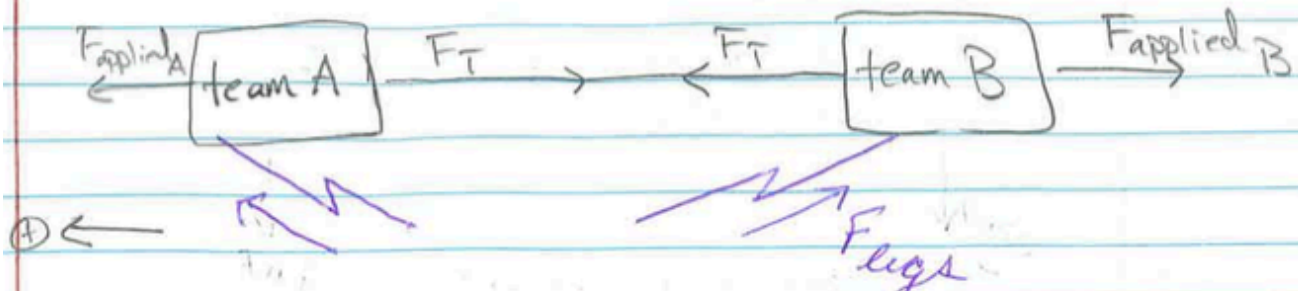
#1 dynamics problem

$\sum F = ma$



In this system, the forces we will focus on are F_T and $F_{applied}$ by both team A and team B. No matter how hard a team pulls, tension will act equally of each team, so F_T is basically irrelevant. The only forces left are force applied. The team that applies the most force on the system will cause the system to accelerate in that direction, causing a team to win. If Team A applies more force, the system will accelerate to the left and Team A will win.

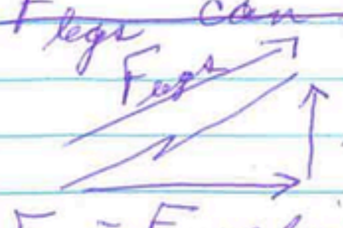
$$\sum F = ma$$

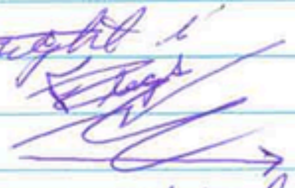
$$F_{applied\,A} - F_{applied\,B} + F_T - F_T = ma$$

$$\boxed{F_{applied\,A} - F_{applied\,B} = ma}$$

The the force applied of the feet of one team is greater than the force applied by the other team's feet, then that team will win.

