

SN: _____, Name: _____

Note: You can use pencil or any pen in answering the problems.
Dictionary, calculators and mathematics tables **are** allowed.
Please hand in both solution and this problem sheet.
ABSOLUTELY NO CHEATING!

Problems (total 5 problems, 100%)

- Angular momentum-1:** (20%) A conical pendulum consists of a bob of mass m in motion in a circular path in a horizontal plane as shown in the figure to the right. During the motion, the supporting wire of length l maintains a constant angle θ with the vertical. Show that the magnitude of the angular momentum of the bob about the vertical dashed line is $L = \left(\frac{m^2 g l^3 \sin^4 \theta}{\cos \theta} \right)^{1/2}$.
- Center of Mass:** (20%) If you were to hang a triangular metal sign from a vertical string as shown in the figure to the right. The bottom of the sign is to be parallel to the ground. At what distance from the left end of the sign should you attach the support string?
- Newton's law:** (20%) A block of mass m is dropped from the fourth floor of an office building and hits the sidewalk below at speed v . From what floor should the block be dropped to double that impact speed?
- Newton's law:** (20%) Two objects are connected by a light string passing over a light, frictionless pulley as shown in figure above. The object of mass $m_1 = 5.00$ kg is released from rest at a height $h = 4.00$ m above the table. Using the isolated system model, Determine the speed of the object of mass $m_2 = 3.00$ kg just as the 5.00-kg object hits the table.
- Energy conservation:** (20%) As shown in Figure 9.30, a bullet of mass m and speed v passes completely through a pendulum bob of mass M . The bullet emerges with a speed of $\frac{v}{2}$. The pendulum bob is suspended by a stiff rod (not a string) of length l and negligible mass. What is the minimum value of v such that the pendulum bob will barely swing through a complete vertical circle?

