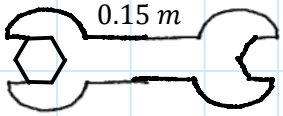
$\tau = Fdsin^*\theta$

P12 - 4.1 - Torque Notes

Torque = Force perpendicular$_{||}$ to distance from pivot $\boxed{\tau = F_{||}d}$; $Fd = Nm$

How much Torque can a 100 N force do on a 0.15 m wrench?

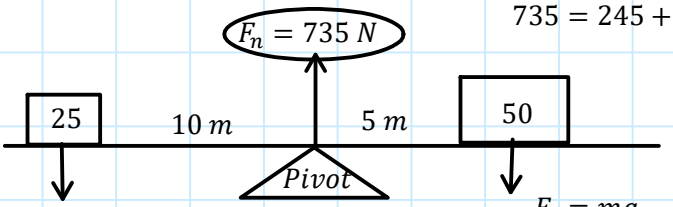


$\tau = Fd$
$\tau = 100(0.15)$
$\tau = 15\ Nm$

Teeter-totter

Balanced! $\boxed{F_{up} = F_{down}}$

$735 = 245 + 490$ ✓



$\tau = Fd$
$\tau = mgd$
$\tau = 25(9.8)(10)$
$\tau = 2450\ Nm$

$F_g = mg$
$F_g = 25(9.8)$
$F_g = 245N$

$\tau_{cc} = \tau_c$
$F_{cc}d = F_cd$

$F_g = mg$
$F_g = 50(9.8)$
$F_g = 490N$

$\tau = Fd$
$\tau = mgd$
$\tau = 50(9.8)(5)$
$\tau = 2450\ Nm$

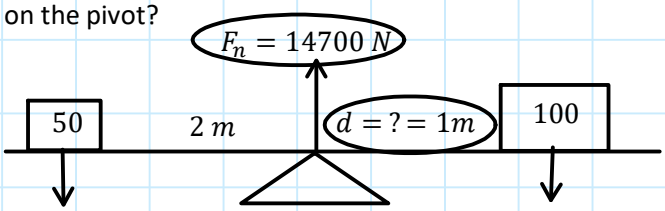
Force was for Fun!

C=CC

Counter − Clockwise Torque = *Clockwise Torque*

Up=Down

How far from the Pivot is the 100 kg block so the system is in equilibrium?What is the upward force on the pivot?



$F_g = mg$
$F_g = 50(9.8)$
$F_g = 4900\ N$

Torque at Pivot $= 0$; $d = 0$!

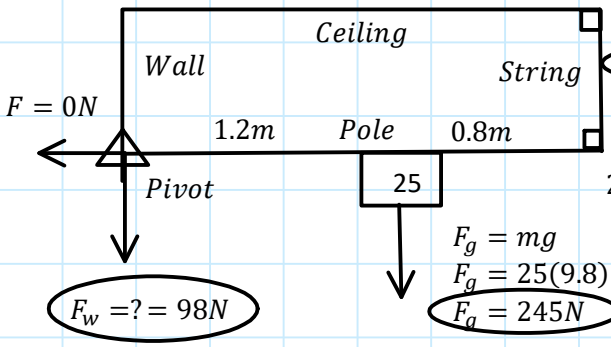
$F_g = mg$
$F_g = 100(9.8)$
$F_g = 9800\ N$

$\tau_c = \tau_{cc}$
$F_{||}d = F_{||}d$
$9800d = 4900(2)$
$d = 1m$

C=CC

Find the Tension in the string. Ignore mass of the pole.

What is the force on the wall by the pole?



$T = ? = 147N$

$\tau_c = \tau_{cc}$
$F_gd = Td$
$245(1.2) = T(2)$
$T = 147\ N$

$F_g = mg$
$F_g = 25(9.8)$
$F_g = 245N$

$F_w = ? = 98N$

C=CC

$F_{up} = F_{down}$
$F_w + T = F_g$
$F_w = F_g - T$
$F_w = 245 - 147$
$F_w = 98\ N$

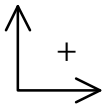
Up=Down

If Pole has mass: $\tau = F_{g||}d$ *is at centre*

You choose the location of the Pivot. Draw a Triangle!

