For Creative Minds

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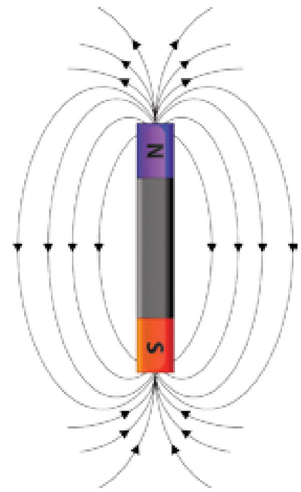
Magnets

Magnetism is a force. The ancient people in the town of Magnesia in Asia Minor—now Turkey—found that some stones attracted and repelled each other. They also attracted things made of iron. They called these stones "magnets." We now call them "lodestones." They are likely formed when a piece of iron ore is struck by lightning. The lightning aligns all the iron particles in the same direction, creating poles. These rocks attract and repel, a force we call magnetism.

So what is a magnet? A magnet is a piece of iron in which all the atoms point in the same direction. All north-seeking atoms point one way (North-seeking pole or N) and all the south-seeking atoms point in the opposite direction (South-seeking pole or S). Electricity, like lightning, can make magnets. Now we make magnets by passing a piece of iron through an electric field. The electric field aligns all the iron atoms in the same direction. The N poles of magnets pull toward—attract—the S poles of other magnets. The N poles of magnets push away—repel—the N poles of other magnets. The S poles of magnets also repel the S poles of other magnets. An easy way to think of this is to say that like poles repel and unlike (or opposite) poles attract.

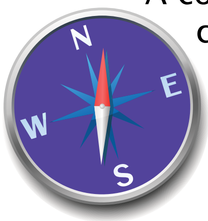


Earth itself is like a giant magnet, with a north pole and a south pole. Around the year 1000, the Chinese discovered that a steel needle rubbed against a lodestone and allowed to swing freely would always point toward the north. Steel is made mostly of iron. The Chinese began using these needles as compasses.

Earth has a magnetic field around it. The funny thing is, as Dena found out, the north magnetic pole is not the same as the north geographic pole. The north and south magnetic poles move. The purple line on this map shows the change in magnetic north from 1905 to 2016.

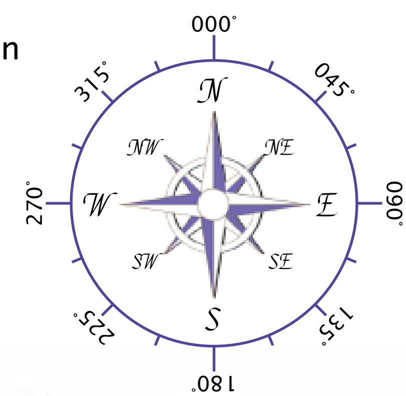
Map Skills

To find your way from one place to another, you need to know at least two things: the direction you should travel and the distance you need to go.



A compass is a tool that uses a magnet to determine direction. Directions on a compass are measured in degrees (˚), with 360˚ in a circle. North is 000˚, or 360˚. If you face north, east (090˚) is the direction to your right, south (180˚) is behind you, and west (270˚) is to your left.

The needle of a compass always points to magnetic north. When you use a compass, hold it flat and rotate the compass so that the number 000˚ lines up under the needle. Then you can walk in the direction you need to go, keeping 000˚ lined up under the needle the whole time.

