Static Equilibrium - $\vec{v} = \emptyset$; $\vec{a} = \emptyset$
Object at Rest

Dynamic Equilibrium - $\vec{v} \neq \emptyset$; $\vec{a} = \emptyset$
object @ constant velocity

} = Equilibrium

Both Cases: $\Sigma F_{net} = \emptyset$

$$(F_{net})_x = F_{1x} + F_{2x} + \dots = \emptyset$$

$$(F_{net})_y = F_{1y} + F_{2y} + \dots = \emptyset$$

$$\Sigma F_x = ma_x = \emptyset \quad \& \quad \Sigma F_y = ma_y = \emptyset$$

Steps: Strategy 5.1

1) Check if $\vec{a} = \emptyset$ then Newton $\vec{a} \neq 0$; apply Kinematics
If so, use Newtons Second law

2) Draw a free body diagram to show all forces

3) Determine which forces need to be solved for you need one equation for each unknown

4) Solve

5) Check for correct units, reasonability

6) Write a one sentence answer to ensure your answer addresses the question

Newtons Law: Objects @ rest stay @ rest, objects in motion stay in motion, unless

Newtons Law 2: $\vec{F} = m\vec{a}$

Newtons Law 3: for every action there is an equal & opposite rxn

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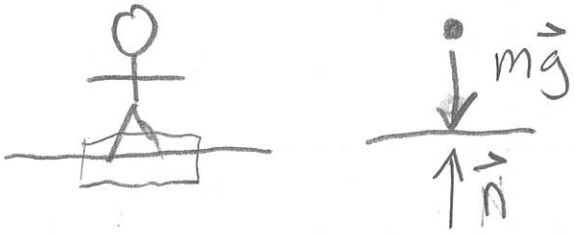
Equilibrium: not undergoing acceleration

$$\sum F_{net} = \phi$$

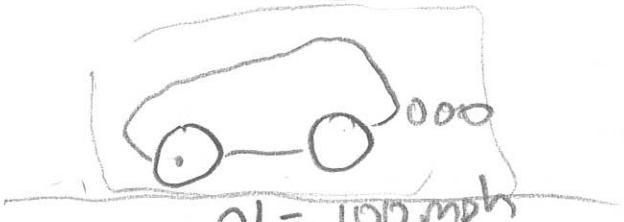
$m\vec{g}$ = Weight

Static Equilibrium



$$\sum \vec{F} = -mg + n = \phi$$

dynamic equilibrium



$v_i = 100$ mph

$v_f = 100$ mph

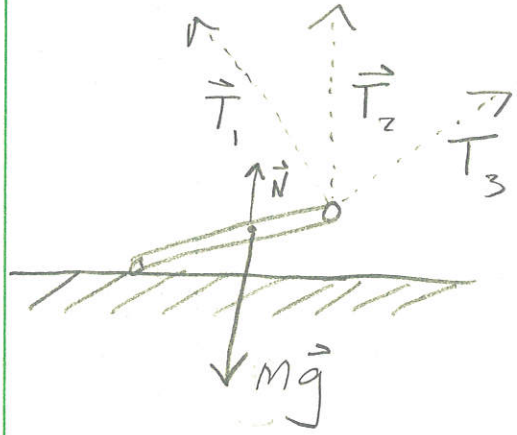
$\vec{a} = \phi$.

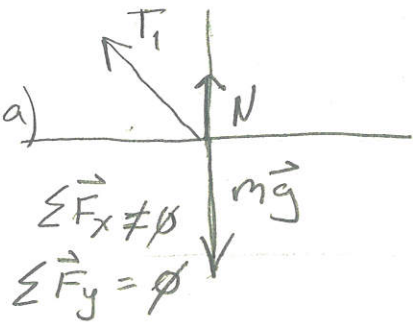
Example 5.3

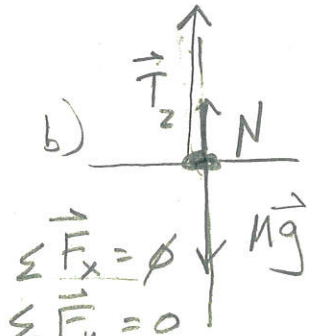
Imagine a rod on a frictionless sheet of ice lifted by a string. If the rod is at rest, then what is the general angle of the string from the horizontal surface of the ice?

