Activity One

Magnets

- ❖ Every magnet has at least one north and one south pole
- ❖ Opposite poles attract (pull toward) each other
- ❖ Like poles repel (push away) from each other

Materials:

*Variety of magnets: block magnets, N/S bar magnets, horseshoe magnets

*Alnico bar magnet

Engage:

Before class begins tape the alnico bar magnet to the palm of your hand. Tell the students to watch as you make four ordinary paperclips disappear without touching them. Sweep your hand over the paperclips and they "disappear". You will get a lot of "how'd you do that?" Tell the students it's not magic, it's science. Show them the hidden magnet in your palm and tell them they will get a chance to experiment with magnets themselves.

Explore and Discuss:

1) Point out the ends of the alnico bar magnet marked N and S. Explain that every magnet has two ends or sides called a north pole and a south pole. How would you explain a pole? (positive or negative, north = negative)
2) Give students two like magnets, such as two bar magnets. Have them find the poles.
3) Have the students move the magnets around so that different poles face each other.
4) Discuss the pulling or pushing force that students feel. Ask them to explain what happens when opposite poles face each other (the magnets attract each other); when like poles face each other (the magnets push away/repel). Does the polarity direction matter?
5) Have the students get two other magnets and determine which poles are like and opposite.

Questions to Dig Deeper:

1. What's your evidence?
2. How did you arrive at that conclusion?
3. Does it, or will it, always work that way?

Extension:

Let the students try a "magic trick". Have them hold a pencil and slide a ring magnet onto it. Then challenge them to slide a second ring magnet onto the pencil so that it "floats" above the other. Have the class explain how the trick works.

Sources: www.DowlingMagnets.com, Comprehensive Magnet Lab Kit
www.Homesciencetools.com

Activity Two

Will The Magnet Attract It?

- Magnets attract objects that contain iron.
- Objects that contain iron are called “ferrous”.

Materials:

*Variety of magnets

*Bag containing items that will stick to the magnet and those that won’t

*Will the magnet attract it worksheet

Explore & Discuss:

1) Give the students the worksheet and bag of items. Make predictions “will the magnet attract the item?”
2) Now pass out a variety of magnets and let the students explore.
3) Was their prediction right? Why or why not was their prediction correct? What’s the evidence?

Sources: www.DowlingMagnets.com, Classroom Attractions Comprehensive Magnet Lab
Betterlesson.com

Activity Three

Going Through Solids and Liquids

- ❖ A magnet's force can act through solids and liquids
- ❖ Stronger magnets can attract through thicker materials

Materials:

*Variety of magnets

*Steel shapes from the Dowling Magnet Lab

*Shallow plastic container

*Sheet of paper, cardboard, pieces of cloth, aluminum foil, and other nonmagnetic materials

*3 Bottles filled with paperclips: 1st bottle filled with water, 2nd filled with oil, 3rd filled with corn syrup

Explore and Discuss:

1) Have students place steel shapes in the plastic container and hold a magnet near the shapes. Discuss what happens. Then tell them to lay a sheet of paper on the shapes. Ask if the magnet will still be able to pick up the shapes. Let the students investigate their hypothesis. Discuss the results.
2) Have the students test to see what other materials a magnet's force can act through. (For example, students can put the magnet under the plastic container and then move the magnet under it to see if the steel shapes move).
3) Have students try the activity with different magnets. Help the class see that stronger magnets can attract through thicker materials.

Questions to Dig Deeper:

1. Why do you think that?
2. What's your evidence?
3. How did you arrive at that conclusion?
4. Does it always work that way?
5. What if it had been _____ instead of plastic?
6. Let's take that suggestion and how can we push it a little further?

Extension:

Using the 3 bottles filled with paperclips and different liquids, try moving the paperclips around the bottle by moving a magnet wand around the bottle. Try it with other magnets. Talk about how the thickness of the liquid and the strength of the magnet affects the results.