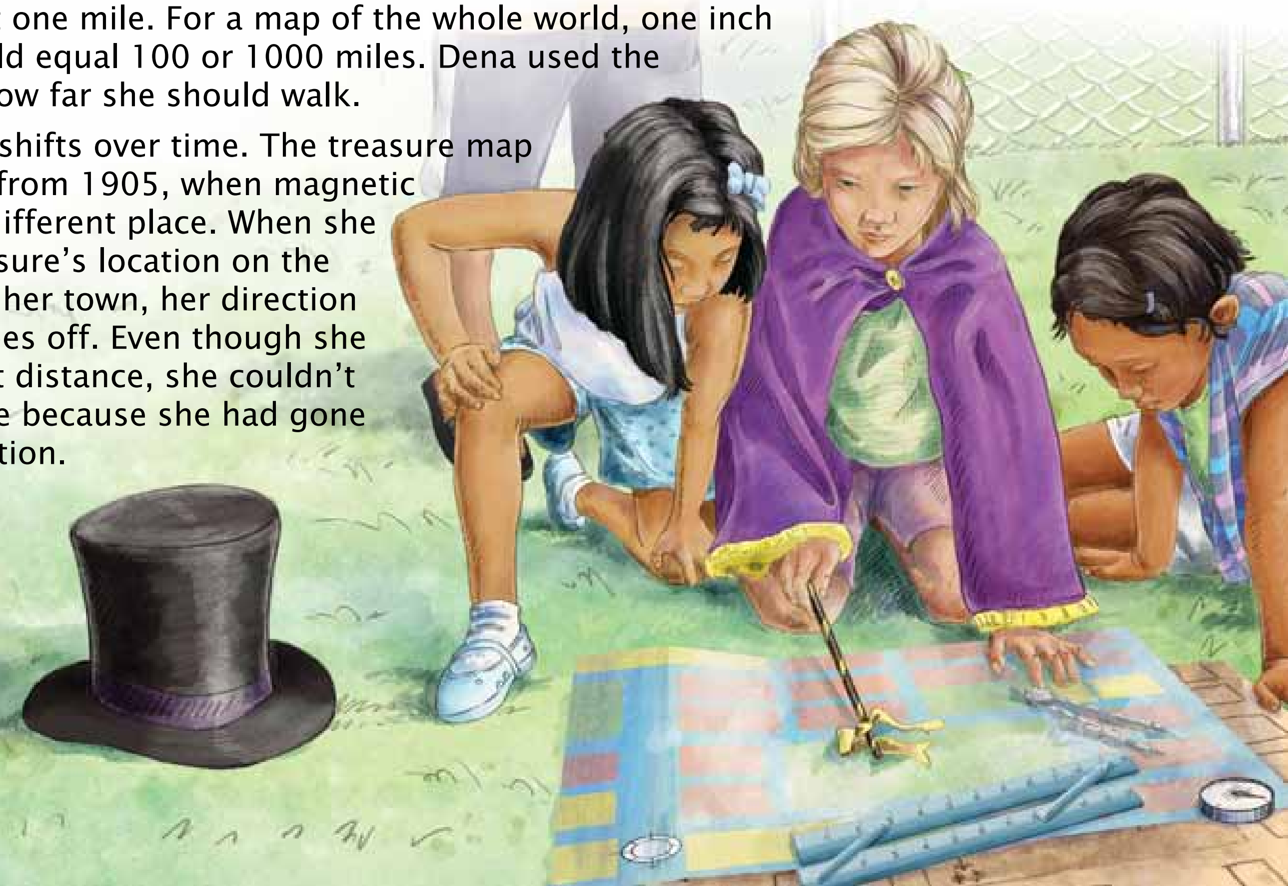


Maps have a compass rose to show which direction on the map is north. Dena used the compass rose on the map to find the direction from the school to the treasure. She used her compass to make sure she was going the right way.

But even if you know what direction to go, you can still travel too far or not far enough and miss your destination completely. When you travel from one place to another, you need to know both the direction and the distance.

Maps have scales that show how the distance on the map relates to distance in real life. For a map of a town, one inch on the map might represent one mile. For a map of the whole world, one inch on the map could equal 100 or 1000 miles. Dena used the scale to know how far she should walk.

Magnetic north shifts over time. The treasure map Dena used was from 1905, when magnetic north was in a different place. When she plotted the treasure's location on the modern map of her town, her direction was a few degrees off. Even though she walked the right distance, she couldn't find the treasure because she had gone the wrong direction.



Make Magnetic Magic

Move Paperclips

For this trick you will need:

- metal paper clips
- magnets
- stiff cardboard, like a game board
- cloth covering (optional)

Hold the board with one hand or put it on a stand. Place the paper clips on top of the cardboard. Make the paper clips move by moving the magnet underneath. Be careful you only move your hand, not your arm; bend at the wrist.

