Elevator Questions

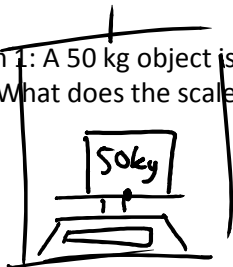**Solving Force Questions**
Step 1: Draw a picture and a force diagram
Step 2: Write F_{net} equations for horizontal and vertical
Step3: Solve

The Scale Reads the Normal Force

Problem 1: A 50 kg object is in an elevator on a Newtonian scale that is not moving.
   a) What does the scale read?

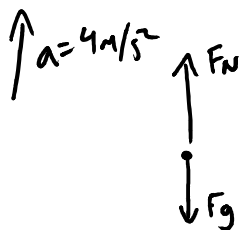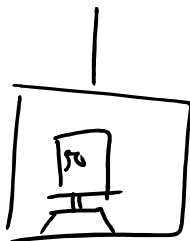Vertical ($a=0$)

$$F_{net} = m\cancel{a}$$
$$F_N - F_g = 0$$
$$F_N = F_g$$
$$= mg$$
$$= (50)(9.8)$$
$$\underline{\underline{F_N = 490\,N}}$$

   b) What does the scale read if the elevator is accelerating upwards at 4 m/s/s.

Vertical

$$F_{net} = ma$$
$$F_N - F_g = ma$$
$$F_N = ma + mg$$
$$= (50)(4) + (50)(9.8)$$
$$\underline{\underline{F_N = 690\,N}}$$

   c) What does the scale read if the elevator is accelerating downward at 7m/s/s?

Vertical $a = -7\,m/s^2$

$$F_N - F_g = ma$$
$$F_N = ma + F_g$$
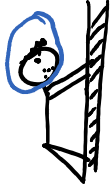$$F_N = (50)(-7) + (50)(9.8)$$
$$\underline{\underline{F_N = 140\,N}}$$

Tension Questions
Tension is the force within a rope. The rope transfers the force at one end and redirects it to the other end.

Example: Victor is climbing $\overset{up}{\vee}$ a rope on the moon, at 3 m/s². How much tension is in the rope?

at 3m/s^2. How much tension is in the rope?

Vertical

$T - F_g = ma$

$T = ma + mg$

$T = (77)(3) + (77)(1.6)$

$= (77)(4.6)$

$T = 354.2N$

$m = 77kg$

$g_{moon} = 1.6 \text{m/s}^2$

Tension is a **Force**

Problem 2: A 5̶0̶k̶g̶ 77 astronaut on the moon (g=1.6m/s/s down) climbs a rope that has a maximum breaking force of 750N. What is the maximum acceleration up the rope? ~~and~~

Vertical

$F_{net} = ma$

$T - F_g = ma$

$\dfrac{T - mg}{m} = \dfrac{ma}{m}$

$\dfrac{T}{m} - g = a$

$\dfrac{750}{77} - 1.6 = a$

$\boxed{8.14 \text{m/s}^2 = a}$