Momentum problems and calculations **Name_____**
Honors physics

Momentum

1. Which has a greater momentum: a 0.010 kg bullet going 400 m/s OR a 60 kg student walking at 2 m/s? Which has more inertia? Which has more kinetic energy?

2. What is the velocity of a 90.0 kg football player running with a momentum of 685 kgm/s ?

3. What would the velocity of a 0.010 kg bullet need to be in order to equal the momentum of a 75 kg person running at 8.0 m/s?

Impulse

4. A running back is initially running with a momentum of 780 kgm/s. He is hit head-on (slowed down but not stopped) by a linebacker so that the running back's momentum is 250 kgm/s after the collision. What is the impulse delivered to the running back? What impulse is delivered to the linebacker? Who exerts a larger force on the other?

5. A 0.145 kg baseball is traveling to the right at +40.0 m/s. The baseball is hit back to the left at -30.0 m/s. What is the initial momentum of the baseball? What is the final momentum of the baseball? What is the impulse delivered to the baseball? If the collision lasts for 0.0007 s, what is the average force on the ball?

6. On a dart gun, an average force of 1.2 N is applied to a 0.013 kg Nerf dart over 0.15 seconds. Calculate the impulse delivered to the Nerf dart. If the dart initially starts from rest, what is the final velocity of the dart?

Recoil Problems

7. A 5.0 kg gun fires a 0.012 kg bullet at 300 m/s. What is the recoil velocity of the gun?

8. A 50.0 kg student is standing on a skateboard holding the same 5.0 kg gun. If the student fires the 0.100 kg bullet at 325 m/s, what is the recoil velocity of the student-gun system?

9. Two astronauts are in frictionless space, floating around. Jim is 150 kg and Sam is 80 kg. They get into an argument and Sam pushes Jim away at 2.0 m/s. Calculate the resulting velocity of Sam.

Perfectly Inelastic collisions (objects stick together)

10. A 0.050 kg bullet is fired at 390 m/s into a steel block that is 2.00 kg. The block is at rest on a frictionless surface. The bullet lodges inside the block. (a) What is the resulting velocity of the bullet-block system after impact? (b) Determine the total KE before the collision. Then determine the total KE after the collision.

11. A 0.010 kg bullet is fired at 400 m/s into an 80.0 kg stunt person wearing a Kevlar bulletproof vest. The stunt person is at rest, standing on roller skates (no friction). The bullet lodges inside the vest. What is the resulting velocity of the stunt person-bullet system?

12. A 2,000 kg truck going 20 m/s East collides head-on with an 800 kg car going 15 m/s West. After the collision, the car and the truck stick together. With what velocity will the car-truck system leave the collision? (Be careful of the sign for your velocities.)

Objects Bouncing off each other

13. A 25.0 kg bumper car moving to the right at 4.0 m/s collides with a 35.0 kg bumper car moving to the left at -1.83 m/s. After the collision, the 35.0 kg bumper car is going 3.03 m/s to the right. What is the final velocity of the 25.0 kg bumper car?

14. A 1.3 kg block moving at 3.0 m/s to the right has a head-on collision with a stationary block of mass 2.8 kg. After the collision, the 2.8 kg block is moving at 1.9 m/s to the right. (a) What is the velocity of the 1.3 kg block after the collision? (b) Is this a perfectly elastic collision? Evidence?