PHYS 100: Survey of Physics PS 12

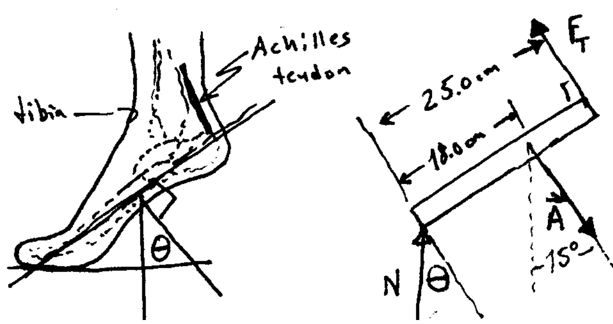
Fall 2012 v1.5

Reading:

This assignment is on Chapters 10 and 11. We will start on sound (Chapter 12) and thermo (Chapter 13) next week.

Problems:

1. When we stand on the ball of our foot as shown the normal force supports our weight. A mechanical model of the foot is also shown where F_T is the force exerted by the Achilles tendon and A is the force exerted by the tibia on the foot. Note that the weight of the foot is small relative to the total weight so we neglect it here.



   (a) Set up this statics problem, finding $\sum \vec{F} = 0$ and $\sum \tau = 0$.
   (b) OPTIONAL (1/2 pt.) Find the values of F_T, A and θ when the foot supports a weight of 710 N.

2. Water flows horizontally out of a small hole in the bottom of a soda bottle. If the bottle is 1.0 m off the ground and the water lands 0.67 m from the base of the bottle, what is the height of water in the bottle?

3. Ch 11 Question 8

4. Ch 11 P 7

5. A 33 g bird lands on a bird feeder (310 g) suspended by a spring. If after landing the bird and feeder bounce up and down at frequency of 2.61 Hz, what is the spring constant?

6. I claimed that the dynamics of a hanging mass-on-a-spring is the same as the horizontal simple harmonic oscillator done discussed in class. Show this starting with a free body diagram of the hanging mass and $F = ma$. You need to use the key observation that we describe the oscillation around equilibrium.

7. In setting up a demo to show the relation between uniform circular motion and simple harmonic oscillation you have a 78 RPM turntable and a $k = 3.5$ N/m spring. How much mass should you hang from the spring so that the frequencies are identical?

8. Ch 11 P 19

9. Ch 11 P 27

10. Ch 11 P 32

11. Ch 11 P 36

12. Open the wave-on-a-string Phet simulation.
    (a) Give the end of the string a good wiggle. Describe what happens on the right end of the string for each of the three possible boundary conditions: Fixed End, Loose End, and No End. Feel free to adjust the damping so you can more clearly see the motion.
    (b) Fix the right end, decrease the damping to zero, and add the driving force with the "Oscillate" button. Wait a little while. What is happening?