STEM Connections

Maglev Vehicle

Below are ideas for connecting the Maglev Vehicle activity to STEM concepts and principles. For more ideas and detailed STEM lessons, consult the *Maglev Vehicles Teacher's Guide*.

ACTIVITY OVERVIEW

Students design, build and test Maglev Vehicles on a maglev track.

SCIENCE

Repulsive Forces & Load Capacity

In this activity, students will investigate the relationship between the repulsive forces at work in the Maglev Vehicle and the load capacity of the vehicle.

Have students construct Maglev Vehicles from the kit of materials. Have students test their vehicles on the Pitsco Maglev II Track to ensure the vehicles run smoothly down the track when one end of the track is slightly elevated (three to four inches).

Have students measure and record the weight of their Maglev Vehicles and then add several large steel washers to the vehicles to simulate a load. Students should measure the mass of the vehicle plus the load and determine the amount of load added to the vehicle.

Students will test the vehicles on the track again to determine if they will still move down the track smoothly with the additional load and record their observations.

Have students load more and more washers on the vehicles, recording the amount of mass added each time, testing the vehicle, and observing the results of the ever-increasing load. Have students determine the maximum load capacity for their vehicles and relate that to the repulsive forces acting between the vehicles and track magnets.

ENGINEERING

Design Challenge

In this activity, students in teams of four will design their own maglev vehicles using a variety of parts and pieces (either from a discrete parts assortment you provide or from items they bring from home and so on). The challenge is for the team to design a vehicle that will carry a 50 g load down the eight-foot Maglev II Track in as short a time as possible.

Teams should use the Design Loop process throughout this activity. They should take notes in an engineering notebook and provide sketches and drawings of both their ideas and their actual prototypes.

Teams should be encouraged to think creatively through brainstorming and to develop several prototypes for testing. Several class periods should be devoted to this project.

A rubric for grading should be set up to include challenge results (sorted by fastest to slowest), thoroughness of notes, clarity of sketches and drawings, and design prototypes built.

TECHNOLOGY

Measuring Velocity

In this activity, students will measure the time that their Maglev Vehicles take to go down the eight-foot Maglev II Track that is elevated five inches at one end and determine the average velocity of the vehicle.

Have students construct Maglev Vehicles from the kit of materials. Have students test their vehicles on the Pitsco Maglev II Track to ensure the vehicles run smoothly down the track when one end of the track is elevated five inches.

Students should use as many methods as possible to determine the velocity of the vehicles as they glide down the track. Some options might include:

- Stopwatch and tape measure
- Ultrasonic sensor (Vernier or Texas Instruments, for example)
- Photogate timer

Students should record the results with each method used, doing three trial runs and averaging the velocity as measured/calculated for each method.

Students should compare and contrast the various measurement methods in terms of ease of use, accuracy, cost, and so on.

MATH

Investigating Component Vectors

In this activity, students will work with the component vectors of a velocity vector for their maglev vehicles. Component vectors are the two vectors in the x and y directions that add together to create the velocity vector.

First, students will build maglev vehicles and determine the velocity (using whatever technologies are available) of the vehicle as it goes down the eight-foot Maglev II Track. The velocity should be measured and recorded at five-degree intervals of track elevations.

Students will calculate the x and y component vectors for the velocity at each elevation.

Students should analyze the trend of the x component vector and the y component vector as the track becomes steeper. Students should postulate a function that would describe the trend for both the x and y component vectors.

The data for the x and y component vectors should be graphed, and students should compare and contrast the graph with the function they postulated.

PITSCO EDUCATION