**Physics 2204**                **Worksheet #5**                **14 Feb 07**
                                    Momentum

$p = m \, v$                    $F \, \Delta t = m \, \Delta v$                    $p_A + p_B = p'_A + p'_B$

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1.  Calculate the momentum of each of the following objects.
    a)    a 0.40 kg rock thrown downwards with a velocity of 20 m/s
    b)    a 1000 kg car moving at 100 km/hr

2.  If the momentum of a 7.0 kg bowling ball is 15.0 kg·m/s [left] what is its velocity?

3.  A bullet travelling at 1100.0 m/s has a momentum of 4.5 kg·m/s.  What is its mass?

4.  What impulse is exerted in each of the following situations?
    a)    a force of 25 N [E] is exerted on a cart for 3.2 s.
    b)    a hockey stick is in contact with a puck for 0.05 s and exerts a force of 120.0 N.

5.  A pool ball rolls towards a cushion at 3.0 m/s and rebounds straight back at 3.0 m/s.  If the mass of the ball is 250 g, what is its change in momentum?

6.  A 7.0 kg bicycle with a 50.0 kg cyclist is moving at uniform motion when the cyclist pushes the pedals, causing it to speed up to 5.0 m/s in 1.0 s without changing direction.  If the average force exerted on the pedals was 80.0 N, what was the bicycles initial velocity?

7.  A loaded freight car of mass 5000 kg is rolling to the left at 4.0 m/s when it collides and sticks to an empty car of mass 1000 kg rolling to the right at 3.0 m/s.  What is the velocity of the pair after the collision?

8.  A rifle of mass 5.0 kg fires a 30 g bullet at 350 m/s.  What is the recoil velocity of the rifle?

9.  A 1.0 kg ball moving with velocity of 2.0 m/s to the right collides straight on with a stationary 2.0 kg ball.  After the collision the 2.0 kg ball moves off to the right at 1.2 m/s. What is the velocity of the 1.0 kg ball after the collsion?

10. A 5000 kg boxcar moving at 5.2 m/s on a level frictionless track collides with a stationary 5000 kg car on the same track.  If they hook together in the collision how fast are the cars moving afterwards?

11. A 75 kg girl is running at 3.0 m/s and jumps onto a sled that has a mass of 5.0 kg and is already moving in the same direction as the girl at 2.0 m/s.  What will be the final velocity of the girl and sled, assuming no friction?

12. With what speed must a 12.0 kg monkey be running in order to completely stop a 12000.0 kg freight train moving at 140.0 km/hr?

Answers:
1. a) 8.0 kg.m/s
   b) 27 800 kg.m/s

2. 2.14 m/s [left]

3. 4.1 g

4. a) 80.0 N.s
   b) 6.0 N.s

5. -1.5 kg.m/s

6. 3.6 m/s

7. -2.8 m/s

8. -2.1 m/s

9. -0.4 m/s

10. 2.6 m/s

11. 2.9 m/s

12. 140, 000 km/hr....(fast monkey)