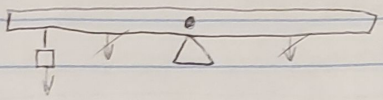
PHYS 407

1.



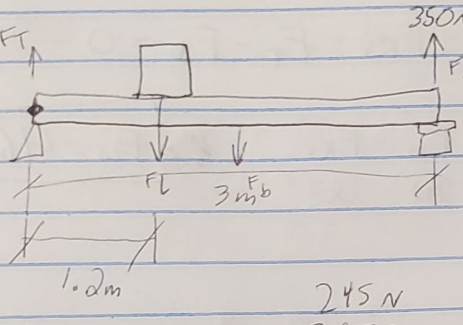
$m_1 = 0.1\,kg \rightarrow 0.98\,N$

$m_2 = 0.25\,kg \rightarrow 2.45$

$0.98 \cdot 0.4 = 2.45\,d \qquad d = 0.16\,m$

It should be placed at the 66cm mark

2.



$m_b = 25\,kg \rightarrow 367.5\,Nm$

245N

$350 \cdot 3 = 1{,}050\,Nm$

245N

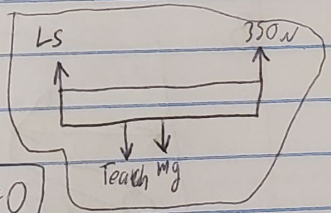
$F_T + 350_N = 367.5\,Nm + F_L \qquad F_T + 350 = F_L + 245$

$0 = T_L + T_b - T_s \qquad T_L = T_s - T_b$

$T_b = 367.5\,Nm \qquad T_s = 1{,}050\,Nm \qquad T_L = 682.5\,Nm$

$F_T = T_T / d \qquad F_T = 568.75\,N \rightarrow 142.19\,lbs$

Teacher weighs 142.19lbs



3. $\sum F_y = F_{LS} + F_{RS} - m_T g - m_b g = 0$

3. Since we have 2 unknowns, using Newtons 2nd law in angular form allows us to solve for one of the unknowns which we can now solve for the other unknown.

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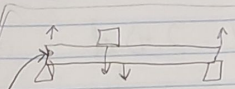
4. 0 Nm

5. 

$\Sigma \tau = \tau_{RS} - \tau_T - \tau_b = 0$

$F_T = 568.75\ N$

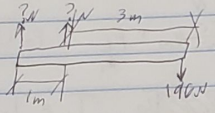
6.

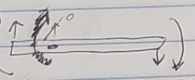
$\Sigma F_y = F_{LS} + F_{RS} - F_T - F_b = 0$

$F_{LS} = F_T + F_b - F_{RS}$

$568.75 + 245 - 350$

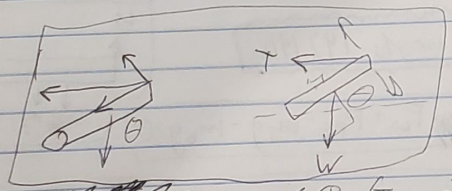
$F_{LS} = 463.75\ N$

7. 



$\Sigma \tau = \tau_{LS} + \tau_K = 0$

$\tau_{LS} = -\tau_K$

8. 

$\Sigma \tau = (T \sin\theta) d - (mg \cancel{\sin\theta}\ \cos\theta)\, d/2 = 0$

$d T \sin\theta = d/2\,(mg\cos\theta)$

9. $T = mg \cot\theta$

$\theta = 0° \rightarrow T =$ undefined

$\theta = 90° \rightarrow T = 0$

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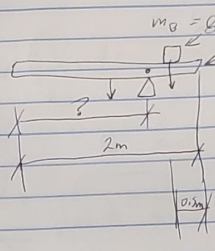
10. 

$\Sigma \tau = \tau_P - \tau_B = 0$

$\tau_P = \tau_B$

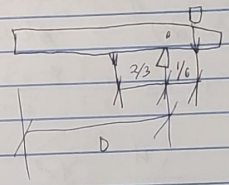
$\tau_P = 19.6(1-d)$ $\quad \tau_B = 78.4(0.5-d)$

$19.6(1-d) = 78.4(0.5-d)$

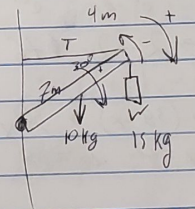
$19.6 - 19.6d = 39.2 - 78.4d$

$-19.6 \quad +78.4d \quad -19.6 \quad +78.4d$

$\frac{58.8d}{58.8} = \frac{19.6}{58.8}$ $\quad d = 0.333\ m$



$D = 1.67\ m$

11. 

$\Sigma \tau = \tau_1 + \tau_2 - \tau_T = 0$

$\tau_T = \tau_1 + \tau_2$

$\tau_1 = 15 \cdot 9.8 \cdot 7 = 1029\ Nm$

$\tau_2 = 10 \cdot 9.8 \cdot 3.5 = 343\ Nm$

$\tau_T = T \sin 30 \cdot 4.62 = 1372\ Nm$

$T = 593.94\ N$

$L \cos 30 = 4$ $\quad L = 4/\cos 30 = 4.62\ m$

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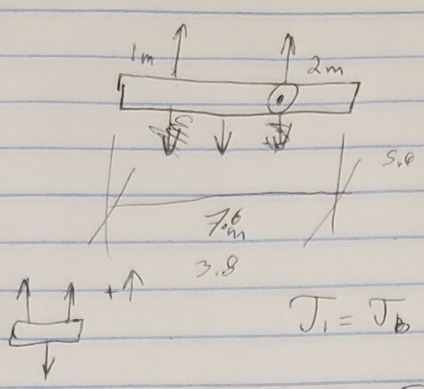
12.



$m_b = 50\,kg$

$\Sigma \tau = \tau_1 - \tau_b = 0$

$\tau_b = 50 \cdot 9.8 \cdot 1.8 = 882\ Nm$

$\tau_1 = F_1 4.6 = 882\ Nm$

$F_1 = 191.74\ N$

$\tau_1 = \tau_b$

$\Sigma F_y = F_1 + F_2 - F_b = 0$

$F_1 + F_2 = F_b \qquad F_2 = F_b - F_1$

$F_2 = 298.26\ N$

Sam = 191.74 N

Joe = 298.26 N

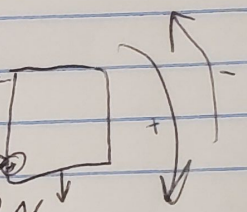
13.

$\Sigma \tau = \tau_d - \tau_2 = 0$

$\tau_d = 10 \cdot 9.8 \cdot 0.5 = 49\ Nm$

$\tau_2 = F_n(1.7) = 49\ Nm$

$F_2 = 28.82\ N$



28.82 N