~~F_{legs} can be thought~~



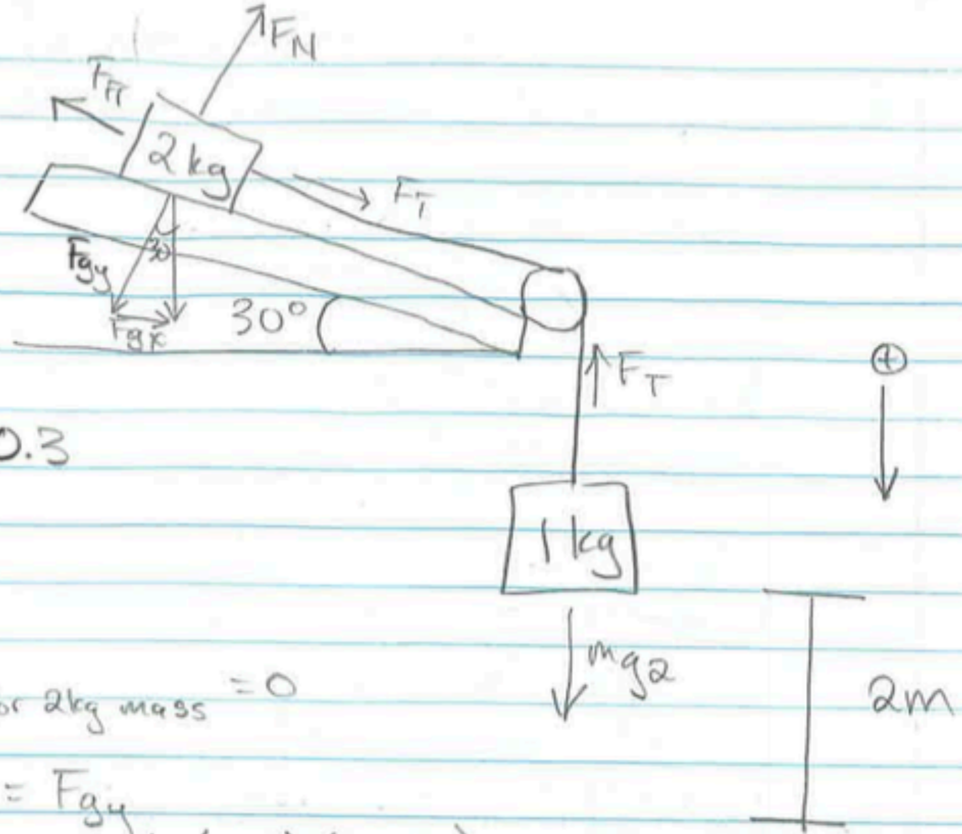


$\sum F_y = ma_y = 0$

vertical component of ~~normal~~ $F_{legs} = mg$

$F_H \cong F_{applied\,B}$

#2



$\mu = 0.3$

a) $\sum F_{y\text{ for 2kg mass}} = 0$

$F_N = F_{gy}$

$F_N = \cos(30)(2\text{ kg})(10\ \frac{m}{s^2})$

$F_N = 17.32\ N$

$F_{Fr} = \mu F_N$

$F_{Fr} = (0.3)(17.32\ N)$

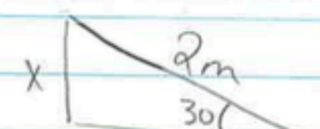
$F_{Fr} = 5.196\ N$

$W_{Fr} = F_{Fr} \cdot d$

$W_{Fr} = (5.196\ N)(2\ m)$

$\boxed{W_{Fr} = \text{heat}_E \text{ liberated} = 10.4\ J}$

b)



$\sin(30) = \frac{x}{2m}$

$x = 1\ m$

$\Delta PE = -PE_0 + PE_f$

PE final

$\Delta PE = [-(2\text{kg})(10\ \frac{m}{s^2})(1\ m) + -(1\text{ kg})(10\ \frac{m}{s^2})(2m)] + 0\ J$

$\boxed{\Delta PE = -40\ J}$

c) conservation of energy will be used

$\Delta PE_0 = \Delta KE_f + \Delta TE$

$40\ J = \frac{1}{2}(2\text{ kg} + 1\text{ kg})(v)^2 + 10.4$

$\boxed{v_{f\text{ system}} = 4.44\ \frac{m}{s}}$

d) $v_{avg} = \frac{v_0 + v_f}{2}$ $\quad v_{avg} = \frac{0 + 4.44\,\frac{m}{s}}{2}$

$$\boxed{v_{avg} = 2.22\ \frac{m}{s}}$$

$\Delta x = (v_{avg})(t)$ $\qquad v_f^2 = v_0^2 + 2ax$

$2m = (2.22\ \frac{m}{s})(t)$

$$\boxed{t = .90\ s}$$

$\vec{v_f} = v_0 + at$

$4.44\ \frac{m}{s} = 0 + (a)(.90\ s)$

$$\boxed{a = 4.93\ \frac{m}{s^2}}$$

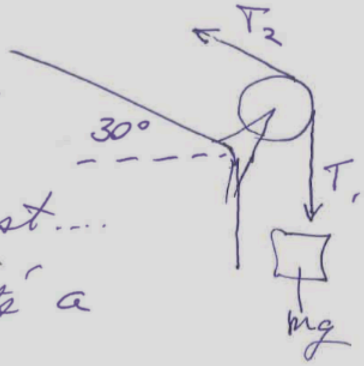
e) $\sum F_{1kg\ mass} = m a_{1kg\ mass}$

$mg - F_T = ma$

$(1\ kg)(10\ \frac{m}{s^2}) - F_T = (1\ kg)(4.93\ \frac{m}{s^2})$

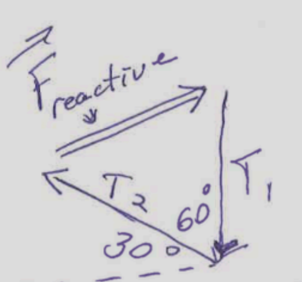
$$\boxed{F_T = 5.07\ N}$$

f) This is a dynamics problem because we have forces acting on an object at rest.... in equilibrium it's a statics Problem



$\sum \vec{F}_{wheel} = m\vec{a}_{wheel} = 0$

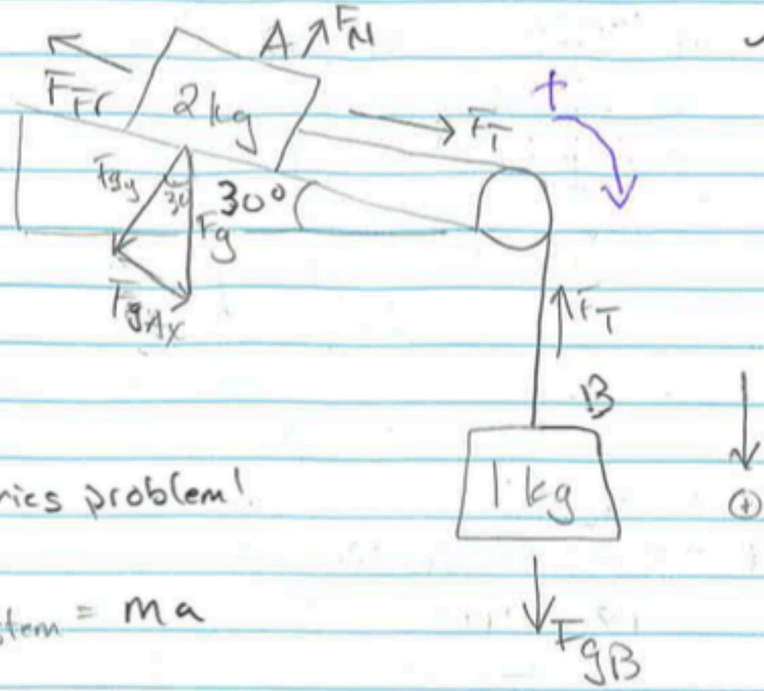
because the wheel is massless + frictionless, $T_1 = T_2 = T$, so the Reactive Force of the bracket must Provide the force to keep $\sum \vec{F} = 0$



