Flying Paperclip

Overview: In fields, the closer something gets to the source of the field, the stronger the force of the field gets. This is called the inverse-square law.

What to Learn: The inverse-square law applies to quite a few phenomena in physics. When it comes to forces, it basically means that the closer an object comes to the source of a force, the stronger that force will be on that object. The farther that same object gets from the force's source, the weaker the effect of the force.

Materials

- magnets (4)
- paper clip
- string
- ruler
- tape

Lab Time

1. Tie the string to one of the paperclips.
2. Tape the end of the string to the table.
3. Bring your magnet close to the paperclip so the paperclip flies up to it.
4. Using a ruler, measure how far your magnet is when the paperclip falls back to the table. Which part of your magnet is it most attracted to? Which part of the magnet is the strongest? That's the side of the magnet we want to use when you record your data.
5. Repeat steps 3 and 4 with all of your different magnets.
6. Complete the data table. (Don't forget your units in column 3! Did you measure in inches, feet, centimeters…?)

Flying Paper Clip Data Table

Type/Shape of Magnet	Which part is the strongest?	How far before the paperclip falls?

Reading

The inverse square law states that the closer something gets to the object causing the force, the stronger the force gets on that object. The inverse square law applies when some force or energy is radiated outward from a point source. Imagine turning on a light in the middle of the room. The light bulb is your point source, and the light coming from the bulb will spread out the further it gets from the source. Since the surface area of a sphere is proportional to the square of the radius, the farther the light gets from the source, the more spread out it will be. The inverse square law is seen in gravitation problems between two point masses as they increase their distance apart from each other, in electrostatics between two electrically charged particles, in light (and other electromagnetic radiation) as the intensity radiates from a point source, and in acoustics as the sound pressure gets further from its source.

Exercises: Answer the questions below:

1. Circle one: The closer you get to the magnet, the (stronger | weaker) the force of the magnetic field is on the paper clip.

2. Why does it matter which way you orient the magnet in this experiment?

3. Which magnet has the strongest magnetic field?

4. Is the north or south pole stronger on a magnet?

Answers to Exercises: Flying Paperclip

1. Circle one: The closer you get to the magnet, the (**stronger** weaker) the force of the magnetic field is on the paper clip.
2. Why does it matter which way you orient the magnet in this experiment? (The magnetic force is strongest at the magnetic poles.)
3. Which magnet has the strongest magnetic field? (Refer to your data.)
4. Is the north or south pole stronger on a magnet? (Neither – they are identical in force.)