P12 - 4.2 - Trig Torque Notes

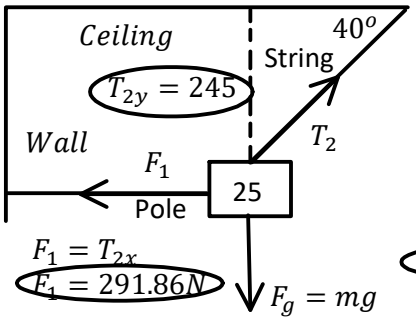
Find the Tension the string and force on the pole/wall.



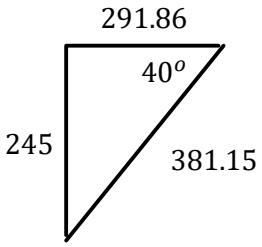
Up=Down

$$A = H\cos\theta$$
$$T_{2x} = T_2\cos\theta$$
$$T_{2x} = 381.15\cos 40$$
$$T_{2x} = 291.86N$$

$$A = \frac{O}{\tan\theta}$$
$$F_1 = \frac{mg}{\tan\theta}$$
$$F_1 = \frac{25(9.8)}{\tan 40}$$
$$F_1 = 291.86N$$



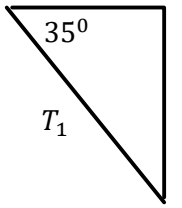
$$O = H\sin\theta$$
$$T_{2y} = T_2\sin\theta$$
$$T_2 = \frac{T_{2y}}{\sin\theta}$$
$$T_2 = \frac{245}{\sin 40}$$
$$T_2 = 381.15N$$



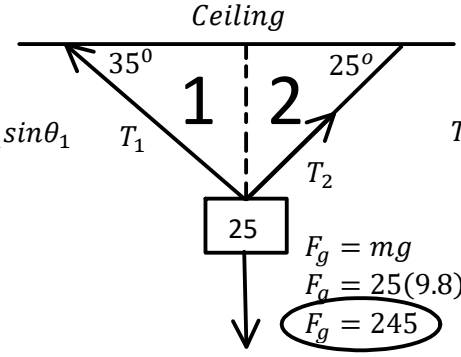
$$F_1 = T_{2x}$$
$$F_1 = 291.86N$$

$$F_g = mg$$
$$F_g = 25(9.8)$$
$$F_g = 245$$

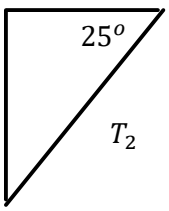
Left=Right



$$T_{1x} = T_1\cos\theta_1$$
$$T_{1y} = T_1\sin\theta_1$$



$$T_{2x} = T_2\cos\theta_2$$
$$T_{2y} = T_2\sin\theta_2$$



$$F_g = mg$$
$$F_g = 25(9.8)$$
$$F_g = 245$$

$$T_{1x} = T_{2x}$$
$$T_1\cos\theta_1 = T_2\cos\theta_2$$
$$T_1\cos 35 = T_2\cos 25$$
$$T_1 = \frac{T_2\cos 25}{\cos 35}$$

$$T_1 = \frac{(231.74)\cos 25}{\cos 35}$$
$$T_1 = 256.4N$$

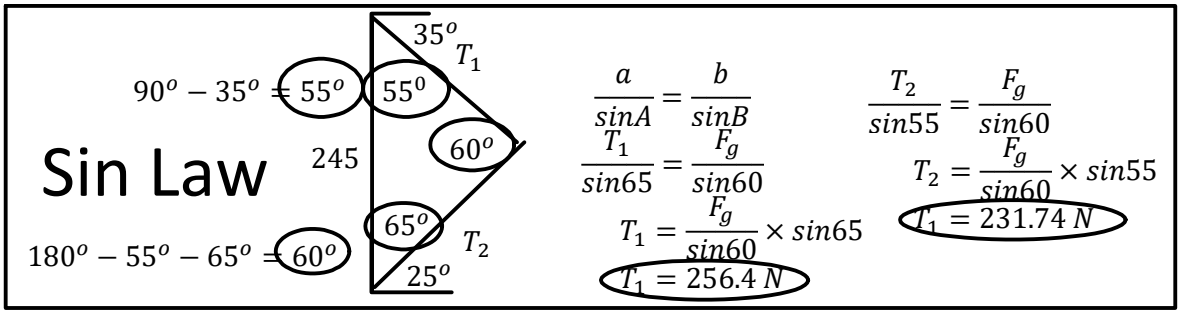
$$T_{1y} + T_{2y} = F_g$$
$$T_1\sin\theta_1 + T_2\sin\theta_2 = 245$$
$$T_1\sin 35 + T_2\sin 25 = 245$$

Left=Right

$$\left(\frac{T_2\cos 25}{\cos 35}\right)\sin 35 + T_2\sin 25 = 245$$
$$0.6346\,T_2 + 0.4226\,T_2 = 245$$
$$1.057\,T_2 = 245$$
$$T_2 = 231.74\,N$$

Up=Down

Sin Law



$$\frac{a}{\sin A} = \frac{b}{\sin B}$$
$$\frac{T_1}{\sin 65} = \frac{F_g}{\sin 60}$$
$$T_1 = \frac{F_g}{\sin 60} \times \sin 65$$
$$T_1 = 256.4\,N$$

$$\frac{T_2}{\sin 55} = \frac{F_g}{\sin 60}$$
$$T_2 = \frac{F_g}{\sin 60} \times \sin 55$$
$$T_1 = 231.74\,N$$

Use Force Perpendicular to beam

P12 - 4.3 - Torque Force Notes

A 280 *kg tower is suspended on* 880 *kg bridge. Find the Force on each Pillar.*

C=CC

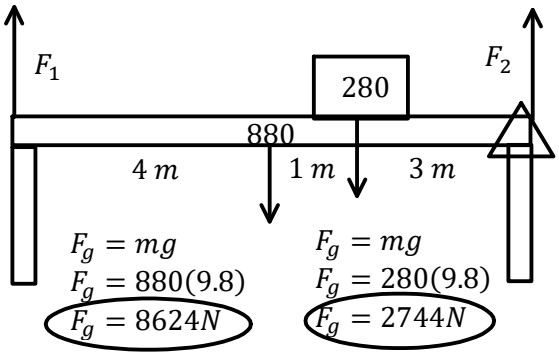
$\tau_{cc} = \tau_c + \tau_c$

$F_1 d = F_{||} d + F_{||} d$

$F_1(8) = 8624(4) + 2744(3)$

$F_1 = 5341\ N$

The pivot force is not considered in this calculation



$F_g = mg$

$F_g = 880(9.8)$

$F_g = 8624N$

$F_g = mg$

$F_g = 280(9.8)$

$F_g = 2744N$

Up=Down

$F_1 + F_2 = F_g + F_g$

$5341 + F_2 = 8624 + 2744$

$F_2 = 6027\ N$

A 2800 *kg tower is suspended on* 8800 *kg bridge. Find the Force on each Pillar.*

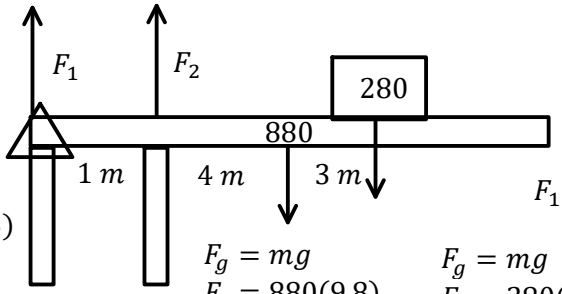
C=CC

$\tau_{cc} = \tau_c + \tau_c$

$F_2 d_1 = F_{||} g + F_{||} g$

$F_2(1) = 8624(4) + 2744(3)$

$F_2 = 53704\ N$



$F_g = mg$

$F_g = 880(9.8)$

$F_g = 8624N$

$F_g = mg$

$F_g = 280(9.8)$

$F_g = 2744N$

Up=Down

$F_1 + F_2 = F_g + F_g$

$F_1 + 53704 = 8624 + 2744$

$F_1 = 6027\ N$