Conservation of Momentum Name_____hr_____

For momentum problems, the BIG IDEA is that when there are two or more objects hitting, pushing, pulling, sticking to, or interacting with each other, THE TOTAL MOMENTUM OF THE SYSTEM IS CONSERVED. Simply put, if you add up the momentum (positive and negative) of each object before the collision, it is the same total as after the collision. This is like people going into a room with money; whatever they go in with, they go out with, even if they exchange some money. Some people gain, but others lose the same amount.

WRITE DOWN THE FORMULA!! (**I MEAN IT!!!!**) $\vec{p} = m \times \vec{v}$

Momentum = Mass · Velocity
kg · m/s = kg · m/s

Note that you can use speed the same as you would use velocity, as long as you use + and – signs to indicate what direction something is moving, and keep track of which objects have + and – momentums.

1) A 1.5 kg book is falls at a speed of 3 m/s.
Its momentum equals

2) A 1200 kg car moves 200 meters in 8 seconds. Its momentum equals:

3) A 0.500 kg dynamics cart moves 1.2 m in 3 s. p =

4) A 3 kg ball of clay is moving to the right at +8 m/s. A 5 kg ball of clay is moving to the left at -2 m/s. They collide and stick together.

Before collision

After collision

a) Draw diagrams of the balls before and after the collision.
b) Calculate the momentum of each ball before the collision

c) How much *total momentum* do they have before the collision? _____

d) How much *total momentum* do they have after the collision? _____

e) What is the speed and direction (that's velocity!!) of the ball clump after the collision?

5) A 3.2 kg rifle sitting at rest fires a 2 gram bullet at a speed of 670 m/s.

a) What is the momentum of the total system before firing the bullet?

b) What is the momentum of the fired bullet?

c) Calculate the momentum and recoil velocity of the rifle.

Rearranging Newton's 2nd Law gives: **$F\Delta t = m\Delta v$ (Impulse-momentum equation)**
Force · time = mass · change in velocity (page 192)

6) A 5-kg brick is at rest. A 40N force acts on the brick for 6 seconds.

a) Calculate the acceleration of the brick.

b) Calculate the final velocity of the brick.

c) Use the impulse-momentum equation to calculate the change in velocity of the brick.

7) A 1400kg car moving westward with a velocity of 15m/s collides with a utility pole and is brought to rest in 0.30sec. Find the force exerted on the car during the collision.