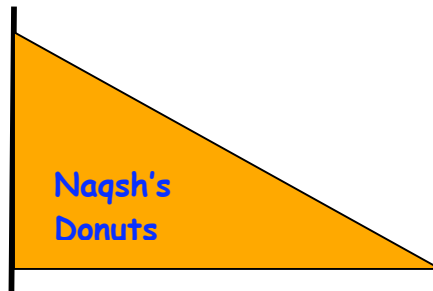# PHYSICS 180

Problem set #8   **Due: 5 PM, Monday, Nov.19ᵗʰ, 2007**

"May the Force be with you."
--Star Wars

1) A 2 kg triangle-shaped sign of negligible thickness is free to swing about a vertical post as shown in the diagram. The height of the sign is 15 cm and the base is 30 cm long.


   i) What is the sign's moment of inertia about the vertical axis to which it is attached?
   ii) A force of 3 N is applied perpendicular to the sign for 2 s at a point 5 cm from the vertical axis. How many revolutions has the sign made from the time the force is applied until 4s thereafter?
   iii) What is the kinetic energy of the sign about the vertical axis after the force is removed and what is the power delivered to the sign 1s after the force is initially applied?

2) Two springs with force constant 4 N/m are connected to either end of a frictionless axle which passes through the center of a solid cylinder of radius 6 cm and mass 0.5 kg, located on a plane which is inclined at 15° as shown.
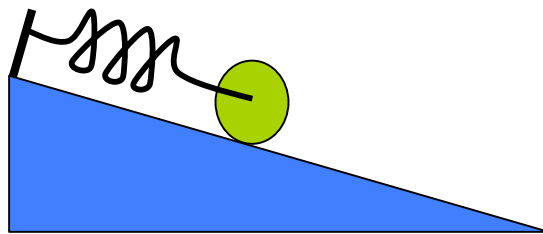
   i) If the cylinder is initially held so that the springs are initially not stretched, what is the maximum angular speed the cylinder attains after it is released if it rolls without slipping?

   ii) What is the period of the subsequent harmonic motion of the cylinder?

3) A 0.4 kg meter stick of width 2 cm is pinned on a frictionless horizontal surface so that it is free to swing about the 50 cm mark as shown. A tiny puck of mass 0.05 kg initially moving at a speed of 4 m/s in a direction perpendicular to the meter stick strikes it at the 70 cm <u>mark</u> and bounces straight back with a speed of 1 m/s.
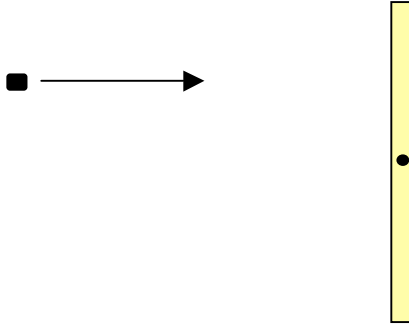
i) What is the angle the meter stick makes with respect to its initial orientation 2 s after the collision? How much kinetic energy is lost in the collision? Assume the duration of the collision is << 1 s.

ii) How do your answers to part i) change if the meter stick is not pinned but is able to move freely (translate and rotate)?

4) Serway: Ch. 10, #84 (page 309).

Practice Problems:
Ch. 10: 22,26,27,30,34,37,41,49,61,66,69,78,86
Ch. 11: 14,17, 20, 28,34,36,39, 47,51,60