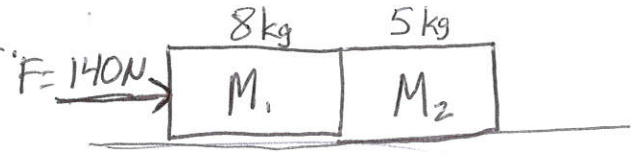
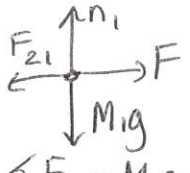
ADDITIONAL PROBLEMS

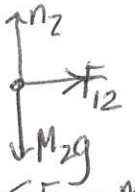
NO FRICTION MENTIONED } HOW NICE!

1. 



$\Sigma F_y = 0$
$n_1 = M_1 g$

$\Sigma F_x = M_1 a$
$F - F_{21} = M_1 a$



$\Sigma F_y = 0$
$n_2 = M_2 g$

$\Sigma F_x = M_2 a$
$F_{12} = m_2 a$

$\Rightarrow$ COMBINE $\Rightarrow F = M_1 a + M_2 a$

$F = (m_1 + m_2) a$

$a = \frac{F}{m_1 + m_2} = \frac{140}{8+5} = 10.77 \frac{m}{s^2}$

$F_{12} = 5(10.77)$

$\boxed{F_{12} = 53.85 N}$

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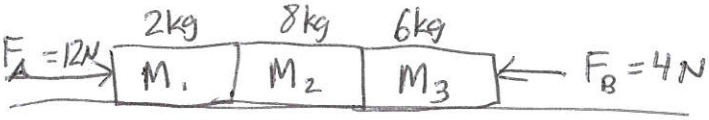
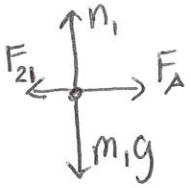
2. 

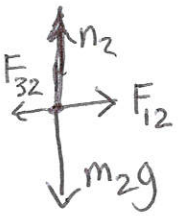
SO FRICTIONLESS
NET FORCE IS TO RIGHT SO ACCELERATION TO RIGHT ALSO

FBD FOR EACH MASS

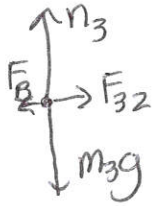


not pertinent

$\Sigma F_y = 0 \quad n_1 = m_1 g$



$n_2 = m_2 g$



$n_3 = m_3 g$

$\Sigma F_x = ma \quad F_A - F_{21} = m_1 a \quad F_{12} - F_{32} = m_2 a \quad F_{32} - F_B = m_3 a$

COMBINE

$F_{32} - 4 = 6(0.5)$

$\boxed{F_{32} = 7 N}$

F_{21} has same magnitude as F_{12}

F_{23} has same magnitude as F_{32}

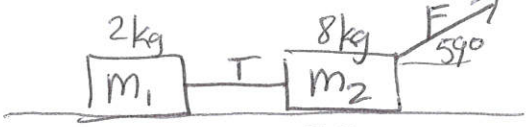
$F_A - F_{21} = m_1 a$
$F_{12} - F_{32} = m_2 a$
$F_{32} - F_B = m_3 a$

$F_A - F_B = m_1 a + m_2 a + m_3 a$

$a = \frac{F_A - F_B}{m_1 + m_2 + m_3} = \frac{12-4}{2+8+6} = 0.5 \frac{m}{s^2}$

ONCE YOU FIND ACCEL THEN GO TO THE EQUATION

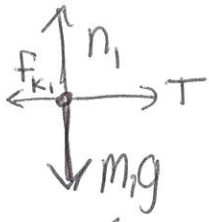
3.



$\mu = 0.32$

$a = 3.9\ m/s^2$

$F = ?$



$\Sigma F_y = 0 \quad \Sigma F_x = m_1a$

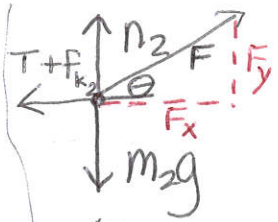
$n_1 = m_1g \quad T - f_{k_1} = m_1a$

$T - \mu_k n_1 = m_1a$

$T - \mu m_1 g = m_1a$

$T = \underbrace{m_1a + \mu m_1 g}_{\text{all knowns}}$

$T = 14.07N$



$\Sigma F_y = 0 \quad \Sigma F_x = m_2a$

$n_2 + F_y = m_2g \quad F_x - T - f_{k_2} = m_2a$

$n_2 + F\sin\theta = m_2g \quad F\cos\theta - T - \mu n_2 = m_2a$

$n_2 = m_2g - F\sin\theta$

substitute

$F\cos\theta - T - \mu(m_2g - F\sin\theta) = m_2a$

$F\cos\theta - T - \mu m_2 g + \mu F\sin\theta = m_2a$

$F\cos\theta + \mu F\sin\theta = m_2a + T + \mu m_2 g$

$F(\cos\theta + \mu\sin\theta) = m_2a + T + \mu m_2 g$

$F = \dfrac{m_2a + T + \mu m_2 g}{\cos\theta + \mu\sin\theta}$

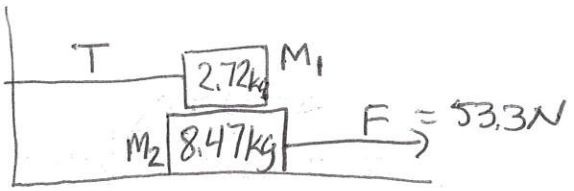
$F = \dfrac{8(3.9) + 14.07 + 0.32(8)(9.8)}{\cos 59 + 0.32\sin 59}$

