Announcements

1. "Extra" practice problems available on the web:
   http://www.wfu.edu/~natalie/f02phy113/extrapractice
2. Physics seminar and SPS on Thursday.

The basic laws of motion

Sir Isaac Newton (1642-1727)

$$\mathbf{F} = m\,\mathbf{a}$$

mass

acceleration

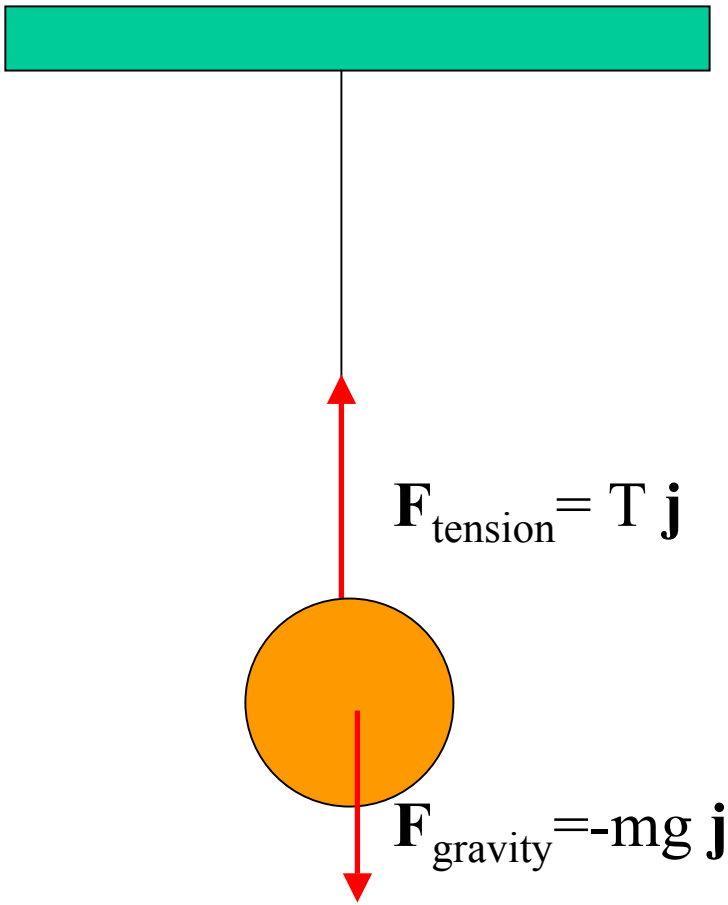
net "force"

1. In absence of a net force, an object remains at constant velocity or at rest.
2. In the presents of a net force, the motion of an object of mass m is described by $\mathbf{F = m\,a}$.
3. $\mathbf{F}_{12}=-\mathbf{F}_{21}$

Units of force: 1 N = 1kg m/s^2 = 0.2248 lb

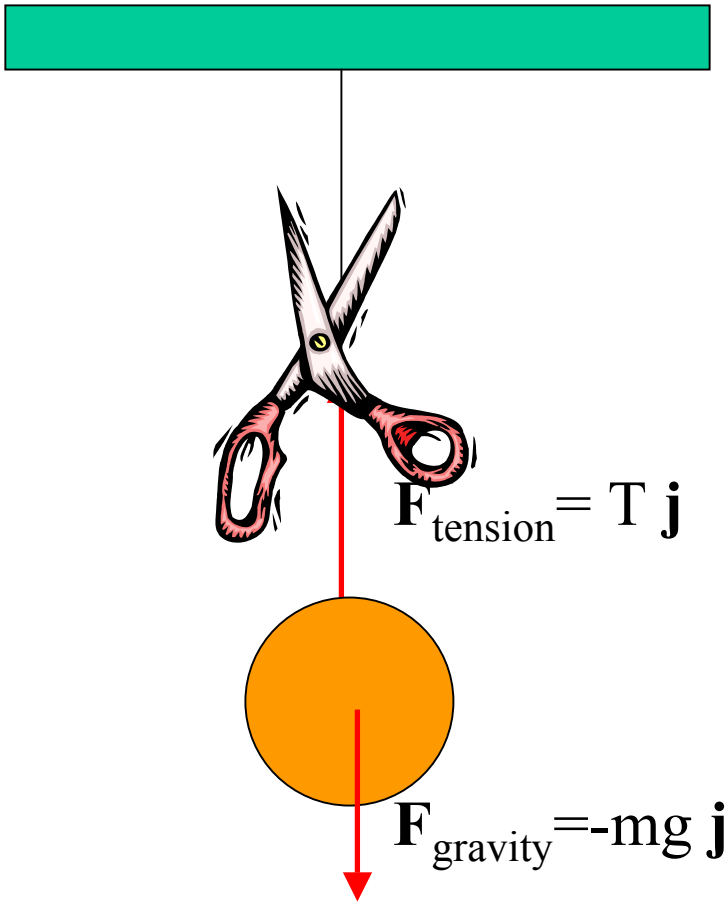
(quarter pound hamburger ~ 1 Newton burger)

