Science Fair Project

MS Students

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Due: Jan.27th

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Due: Jan 27th

Science Fair topics template

TITLE A

Step-: 2 Project Ideas Proposal

Name, Last Name:

Assigned: 10/27

Deadline: 11/05

1st Idea: Catapult

(Please circle one: engineering/science)

2nd Idea: Magnetic train model

(Please circle one: engineering/science)

My Final idea: Magnetic train model

Question: How does the strength of magnetic repulsion affect the levitation height of a model maglev train?

Resource(s):

https://quantumlevitation.com/magnetic-levitation-science-project/

Science Fair Topics - Draft

1. Write down the topic you chose:

Magnetic levitation trains use the repulsive force between magnets to float above their tracks, reducing friction and allowing for smooth, fast movement. For our science fair project, we are exploring how the strength of magnetic repulsion affects the levitation height of a model maglev train. By testing different strengths of magnets and measuring how high the train floats above the track, we hope to better understand how magnetic forces make maglev trains work and why stronger magnets can improve their performance.

2. What made you want to pick this topic?

We chose this topic because we've always been fascinated by how maglev trains can float and move so quickly without touching the tracks. The idea that magnets can be used for transportation seemed almost like science fiction, and I wanted to learn more about the science behind it.

3. Do you find these topics interesting? Why?

Yes, we found these topics very interesting because they show how science can be used to solve real-world problems in creative ways. Magnetic levitation combines physics and engineering to create trains that are faster, quieter, and more efficient than traditional ones. Learning about how magnetic forces work and seeing them in action makes science feel exciting and relevant. Plus, exploring these topics can inspire new ideas for future inventions and technologies.

Science Fair Topic and Question - Final

Which topic did you choose?

I chose to investigate how the strength of magnetic repulsion affects the levitation height of a model maglev train. This topic focuses on exploring the relationship between magnet strength and how high a maglev train can float above its track, which is a key part of understanding how magnetic levitation works in modern transportation.

What question(s) are you testing?

I am testing the question:How does the strength of magnetic repulsion affect the levitation height of a model maglev train? Specifically, I want to find out if using stronger magnets will make the model train float higher above the track, and how changing the strength of the magnets changes the distance between the train and the track.

How are you going to test your hypothesis?

To test this hypothesis, I will build a simple model maglev train using a small, lightweight train car and a magnetic track. I will use different magnets with varying strengths on both the train and the track. For each test, I will carefully place the train on the track and measure the distance between the bottom of the train and the track (the levitation height) using a ruler or caliper. I will repeat this process with each set of magnets, recording the levitation height for each strength. By comparing the results, I can see how changing the magnet strength affects how high the train floats. This experiment will help me determine if stronger magnetic repulsion increases the levitation height of the maglev model.

Background Research Source 2

If this source is a: _____ Magazine _____ Newspaper _____ Other **Title of the publication:**
Title of Article:
Author's Name:
Date Published:
Edition: Volume Number: Page Number(s): (if applicable) (periodicals or encyclopedias)

This source is a: ____x__ Website _____ Other **The URL is http://** **https://quantumlevitation.com/magnetic-levitation-science-project/** **https://science.howstuffworks.com/transport/engines-equipment/maglev-train.htm** **https://www.newenglandwire.com/application/the-repulsive-attractive-world-of-maglev/** **Last Date of Access: 10/26/2025**
Title of Article:
Author's Name: [=
Date of Article:

Science Fair Hypothesis

TITLE B

Hypothesis: Use your background research to help you create a HYPOTHESIS that predicts the outcome of your experiment

What is your Hypothesis?

If the magnetic field strength is increased by stacking more magnets, then the levitation height of the model maglev train will increase because a stronger magnetic field produces a greater upward magnetic force that counteracts the gravitational force acting on the train

Materials

Make a list of all the Materials you used for this experiment

- Long piece of cardboard
- Small wooden block (train)
- Magnetic strips
- Ruler
- Hot glue
- Non-magnetic guides

Procedure

What are the steps you followed during this experiment?

Write all of them down. Make sure they are exactly what you followed while doing the experiment.

- Construct a straight track and secure permanent magnets with the same polarity facing forwards
- Attach magnets with matching polarity in the base of the model train
- Position the train above the track so repulsive forces cause levitation
- Install non-magnetic size guides to stabilize the movement
- Measure levitation height using a ruler
- Increase magnetic field strength by stacking additional magnets
- measure levitation height after each increase
- Repeat trials and calculate average values

Variables

What are the Variables of your experiment?

