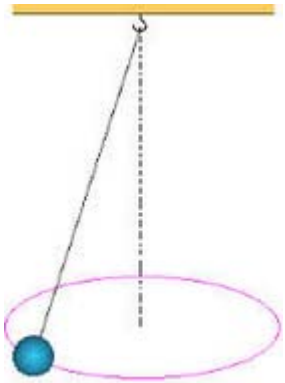
Name: ID:

General Physics I (151)

**Discussion Questions #4**

## Forces

1. A conical pendulum moves in a horizontal circle of radius $r$. The pendulum bob has a mass $m$ and the string makes an angle $\theta$ with the vertical. You are asked to calculate the tension $T$ in the string and the speed $v$ of the bob.



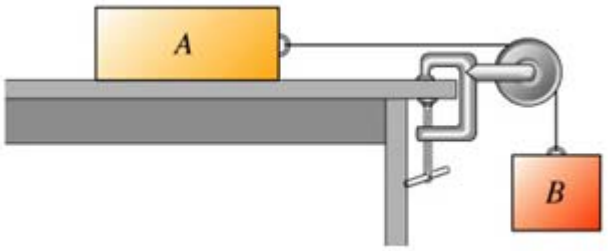
a) Draw a free-body diagram for the pendulum bob.

b) Write the equations for Newton's 2nd law $\mathbf{F}_{\text{net}} = m\mathbf{a}$ in the vertical and horizontal directions.

c) Solve these to determine the speed of the bob in terms of $r$, $\theta$ and $g$.

d) Now solve to determine the tension $T$ in terms of $m$, $\theta$ and $g$.

2. Consider the system shown in the figure below. Block A has weight $w_A$ and block B has weight $w_B$. Once block B is set into downward motion, it descends at a constant speed. Assume that the mass and friction of the pulley are negligible.




a) Draw free-body-diagram for each of the blocks.

b) Write an expression for $F_x$, the net force acting horizontally on block A.
Express your answer in terms of some or all of the variables $\mu$, $T$ (the tension in the rope), and other given variables. Take positive to be to the right.

c) Write an expression for $F_y$, the net force acting vertically on block B.
Express your answer in terms of some or all of the variables $\mu$, $T$ (the tension in the rope), and other given variables. Take positive to be downward.

d) Calculate the coefficient of kinetic friction μ between block A and the table top.
Express your answer in terms of some or all of the variables $w_A$, $w_B$, and $g$ (the acceleration due to gravity).

e) Now suppose a cat, also of weight $w_A$, falls asleep on top of block A. If block B is then set into downward motion, what is the magnitude of its acceleration?
Express your answer in terms of some or all of the variables $w_A$, $w_B$, and $g$.