AP PHYSICS

MOMENTUM AND IMPULSE PROBLEMS

For each problem:

A. Identify the given information and the unknown.
B. Write any formula used.
C. Rearrange the formula to solve for the unknown variable.
D. Plug in numbers with units.
E. Solve, giving the answer in 3 significant figures with the correct unit.

1. 2409 kg pick-up truck driven by Ford Tuff has a velocity of 35.2 m/s east. What is the magnitude of the momentum of the truck in kg-m/s?
2. A 1909 kg police pursued van is driven by Chase Mee. The van exhibits a momentum of 3409 kg-m/s. What is the velocity of the van in m/s as it veers rightward into a guardrail?
3. Rocky Sirface, an astronaut with a mass of 101 kg, wears a space suit with a mass of 35 kg . If Rocky walks on the moon at a rate of 3.2 m/s eastward, what is the magnitude of the momentum of the astronaut and his suit in kg-m/s?
4. Rocky the astronaut from the problem above decides to run around on earth (6 times the acceleration due to gravity as compared to the moon) in his space suit with a velocity of 3.2 m/s westward. What would be the magnitude of the momentum in kg-m/s?
5. A force of 602 N is applied to a 3613 kg object for 29 seconds. What is the change in velocity that the object experienced?
6. P. Lise Go pushed her 663 kg vehicle from rest to 2.6 m/s in 19 seconds. What is the magnitude of the impulse on the car? (No + or - signs.)
7. Lee Mealone, a hermit, pushes a 14090 gram boulder into the wall of his cave at a speed of 3.7 m/s, the boulder is brought to a stop in 1.4 seconds. What was the magnitude of the average force in Newtons of the boulder on the wall? (No + or - signs.)
8. If an ostrich with a mass of 170.4 kg and is running northward with a velocity of 16.1 m/s, then with what velocity must a chicken run with a mass of 42.6 kg to have the same momentum as the ostrich?
9. Air bags are designed to protect passengers during collisions by extending the time of impact. A force of 64.5 Newtons is required to stop a moving passenger in 0.9 seconds with an airbag. The amount of time required without an airbag is 20 times less. What would be the force of impact (in Newtons) without an airbag?
10. A 1.9 kg object is thrown upward with an initial speed of 9 m/s. The ball is caught when it has a downward speed of 9 m/s. How long (in seconds) was the ball in the air? (Hint: use the weight of the ball as the force and use 9.8 m/s/s for acceleration due to gravity.)
11. A 1.81-kg rubber ball moving with a speed of 5.36 m/s strikes a wall and rebounds with a speed of 1.8 m/s in the opposite direction. Determine the impulse (in Newton-second) encountered by the ball.
12. A 76-kg football player moving with a speed of 6.68 m/s collides mid-air with another player and gets knocked backwards. If the player experiences a force of 782 N over a time period of 0.910 s, then determine the final speed (in m/s) of the player. (No + or - signs.)