



**Gold Seal:**

Copernicus Education Gateway

<b>Author(s):</b> Thomas Venezia			<b>Lesson Title:</b> Biology, Physics and Automobile Safety Design			
<i>Grade Span</i>			<i>ICLE Application Model</i>			
<b>K-4</b>	<b>5-8</b>	<b>9-12</b> <b>X</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D X</b>

**Instructional Focus:**

**Science and Technology**

Students develop skills in using technology and recognize the relationship between technology and science, including its potential and limits

**Science in Personal and Social Perspectives**

Students apply scientific principles to personal and social issues.

**Problem-Solving and Mathematical Reasoning**

Students apply a variety of problem-solving strategies to investigate and solve problems from across the curriculum as well as from practical applications.

**Writing**

Students write for a variety of purposes and audiences with sophistication and complexity appropriate to the grade level.

**Performance Task**

- The lesson will begin with a Ruler Drop Activity, which tests reaction time. If you know the force of gravity and the distance the ruler drops, you can calculate the reaction time.
  - $S = \text{distance}$
  - $g = \text{acceleration due to gravity} = 384 \text{ in./sec.}^2$
  - $S = gt^2/2$
  - $t^2 = 2S/g$
  - Students should work in pairs. Each student should drop the ruler 3 times and get an average.
- Discuss the significance of reaction time as it relates to automobile accidents.
- Once you know the reaction time, you can calculate the distance a vehicle will travel before the driver even begins to apply the brake.
  - $60 \text{ mph} = 88 \text{ ft/sec}$
  - $.44 \text{ seconds} \times 88 \text{ ft/sec} = 38 \text{ ft}$
- Review several examples at various speeds.
- Students will then complete an assignment that will challenge them to answer several questions.
  - What is the significance of this information relative to automobile safety?
  - What have car manufacturers done to address this problem?
- At this point I would assign the students the task of creating other automobile safety devices. They will need to design the device, develop a written explanation and defense and provide accurate technical drawings.

Materials Needed

- Ruler, stop watch, pictures of cars

The pictures of cars would be used to explain how auto design has changed as a result of understanding more about reaction time. Larger taillights help gain driver's attention more quickly.

### ICLE Essential Skills

Know and apply the principles of scientific inquiry. (*Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.*)  
(Not Ranked s114)

Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5)

Understand **basic algebraic properties** (i.e., commutative:  $ab = ba$ ; associative:  $ab(c) = a(bc)$ ; and distributive:  $a(b+c) = (ab)+(ac)$ ). (m3)

Present information in well-organized fashion that will be clear to the target audience. (ela 11)

### Scoring Guide:

Score each of the following characteristics on a scale of 4 to 0, where 4 = surpasses expectations; 3 = high quality performance; 2 = satisfactory quality performance; 1 = minimum quality performance; 0 = does not meet expectations.

CHARACTERISTIC	CRITERIA	SCORE
<ul style="list-style-type: none"> <li>Conduct experimentation</li> </ul>	<ul style="list-style-type: none"> <li>Conducts experiment as directed</li> <li>Data is collected and recorded accurately</li> </ul>	_____
<ul style="list-style-type: none"> <li>Apply algebraic operations and mathematical computations</li> </ul>	<ul style="list-style-type: none"> <li>Accurately calculates reaction time</li> <li>Accurately calculates stopping distance at several speeds</li> </ul>	_____
<ul style="list-style-type: none"> <li>Transfer Information to modern vehicles</li> </ul>	<ul style="list-style-type: none"> <li>Identifies two automobile safety design features related to the issue</li> </ul>	_____
<ul style="list-style-type: none"> <li>Engineering Design</li> </ul>	<ul style="list-style-type: none"> <li>Proposes a potential design feature that is plausible</li> </ul>	_____
<ul style="list-style-type: none"> <li>Written Explanation and Defense</li> </ul>	<ul style="list-style-type: none"> <li>The written defense is technically correct in grammar and spelling</li> <li>The written defense is effectively explains and defends the design</li> </ul>	_____
<ul style="list-style-type: none"> <li>Drawings/Models (Optional)</li> </ul>	<ul style="list-style-type: none"> <li>The model/drawing effectively describes the proposed design feature</li> </ul>	_____
		_____

**Keywords**

<b>English Language Arts</b>	<b>Mathematics</b>	<b>Science</b>
<b>Reading</b>	<b>Algebra</b> Algebraic Operations	<b>Earth Science</b>
<b>Writing</b> Expository	<b>Geometry</b>	<b>Life Science</b>
<b>Communications</b>	<b>Statistics</b>	<b>Chemistry</b>
<b>Literature</b>	<b>Calculus</b>	<b>Physics</b> Gravity Biomechanics Motion Scientific Inquiry
<b>Other</b>	<b>Trigonometry</b>	<b>Other</b>
	<b>Other</b>	

## Biology, Physics and Automobile Safety



Van



Car