CARDINAL COMPASS - NO. 2 • HANDS-ON LEARNING • WITH CARL THE CARDINAL

Magnets

VOL. 2

The pull you cannot see. Why some things stick and some do not. How a rock helped sailors cross the sea. And three experiments you can do safely at home.



A horseshoe magnet lifts a chain of paperclips. Nothing is glued. A pull you cannot see is holding them up.

Read together | **Build together** | **Adult with you for every experiment**



Meet Carl - Magnet Carl

Carl the Cardinal is your guide. For magnets, he holds a big horseshoe magnet. His green neckerchief and gold compass medallion stay on. Color your own Carl on the last page.

Carl asks the question for this whole book: **if we cannot see the pull, how can we prove it is really there?** Keep that question in mind. You will answer it on page 10.

How to use this book: Pages 2-3 tell the story. Page 4 is safety. Read it first. Then do the three experiments on different days. Finish with the questions. Color Carl at the end.

Keep a notebook near you. Write what you guess. Write what you see.

You will need, for all three experiments: ordinary classroom or craft magnets only (fridge magnets, or a craft bar or horseshoe magnet - not small high-powered magnets; two magnets with poles marked N and S if you have them, for the optional test on page 9), about 20 steel paperclips, short string (about as long as your hand), tape, a sheet of paper, thin cardboard, a small stack of books or a sturdy block, a steel sewing needle (grown-up only), a small cork or a leaf, a bowl and water, a reference compass (a purchased compass or a grown-up's phone compass) for checking, the test things on page 5, a small box with a lid for counting and storing the pieces, a notebook, and a pencil.

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What is a magnet?

A **magnet** is a thing that can pull some kinds of metal toward it. It can also push or pull another magnet, without touching it.

Attract means to pull toward. A magnet attracts a paperclip. The clip moves to the magnet.

Repel means to push away. Two magnets can repel each other. They push apart.

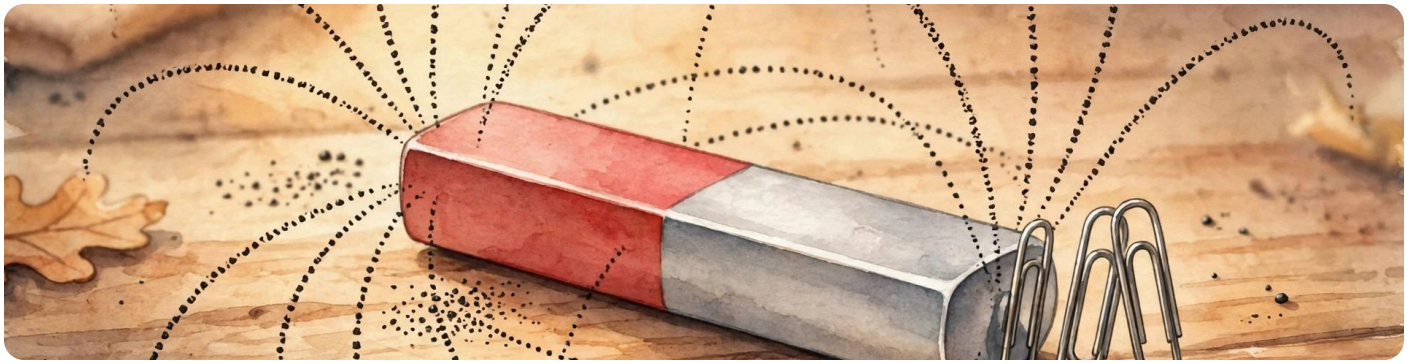
Poles are the two ends of a magnet. The pull is strongest at the poles. One end is called the north pole. The other end is called the south pole.

Magnetic field is the area around a magnet where its push and pull can be felt. You cannot see the field. You can see what it does.

Same poles push. Different poles pull.

Bring the north pole of one magnet near the north pole of another. They **repel**. They push apart. Now turn one magnet around. North pole meets south pole. They **attract**. They pull together, fast.

Short rule: **same poles repel, different poles attract.** You can test this in the optional test on page 9, if your magnets have marked poles.



The dotted loops trace the field around a bar magnet. The field is invisible. The pattern it makes is not.

Strongest at the poles - paperclips gather at the ends of a bar magnet, not the middle.

Weaker with distance - move a magnet far away and the pull fades. You will feel this on page 7.

Some things stick - iron and many kinds of steel are pulled strongly. Many other things are not pulled at all.

No touch needed - the pull can reach across a small gap of air. That is the field at work.

What would you do? The compass that turned

On a walk, Carl passes a big steel gate and his compass needle swings away from north. Nobody touched it. What would you test before you trusted it again?

A needle answers **every** magnetic pull near it. Earth's field is steady but gentle. Up close, iron, steel, or another magnet can pull harder. That extra pull is **interference**: a nearby magnetic influence that disturbs the needle.

Test it: step well away from the gate. Does the needle settle back? Walk closer slowly. Does it turn again? Trust it only when it agrees away from the gate. Write what you saw.