## Title: Mouse Trap Cars

### Grade Level and Course: 8th Grade Physical Science

### Materials:
- Mouse Trap Car “kit”
  1. Complete kits are commercially available from several sources, such as Pitsco ([www.shop-pitsco.com](http://www.shop-pitsco.com)), Kelvin Scientific ([www.kelvin.com](http://www.kelvin.com)).
  2. Another approach is to have students, working in teams, bring in their own supplies to design their own car. The teacher would supply mouse traps and students would be responsible for other pieces, such as:
    - Wheels (such as used CD’s, bottle caps)
    - Axles (such as wood dowels, bamboo skewers)
    - Car body (such as thin wood, styrofoam, rigid plastic)
    - Lever arm extension (such as metal rod, piece of coat hanger)
    - String (such as kite string, fishing line)
  3. An open area for mouse trap car testing and data collection, such as blacktop (smooth surface, protected from wind, is best) or school gymnasium. Track length should be at least 30 meters.
  4. Student stop watches, meter sticks for data collection.

### Instructional Resources Used:
- (concept maps, websites, think-pair-share, video clips, random selection of students etc.)
  1. Demonstration Mouse Trap Car
  2. Video links, for example
    - [http://www.youtube.com/watch?v=7f9bP-7Unrk&feature=related](http://www.youtube.com/watch?v=7f9bP-7Unrk&feature=related)
    - [http://www.youtube.com/watch?v=KWKYNd3IcQc&feature=related](http://www.youtube.com/watch?v=KWKYNd3IcQc&feature=related)
    - [http://www.youtube.com/watch?v=8EqF59zTjjM&feature=related](http://www.youtube.com/watch?v=8EqF59zTjjM&feature=related)
  3. Compare “MESA” (Math Engineering Science Achievement) guidelines for student Mouse Trap Car competition.
    - [http://mesa.ucop.edu/mesa_day_rules/Mousetrap_Car_MS_2010-2011.pdf](http://mesa.ucop.edu/mesa_day_rules/Mousetrap_Car_MS_2010-2011.pdf)
  4. Students participate in Think-Pair-Share discussing variables affecting the performance of a Mouse Trap Car and ideas to make it travel farther.

### California State Standards: (written out)

- Eighth Grade Science, Standard One, Motion
  1.b. Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.
  1.c. Students know how to solve problems involving distance, time and average speed

### Lesson Objectives:

1. Students will work collaboratively to build a mouse trap powered vehicle
2. **Students** will collect distance and time data and calculate speed of their cars.
3. Students will record data from **multiple trials, then average and graph results**.

### Differentiation Strategies to meet the needs of diverse learners:

- **English Learners:**
  1. Teacher thoroughly models all steps of building, testing, and making modifications of mouse trap cars
  2. Where possible, EL students should be assigned **bilingual** lab partners or mixed proficient groups to facilitate assistance from peers
  3. Teacher will use visual scaffolding such as flash cards, word walls, and visual dictionaries. EL’s should be drawing and referring to graphical representations of material being covered.

- **Special Education:**
  1. The detailed motor skills involved in this activity may make it prohibitive for special education students. In such case, a single teacher demonstration car could be used and students would record and graph data in groups or individually.
  2. Modifications could be discussed and tested as a class.

- **GATE:**
  1. Gate students will excel in the design challenge element of this activity. Most will eagerly bring in materials to build and test a mouse trap car. Students will be able to proceed with a minimum of directions.
  2. Students can be assigned web research for outside of class to access some of the resources available on the internet.

### ENGAGE

- **Describe how the teacher will capture the students’ interest.**
  1. Demonstrate a model mouse trap car to the class. Class discussion focuses on why the car works and variables that effect its performance.
  2. Show brief video (see above) modeling mouse trap car motion.

- **What kind of questions should the students ask themselves after the engagement?**
  1. How can the car be modified to improve the distance **traveled**?
  2. What data do we need to determine the speed of the vehicle?

### EXPLORE

- **Describe the hands-on laboratory activity that the students will be doing.**
  1. Teacher will impose rigorous safety guidelines about the use of a mouse trap. Although the mouse trap can provide a substantial “pinch” on a person’s finger, the mouse trap will not break the skin or hurt a person.
  2. Students, working in cooperative groups, will build and test a mouse trap powered car. If using a kit, build it according to instructions. If designing the car from student-acquired materials, then students begin a longer process of “trial-and-error” process of building a the car.
List the “big idea” conceptual questions that the teacher will ask to focus the student exploration.

- What “variables” affect the performance of the car?
- How could the car be modified to increase the distance traveled?

**EXPLAIN**

- What is the “big idea” concept that students should have internalized from doing the exploration?
  Students will gain experience in gathering data to solve and graph speed, distance and time problems in a collaborative and engaging format.

- List the higher order questions that the teacher will ask to solicit student explanations for their laboratory outcomes, and justify their explanations.
  1. What data is needed to calculate the speed of the mouse trap car
  2. Why do we collect data on several different trials.

**EXTEND**

- Explain how students will develop a more sophisticated understanding of the concept.
  1. Student can compare variations of mouse trap car design solutions.
  2. Students can participate in a final “competition” for distance traveled.

- How is this knowledge applied in our daily lives?
  1. Speed is commonly applied for students in everything from walking, bicycling, and traveling in car, as well as understanding airplane and spacecraft flight.

**EVALUATE**

- How will the student demonstrate their new understanding and/or skill?
  1. Students will successful build and test their mouse trap cars.
  2. Students will successfully collect data from three tests of their mouse trap cars, then calculate and graph speed.

- What is the learning product for the lesson?
  Students will accurately solve speed-distance-and-time problems in a collaborative, problem-solving investigation, as well as represent their data graphically.

**Background Knowledge for the Teacher:**

Mouse Trap Cars can be a highly engaging, “design challenge” activity. If this activity is extended to having students bring in their own materials and participate in a final competition, students will be very creative in their “problem solving” skills.

Student pages are attached.
Measuring Speed With Mouse Trap Cars

Let’s measure speed, distance and time with a car powered only by a mousetrap!

Step 1
Build a “Mouse Trap Car” that will travel as far as possible with only a single mouse trap as its power source.

Step 2
Test your car three times. Record distance traveled and time for each trial.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Distance Traveled (m)</th>
<th>Time (Seconds)</th>
<th>Speed Formula</th>
<th>Speed of car</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<tr>
<td>Average</td>
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</tr>
</tbody>
</table>

Step 3
Graph your results below. Make sure to correctly label your graph! What value should be placed on the axis? _________ On the y axis? _________

1. Explain what your graph means ________________________________

____________________________________________________________________________

2. If you were going to design a new Mouse Trap Car, what would you do differently?