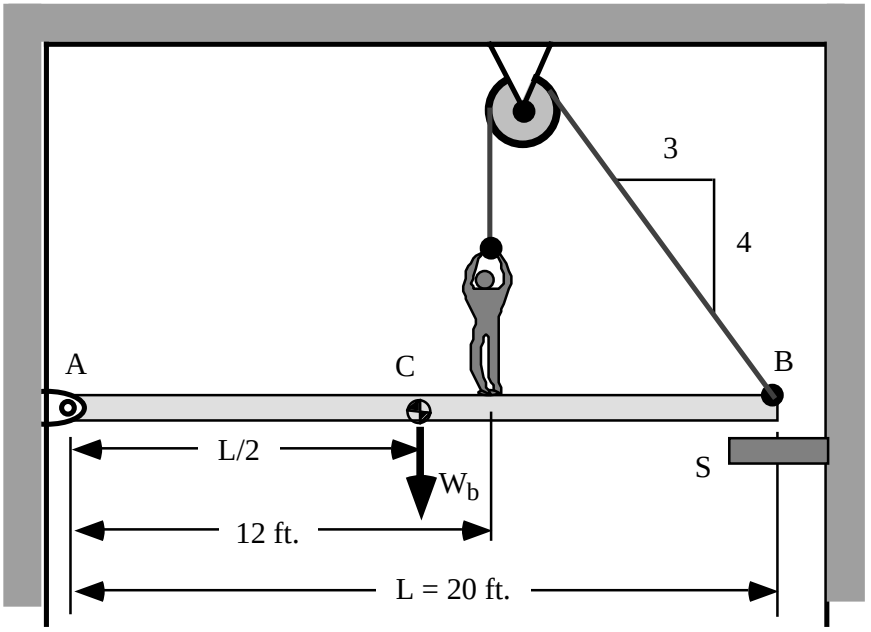
Equilibrium and Worker aligning a beam:

A construction worker is trying to align the right end of the wooden beam, AB, so that it can be fastened to a wall to the right of **B**. He is standing at 12 feet from the pin joint at **A** and pulling with tension **T** on the rope. The rope goes over a light frictionless pulley and is attached to the end of the beam at point **B**. The worker is perfectly safe since the mechanism "S" can support the beam and worker if the rope slips from the worker's hands. For the position shown, the rope has a slope of 4/3 at the end of the beam, also as shown. The beam is uniform, with a weight $\mathbf{W_b}$ = 160 pounds concentrated at the center **C** and the worker weighs 240 pounds fully dressed. In order to reduce the tension in the rope and to provide support to the worker-beam system, a force (not shown in the figure) of 80 lb is applied to the beam at a distance of 4 ft from end "B" vertically upward.



a. Draw **separate, free-body force diagrams** of the beam and the worker, showing all the forces acting on them.

b. In a static situation, what is the **maximum tension** that the worker can exert on the rope?

c. For the positions and weights given, what **tension** is required to support the beam in static equilibrium?

d. Determine the **reaction forces** at hinge pin **A** for equilibrium under these conditions.

e. What is the **maximum beam weight**, that the worker can support by this method?

(Assume the beam to be uniform and length L= 20 ft)