

Mechanical Engineer: Industrial Magnets

NGSS Standard: 3-PS2-3



Adventure Description:

In this adventure, students will think like a mechanical engineer and design a new MAGLEV train car to be used on a MAGLEV track.



Activity

Teacher note: This activity requires teacher prep. Follow instructions on [Handout: Teacher Prep](#).

Step One: Background Information on Mechanical Engineers and Construction (10 minutes)

- Watch [Video: Industrial Magnets](#)
- Give students 5 minutes to experiment with disc or bar magnets. Ask students to arrange the magnets so that they can hold a piece of paper suspended between them. Note how the magnets are still attracted to one another, but aren't touching.
- Tell students that magnets have two poles; a positive and a negative. When the poles of one magnet are pushed close to the poles of another magnets, they either repel (push apart) or attract (pull together). You (the teacher) should demonstrate the repulsion of positive-positive and negative-negative interactions and the attraction of positive-negative interactions.
- Explain to students that mechanical engineers are engineers that build new structures, devices, or buildings out of materials like iron and steel. Tell students that mechanical engineers have created new transportation that uses the poles of magnets to make a train car move along a track. These trains are called MAGLEV trains. Show [Handout: MAGLEV Train](#). Walk through the handout together as a class.
 - Discuss how there are magnets with opposite poles on the track and inside the train. This causes the magnets to repel each other, like students watched in the demonstration.
- Explain to students that they will think like a mechanical engineer and design a new MAGLEV train car to be used on a MAGLEV track!

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Step Two: Building a MAGLEV Train Car (15-20 minutes)

- Explain to students that they will now build and design a MAGLEV train car to use on a MAGLEV track!
- Provide students with [Handout: Building a MAGLEV Train Car](#). Walk through the steps together as a class.
- Provide students with the following materials:
 - Template for the bottom of the train car. This should be the width of the train track from the handout.
 - Magnets (Start by giving each group 2 magnets and give more as necessary - up to 8 per group).
 - Art supplies and building materials (cardboard, construction paper, markers, crayons, glitter)
- Have students create their train car. Encourage students to be creative while decorating their train car!
- When students are finished decorating, give them a couple of minutes to attach magnets to the bottom of their train car with tape.
 - Teacher Note: The orientation of the magnetic poles is not important at this step; students will make their own adjustments in the next step.

Step Three: Testing Maglev Train Car (15-20 minutes)

- Explain to students that they will now test their MAGLEV train car on the track!
- Provide groups with their train track. If you opted for creating only a few tracks, instruct students to form a line for testing.
- Instruct students to follow Step 3 on the handout.
- Allow students to test their MAGLEV train cars on the track!
 - Teacher Note: If student's train cars do not float, encourage them to experiment with the magnets. Instruct students to use a different type of magnet or to flip the magnets over so that the other magnetic pole is facing the tape.

Step Four: Discussion (5-7 minutes)

- Have students show their MAGLEV train car to the rest of the class. Ask students to discuss what worked and what didn't when they were experimenting with the magnets.

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- Have a concluding class discussion about how magnets do not have to be in contact with each other to work. The magnets can be separated by paper or tape, like we saw with the maglev train car, and will still attract or repel each other. The MAGLEV train car works by using the poles of magnets. The poles are set up one way in the train car, and the opposite way in the magnetic tape. This causes the tape and the magnets to repel one another, which makes the train car float!

Materials List

Provided online:

- Video: Industrial Magnets
- Handout: Teacher Prep
- Handout: Maglev Trains
- Handout: Track Template
- Handout: Building a Maglev Train Car

Not provided (each pair of students needs):

- Assorted magnets for experimentation
- 4 bar magnets
- 4 disc magnets
- Strong tape
- Magnetic tape
- Art supplies and building materials

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