Grade Level/Course: Grades 3 - 5/Elementary Science
Lesson/Unit Plan Name: Introduction to Magnetism and Electricity
Rationale/Lesson Abstract: Through activities involving compasses, magnets and simple circuits, students will explore magnetism, electromagnetism and their relationship to electricity.
Timeframe: 1 - 2 sessions
Next Generation Science Standards): Motion and Stability: Forces and Interactions (3-PS2) Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. (3-PS3) Energy can be transferred in various ways and between objects. (4-PS3-1), (4- PS3-2),(4-PS3-3),(4-PS3-4)

Instructional Resources/Materials:

For teacher:
1 strong but small magnet

Full class:
Science notebooks and pencils

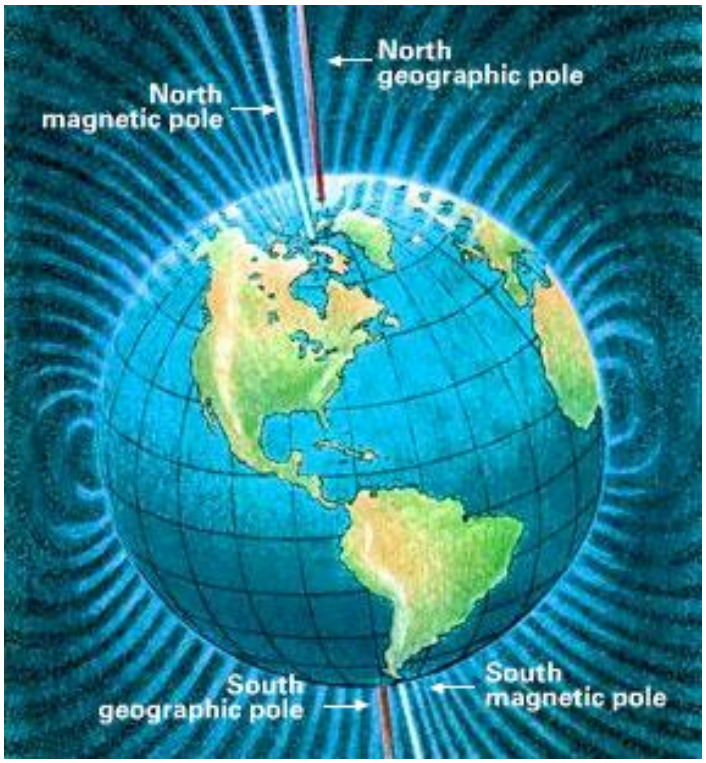
For each pair of students:
2 compasses
2 bar magnets (preferably ones that have N and S on each end to designate poles)
1 D cell
1 foot long 22 gauge insulated copper wire (stripped about ½ inch on each end) or one alligator clip

Activity/Lesson:

What is a Compass and What Makes it Work?
Begin activity with discussion about what is a compass? If students are in pairs, have them TPS or if in table groups -- have them share out in their group. Then bring discussion full class. If not mentioned, include in discussion what directions are listed on compass (N-S-E-W) and which direction most compasses will point to. Write responses on white board. Have students take notes in their science notebook.

Now direct students to the question -- What makes a compass work? Again, take answers and put on white board. You may want to frame this as a K-W. What students know, what they want to know.

Now show pdfs of the earth included with this lesson either on your computer or document camera. Explain that our earth is like a magnet. It has two poles, north and south. The earth has two hemispheres and we live in the northern hemisphere.



Therefore, compasses point north because the strongest magnetic pull in the northern hemisphere is in the north.

Pass out compasses. Tell students to put them on their desks and try to find which way is North. Allow students time to play with them. After awhile, reconvene and ask students which way is north and south. (It would be helpful if you knew this information

