

# RAFT IDEAS

**Topics:** Magnetism,  
Magnetic Fields

## Materials List

- ✓ 5 ring magnets
- ✓ Dowel, 9 mm (3/8") diameter or equivalent)
- ✓ Stand(s) for end(s) of dowel

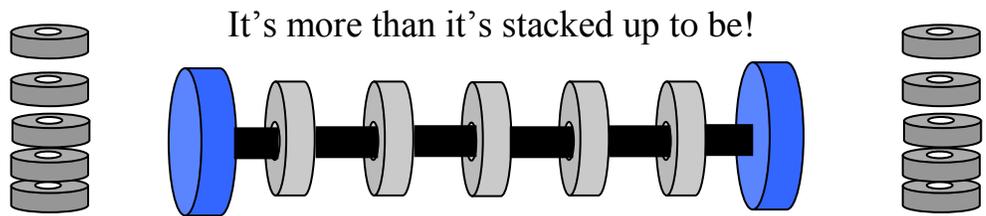
This activity can be used to teach:

- Magnets and magnetic interactions (Next Generation Science Standards: Middle School, Physical Science, 2-3, Middle School, Physical Science, 2-5)
- Science & Engineering Practices (Next Generation Science Standards: Grades 4-8)



Atmospheric Magnet Model by Paul Doherty, The Exploratorium  
Written by Michael Pollock (RAFT)

## Levitating Ring Magnets



The repelling magnetic force between magnets with the same poles facing each other is the basis for this scientific toy. Students can explore and “feel” how the strength of magnetic repulsion **increases** as the distance **decreases**.

### Assembly (if not already assembled)

1. Place 5 donut magnets onto the dowel with the same poles facing each other for each pair (north to north / south to south). If the magnets attract each other, then simply remove the top magnet, flip it over, and reinsert it over the dowel.
2. Optional: Place or replace the top cover or stand on the dowel.

### To Do and Notice (Note: Shaking the magnets back and forth may cause **breakage!**)

1. Hold the dowel horizontally. You may need to give the dowel some slight shakes so that the magnets will space out more evenly. Why do they do this?
2. Optional: Hold magnets all together at one end. Predict what will happen when you release the first magnet and then the others in turn. Note how the spacing between magnets changes as more magnets are released. This is a rough demonstration of the conservation of momentum.
3. Once all the magnets are released and evenly spaced on the dowel, predict what will happen to the magnets when the dowel is held vertically.
4. How can the variation in spacing between magnets be explained? The stack can be inverted to show that it is not due to the magnets having different strengths.

### The Science Behind the Activity

In the horizontal position the dowel supports the released magnets so only the repelling force of the same, or like, magnetic poles is acting on the magnet pairs. This causes equal spacing between the magnets. The friction of the magnets moving on the dowel can cause some minor variations in spacing. When the dowel is held vertically each magnet is still repelling the others but now gravity pulls them closer together. The effect is greatest for the bottom pair of magnets, because of the additional weight above them, and this effect decreases for each higher magnet pairing.

### Taking it Further

How many 9 mm (3/8") metal washers would be needed to force 2 repelling ring magnets to come together on the dowel? Surprisingly it can take 40-45!

This scientific toy can be used to demonstrate or model a number of science concepts:

- Atmospheric and oceanic density variations with height/depth
- A Meglev launcher or train
- Molecular and atomic repulsion

### Web Resources (Visit [www.raft.net/raft-idea?isid=190](http://www.raft.net/raft-idea?isid=190) for more resources!)

For details about atmospheric models and Meglev launcher, visit:

[http://www.exo.net/~pauld/summer\\_institute/summer\\_day16magnetism/%20Magnetic\\_atmosphere\\_model.html](http://www.exo.net/~pauld/summer_institute/summer_day16magnetism/%20Magnetic_atmosphere_model.html) and  
[http://media.nasaexplores.com/lessons/01-027/5-8\\_3.pdf](http://media.nasaexplores.com/lessons/01-027/5-8_3.pdf)

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