Lab: Electric Motors AP Physics

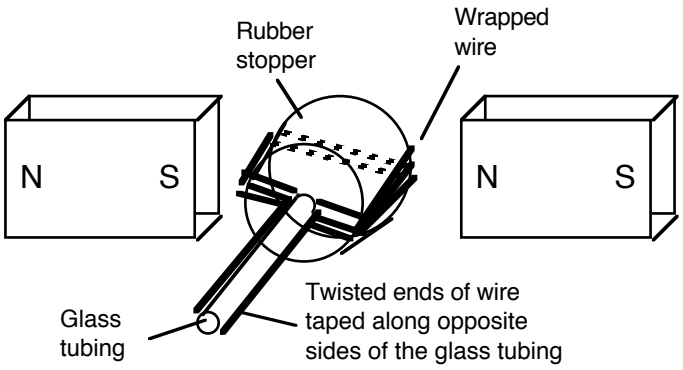
Background
A current running through a wire, in the presence of an external magnetic field, experiences a magnetic force. The magnitude and direction of that force is described by the equation $\vec{\mathbf{F}} = I\vec{\mathbf{L}} \times \vec{\mathbf{B}} = ILB\sin\theta$. The direction of force can be predicted by using the Right Hand Rule.

Objective
To build an electric motor that will run for at least 10 seconds.

Equipment

1 wood block	1 glass tube with rubber stopper	1 long, plastic-coated wire
4 paper clips	6 pushpins or thumb tacks	metal file

Set-Up



Procedure
1. Wrap the wire around the rubber stopper, leaving about 10 cm free on each end.
2. Bend each free end of wire into a loop, and then twist each loop into a tightly-twisted wire.
3. Use two pieces of tape to secure the two twisted wires on opposite sides of the glass rod.
4. Use a file to scrape off the plastic coating on the outside of the twisted wires.
5. Use two paper clips to make a holder for the glass rod. Attach the paper clips to the end of the wood block using two pushpins on each side. Make sure the glass rod can spin easily in the holders.
6. Attach two more paper clips to the block so that they make contact with the twisted wires as the rod spins. The ends of these paper clips should hang off the side of the block, so that wires can be clipped on there.
7. Take your motor up to the front desk. Attach a voltage source to the clips that make contact with the wires, and put the wire coils inside the powerful magnets.
8. Turn on the voltage source, give your motor a starting push, and watch it spin!

Questions
1. The picture below is a simplified picture of your motor. On the diagram, indicate
   a. the direction of the magnetic field around the rotor,
   b. the direction of force acting on the coils in the motor, and
   c. the direction of rotation of the rotor.
2. Using what you know about the forces that magnets apply to a current, explain why your motor spins.