Examples



$$\mathbf{F} = \mathbf{F}_{net} = \mathbf{F}_{tension} + \mathbf{F}_{gravity} = (T - mg)\,\mathbf{j} = \mathbf{0}$$

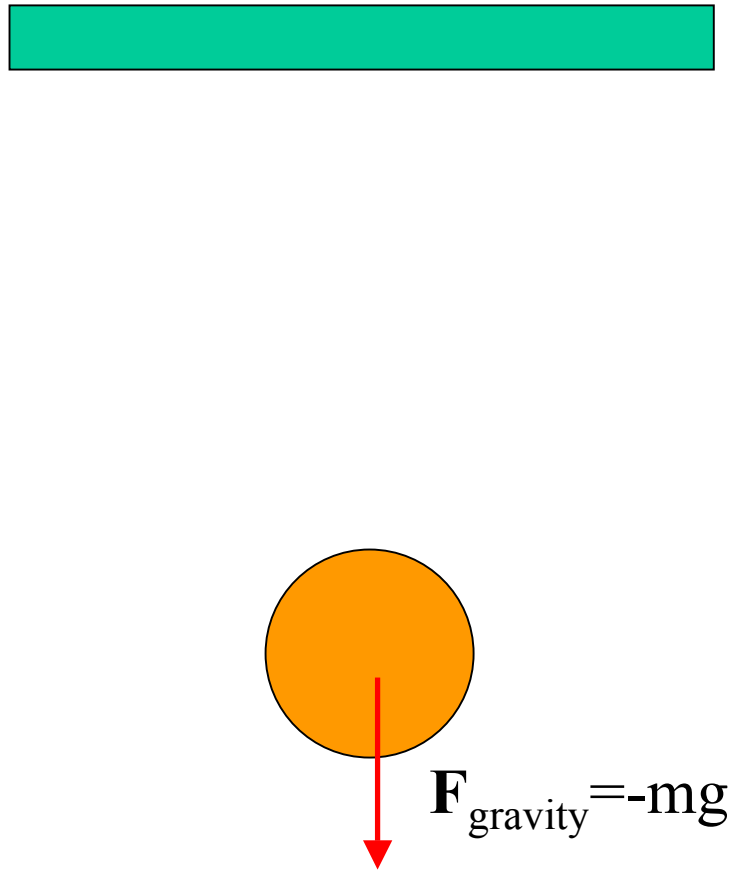
Examples



$\mathbf{F}_{tension} = T\,\mathbf{j}$

$\mathbf{F}_{gravity} = -mg\,\mathbf{j}$

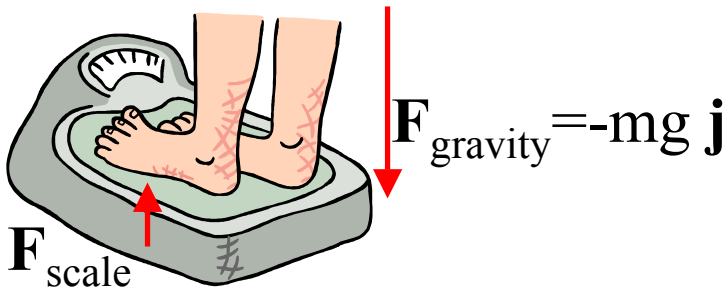
$\mathbf{F} = \mathbf{F}_{net} = \mathbf{F}_{tension} + \mathbf{F}_{gravity} = (T - mg)\,\mathbf{j} = \mathbf{0}$



$\mathbf{F}_{gravity} = -mg\,\mathbf{j}$

$\mathbf{F} = \mathbf{F}_{net} = \mathbf{F}_{gravity} = (-mg)\,\mathbf{j} = m\mathbf{a}$

