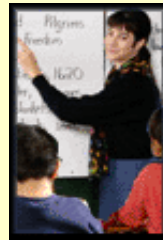


## HEAVY ISSUES

Grade: Fourth Grade

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## SAFETY MESSAGE:

- You cannot outrun a train.

## OVERVIEW

This hands-on lesson helps students learn how drastic the difference is between the mass of people, vehicles and trains. Through the actual comparisons of the masses of all three, students will understand why it is important not to trespass on the tracks.

## SUGGESTED TIME ALLOWANCE

40 minutes

## OBJECTIVES

Students will be able to:

- Describe how the masses of a train, a vehicle and a person differ greatly.
- Support the safety messages by explaining why it is important to respect the size of trains.

National Academic Content Standards addressed by this lesson.

## MATERIALS

- 3 objects of varying mass to represent a train, a car and a person:  
One "train" can be used for the whole class. Provide

materials for one "car" and "person" per student.

- Train: 1-pound or 500-gram weight. These objects weigh about a pound: A model HO engine\*; a box of sugar; a stapler. (This represents the average freight train, which weighs about 8,000 tons)
- Car: 0.004 oz. or 0.125 gram mass. Use a piece of notebook paper about 5.0 cm x 4.5 cm or 2" x 1.75". (This represents the average car, which weighs about 2 tons.)
- Person: 0.0003 oz or 0.01 gram mass. Use a piece of notebook paper about 1.5 cm square or 0.75" x 0.5". (This represents a 200 lb. person)
- Note – To substitute other objects, divide the weight of the object representing the train by 4,000 to get the car weight and divide the car weight by 20 to get the weight of the person. \*HO dummy locomotives weigh about 300 g, so you will have to adjust your weights/sizes of paper accordingly.
- Paper
- Pencils
- Ruler
- Scissors
- Balance – One Per 3-5 Students
- Bridge, Tunnel and Train Yard Overhead

## VOCABULARY

Mass, weight, grams

## PROCEDURES

### TEACHER PREPARATION:

Read background material on trespassing (Track Facts and Myths & Realities). Prepare materials for scientific observation and have materials ready for students prior to starting lesson.

### MOTIVATION:

Ask students whether they have ever seen these movies (or others): *The Borrowers*, *Honey*, *I Shrunk the Kids*, *Antz*, or *A Bug's Life*. *What do these movies have in common?*

(They all provide a perspective on being a VERY small being.) *Can you imagine being so small that a flower growing in the garden looks big? That a regular-sized child looks like a giant? Or that your desk looks like a huge skyscraper?* Ask students how they might express the difference between their own size, if they were as small as an ant, and their desk? Introduce words such as mass and weight, and ask them to consider the difference in the mass of an ant and the mass of their desks. Have them measure the height of their desks, and estimate the "height" of an ant and come up with a way to express the difference mathematically. *How much does your desk weigh? How might you express the difference between the weight of your desk and the weight of an ant? What about the weight of your desk vs. the weight of a car?* Tell them that today's science lesson will help to put into perspective the difference between the mass of a train, the mass of a car, and the mass of a person. If needed, review the vocabulary words.

### **ACTIVITY:**

1. Have students individually measure and cut out pieces of notebook paper (as directed) that correspond to a car and a person and label them accordingly. In teams of 3-5, have them weigh each piece of paper using the balance and mark their weights on the paper. Their teams should describe the difference between the weights of both objects.
2. Pass the sugar, stapler or whatever you have chosen to use, around the room to have students weigh it and hold it to physically compare this "train" with their car and person. Have each student write down the approximate difference between the train, the car and the person, using words like, "The train is X times heavier than the car."
3. Discuss the comparisons as a class, using the calculations provided in the materials section.

## CONCLUSION:

Use overhead transparencies to wrap up with a discussion of safety around railways. Discuss the following situations/questions:

- *Now that you have compared a train, a car and a person's mass, what reasons could you give someone as to why they would not want to be trapped on a bridge that is made only for a train? Or to be trapped in a tunnel made for a train?*
- *Now that you know the vast difference between a person's weight and the weight of a train, why do you believe there are laws that make it illegal for people to walk on the railroad tracks?*

## HIGHER ORDER THINKING

To assure students are using critical thinking skills, pose challenges, such as this, at an appropriate place within the lesson: Provide four possible sets of items that could be used to do this lesson, making sure that the differences in mass are mathematically accurate.

## ASSESSMENT

- Successful completion of scientific observations (Describe how the masses of a train, a vehicle and a person differ greatly.)
- Ability to explain the mass difference of objects (Support the safety messages by explaining why it is important to respect the size of trains.)

## EXTENSIONS

**Social Studies:** Take the class on a field trip to a local railroad to view equipment and/or take a short train ride. Point out the size and overhang of the equipment. Point out that the locomotive has no steering wheel.

Have students and/or teacher take pictures or video of students by a train for later size comparison and classroom discussion.

## TEACHER RESOURCES

Background information on trespasser safety (Track Facts and Myths & Realities - Acrobat Reader required)

David's Run video

David's Run video clip (Quicktime required)

Video utilization tips for David's Run

## NATIONAL ACADEMIC CONTENT STANDARDS

These standards are provided by the Mid-continent Regional Educational Laboratory (McREL) online publication, Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education. <<http://www.mcrel.org/standards-benchmarks/>>

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The following standards are addressed by the activities of this lesson:

### **Life Skills: Thinking and Reasoning**

Level II: Upper Elementary (Grades 3-5)

Standard 3: Effectively uses mental processes that are based on identifying similarities and differences (compares, contrasts, classifies)

Benchmark: Understands that one way to make sense of something is to think how it is like something more familiar

### **Mathematics:**

Level II: Upper Elementary (Grades 3-5)

Standard 4: Understands and applies basic and advanced properties of the concepts of measurement

Benchmark: Selects and uses appropriate tools for given measurement situations (e.g., rulers for length, measuring cups for capacity, protractors for angle)

### **Science**

Level II: Upper Elementary (Grades 3-5)

Standard 15: Understands the nature of scientific inquiry

Benchmarks:

- Plans and conducts simple investigations (e.g., makes systematic observations, conducts simple experiments to answer questions)
- Uses simple equipment and tools to gather scientific data and extend the senses (e.g., rulers, thermometers, magnifiers, microscopes, calculators)
- Knows that good scientific explanations are based on evidence (observations) and scientific knowledge

To see related standards for your state, search [Achieve's Clearinghouse](#):

< <http://www.achieve.org/achieve/achievestart.nsf/Search?OpenForm> >

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