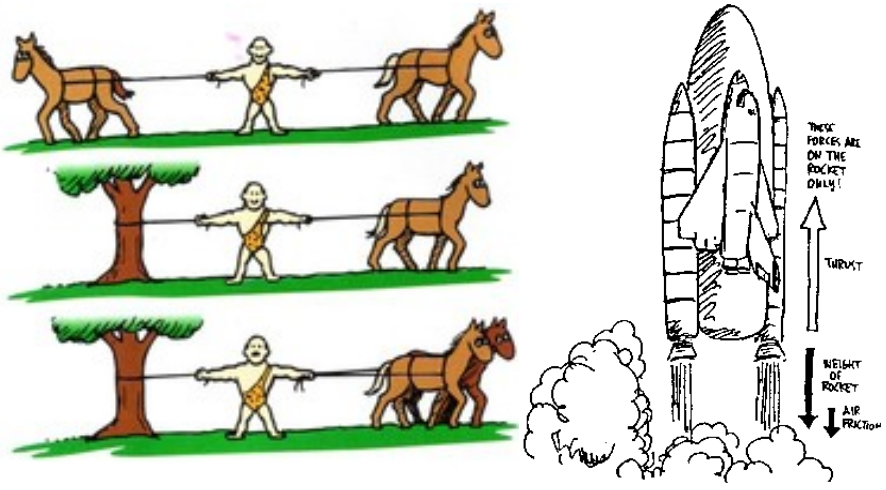
Law of Interaction

Whenever one object exerts a force on a second object, The second object exerts a force that is equal in magnitude and opposite in direction to the first object.

"For every action, there is an equal and opposite reaction."



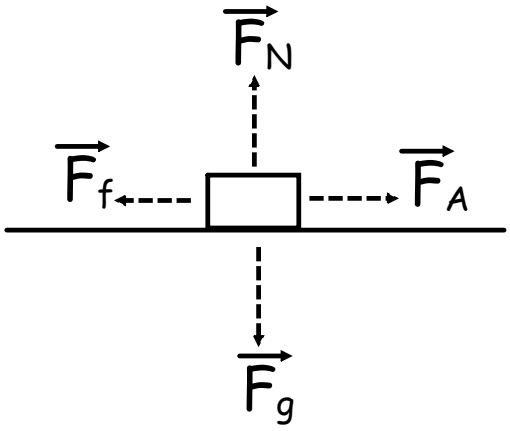
Which scenario would you rather be in.
Rank them 1 to 4

When you drop an apple of mass 0.40 Kg, it accelerates towards the earth at 9.80 m/s^2. According to Newton's 3rd Law, the apple must exert an equal and opposite force on the earth. If the mass of the Earth is 5.98×10^{24} kg, what is the magnitude of the earth's acceleration caused by the apple?

1. In order to break a wooden block using martial arts, the hand undergoes an acceleration of -6500.0 m/s^2. If the hand and forearm have an mass of 700.0 g. What force is exerted on the hand by the wooden block.

Concept of Lift Force and Force of Gravity

Remember, the net force on an object at rest with constant speed will be zero. In that case...

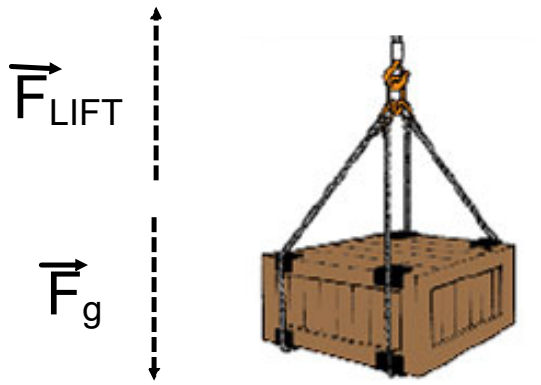


Vertically, we can see this equals

$$\vec{F}_{NET} = \vec{F}_N + \vec{F}_g$$

But what if an object is being lifted?

When an object is being lifted, the tension in the rope is the force, but it works both ways (Newtons 3rd Law). The rope is exerting a force on the object but the object is also exerting a force on the rope.



So the net force in this instance would be,

$$\vec{F}_{NET} = \vec{F}_{LIFT} + \vec{F}_g$$

Using the idea that $\vec{F} = ma$, each force can be broken down into 2 components.

$$m\vec{a}_{NET} = m\vec{a}_{LIFT} + m\vec{g}$$

a) A 1.8 kg ball is thrown in the air with an acceleration of 6.2 m/s^2. What is the lift force exerted by the person throwing the ball?

b) A person in an elevator is going down with an acceleration of 2.0 m/s^2. If the combined mass of the person and elevator is 3500.0 kg, what is the lift force?

$F_{net} = F_{lift} + F_g$

$F_{lift} = F_{net} - F_g$

$F_{lift} = ma_{net} - mg$

$F_{lift} = (3500.0kg)(-2.0\ m/s^2)-(3500.0kg)(-9.8m/s^2)$

note the negative acceleration

$F_{lift} = -7000.0N + 34300N$

$F_{lift} = 27300N\ [up]$

$F_{lift} = 2.7 \times 10^4\ N\ [up]$