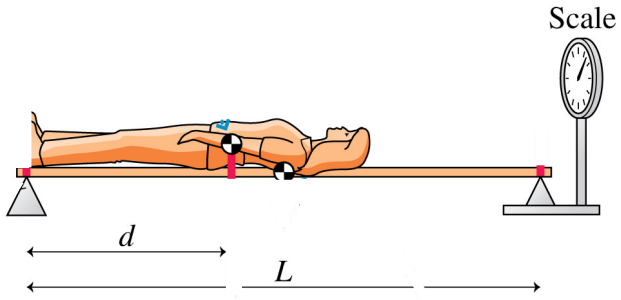
Static Equilibrium

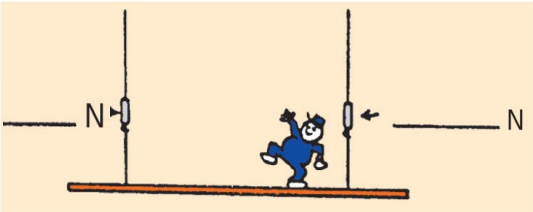
Remarks:

- Identify the system that must remain in equilibrium. It *may not* be the body for which you are trying to find information.
- Recall that there are <u>two</u> conditions for equilibrium. Many problems cannot be solved until you apply both conditions.

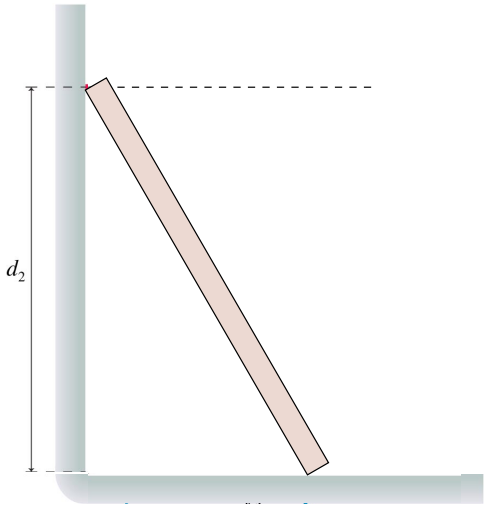
1. **Resting on a Plank:** A person of mass m = 61.2 kg lies on a rigid board that weighs 60 N. The board has a length L = 2.5 m and rests atop a scale and a support (see Figure). The reading on the scale is F_s = 250 N. If the board is in equilibrium, where is the center of mass of the person located?



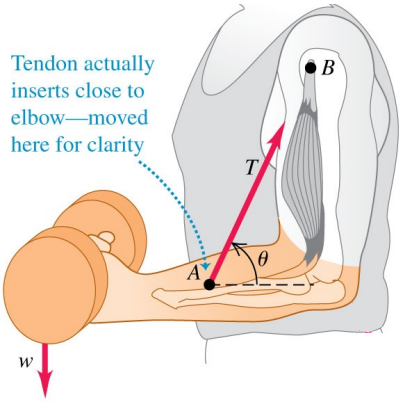
2. **Painter on Scaffold:** A painter of mass m = 80 kg stands on a scaffold of mass M = 20 kg. The scaffold is supported by two ropes, equidistant from the center, that are separated a distance d = 2 m. If the painter is standing 1.5 m from the left rope and the scaffold is in equilibrium, what are the tensions in the ropes?

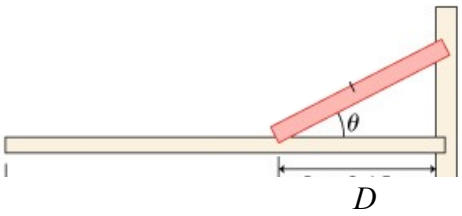


3. **Ladder Slip:** A 3.0-m-long ladder leans against a frictionless wall at an angle of 60°. What is the minimum value of μ_s, the coefficient of static friction with the ground, that prevents the ladder from slipping?



4. **Pumping iron:** The forearm of mass m and length L is in equilibrium under the action of the dumbbell weight **w**, the tension T in the tendon connected to the bicep a distance D from the elbow joint, and the force at the elbow joint (not shown). Find T, and the force exerted by elbow.





Prefer numerical problems? Let $m = 2$ kg, $L = 0.30$ m, $w = 100$ N, $D = 0.1$ m and $\theta = 60°$.