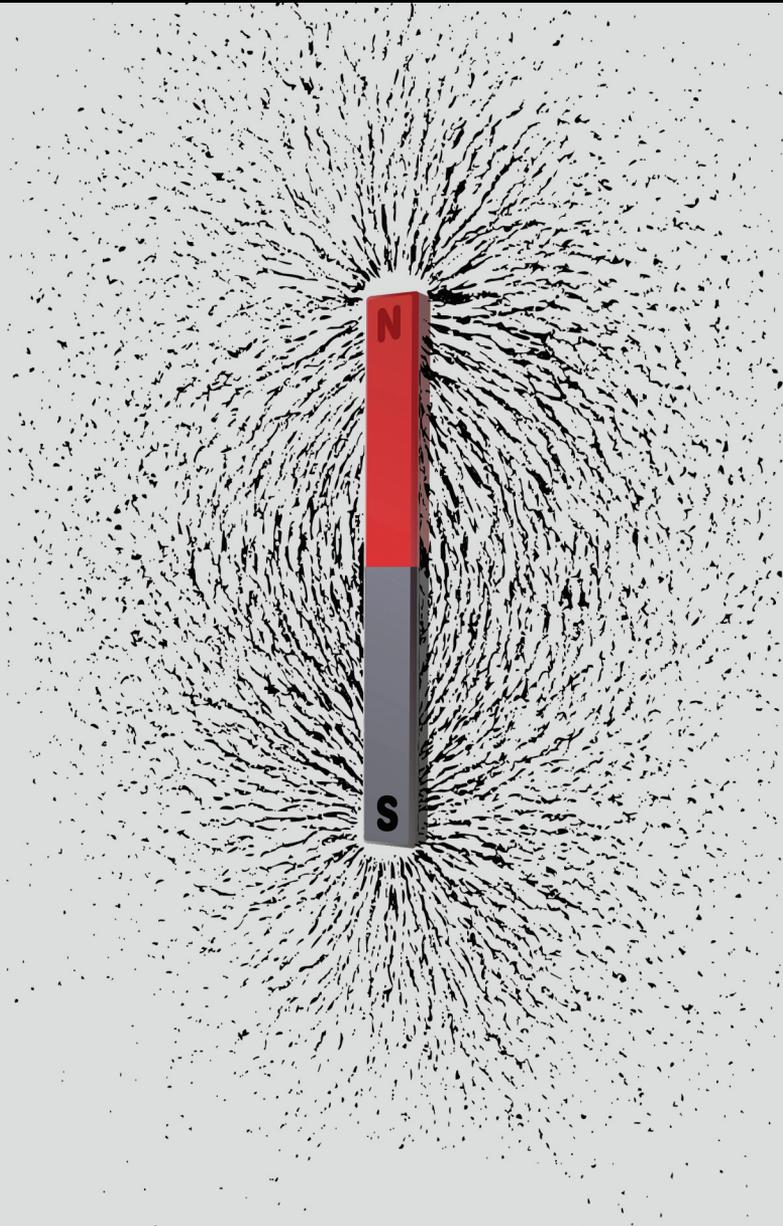


Junior Science Book of

# Magnets



Rocco V. Feravolo







Junior Science Book of  
**Magnets**

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This edition published 2025  
by Living Book Press

ISBN: 978-1-76153-428-7 (hardcover)  
978-1-76153-429-4 (softcover)

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# Magnets Attract

Magnets have a strange power. They attract things of iron or steel. They seem to work like magic.

Hold a magnet near a pin, but not touching it. The pin jumps to the magnet and clings to it. Even when you lift the magnet, the pin hangs on. Try a nail. The same thing happens. We say the magnet attracts the steel pin or the iron nail.

Magnets are made in hundreds of shapes and sizes. The kind we see most often is shaped like a horseshoe. As you might guess, it is called a horseshoe magnet. You can buy one in a hardware store or in a toy shop.



Another kind of magnet is the bar magnet. It looks like this:



Magnets make interesting toys. But they do a great deal of work in houses and offices and factories. They make telephones work and doorbells ring. They pick up huge pieces of iron and steel. They even help to make electricity.

