My interest in magnetic levitation began when I saw the TedTalk by Boaz Almog where he levitates a superconductor and then explains how it happened using quantum levitation and locking with my dad. We like to watch BBC science videos together. (Almog, 2012) He said we could probably figure out how to set up something like that for my next science fair project. I like learning about thermodynamics and the effects temperature has on things. I did further research and read about the Shanghai Maglev train in China that uses superconducting magnetic levitation to move on its tracks at high speeds without friction because it doesn't touch the tracks, it levitates above them. I decided that is what I would try to recreate a model of this for my science fair project. Sadly, I ran into problems while trying to get the right supplies. I originally asked my mom for a superconducting kit to explore true superconductor levitation, but it was out of our budget. I changed plans and tried to find dry ice to experiment with extreme cold, but we couldn't find it anywhere to buy anywhere in Yuma County.

When I couldn't find the supplies I needed, I got creative and used our home freezer to cool my magnets down to between 0°F and 1°F. I discovered that even these slightly cold temperatures changed the molecular behavior of the magnets, allowing them to create a stronger field that noticeably increased the height of the levitation. This is because lower temperatures reduce the internal thermal vibrations of the atoms, allowing the magnetic domains to align more easily and create a more powerful force (Great Magtech, 2026). According to the research I read, "this relates to how professional maglev trains use "electrodynamic suspension," which relies on the power of magnetic fields to push the train away from the guide rail"(Bonsor & Chandler, 2019).

From my research I read that supercooled maglev trains utilize superconductors kept below -452°F; this extreme cold slows the molecules down, which strengthens the magnetic field and increases levitation power (Rancho Labs, n.d.). These high-tech trains even use liquid helium to cool the magnets in their superconductors to maintain that strength (Rancho Labs, n.d.).

All in all, this project taught me that even when you can't get the materials you want, you can use what you have to try to make your project work. I enjoyed designing my train. In the future, I want to build this model again and save up money to buy the

superconductor kit to see the levitation height increase even more.

References

Almog, B. (2012, June). *Boaz Almog "levitates" a superconductor* [Video]. TED Conferences. YouTube. https://youtu.be/PXHczjOg06w

Bonsor, K., & Chandler, N. (2019, May 20). *How maglev trains work*. HowStuffWorks. science.howstuffworks.com. Accessed 15 Nov. 2025.

Great Magtech. (2026). *How does temperature affect magnets*. www.gme-magnet.com. Accessed 6 Jan. 2026.

Rancho Labs. (n.d.). *Maglev train project: The future of transportation*. www.rancholabs.com. Accessed 23 Nov. 2025.