9 Linear Momentum

Name_____

Concepts & Calculations

AP Physics

_____ 1. In which of the following situations would the total momentum of the colliding objects be conserved the best not only during but also **after** the collision?
A) Two cars collide and the wreckage slides across the road until it comes to rest.
B) Two railroad cars collide as they roll down a hill.
C) Two ice skaters run into each other, clutch each other, and slide onward.
D) A baseball is thrown against a wall and bounces.

_____ 2. A cannon, initially at rest, is fired. After the shot...
A) the speed of the cannon and shell are the same.
B) the momentum vector of the cannon is identical to the momentum vector of the shell.
C) the acceleration of the cannon is equal and opposite to the acceleration of the shell.
D) the total momentum of the cannon and shell is zero.

_____ 3. Two gliders having the same mass and equal but opposite velocities move toward each other on an air track and stick together. After the collision, the speed of the gliders is...
A) twice the original speed.
B) the same as the original speed.
C) one-half the original speed.
D) zero.

_____ 4. A moving freight car runs into a car that is half as massive at rest on the track. The cars couple together. Compared to the velocity of the first car before the collision, the velocity of the coupled cars after the collision is...
A) two-thirds as great (reduced by one-third).
B) half as great (reduced by half).
C) one-third as great (reduced by two-thirds).
D) one-fourth as great (reduced by three-fourths).

_____ 5. The conservation of zero total momentum is **NOT** illustrated by the example of...
A) a rocket moving forward as exhaust is blown backward.
B) a ball rebounding after it strikes a wall.
C) a gun recoiling as a bullet is fired.
D) a motionless skater shoving another motionless skater and being hurled backward.

_____ 6. In order to catch a ball, a baseball player moves his hand backward in the direction of the ball's motion. Doing this reduces the force of impact on the player's hand principally because...
A) the time of impact is increased.
B) the change in momentum is reduced.
C) the initial velocity of the baseball is reduced.
D) ALL OF THE ABOVE

Show your work on the following problems, including equations, units, and 3 significant figures.

7. Mr Meador, 55.0 kg, is ice skating at 6.00 m/s when he runs head-on into the lovely Momenta Impulse, 85.0 kg, who was traveling toward him at 4.50 m/s. At what speed and in which direction do the ice skaters travel if they move together after the collision?

8. A 4.00 kg object traveling westward at 25.0 m/s hits a 15.0 kg object at rest. The 4.00 kg object bounces eastward at 8.00 m/s. What is the speed and direction of the 15.0 kg object?

9. A bullet of mass 0.0400 kg is fired from a 2.00 kg gun with a speed of 300. m/s. What is the recoil speed of the gun?

10. A block of wood weighing 0.900 N rests on a table. A bullet weighing 0.100 N traveling with a velocity of 100. m/s hits the block of wood and sticks in it.
    a) What is the velocity of the bullet-block combination after the collision?

    b) The coefficient of kinetic friction between the rough block and the table is 0.800. How far will the block slide before it skids to a stop? SHOW ALL OF YOUR EQUATIONS AND WORK

11. A 125 kg fullback traveling at 3.00 m/s collides with another player and comes to rest in 1.50 s. Use the impulse equation to find the average force of the impact.

