

## Teacher Resource

AP Physics 1

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### Momentum

#### Purpose

The purpose of this activity is to calculate the momentum of a small toy car. The students will determine the mass and velocity of the car, and then determine its momentum.

#### Instructions:

1. Provide the students with the following materials:

- 1 toy car (either a small wind-up car or a battery-powered car will work)
- stopwatch or a device that will measure to hundredths of a second
- meterstick or tape measure (metric measurements are preferred)
- books or boards to make a small track
- spring scale to determine mass of the car

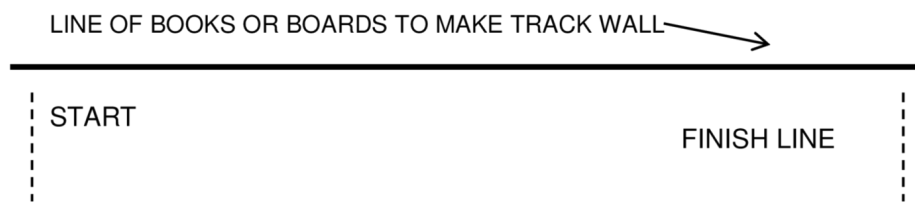
The goal of this experiment is to determine the momentum of a small toy car.

The students will be asked to determine the mass and velocity of a toy car, and then calculate its momentum. Following this, there is a handout with a set of questions for the students to answer.

#### Track diagram:

When the students construct their track for the cars, the following diagram should assist them. The track should be very similar to the track used in the Meeting Point activity.

Note that distances should be measured in meters, if possible. All calculations should be done in meters per second and kilograms.



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**Scoring Guidelines:**

Scoring should be done based upon the thoroughness of the lab write-up and the accuracy of the calculations. A sample rubric could be:

All sections included	10%
All materials in the materials list were used	5%
No materials used that were not listed	5%
Procedure detailed enough for others to follow	10%
Results section contains calculations necessary to determine the momentum of the car	10%
Analysis contains the momentum of the car	30%
Sources of error are discussed especially regarding the method used to determine the momentum of the car	15%
Practical applications of the lab are discussed	15%

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Please include this information in your laboratory write-up.

#### Calculations:

1. Velocity of car
  
2. Momentum of car

#### Questions:

1. Determine the momentum of the car. Show your calculations as part of your laboratory write up.
  
2. Determine the kinetic energy of the car. Show your calculations as part of your laboratory write up.
  
3. If the velocity of the car were to double, how would the momentum of the car be affected?

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#### Answer Key:

1. Determine the momentum of the car. Show your calculations as part of your laboratory write up.

Answers here will vary based on the mass of the car and the velocity. The mass of the car should be measured in kilograms and the velocity in m/s. The calculation for momentum is:

$$\text{momentum} = \text{mass} \times \text{velocity}$$

2. Determine the kinetic energy of the car. Show your calculations as part of your laboratory write up.

Answers again will vary. The kinetic energy of the car can be calculated using the formula:

$$\text{Kinetic Energy} = 1/2(\text{mass})(\text{velocity})^2$$

3. If the velocity of the car were to double, how would the momentum of the car be affected?

If the velocity of the car doubled, its momentum would double as well.