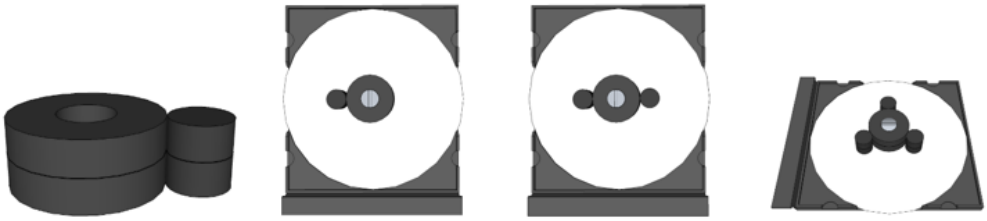
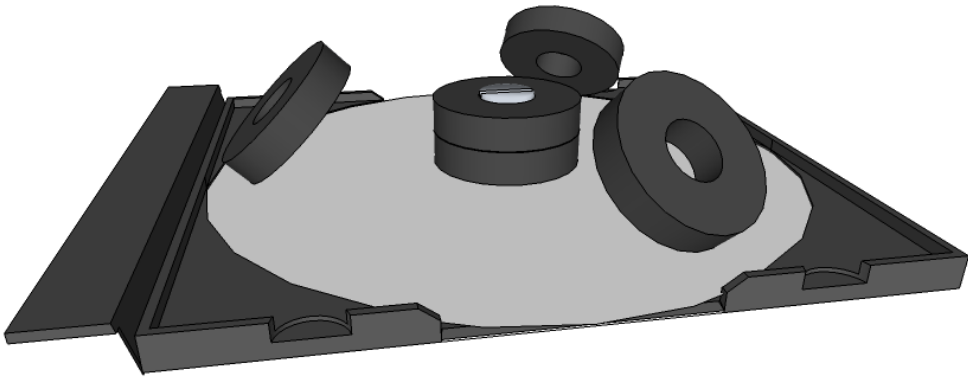
MYSTERIOUS MAGNETIC MOVEMENTS

Explore magnetic attraction and repulsion



A variety of scientific and gravity “defying” demonstrations can be done by combining pill and ring magnets in unique ways to create a multipurpose demo unit.



Curriculum topics

- Energy
- Engineering/Design
- Magnetism
- Problem Solving

Subjects

- Engineering
- Performing Arts
- Physical Science

Grade range: 4 – 8

Who we are: Resource Area for Teaching (RAFT) helps transform the learning experience by inspiring joy through hands-on learning.

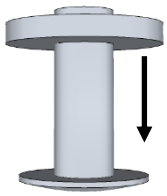
Share Your feedback!
http://bit.ly/RAFTkitsurvey

Materials

Use the following items to assemble each project:

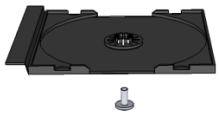
- Aluminum screw and post, ½" long, 3/8" diameter (1)
- Washer, non-magnetic, ½" OD, 3/8" ID (1)
- CD media tray w/ open center hole (1)
- White paper disc, Cd size (1)
- Ring magnets (5)
- Pill magnets (12)
- Jumbo craft stick (1)
- Small sticker (1)

To Do and Notice



1 Place the washer over the post and push downward toward the head of the post (right). Lower the media tray (CD side up) over the post and washer. Align the washer so it fits into the tray's circular indentation (below). Place the white paper disc into the CD section of the media tray.

2 Stack two ring magnets, centered, over the end of the post oriented so they attract each other. Insert the screw into the post and carefully twist the two parts together (see below). The post and screw should thread together easily, if not unscrew and try again. Use the narrow edge of the jumbo craft stick as a "screwdriver" to tighten screw if needed.



3 **Model orbiting planets or moons:** Orient 2 stacked pill magnets so the sides are attracted to the ring magnets. Rotate the pill magnets around the rim by swirling the tray in a "hula-hoop" type motion. Add a 2nd pair of pill magnets and repeat, noting how one pair of pill magnets repels the other pair. Add more pairs of pill magnets and continue observing their motion around the rim (see top of title page).

