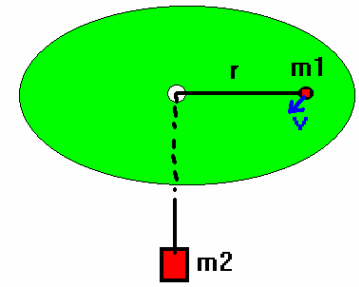
	Physics 210: Practice Exam	Name _____

These problems were chosen at random from our worksheets.

(1) Suppose one of my faster cats is chasing a mouse (which is even faster). My cat leaps into the air at a 33^0 angle. If my cat was initially moving at 10 m/s, (a) what was my cat's range and (b) how long was my cat in the air?

(2) Suppose a block of wood of mass m is kicked along the floor with an initial velocity v. The block has a coefficient of kinetic friction of μ between the floor and the block. How far will the block slide till it stops. If the block has an initial velocity v=5 m/s and μ=0.3, provide a numerical answer together with correct units.

(3) A mass m1 is lying on a frictionless table with a hole in the center at a distance r from the hole. A massless string is connected to m1 and passes through the hole to connect to a mass m2. What tangential velocity must m1 have in order to suspend m2?



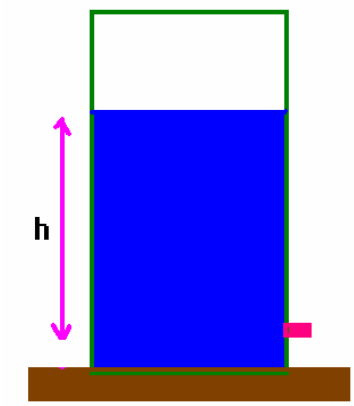
(4) Suppose a star of radius R_1 has a period of 20 days. The star suddenly collapses to a radius R_2 which is smaller by a factor of 10000 without losing mass. What is the new period of the star? You may assume that the moment of inertia of the star is that of a solid sphere ($I = \frac{2}{5}mR^2$). Also, compare the ratio of kinetic energy before and after the collapse.

(5) Cowboy Ryan decides it's time to take a break from the dairy bar and takes a road trip to Cape Hatteras for a visit to the lighthouse (http://www.nps.gov/caha/index.htm). While there, he looks up and notices a very large spider dangling a mere 10 cm above his eye. He also notices that the massless silk thread connecting the spider is connected to the roof. Suddenly, he remembers my class and sets the spider into motion and times the period of oscillation.
(a) If the total length of the thread was 25 m, what period did he measure?
(b) Cowboy Ryan notices another spider up higher which is oscillating with a period of 5 s. How long is the second spider's thread?
(c) Now, suppose the first spider became scared of Cowboy Ryan's eye and extended itself another 2 m closer to the floor (Cowboy Ryan is very tall). What would the period of oscillation be now?

(6) Suppose an open organ pipe of length L_1=1 m is in its first mode of oscillation. A second organ pipe, which is longer is also in its first mode of oscillation. An observer hears a beat frequency of 3 Hz. How much longer is the second organ pipe? The speed of sound is 343 m/s.

(7) Suppose that 2 moles of an IDG go through the following process with P=1 atm:
(1) T_i=300K, T_f=600K adiabatic process.
(2) V_i=0.05m^3, V_f=0.10m^3 isothermal process
(3) T_i=600K, T_f=300K, adiabatic process
(4) V_i=0.10m^3, V_f=0.05m^3 isothermal process
Calculate the following quantities:
(a) The total heat added to the process
(b) The total heat evolved by the process
(c) The net heat added to (or evolved from) the system.
(d) The Work done by the system along the entire process.
(e) ΔU for this entire closed process.
(f) Define the engine's efficiency by: $E \equiv \frac{W}{Q_{input}}$ Find out how efficient this engine is.

(8) Consider a tank as shown. There is a small hole near the bottom. Suppose that the tank is not so high so that the atmospheric pressure makes a big difference from the top to the bottom.



(a) If the tank is open to the atmosphere at the top, how fast does the fluid flow out?
(b) If the top of the tank has a pressure P greater than the atmospheric pressure, how fast does the fluid flow out?
(c) Suppose that the tank was closed at the top but initially did not have an over pressure. When would the fluid stop flowing out of the tank?
(d) How far can a vacuum lift a column of water?