Dependent Variable: levitation height

Independent Variable: magnetic field strength/number of stacked magnets

Control Variable: train mass, magnet orientation, magnet placement distance, measurement method

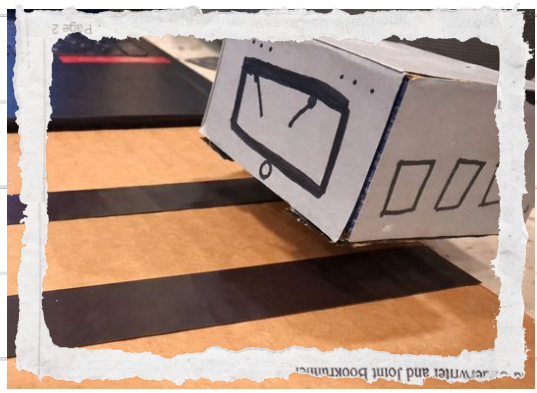
Testing the Hypothesis - Experiment

EXPERIMENT Collect and record data. Take pictures. Write everything in your science fair notebook, even mistakes and problems! Conduct your experiment multiple times to see if anything changes.

Trial 1:

Trial 2:

Trial 3:



TITLE D

Results

Put your data into graph form and study you graph to see what kinds of trends you notice.

Trials	magnets	measurements (cm)
Trial 1	1 Magnet	0.5 cm
Trial 2	2 Magnet	1 cm
Trial 3	3 Magnet	2 cm

Conclusion

Based on your results, what was the outcome?

Does your data show that your hypothesis was correct?

What kinds of problems did you have?

What would you do differently next time?

The results of this experiment support my hypothesis. When I increased the magnetic field strength by stacking more magnets, the levitation height of the model maglev train also increased. The train levitated lowest with one magnet and highest with three magnets, showing that a stronger magnetic field produces a greater upward magnetic force. This upward force was able to better counteract the gravitational force pulling the train down, so the train floated higher. Although there may have been small measurement errors and limits to how many magnets could be stacked safely, the overall trend in the data shows that increasing magnetic field strength does increase levitation height, just as my hypothesis predicted.

Rough Draft Report

Floating Forward: Magnetic Levitation

Magnetic levitation, or maglev, uses magnetic forces to lift objects so they do not touch a surface. In this project I built a small model maglev train to investigate how the strength of magnetic repulsion affects levitation height. My goal was to test whether increasing magnetic field strength by stacking identical magnets on the track and train would produce a greater upward force and therefore raise the train higher above the track.

To carry out the investigation, I constructed a straight track from cardboard and attached permanent magnets to the track with their like poles facing upward. I attached the same kind of magnets to the bottom of a small wooden block that served as the model train, making sure the orientations matched so the train and track would repel. Non-magnetic side guides were added to keep the train aligned and reduce tipping. Using a ruler, I measured the distance from the top of the track to the bottom of the train to record levitation height. I tested three conditions by stacking 1, 2, and 3 identical magnets on both the track and train. For each condition I ran three trials and recorded the measurements to compute average levitation heights.

The raw results showed a clear upward trend. With one magnet the train levitated about 0.5 cm above the track. When two magnets were stacked, the levitation height increased to about 1.0 cm. With three magnets the train rose to about 2.0 cm. These values were consistent across repeated trials in this experiment, producing average heights of 0.5 cm, 1.0 cm, and 2.0 cm for 1, 2, and 3 magnets respectively. The data indicate a direct relationship between the number of magnets (and therefore magnetic field strength) and levitation height: as magnetic strength increased, so did the upward lift on the train.

This outcome supports the hypothesis that adding magnets increases levitation height because stacking magnets strengthens the magnetic field and thus the repulsive force opposing gravity. However, the gains in height did not increase linearly without limit. The increase from one to two magnets was smaller than the increase from two to three in these measurements, and physical limits such as gravity, magnet alignment, and system stability will eventually prevent further useful lifts. In this model, stability is important: small misalignments, uneven glue or cardboard surfaces, and the accuracy of ruler measurements could introduce error. Measurement uncertainty is likely the largest source of error because levitation heights were small; using calipers or photographic measurement could reduce this error. Other possible errors include slight differences in magnet placement and friction with the side guides.

The experiment has real-world relevance because maglev trains rely on magnetic repulsion to float and reduce friction, improving efficiency and ride smoothness. This simple model demonstrates how stronger magnetic fields can increase lift, but it also shows practical constraints. For future work, I would test a wider range of magnet strengths and types (for example, comparing neodymium to ceramic magnets), vary the mass of the train to observe how weight affects lift, and use more precise measurement tools. It would also be useful to measure lateral stability and how different guide designs influence performance. Recording video and analyzing frames could improve measurement precision and reveal transient behavior as the train settles into levitation.

