

Lab Partners: \_\_\_\_\_

**Purpose:**

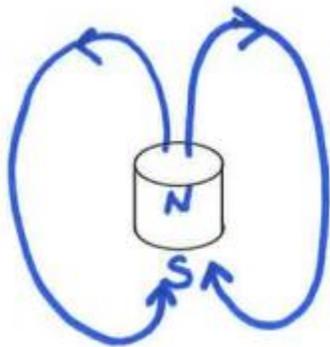
*In this lab you will build a simple electric motor. The purpose of building an electric motor is to help you understand how they work and to help you learn what factors affect the operation of an electric motor.*

**Background:**

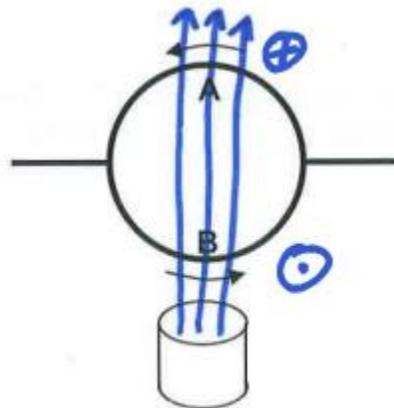
*In most electric motors, the magnetic field continually needs to change direction. In order to change the direction of the magnetic field the direction of the current in a wire needs to be reversed. Because reversing an electric current in a DC motor or switching it on and off requires some sort of moving part, it makes sense to have the rotor (the moving part) be an electromagnet. Such an electromagnetic rotor is called an armature. Most electric motors run because the direction of the current is changed. This is more effective because a force is continually applied to the armature. The motor you will make is not going to change the direction of the current but rather just turn the current on and off. Therefore, the force that makes it work will only be applied to the armature for half of the rotation.*

**Pre-Lab Questions:**

1. If the north pole is facing up and the south pole is facing down, draw the magnetic field directly above and below the magnet.



2. If you have current running through your armature in the direction shown on the diagram below, use the second right hand rule to determine **and label** the direction of the force at points A & B.



3. The force from #2 causes the armature to rotate until the insulated part of the armature touches the paper clip (so no current flows). If there is no current there is no Force.

The armature however stays in motion due to its Inertia. This is an example of what law of physics?

Newton's second law

## Magnetism

### Materials:

For this lab you will need a D Cell battery, a magnet, two jumbo paper clips, thin enameled wire, a rubber band, and sandpaper.

### Procedure:

### Analysis:

1. What are the two basic parts to your electric motor?

The two basic parts of an electric motor are a magnet and a current carrying coil.

2. Give a brief description of how the electric motor you made works including how the force is generated and how it acts on the coil.

A current carrying coil is placed in a magnetic field so that the field produces a force on the coil. The force on the coil causes the coil to rotate resulting in a small electric motor.

3. In most electric motor the current in the armature periodically changes direction in order to keep the forces acting on the coin in the same direction. In the motor, you made did the current change direction? If so explain how, if not explain what you did instead to keep the motor spinning in the same direction.

No, we were unable to change the direction of the current as the motor rotated. This would require the addition of what is called a commutator to flip the current when the force changes direction. In our motor we interrupted the current while the forces were in an opposite direction allowing the motor to rotate freely until the forces were in the original direction.

4. Find two ways to make the motor rotate the other way. (Try it)

1. Flip the direction of the magnetic field. (Turn the magnet over)
2. Flip the direction that the current flows through the coil.

5. How could you make the motor run faster?

A motor can be made to run faster by adding more voltage (current), adding more coils, and increasing the magnetic field strength.

