Physics I (PHYS 200): PS 4

Fall 2013 v1.5

We move into working with energy (please note the pun there) this week, after finishing with a bit more on friction and drag.

I will be away starting Wednesday mid-afternoon, due to a talk I am giving on Thursday. So the best times for office hours this week are Monday after class, Tuesday afternoon, or Wednesday morning. If you are able please start early so we can discuss your questions before I go. Don Bunk, who is teaching Phys 100, has graciously offered to teach on Friday.

Reading:

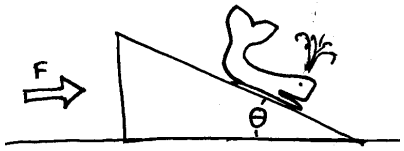
HRW Chapter 6 (which has some new material like drag forces)
New material on energy for this week will be in Chapter 7

Problems:

Due in class Monday, September 30.

(1) HRW 5.82

(2) A whale of mass m rests on an incline plane of mass M. Assuming that all surfaces are frictionless find the force F that must be applied to the incline plane so that the whale remains at the same position on the inclined plane. i.e. so that the whale doesn't slip down the plane. Let the plane have an angle θ.



(3) HRW 6.1

(4) HRW 6.9

(5) HRW 6.19

(6) HRW 6.49

(7) HRW 6.51

(8) HRW 6.54

(9) Snow piled on a roof sometimes slides off in one big whoosh. Consider a roof with a pitch (or slope) of 30^o

  (a) What is a minimum coefficient of static friction needed to keep the snow from sliding down the roof?

  (b) As the roof warms and melts the snow, the coefficient of static friction decreases and the snow lets go. Assuming that the distance from one part of the snow is 5.0 m from the edge of the roof and that the coefficient of kinetic friction is 0.20, find the speed of the snow as it leaves the roof.

  (c) If the edge of the roof is 10.0 m from the ground, at what speed does the snow hit the ground?

(10) Police, examining an accident scene involving two cars, measure skid marks of one car to be 81 m long. Knowing that the coefficient of kinetic friction between the tire and the road is 0.80, estimate the initial speed of the car.

(11) At the "spinning room" ride at a fair what is the coefficient of static friction that will hold folks from falling, once the floor of the room is opened up? Assume for this one that the room is 5.0 m in radius and has a period of 2.0 s. It feels like one is "pressed against the wall". Is

there really an outward force pushing folks against the wall? (Please say no!) What is the force that does this and what does it support?

(12) Amber pulls a sled of mass m by a rope along a horizontal snowy surface at a constant speed. The coefficient of friction between the snow and the sled is μ. Assume that the rope makes an angle of θ with the surface.
   (a) Draw the force diagrams for the sled and Amber.
   (b) Calculate the tension in the rope.