QuickView

Students find the effect of a vehicle's mass on the distance traveled.

Standards Addressed

NSTA 5-8

Students develop abilities necessary to do scientific inquiry.

- Students identify questions that can be answered through scientific investigations.
- Students use appropriate tools and techniques to gather, analyze, and interpret data.
- Students think critically and logically to make the relationships between evidence and explanations.
- Students communicate scientific procedures and explanations.
- Students use mathematics in all aspects of scientific inquiry.

Students develop understandings about scientific inquiry.

- Students understand mathematics is important in all aspects of scientific inquiry.

Students develop abilities for technological design.

- Students evaluate completed technological designs or products.

NCTM 6-8

Students understand numbers, ways of representing numbers, relationships among numbers, and number systems.

- Students work flexibly with fractions, decimals, and percents to solve problems.

Students understand meanings of operations and how they relate to one another.

- Students understand the meaning and effects of arithmetic operations with fractions, decimals, and integers.

Students compute fluently and make reasonable estimates.

- Students select appropriate methods and tools for computing with fractions and decimals from among mental computation, estimation, calculators or computers, and paper and pencil, depending on the situation, and apply the selected methods.

Students understand patterns, relations, and functions.

- Students represent, analyze, and generalize a variety of patterns with tables, graph, words, and, when possible, symbolic rules.
- Students relate and compare different forms of representation for a relationship.

Students use mathematical models to represent and understand quantitative relationships.

- Students model and solve contextualized problems using various representations, such as graphs, tables, and equations.

Students understand measurable attributes of objects and the units, systems, and processes of measurement.

- Students understand both metric and customary systems of measurement.

Students apply appropriate techniques, tools, and formulas to determine measurements.

- Students use common benchmarks to select appropriate methods for estimating measurements.

- Students select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels or precision.

Students develop and evaluate inferences and predictions that are based on data.

- Students make conjectures about possible relationships between two characteristics of a sample on the basis of scatterplots of the data and approximate lines of fit.

Students build new mathematical knowledge through problem solving.

Students solve problems that arise in mathematics and in other contexts.

Students recognize and use connections among mathematical ideas.

Students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

ITEEA 6-8
Students develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

- Students learn that knowledge gained from other fields of study has a direct effect on the development of technological products and systems.

Students develop the abilities to assess the impact of products and systems.

- Students learn to design and use instruments to gather data.

NCTE K-12
Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

Students use a variety of technological and informational resources to gather and synthesize information and to create and communicate knowledge.

Students use spoken, written, and visual language to accomplish their own purposes.

Time Required

90-180 minutes (will vary with class size)

Content Areas

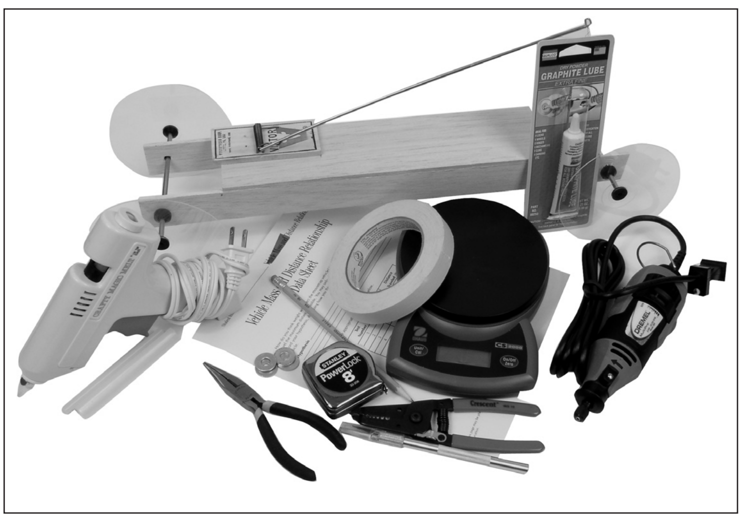
Primary: Technology
Secondary: Math; science; language arts

Vocabulary

- weight
- mass
- protocol
- variable
- hypothesis
- guess

Materials

- Mousetrap vehicle completed to the manufacturer's instructions with no design modifications
- Graphite (optional)
- Tape measure
- Masking tape
- Timber cutter or hobby knife
- Dremel tool or portable hand drill
- Wire cutters
- Needle-nose pliers
- Cool-melt glue gun and glue slugs
- Washers
- Scale or balance for finding the mass of vehicles
- "Vehicle Mass and Distance Relationship Data Sheet"
- Pencil



Procedure

1 Locate a smooth, flat surface – preferably a hallway or classroom floor space – on which to set up a testing track.

The smoother the surface, the smoother the ride. If setting up on a tile floor, you may want to have students place a band around the rear drive wheels. The middle section of a balloon works well for this.

