Magnets and Migration: Investigation
Transcript

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[background music]

We're trying to figure out how the earth's magnetic field helps animals to navigate. To do this, we're going to start by using a model to represent what the earth's magnetic field looks like on a large scale. Then you'll have a chance to see if you can design your own model and prove that there's a magnetic field around smaller objects too.

Find your Asombro science kit - you'll need it for the rest of this video. Take a look at what's inside and find a tool that you think could help us see the earth's magnetic field from a distance.

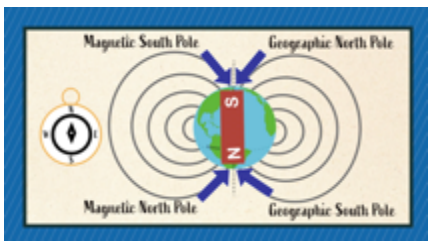
Did you pick the compass? We're going to use this compass and the magnet to draw what the magnetic field around the earth looks like.

Why does a compass always point north? Does the needle just float around and randomly point in any direction? No, the compass needle is magnetic. If you place a magnet near a compass you can see that it moves the needle. Compasses work because the earth is like a giant magnet.

Hold the piece of paper from your kit with the picture of the earth facing up. Set the compass on top of the earth and rotate the paper until the north arrow of your compass is lined up with the north pole of the earth. If your compass needle isn't turning when you move, try tapping it gently. Set the paper down with the north arrow still pointing to the north pole, and get your bar magnet. Hold your bar magnet above the paper. Line up the north and south poles of the magnet with the geographic north and south poles of the earth. Lower your magnet down slowly towards the compass until you notice something change. What happened? Even though the compass and the magnet were not touching, was the magnet able to exert a force on the compass?

Edpuzzle question: What happened when you placed the bar magnet over the compass?

You might think that if the earth acts like a giant bar magnet, the north side of our magnet should represent the geographic north pole of the earth. But you know the opposite ends of a magnet attract - north attracts south and they stick together. If north is paired with north, the magnetic forces repel each other. You should have seen that the compass flipped directions when it entered the magnetic field of the magnet. So if we use our magnet as a small scale model of the earth, we actually need to place the bar magnet's south pole at the earth's geographic north pole. Compasses work because the north arrow is attracted to the earth's magnetic south pole, which is located at its geographic north pole.



Now we can set our bar magnet in the correct direction on top of our Earth. Set your bar magnet so the south pole of the magnet is aligned with the north pole of the earth. If you need to rotate your paper now, that's okay. Next, you're going to draw the magnetic field of your magnet that's modeling the earth.

Start with your compass at the lower right corner of your magnet.

Draw a dot where you see the north arrow pointing.

Remember that the magnet doesn't need to be touching the compass to exert a force on it. Move the compass away from the magnet so it's on the other side of the dot you just drew, and draw another dot where the north arrow is pointing now. If your lines go off the edge of the paper and look more like this, that's okay. Just pick up your compass and start again from the top right side of your paper like this. Continue this process until you get to the other end of the magnet, then connect your dots.

Edpuzzle question: Do these steps, then click "I'm ready" when you're ready to move on.

Now you're going to do it again, but start with the compass a little higher. Repeat the same process and connect your dots.

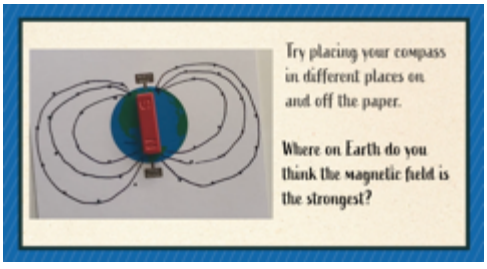
Edpuzzle question: Do these steps, then click "I'm ready" when you're ready to move on.

These lines we drew indicate the magnetic field. If you were to repeat this process over and over again, you would get lines that look like this, and it would be a mirror image on the other side of the magnet. As we move the compass farther away from the magnet, what happened to the force the magnet was exerting on the compass?

Take a moment to look at the magnetic field lines you drew, and try placing your compass in different places on and off your paper. If this magnet is a model of the earth, where on Earth do you think the magnetic field exerts the strongest magnetic force based on the behavior of your compass?

Edpuzzle question: Where on Earth do you think the magnetic field is the strongest?

The earth's magnetic field is strongest at the poles and weakest at the equator. It's strong close to the magnet and weaker the farther away you get from it. Try slowly moving your compass away from the magnet. Can you find the point where the magnet's magnetic field is no longer strong enough to move the compass?



Now it's your turn to find a way to show the magnetic fields. In your kit you'll find these supplies. You'll need your bar magnet, the back side of your paper with the magnet picture, and the bag of iron filings from your kit. You won't need your compass for this part, so you can put it off to the side. Iron filings are tiny pieces of iron, which is magnetic. You can see that the magnet exerts a force on the iron filings.

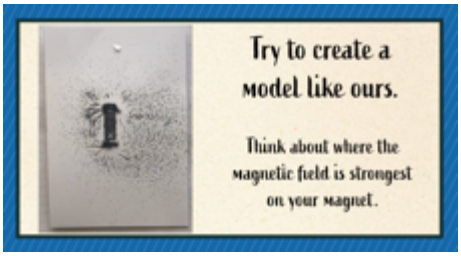
Your goal is to create a model of the earth's magnetic field using the bar magnet and the iron filings. Feel free to take the iron filings out of the bag, but remember to put a piece of paper underneath so you can clean them up later.

Take a couple minutes to experiment and see what happens when you use the bar magnet and the iron filings together. When you think you've created a model of the earth's magnetic field, describe what you did in the answer box to the right.

Edpuzzle question: Describe the model that you created, and explain how it shows Earth's magnetic field.

So what did you observe? Were the iron filings attracted to the magnet? Here's the model we made - and here's what we did to create it. See if you can get the same results we did. Consider what this model shows us about where the magnetic field is the strongest around your bar magnet. Is this the same as you saw with your compass and our model of the earth? Try it out, then click 'I'm ready' when you're done experimenting.

Edpuzzle question: Try to create a model of Earth's magnetic field that looks like ours. Think about where the magnetic field is the strongest on your magnet. Click 'I'm ready' when you're done.



If your model doesn't look like ours, that's okay. If you repeat this experiment a hundred times, you would on average get results that look something like this. If your model didn't look exactly like ours, why not? Were there other variables around that may have influenced your model?

Great work creating models of the earth's magnetic field. In the next video, we'll use what you've learned about the earth's magnetic field to talk more about animals and how they use it to navigate. Head back to Canvas and answer the assignment questions, then click on the next video to continue.