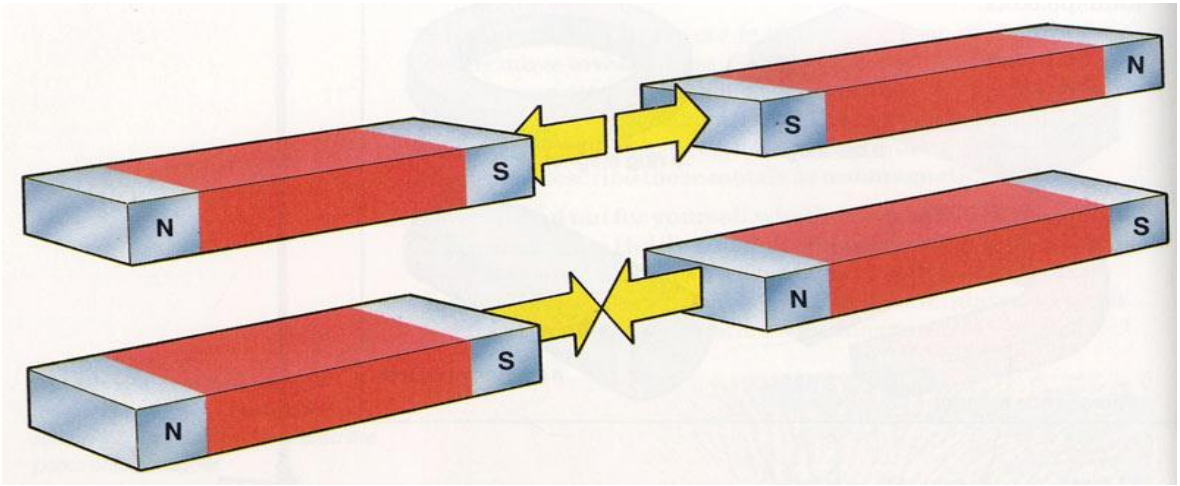
going into the lesson.)

Introduce Magnets
Now for the fun part. Ask students if anything can change the direction of your compass needle. Have them think about it and discuss it in their groups or with their pairs. You walk around with your teacher magnet hidden in your hand past their desks and compasses. Students should begin to notice that the needles are jumping. Sooner or later, someone will say you must have a magnet in your hand. Continue the discussion.

Remind students that the compass is affected by the magnetism of the earth -- pulled by north and south poles. What happens when the north pole and the south pole of a magnet are put together?

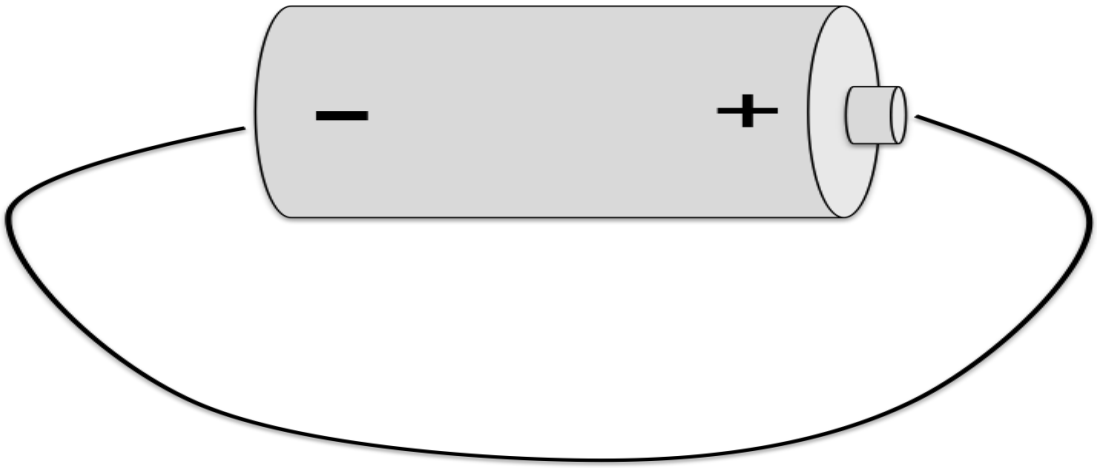
Introducing Magnetism
For this second activity, it is important that you collect the compasses or they will be demagnetized. Pass out two bar magnets to each pair of students. Again, allow them time to explore how they react with each other.

After 5 minutes, bring students back together as a class. Remind students to take notes in their science notebooks. Draw pictures of a bar magnet on the board. Now have students share out what happened when magnets were put together. Draw pictures of different positions of north and south poles and what happened when they were brought together. Introduce the vocabulary words -- attract and repel -- define for students in terms of magnetic poles and have students record in their science journals.



