# Physics 1000 Loops, Currents, and Magnets

## Purpose

To explore the relationship between magnets and currents flowing through wires.

## Part I: Coils and Magnets

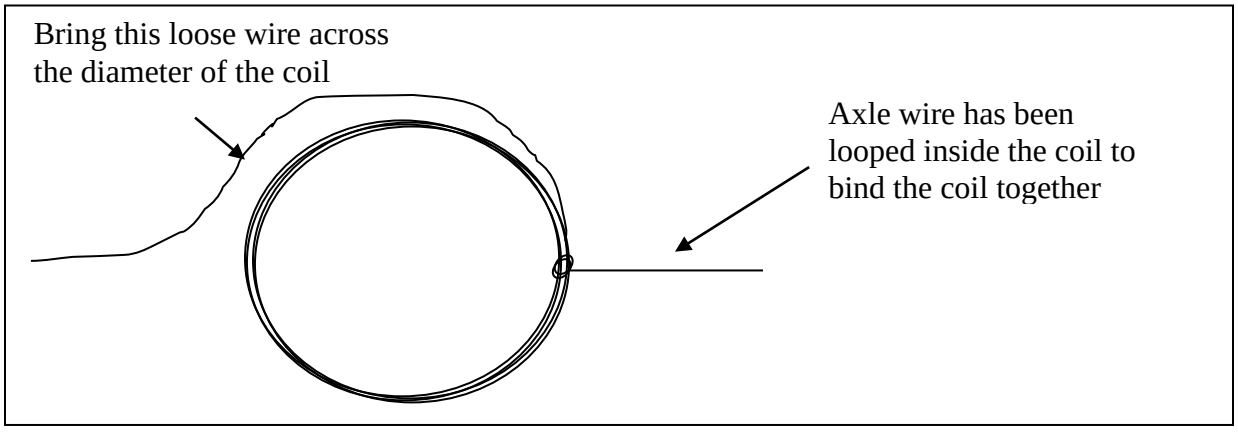
In groups of two, determine the maximum AC voltage that can be achieved by rapidly oscillating a magnet through the provided coils. The magnet should be attached to the end of a short piece of steel rod so that you can hold on to the magnet. Connect leads to the VΩ and COM ports of a multimeter and make sure the multimeter is set to read AC voltage. Depending on the meter, the dial will need to be set to the appropriate ~V range, or the dial will need to be set to an appropriate voltage range and the switch will need to be set to AC. Ask you TA for help if necessary. The other ends of the leads should be connected to a coil. Only one coil should be connected to the multimeter at a time. After the multimeter is connected to a coil, rapidly oscillate the magnet in and out of the coil to achieve the maximum voltage possible and record the voltage for each coil on the data sheet.

The larger of the two coils has 2920 turns of wire, and the smaller of the two coils has 235 turns of wire.

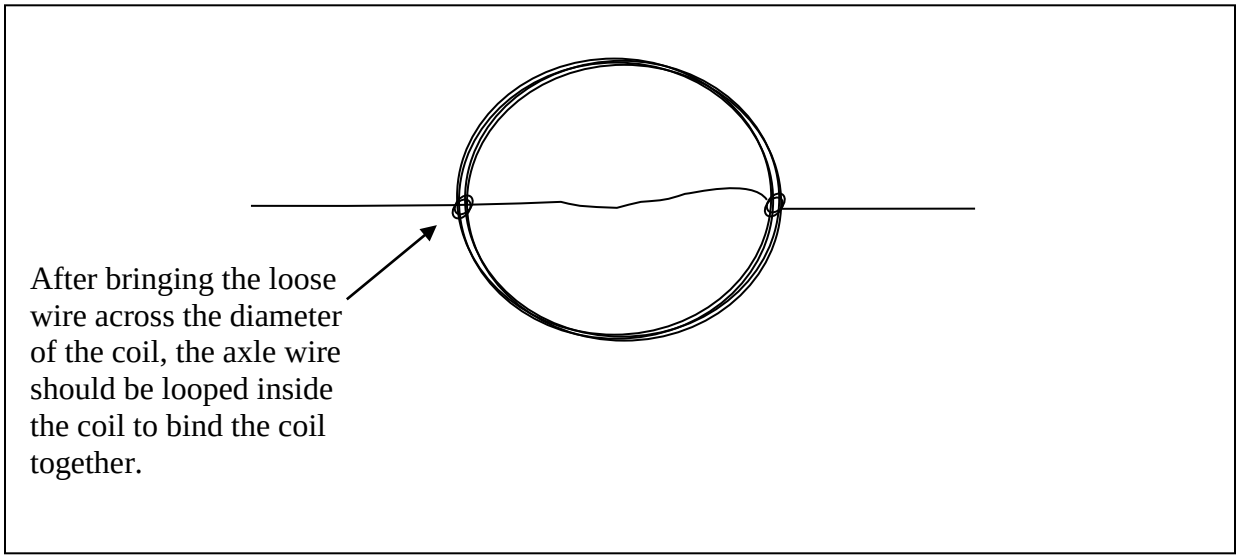
## Part II: Building a Simple Motor

Working in groups of two, each group should build two working motors such that each student will have their own working motor.

