Lots of people have emailed me about building some sort of maglev train as a science project. Here are my suggestions.

A truly levitated maglev train is a very complex device. Permanent magnets alone cannot suspend a train car. You’d also need coils, amplifiers, and negative feedback too. I’d only recommend the coils/sensors approach if you are a college student or fairly advanced highschooler.

However, there’s a way to make a simple permanent-magnet maglev train. Instead of using coils and electronics, we just put guide rails on the sides of the track. The guide rails will lightly touch your train and keep it centered. Because real science involves striking out into the unknown, I’m not going to give detailed plans here. Just enough info to get you started.

The lifter-rails under your train will be small square ceramic magnets. Radio Shack stores in the US sell a good type, the 1” x 3/4” square with a hole in the center. Each foot of train track will require 32 of these magnets. Less expensive magnets are available from All Electronics, but I haven’t tried these (see links at end of article).

First mark one pole on all of your magnets so you later can lay them down with the same pole facing upwards. To do this, stick your magnets all together in one big long stack. Now use a permanent marker to make an “X” on flat face of one end of the stack. Pull the marked magnet off the stack, make an “X” on the next one, etc., until you’re out of magnets. Mark every single one on the same side.

Before building an entire huge track, make a “test bed” about one foot long. For a base, you can use cardboard or wood. Don’t use iron or steel of course. You’ll be lining up your magnets side by side in long rows. One way to do this is to stick them to a strip of duct tape, then lay the strip down on the cardboard or wood and rub the tape down to hold the magnets underneath. Position each magnet carefully on the tape so the row is very straight. Make two parallel rows of magnets with about 5cm of space between the rows. Make sure the rows are perfectly parallel. It might help to measure with a ruler and draw lines on the base first.

For a temporary “car”, cut out a square of cardboard 9cm by 15cm . Tape four magnets to the corners, flipping the magnets correctly so they will repel from the tracks when the cardboard is laid down. Position the magnets on the cardboard so they will be exactly over the magnets on the track.

If you place your cardboard “car” on your magnet track, you’ll find that it will twist or flip over and fall, and will not hover. But if you gently hold it by its sides, you can keep it floating in position. Does this give you ideas? What if you place one long board on each side of your track? The “car” will touch the two boards and will stop slipping sideways, but the boards will not stop the car from slipping down the track.
Once you get this part working, you can build a much longer track. You can build a real car too, one that looks like a train, although you'll have to find very lightweight construction materials. You can try thinking up ways to reduce the friction with the side rails. Maybe try aluminum angle strips instead of wood, or sand the wood smooth and paint it with something hard and shiny.

But how can you drive your train forward? I don't know. You'll have to think of something. There are only two ways to move a hovering object. One is to grab something on the ground and pull or push forwards (this includes tilting the rail to become a ramp; using gravity to pull the car forwards.) The other way is to force something out the back, which drives the car forward. Use the car to launch marbles rolling down a tiny ramp? Use a propeller? Squirt water? Rocket engine?

More advanced project: Linear Motor Train Propulsion

Someone else's version:

MAGNET MAN, levitating train
http://my.execpc.com/~rhoadley/magtrain.htm

CERAMIC MAGNET SUPPLIERS

- Radio Shack 1 in. rectangle, $2.60 for 5
- All Electronics: 1-7/8" x 3/4" x 1/8" magnet $0.50 each
- 0.7" disk magnet, $0.09 each

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