Magnetism Facilitator Guide

This manual breaks the activity with the Engage, Explore, Explain, (Extend) method. It is designed to help people doing the activity and building their lesson plan.

Learning objective

To recognize the effect of magnetism, more specifically those caused by magnets such as attraction and repulsion, and identify situations in which magnets are needed.

Science concepts

Magnetic fields, magnetic forces and electromagnetism.

Material (inside a coller bag)

1. Iron filings
2. Magnets (at least 2 per groups with different strengths)
3. Petri dishes filled with iron filling
4. Little compasses
5. Sheets of paper 11 by 16 inches (one per group)

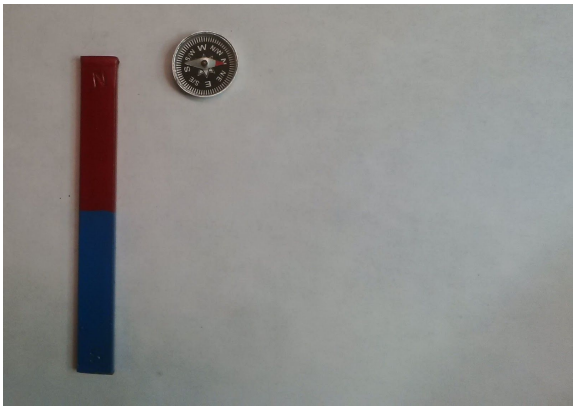
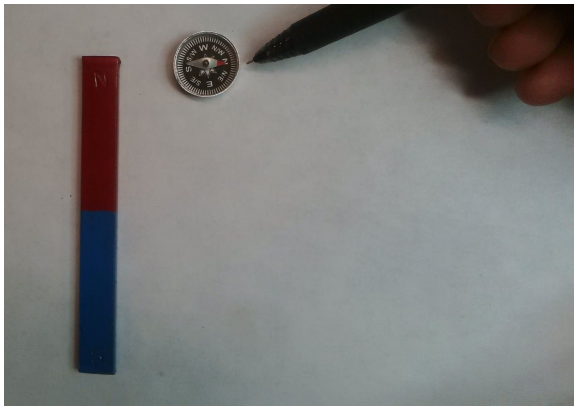
Part 1 : Magnetism

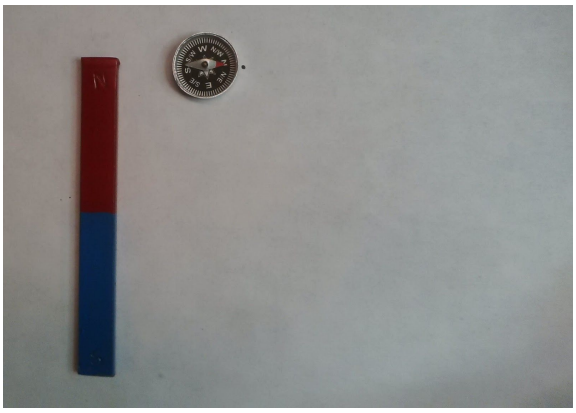
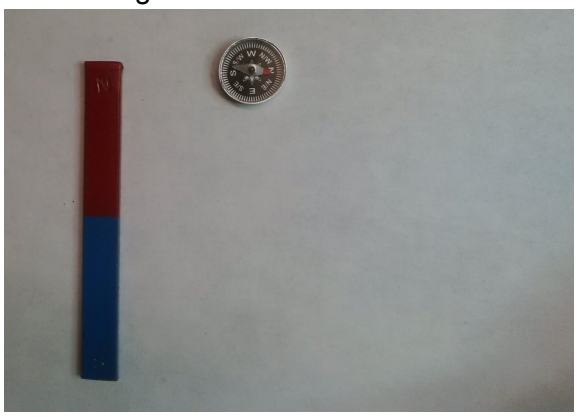
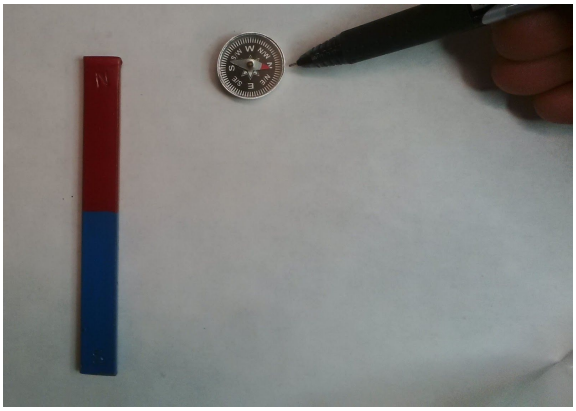
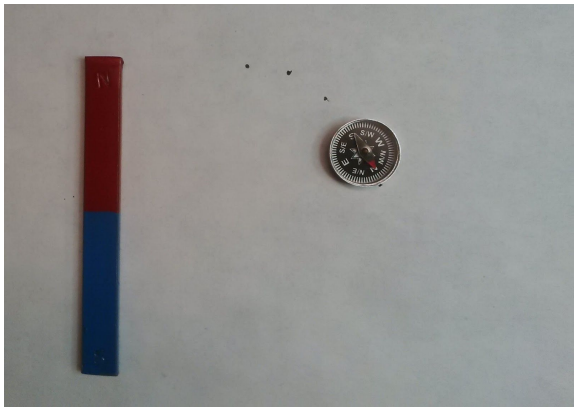
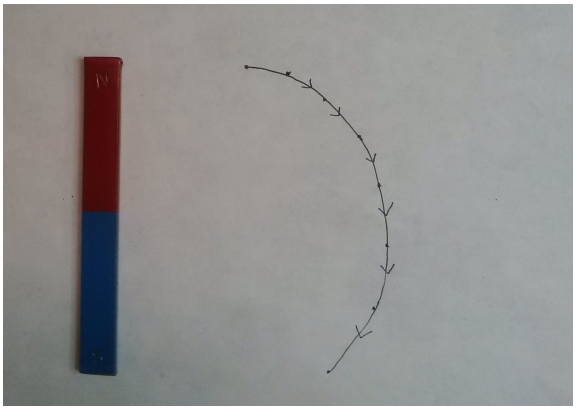
ENGAGE

