

## The Magic Magnet

Students create and test their own Magic Magnet.



### You will need:

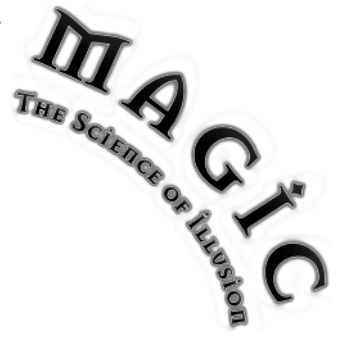
- Two uncoated, 16-penny nails
- Box of straight pins
- Bar magnet



### Try this:

1. Ask students to name things they know are magnetic. Ask: What do they know about magnets? Divide students into small groups. Present the activity first as a demonstration using magic and then allow them to do the activity as you explain the science behind the transformation of an ordinary nail into a magnet.
2. Empty the pins onto the table. Is the nail magnetic? If so, it should be able to lift a straight pin from the pile. Have a student touch the nail to the pins to see if the nail acts like a magnet. It should not.
3. Tell students that you can use magic to make the nail magnetic. Hold a scarf in one hand with the bar magnet hidden inside. Take the same nail and stroke it with the bar magnet under the scarf. Don't rub the nail back and forth but go from one end to the other. To distract the students, use magic words and gestures.
4. Show the nail again and have a second volunteer touch the nail to the pins again. The nail should now be magnetic and be able to lift a pin.
5. Pass out nails, pins and bar magnets to each group, if possible. Tell them that the nail actually was not magnetized by magic, but by a solid understanding of science. Challenge them to use the bar magnet to try to make a nail magnetic. Have one person in each group keep track of what works and what does not work. Do they think the nail will stay magnetic indefinitely? How could they find out? As time allows, have students design and undertake an experiment to figure it out. Another idea is to have students predict what will happen if they brush the nail against the bar magnet for longer and then test the nail's magnetic strength.
6. Wrap up with a discussion of magnetism. If they had never heard of magnetism, would they be amazed by magnets' power to lift things? Many people were when, a long time ago, magicians used electromagnetism (see next activity) to create magical illusions in their acts.





## The Magic Electromagnet

Try making a more powerful Magic Magnet using electric current.



### You will need:

- Two uncoated, 16-penny nails
- Box of straight pins
- 6 or 9-Volt battery
- Roll of #22 insulated copper wire



### Try this:

1. For a stronger magnet, use electricity to magnetize a nail. Please see previous activity for ideas on giving this a more magical effect.
2. Leaving a 6-inch tail, wrap insulated copper wire around one nail, starting at the top of the nail and moving down. Wrap the wire tightly, trying hard not to leave spaces between coils. When you get near the end of the nail, loop the wire under the previous loop and cut the wire so you have another 6-inch tail.
3. Hook each of the wire tails to one of the terminals on the battery. You have created an electromagnet, similar to the one used in the Light and Heavy Chest Illusion in the Magic exhibit. Touch the electromagnet to the pile of pins. The nail should pick up several pins.
4. Unhook the nail from the battery. Have a student come up to test whether it still acts like a magnet. If you wish to demagnetize the nail all you have to do is take it out of the wire casing and toss it on a hard surface once or twice. This will jumble the atoms that make up the nail, forcing the nail to lose its magnetic pull.



Look on the next page to find out how this trick works!





## The Magic Magnet

### What's happening?



The nail can become magnetic when you rub it against a bar magnet through a process called magnetic induction. During induction, the bar magnet straightens out the iron atoms inside the nail. When the atoms are aligned in one direction, the nail becomes a magnet. Through the force of magnetism, the nail can then attract other objects that contain iron. (The nail, too, must be made at least partly from iron for this to work.)



Creating an electromagnet is a little bit different. By wrapping wires around the nail and then turning on the battery, you create an electric current moving from one end of the wire to the other. As the electric current moves it creates a magnetic field around the wire. Coiling the wire around the nail makes a stronger, single magnetic field that surrounds the nail, which changes it into a magnet. Increasing the amount of electric current and/or the number of wraps in a coil increase the strength of the electromagnet. Electromagnets and electromagnetic fields are used in anything that has a motor. When electromagnetism was first discovered it was used widely by magicians. Many people did not know about electromagnets and so could only explain effects made with electromagnetism as magic.



### Want to learn more? See what happens when you...



#### *For the Magic Magnet Activity*

1. Brush the nail with the bar magnet for longer or shorter periods of time. How does this alter the nail's magnetic strength?
2. Try using a horseshoe or circular magnet instead of a bar magnet to magnetize the nail.



#### *For the Magic Electromagnet Activity*

1. Experiment with the number of wraps around the nail. Does it change the strength of the magnet, as measured by the number of pins it picks up?
2. Try these activities with different-sized nails. Does nail size influence the number of pins that it picks up?
3. Change the tightness of the wrapped coils. Does it affect the strength of the electromagnet?
4. Try using your magnetized nail to turn another nail into a magnet.