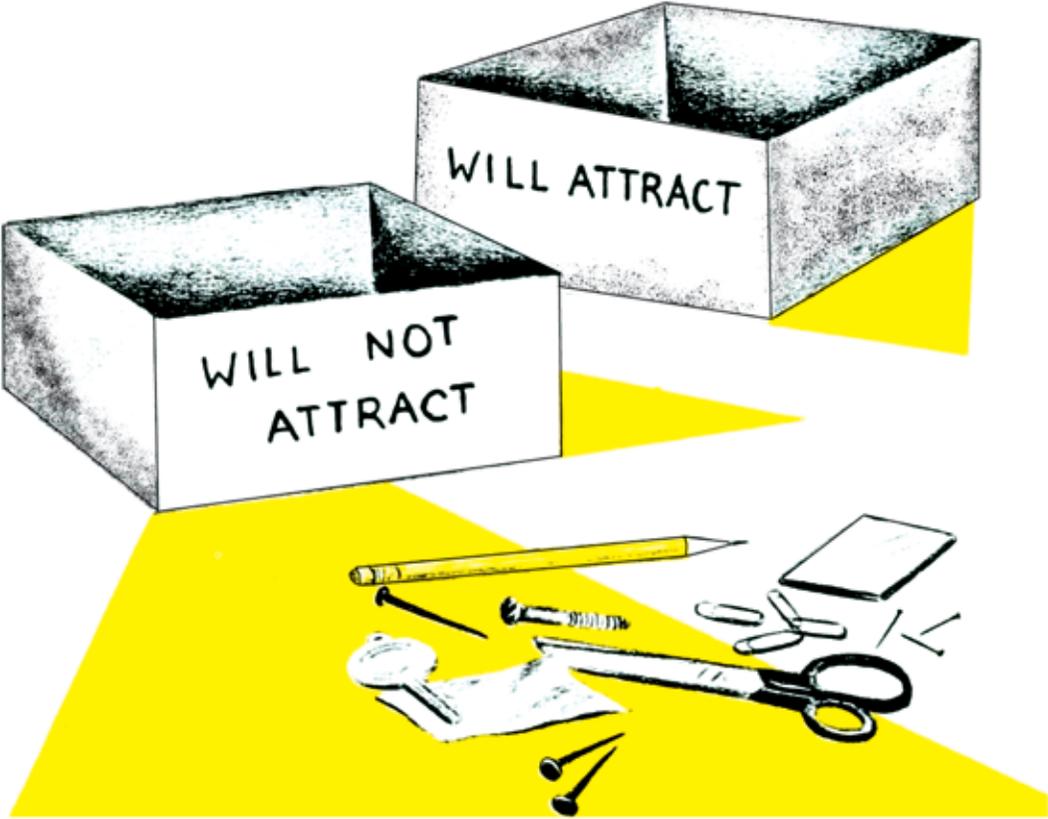
To learn how a magnet works, test it with different things. Hold it close to a button on your coat. Nothing happens. Hold it over a piece of paper. The paper won't move. See if you can pick up a penny or a nickel or a dime. The coins will stay on the table.

Now try the magnet with a paper clip. Watch it jump!

Slide your magnet very slowly across the table toward the paper clip. Notice how far it jumps. A strong magnet will pull a paper clip more than an inch away.

You can experiment with dozens of different

things. Get two large cardboard boxes. Label one box WILL ATTRACT and label the other WILL NOT ATTRACT. Then start testing with paper clips, keys, pencils, scissors, screws, tinfoil, glass and anything else you find. Everything that sticks to the magnet goes into the WILL ATTRACT box. Everything else goes into the WILL NOT ATTRACT box.



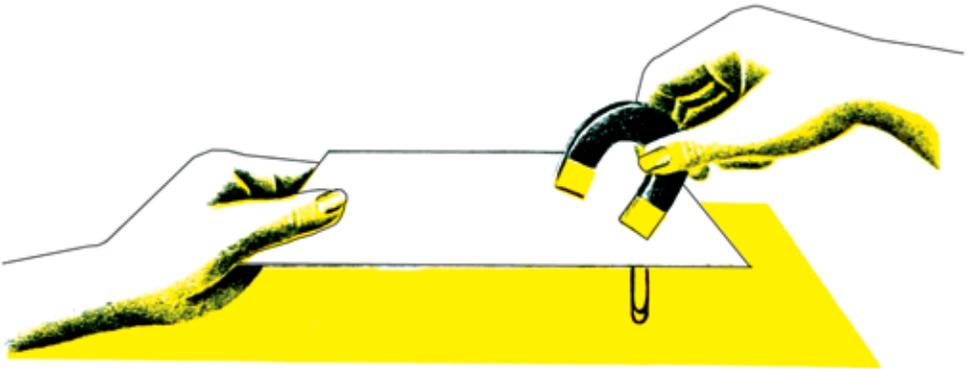
Take a careful look at all the things that went into the WILL ATTRACT box. You will see that each of them is made of iron or steel, or is partly iron or steel. Magnets always attract iron or steel. They won't attract copper, lead, gold, silver, aluminium, brass, zinc or most other metals. They won't attract glass or wood or plastics.

