The Amazing Floating Train: How Much Weight Can A Maglev Train Hold?

Kit Contents

<table>
<thead>
<tr>
<th>QTY</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>23 1/2&quot; self sticking magnetic strips</td>
</tr>
<tr>
<td>2</td>
<td>5 7/8&quot; self sticking magnetic strips</td>
</tr>
<tr>
<td>2</td>
<td>Plastic angles</td>
</tr>
<tr>
<td>4</td>
<td>4 1/2&quot; sheet metal screws</td>
</tr>
<tr>
<td>1</td>
<td>5/16&quot; x 3/16&quot; x 24&quot; wood strip</td>
</tr>
<tr>
<td>1</td>
<td>3/4&quot; x 1/2&quot; x 24&quot; wood strip</td>
</tr>
<tr>
<td>1</td>
<td>1 1/2&quot; x 1 1/2&quot; x 5&quot; wood block</td>
</tr>
<tr>
<td>1</td>
<td>Decal sheet</td>
</tr>
<tr>
<td>3</td>
<td>Ring magnets</td>
</tr>
<tr>
<td>1</td>
<td>Wooden dowel</td>
</tr>
</tbody>
</table>

You will also need from home:
- Wood or craft glue
- Pencil
- Ruler
- Plastic cups (2), 8 oz or 16 oz
- Extra cup or glass to pour water
- Measuring cup with milliliter (mL) markings or a kitchen scale that can measure grams
- Optional: Sandpaper to sand the wooden block into a train shape
- Optional: Paint and paint brushes to decorate the train

Summary

Prerequisites
- None

Safety
- When working with magnets, keep them away from your mouth, and away from small children and pets.

Abstract

While trains that fly through the air might still be science fiction, trains that float just above the tracks without actually touching them are real and are actually used in a few countries today. This technology is called magnetic levitation. In this physics science project, you will build your own levitating train model and test how much weight it can hold before it stops hovering above the tracks.

Objective

Test the amount of weight that a magnetic levitating train can hold.

Introduction

Have you ever seen a science fiction movie or show where vehicles hover just above the ground without touching it?
The train, however, cannot carry an unlimited amount of weight; the magnets can only supply a limited amount of force depending on how strong they are. Eventually, if you add too much weight to the train, it will sink down and touch the tracks. In this physics science project, you will build your own maglev train model and see how much weight it can hold before sinking to the tracks.

**Experimental Procedure**

1. Follow the instructions that came with your Magic Bullet Train kit to assemble the train with the help of an adult. If you are going to shape and decorate your train, now is the time to use your sandpaper and paint. Be sure you allow some time for your paint to dry. Important: Make sure you screw the plastic angles as close as possible to the bottom of the wooden block; this will prevent the belly of the train from scraping against the top of the track.

If you are using sandpaper to make your wooden block into a train shape, be sure to leave a flat surface in the middle on top of the train; you will need a place on which to put the plastic cup later.
Dowling Magnets, the maker of the Magic Bullet Train kit, has a helpful instructional video:

Watch this instructional video from Dowling Magnets on how to assemble your Magic Bullet Train kit:

[http://www.youtube.com/watch?feature=player_embedded&v=G7c6U0nittw](http://www.youtube.com/watch?feature=player_embedded&v=G7c6U0nittw)

1. Center and place one of your plastic cups on the top of the train.
2. Slowly pour water into the plastic cup. Keep a close eye on the bottom of the train; it should start to get closer to the track.
3. Continue to add water until the train just barely starts to touch the track. As soon as you see part of the train touch the track, stop adding water. Keep in mind that your train might not stay perfectly level when it does finally touch the track; it could tilt to one side, with only one corner touching the track. This is okay, just stop adding water as soon as any part of the train touches the track. In your lab notebook, make sure you record how the train touches the track; is it just one corner or edge, or does the whole bottom of the train touch the track evenly?

![Figure 4](https://via.placeholder.com/150)

**Figure 4.** As you gradually add water to your plastic cup, your maglev train will sink closer to the tracks. Stop adding water as soon as any part of the train touches the track, even if it is just a corner or an edge.

