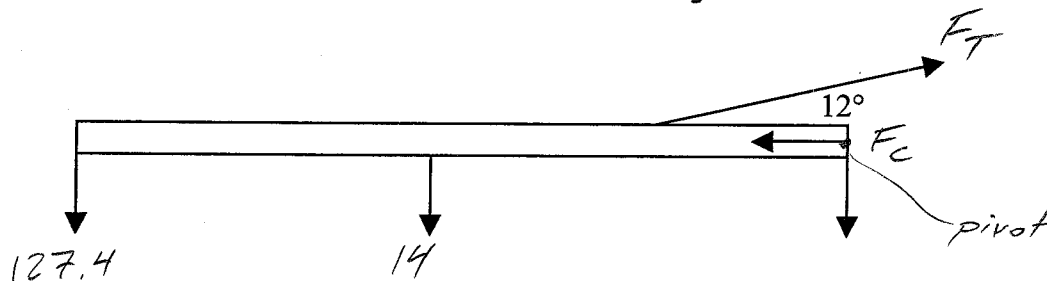


Phys 10154 - Fall 2006 - Exam #8B

Be sure to answer with the proper units and significant figures. Indicate your answers clearly with boxes. **SHOW ALL WORK.** Even if your answer is correct, I will deduct points if I can't see how you solved the problem. Both problems are worth 50 points.

#1. A person holds a 13-kg weight with his outstretched arm, which is represented by a uniform 14-N horizontal rod. The other forces on the arm include the reaction force exerted by the elbow joint on the arm and also the force of the bicep tendon, which is attached to the arm at a point 18% of the way down the arm from the elbow, making an angle of 12° with the arm. All five forces are represented in the diagram below.

Find the force exerted by the bicep tendon and also the "compression force" acting on the arm, which is the component of the elbow's reaction force directed along the arm.



$$\Sigma F_x = F_T \cos 12^\circ - F_c = 0$$

$$\Sigma \tau = + (127.4) \sin 90^\circ + 0.5 (14) \sin 90^\circ - 0.18 F_T \sin 168^\circ = 0$$

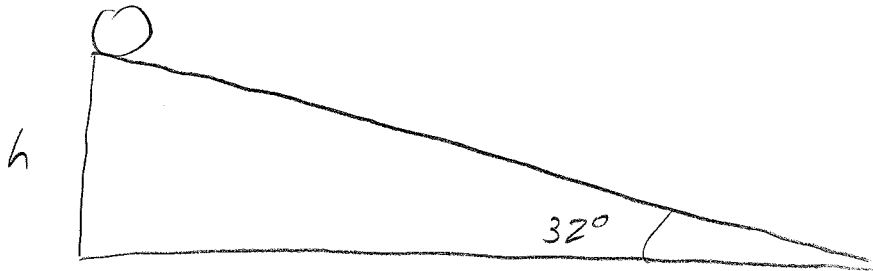
$$127.4 + 7 - 0.18 F_T \sin 168^\circ = 0$$

$$F_T = \frac{134.4}{0.18 \sin 168^\circ} = \boxed{3600 \text{ N}}$$

$$F_c = F_T \cos 12^\circ = \boxed{3500 \text{ N}}$$

#2. A cylinder of radius 15 cm rolls without slipping down a 5.0 meter long ramp inclined 32° with respect to the horizontal. If it starts from rest, then at the bottom of the ramp, what is its angular velocity?

Also, assuming a small sticker is attached to the rim of the cylinder, what total distance does the sticker travel (in meters) during this rolling motion?



$$\Sigma W_F = W_{grav} = \Delta K$$

$$mg(5 \sin 32^\circ) = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 - 0$$

$$25.97 \text{ m} = \frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{1}{2}mR^2\right)\left(\frac{v^2}{R^2}\right)$$

$$25.97 \text{ m} = \frac{1}{2}mv^2 + \frac{1}{4}mv^2$$

$$25.97 = \frac{3}{4}v^2$$

$$v = \sqrt{\frac{4}{3}(25.97)} = 5.9 \text{ m/s}$$

$$\omega = \frac{v}{R} = \frac{5.9}{.15} = \boxed{39 \text{ rad/s}}$$

$$1 \text{ rev} = 2\pi(.15) = 0.942 \text{ m}$$