Linear Momentum and Force

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Momentum

-The quantity of motion of a moving body and it implies a tendency to continue its course

-p=mv

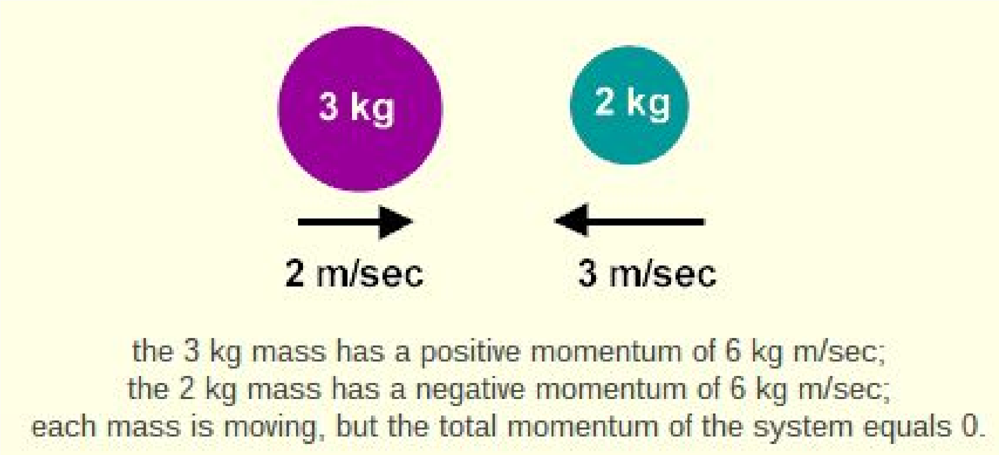
-SI unit for *p* is *kg* x *m/s*

Newton's Second Law of Motion

The net external force equals the change in momentum of a system divided by the time in which it changes

Fnet=ma → Fnet=mv/t → Fnet=p/t → Fnet x t = p (only if mass is constant)

Forces in opposite directions



Fnet = 0

1. An object that has a small mass and an object that has a large mass have the same momentum. Which object has the largest kinetic energy?

1) K.E. → the energy an object possesseses due to its motion

If the momentum is the same, the multiplication of mass and v has to equal the same therefore the object with smaller mass (with great velocity) will have the greatest K.E.

$$K.E. = \frac{1}{2} m \cdot v^2$$

$$p = mv$$

i.e: $1 \cdot 2 = 2$

$2 \cdot 1 = 2$

2. An object that has a small mass and an object that has a large mass have the same kinetic energy. Which mass has the largest momentum?

2) $K.E. = \frac{1}{2} m \cdot v^2$

i.e: $2 = \frac{1}{2}(1)(2)^2$ smaller mass $\rightarrow p = (1)(2) = 2$

$2 = \frac{1}{2}(4) \cdot 1^2$ bigger mass $\rightarrow p = (1)(4) = 4$

If the kinetic energy is the same, the object with a larger mass has a greater momentum.

5) A runaway train car that has a mass of 15,000 kg travels at a speed of 5.4 m/s down a track. Compute the time required for a force of 1500 N to bring the car to rest.

5) $F_{net} = \frac{\Delta p}{\Delta t}$

$1500\ N = \frac{15{,}000 \cdot 54\ m/s}{t}$

$t = 54\ s$

6.The mass of Earth is 5.972x10^24 kg and its orbital radius is an average of 1.496x10^11 m. Calculate its linear momentum.

6) $v = \frac{2\pi r}{t} = \frac{2\pi(1.496 \times 10^{11})}{365 \times 24 \times 3600} = 29806.1\ m/s$

$p = mv$

$p = (29806.1 \times 5.922 \times 10^{24})$

$p = 1.78 \times 10^{29}\ kg \cdot m/s$

Lab

https://phet.colorado.edu/en/simulation/forces-and-motion-basics