CaSTL

Magnetic Force—Part 2

Boys and Girls Club After School Science
NSF Center for Chemical Innovation
Chemistry at the Space Time Limit (CaSTL)
https://www.castl.uci.edu/

Lesson Objective: Children will understand the forces of magnets while in cooperative groups and by making observations and talking to their partners to notice patterns of push and pull.

Materials Used: donut magnets, a pencil, magnetic wands, aluminum foil, penny, aluminum pie plate, AIMS lesson (Help the Hound Find Its Bone—dog figure and track on card stock with paper clips), large classroom-sized versions of the worksheets, and copies of the attached worksheets

Student Talk Strategies: *Report to a Partner, Revoicing*

Classroom Management: CHAMPs

Conversation: Children may talk with inside voice to their partners only. **Help:** If children need help, one of the group will raise a hand to let the teacher know. **Activity:** Children will use manipulatives, make observations, and draw the materials and forces. **Movement:** Children will stay at their place. **Participation:** All children in the group are expected to take turns and handle the manipulatives.

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ENGAGE: *Connect to Prior Knowledge and Experience, Create Emotionally Safe Learning Environment, Preview New Vocabulary*		**Estimated time: 15 minutes**
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher reviews students' prior knowledge of forces from previous lessons. Teacher scribes students' answers.	1. What is a force? How do forces work? What are examples/demonstrations of forces? Can you name some forces?	1. Students report out to the whole class.

2. Teacher tells students that there is another force that they will observe today. It's called Magnetic Force. Teacher demonstrates the "Floating Magnets" activity by using a pencil and donut magnets to make magnets "float". Teacher has students think about the forces applied to magnets when piling on more and more magnets to the pencil and observing how the added magnets make the downward force greater. 3. Teacher has students report any further observations and comments from the investigation.	2. What do you observe happening? What do you notice? Why do you think this happening? 3. What else did you notice?	2. Students report their observations to an elbow partner. Then, they report out to the class as the teacher scribes. Students then try the experiment in pairs. One student should hold the pencil vertically with thumb and index finger. The partner should place a donut magnet on the pencil and have it rest on the student's thumb and finger. The partner should then drop the other donut magnet onto the pencil.
EXPLORE: ***Hands-On Learning, Contextualize Language, Use of Scaffolding (Graphic Organizers, Thinking Maps, Cooperative Learning), Use of Multiple Intelligences, Check for Understanding***		**Estimated time: 15 minutes**
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher gives students a new magnet and asks them, in pairs, to first predict and then to investigate different objects around the room that are attracted to the magnet.	1 Report to a partner: Ask your elbow partner, "What do you think will be attracted to the magnet?" "Why do you think that?"	1. Children respond individually by talking to an elbow partner. **Naïve conception:** Some children think that all metals are attracted to magnets
EXPLAIN: ***Listening, Speaking, Reading, and Writing to Communicate Conceptual Understanding***		**Estimated time: 5 minutes**
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher has pairs report out. Teacher records findings in a T-chart, using drawings and words (attracted/not attracted).	1. Each group will now tell us what they observed. What did you find around the room that was attracted to the magnet? Was your prediction correct?	1. Children in their groups tell the whole class what they observed.

2. Teacher listens to groups' reports and repeats or **Revoices (one of the five productive talk moves)** what they say to be sure that the class is noticing patterns and the learning is addressing the standards.		
EVALUATE: ***Thinking Maps, Summarize Lesson and Review Vocabulary, Variety of Assessment Tools, Games to Show Understanding*** **Estimated time: 5 minutes**		
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher holds up a different common object one at a time: aluminum foil, penny, and other items) and asks the students if the objects will be attracted to the magnet. Teacher takes a vote. Then, the teacher performs the demonstration.	1. Teacher asks each student to ask their partner, "Do you think this ____ will be attracted to the magnet?" Each student must respond. Was the object attracted to the magnet?	1. Children decide whether the object will be attracted. They vote. Students observe and reflect on their prediction.
EXTEND: ***Group Projects, Plays, Murals, Songs, Connections to Real World, Connections to Other Curricular Areas*** **Estimated time: 5 minutes**		
Teacher's Role	**Teacher Questions**	**Children's Role**
1. Teacher distributes the "Hound" activity and tells the student that they will play a racing game which demonstrates how magnetic force can pull object (even through paper). Student race the magnetic dogs (held together by metal paperclips).	1. What is causing the doggies to move? What is that force?	1. Children move the doggies on paperclips with the magnet and observe how magnetic force moves objects.

Student Talk Strategies

Adapted from *Avenues* (2007). Hampton Brown.

Design	Description	Benefits and Purposes
Report to a partner 	• Each student reports his/her own answer to a peer. • The students listen to their partner's response. ("Turn to a partner on your left." "Now turn to a partner on your right" etc.)	• This allows students to talk to different students in the class and gives each student an opportunity to share and listen to various answers and language structures. • Talking one-on-one with a variety of partners gives risk free fluency practice. • Students practice speaking and listening.

Teacher Background Information

from http://home.interserv.com/~skyblade/wim.htm

Just What Is Magnetism?

Basically, **magnetism** is the force that causes a nail or paper clip to be pulled toward a magnet. Play around with a magnet and you'll quickly see magnetism in action!

But HOW does magnetism work?

That's a little harder to explain. But start with this...
Imagine two kids, trying to pull a wagon. One pulls from one side, and the other pulls from the exact opposite side.

