Unit 6: Momentum

Momentum

Any moving object has momentum which depends on:

1. mass
2. velocity

$$p = mv$$

Where: (greek letter "myu")

- p = momentum
- m = mass (kg)
- v = velocity (m/s)

- Momentum is a vector quantity, meaning is has both magnitude and direction
- The units are kg m/s but can also be written as N · s.

Ex 1: Calculate the momentum of a 6.2 kg pumpkin traveling at a velocity of 5.0 m/s west.

$p = mv$

$= (6.2\text{ kg})(5.0\text{ m/s})$

$= 31\text{ kg m/s}$ West

Ex 2: A baseball of mass 0.14 kg is moving at 35.0 m/s.

a. Find the momentum of the baseball.

$p = mv = (0.14\text{ kg})(35.0\text{ m/s}) = 4.9\text{ kg m/s}$

b. Find the velocity at which a bowling ball, mass 7.6 kg, would have the same momentum as the baseball.

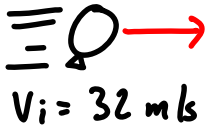
$p = mv \quad v = \frac{p}{m} = \frac{4.9\text{ kg m/s}}{7.6\text{ kg}} = 0.64\text{ m/s}$

Remember that:

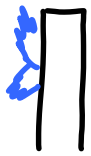
Change = final - initial

Ex3:

a) A 0.50 kg water balloon is thrown against a wall at 32 m/s coming to a stop. What was its change in momentum? (constant)



$v_i = 32\text{ m/s}$



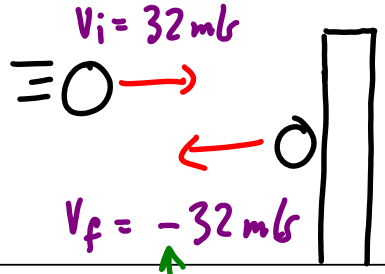
$v_f = 0\text{ m/s}$

$\Delta p = \Delta(mv)$

$\Delta p = m\Delta v = m(v_f - v_i)$

$= (0.50\text{ kg})(0 - 32\text{ m/s}) = -16\text{ kg m/s}$

b) A 0.50 kg bouncy ball is thrown at 32 m/s, bouncing back with the same speed. How does its change in momentum compare to that of the water balloon?



going backwards so negative

$\Delta p = m\Delta v$

$= m(v_f - v_i) = (0.50\text{ kg})(-32 - 32)$

$= -32\text{ kg m/s}$