CHAPTER EIGHT SOLUTIONS

8.11 Total torque about the elbow gives

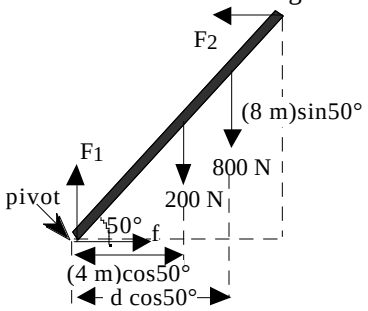
$-(0.330\text{ m})(2.00\text{ kg})(9.80\text{ m/s}^2) + F_B\cos 75°(0.080\text{ m}) = 0,$

or $F_B = 312$ N.

8.21 Use $\Sigma F_y = 0$: $F_1 - 200\text{ N} - 800\text{ N} = 0.$

Thus, $F_1 = 1000$ N.

The friction force, f, at the base of the ladder is $f = \mu_s F_1$ when the ladder is on the verge of slipping. Thus, $f = 0.6(1000\text{ N}) = 600$ N.



Now use $\Sigma F_x = 0$: $f - F_2 = 0$, or $F_2 = f = 600$ N.

Finally, use $\Sigma\tau = 0$ with the pivot pt. at the base of the ladder. The lever arm for the 200 N force is $(4.0\text{ m})\cos 50° = 2.57$ m.

The lever arm for the 800 N force is

$d\cos 50° = 0.643d$, where d is the distance from the base of the ladder up to the position of the person. Finally, the lever arm for the force F_2 is $(8\text{ m})\sin 50° = 6.13$ m. We have:

$-(200\text{ N})(2.57\text{ m}) - (800\text{ N})(.643d) + (600\text{ N})(6.13\text{ m}) = 0$

giving, $d = 6.2$ m.

ANSWERS TO EVEN ASSIGNED CONCEPTUAL QUESTIONS

14. (a) Consider two people pushing with equal magnitude forces in opposite directions and at opposite ends of a table. The net force will be zero, yet the net torque is not zero. (b) Consider a falling body. The net force acting on it is its weight, yet the net torque about the center of gravity is zero.