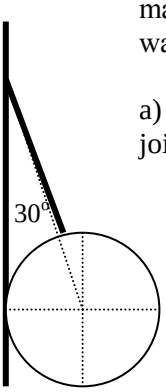
Workshop module 11 - Physics 113, Fall 2012

Statics, start of fluids

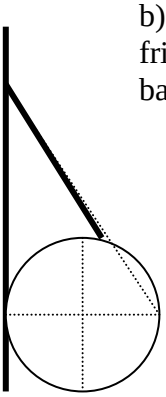
1. You can probably stand flatfooted on the floor, then rise up and balance on your tiptoes. Why can't you do it if your toes are touching the wall of the room? (Try it!)

2. Consider a uniform ball of radius 0.2 m and mass 0.75 kg held against a frictionless wall by a massless string as shown in the diagram below. The string makes an angle of 30 degrees with the wall.



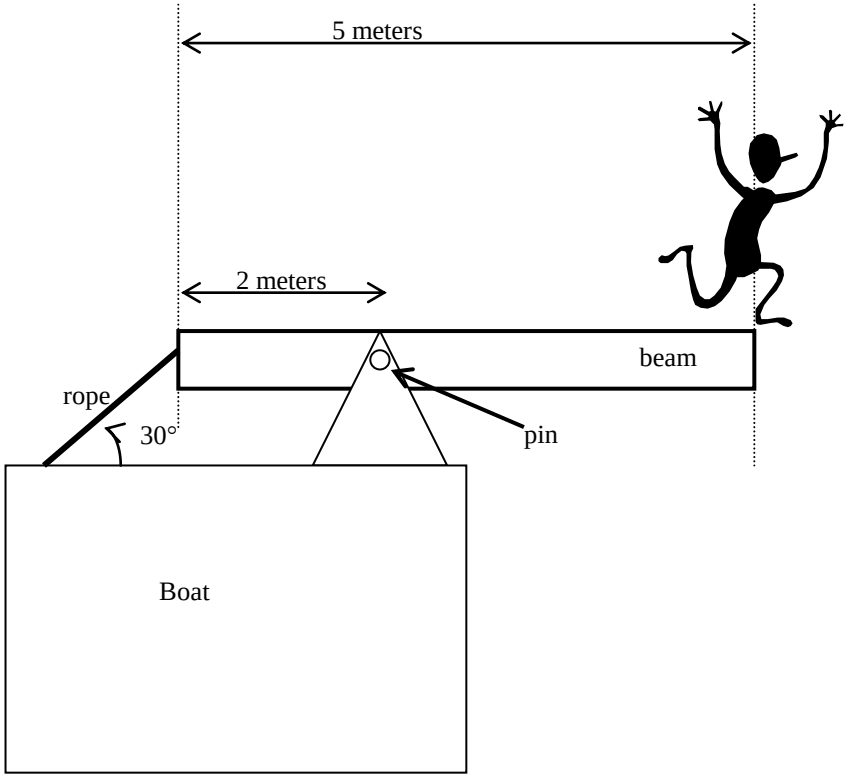
a) Find the tension in the string and the normal force of the wall against the ball assuming the line joining the wall to the ball extends through the center of the ball (drawn imperfectly below).

b) Is it possible for the configuration below to be in static equilibrium if the wall is frictionless? In this configuration the line joining the wall to the ball passes through the ball as shown. Why or why not?

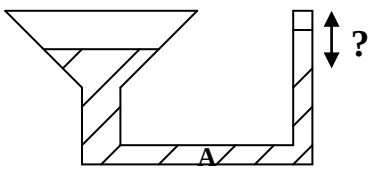


3. Two heavy disks are connected by a short rod of much smaller radius. (Picture a dumbbell … not the person beside you … a weightlifter's dumbbell!) The system is placed on a narrow inclined plane so that the disks hang over the sides and the system rolls down the inclined plane on the rod (the part that connects the two weights) without slipping. Near the bottom of the incline the disks touch the horizontal table top and the system takes off with greatly increased translational speed. Explain why this happens.

4. While snorkeling in the Bahamas you get tired of the beautiful fish and examine the makeshift diving platform your friends have constructed on the boat. It consists of a uniform, stiff, wooden beam with a mass of 10 kg and a length of 5 m pinned to a support so that it can rotate freely about the pin axis. The pin is located at a distance of 2 m from one end of the beam. The boat end of the beam is also held in place by a rope that makes an angle of 30 degrees with the horizontal when it is taut. When your friend Max stands right at the end of the beam (as shown in the drawing on the next page), what is the tension in the rope and the force on the pin? Max has a mass of 70 kg.



5. A rubber hose is attached to a funnel, and the free end is bent around to point upward. Water is poured in the funnel until it is partially filled. The fluid reaches static equilibrium. Is the pressure greater toward the left or the right of point A? How does the level of the water in the funnel compare to that in the hose? Why?



6. How do hot-air balloons work?