→ $\mathbf{a} = -g\mathbf{j}$



$$\mathbf{F}_{scale} + \mathbf{F}_{gravity} = \mathbf{0};\ F_{scale} = mg$$

Question: What if you step on the scale in the elevator?

$$\mathbf{F}_{scale} + \mathbf{F}_{gravity} = m\,\mathbf{a};\quad F_{scale} = mg + m\,a$$

On line quiz

An object having a mass of 2 kg is moving at constant velocity of 3 m/s in the upward direction near the surface of the Earth. What is the net force acting on the object?

a. 0 N.

b. 6 N in the upward direction.

c. 25.6 N in the upward direction.

d. 19.6 N in the downward direction.

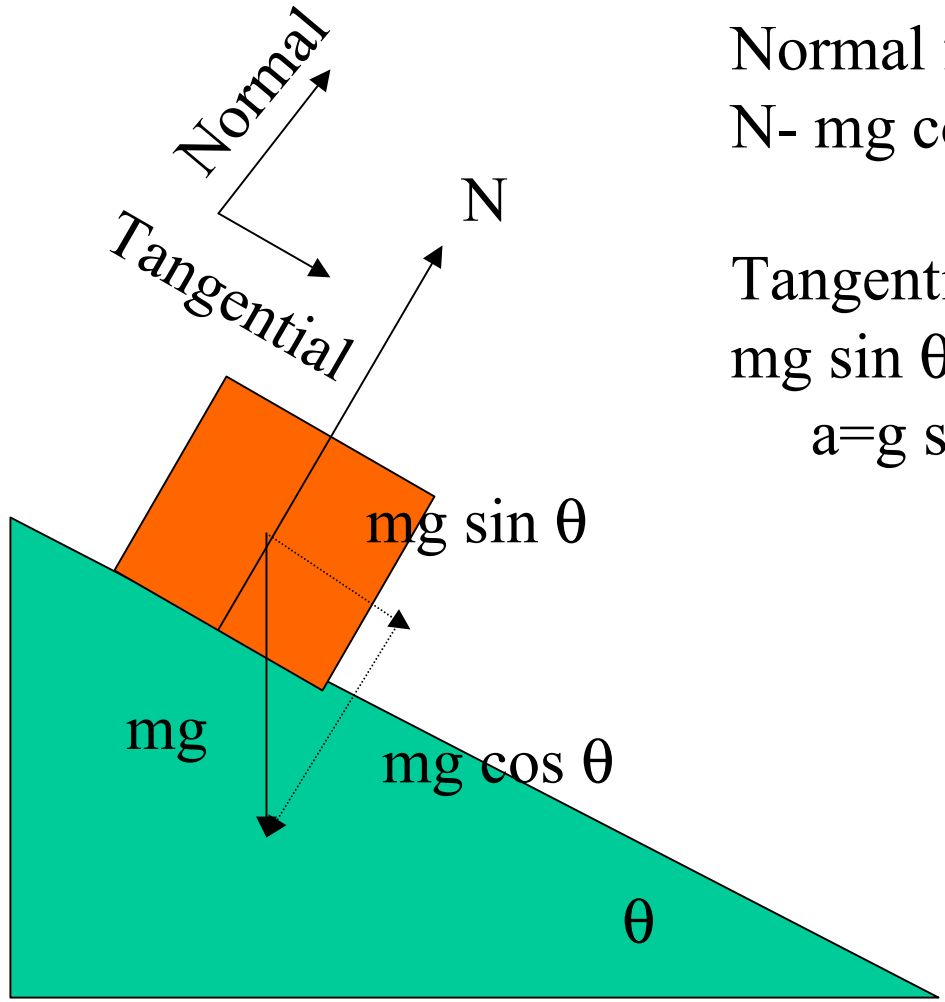
Peer instruction question

Realizing that the Earth rotates about its axis once every 24 hrs. and that in Winston-Salem, this means that you are moving in a circular at a speed of v~400 m/s at a radius of r~5000 km from the axis of rotation. What can you say about your centripetal acceleration?

(a) It is too small to measure.

(b) It has no effect, since you are moving together with everything else.

(c) It has a measureable effect.



Normal forces:

$N - mg\cos\theta = 0$

Tangential forces:

$mg\sin\theta = ma$

$a = g\sin\theta$