

Lab D10 Simple Motors and Generators

A Quick Review Lesson on Magnetic force

Single particle & magnetic force

The four things necessary for a particle to experience a magnetic force are _____, _____, _____ and _____.

The expression for the magnitude of the magnetic force on a charge is _____.

The direction of the magnetic force is always perpendicular to the _____ and the _____.

To determine the direction of the force on a moving charge, we use the _____ rule. The thumb represents the _____, the fingers represent the _____ and the palm stands for the _____.

Current and magnetic force

Now consider a straight wire of length L which carries a DC current. If a total amount of charge Q travels the length of the wire in time t , we can modify our force equation for a single charge by multiplying and dividing by _____ like so :

recalling that Q/t is simply I and vt is simply L , we have:

which represents the magnetic force on a current carrying wire. As in the case for a single charge, the force is largest when the wire is oriented _____ to the field and goes to zero when the wire is _____ to the field.

One dramatic demonstration of the magnetic force on a current carrying wire (which you saw) is:

Magnetic force and current loops

Diagram/describe the forces on the different parts of the current loop in the magnetic field shown on the board:

What might happen to the loop due to these forces?

In what orientation does the loop feel the largest twisting force?

In what orientation does the loop feel the least twisting force? How does the loop make it past this position?

What is the problem with a continuous connection to the DC source? How is this remedied?

What happens if the single loop is increased to several loops to make a coil?

The basic principle involved in making a coil rotate in a magnetic field is the basic principle of a DC _____ which converts _____ energy to _____ energy.

Now you will make your own very simple motor following the step-by-step instructions of your teacher....

The electrons move through a coil of copper wire. The means of making the electrons in the wire move will be a _____ which converts _____ energy to _____ energy. The magnetic field will be supplied by _____.

Be patient with yourself, but don't spend more than 10 minutes on this! This motor is a crude and delicate device. It requires careful handling and a bit of luck for success. If you have trouble, try moving the magnet slightly or repositioning the coil. :)

Sketch your motor, labeling the parts.

Challenge: What can you change to make your coil rotate in the opposite direction? Describe. Try it!

A quick experiment with the Genecon

A Genecon is a device which can serve as an electric motor. What is the energy conversion involved in this case?

The really neat thing about the Genecon is that it can also be used as an electric generator. What is the energy conversion involved?

You may choose one of the following explorations.

I. Use various batteries to apply different voltages to the Genecon leads so that the handle of the Genecon rotates. Record the input voltage and the turning frequency of the Genecon--describe your data collection method. Construct a graph of output frequency versus input voltage. You need AT LEAST 4 data points for your graph. Describe the shape of your graph. Is the Genecon being used as a motor or a generator in this case--explain? Write up your investigation and be prepared to share your results with the class.

II. Hook the leads of two Genecons together. Your goal here is to turn one of the handles and observe that the other handle turns on its own. Do not turn too fast or you will strip the plastic gears inside the Genecon! Measure the input turning frequency and the output turning frequency --describe your data collection method. Construct a graph of output frequency versus input frequency. You need AT LEAST 4 data points for your graph. Describe the shape of your graph. Are the Genecons being used as a motors or a generators or both in this case--explain? Write up your investigation and be prepared to share your results with the class.