Gizmos

Name: _____ Date: _____

Student Exploration: Magnetism

Vocabulary: attract, bar magnet, ferromagnetic, magnetize, north pole, repel, south pole

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. What happens when you place two magnets close together? _____

   _____

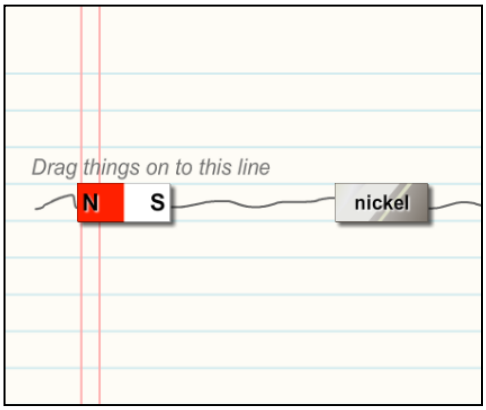
2. What objects do magnets stick to? Make a list. _____

   _____

3. What do these objects have in common? _____

Gizmo Warm-up: What is attracted to magnets?

A **bar magnet** is a simple rectangular magnet. If you hang a bar magnet by a string, the **north pole** (N) of the magnet will tend to point north while the **south pole** (S) of the magnet points south.



1. Look at the materials at the bottom of the Gizmo. Which ones do you think will stick to a bar magnet?

   _____

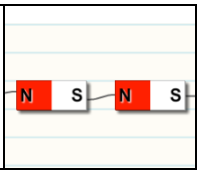
2. **Ferromagnetic** materials are strongly attracted to magnets. Drag a bar magnet and the piece of **nickel** onto the scribbled line. Press **Play** ( ).

   A. Is nickel ferromagnetic? _____

   B. How do you know? _____

3. Test copper, wood, glass, and iron. Which ones are ferromagnetic? _____

   _____

Activity A: **Attract or repel?**	Get the Gizmo ready: • Check that the MAGNETIC FORCES tab is selected. • Click **Reset** ( ).	

Question: How do magnets interact?

1. Observe: Drag two bar magnets onto the paper and press **Play**. Then click **Reset**. Change *one* of the magnets (either from **N-S** to **S-N**, or vice-versa). Click **Play** again.

   A. What happened the first time? _____

   B. What happened the second time? _____

2. Form hypothesis: Magnets are either pulled together (**attracted**) or pushed apart (**repelled**). Based on what you have seen, when are magnets attracted and when are they repelled?

   _____

   _____

3. Predict: Based on your hypothesis, which pairs of magnets will be attracted to each other? Which will be repelled? Record your predictions below. (Leave the result blank for now.)

Left magnet	Right magnet	Prediction (Attract or repel?)	Result (Attract or repel?)
N S	N S		
N S	S N		
S N	S N		
S N	N S		

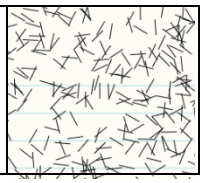
4. Run Gizmo: Test your predictions using the Gizmo. Record your results in the table.

5. Draw conclusions: Fill in each blank below with the correct word.

   A. The south pole of a magnet is attracted to the _____ pole of another magnet.

   B. The south pole of a magnet is repelled by the _____ pole of another magnet.

   C. The north pole of a magnet and the north pole of another magnet will _____ each other.

Activity B: **Magnetic field lines**	Get the Gizmo ready: • Click **Reset** and drag all objects off the paper. • Select the MAGNETIC FIELD LINES tab.	

Question: If you scatter iron filings (little slivers of iron) around a magnet, you will see a pattern of magnetic field lines. What do these lines show you?

1. Observe: Drag *one* magnet onto the paper. Click **Sprinkle filings** and then **Tap table** five or six times. Sketch the pattern you see in the box:

   What do you notice about the iron filings?

   _____

2. Observe: Drag a second magnet next to the first. Click **Sprinkle filings** and then click **Tap table** several times. Sketch what you see.

   Will these magnets be attracted or repelled?

   _____

3. Observe: Now switch one of the magnets. Click **Sprinkle filings** and then click **Tap table** several times. Sketch what you see.

   Will these magnets be attracted or repelled?

   _____

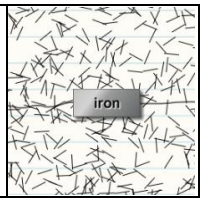
4. Draw conclusions: Compare the magnetic field lines you have sketched. How can you use the field lines to tell if magnets will be attracted or repelled?

   _____

   _____

5. Extend your thinking: Observe the magnetic field lines produced by an **N-S** magnet and the **mystery** magnet. Will these magnets attract or repel each other? First, make a prediction below. Then, check your answer on the MAGNETIC FORCES tab.

   Prediction: _____ Actual result: _____

Extension: **Magnetic materials**	Get the Gizmo ready: • Select the MAGNETIC FIELD LINES tab. • Drag an **S-N** magnet and the **copper** bar onto the paper.	

Question: Why do magnets attract certain materials?

1. Observe: Click **Sprinkle filings** and then click **Tap table** several times. Look closely at the filings near the **copper** bar. Does copper have any effect on the filings?

   _____

2. Observe: Repeat the experiment with **iron**. What effect does iron have on the filings?

   _____

   _____

3. Analyze: Which of these materials is ferromagnetic? _____

4. Draw conclusions: How can you tell if an object is ferromagnetic by looking at its field lines? Discuss your answer with your teacher and classmates.

   _____

   _____

5. Apply: Select the MAGNETIC FORCES tab and experiment with the Gizmo. Try to answer the questions below. Share your findings with your classmates and teacher.

   A. Can a magnet ever *repel* a ferromagnetic material? _____

   B. In the Gizmo, does one ferromagnetic material attract another? _____

6. Experiment (optional): When a ferromagnetic material like iron is placed near a magnet, it becomes **magnetized**—it actually becomes a magnet! (Look at the field lines when iron is near a magnet.) Even after the magnet is removed, iron can stay magnetized for a while.

   In "real life" (not in the Gizmo), rub a metal paper clip with a magnet. What happens when you touch another paper clip with your magnetized paper clip?

   _____