Step 1: $\vec{a} = \emptyset$? yes

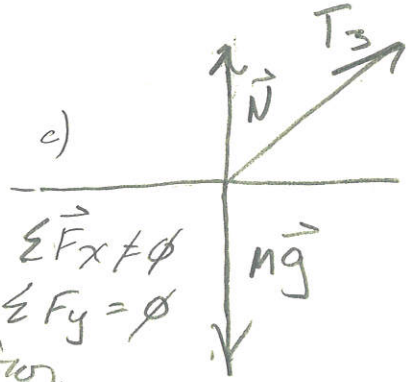
Step 2: Free body diagram(s)







Step 3: Solve
See Equations



Step 4 & 5 combined

Since there is no friction, a & c can not be correct, so, The string needs to be $\perp$ to the ice

Example 5.4: Tension towing a car

Given: $m = 1500\,kg$

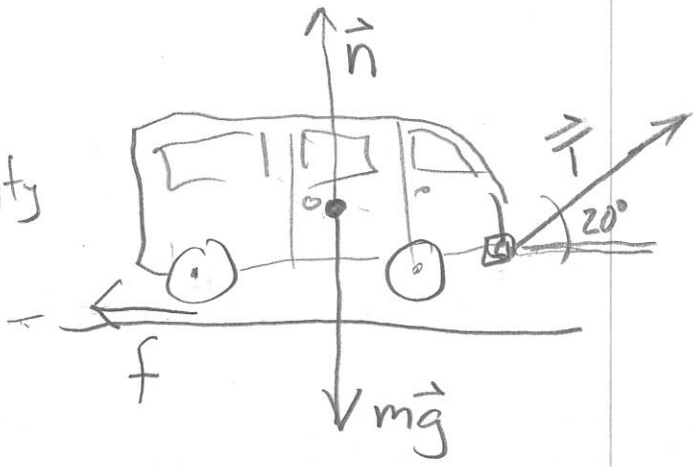
$\vec{v} > \emptyset$

$\vec{a} = \emptyset$; steady velocity

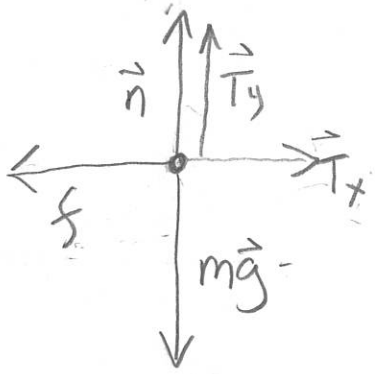
$\measuredangle = 20°$

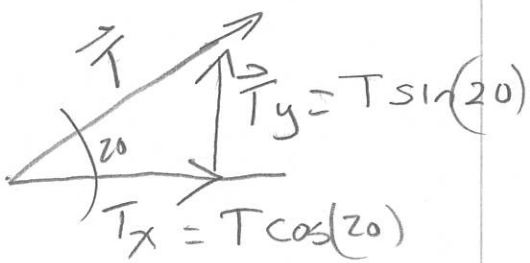
$F_{fr} = 320\,N$

$T = ?$



Draw Free body Diagram





$\Sigma \vec{F}_x = \emptyset = -f + T_x$

$\Sigma \vec{F}_x$: $320\,N = T\cos(20)$

$\Sigma \vec{F}_y = \emptyset = -m\vec{g} + \vec{n} + T_y$

$\frac{320\,N}{\cos(20)} = T$

$340.5\,N = T$

$\Sigma \vec{F}_y$: $mg = n\,T_y$

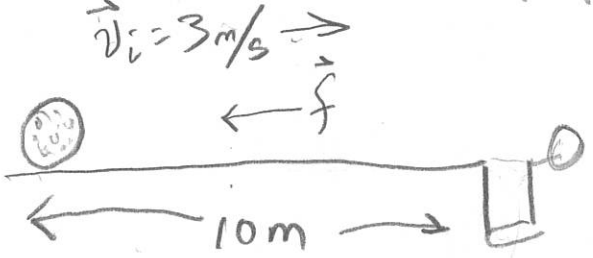
$1500\,kg \cdot 9.81\,m/sec^2 = n + 340.5\sin 20\,N$

$14{,}715\,N = n + 116.5$

$14{,}598\,N = n$

The tension on the rope is 341 N to overcome the force of friction of 320 N.

