Newton's Laws

Thought Experiments - p153

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	A	B	C	D
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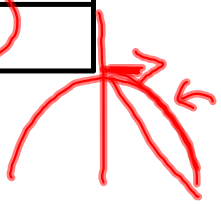
2				
3				



Newton's First Law - Law of Inertia

An 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

acceleration is directly proportional to force $(a \propto F)$

acceleration is inversely proportional to mass $(a \propto \frac{1}{m})$

Combine proportionalities:

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

$$F \propto ma$$

$$F = kma$$

$(k$ is "special"$)$

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

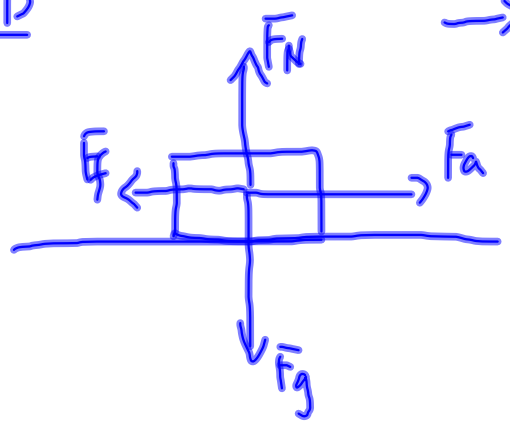
$$\boxed{\vec{F}_{net} = m\vec{a}}$$

Where $\vec{F}_{net}$ is the unbalanced force (N)

m is the mass (kg)

$\vec{a}$ is acceleration (m/s^2)

FBD



$\rightarrow +$

If $F_a > F_f \Rightarrow +$ acc

If $F_a < F_f \Rightarrow -$ acc

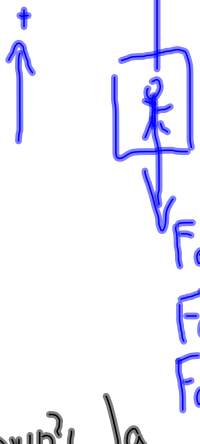
If $F_a = F_f \Rightarrow$ no acc

MP|162

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

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

$\vec{a} = ?$



Since $T > F_g$, the acc is upward

$F_g = (7.00 \times 10^2 \text{ kg})(9.81 \text{ m/s}^2)$

$F_g = 6867 \text{ N}$

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

$T - F_g = ma$

$7500\text{N} - 6867\text{N} = (7.00 \times 10^2 \text{ kg})a$

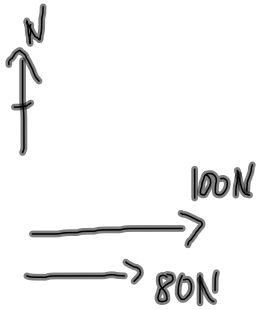
$+633\text{N} = (7.00 \times 10^2 \text{ kg})a$

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

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

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

(going up | speeding up)
going down | slowing down)



$\vec{F}_{net} = 180\text{N [E]}$

$\vec{F}_{net} = 100 - 80\text{N} = 20\text{N [E]}$

PP|163