

DAY 18

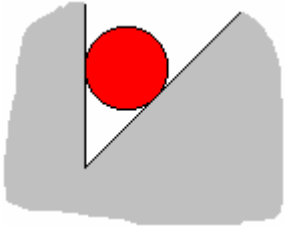
Homework Assignment (see syllabus for homework collection information)

1. A 20 kg box rests on a conveyor belt that makes an angle θ with the horizontal. The coefficient of static friction between the belt and the box is $\mu = 0.5$. What is the maximum θ can be before the box starts to slide down the belt?
2. A mass m rests on an incline that makes an angle θ with the horizontal. The coefficient of static friction between the incline and the mass is μ . What is the maximum θ can be before the mass starts to slide down the incline? Give your answer in terms of μ , m , and g .
3. A frog can leap with a speed of 5 m/s. If the frog leaps upward at an angle of 20° , how far can it jump over level ground?

4. **PHY 231 ONLY**

Show that, in the above problem, the angle at which the frog gets the maximum distance out of its jump is 45° .

5. In example problem #1 for today, the archer must raise his aim in order to hit the target. He cannot just aim straight at the target if he wants to hit it. By how much (in degrees) must he raise his aim?
6. A stunt skier goes off a ramp that is angled upward at 70° while moving at a speed of 50 mph. How high above the top of the ramp will she go?



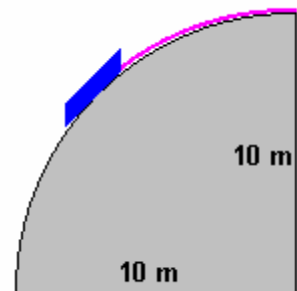
7. The red ball weighs 20 lb and has diameter 10 inches. All points of contact are smooth & slippery. The angle of the "V" is 45° . Find the contact forces on the ball in lbs.



<http://www.freestyleski.com/e/photos/index.htm>

8. Some workmen are fixing the dome of a capitol building. The dome has a radius of 10 m. The workmen are in a basket (blue in the diagram) on the dome.

The workmen and basket has a combined mass of 250 kg. The coefficient of static friction between the dome and the basket is $\mu_s = 0.6$. The basket is also supported by a cable (purple in the diagram) which is affixed to the top of the dome. By letting the cable out or in the workmen can move up or down the dome. There is no

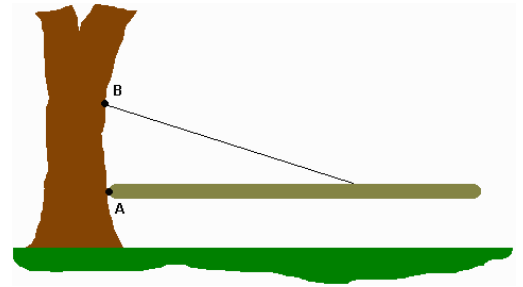


significant friction between the cable and the dome.

When the cable is 11 meter long (i.e. the purple segment in the diagram is 11 m), what is the tension in the cable?

9. A hunter decides to build a cheap gate for his hunting ground by cutting down a small oak tree, trimming off the branches, and attaching it to another tree as shown.

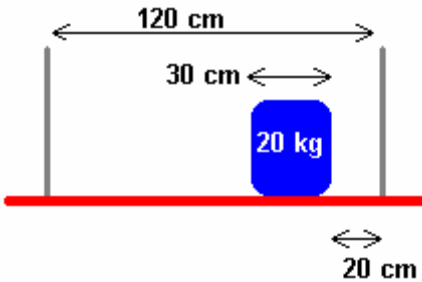
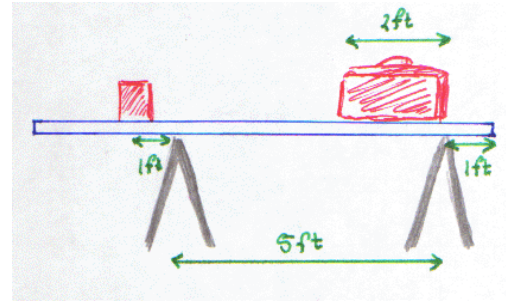
The horizontal oak log is 12 ft long and 6 inches in diameter. The cable is 9 ft long. The point where the cable is attached to the tree (B) is 4 ft above the point where the log joins the tree (A).



What is the tension in the cable?

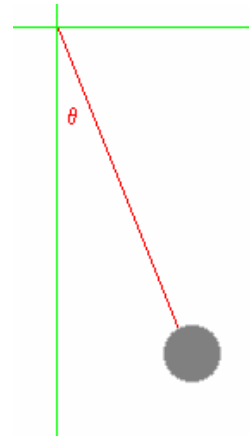
HINT -- densities table.

10. Two sawhorses are separated by 5 ft. A 10 ft board that weighs 20 lbs lies across them, with one end hanging over the right sawhorse by 1 ft. A 40 lb tool box 2 ft long sits so that its right edge is directly above the right sawhorse. A 10 lb gallon of paint sits with its center 1 ft to the left of the left sawhorse. Find the force on the top of each sawhorse.



11. A board of mass 5 kg hangs from two ropes as shown. On the board is a 20 kg mass. Find the tension in each rope.

12. A student makes a wind gauge from spheres of different material. The spheres are hung from a support, and the force of wind blowing on them causes them to swing away from the support at some angle θ .



What will θ be if the wind is 20 mph and the sphere is made of solid oak with a diameter of 3 inches? What if the sphere is made of Styrofoam?

13. In example #6, what height for the truck's cm have would cause the rear tires to lose contact with the ground and provide no braking force at all (meaning the truck might flip over)?