometry, which parts of the anatomy should represent which electromagnetic quantities?