4 **Model the regular patterns in crystal:** Note that as more pill magnet pairs are added the pill magnet pairs will move to be evenly spaced around the ring magnets.

5 **Model the flow of electric current:** Place all 6 pairs of pill magnets around the ring magnets. Move 1 pair of pill magnets to cause the others to move around in a "circuit." Move the pill magnets either clockwise or counterclockwise to model DC (direct current) flow. Wiggle a pair of pill magnets back and forth to model AC (alternating current).

6 **Tilting ring magnets:** Remove the pill magnets. Place a third ring magnet on top of the stacked ring magnets, oriented so it is attracted. Lift the 3rd magnet off the stack and lower to the media tray, keeping the bottom face tilted towards the stack. Slide the magnet until the back edge is at a point near the edge of the circle (see middle of title page).

7 Position the magnet so it does not fall when released. If the magnet "jumps" to the stack of magnets, move it a little farther away and release. If the magnet falls flat, move it closer to the stack before releasing. Repeated trials may be required for success.

8 When a magnet can remain in a tilted position, without being held, add a 2nd magnet on the opposite side. When the 2 ring magnets are stable, add a 3rd ring magnet between the two! Note how the magnets move to be equal distance from each other.

9 **Share** student learning with RAFT! Submit photos/video via email at education@raft.net or on social media (Facebook, Twitter, Instagram).

Core Content Skills:

Science & Engineering (NGSS)

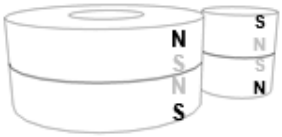
Developing and Using Models, Planning and Conducting Investigations, Generating and Comparing Design Solutions, Properties of Matter, Magnetic Forces and Interactions, Energy Transfer and Conservation

Social Emotional Learning

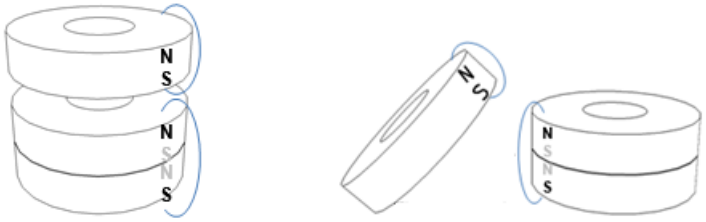
- Self-awareness
- Self-management
- Responsible decision-making

The Content Behind the Activity

Modeling with Pill Magnets: The pairs of ring and pill magnets are positioned so their opposite poles are attracting each other. The magnetic poles of the pill magnets are oriented opposite the poles of the ring magnets to also be attracted. The pill magnet pairs will repel each other since the pill magnets share the same orientation of their poles when attached to the ring magnet (like magnet poles repel each other).



Ring Magnets: Initially the 3 stacked magnets are attracted but when the top magnet is pulled off and tilted it is repelled. At a certain distance from the stack the magnet can be oriented so that the repelling force of the magnet counterbalances the attractive force of gravity, so the magnet does not fall when released.



Reuse

This kit uses 100% reusable materials designed for other uses. To continue making a positive impact in reducing waste, reuse these materials in other projects. Additionally, any unused materials can be collected and delivered back to RAFT.

Feedback

Please comment on this kit by taking this short survey: http://bit.ly/RAFTkitsurvey. Let us know of any material concerns (missing, broken, or poorly fitting parts) as well as any suggestions for improvement.

Visit https://raft.net to view related activities!

Amazing Magnetic Worms
Floating Garden of Magnets
Magnetic Field Line Viewer
Magnetic Perturbations
Mini Magnet Wands

Resources

- Magnetic field line images – https://bit.ly/2VsbT4E
- YouTube video (5:53), Magnetic Fields – http://bit.ly/2V4HIS4