

## MagLev Trains – Transportation Engineering Unit ( 2 Parts )

Lesson adapted from the Engineering is Elementary “The Attraction is Obvious: Designing Maglev Systems” curriculum from The Museum of Science, Boston.

## Lesson Preparation – Part 1 (<1 hour active time)

### Materials (for 24 students) :

- Cardboard Box ( 12" by 3", 1 per group plus 1 extra )
- Paper Cups ( 3-5 oz, 1-2 per group )
- Single Pole Strip Magnet ( 1/2", 2 feet per group )
- Disk Magnets ( 3/4", 4-6 per group )
- Ring Magnets ( 4-6 per group )
- Bar Magnets ( 2-4 per group )
- Foam Tray ( 6" by 8", 2 per group )
- Manilla Folders ( 2-3 per group )
- Masking Tape ( 1 roll )
- Play Money (5\$, 10 bills per group )
- Overhead Transparency ( 1 per class )
- MagLev Train Worksheet ( 1 per student )
- MagLev Train Presentation ( 1 per group )

### Before Lesson:

1. Watch the video here: <http://www.eie.org/eie-curriculum/resources/how-prepare-sample-maglev-track> and prepare a sample MagLev Train for the class.
2. Fold the boxes, and prepare "tracks" for each group with the manila folder and tape.
3. Depending on the ability of the students, you may choose to pre-cut the foam trays into 4" by 3" squares. These will act as the main platform for the students' trains. As these platforms need to be accurately cut for the activity to be successful, some groups will benefit from this preparation.

## Lesson Plan – Part 1 (50 min)

### Opening (5 Min)

Begin by reviewing what the students know about transportation engineering. What is a transportation engineer? What do they do? *Transportation engineers work with all areas of transportation, train, planes, cars, boats, roads ect. But they don't just build objects, they have to solve lots of other problems as well.*

Ask the students what they think “MagLev” means. Discuss the meaning of both magnetism and levitation. Show the Tony Hawk video in the presentation as an example of this technology. ( <https://www.youtube.com/watch?v=HSheVhmcYLA> )

Have the students think about why we might use “MagLev” instead of wheels on tracks.

Review the behavior of magnets with the students.

### Introduce the Engineering Challenge (10 min)

Bring up the Engineering Design Process and review the steps with the students. Ask the students what the first step is. *The students need to define the problem.*

Allow the students to ask questions until they have established the problem, the budget, and the materials available.

Show the students the demonstration MagLev train and explain how the track sits inside the box. The box and the track will not count as part of the students materials.

Have the students fill out the problem section of their worksheet, and give them time independently to work on the imagine section.

### Exploration (30 min)

Group the students up and have them work on the plan section of their worksheet.

Hand out 10 5\$ bills to each group. Once a group has a list of supplies, they can send one student to collect their materials.

Allow the students to build and test their designs.

### Closing (5 min)

Gather students together and have them complete the ‘improve’ section on their worksheet.

What was the most difficult about this challenge? What was the easiest? Did they learn anything that would help them next time?

Finish by letting students ask questions about transportation engineering.