Momentum Worksheet

Monday, June 27, 2011
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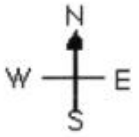
Physics 11

Momentum Worksheet

60 marks

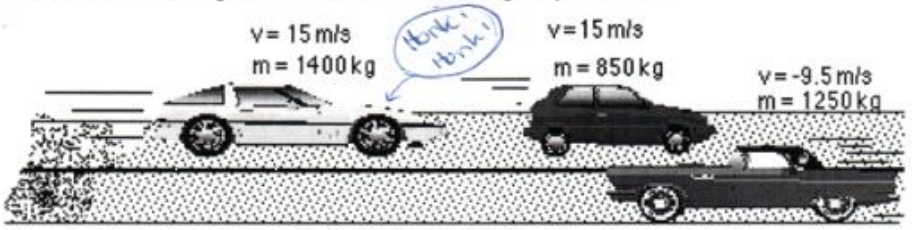
1. Calculate the momentum for the following: (4 marks)



   a) a 250 kg motorcycle travelling at 14 m/s
   b) a 45000 kg truck travelling at 25 m/s
   c) a 2300 kg satellite travelling at 7500 m/s
   d) a 1.2×10^{-8} kg paramecium travelling at 3.5×10^{-5} m/s

2. What is the impulse for each of the following: (4 marks)
   a) 500 N of force applied over 11 s to a car during a collision.
   b) 1500 N of braking force applied over 6.5 s to stop a car.
   c) a 2600 kg truck slows from 12 m/s to 9.0 m/s.
   d) the 45000 kg space shuttle increases its speed by 500 m/s.

3. Three cars are travelling on a section of a two lane highway as shown:



   Calculate the total momentum of the system. (2 marks)

4. An 8.0 kg bowling ball is rolling at 2.0 m/s when it slams into a bowling pin.
   a) Calculate the momentum of the bowling ball. (2 marks)
   b) The Collision between the ball and the pin lasts for 0.25 s and slows the ball down to 1.6 m/s. What amount of force does the pin place onto the ball? (3 marks)
   c) What force does the ball place onto the pin? (1 mark)

5. A gravel truck is moving east with a momentum of 3.0×10^5 kgm/s. The truck's driver slams on the brakes for 6.0 s to slow the truck. The truck now has a momentum of 1.0×10^5 kgm/s. What net force must be applied to change the trucks momentum? (3 marks)

6. What force is required to accelerate a 1500 kg car from 0.0 m/s to 23 m/s in 3.5 s? (3 marks)

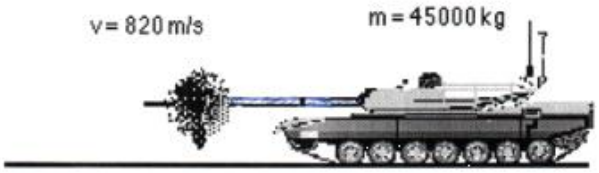
7. A football player is running due west when he is tackled by one member of the opposing team that was travelling east. Compare the total momentum before and after the collision. (2 marks)

8. A baseball with a mass of 0.140 kg is thrown by a pitcher at a speed of 45 m/s and then hit by a batter. The ball is in contact with the bat for 0.012 s and is driven directly into center field with a speed of 53 m/s.

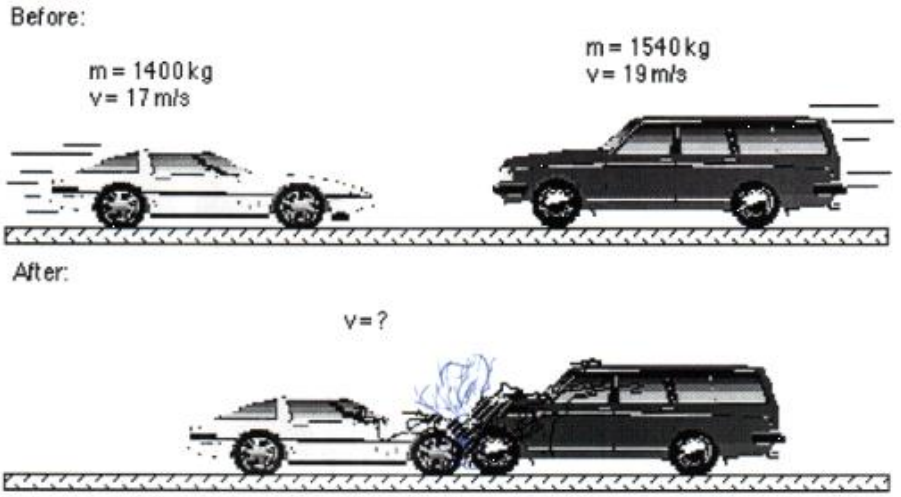
a) What is the momentum of the thrown ball? (2 marks)
b) What is the momentum of the batted ball? (2 marks)
c) What was the impulse on the ball? (1 mark)
d) What force was applied to the ball? (2 marks)

9. A 45 kg physics student dives away from a stationary canoe with a velocity of 3.0 m/s. The mass of the canoe is 145 kg. What is the recoil velocity of the canoe? (4 marks)

10. A 45000 tank initially at rest fires a 25 kg shell horizontally out of its gun at a velocity of 820 m/s. What is the initial recoil velocity of the tank? (4 marks)

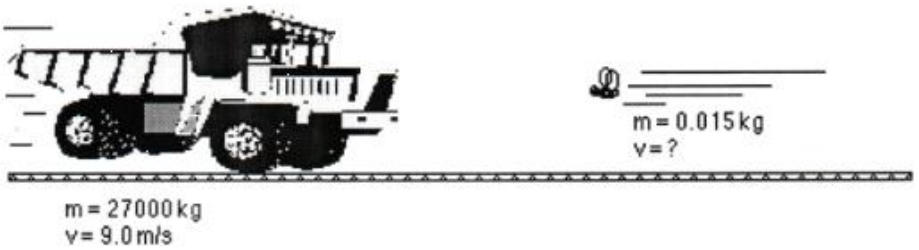


11. A 1400 kg Corvette travelling at 17 m/s due east collides head on with a ~~1250~~ 1540 kg Station wagon travelling at 19 m/s due west. As a result of the collision the two vehicles stick together. With what **initial** speed and direction do the two cars move off at if the accident occurs on a very wet slippery surface? (5 marks)



12. Suppose you throw a rubber ball at some speed in to a pillow which stops the rubber ball. Now suppose you throw the same rubber ball at the same speed against a hard wall which causes the ball to bounce straight back at some speed.
    a) Which ball experiences the greater impulse? Explain. (2 marks)
    b) Which ball experiences the greater change in momentum? (1 mark)
    c) If the ball is in contact with the pillow and the wall for the same time, in which case will the ball experience the greater force? (1 marks)

13. How fast must a 0.015 kg fly have to travel to stop a 27000 kg truck travelling at 9.0 m/s? (4 marks)



14. A 7.0 kg toy train engine is pulling a 5.0 kg car at 2.3 m/s due west. A small explosion causes the engine to break away from the car and travel at a speed of 3.1 m/s due west. what is the speed and direction of the car after the explosion? (5 marks)

15. A 2.0 kg blob of putty moving at 3.0 m/s slams into and sticks to a 4.2 kg blob of putty initially at rest. What is the speed of the combined blobs of putty after the collision? (3 marks)