Making This Country Great With golf

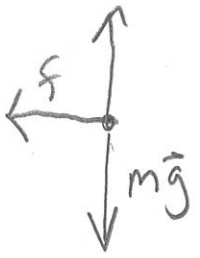


$g = 46 grams$

$F_f = 0.0020 N$

$v = 3 m/s$

Will the golfer make the country great by making the tremendous shot.



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

$$\frac{\vec{F}}{m} = \vec{a} = \frac{0.0020 N}{0.046 kg}$$

$$\vec{a} = 0.435 m/sec^2$$

Vars

$x_i = 0 m$

$x_f = ?$

$v_i = 3 m/s$

$v_f = \emptyset m/s$

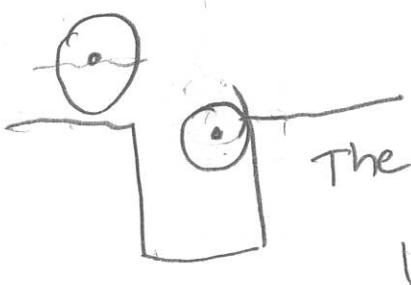
$\vec{a} = 4.35 m/s^2$

$$v_f^2 = v_i^2 + 2a(x_f - x_i)$$

$$\emptyset = 3^2 m/s + 2(0.435 \frac{m}{sec^2})(x_f - \emptyset)$$

$$3^2 = 0.87 x_f$$

$$\frac{9 \cancel{m^2/sec^2}}{0.87 \cancel{m/sec^2}} = x_f = 10.3 m$$

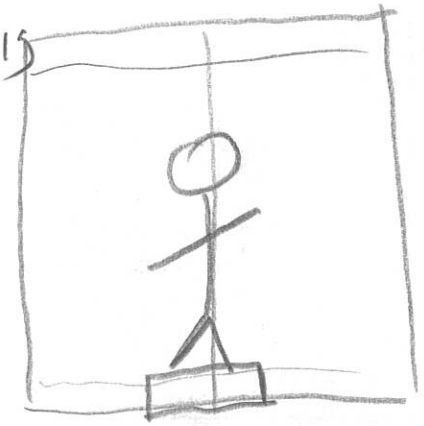


The look of success!

Yes the country is great again

Ph Fun w/ Phys - Elevator Style

Was the elevator traveling up or down?

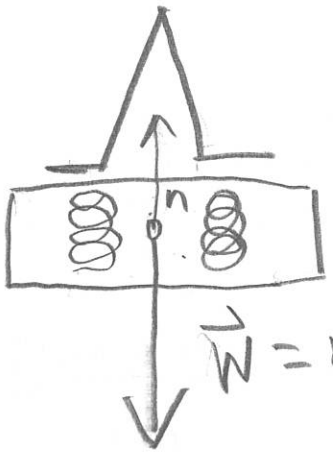


$m = 70\,kg$

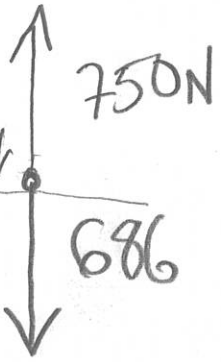
$v = 5\,m/s$

$\vec{g} = 9.81\,m/s^2$

Scale = 750 N @ stop of Elevator



$\vec{W} = m\vec{g} = 686\,N$



$\Sigma \vec{F}_y: m\vec{g} + \vec{n} + m\vec{a}_y$

$m\vec{g} = \vec{n} + m\vec{a}_y$

$686N = 750N + 70(-\vec{a}_y)$

$\frac{-750 + 686}{70} = \vec{a}_y$

$0.91\,m/sec^2 = a\vec{y}$

$v_i = 5\,m/s$

$v_f = 0\,m/s$

$\vec{a} = -0.91\,m/s$

Moving downward

So, which way makes the velocity > 0

And elevator was made abroad very bad.

Dylan: Good Refresher

William: Good to have a good classmate

Laeli: Good refresher

Tom: Good review;

Brandon: Good, no worries

Trey: Still needing book...