Investigations in Magnetism Across Scale

Investigation 4:
Straw Magnets

Name ____________________ Per ____

Your Goal: is to make a model of a magnet, a “straw magnet,” using what are called iron filings (little shavings of iron) and a drinking straw. You will magnetize and demagnetize your magnet and then propose a theory to explain how these processes occur. You may work in groups but everybody should get to make their own straw magnet to take home!

Things you will need:
- Soda straw
- Compass
- Iron filings
- Plastic weighing dish
- Low temperature hot glue gun
- Plastic pipet
- Bar magnet
- Scissors

Safety! You will be using a hot glue gun with hot glue. Please do not burn yourself!

Procedure

1. Plug one end of a straw (8-10 cm long) with hot glue (figure 1). Let it cool for a few minutes.
2. While the glue is cooling, make a small plastic funnel by snipping off the stem and top part of the bulb from a disposable pipet (share 1-2 between everyone at your table). The stem of the pipet should fit into the straw.
3. Add enough iron filings into a plastic weighing dish to fill the straw.
4. When the glue has cooled, use the plastic dish and the pipet funnel to almost fill the straw with iron filings (figure 2). Do this over a piece of paper you can put what you spill back into the dish. Don’t make a mess!
5. Tap the straw gently and add iron filings if necessary. Allow enough room to have a tiny bit more space than you need to glue the end closed (figure 3).
6. Glue the second end closed with a plug of glue.
7. Magnetize your straw magnet by rubbing it with one end of the permanent magnet, rubbing in one direction (Figure 3) Fifteen to twenty times should be sufficient.
8. Without disturbing the filings inside the straw, gently lay it down in the middle of the space at the top of the next page.
9. Map out the magnetic field around your straw magnet using a compass. Show the direction of the compass needle at various points around the straw. If you think the straw has magnetic poles, label them N and S.

10. Now, pick up the straw and shake it up and repeat steps 9 and 10 using the compass. Draw a sketch, as before, showing the positions of the compass needle as you move it around the straw magnet.
11. In what ways does the straw magnet help you understand how something like a nail or a wire could be magnetized and de-magnetized?

   a. Did the straw magnet ever have a magnetic field? Explain how you know.

12. How is magnetizing and un-magnetizing something like a nail or a wire different from magnetizing and un-magnetizing the straw magnet?

13. In a magnet or a magnetized object, the origin of the magnetic field surrounding the object is dependent upon the concept of alignment. What does alignment mean in this context? What is aligning and how would this contribute to the origin of the field?
14. Magnetic domains in a ferromagnetic material, like a nail or a steel wire, are actually about the size of a single iron filing in your straw magnet.
   a. Draw a picture of a section of your straw magnet showing 15-20 iron filings (magnetic domains), indicating the magnetic moment of each with an arrow, in the magnetized straw magnet.

   b. Draw a similar picture, showing the magnetic moments of the domains in the unmagnetized straw magnet.

15. Making an analogy is using something familiar to try to explain something more difficult or abstract. Think of an analogy that you think you could use to help someone else understand what happens when you use a magnet to magnetize something like a wire or a nail.