



Making and Breaking Magnets



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Overview

Can you turn a paper clip into a magnet? If you create a magnet, can you then take away the magnetic-ness? The answer to both questions is 'yes'; let's investigate how and why.

Doing the activity

Carefully unwrap the neodymium magnet (keep it away from credit cards, cell phones, computers, other magnets, etc.); you have two paper clips included in the bag with this magnet. If you just touch the paper clips together, can you pick one up using the other? Now, tap the end of one of the paper clips against the neodymium magnet about 10 times. Try picking up the other paperclip again — what happens now? If you drop the paper clip you tapped against the magnet onto a hard surface, does anything change when you try to pick up the other paper clip?

Necessary materials:

- neodymium magnet*
- paper clips

***Be careful with this magnet!** It's very strong, and can wipe credit cards, do bad things to cell phones, break if it "jumps" to a surface, etc.

What's happening

The paper clips are made of steel, which is *ferromagnetic* because it contains iron. As we discussed in the *Magnetic Surprises* activity, ferromagnetic materials aren't permanent magnets on their own, the way the neodymium magnet is, but they can be *magnetized* by a strong magnetic field. Ferromagnetic objects contain lots of little magnetic subunits called *magnetic domains*. When the object isn't in a magnetic field, these domains aren't organized in any particular way. The north and south poles of the domains all point in different directions, so overall, the material doesn't act like a magnet (for more on magnetic poles, see the *Refrigerator Magnets* activity).

There are domains inside the paper clips. The field from the neodymium magnet makes the domains that line up with the field get bigger; as these aligned domains grow, they make the domains that don't line up shrink. Now the domains aren't randomly scrambled anymore, and so the paper clip acts like a magnet overall — it has been magnetized. The big domains give the paperclip distinct north and south poles. Because the other paper clip is also ferromagnetic, it's attracted to the magnetized paper clip just like it would be to any other magnet! However, you can re-scramble the domains. Dropping the paper clip jostles all the little iron particles in the domains, which breaks the organization. When the domains are no longer organized, the paper clip is no longer magnetized.

Summing up

Some things can be made into magnets, but their magnetism can be broken. Can you re-magnetize the paper clip?

For more information

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