High School Physics Safe Driving Lesson Plan

Reaction Time & Stopping Distance

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Lesson Plan - High School Physics
Reaction Time & Stopping Distance

Related National Standard:
Next Generation Science Standard HS-PS21
Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Purpose:
To introduce the topic of reaction time and stopping distance as a practical application of Newton's second law of motion.

Objectives(s):
1. Students will measure and calculate their individual reaction times using meter sticks and the acceleration due to gravity.

2. Students will perform acceleration calculations related to the stopping distance of an automobile using reaction times and automobile data.

Key Vocabulary Terms:
net force; acceleration; initial velocity; final velocity; displacement; reaction time; braking force; stopping distance

Background Information:
Hundreds of multiple vehicle crashes occur on interstate highways each year. One major cause of these crashes is following too closely. A driver's awareness of vehicular stopping distance may result in better decision making.

Resources & Materials: 1 meter stick per group; calculators; automobile data

Procedure:
1. Each student will determine his/her reaction time by catching a meter stick dropped vertically lengthwise between his her thumb and forefinger. The distance the stick falls will be used to calculate the student's reaction time. [$t = (2d/g)^{1/2}$]

2. Each student will calculate the distance in meters that a car will travel during his/her reaction time if it is moving at 70.0 miles/hour. Conversion from miles/ hours to meters/second is necessary. [$d=vt$]

3. Each student will calculate perception distance for a car moving at 70.0 miles/hour. Perception distance is the distance the car will travel in the 1.75 seconds it takes the average alert driver to perceive a hazard (the time between when the eyes see it and when the brain recognizes it).

4. Each student will calculate braking distance (displacement after brakes are applied) for the average passenger car using the following data:
   initial velocity = 70.0 miles/hour
   mass = 1.57X10^3 kg
   braking force = 1.42X10^4 N
   [$a=F/m$; $d = (v_f^2-v_i^2)/2a$]

5. Each student will calculate the total stopping distance by summing the results of steps 2, 3, and 4.

6. Each student will calculate the minimum safe following distance at 70.0 miles/hour. Assuming that the car being followed has the same braking distance as calculated in step 4, the minimum safe following distance is the sum of the results of steps 2 and 3.

7. The class will discuss conditions which would alter the calculated distances.

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