

OVERVIEW

Is it magic or magnets? We will explore how motion, stability, and force interact with each other by creating our own magnetic levitation device with an emphasis on design.

GRADES: 4-12

STANDARDS: NGSS 3-PS2-3

MATERIALS: 10 ring magnets ($\frac{3}{4}$ inner diameter), pencil, cardboard, arts and crafts supplies.

TERMS: *Dipole* is a pair of electrical charges or magnetic poles of equal and opposite polarity.

Force is a push or pull or twist on an object due to an interaction with another object.

Magnetism is a force caused by a piece of metal, like a magnet, that attracts or repels other objects.

DO

- Let's play with the magnets.
 - Put two magnets together and take note on the sides where they attract or repel each other. Repeat for the rest of the magnets.
 - Take your pencil, hold it upright or use a table and slide the magnets through so that they are all levitating. Write down your observations.
- Based on our observations, let's design a way to levitate the pencil using all of our materials.
- Draw different ways on how you think you might create a way for a pencil to levitate.
- Using our materials, build a prototype of your idea, test, and improve.
 - Not ready to design on your own? For step-by-step instructions, check this link out: <https://www.instructables.com/Magnetic-Levitating-Pencil/>

REFLECT AND APPLY

- From the first part of step 1, why do you think magnets either repel or attract each other? Why do some magnets have labels such as 'north' and 'south' poles?
- Based on your observations from the second part of step 2, what did you notice about the distance from each magnet?
 - Want to know more? Follow: <https://www.exploratorium.edu/snacks/magnetic-atmosphere-model>
- If you decided to design your own magnetic levitation device, how many attempts did it take for a successful design? What did you learn at each attempt?

- How does your process relate to the engineering design process? <https://store.extension.iastate.edu/product/15759>

MAKER CHALLENGE

Magnets can be used for various things such as maglev trains and something as simple as buttonless shirts. What other ways can magnets be helpful to you or your community? If you want to help others through design, be sure to look at the Double Diamond design process: <https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond>

Once completed, with an adult's permission, email a photo of your work to inventstem@iastate.edu. We would love to see your idea!

CAREER CONNECTIONS

Geomagnetists are a specialist type of geologist who study the magnetic processes of geological features and the Earth as a whole. They study the geomagnetism caused by the Earth spinning on its axis as it orbits the sun and the magnetic processes caused by mountain ranges, ocean trenches, and shifting tectonics, which affect the geomagnetic field of the Earth. This research informs the understanding of the formation of the Earth and other planets. It is useful in industry as studying the magnetic fields of the Earth can help predict where resources might be situated.

To learn more about specific careers, go to <https://nustem.uk/blog/careers/topic/forces-and-magnets/>

LEARNING EXTENSIONS

Want to learn more about magnetism? Check out the following links:

- <https://nationalmaglab.org/education/magnet-academy/plan-a-lesson>
- <https://www.exploratorium.edu/snacks/tag/magnet>
- <https://www.instructables.com/Magnetic-Levitating-Pencil/>

Videos:

- Electromagnetism 101: <https://youtu.be/Elv3WpL32UE>
- Magnetism: <https://youtu.be/s94suB5uLWw>
- Magnets How It's Made: <https://youtu.be/qed4ynPYVIA>
- Maglev Trains: <https://youtu.be/alwbrZ4knpg>



We welcome your feedback! Please use this QR code or link to contact us. <https://form.jotform.com/isu4h/ResourceFeedback>

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