Questions to throw around: *What do you know about magnets?* (possible answers : they have north and south poles, they attract magnets, they attract metals, the earth is like a giant magnet, the sun is like a giant magnet. *What happens when you cut a magnet in two?*
When do you use magnet? (possible answers : fridge magnets, compass, to change kinetic energy into electric energy (intense if they know that), to pick up things from cattle stomach (you actually leave the thing in their stomach forever and it attracts small nails etc to avoid making the cattle sick)) (Can opener, floating trains, what keep the fridge's door closed, MRI in hospitals, car engines)

EXPLORE

Distributes bar magnets and compasses from them to play with and ask them what they have observed. Keep their observation and keep them for later. Depending on their level of magnetism knowledge, tell them to dispose the magnets on their large sheet of paper and draw a circle around the position of the magnet.

Place the compass somewhere 	Mark the red needle position (part 1) 

Mark the red needle position (part 2) 	Move along the direction of the needle 
	
	1. take the compass place it somewhere around the magnet 2. mark a dot where the arrow points 3. move the compass a little bit in the direction indicated by the needle 4. repeat steps 2 and 3 over and over again 5. connect the dots with a line 6. repeat steps 1 to 5 as much as you want

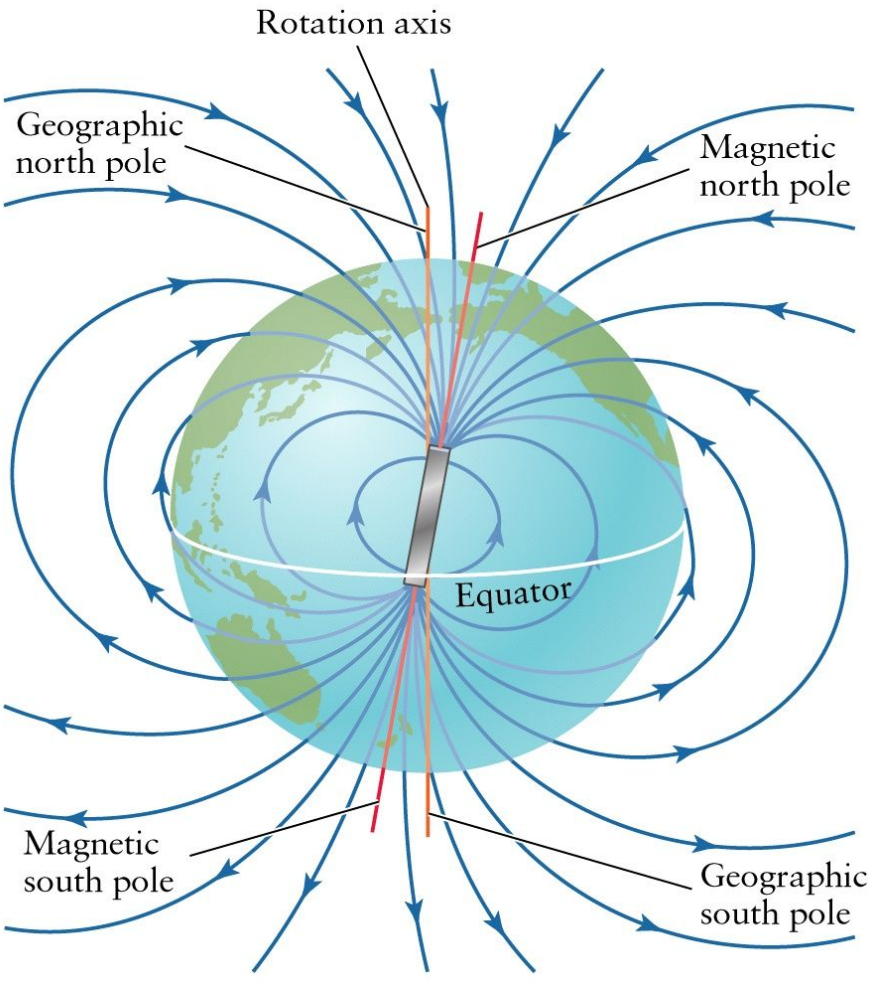
EXPLAIN

Explain that by convention, we indicate the direction of the line with the direction the red part of the compass was pointing.

Define the magnetic poles as the place where the lines go into/out the magnet, the place where it goes out is called north magnetic pole and the place where the lines goes in is called south magnetic pole.

Tell them that a compass is made with a small piece of a magnet, and this magnet wants to align with its south magnetic pole pointing towards the north pole of the big magnet and its north pole pointing along the south pole of the big magnet.

This could be a nice time to explain that the earth has a magnetic field which is similar to the one of a bar magnet like the one they have :



source : teolaktin4f.wikispaces.com

EXTEND :

What happens if we stick two magnets together N to S ? Tell them we can figure that out with the new technique we have!

