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Homework 8

Homework-8 chapter 12 [3,5,8,9,11,20,22,26,71]
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classical Physics - I (210)
0101 professor Van, Hoett

Q3] mass m is the stationary, tension on the rope is mg. force of the slig must be mg, upward.

$$\Sigma \tau = mgx_2 - mgx_1 = 0 \rightarrow m = m\frac{x_1}{x_2} = (15.0\,kg)\frac{(35.0\,cm)}{(78.0\,cm)}$$

$$= \boxed{6.73\,kg}$$

Q5] a] Let $m = 0$.

$$\Sigma \tau = F_B(1.0\,m) - Mg(4.0\,m) = 0 \rightarrow$$

$$F_B = 4Mg = 4(52\,kg)(9.80\,m/s^2)$$

$$= \boxed{2038\,N \approx 2.0\times10^3\,N,\ up}$$

By using Newtons second law

$$\Sigma F_y = F_B - mg - F_A = 0 \rightarrow$$

$$F_A = F_B - mg = 4Mg - Mg = 3Mg = 3(52\,kg)(9.80\,m/s^2)$$

$$= \boxed{1529\,N \approx 1500\,N,\ down}$$

b] Now $m = 28\,kg$

$$\Sigma \tau = F_B(1.0\,m) - mg(2.0\,m) - Mg(4.0\,m) = 0 \rightarrow$$

$$F_B = 4Mg + 2mg = [4(52\,kg) + 2(28\,kg)](9.80\,m/s^2)$$

$$= \boxed{2587\,N \approx 2600\,N,\ up}$$

$$\Sigma F_y = F_B - mg - Mg - F_A \rightarrow$$

$$F_A = F_B - mg - Mg = 4Mg + 2mg - mg - Mg = 3Mg + mg$$

$$= [3(52\,kg) + 28\,kg](9.80\,m/s^2) = \boxed{1803\,N \quad 1800\,N,\ down}$$

8] m = beam mass.
M = mass of piano.
$\Sigma t = F_R L - mg(\frac{1}{2}L) - mg(\frac{1}{4}L) = 0$
$F_R = (\frac{1}{2}m + \frac{1}{2}m)g = [\frac{1}{2}(110\,kg) + \frac{1}{4}(320\,kg)]$
$(9.80\,m/s^2) = 1.32 \times 10^3\,N$
$\Sigma F_y = F_L + F_R - mg - mg = 0$
$F_L = (m + M)g - F_R = (430\,kg)(9.80\,m/s^2) - 1.32 \times 10^3\,N$
$= \boxed{2.89 \times 10^3\,N}$
So, there are two results
$\boxed{F_R = 1300\,N, d \quad F_L = 2900\,N \text{ down}}$

9] calculate the torques about the left end of the beam
$\Sigma t = F_B(20.0\,m) - mg(25.0\,m) = 0 \rightarrow$
$F_B = \frac{25.0}{20.0} mg = (1.25)(1200\,kg)(9.80\,m/s^2)$
$= \boxed{1.5 \times 10^4\,N}$
$\Sigma F_y = F_A + F_B - mg = 0$
$F_A = mg - F_B = mg - 1.25mg$
$= -0.25mg = -(0.25)(1200\,kg)(9.80\,m/s^2)$
$= \boxed{-2900\,N}$
So $\vec{F_A}$ points down

11) Using the newtons second law for the both horizontal and vertical direction.

$\Sigma F_x = F_{T2} - F_{T1}\cos\theta = 0 \rightarrow F_{T2} = F_{T1}\cos\theta$

$\Sigma F_y = F_{T1}\sin\theta - mg = 0 \rightarrow F_{T1} = \frac{mg}{\sin\theta}$

$F_{T2} = F_{T1}\cos\theta = \frac{mg}{\sin\theta}\cos\theta = \frac{mg}{\tan\theta} = \frac{(190kg)(9.80)}{\tan 33^\circ}$

$= \boxed{2867N \approx 2900N}$

$F_{T1} = \frac{mg}{\sin\theta} = \frac{(190kg)(9.80m/s^2)}{\sin 33^\circ} = \boxed{3418N = 3400N}$

20) $\Sigma t = (F_T\sin\theta)l_2 - m_1 g l_1/2 - m_2 g l_1 = 0 \rightarrow$

$F_1 = \frac{\frac{1}{2}m_1 g l_1 + m_2 g l_1}{l_2\sin\theta} = \frac{\frac{1}{2}(155N)(1.70m) + (215N)(1.70m)}{(1.35m)(\sin 35.0)^\circ}$

$= \boxed{642.2N \approx 642N}$

$\Sigma F_x = F_{Hx} - F_T\cos\theta = 0 \rightarrow F_{Hx} = F_T\cos\theta$

$= (642.2N)\cos 35.0^\circ = \boxed{526.1N \approx 526N}$

$\Sigma F_y = F_{Hy} + F_T\sin\theta - m_1 g - m_2 g = 0 \Rightarrow$

$F_{Hy} = m_1 g + m_2 g - F_T\sin\theta$

$= 155N + 215N - (642.2N)\sin 35.0^\circ$

$= \boxed{1.649N \approx 2N}$

22) $\Sigma t = F_B l - mg(l/2) - \frac{1}{2}mg(l/4) = 0 \rightarrow$

$F_B = \frac{5}{8}mg = \frac{5}{8}(940kg)(9.80m/s^2) = \boxed{5758N = 5800N}$

$\Sigma F_y = F_A + F_B - mg - \frac{1}{2}mg = 0 \rightarrow$

$F_A = \frac{3}{2}mg - F_B = \frac{7}{8}mg = \frac{7}{8}(940kg)(9.80m/s^2)$

$= \boxed{8061N \approx 8100N}$

26] $\Sigma F_y = F_T \sin 3.5° + F_T \sin 3.5° - mg = 0 \rightarrow$

$$F_T = \frac{mg}{2(\sin 3.5°)} = \frac{(0.75kg)(9.80m/s^2)}{2(\sin 3.5°)}$$

$= \boxed{60N}$ which's higher than ~7.5N so the tension has to be large to have a larger enough vertical components to hold up the shoot

71] The mass of the pail is m_p

The mass of the scaffold is m

The mass of the painter is M

$\Sigma \tau = mg(2.0m) + m_p g(3.0m) - Mgx = 0 \rightarrow$

$$x = \frac{m(2.0m) + m_p(3.0m)}{M} = \frac{(25kg)(2.0m) + (4.0kg)(3.0m)}{65.0kg}$$

$= \boxed{0.9538m \approx 0.95m}$

So the painter can walk to within $\boxed{5cm \text{ of right}}$

To find the distance to the left that painter can walk

$\Sigma \tau = Mgx - m_p g(1.0m) - mg(2.0m) = 0 \rightarrow$

$$x = \frac{m(2.0m) + m_p(1.0m)}{M} = \frac{(25kg)(2.0m) + (4.0kg)(1.0m)}{65.0kg}$$

$= \boxed{0.8308m \approx 0.83m}$

So the painter can walk within $\boxed{17cm \text{ of the left edge}}$