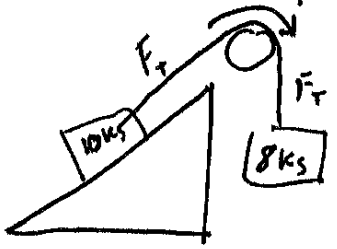
Ramps + Pulleys Practice

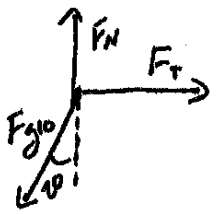
1



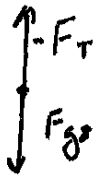
$a = ?$, $F_T = ?$

FBD's

10 kg:



8 kg:



$$a = \frac{\Sigma F_{10x}}{10\text{kg}} = \frac{F_T - (10\text{kg})(10\%)\sin(10)}{10} \qquad a = \frac{\Sigma F_8}{8\text{kg}} = \frac{8g(10) - F_T}{8}$$

$$8\left(\frac{F_T - 34.2}{10}\right) = \left(\frac{80 - F_T}{8}\right).10$$

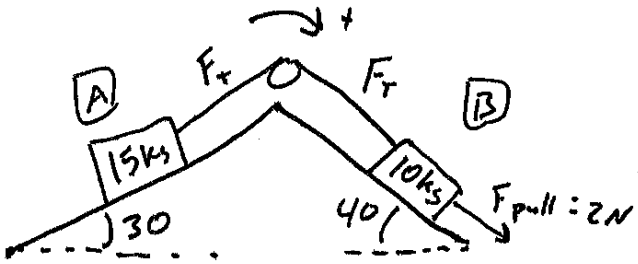
$$8F_T - 273.6 = 800 - 10F_T \quad +10F_T$$

$$18F_T = 526.38$$

$$F_T = 29.2\text{ N}$$

$$a = \frac{80 - 29.2}{8} = 50.76\text{ m/s}^2 \rightarrow \text{moving down the ramp!}$$

[2]

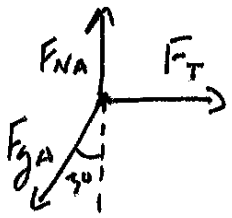


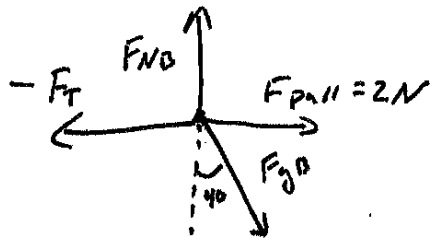
$a = ?$

$F_T = ?$

FBD's

(A) vs (B)





$$a_x = \frac{\Sigma F_{xA}}{m_A}$$

$$a = \frac{F_T - F_{gAx}}{m_A}$$

$$a_x = \frac{\Sigma F_{xB}}{m_b}$$

$$a = \frac{F_{pull} + F_{gBx} - F_T}{m_b}$$

$$\frac{F_T - (15kg)(10)\sin(30)}{15kg} = \frac{2N + (10kg)(10\%)\sin(40) - F_T}{10kg}$$

$$10(F_T - 75) = 15(66.28 - F_T)$$

$$10F_T - 750 = 994.2 - 15F_T$$

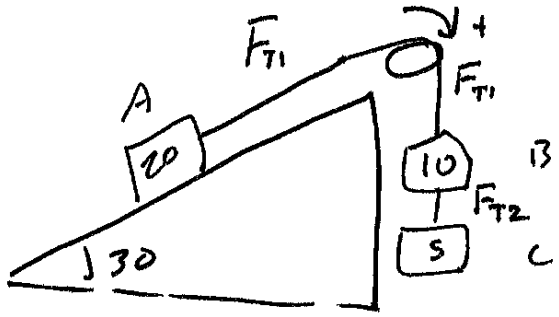
$$25F_T = 1744.2$$

$$\boxed{F_T = 69.77N}$$

$$a = \frac{F_T - F_{gAx}}{m_A} = \frac{69.77 - 66.28.75}{15} = \boxed{-0.3249\ m/s^2}$$

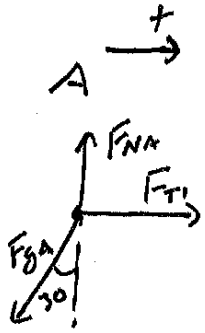
↳ moving acceleration to the left!

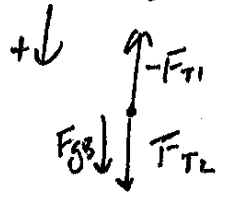
3

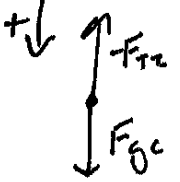


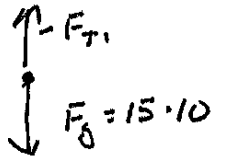
$F_{T1} = ?$ $F_{T2} = ?$ $a = ?$

FBD's









$$a_x = \frac{\Sigma F_{xA}}{m_A}$$

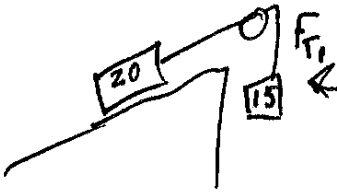
$$\overset{?}{a_x} = \frac{\overset{?}{F_{T1}} - F_{gA}\sin 30}{m_A}$$

$$\overset{?}{a_x} = \frac{F_{gB} + \overset{?}{F_{T2}} - \overset{?}{F_{T1}}}{m_B}$$

$$\overset{?}{a_x} = \frac{F_{gC} - \overset{?}{F_{T2}}}{m_A}$$

3 eqs, 3 unknowns

→ Combine objects to reduce algebra.



$$a_x = \frac{F_{gB+C} - F_{T1}}{m_B + m_C}$$

$$a_x = \frac{150N - F_{T1}}{15\,kg}$$

Use A and (B+C)

$$\frac{F_{T1} - 200 \cdot \sin 30}{20kg} = \frac{150N - F_{T1}}{15\,kg}$$

$$15F_{T1} - 1500 = 3000 - 20F_{T1}$$

$$\therefore F_{T1} = 128.57\,N$$

Use to find a_x. For object A:

$$a_x = \frac{128.57N - 100N}{20kg} = 1.429\,m/s^2$$

plug in to find F_{T2}

$$1.429 = \frac{50N - F_{T2}}{5}$$

$$\therefore F_{T2} = 42.86\,N$$