4. If your plastic cup is completely full and the train is still not touching the track, either add a second cup, or start over using a larger cup.
5. Now it is time to take your measurements.
   a. If you do not have a kitchen scale, pour the water from the plastic cup into the glass measuring cup and measure its volume in milliliters (mL). One milliliter of water has a mass of one gram (1g), so you can use the water’s volume to figure out its mass. For example, 10 milliliters (mL) of water has a mass of 10 grams (g).
   b. If you have a kitchen scale, take the plastic cup off the train (do not pour the water out!) and use it to measure the mass of the plastic cup, including the water.
6. Once you have determined the mass of the water, record this value in your lab notebook. Also record which part of the train touches the track (corner only, edge only, entire bottom of train). Note: If you are not using a kitchen scale, your calculation will not include the mass of the plastic cup, but you can assume the water itself is much heavier than the cup, so this is okay as an approximation. You can use a data table like this one to record your results:

<table>
<thead>
<tr>
<th>Trial</th>
<th>Mass of water (grams [g])</th>
<th>Part of train that touched track first</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1.** An example data table for you to keep track of your results.

7. Repeat steps 2–7 four more times, starting with an empty plastic cup on top of the train each time. Be sure to record your measurements and observations in your lab notebook.
8. Analyze your results. Have an adult help you calculate the average mass of water for your five trials. Scientists like to calculate the average of their results because small changes in each trial mean you might not get exactly the same number each time.
   a. How much water did your train support on average?
   b. Did the same part of the train always touch the track first, or were your results different for each trial?

**Variations**

- The Magic Bullet Train kit contains several ring magnets. Can you use these magnets to make a magnetic “brake” at the end of your track, to prevent the train from falling off (for example, if you give the train a good push, or tilt the track so it slides downhill)? Hint: You should use a sturdy piece of cardboard or another block of wood to form a “stop” at the end of the track, then attach one magnet to the train and one to the stop.

**Related Links**

- [Science Fair Project Guide](http://www.sciencebuddies.org/science-fair-projects/project_guide_index.shtml)
- [Other Ideas Like This](http://www.sciencebuddies.org/science-fair-projects/search.shtml?v=solt&pi=Phys_p093)
- [My Favorites](http://www.sciencebuddies.org/science-fair-projects/recommender_show_favorites.php)

If you like this project, you might enjoy exploring these related careers:

- **Physicist**
  
  Physicists have a big goal in mind—to understand the nature of the entire universe and everything in it! To reach that goal, they observe and measure natural events seen on Earth and in the universe, and then develop theories, using mathematics, to explain why those phenomena occur. Physicists take on the challenge of explaining events that happen on the grandest scale imaginable to those that happen at the level of the smallest atomic particles. Their theories are then applied to human-scale projects to bring people new technologies, like computers, lasers, and fusion energy. [Read more](http://www.sciencebuddies.org/science-fair-projects/science-engineering-careers/Phys_physicist_c001.shtml)
Physics Teacher

Our universe is full of matter and energy, and how that matter and energy moves and interacts in space and time is the subject of physics. Physics teachers spend their days showing and explaining the marvels of physics, which underlies all the other science subjects, including biology, chemistry, Earth and space science. Their work serves to develop the next generation of scientists and engineers, including all healthcare professionals. They also help all students better understand their physical world and how it works in their everyday lives, as well as how to become better citizens by understanding the process of scientific research. Read more

Credits

Ben Finio, PhD, Science Buddies

Last edit date: 2013-12-16

Contact Us

If you have purchased a kit for this project from Science Buddies, we are pleased to answer any question not addressed by the FAQs on our site. Please email us at help@sciencebuddies.org after you have checked the Frequently Asked Questions for this PI at http://www.sciencebuddies.org/science-fair-projects/project_ideas/Phys_p093.shtml#help

In your email, please follow these instructions:

1. What is your Science Buddies kit order number?
2. Please describe how you need help as thoroughly as possible:

Examples

Good Question I'm trying to do Experimental Procedure step #5, "Scrape the insulation from the wire..." How do I know when I've scraped enough?

Good Question I'm at Experimental Procedure step #7, "Move the magnet back and forth..." and the LED is not lighting up.

Bad Question I don't understand the instructions. Help!