Detecting the Magnetic Field

Overview: Remember, there are four different kinds of forces: strong nuclear force, electromagnetism, weak nuclear force, and gravity. There are also four basic force fields that you come into contact with all the time. They are the gravitational field, the electric field, the magnetic field, and the electromagnetic field. Notice that those four force fields really only use two of the four different kinds of force: electromagnetism and gravity. Let's take a quick look at what causes these four fields and what kind of objects they can affect, starting with the magnetic field.

What to Learn: Magnets can be used to make some objects move without being touched.

Materials

- needle
- foam (small piece)
- magnet
- cup or bowl
- water
- compass

Lab Time

1. To make a compass, you need a needle and a compass.
2. Swipe the needle with the magnet – only in one direction – many, many times.
3. Stick the magnetized needle through a piece of foam so that it will float.
4. Place the foam and needle in a cup or small bowl of water.
5. You can check the needle with a compass to make sure they are pointing the same direction.
6. Look at the compass, but don't pick it up. Walk anywhere and keep your eye on the compass.
7. Turn in circles and keep your eye on the compass (don't get too dizzy).
8. The Earth's magnetic force field, one of those strange and mysterious force fields, always pushes that needle in the same direction. It's invisible and you can't feel it … but the needle can!

Detecting the Magnetic Field Data Table

To complete these trial runs with your compass, you'll need to calibrate your compass first. Find North by using a real compass, and then look at your compass. The needles should be facing the same direction (if not, re-magnetize your needle). Mark the side of your cup that the needle points to with a "N, just like the real compass has. Mark the other three directions (South, East, and West) based on your mark for North.

Now you're ready to do your experiments.

Location of Compass	Direction Indication?

Reading

You're probably fairly familiar with magnetic fields. If you've ever stuck a magnet to a refrigerator, you've taken advantage of magnetic fields. Sticking a magnet to a refrigerator is one of those everyday experiences that should just be absolutely flabbergasting. There you are holding an "I'd Rather be Relative" magnet and it sticks to the fridge! But wait a minute, if you put it on the wall … it falls off! How does it "know" what to stick to? Not only does it stick to the fridge, it also pushes some things away, attracts other things and couldn't care less about still other things. What's that all about?! We rarely think about what magnets do but, wow, the things they do are weird!

Magnetic fields come from objects that have a surplus of electrons all moving in the same direction. This can be an electric wire with current running through it or one of several special types of metals. Iron, nickel and cobalt are the most common metals that can be magnetic. Magnetic fields can only affect objects that can be magnetic themselves. That's why a magnet can attract an iron nail, but it can't attract an aluminum can. The iron nail can be magnetic, but the aluminum cannot. Magnets can also be attractive or repulsive. Two magnets with the same kind of poles facing one another will push themselves apart. Two magnets with opposite poles facing one another will pull themselves together.

Using a compass and the Earth, you can do a simple experiment to detect the magnetic field of our planet. (If you don't have a compass, just slide a magnet along the length of a needle several times (make sure you only swipe in one direction!) then stick it through a cork or bit of foam. Float the needle-foam thing in a cup of water.)

Again a very simple little activity, but I hope you can see the point. No matter where you went or what you did, that needle always pointed the same direction! The Earth's magnetic force field, another strange and mysterious force, always pushes that needle in the same direction. It's invisible and you can't feel it … but the needle can!

Exercises Answer the questions below:

1. Why does the needle need the foam?

2. Why do we use water?

3. What are the forces in a magnetic field?

Answers to Exercises: Detecting the Magnetic Field

1. Why does the needle need the foam? (So it can float and align with the magnetic field.)
2. Why do we use water? (Water is very low-friction, so it allows the needle to move and orient itself.)
3. What are the forces in a magnetic field? (attractive and repulsive)