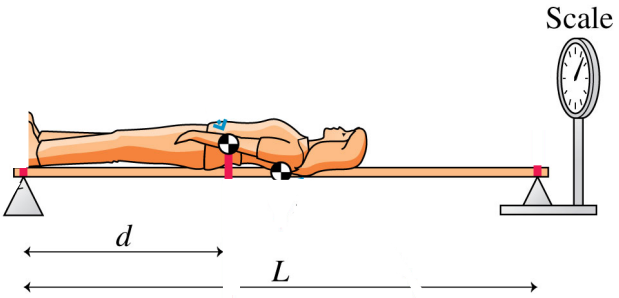
Static Equilibrium

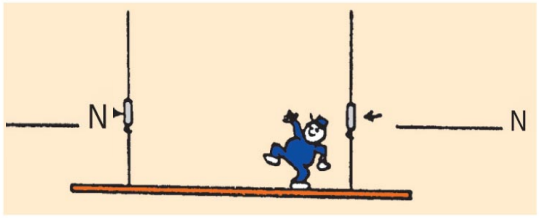
Remarks:

- 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 require that you apply both conditions to solve them (or the second condition for equilibrium twice).

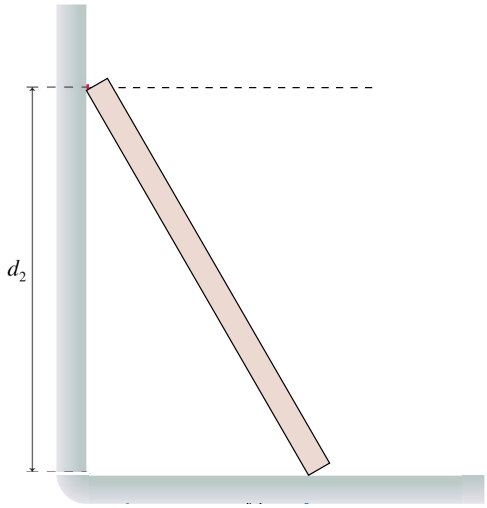
1. **Resting on a Plank:** A person of mass m = 61.2 kg lies on a rigid board that weighs 60 N. The board has a length L = 2.5 m and rests atop a scale and a support (see Figure). The reading on the scale is F_s = 250 N. If the board is in equilibrium, where is the center of mass of the person located?



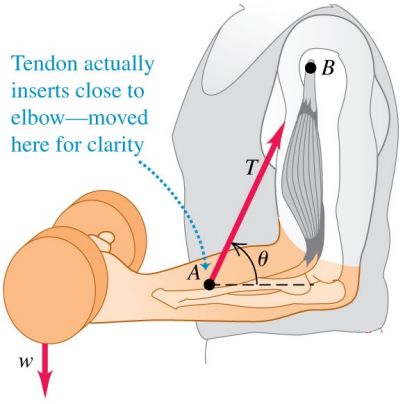
2. **Painter on Scaffold:** A painter of mass m = 80 kg stands on a scaffold of mass M = 20 kg. The scaffold is supported by two ropes, equidistant from the center, that are separated a distance d = 2 m. If the painter is standing 1.5 m from the left rope and the scaffold is in equilibrium, what are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

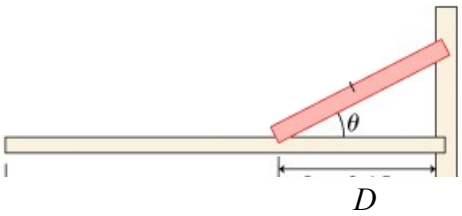


3. **Ladder Slip:** A 3.0-m-long ladder leans against a frictionless wall at an angle of 60°. What is the minimum value of μ_s, the coefficient of static friction with the ground, that prevents the ladder from slipping?



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 $\theta = 60°$.