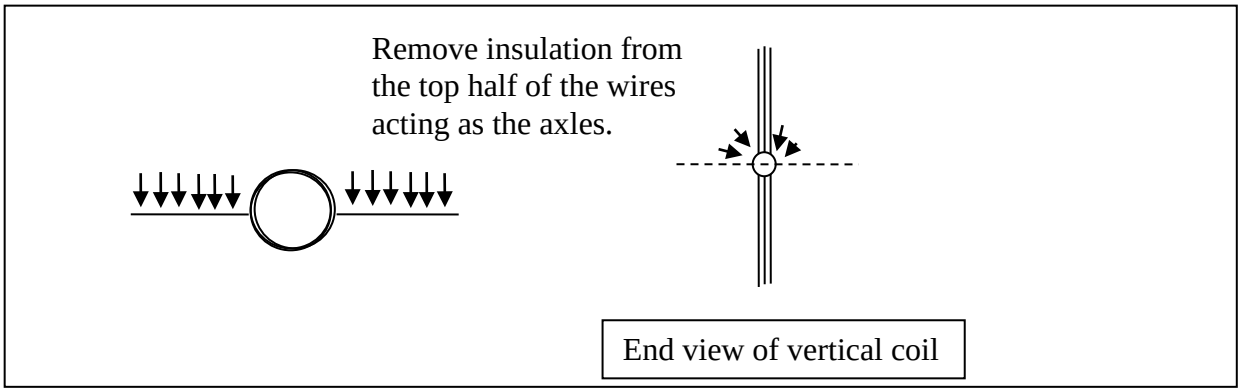
1. Starting with approximately 20” of 24 awg wire, make a coil using the AA battery as a form. You will need approximately 2” of wire on opposite sides of the coil to use as axles so do not wind all of your wire around the AA battery.
2. Carefully remove the coil from the AA battery.
3. Your coil will need to be secured by looping the wires that will be the axles through the coil one or two times thus binding the coil together and holding the axles in place.



4. It is important to balance the coil as much as possible. The loose length of wire shown in the diagram above will form a half loop and cause the coil to be unbalanced (The top will weigh more than the bottom). Instead of forming a half loop, bring the loose wire straight across the diameter of the coil. Now loop this wire through the coil one or two times to secure the coil and axle in place.



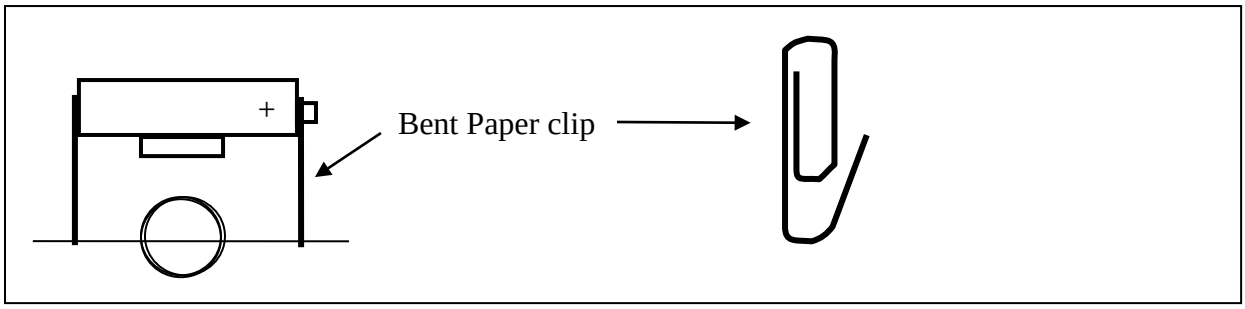

5. Once your coil is secure, you will need to remove some of the reddish insulation that is coating the wire. It is important to only remove half of the insulation around the circumference of the wire.




With the axles horizontal and the coil held in a vertical position, carefully remove the top half of the insulation from each axle using sand paper. Place the axle on the sanding board and move the sand paper away from the coil towards the end of the axle in a uniform stroke. Do not try to run the sand paper back towards the coil. The sanding stroke should start at the coil and move towards the end of the axle. This method will least likely cause the wire to bend. It is important to remove the insulation from the same 'top' side on both axles. Otherwise, current will not flow.

6. Align your axles the best you can so that they are in line with each other at opposite sides of the coil.
7. Attach a round magnet to the AA battery. Note: If the AA battery is not an alkaline battery, the magnet may not stick because the case of the battery may not be made of steel. In this case, you may have to use a hot melt glue gun to secure the magnet in place.

8. Bend two paper clips so that the axles of the motor will be able to slide into position under the magnet.




9. While holding one paper clip in place at each end of the battery with your thumb and finger, slide the coil into position under the magnet.
10. Flick the coil with your finger if the coil does not begin to turn.
11. If your coil does not turn continuously, check to make sure that the insulation was removed in the proper locations and that a sufficient amount of insulation was removed.

After you have built your motor and it works, you will be allowed to take the 3/4" diameter magnet, the paperclips, and your coil home. DO NOT take the AA battery home. You should be able to use a AA, C, or D battery at home to make your motor work. However, the battery will need to be an alkaline type battery so that the magnet will attach to the battery. Alkaline batteries utilize a steel can to contain the active ingredients of the battery. Carbon zinc batteries use zinc cans.

At home, each student will need to research how their motor works and type an explanation of how their motor works. The guidelines for the explanation are as follows:

- Typed double spaced.
- 250 to 300 words
- Include hand drawn diagrams to insure the explanation is as clear as possible.
- All resources that were utilized during the research must be listed.
- The magnet must be returned with the typed explanation.

The typed explanation and the magnet must be turned in to the TA during the next lab meeting. You may keep your coil and paperclips, but your magnet must be returned to receive credit for your typed summary.

**Name: _____** **Name: _____**

# Data Sheet
# Physics 1000
# Loops, Currents, and Magnets

## Part I Coils and Magnets

Maximum Voltage for the Larger Coil: _____

Maximum Voltage for the Smaller Coil: _____

Explain the voltage difference between each coil.

_____

_____

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_____

_____

_____

_____

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## Part II Building the Simple Motor

TA Check of Motor 1 _____

TA Check of Motor 2_____

*Each student will be required to turn in a typed explanation of how the motor works next week.*