$= \dfrac{70.358}{0.7893}$

$= 89.14N$

YOU CAN PLUG NUMBERS FOR KNOWNS IN EARLIER IF THAT HELPS YOU SEE THAT ~~ALL~~ YOU ARE SOLVING FOR F ~~

4.

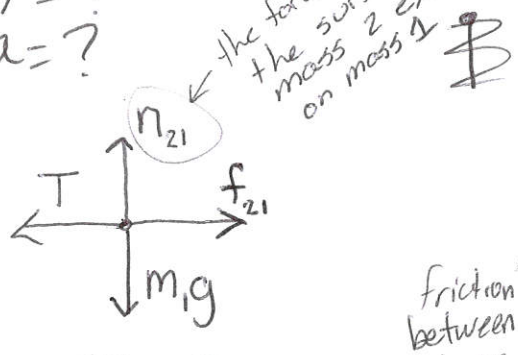


$\mu = 0.152$

$T = ?$

$a = ?$

WELL, THIS IS MOST LIKELY A QUESTION THAT WOULD BE CONSIDERED "BONUS" TERRITORY. YEAH... WOULDN'T WORRY TOO MUCH ABOUT THIS ONE!!!



$\Sigma F_y = 0$

$n_{21} = m_1 g$

$\Sigma F_x = 0$

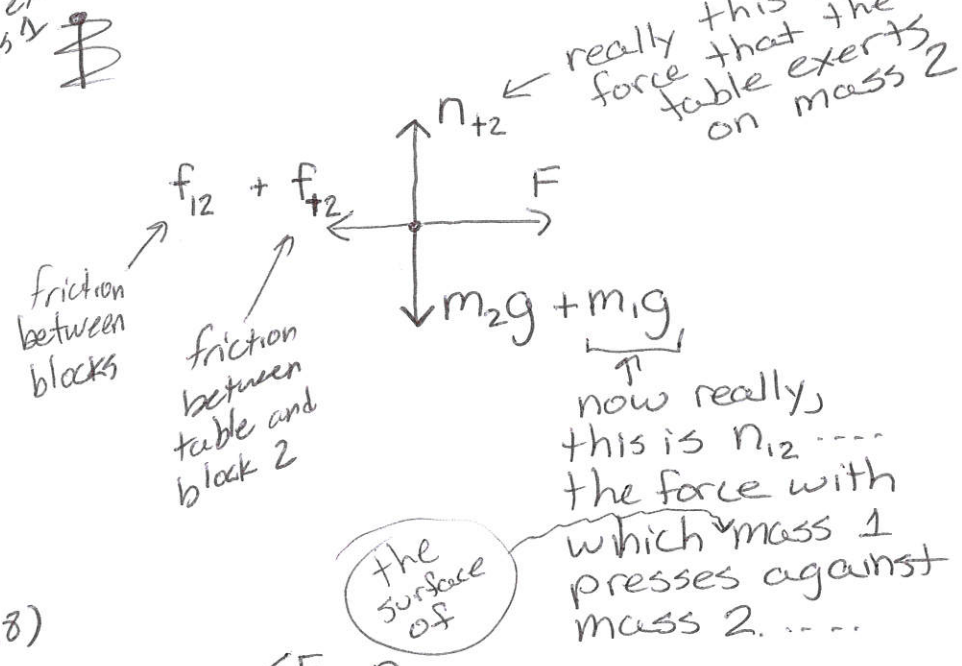
$T = f_{21}$

$T = \mu n_{21}$

$T = \mu m_1 g$

$T = 0.152(2.72)(9.8)$

$\boxed{T = 4.05\,N}$



$\Sigma F_y = 0$

$n_{t2} = m_2 g + m_1 g$

$= 8.47(9.8) + 2.72(9.8) = 109.662$

$\Sigma F_x = m_2 a$

$F - f_{12} + f_{t2} = m_2 a$

F: known; f_{12}: you found this; f_{t2}: subst; $m_2 a$: unknown

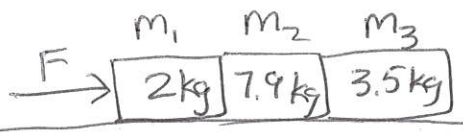
$F - f_{12} - \mu n_{t_2} = m_2 a$

$F - f_{12} - \mu(m_2 g + m_1 g) = m_2 a$

$53.3 - 4.05 - 0.152\left(2.72(9.8) + 8.47(9.8)\right) = 8.47a$

$\boxed{a = 3.85\,m/s^2}$

5.

