

II. LAW OF CONSERVATION OF MOMENTUM

In a closed system:

When two objects interact....

The SUM of their momentum _____ the
interaction equals the SUM of their momentum
_____ the interaction.

“ Total momentum before Interaction = Total momentum After Interaction ”

A) Collision Problems

Example 1) A 3 kg object traveling 6 m/s east has a perfectly elastic collision with a 4kg object traveling 8 m/s west. After the collision, the 3kg object will travel 10 m/s west.

- 1) Find the total momentum **BEFORE** the collision.

$$\text{Total momentum before} = \mathbf{m_1v_1 + m_2v_2}$$

DO YOU REMEMBER?? How we designate east and west when we use equations?

- 2) What is the total momentum **after** the collision?
- 3) What is the velocity of the 4 kg object after the collision?

Example 2) A 10kg Block A moves with a velocity of 2 m/s to the right and collides with a 10 kg Block B which is at rest. After the collision Block A stops moving and Block B moves to the right.

- a) Find the total momentum after the collision

- b) Find the velocity of Block B **after** the collision.

Example) A 10 kg cart moving with a velocity of 10 m/s East collides and attaches itself to a 10 kg cart moving at a velocity of 50 m/s west.

Draw a quick picture

- 1) Find the total momentum before the collision

- 2) Find the total momentum after the collision

- 3) What is the velocity of the attached carts after the collision?

B) Recoil Problem - When interacting objects start from rest

Example 1) A 4 kg rifle fires a 5×10^{-3} kg bullet at a velocity of 500 m/s. What is the velocity acquired by the rifle?

Total Momentum Before Interaction = Total Momentum After Interaction

Why is the total momentum before Zero???

Subtract m_2v_2 from both sides

In problem Solving, remove negative sign and use

(Not in Reference Table)

Important: Regents almost always has an question that asks you to use this equation

Example 2) 2 magnets of 1 kg and .5 kg are arranged **at rest** on a horizontal frictionless surface. When the strings holding them together is cut they move apart under the magnetic force of repulsion.

- a) What is the total momentum of the magnets before the string is cut?
- b) What is the total momentum of the magnets after the string is cut?
- c) What is the velocity of the .5 kg mass when the velocity of the 1 kg magnet is 30 m/s?