Student Name: _____   Roll No& Section: _____

Program: BCS   **Assignment # 3**
Semester: Fall 2020   Total Marks: **10**
Time Allowed: **Next Monday**   Date: 12-12-2020
Course: Applied Physics   Instructor: Dr. Mustafa Haider

Problem#1

A 50-g mass is attached to a spring and undergoes simple harmonic motion. Its maximum acceleration is 15 m/s^2 and its maximum speed is 3.5 m/s.

Determine the (a) angular frequency, (b) spring constant, and (c) amplitude.

Problem#02

A 2.00-kg object is attached to a spring and placed on a frictionless, horizontal surface. A horizontal force of 20.0 N is required to hold the object at rest when it is pulled to x = 0.200 m from its equilibrium position (at x = 0), and then released from rest and it subsequently undergoes simple harmonic oscillations.

(a) Find the force constant of the spring, k, and the frequency of the oscillations, f.
(b) Calculate the maximum speed of the object, v_{max}. Where does this maximum speed occur?
(c) Find the maximum acceleration of the object, a_{max}. Where does the maximum acceleration occur?
(d) Calculate the total energy of the oscillating system.
(e) Determine the speed and the acceleration of the object when its position is equal to one-third the maximum value, $x = \dfrac{A}{3} \Rightarrow v = ?, \ a = ?$
 (f) Express the position, velocity, and acceleration as functions of time, x(t), v(t), a(t).

Problem#03

A particle moving along the x axis in simple harmonic motion starts from its equilibrium position, the origin, at t = 0 sec and moves to the right. The amplitude of its motion is A = 2.00 cm, and the frequency is f = 1.50 Hz.

(a) Find an expression for the position of the particle as a function of time.
(b) Determine the maximum speed and maximum positive acceleration of the particle.
(c) Find the total distance traveled by the particle between t = 0 and t = 1.00 s.

Problem#4

What is the period of 60.0 Hz electrical power?

Problem#5

If your heart rate is 150 beats per minute during strenuous exercise, what is the time per beat in units of seconds?

Problem#6

Find the frequency of a tuning fork that takes 2.50×10^{-3} s to complete one oscillation.

Problem#7

A stroboscope is set to flash every 8.00×10^{-5}s. What is the frequency of the flashes?

Problem#8

(a) What is the maximum velocity of an 85.0-kg person bouncing on a bathroom scale having a force constant of 1.50×10^6 N/m, if the amplitude of the bounce is 0.200 cm? (b)What is the maximum energy stored in the spring?

Problem#9

Consider a spring that is standing on end in the vertical position. You place 100 grams on the spring, and it compresses a distance of 9.8 cm.
   a) If an additional 200 grams are placed on top of the 100-gram mass, how much will the spring compress?

b) What is the spring constant?

Problem#10

A spring is hanging freely from the ceiling. You attach an object to the end of the spring and let the object go. It falls down a distance 49 cm and comes back up to where it started. It continues to oscillate in simple harmonic motion going up and down a total distance of 49 cm from top to bottom. What is the period of the simple harmonic motion?

Problem#11

A 1.50-kg object on a frictionless horizontal surface oscillates at the end of a spring (force constant k = 500 N/m). The object's maximum speed is 70.0 cm/s (a) What is the system's total mechanical energy? (b) What is the amplitude of the motion?

Problem#12

A 3.0-kg object on a frictionless horizontal surface oscillates at the end of a spring with an amplitude of 8.0 cm. Its maximum acceleration is 3.5 m/s2. Find the total mechanical energy.

Problem#13

You are given a meterstick and asked to drill a small diameter hole through it so that, when the stick is pivoted about a horizontal axis through the hole, the period of the pendulum will be a minimum. Where should you drill the hole?
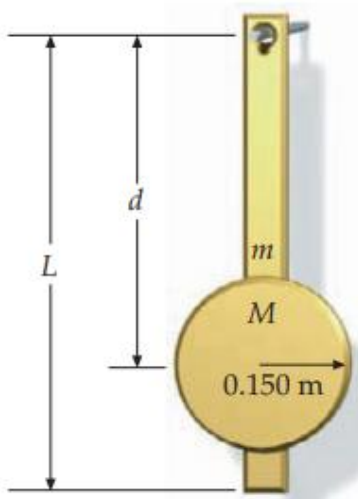
Problem#14

A 450-g mass on a spring is oscillating at 1.2 Hz, with total energy 0.51 J. What is the oscillation amplitude?

Problem#15

Following figure shows the pendulum of a clock in your grandmother's house. The uniform rod of length L = 2.00 m has a mass m = 0.800 kg. Attached to the rod is a uniform disk of mass M = 1.20 kg and radius 0.150 m. The clock is constructed to keep perfect time if the period of the pendulum is exactly 3.50 s. (a) What should the distance d be so that the period of this pendulum is 2.50 s?

(b) Suppose that the pendulum clock loses 5.00 min/d. To make sure your grandmother will not be late for her quilting parties, you decide to adjust the clock back to its proper period. How far and in what direction should you move the disk to ensure that the clock will keep perfect time?

☺Good Luck☺