



Momentum

POS Checklist:

- define momentum as a vector quantity equal to the product of the mass and velocity of an object ($p = mv$).

what does it mean to be conserved?

defn:

things that are conserved:

what do you know about momentum ?



Momentum

"Is the product of mass and velocity."

$$\vec{p} = m\vec{v}$$

where:

m = mass (kg)

\vec{v} = velocity (m/s)

\vec{p} = momentum (kgm/s)

All objects in motion
have momentum.

Momentum is a
vector quantity.

Practice Problems (From Handout):

1. While stepping off a skateboard, the rider propels the skateboard with a velocity of 2.50 m/s [N]. If the mass of the skateboard is 2.2 kg, calculate the momentum of the skateboard.
2. A 900 kg car has a momentum of 1.35×10^4 kgm/s [E]. Calculate the velocity of the vehicle.
3. A ball thrown with a velocity of 32.0 m/s [W] has a momentum of 4.5 kgm/s [W]. What is the mass of the ball?

Momentum and Newton's Second Law



Our old friend Newton had momentum in mind when he penned his famous second law:

$$\vec{F} = m\vec{a}$$

"a net force causes acceleration"

Newton found a way to connect forces to momentum.

$$\vec{F} = m\vec{a}$$

"a net force causes acceleration"



some math

$$\vec{F} = \frac{\Delta\vec{p}}{\Delta t}$$

This means that any change in momentum causes a change in force, or vice-versa.

We now have two equations to calculate momentum:

$$\vec{p} = m\vec{v}$$

or

$$\vec{p} = \vec{F}\Delta t$$

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4. A water balloon with a mass of 4.00 kg is dropped from a window. The balloon reaches a velocity of 31.3 m/s just before striking the ground.

a) Determine the momentum of the balloon just before it strikes the ground.

b) If the velocity of the balloon is 0 upon striking the ground, determine the change in momentum of the balloon.

c) If the impact with the ground took 0.011 s, calculate the force exerted by the ground on the balloon.

5. A 2000 kg car traveling 25 m/s strikes a tree and comes to rest. If the impact took 0.23 s, determine the force exerted on the car.

6. A 500 g rubber ball is thrown at a velocity of 5.00 m/s and strikes a wall. After only 0.25 s, the ball rebounds straight back with a velocity of -4.50 m/s. Calculate the force exerted on the ball.

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