This is an equlateral Δ, so $F_{reactive} = T$ 30°

#3

$\mu = 0.3$



*dynamics problem!

$\sum F_{system} = ma$

$F_{gB} + F_{gAx} - F_{Fr} = ma$

$(1\ kg)(10\ \frac{m}{s^2}) + (\sin 30)(2\ kg)(10\ \frac{m}{s^2}) - (0.3)F_N = (1+2\ kg)(a)$

$\sum F_{yA} = 0$

$F_{gy} = F_N$

$\cos(30)(2\ kg)(10\ \frac{m}{s^2}) = F_N$

*$F_N = 17.32$

$\Sigma F = ma$

$10\ N + 10\ N - (0.3)(17.32\ N) = (3\ kg)(a)$

$\boxed{a = 4.93\ \frac{m}{s^2}}$

$\sum F_B = F_{gB} - F_T = ma$

$(1\ kg)(10\ \frac{m}{s^2}) - F_T = (1\ kg)(4.93\ \frac{m}{s^2})$

$\boxed{F_T = 5.07\ N}$

$y_f = y_0 + v_0 t + \frac{1}{2}at^2$

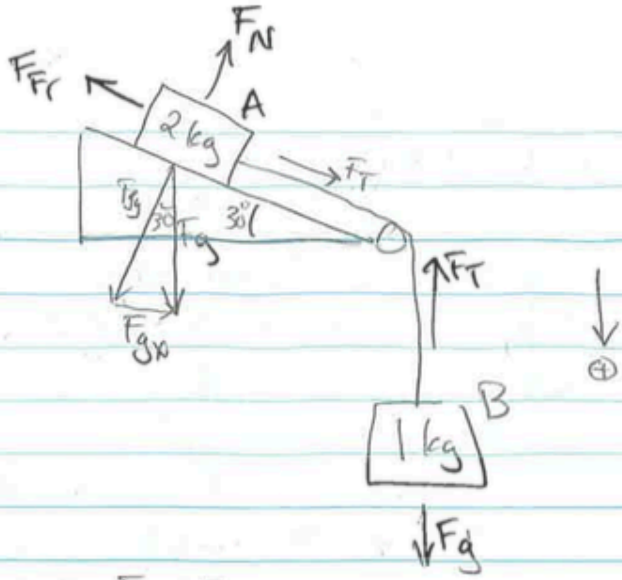
$0m = 2m + \frac{1}{2}(-4.93\ \frac{m}{s^2})(t^2)$

$t = .9\ s$

$v = a(t)$

$v_f = (4.93\ \frac{m}{s^2})(.9\ s)$ $\boxed{v_f = 4.4\ \frac{m}{s}}$

#4



$\mu = 0.3$

$\sum F_{y_A} = 0 = F_{gy} - F_N$

$F_N = \cos(30)(2\,kg)(10\,\frac{m}{s^2})$

☆ $F_N = 17.3\ N$

$\sum F_{x_A} = F_T + F_{gx} - F_{Fr} = ma$

$F_T + (\sin 30)(2\,kg)(10\,\frac{m}{s^2}) - (0.3)(17.3N) = (a)(2kg)$

$F_T + 4.81 = (2\,kg)(a)$

$a = \frac{F_T + 4.81}{2\,kg}$

$\sum F_B = F_g - F_T = ma$

$(1\,kg)(10\,\frac{m}{s^2}) - F_T = (1\,kg)(a)$

$10\,\frac{kg\,m}{s^2} - F_T = \frac{F_T + 4.81}{2\,kg}$

$20 - 2F_T = F_T + 4.81$

$20 = 3F_T + 4.81$

$3F_T = 15.19\ N$

$\boxed{F_T = 5.06\ N}$

$a = \frac{(5.06\ N) + 4.81}{2\,kg}$

$\boxed{a = 4.94\ \frac{m}{s^2}}$

$2m = 0m + \frac{1}{2}(4.94\,\frac{m}{s^2})t^2$

$t = .9\ s$

$v_f = a(t)$

$v_f = (4.94\,\frac{m}{s^2})(.9\,s)$ $\quad v_f = 4.44\ \frac{m}{s}$

like ... best

They liked #3 best