Sources: www.DowlingMagnets.com, Classroom Attractions Comprehensive Magnet Lab

Activity Four

Make a Magnet

- ❖ There are permanent magnets and temporary magnets
- ❖ An object made of iron becomes a magnet when it is held within a magnetic field or in contact with a magnet

Materials:

*N/S bar magnets or block magnets

*Steel paperclips and a nail for each group

Explore and Discuss:

1) Ask students to touch two paperclips together. They will see that nothing happens. Then have them place one paperclip on a magnet so that a bit of the clip sticks out over the end. Have students see if they can attach a second paper clip at the end of the first clip. Discuss what happens.
2) Have students see how long they can make their chain of paper clips. Can they use different configurations, different magnet strengths to make paper clip chains?
3) Tell the students to remove the top paperclip carefully from the magnet. Discuss how the paperclips remain attached for a short time even without the use of a magnet. Explain that the first paper clip has become a temporary magnet; unlike permanent magnets, temporary magnets eventually lose their magnetism.

Extension:

Have the students make a temporary magnet by stroking a nail 20 times in one direction against one of the Alnico N/S magnets. (*tip: this does not work well with any of the weaker magnets in the kit and the effect does not last long*) Let them see if they can pick up a paperclip or some steel shapes with the nail. Discuss what made it work.

Magnets are atomic powered. The difference between a permanent magnet and a temporary magnet is in their atomic structures. Permanent magnets have their atoms aligned all the time. Temporary magnets have their atoms aligned only while under the influence of a strong external magnetic field.

Sources: www.DowlingMagnets.com, Classroom Attractions Comprehensive Magnet Lab

Activity Five

Strength Test

- ❖ Every magnet is surrounded by an invisible magnetic field
- ❖ A magnet's force is strongest at the poles
- ❖ You can see the effects of the magnetic field of a magnet in the pattern of iron metal filings exposed to a magnet

Materials

*Shallow plastic container

*N/S bar magnets

*Steel shapes

*Strength Test Worksheet and/or Picturing Magnetic Fields Worksheet

*Bags with iron filings & white sheet of paper for each group

Explore and Discuss:

1) Have the students spread the steel shapes in the bottom of the plastic container. Tell them they are going to find out if all parts of a magnet "pick up" objects equally.
2) Instruct students to hold a N/S bar magnet by the middle and lower it slowly into the container. The steel shapes will "jump up" and cling to the magnet.
3) Have students carefully raise the magnet and observe what part of the magnet the shapes cling to. Have students record their observations on the activity sheet.
4) Discuss the results. Explain that the shapes "jumped up" and clung to the magnet, because a magnetic field surrounds every magnet; most of the shapes clung to the magnet's poles (ends) because the magnetic force is strongest there.
5) Repeat the activity with other kinds of magnets. Allow them to investigate, reflect, and apply.

Questions to Share, Expand and Clarify Thinking:

1. What more can you say about that?
2. What do you mean by that?
3. What's another example?

Extension: Have each student group lay a magnet flat on a table with a white sheet of paper over it. (this works best with a bar or horseshoe magnet) Give each student group one of the Ziploc bags with iron filings. Have them gently shake the bag to evenly distribute the iron filings throughout the bag then lay the bag on top of the paper and magnet. Have them observe the pattern of iron filings. Extend this by trying different shaped magnets to see what their magnetic fields look like. Students can also see if the pattern changes with two bar magnets placed with similar poles facing each other or with opposite poles facing each other. You can choose to have students draw pictures of what they observe on the Exploring Magnetic Fields Data Sheet.

Sources: www.Homesciencetools.com

DowlingMagnets.com, Classroom Attractions Comprehensive Magnet Lab

Picturing Magnetic Fields Worksheet

Name: ______________________

Lay the bag with iron filings on your desk and gently shake it back and forth until you get a thin layer of filings throughout the case. Put a bar magnet underneath a white sheet of paper then gently lift up the bag and lay it over the paper and magnet. What happens?

