

Unit II: STEM Unit: Designing Maglev Systems

Content Area: **Science**
Course(s): **Science 3**
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Enduring Understandings

The like poles of magnets repel and opposite poles attract.

Some materials are magnetic, while others are not.

Magnets are surrounded by a magnetic field.

The magnetic forces of attraction or repulsion can be intensified by increasing the magnetic field.

The like poles of magnets repel and opposite poles attract.

Some materials are magnetic, while others are not.

Magnets are surrounded by a magnetic field.

A model is a representation of an object or system, usually built to scale.

Changes in one variable can result in a single effect or multiple effects.

Changes in one variable can simultaneously result in both favorable and unfavorable effects.

A system may lose efficiency or fail if one part is missing or malfunctioning or if a subsystem is not working.

Magnetic fields are not affected by the presence of non-magnetic materials.

The like poles of magnets repel, and opposite poles attract.

The magnetic forces of attraction or repulsion can be intensified by increasing the magnetic field.

Magnetic fields are not affected by the presence of non-magnetic materials.

- Almost all objects we use everyday are examples of technology.
 - Technology can be made of many different kinds of materials.
 - Engineers design technology to solve problems.
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- Transportation engineers are concerned with the safety and efficiency of systems that are used to move people or objects from one place to another
 - Maglev transportation systems take advantage of the magnetic force of repulsion
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- Transportation engineers are concerned with the safe and efficient movement of people and objects.
 - Intersection design requires balancing the needs of multiple parties.
 - An increase in safety can often lead to a decrease in efficiency.
 - The effects of transportation engineering are all around us.
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- Magnets have poles.
 - The like poles of magnets repel, while opposite poles attract.
 - Magnets are surrounded by magnetic fields.
 - The magnetic forces of attraction or repulsion can be intensified by increasing the magnetic field.
 - Magnetic fields are not affected by non-magnetic materials.
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- Engineers use a series of steps, called the Engineering Design Process, to design solutions to problems.
 - Transportation engineers are often concerned with designing systems rather than objects.
 - A system is a type of technology.

Essential Questions

What metals are magnetic?

How did you know which objects were magnetic?

How did you know which objects were not magnetic?

How do people use magnets?

What makes a magnet magnetic?

What are some characteristics of magnets?

What types of metals does a magnet attract?

What are technologies and who designs them?

What types of problems do transportation engineers solve and what are some factors they work to balance?

How can we use the properties of magnets to help us design a maglev transportation system?

How can we use our knowledge of the properties of magnets, the Engineering Design Process, and our creativity to design a maglev transportation system?

Content

Hikaru's Toy Troubles Storybook

Hikaru's family owns a toy shop in Tokyo and business has always been good—but now a new toy store across town is drawing customers away. Hikaru happens to visit his neighbor, a transportation engineer and learns that she's working on a new project: a maglev train system. That gives him an idea! Can Hikaru and his friends engineer an amazing model maglev train system that will attract customers back to his family's store?

✖ <http://www.eie.org/sites/default/files/HikarusToyTroubles.pdf>

✖ <http://www.eie.org/eie-curriculum/resources/designing-maglev-system-grade-4-medford-ma>

✖ <http://www.eie.org/eie-curriculum/resources/listing?unit=2628&lesson=166&resourceType=193>

✘ <http://www.eie.org/eie-curriculum/resources/what-technology-grade-4-worcester-ma>

✘ <http://www.eie.org/eie-curriculum/curriculum-units/attraction-obvious-designing-maglev-systems>

✘ http://www.eie.org/sites/default/files/PDG_DesigningMaglevSystems.pdf

✘ <http://www.magnetgames.net>

Skills

- Apply the Engineering Design Process
- Apply science and math in engineering
- Employ creativity and careful thinking to solve problems
- Envision one's own abilities as an engineer
- Troubleshoot and learn from failure
- Understand the central role of materials and their properties in engineering solutions

Standards

SCI.3-5	Engineering Design
SCI.3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
SCI.3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
SCI.3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
SCI.3-PS2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets.
SCI.3-PS2-3	Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.