Lesson Preparation – Magic Magnets (<1 hour active time)

Materials (for 24 students) :

Bar Magnets (2 per group)

Ring Magnets (2 per group)

Paper Clip (1 per group)

String (1’ per group)

Masking Tape (1 roll per group)

Magic Magnets Presentation (1 per class)

Magic Magnets Worksheet (1 per student)

Before Lesson:

1. Cut string into on foot sections and tie a paperclip to one end.

Lesson Plan – Magic Magnets (50 min)

Opening (5 Min)

Begin by reviewing what the students know about electrons. How are electrons involved in static electricity? How are electrons involved in regular electricity? *Students should know that electrons are negatively charged and that they can move from atom to atom. In static electricity, electrons are transferred from one place to another, and they stay there; in regular electricity electrons flow in a circle and create energy.*

Ask them to describe a magnet and give an example of how they work.

Ask them how they think magnets work and why they stick to some things and not others.

Magnetic Materials (10 min)

Put up the slide of the magnet divided into regions. Explain that these regions represent all the atoms in the magnet. Ask the students what they would expect to find in each of these regions. *Protons, neutrons, and electrons.*

Tell the students that because electrons are so excited, they have another property, they spin! You can physically demonstrate that the electrons can spin one of two ways, to the left or to the right. Pull up the next slide and tell the students that as scientists, we draw electrons spinning one way as an up arrow, and electrons spinning the other way as a down arrow.

Bring up the slide with the electrons that are spinning in all directions. This is a normal, non-magnetic material. In this material, all the electrons are pulling in different directions and cancel each other out.

Bring up the slide with the electrons all spinning in the same direction. Tell the students that this is what electrons look like in a magnetic material. Ask them what they think happens in this case. *All the electrons are pulling in the same direction, resulting in a force we know as magnetism.*

Materials with electrons spinning in the same direction like to stick together.

Have the students fill in the empty magnet on their worksheet with electrons as they look in a magnet. Describe a pole, and have the students label the heads of their arrows as the north pole, and the tails of their arrows as the south pole.

Tell the students that we know of only three elements that can have magnetic properties, nickel, iron, and cobalt.

Properties of Magnets (15 min)

Hand out two bar magnets and two ring magnets per group. Have the students inspect their bar magnets for the north and south pole indications.

Ask the students what they think happens when we split a magnet in half? You can have the students model this process by putting their bar magnets end to end. When they break it into two smaller magnets, does it still have a north and south pole? *It does. When you break a magnet it retains all the properties of the original magnet; all the electrons are still spinning in the same direction.*

Have the students experiment with the bar and ring magnets. Which ends like to be close to one another? Which ends don't? Where are the poles on the ring magnets? Students can thread the ring magnets over a pencil held upright on a desk to observe ring magnet behaviors.

Magnetic Fields (15 minutes)

Ask the students why they think a magnet sticks to a non-magnetic material, like a paperclip. Show the slides illustrating that the spinning electrons in a magnet can align the electrons in other materials, making all the electrons spin in the same directions so that the magnet can stick.

Ask the students where they think the magnet is strongest. Go through the slides with the magnetic field lines and have the students follow along on their worksheets.

Hand out the paperclips on a string and tape them so that they hang down from a surface. Have the students use their magnets to find out where they exert the most force on the paper clip.

Closing (5 min)

Gather students together and ask them what they observed about magnets. What happened with the paperclip?

Have them imagine the kinds of things they could build with a magnet.

Finish by letting students ask questions about electrons and magnets.