2 Using the masking tape, create a starting line. To do this, place a piece of masking tape approximately 60 centimeters long on the floor. This should give you enough space to place two cars on the starting line at one time, if necessary.

3 Find the mass of the mousetrap vehicle. Record the stock vehicle's weight on the data sheet.

You may want to discuss the difference between weight and mass with students.

4 Place the stock mousetrap vehicle on the starting line.

Students should use a mousetrap vehicle that has not been altered or redesigned.

5 Release the car and measure the total distance traveled by the car. Establish a protocol for measuring the distance. Will you measure from the starting line to the rear of the car or from the starting line to the front of the car?

You may want to discuss with students that in order for scientific testing to be valid, variables must be controlled as much as possible. This is why they are instructed to establish a way to measure the distance. This helps to ensure that the measurements are taken in the same manner each time and therefore should be as accurate as possible from one test to the next. You may also want to point out to students that having a procedure for taking the measurement helps make the experiment easier to replicate. This is another requirement of good scientific design.

6 Record the distance measurement on your "Vehicle Mass and Distance Relationship Data Sheet."

7 How do you think mass will affect the mousetrap vehicle?

You will need to provide washers or laboratory masses for students to use to add mass to their vehicles.

8 Record a hypothesis on your data sheet.

Students may need a refresher on what a hypothesis is and how it is different from a guess. Students should understand that a hypothesis is based on prior knowledge or prior experimentation.

9 Ad washers or laboratory masses to the vehicle and complete Steps 3-6. You will need to complete at least three tests of the vehicle at different masses. For each test, record on your data sheet the vehicle's mass and the distance traveled by the vehicle.

10 Use the data from your tests to create a graph that shows any relationship between weight and distance.

11 Compare your data with that of other students. Record your recommendations for building a car that will go the maximum distance.

QuickView

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Materials

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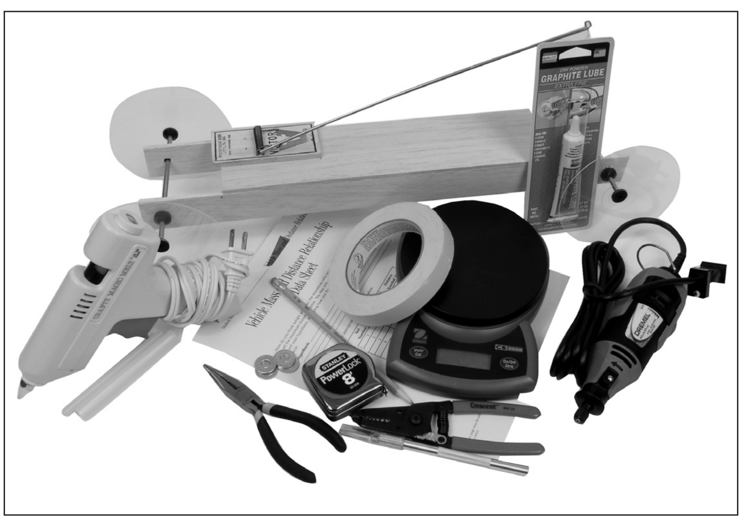


Procedure

1 Locate a smooth, flat surface – preferably a hallway or classroom floor space – on which to set up a testing track.

2 Using the masking tape, create a starting line. To do this, place a piece of masking tape approximately two feet in length on the floor. This should give you enough space to place two cars on the starting line at one time, if necessary.

3 Find the mass of the mousetrap vehicle. Record the stock vehicle's mass on the data sheet.

4 Place the stock mousetrap vehicle on the starting line.

5 Release the car and measure the total distance traveled by the car. Establish a protocol for measuring the distance. Will you measure from the starting line to the rear of the car or from the starting line to the front of the car?

6 Record the distance measurement on your data sheet.

7 How do you think weight will affect the mousetrap vehicle?

8 Record a hypothesis on your data sheet.

9 Add washers or laboratory masses to the vehicle and complete Steps 3-6. You will need to complete at least three tests of the vehicle at different masses. For each test, record on your data sheet the vehicle's weight and the distance traveled by the vehicle.