A magnet can sometimes be a detective. It can tell you what things really are. You know that a magnet won't pull anything made of copper. Take a paper clip that looks like copper and watch it jump to the magnet. This is because the paper clip isn't really copper. It is steel, colored like copper. A magnet attracts steel.

Try your magnet on the hinges of a door. They are the color of brass. A magnet doesn't at-

tract brass. If it sticks, you know the hinges aren't solid brass. They are steel with a thin coating of brass.

Try your magnet on a house key that is the color of steel. It probably won't stick. House keys are usually made of soft metals, not iron or steel.



## Even Through Glass

A cat can smell fish through several pieces of paper. A magnet can attract metal through several dozen sheets of paper - or even through glass.

Put a paper clip on a table and hold a sheet of paper over it. Put the magnet against the top of the paper. The paper clip will jump up.

Now use a thin magazine or booklet. If your magnet is strong enough, it will attract a paper clip underneath.

Put your magnet next to the paper label on a tin can. The magnet sticks to the paper. That is because the can is really made of thin steel, with a coating of tin over it. The magnet pulls through the paper and tin because of the steel inside.



Put a few nails in an empty glass jar. Move your magnet up and down on the outside. The nails will move up and down, too. The pull of the magnet goes through glass.



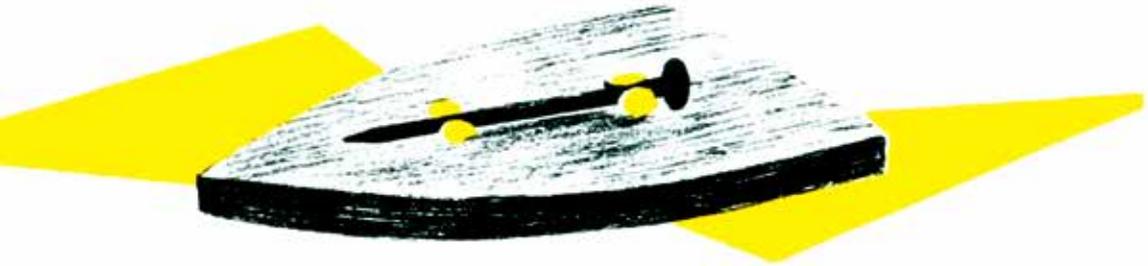


A magnet will also pull through a thin piece of wood. Find some plywood or the side of a box about 1/4 inch thick. Put a nail or paper clip on top. Move the magnet around underneath, and the nail will move, too. But if the wood is a thick board, the magnet can't pull through it.

You can make a toy boat that runs by magnetic power. First, make a boat about 3 inches long



out of a small block of wood. Fasten a nail on the bottom with tacks.



Drive a nail part way into the other side for a mast. Be careful not to split the wood. Put a piece of paper over the nail to make a sail.



Get a large aluminium pie plate or aluminium baking dish for your lake. It won't be damaged. The pie plate should be a few inches above the table so you can get your hand beneath it. You

can rest it on tin cans or a wire stand from a coat hanger. Twist the coat hanger so it has three legs.



Put the pie plate on the stand and fill it with water. Set your boat in the water. Hold the magnet under the pie plate and move it around. You have a mystery boat. It moves wherever you guide it.

Of course there's an answer to the mystery. It's the nail on the bottom of the boat. The magnet pulls through the plate and the water to the nail. The iron nail is attracted to the magnet.



## Why a Magnet Attracts

Nobody knows exactly why a magnet attracts things.

Most scientists think the secret is in the way iron is made. Iron looks hard and solid. But it is really made of millions and millions of moving bits called molecules. They are much too small to see with your eye. But we know they are moving all the time. Each molecule is a tiny magnet by itself. If the molecules

are scattered every which way, they all pull in different directions. There is no magnetic force then.

Think of four people pulling in different directions on two ropes tied in the middle.