What happens? The wagon doesn't move!

Now, imagine that the two kids realize that it isn't working and switch positions. The both pull from the same side.

The wagon moves!

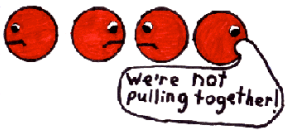
And this applies to magnetism HOW?

Everything around you is made up of tiny particles. One of those particles is the **electron**.  *Hi! We're electrons!*

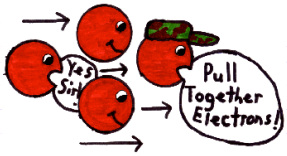
These electrons are soooo tiny, that you can't see them without the most powerful of microscopes. As the name might suggest, electrons have an electrical charge. And whenever electricity moves, a magnetic field is created.

So, if these electrons are in everything, and they're magnetic, how come only some metals are magnetic, and not, for example, the family dog?

Think back to the example of the kids pulling the wagon. In most things, the electrons send their magnetic pull in different directions. If you're pulling on something from all different directions, it's not going to move.



In metals that are magnetic, the electrons are all facing the same way. So when they all pull in the same direction, things will move!



Magnets (More Teacher Background Information)

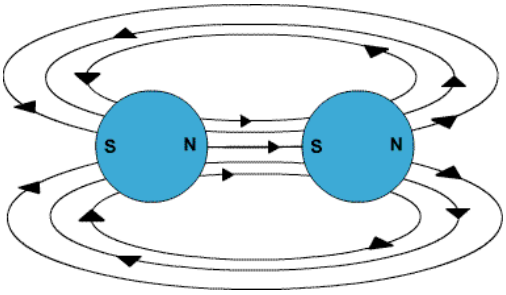
Although individual particles such as electrons can have magnetic fields, larger objects such as a piece of iron can also have a magnetic field, as a sum of the fields of its particles. If a larger object exhibits a sufficiently great magnetic field, it is called a magnet.

Magnetic force

The magnetic field of an object can create a magnetic force on other objects with magnetic fields. That force is what we call magnetism.
When a magnetic field is applied to a moving electric charge, such as a moving proton or the electrical current in a wire, the force on the charge is called a Lorentz force.

Attraction

When two magnets or magnetic objects are close to each other, there is a force that attracts the poles together.

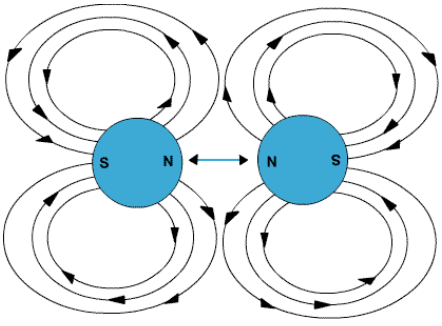


Force attracts N to S

Magnets also strongly attract ferromagnetic materials such as iron, nickel and cobalt.

Repulsion

When two magnetic objects have like poles facing each other, the magnetic force pushes them apart.



Force pushes magnetic objects apart

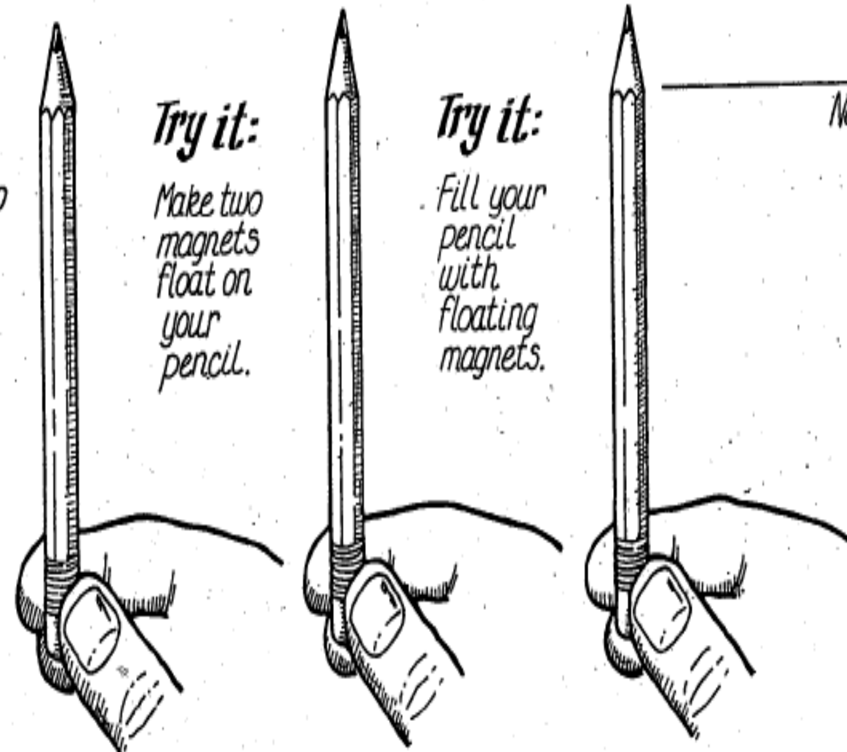
FLOATING MAGNETS

Name ____________

Try it: Make two magnets stick together on your pencils.

Try it: Make two magnets float on your pencil.

Try it: Fill your pencil with floating magnets.



Draw a picture of what you did.

Now try this: Using what you have learned, make a magnet pop off your pencil. How did you do it?