You can make this trick more like a magic show by covering your cardboard with a piece of cloth. Remember, part of the show is talking to your audience so they forget about the hand under the cardboard. Magic!

Float a Lodestone

For this trick you'll need:

- lodestone
- string
- marker

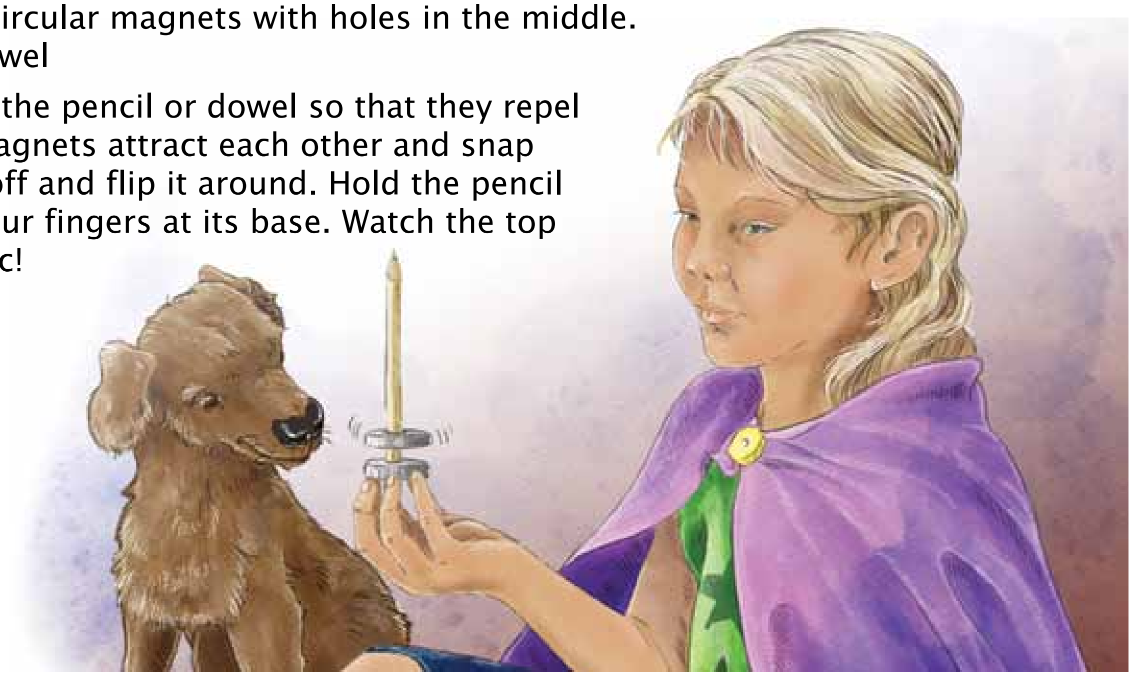
Before you perform this trick, use a compass to figure out where north is and which end of the stone points north. Mark that end with a marker. Predict which way the stone will point when it stops (that would be north on the compass). Float the loadstone on a piece of wood in a tub, or hang it from a string. Give the stone a twirl. Magic!

Make a Magnet Hover

For this trick you will need:

- two or more circular magnets with holes in the middle.
- pencil or a dowel

Put the magnets on the pencil or dowel so that they repel each other. If the magnets attract each other and snap together, take one off and flip it around. Hold the pencil pointing up, with your fingers at its base. Watch the top magnet hover. Magic!



Float a Magnet in a Pipe

For this trick you'll need:

- copper or aluminum pipe .75 inches in diameter (from your local hardware store)
- three neodymium disk magnets (.7 inches or less in diameter)
- pebble or other heavy, non-metallic object.

Touch the magnets to the outside of the pipe. Any attraction? Hold the pipe in your hand and drop the heavy, non-metallic object through its center. What happens?

Now hold the pile of magnets above the pipe. Drop them through the pipe's center. What happens now? Turn the magnets over. Is there a difference?

The non-metallic object will drop very quickly, but the magnets will seem to float down the tube. Even though the pipe is not magnetic, the magnets create an electric current which slows their fall. Magic!