Straw Magnets	Name	Per
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**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.
- 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. Now **put the magnet far away**.
- 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.



Figure 1



Figure 2

Figure 3



- 9. Trace an outline of your straw in the space below and draw the magnetic field surrounding it. Label the North and South poles of your straw magnet.
  - a. Show the direction of the compass needle on each field line around the straw.
  - b. Label the North and South poles of your straw magnet.

10. Now, pick up the straw and shake it up. Place it in the space below and draw an outline. Now repeat steps 9 and 10 using the compass. Draw a sketch, as before, showing the positions of the compass needle around the straw magnet.

11. In what ways does the straw magnet help you understand how something like a nail could be magnetized and de-magnetized?

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

12. How do you think magnetizing and un-magnetizing something like a nail or a wire is **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 do you think alignment means in this context? What is aligning and how would this contribute to the origin of the magnetic 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.

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