What does the magnetic field look like around a bar magnet? Draw a picture of what you see.	What does it look like when you have 2 magnets under the case that are attracted to each other? Draw a picture of what you see.
What does is look like when the 2 magnets are repelling each other? Draw a picture of what you see.	What does the magnetic field look like around a magnet with a different shape? Draw a picture of what you see.

Name: ____________________

Strengths Test Worksheet

Question:
What part of a bar magnet is the strongest?

Prediction:
Write what you think the answer is.

____

____

Directions:
1. Fill the bottom of the plastic tray with steel shapes.
2. Hold a bar magnet in the middle. Lower the magnet into the container.
3. Look to see where the steel shapes are attracted to the magnet.

Results:
Draw a picture showing what the bar magnet looked like when you took it out of the container.

Conclusion:
What part of a bar magnet is the strongest?

____

____

Source: www.DowlingMagnets.com, Comprehensive Magnet Lab kit

Activity Six

Electromagnetism

- Electricity can be used to make a magnet called an electromagnet
- An electric current flowing through a wire produces a magnetic field
- The strength of an electromagnet can be increased by wrapping the wire in a coil around an iron or steel rod
- Electromagnets can be used to move things

Materials:

- Insulated copper wire
- Battery
- Iron nail
- Paperclips
- Toy cars

Explore and Discuss:
Share information with the students about electromagnets. Electric current flowing through a wire creates a magnetic field that attracts ferromagnetic objects, such as iron or steel. This is the principle behind electromagnets. An electromagnet is wire tightly wrapped around a ferromagnetic core. When the wire is connected to a battery, it produces a magnetic field that magnetizes the core. An electromagnet is only magnetic when it has electricity flowing through it. Electromagnets are temporary magnets as their magnetic force stops when the electric current is turned off. Many household items such as computers, TVs, refrigerators and other electric motors use electromagnets to make them work. Electromagnets are also used when a very strong magnet is necessary. You may choose to show the students a video of a large electromagnet in use such as this one:
https://www.youtube.com/watch?v=XBWy9gzGGd4

Demonstrate making an electromagnet with the battery, copper wire and nail.

1. Tightly wrap the wire around the nail. If you have enough wire, wrap more than one layer.
2. Ask the students if they think the nail will pick up paperclips. Try to pick up some paperclips with the wire-wrapped nail.
3. Hook the uninsulated ends of the wire to the battery and try again to pick up the paperclips with the nail. Ask the students why it works this time. The electricity will create a magnetic field and the nail will attract the paperclips. (*Don't leave the wire hooked up to the battery for very long- it will get hot and drain the battery very quickly)*.
4. Ask the students what they think will happen if you wrap more or less wire around the nail.

Extension:

Share with the students that a maglev (magnetically levitated) train doesn't use a regular engine like a normal train. Instead, electromagnets in the track produce a magnetic force that pushes the train from behind and pulls it from the front. You may choose to show them a video of a maglev train in action such as this one: https://science.howstuffworks.com/transport/engines-equipment/maglev-train.htm

Use bar magnets and toy cars to give the students an idea of how it works.

1. Have the students tape a N/S bar magnet to a toy car with the north pole at the back of the car and the south pole at the front.
2. Put the car on a table or the floor. Hold another bar magnet behind the car with the south pole facing the car. As you move the magnet near the car, what happens? The south pole of your magnet repels the north pole of the magnet on the car, making the car move forward.
3. Have someone else hold another magnet in front of the car, with the north pole facing the car. Does the car move faster with one magnet pushing from behind and the other magnet pulling from ahead?

Ask the students why the car moves. How might this work to make a train move? In this demonstration, the permanent magnets have to move with the car to keep it going. In a maglev track, though, the electromagnets just change their poles by changing the direction of the electric current. They stay in the same spot, but their poles change as the train goes by so it will always be repelled from the electromagnets behind it and attracted by the electromagnets in front of it.

Source: www.homesciencetools.com