Physical Science 101 Name:_____
Homework #4

1. A 3500-lb car is traveling at 25 mph. After 2 minutes traveling at this speed, the car strikes a 2000-lb parked car and the two cars begin traveling together. After the collision, is it possible for the two cars to travel at 25 mph? Justify your answer without a calculation.

2. A 3500-lb car is traveling at 25 mph. After 2 minutes traveling at this speed, the car strikes a 2000-lb parked car and the two cars begin traveling together.
   a. Prior to the collision, what is the linear momentum of the traveling car?

   b. After the collision, what is the linear momentum of the two cars? Justify your answer.

   c. Ignoring friction, determine the speed of the second car (the one that was parked prior to the collision) immediately after the collision. Justify your mathematical steps.

3. A Volkswagon Beetle (a small car, mass = 1000 kg) and a Cadillac Escalade (a large SUV, mass = 2000 kg) collide in a head on collision. Before the collision the Beetle is going west at 20 m/s and the Escalade is going 15 m/s east. After the collision, the cars are stuck together. What is their velocity just after the collision?

4. Two carts collide on a level, frictionless track. Cart A has a mass of 200 g and is initially stationary. Cart B has a mass of 100 g and is initially moving with a velocity of + 2.0 m/s. After the collision between the carts, cart B has a velocity of - 0.5 m/s. Calculate the velocity of cart A after the collision. (Use conservation of momentum; KE is not conserved.)

5. Two identical 2.8 kg blocks are dropped from the roof. One block (block number one) lands on a platform of concrete that is 3.3 meters above the ground while the other block (block number two) lands on a net that is also 3.3 meters above the ground. Both blocks fall freely for 2.0 s before landing.
   a. How fast is block number one going just as it strikes the concrete platform?

   b. How fast is block number two going just as it strikes the net?

   c. Consider the motion of block number one starting when it just reaches the platform until it stops. Calculate the overall change in the block's momentum during this motion.

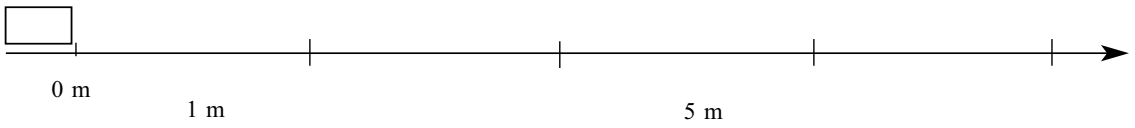
   d. Consider the motion of block number two starting when it just reaches the platform (net) until it stops. Calculate the overall change in the block's momentum during this motion.

6. Considering the blocks in the previous problem:
   a. Has one of the blocks experienced a greater impulse during the collision that causes it to stop? If so, identify which block. Justify your decision.

   b. Has one of the blocks experienced a greater force of collision? If so, identify which block. Justify your decision.

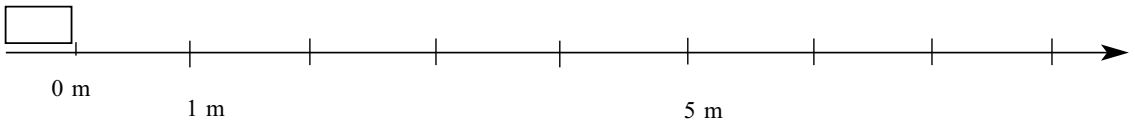
   c. Did the net or the block that struck the net experience a greater force? Justify your answer.

7. A cart travels at a constant acceleration of 1 m/s/s along a marked path. The cart starts from rest at the 0 m mark. Sketch the location of the cart at 1 second, 2 seconds, 3 seconds, and 4 seconds after the initial point. Justify your sketch.



Justification.

8. A cart going + 6 m/s at the initial position of 0 meters, experiences a constant acceleration of -2 m/s/s along a marked path. Sketch the location of the cart at 1 second, 2 seconds, 3 seconds, and 4 seconds after the initial point. Justify your sketch.



Justification.

9. A ball is thrown straight upward with an initial speed of 12 m/s. Assume air resistance is negligible.
   a. How much time is the ball in the air, assuming it lands at the same position from which it was thrown?

   b. How high will the ball go?

10. A ball is dropped from a building that is 35 m tall. Assume air resistance is negligible.
   a. How much time will elapse between the release of the ball and when it hits the ground?

   b. How fast will the ball be going right before it hits the ground?