Instructions: You have a total of 50 minutes to complete this test.
Answer each of the following questions completely.

Time Start_____ Time finish_____ Pledged_____

You must supply all details that led to your answer.
You must provide correct SI units where required.
Do not discuss any aspect of this test with anyone until I return the test.

[1](a) An closed organ (1 end closed) pipe has a length of 2.50 m. Assuming that the speed of sound is 343 m/s, find the frequency of oscillation of the **next to lowest lying mode** in this organ pipe.

[1](b) How long would an organ pipe (with both ends open) need to be so that the lowest lying mode has a frequency of 50 Hz?

[1](c) What tension would a string of length $5.00\,\text{m}$ with a mass per unit length $\mu = 1.00\text{x}10^{-3}\,\text{kg/m}$ need to have so it would have a lowest frequency of oscillation of 35 Hz when both ends of the string are fixed?

[1](d) if a string is 10 m long with a mass per unit length of $\mu = 0.1\,\text{kg/m}$ were under a tension of 100N, how long would it take a transverse pulse to travel the length of the string?

[2] Suppose a simple pendulum has a length of 15.0 m. You may assume the acceleration due to gravity is $g=9.8\,m/s^2$.

[2](a) What is the period of small oscillations about the equilibrium position?

T=_____

[2](b) What mass should be placed on a spring with a spring constant of $k=3.0\,N/m$ in order to produce a period of 3 seconds?

m=_____

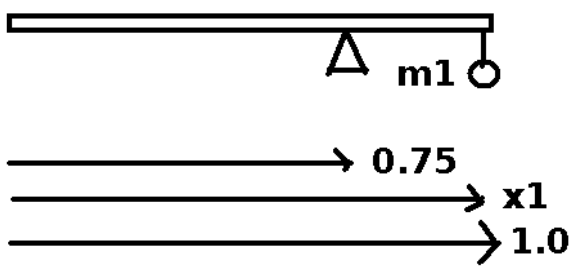
[2](c) If the spring mass system in problem 2(b) is displaced through a maximum displacement of $x_{max}=0.5$ m, what is the total energy of the system?

E=_____

[2](d) What is the kinetic energy of the mass spring system in (2c) when the mass passes through the equilibrium position corresponding to zero displacement?

K=_____

[3] A meterstick of mass m=1.0kg and length L=1m is on a pivot at x=0.75m. Find the position that a mass m_1=5 kg would need to be placed so that the system would be in static equilibrium by answering the following questions.



[3a] Sketch in and properly **label all forces** on the diagram above. Do not neglect the weight of the meterstick, noting that it acts at the center of mass of the meterstick. Indicate the force from the pivot as Fp.

[b] Apply Newton's law to find the force exerted by the pivot. Your answer here is numeric with correct SI units.

F_p =_____

[c] Now, consider the axis to be located at the pivot (x=0.75). Write the torque equation (using correct signs) required to achieve static equilibrium. Note that mass m_1 is at (x_1 -.75) from the pivot. Your answer involves the symbols m, m_1, g and x_1. All other distances you may replace by their actual values.

$\Sigma\Gamma$=0=_____.

[d] Solve for the position x_1 where the mass m_1 would be placed for static equilibrium to result. Your answer here is numerical with correct SI units.

x_1=_____

[4] A wheel of radius R and mass has a moment of inertia given by $I=\frac{1}{2}mR^2$ about it's axis. In this problem, you may assume m=3 kg and R=0.1 m and be sure to use correct SI units in your answers.

(a) if the wheel is spinning with a frequency f=10 Hz, what is the angular velocity of the wheel?

ω=_____

(b) What is the angular momentum of the wheel if it is just spinning with a frequency of 10 Hz but not translating?

L=_____

(**c**) if the wheel is spinning with a frequency f=10 Hz, what is the kinetic energy of the wheel?

K=_____

(**d**) If the wheel rolls without slipping on a flat surface, how far will the center of mass of the wheel translate in 1 second?

x=_____