

Impulse & Momentum

Impulse (J)

The effect of a net force acting on an object.

Equation

$$J = F t$$

force

time

Units

(N·s)

Momentum (P)

Mass in motion.

Equation

$$P = mv$$

Units

$$(kg \cdot m/s)$$

$$\left(\overbrace{kg \cdot m/s^2}^N \cdot s \right)$$

$$(N \cdot s)$$



Newton's 2nd Law

$$F = ma$$

$$a = \frac{\Delta v}{t}$$

$$F = \frac{m \Delta v}{t}$$

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

How are Impulse and Momentum related?

$$J = Ft = \Delta p$$

$$Ft = m \Delta v$$

- A large change in momentum requires a large force, or a long time.

Example Problem

According to Newton's Third Law of Motion, small thruster rockets can be used to make fine adjustments in satellite orbits. One such rocket has a thrust of 35 N. If it is fired to change the velocity of a 72,000 kg satellite by 63 cm/s, how long should it be fired?

$$m = 72,000 \text{ kg}$$

$$F = 35 \text{ N}$$

$$\Delta v = 63 \text{ cm/s}$$

$$= .63 \text{ m/s}$$

$$t = ?$$

$$\frac{m \Delta v}{F} = \frac{F t}{F}$$

$$t = \frac{(72,000 \text{ kg})(.63 \text{ m/s})}{(35 \text{ N})}$$

$$t = 1,296 \text{ s}$$