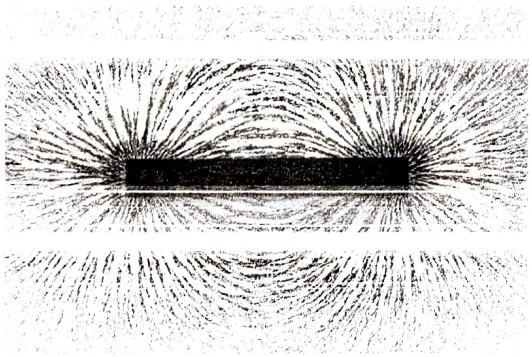
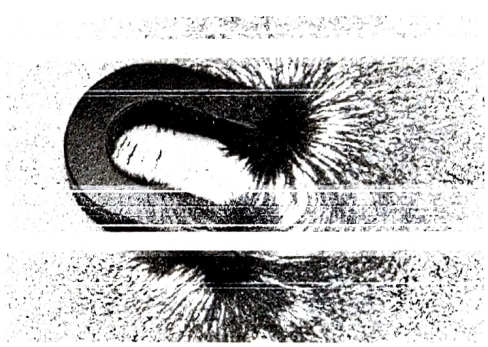
Section	Group	Name	Signature
Grade		Jacob Hall	Jacob Hall

Materials: • Web "Magnets and Electromagnets" simulation

After this activity you should know: • *the general direction of the magnetic field outside and inside bar magnets, horseshoe magnets and the planet Earth* • *magnetic fields are caused by currents* • *the general direction of the magnetic field near a current carrying coil.*

Please view the video of the magnetic field demonstrations: https://psu.mediaspace.kaltura.com/media/1_ceq4oal5

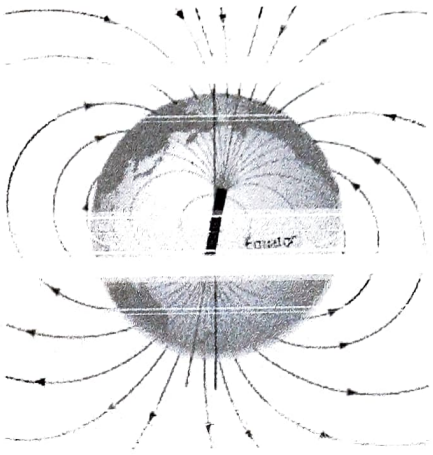
1. The figure below shows what happens when iron filings are sprinkled around a magnet. The iron filings line up in the direction of the magnetic field at that point.

Bar Magnet	Horseshoe Magnet
	

2. Open the simulation https://phet.colorado.edu/en/simulation/legacy/magnets-and-electromagnets. This allows one to run Java on a browser without installing Java on your computer. You can also download the program if you have Java on your computer. Note that the simulation may not work on Apple machines.

• The field lines go from the north magnetic pole to the south magnetic pole both inside and outside the magnet very similar to the electric field lines of an electric dipole.	F
• The magnetic field lines goes from the north magnetic pole and to the south magnetic pole outside the magnet but from the south magnetic pole to the north magnetic pole inside the magnet.	T
• Magnetic field lines never end but always loop around on themselves.	T
• If you cut a magnet into two, one piece will only have a north magnetic pole and one piece will only have a south magnetic pole.	F
magnetic poles.	T

3. The diagram shows the Earth's magnetic field lines. Choose one answer.



- Outside the Earth, the magnetic field points away from Antarctica and toward the Arctic (in northern Canada). Therefore, the south **magnetic** pole is in Antarctica and the north **magnetic** pole is in the Arctic.
- Outside the Earth, the magnetic field points away from Antarctica and toward the Arctic (in northern Canada). Therefore the north magnetic pole is in Antarctica and the south **magnetic** pole is in the Arctic.
- Outside the Earth, the magnetic field points toward Antarctica and away from the Arctic (in northern Canada). Therefore the south **magnetic** pole is in Antarctica and the north **magnetic** pole is in the Arctic.
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4. An electromagnet is usually just a coil of wire carrying a current.

a. Connect the coil with the DC power supply (with voltage at a minimum). Lay the coil on its side so the axis of the coil is parallel to the table surface.

b. Place the compass near the coil. Turn on the power supply and increase the voltage to about 2 Volts. What happens to the compass when you increase the current?

It orients itself with the magnetic field generated by the current.

c. Move the compass around near the coil. What happens to the compass needle as you move it around the coil?

It moves with the field.

d. Check the "Electromagnet" box in the simulation. Vary the voltage and the number of loops in the coil. State whether each statement below is true or false. You can use "Show Field Meter" to measure the magnetic field.

• The magnetic field lines of the electromagnet are like the electric field lines of a point charge.	F
• The magnetic field lines are similar to that of a bar magnet.	T
• The magnitude of the magnetic field increases with increasing current.	T
• The magnitude of the magnetic field increases with the number of loops.	F
• Magnetic fields are generated by currents.	T