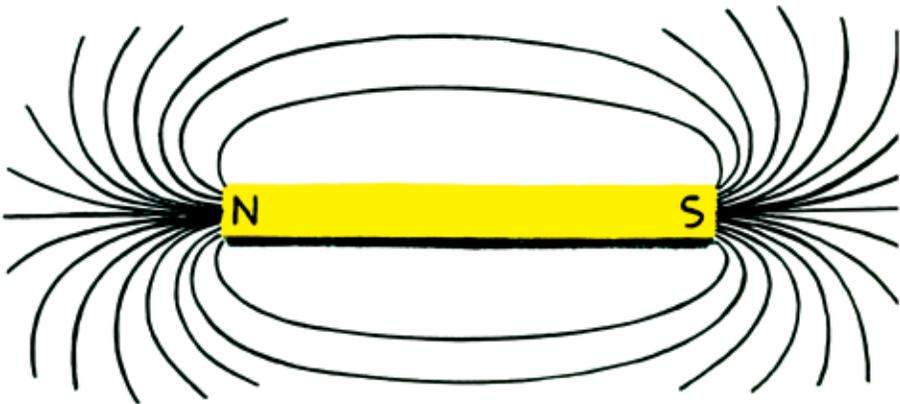


Nobody moves. The force of each one is wasted. But if you line up the four people to pull in the same direction, you have a strong force.



Probably the same thing happens with the molecules in iron. In a magnet, the iron molecules are lined up. They all pull in the same direction. That is magnetic force.

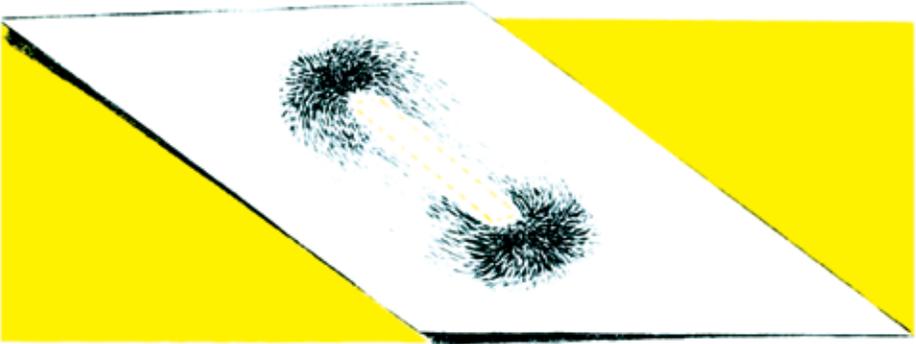
A magnet always pulls hardest at the two ends, called the poles. Your horseshoe magnet won't pick up anything much at the top. A bar magnet won't attract things to its center.



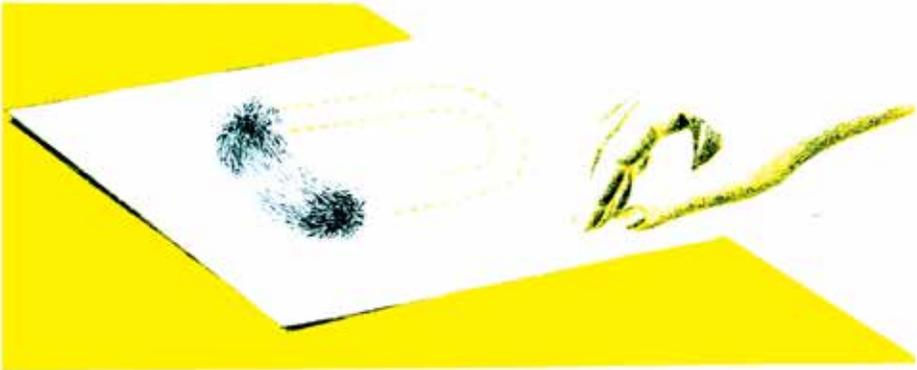
You can see how much the poles pull if you get some iron filings from a machine shop, or from a hole made in iron by an electric drill. Lay

a piece of paper over a bar magnet. Scatter some iron filings on the paper.

Now tap the paper gently. The iron filings will gather at the ends of the magnet. They will go to the poles.



Try the same experiment with a horseshoe magnet. Again the iron filings will be drawn to the poles.



If you could cut a bar magnet in half, each piece would have two poles, too. Every magnet has two poles.

The first magnets were discovered more than 2,000 years ago. They were a kind of iron ore called magnetite. These natural magnets are still found in many parts of the earth. They are known as lodestones. How did they get their pulling power? Probably from the earth itself. The earth has its own magnetism. It is the biggest magnet we know anything about.



## Magnets Push, Too

We generally think of magnets as pulling. But they can also push. This happens when two magnets come together in a certain way. To see how they push, you need two bar magnets.

On one end of a bar magnet you will find the letter N. N stands for North. N marks the North pole of the magnet. Take a soft pencil or crayon