

CHAPTER 5 - Newton's Laws

Newton's First Law (Law of Inertia)

A object at rest or in uniform motion will remain at rest or in uniform motion unless acted on by an external force.

Newton's Second Law

$$a \propto F \quad (\text{direct proportionality})$$

$$a \propto \frac{1}{m} \quad (\text{inverse proportionality})$$

Combining proportionalities:

$$a \propto F \left(\frac{1}{m} \right)$$

$$a \propto \frac{F}{m}$$

$$F \propto ma$$

$$F = kma$$

special k

$$\frac{1N}{1kg \cdot m/s^2}$$

$$\begin{matrix} \swarrow & \downarrow & \searrow \\ N & kg & m/s^2 \end{matrix}$$

acceleration varies directly with the force and inversely with the mass.

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

Mathematical Representation of Newton's Second Law

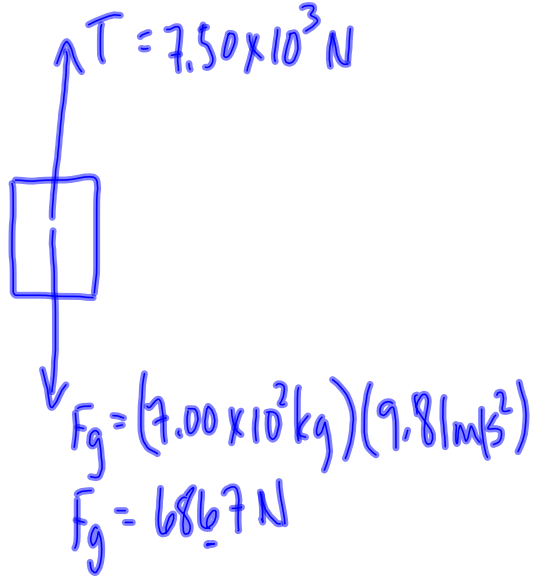
MP/162

$$m = 7.00 \times 10^2 \text{ kg}$$

$$T = 7.50 \times 10^3 \text{ N}$$

$$\vec{a} = ??$$

up +



\vec{a}
↓
size
only

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$\Rightarrow T - F_g = ma$$

$$7.50 \times 10^3 \text{ N} - 6867 \text{ N} = (7.00 \times 10^2 \text{ kg})a$$

$$633 \text{ N} = (7.00 \times 10^2 \text{ kg})a$$

$$a = +0.90 \text{ m/s}^2$$

$$\vec{a} = 0.90 \text{ m/s}^2 \text{ [up]}$$

going up
speeding up
steadily

going down
slowing down
steadily

TO DO: ① PP/163

② Finish SIMS lab

③ HW Probe on PP/144

④ Assignment (due Nov 1)