Classroom Teacher Preparation

Engineering 8: Build a Magnet Detector

Please use the following to prepare for the next SfS lesson.

Description:

Students design, build, and test a magnet detection device. During the testing process, they have the opportunity to observe that not all metals are magnetic. After testing, students will discuss the properties of the materials used in their own and their classmates' devices that make them well- or poorly-suited to the task.

Lesson Objectives – SWBAT ("Students Will Be Able To…"):

3rd-5th

- Create, test, and refine a device for locating the position of hidden magnets on a board
- Compare different materials and design choices, and identify similarities between effective materials

Disciplinary Core Idea (DCI)

PS2 Motion & Stability: Forces and Interactions - PS2.A Forces and Motion and PS2.B Types of Interactions

- (3rd -5th) The effect of unbalanced forces on an object results in a change of motion. Patterns of motion can be used to predict future motion. Some forces act through contact, some forces act even when the objects are not in contact. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

ETS1.C: Optimizing the Design Solution

- (3rd -5th) Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints

Science & Engineering Practice (SEP)

Planning and Carrying Out Investigations

- (3rd -5th) Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

Crosscutting Concept (CCC)

Structure and Function:

- (3rd -5th) Substructures have shapes and parts that serve functions.

Preparation:

This lesson is intended to serve two purposes: first, as an introduction to the behavior of magnets in attracting certain materials (that is, those that are *ferromagnetic*), allowing students to directly observe that not all metals are ferromagnetic, and second, to provide younger students with a fun engineering design opportunity involving magnets.

Room Set Up for Activities:

The SfS instructors will need table space to set up the "store" with the collection of materials students may use in building.

Students will work in pairs or groups of three. Each group will need a table or cluster of desks for a workspace.

Safety:

Students should handle materials with reasonable care. One of the choices of building materials is safety pins; if these are not appropriate for your students, please inform the instructor.

Related Modules:

This lesson may be taught as part of a pair of related modules on **magnetism or forces**, or as part of a group of **engineering** modules. Modules include:

Physics 1: Introduction to Magnetism – Younger students openly explore in order to learn about the behavior and properties of magnetic materials.

Physics 5: Pendulum Patterns – Students measure the periods of pendulums of different lengths and use their results to predict the period for a fourth length.

Physics 19b: Friction Basics – Students experiment with different surfaces and classify their amount of friction.

Engineering 3: (Re)-Building a Bridge – Students design, build, and test prototype bridges that can transport a defined number of people, modeled by weights. During testing, they identify the failure points of their models and use these data to improve their designs, rebuild, and retest.

Engineering 4: Engineering Redesign with Legos – Students must redesign a flawed prototype based on certain constraints (i.e., redesign and rebuild a Lego bookcase in order to easily transport it from classroom to classroom).

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by magnetizing a needle – a ferromagnetic material, like those in the magnet detectors – and using it to make a compass!

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Magnetism basics for kids: https://www.coolkidfacts.com/magnetism-facts-for-kids/
- Magnetism basics for adults: https://www.explainthatstuff.com/magnetism.html
- In the activity, magnetic forces attracted some of the materials. Strong magnetic fields can even affect people's brains! This video is not presented at a 3rd grade level but is a fascinating medical and research application of magnetism: https://www.pbs.org/wgbh/nova/video/magnetic-mind-control