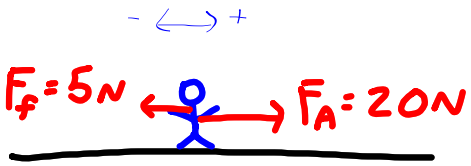
3) An 80. kg student is pulled on roller blades by a friend who exerts a force of 20.0 N. Friction between the wheels and the ground exert a force of 5.0 N. What is the student's acceleration?



$\Sigma \vec{F} = m\vec{a}$

$F_A + F_f = m\vec{a}$

$a = \frac{F_A + F}{m} = \frac{20N + (-5N)}{80kg} = 0.19 m/s^2$

4) A 1000. kg car accelerates from rest to 20. m/s in 5.0 seconds. What net force acts on the car?

$V_o = 0$

$V_f = 20 m/s$

$t = 5 s$

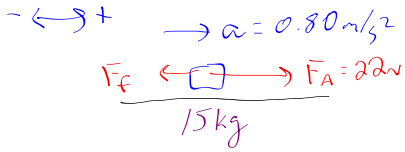
$V_f = V_o + at$

$a = \frac{V_f}{t} = \frac{20. m/s}{5 s} = 4 m/s^2$

$\Sigma \vec{F} = m\vec{a} = 1000kg \cdot 4 m/s^2$

$= 4000 N$

5) A 15.0 kg crate is dragged across the floor with an acceleration of 0.80 m/s^2 by an applied force of 22 N. How much friction is acting on the crate?



$\Sigma \vec{F} = m\vec{a}$

$F_f + F_A = m\vec{a}$

$F_f = m\vec{a} - F_A$

$(15kg \cdot .8 m/s^2) - 22N = -10N$

Mass and Weight

Mass: a measure of amount of matter or inertia

Property: constant

Weight: a measure of amount of gravitational force on an object

Property: varies by location

Relationship between mass and weight:

$$\vec{F}_g = m\vec{g}$$

Variable:	$\mathbf{F_g}$	$\mathbf{g}$
Quantity:	Force of Gravity Weight	acceleration due to gravity Gravitational Field Strength
Units:	[N]	$[m/s^2] = [N/kg]$
Type:	vector	vector

Estimation Skills - some common masses and weights:

Penny = 3 grams (0.003 kg) | 1 kilogram mass = 2.2 pounds | 1 apple = 1 newton

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Estimation Skills - some common masses and weights:

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1. What is the weight of a 1.0 kilogram mass: a) here on Earth? b) In deep space?

$F_g = mg = 1kg \cdot 9.8 m/s^2$
$= 9.8N$

0

2. What is the mass of a 1.0 N apple: a) here on Earth? b) In deep space?

$m \sim .1kg$

$g \sim 10$

$\sim .1kg$

3. What is your mass in the (MKS) metric system of measurement?

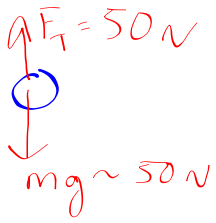
$170\ lbs \div 2.2 \approx 77\ kg$

4. Complete the chart below for your mass and weight in various places using the metric system.

	Earth $g \sim 9.8\ m/s^2$	Moon ($g = 1.6\ m/s^2$)	Deep Space
Mass	77 kg	77 kg	77 kg
Weight	$\sim 760\ N$	$\sim 120\ N$	

5. A 5.0 kg bowling ball is hanging from a rope.

a) Calculate the tension in the rope when the bowling ball is at rest.



$g \sim 10\ m/s^2$

b) What is the tension in the rope when the bowling ball is moving upwards at a constant speed? $(a = 0)$

$50\ N$

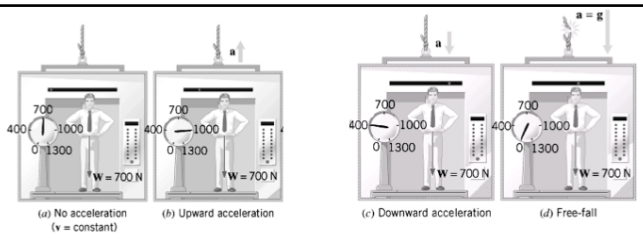
c) Calculate the tension in the rope when the bowling ball is accelerating upwards at 0.50 m/s^2.

$\Sigma F = ma$

$F_g + F_T = ma$

$F_T = ma - F_g$

$= 5\ kg \cdot 5\ m/s^2 - (-50\ N) =$



(a) No acceleration (v = constant) (b) Upward acceleration (c) Downward acceleration (d) Free-fall

$F_g = 700\,N$

$m = 70\,kg$

6. When does the scale read the normal weight of the person?

$a = 0$

7. When does the scale read higher than the normal weight of the person?

$a = upward$

8. When does the scale read less than the normal weight of the person?

$a = downward$

+ ↓ −

9. What does a scale reading actually measure?

normal force

(b)

10. Determine the acceleration of the elevator in cases (b) and (c).

$\Sigma F = ma$

$F_N + F_g = ma$

$a = \frac{F_N + F_g}{m}$

$F_N = 400\,N$: $a = \frac{400\,N + -700\,N}{70\,kg} = -4.3\,\frac{m}{s^2}$

$F_N = 1000\,N$: $\frac{1000\,N + -700\,N}{70\,kg} = +4.3\,m/s^2$

11. The elevator descends, accelerating at -2.7 m/s2. What does the scale read?

12. Suppose the cable snapped and the elevator fell freely. What would the scale read?

Friction

Cause of friction:

Electromagnetic force of attraction