What is the relationship between Magnetism and Electricity?
As part of our exploration, we are going to create a simple electrical circuit. A simple circuit is created by touching the ends of the wire to both ends of a battery. It doesn't power anything like a light bulb or motor, it simply sends electricity in a circular motion. After a short while the battery will begin to get hot and then it will burn out. The simple circuit is really wasted energy. But we will use this to show how magnetism is used to create an electromagnetic force.

This is an introduction to the study of electrical energy. The concept is that there is an electrical current flowing through the wire and this creates a magnetic force field around the wire -- electromagnetism. They can't see the force but hopefully this hands on activity will demonstrate it.



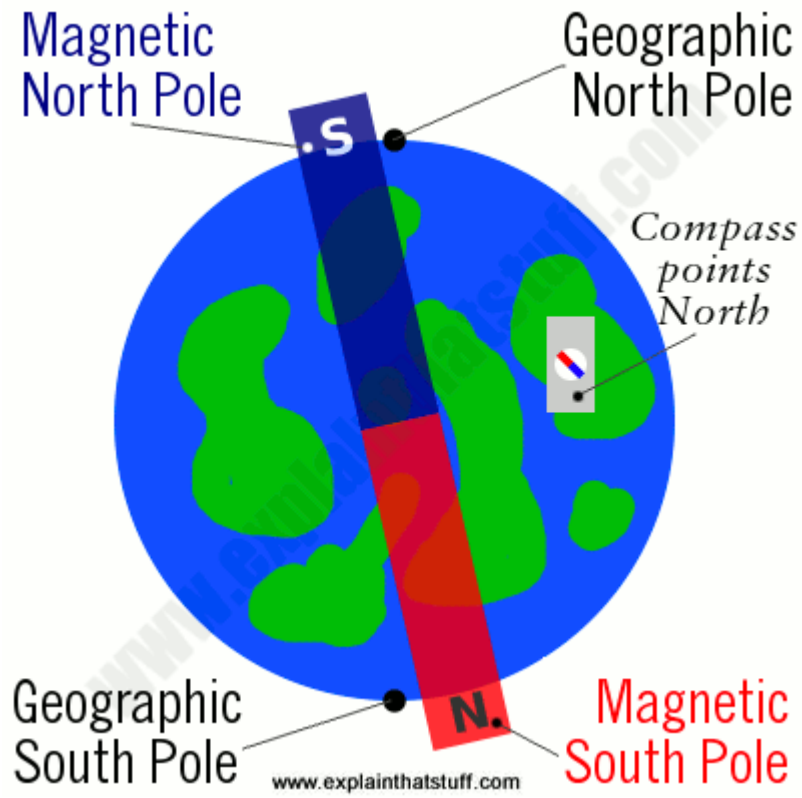
Demonstrate to students how to assemble wire, and D cell, etc. Explain that unless the materials are fully connected in a circle with metal touching metal, the short circuit will not work.

Have students collect and return bar magnets. Next have material getters or passers (one for each table group) come up and get materials to build a simple circuit. You should include a compass in each set of materials.

Have students make the simple circuit and then put the compasses inside and near the simple circuit. They should notice what happens -- hopefully the compass needle is jumping. This is an example of electromagnetic force.

Have students place the compass at different points and see where electrical current is strongest. After about 5 minutes of this hands on activity, have students disconnect their batteries, and collect all materials.

Assessment:
Conduct a full class discussion. Students should be encouraged to share out their own definitions of electromagnetic force. Does the force work along the whole wire the same? What can this force be used to do? (Power a light bulb, a motor, etc.)
Have students draw a picture of their simple circuit and their compass in their science notebook. Have them write what they learned about magnetism.



Extensions to this Activity:

After building a simple circuit, explain that the purpose of electromagnetism is to do work – to power something like a light bulb. You can give students minibulbs, bulb holders, battery holders, and additional alligator clips, and have them create a series circuit.

Internet Resource:

Video: Explaining Earth's magnetic field
http://phys.org/news/2013-11-video-earth-magnetic-field.html

Video: Bill Nye the Science Guy – Magnetism
https://www.youtube.com/watch?v=4bppssq4jsI