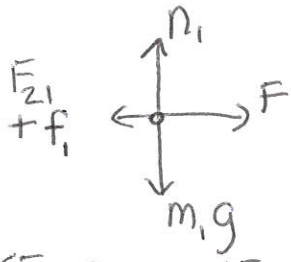


MUST FIND ACCEL. FIRST

$\mu = 0.17$

$F = 110N$

$|F_{23}| = |F_{32}| = ?$

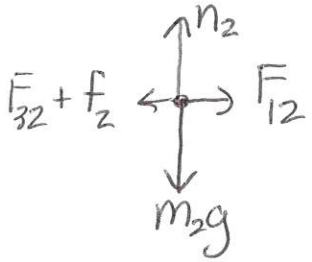


$\Sigma F_y = 0$ $\quad \Sigma F_x = m_1a$

$n_1 = m_1g$ $\quad F - F_{21} - f_1 = m_1a$

$\downarrow$ μn_1

$F - F_{21} - \mu m_1 g = m_1 a$

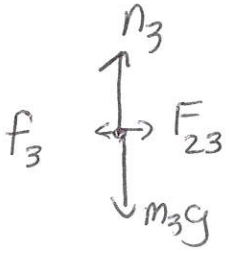


$\Sigma F_y = 0$ $\quad \Sigma F_x = m_2a$

$n_2 = m_2g$ $\quad F_{12} - F_{32} - f_2 = m_2a$

$\downarrow$ μn_2

$F_{12} - F_{32} - \mu m_2 g = m_2 a$



$\Sigma F_y = 0$ $\quad \Sigma F_x = m_3a$

$n_3 = m_3g$ $\quad F_{23} - f_3 = m_3a$

$\downarrow$ μn_3

$F_{23} - \mu m_3 g = m_3 a$

add these three equations together

$|F_{21}| = |F_{12}|$ ← so these cancel

$|F_{32}| = |F_{23}|$ ← so these knock out

$$F - \mu m_1 g - \mu m_2 g - \mu m_3 g = m_1 a + m_2 a + m_3 a$$

$$F - \mu g (m_1 + m_2 + m_3) = (m_1 + m_2 + m_3) a$$

$$\frac{F - \mu g (m_1 + m_2 + m_3)}{m_1 + m_2 + m_3} = a$$

$$a = 6.54 \text{ m/s}^2$$

Then use the equation you already found

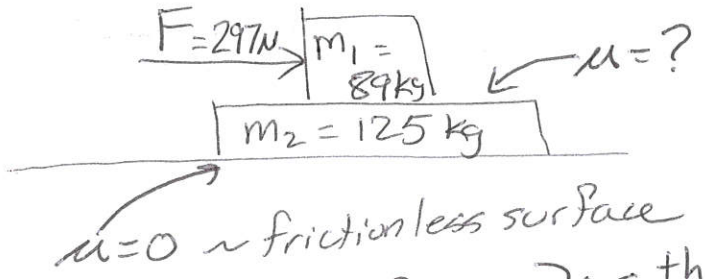
$$F_{23} - \mu m_3 g = m_3 a$$

$$F_{23} = m_3 a + \mu m_3 g$$

$$= 3.5(6.54) + 0.17(3.5)(9.8)$$

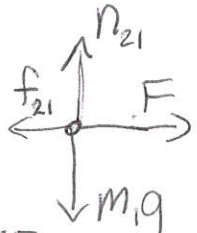
$$= 28.7 \text{ N}$$

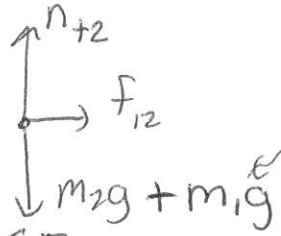
6.



$\mu = 0$ ~ frictionless surface

$a_1 = 3 m/s^2$ ← this is the accel of the top block, block 1





← really ~ it's n_{12} ~ but $n_{12} = m_1 g$ so there

$\Sigma F_y = 0$ $\quad \Sigma F_x = m_1 a$

$n_{21} = m_1 g$ $\quad F - f_{21} = m_1 a_1$

$F - \mu n_{21} = m_1 a_1$

$F - \mu m_1 g = m_1 a_1$

$\Sigma F_x = m_2 a_2$ $\quad \Sigma F_y = 0$

$f_{12} = m_2 a_2$ $\quad n_{12} = m_2 g + m_1 g$

~~$\mu n_{12} = m_2 a_2$~~

$f_{12} = m_2 a_2$] If you know the friction between the two blocks you could find the acceleration of the second block

$297 - \mu(89)(9.8) = 89(3)$

$0.034 = \mu$

once you know mu you, well, lost that train of thought . . . and you kind of do know ~ or could find f_{12}.