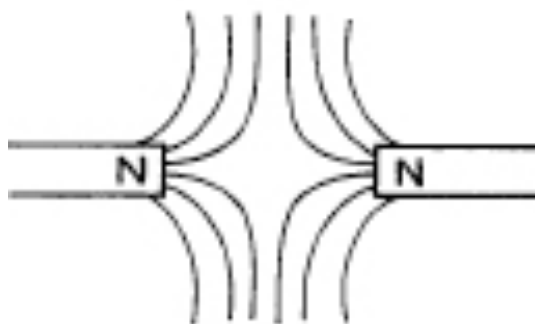


## Lab: Magnetic Force, Part One

When you hold two magnets close to one another, they feel either an attractive or a repulsive force between them, depending on their orientation. It appears that the magnitude of this force depends on the distance between the two magnets. But how?



Question: How does the force between two magnets change if you change the distance between them?

**EQUIPMENT:** This lab requires neodymium magnets, or other very strong magnets. With ordinary bar magnets, the distance over which there's a detectable interaction is only about 1 cm – too small for measuring force vs. distance. With neodymium magnets, there is about 2 cm, which is still tough, but better.

### Pre-lab Discussion

### Whole Class

**10 minutes**

- Show them the magnets. Take “magnet attendance” before and after lab – it’s easy for these to get lost. Warn them that they’re strong enough to erase credit cards.
- Make it clear *what* they’re going to be measuring, that they are trying to explore the relationship between two variables, distance and force. People tend to measure weird things that document something about the strength of the interaction without actually measuring the force in any discernable way.
- Make clear that designing a proper experiment will take up a large amount of time.

### Planning the Experiment

### Groups of 4

**20 minutes**

- Make sure they are varying the distance between the magnets somehow.
- Make sure they are planning to collect an appropriate amount of data.
- Make sure they are aware of how they are measuring the force.
- Make sure they are dealing with variations in the data in some responsible way.

### Data Collecting

### Groups of 4

**20 minutes**

### Class Discussion

### Whole Class

**20 minutes**

- Have each group present their methods *quickly*. After this discussion the students will get an opportunity to make changes to their experiment.
- Think about what you are trying to promote in the class discussions and how you will promote it. More participation? More serious critique of the presenting group? More clarity in the presentations (about differences in experimental technique)? More discussion of variation in the data?

### More Data Collecting

### Groups of 4

**30 minutes**

- Students should use the feedback from the presentations to get better data.

### Writing the Report

### Groups of 4

**10 minutes**