10 Use the data from your tests to create a graph that shows any relationship between mass and distance.

11 Compare your data with that of other students. Record your recommendations for building a car that will go the maximum distance.

Vehicle Mass and Distance Relationship Data Sheet

How do you think mass will affect the mousetrap vehicle? Record your hypothesis, describing how you think mass will affect the distance traveled by the vehicle.

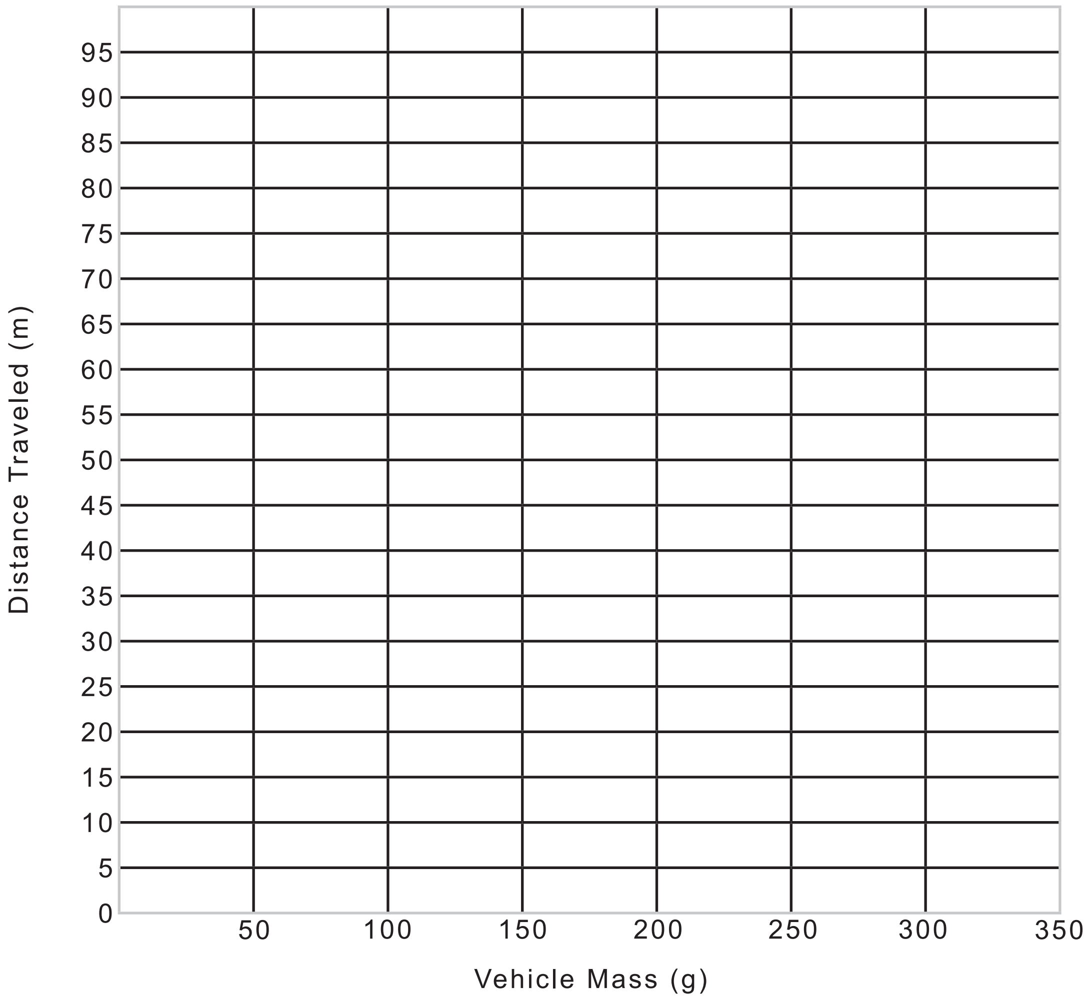
Hypothesis ____
____
____
____

Record your data in the appropriate area of the table below.

Test Number	Mass of Vehicle (g)	Distance Traveled (m)
1		
2		
3		
4		
5		
6		
7		
8		
9		

Vehicle Mass and Distance Relationship

Use the data on the previous page to create a graph showing the relationship between mass and distance.



What conclusion can you make about the relationship between the mousetrap vehicle's weight and the distance the vehicle travels? ____

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What recommendations would you make to the manufacturers of the mousetrap vehicle for increasing the distance the vehicle travels? ____

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