In conclusion, the model maglev experiment supports the idea that increasing magnetic field strength by stacking magnets raises levitation height. While measurement and stability limitations affect exact values, the trend is clear: a stronger magnetic field produced a greater upward magnetic force that better opposed gravity and caused the train to float higher. With improved measurement methods and expanded testing, this investigation could more precisely quantify how magnetic strength, magnet type, and train mass interact to determine levitation height and stability.

Final Draft Report

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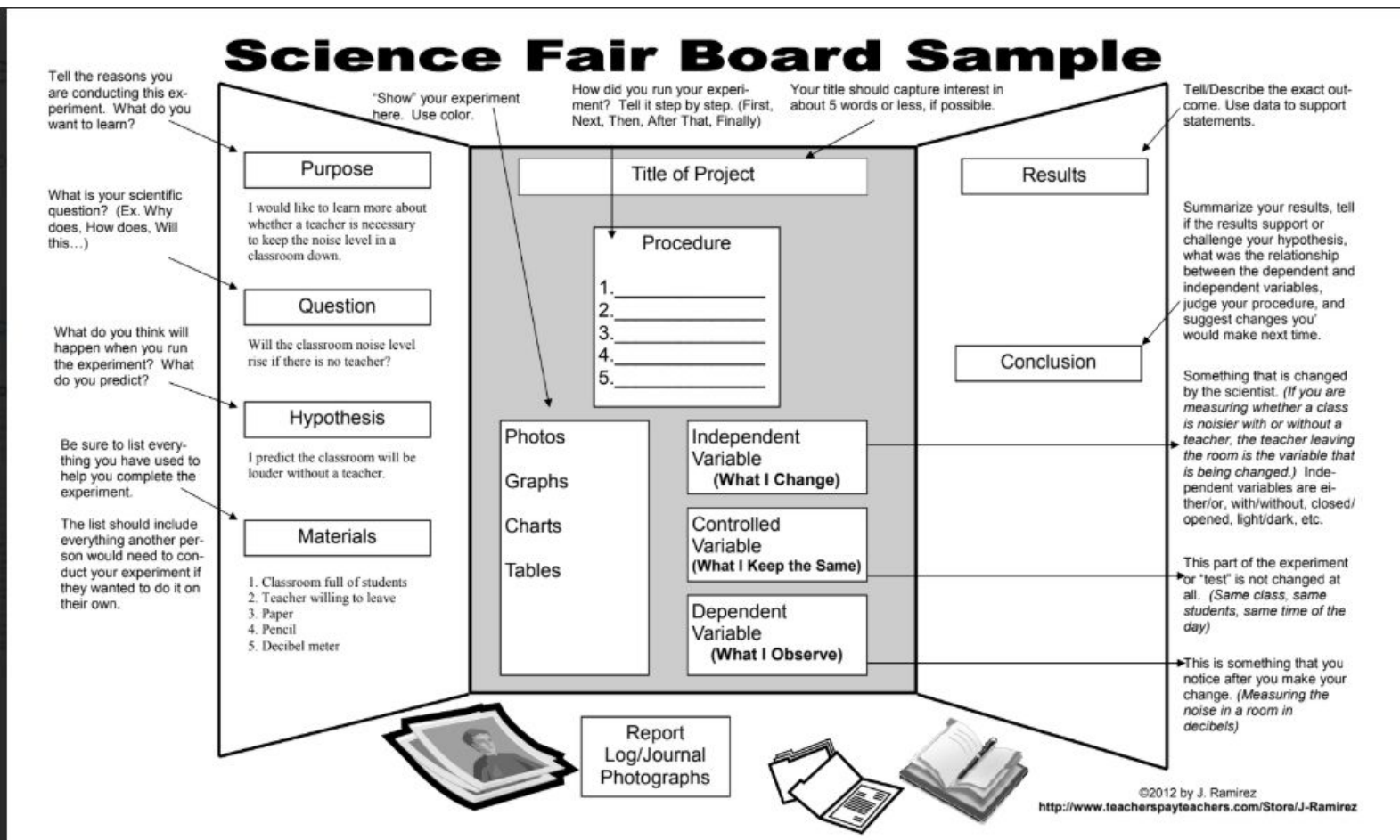
Final Project - Display Board Report

Make a Trifold Poster Board

Have it include all the components you have included in this Binder so far.

Your Finished Poster Board should look something like this: