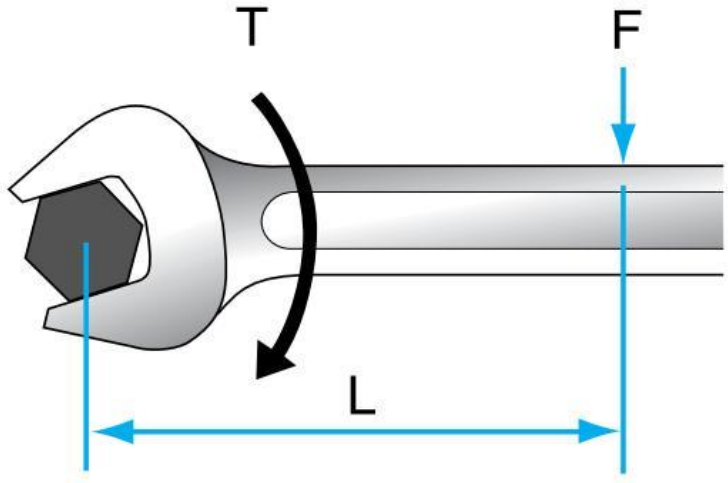
Statics

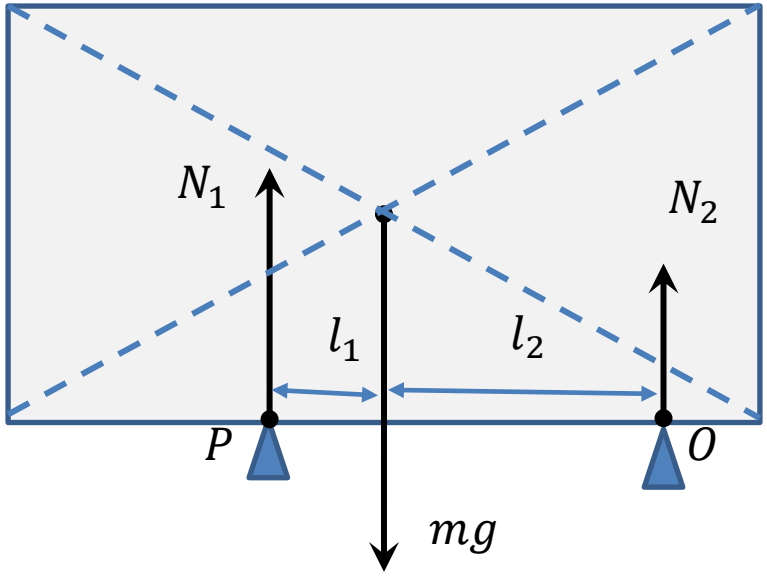


Consider a rigid object in equilibrium. Since it has zero acceleration , and no rotation, the sum of all forces and torques applied should be 0:

$$\sum \vec{F} = 0$$

$$\sum \vec{T} = 0$$

Example: whiteboard on two holders:



We can choose any "axis of rotation" and calculate the torque with respect to it.

- With respect to point P:

$T_P = mgl_1 - N_2(l_1 + l_2)$=0

Note that "clock-wise" is positive direction.

Solving Eq., we obtain: $N_2 = \frac{mgl_1}{l_1+l_2}$

- Similarly, with respect to point O:

$T_0 = -mgl_2 + N_1(l_1 + l_2)$=0

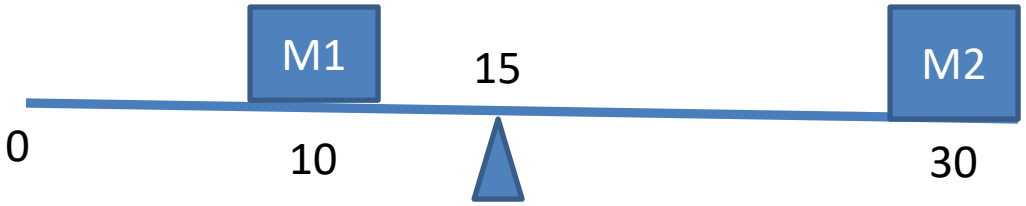
$N_1 = \frac{mgl_2}{l_1+l_2}$ note that $N_1+N_2 = mg$

Homework

Problem 1

a) A ruler is used to balance two weights as shown in figure 1. The ruler total length is 30 cm , it is supported at its center (at 15 cm mark). Mass M1=30 g, is located at 10 cm mark. The other mass, M2 is at 30 cm mark. Find M2

b) Now the mass M1 is moved to 0 cm mark.M2 is still at 30 cm. After that, you can balance the ruler with both masses by placing the support at 10 cm mark. Find the mass of the ruler. *Hint: imaging all mass of the ruler to be concentrated at its center, don't try to "break" ruler onto two parts – it's a hard way*



Problem 2 (experimental) Use a ruler and a pencil to find the ratio of masses of US quarter and US penny. You may use other two coins if you wish, Its OK to use several identical coins. Make a picture of your experiment, describe procedure and give your results.