

Momentum:

Momentum determines how much force a moving object generates in a collision

mass } increasing either of
velocity } these will increase an
 } object's momentum

→ An object with no velocity ($v=0\text{ m/s}$) has no momentum

→ No mass = no momentum

momentum = mass \times velocity

$$p = mv$$

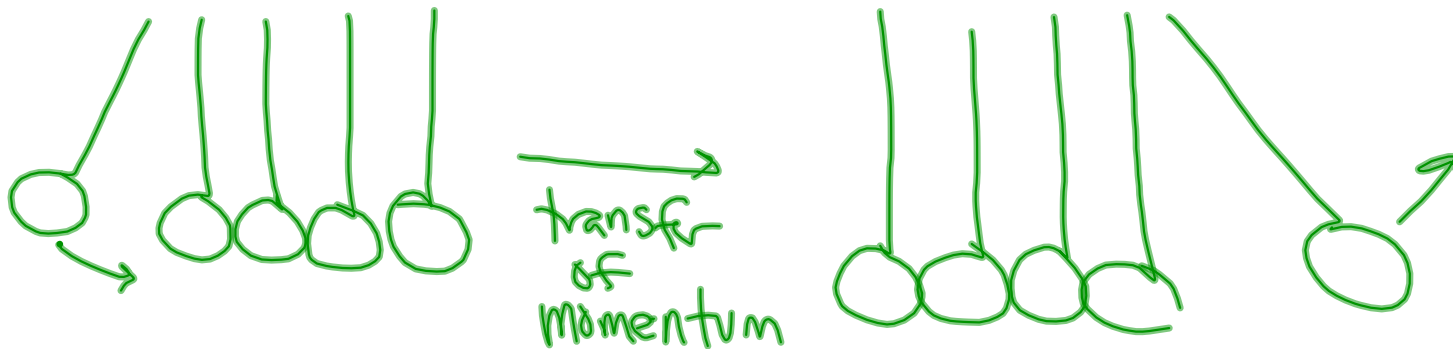
units of mass \rightarrow kilograms (kg)

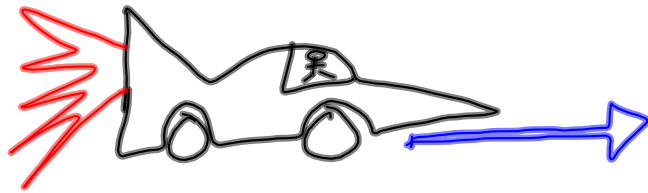
units of velocity \rightarrow $\frac{\text{meters}}{\text{second}}$ $\left(\frac{m}{s}\right)$

Units of momentum \rightarrow $\boxed{\frac{\text{kg} \cdot \text{m}}{\text{s}}}$

Transfer of momentum:

When one object collides with another object, some or all of its momentum can be transferred to the second object





- Mr. Bregar's rocket car has a mass of 1200 kg
- It's moving with a velocity of $7.6 \frac{m}{s}$
- What is its momentum (p)?

$$p = 9120 \frac{kg \cdot m}{s}$$



- Mr. Kirsch's putt putt car has a mass of 622 kg
- If all the momentum from Mr. Bregar's rocket car is transferred, what will Mr. Kirsch's putt putt car's velocity be?

$$v = 14.66 \frac{m}{s}$$

$$\textcircled{1a} \quad m = 1200 \text{ kg}$$
$$v = 7.6 \frac{\text{m}}{\text{s}}$$

$$\textcircled{1b} \quad p$$

$$\textcircled{2} \quad p = m \cdot v$$

$$\textcircled{3} \quad p = 1200 \text{ kg} \cdot 7.6 \frac{\text{m}}{\text{s}}$$

$$\textcircled{4} \quad p = 9120 \frac{\text{kg} \cdot \text{m}}{\text{s}}$$

$$\textcircled{5} \quad p = m \cdot v$$
$$9120 = 1200 \cdot v$$
$$\frac{9120}{1200} = \frac{1200 \cdot v}{1200}$$
$$7.6 = v \checkmark$$

rocket
car

$$\textcircled{1a} \quad m = 622 \text{ kg} \\ p = 9120 \frac{\text{kg} \cdot \text{m}}{\text{s}}$$

$$\textcircled{1b} \quad v$$

$$\textcircled{2} \quad p = m \cdot v$$

$$\textcircled{3} \quad 9120 \frac{\text{kg} \cdot \text{m}}{\text{s}} = 622 \text{ kg} \cdot v$$

$$\textcircled{4} \quad \frac{9120}{622} = \frac{622 \cdot v}{622}$$

$$14.66 \frac{\text{m}}{\text{s}} = v$$

$$\textcircled{5} \quad p = m \cdot v$$

$$p = 622 \cdot 14.66 \\ \checkmark p = 9118.52$$