PHYSICS 122 **Name: Sample Exam**
Spring 2009
Exam1

The exam is worth 100 points. Some of the equations are given below.

1 dimensional kinematic Equations:

$v = v_0 + at$
$v^2 = v_0^2 + 2a(x-x_0)$
$x = x_0 + v_0t + (½)at^2$
$x = x_0 + (½)(v+v_0)t$

Newtons Law

$\Sigma F_x = ma_x$
$\Sigma F_y = ma_y$

$y(x,t) = A\,\mathrm{Cos}(kx - \omega t)$, $k = 2\pi/\lambda$, $\omega = 2\pi/T$,
$\omega = 2\pi f$, $v = \lambda/T$, $v = f\lambda$

$v = \sqrt{T/\mu}$,

$I = P/A$, spherical source $I = P/4\pi r^2$

$\beta = 10 \log (I/I_o)$
$I_0 = 1.00 \times 10^{12}\ W/m^2$

$\cos\alpha + \cos\beta = 2\cos\frac{1}{2}(\alpha+\beta)\cos\frac{1}{2}(\alpha-\beta)$

$f' = f\frac{(v \pm v_o)}{(v \pm v_s)}$ choose right sign

Standing waves:

String: $f_n = \frac{n}{2L}\sqrt{\frac{T}{\mu}}$ Open pipe $f_n = \frac{nv}{2L}$

Closed pipe $f_n = \frac{nv}{4L}$

Simple Harmonic Motion

$F = -kx$
$PE_s = ½\,kx^2$
$\omega = \mathrm{sqrt}(k/m)$
$T = 2\pi/\omega$
$f = 1/T$
$T_{pendulum} = 2\pi\ \mathrm{sqrt}(L/g)$
$X(t) = A\,\mathrm{Cos}(\omega t)$
$V(t) = -\omega A\,\mathrm{Sin}(\omega t)$
$A(t) = -\omega^2 A\mathrm{Cos}(\omega t)$

The multiple choice questions are 3 points each unless mentioned.

A. When an object moving in simple harmonic motion is at its maximum displacement from equilibrium, which of the following is at a maximum ? (2 points)
   a) Velocity
   b) Acceleration
   c) Kinetic Energy
   d) None of the above

B. If you increase the amplitude of simple harmonic motion, the time period. (2 points)
   a) increases
   b) decreases
   c) remains the same

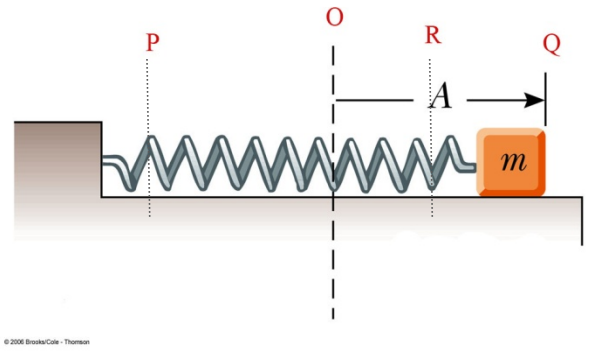
C A grandfather clock depends on the period of a pendulum to keep correct time. Suppose such a clock is calibrated correctly and then the temperature of the room in which it resides increases. The clock
   a) Runs slower because the time period decreases due to decrease in length.
   b) Runs faster because the time period decreases due to decrease in length.
   c) Runs slower because the time period increases due to increases in length.
   d) Runs faster because the time period increases due to increase in length.

D A long rope is hung from a ceiling and waves are sent up the rope from its lower end. The speed of the wave
   a. Increases as the wave travels upward due to a decrease in the tension in the string.
   b. Increases as the wave travels upward due to an increase in the tension in the string.
   c. Decreases as the wave travels upward due to a decrease in the tension in the string.
   Decreases as the wave travels upward due to a increase in the tension in the

E. Problem 16.1
Draw the pattern at t-3 seconds.

PROBLEM 1

A spring of negligible mass stretches 3.00 cm from its relaxed length when a force of 7.50 N is applied. A 0.500 kg particle rests on a frictionless horizontal surface and is attached to the free end of the spring. The particle is initially at its unstretched position of O, and then pulled horizontally so that it stretches the spring 5.00 cm (to a point Q) and is then released from rest at t=0. The particle oscillates between the extremes P and Q. Answer the following. (Make sure your answers have the proper units)



A. What is the force constant of the spring?

B. What are the angular frequency and time period of the motion?

C. What is the total energy of the system? Explain how you found it. Is it a constant quantity?

D. What is the amplitude of motion?

E. What are the maximum velocity and maximum acceleration of the particle? Where do these occur in the picture?

Problem 2

A 1.0 m tall vertical tube is filled with water at 20 degree Celsius. A tuning fork vibrating at 580 Hz is held just over the top of the tube as the water is slowly drained from the bottom.

a) Does the number of modes increase or decrease with the length?

b) Draw the wave pattern for the 3rd harmonic.

c) Find the lengths of the 1^{st} two harmonics seen

Problem # 3

A friend of yours is loudly singing a note at 400 Hz while driving toward you at 25.0 m/s on a day when the speed is 340 m/s.

a)What frequency do you hear? What is the physical reason behind the change?

b) What frequency does your friend hear if you begin to move away from your friend at 10 m/s and you sing at a frequency of 400 Hz.