This illustrate the somewhat counterintuitive property of magnets, when you add two together you get one, and if you “cut” this one in two you still have two magnets with 2 poles each!

If you have time you can also sketch the S to S and N to N configurations.

I created boxes to visualize the field lines of permanent magnets with iron filling, you can show them here as an alternative technique.

Part 2 : “Electromagnetism”

NOTE

This part will be very difficult and nearly impossible to do with students younger than 6th graders (6th graders are still a stretch).

ENGAGE

Introduce the question “What do you know about electromagnetism?”. Try to hint them towards “a phenomenon linking both electricity and magnetism.

Show them that when you connect a light bulb to the battery it turns it on, therefore we know that there is “electricity” flowing down the wire in the form of an electrical current.

EXPLORE

Ask them to observe what happens when they place their compasses close to the wire and they plug it to the + and - of the battery or when it is disconnected.

They should notice that the compass needle is affected by a current flowing into the wire.

EXPLAIN

Fun fact: this experiment was done by Hans Christian Oersted in 1820 when he was teaching electricity to his class, his noticed that the compass needle was affected by the current into the wire. *If you have time you can show them, or let them experiment how the field lines behave around the wire.*

Ask them to coil their wire around the PVC tube (one per student or in groups depending on how many students) and ask them to explore this setup like it was a magnet.

- *If you have time you can ask them to draw the field lines like they did before. This should help them realize that the permanent magnet and the solenoid are essentially the same.*
- *If you don't have time, then focus on the fact that the field is straight inside the solenoid before making the magnets*

With the magnetic field created by the wire, we can build a stronger magnetic field by coiling it around a nail/screw and to connect the two ends to the + and - of the battery, tell them to observe what happens with their little compass.

EXTEND

Explain that the nail itself is not a magnet.

Acknowledgements:

This activity was written by PF (pfduc@physics.mcgill.ca)