**Station 1: Exploring Invisible Forces**

Materials

* 2 Bar magnets
* Various objects of different materials

Procedure

1. Take both magnets and manipulate them in different ways, putting different sides together. Record your observations.
2. Study the objects provided and group them based on what you know about the materials. Which do you think will be attracted to a magnet. Why?
3. Test each object by bringing one magnet closest to it. Record your results in your student guide.

Discussion Questions

1. How did orienting the two magnets different ways affect how they moved? Why do you think this happened?
2. What conclusions can you make about the different objects tested?
3. Do all objects have this “invisible force” acting on them? If not, which ones?

Source

* http://sciencenetlinks.com/lessons/magnets-1-magnetic-pick-ups/

**Station 2: Testing the Strength of an Invisible Force**

Materials

* Paper clip
* Piece of Thread
* Tape
* Small bar or horseshoe magnet

Procedure

1. Tie one end of the thread to the paper clip.
2. Tape the other end of the thread to the table.
3. Hold the magnet above the paper clip.
4. Try to hold the paper clip up in the air without letting the paper clip and magnet touch.

Discussion Questions

1. How do you think the magnet is able to move the paper clip without touching it?
2. Is the magnet always able to move the paper clip?
   1. If not, what factor affects when the magnet can move the paper clip or not?

Source

* http://sciencenetlinks.com/lessons/magnets-2-how-strong-is-your-magnet/

**Station 3: Exploring Invisible Fields**

Materials

* 2 Bar Magnets
* Paper Clip
* Ziploc bags with 3x5 index card and iron filings inside

Procedure

1. Lay the plastic bag on a table and shake it gently back and forth until there is a thin layer of filings on top of the index card in the bag.
2. Lay the paper clip down at the other end of your desk. Gently life up the bag and hold it right over the paper clip. Record your observations.
3. Lay your magnet at the other end of your desk. Repeat Step 1 and then gently lift up your bag to hold it right over the magnet. Record your observations.
4. Repeat Step 1. Place both magnets end-to-end at the other end of your desk. Gently lift your plastic bag and place it on top of the two magnets. Record your observations.
5. Repeat Step 1. Switch magnets so other ends face each other and place at other end of desk. Gently lift your plastic bag and place it on top of the two magnets. Record your observations.

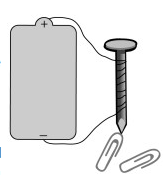
Discussion Questions

1. The fields we have been exploring are invisible, but the iron filings allow us to see the pattern of the field. How did these filings differ in the different scenarios you conducted above?
2. Where do you see the most filings? This is where the field is the strongest.

Source

* http://sciencenetlinks.com/lessons/exploring-magnetic-fields/

**Station 4: Creating Invisible Fields**



Materials

* 5 feet insulated copper wire
* 6-volt battery
* D-size battery
* Large iron nail
* Paper clips

Procedure

1. Tightly wrap the wire around the nail, wrapping more than one layer if possible.
2. Try to pick up some paperclips with the wire-wrapped nail. Record your observations.
3. Strip an inch of insulation off each end of the wire (teacher may do this).
4. Hook up the wire to one battery at both ends.
5. Try to pick up the paperclips with the wire-wrapped nail. Record your observations, including how many paperclips you are able to pick up.

Discussion Questions

1. Does the invisible force exist between just the wire-wrapped nail and the paper clips?
2. How were you able to create the invisible force between the wire-wrapped nail and the paper clips?
3. What factors do you think might affect the strength of the invisible force?

Source

* https://www.homesciencetools.com/a/electromagnetism-science-project