Physics 4A

PLC Activity #9: Momentum

To get credit for this activity, you must show your answers to a PLC tutor and have them initial the sign-out sheet before 4:00 pm on Tuesday.

Show all of your work for each question.

Part 1: Momentum Physlets

Go to Chapter 8: Momentum. Do the following Physlet Physics exercises and answer the questions listed.

1) Physlet Problem 8.3
   Two carts collide with a wall as shown in the animation (position is given in meters and time is given in seconds). Assume the two carts are identical.

   a) Is kinetic energy constant for either collision?

   b) Which cart, top or bottom, undergoes the greater change in kinetic energy due to colliding with the wall?

   c) Is this the same cart that undergoes the greater change in momentum?

   d) Explain how carts can change their momentum but not their kinetic energy.

2) Physlet Problem 8.5
   A large 2500-kg truck (blue) collides with a small car (brown) as shown in the animation (position is given in meters and time is given in seconds). After the collision, the vehicles move at constant velocity. What is the mass of the small car?
3) Go to [http://www.cabrillo.edu/~jmccullough/physlets/index.html](http://www.cabrillo.edu/~jmccullough/physlets/index.html). Click on Physlets Momentum Problem 2 and answer the following:

Determine the ratio of the red mass to the black mass: \( m / M \). *(Hint: Since momentum is a vector, both the x- and y-components have to be conserved. You only need to look at one component to get the answer.)*

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**Part 2: Ranking Task Exercises and Conceptual Questions**

4) A spaceship that is moving along an x-axis separates into two parts. *(a)* Which of the graphs in the figure could possibly give the position versus time for the ship and the two parts? *(b)* Which of the numbered lines pertains to the trailing part? *(c)* Rank the possible graphs according to the relative speed between the parts, greatest first.

![Graphs](image_url)
5) A projectile body moving in the positive direction of an x-axis on a frictionless floor runs into an initially stationary target body in a one-dimensional collision. Assume the particles form a closed, isolated system. Nine choices for a graph of the momenta of the bodies versus time (before and after the collision) are given in the figure. Determine which choices represent physically impossible situations and explain why.

6) The figure shows, from overhead, the path taken by a toy car moving at constant speed; the straight sections are either parallel to the x-axis, parallel to the y-axis, or at 45° to the axis. (a) Rank the curved sections according to the magnitude of the change \( \Delta p \) in linear momentum of the car due to them, greatest first. For which curved sections does \( \Delta p \) have a component in (b) the negative direction of the y-axis and (c) the positive direction of the x-axis?