## PRIOD, FREQUENCY, DISPLACCEMENT, VELOCITY,

1 The processor of a certain computer operates at 3.70 GHz, How much time is required for one processing cycle? [2.7 x 10^{-10} s]

2 Two baseball players warm up with a game of catch. If it takes 6.6 s for the ball to go from one player to the other and then back to the first, what is the frequency of the ball's motion? [0.15 Hz]

3. The figure represents a microwave travelling in air.
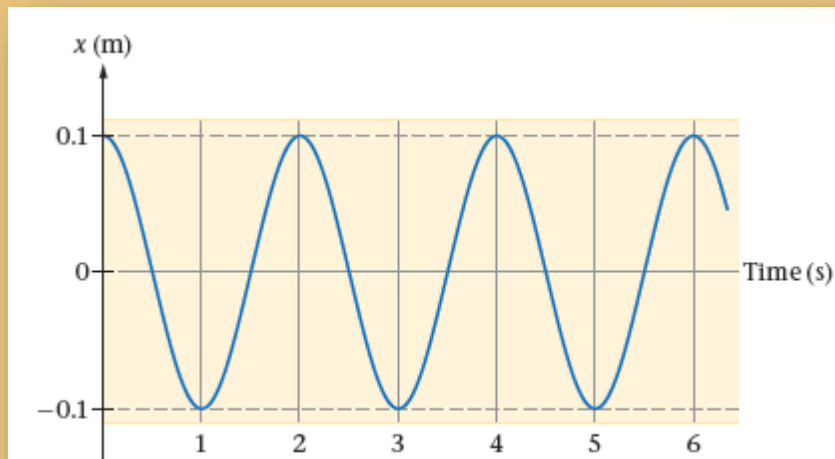
(a) State the period of oscillation
(b) What is the amplitude of oscillation
[2.0 s, 0.1 m]

4. When dragonflies hover, they tend to "bob" up and down with a motion that is an excellent approximation to simple harmonic motion. Suppose that a dragonfly is at x = A at time t = 0, and that its bobbing motion has an amplitude of A = 0.40 cm and a period of T = 0.24 s. Find (a) the position at the time t = 0.10 s
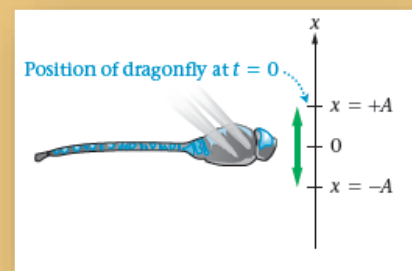

[first find ωt, Then, using the formula $x = A \cos \omega t$]
[-0.34 cm]

5 A piece of paper completes 50 vibrations in 5 s when some waves pass through the surface of water. Find the time period and the frequency of the piece of paper. If the wavelength of the wave is 10cm, find the velocity of the waves
[T = 0.1s , 10 Hz, 1.0 m]

6 A body vibrates with a time period of $\frac{1}{256}$ s produces waves which travel at a velocity of 350 cm/s. Calculate the wavelength of the emitted wave. [λ = 896 m]

MASS-SPRING SYSTEM

1   A horizontal spring with a force constant of 11 N/m is connected to an air-track cart. When the cart is set in motion, the spring causes it to oscillate back and forth with a period of 1.2 s. What is the mass of the cart?   **[0.4 kg]**

2   A common technique used to measure a spring constant is illustrated in Figure . A spring is hung vertically (Fig. a), and an object of mass m is attached to the lower end of the spring and slowly lowered a distance d to the equilibrium point (Fig. b). Find the value of the spring constant if the spring is displaced by 2.00 cm and the mass is 0.550 kg.

(a)   (b)   (c)
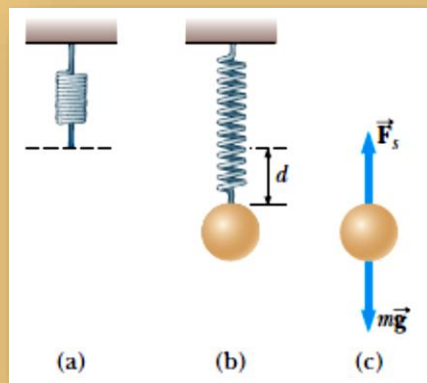
Hint

$$\sum F = F_g + F_s = -mg + kd = 0$$

$$k = \frac{mg}{d} = \frac{(0.550 \text{ kg})(9.80 \text{ m/s}^2)}{2.00 \times 10^{-2} \text{ m}} = 2.70 \times 10^2 \text{ N/m}$$

3   When m_1 = 0.420-kg mass air-track cart is attached to a horizontal spring, it oscillates with a period of 0.350 s. If, instead, a different cart with mass m_2 is attached to the same spring, it oscillates with a period of 0.700 s. Find (a) the force constant of the spring and (b) the mass m_2.

        [m_2 = 0.40 kg]

4   When a family of four with a total mass of 200 kg steps into their 1200-kg car, the car's springs compress 3.0 cm. (a) What is the spring constant of the car's springs

        [6.5 x 10^4 N/m]

5.   The period of vibration of a body of mass 25 g attached to a spring., Vibrates on a smooth horizontal surface. When it is displaced 10 cm to the right of its extreme position, the period of vibration is 1.57 seconds, and the velocity at the end of this displacement is 0.4 m/s. determine the (a) spring constant, (b) total energy (c) amplitude of the vibration.
    [0.4 N/m,   4 x 10^{-3} J. ,   0.1414 m]

6.   A body hanging from a spring is set into motion, and the period of oscillation is to be 0.8 s. After the body has come to rest, it is removed. How much shorter will the spring be when it comes to rest? **[x = 6.2 cm]**

7.   A mass at the end of a spring oscillates with simple harmonic motion with a period of 0.40 s; find the acceleration when the displacement is 4.0 cm.
    [a = -9.87 m/s^2]

8. A body of mass 32 g attached to an elastic spring is performing SHM. Its velocity is 0.4 m/s when the displacement is 8 cm to the right. If the spring constant is 0.4 N/m. Calculate (i) total energy, (ii) the amplitude of its motion
    [3.84×10^{-3} J, x_0 = 0.1385 m]

SIMPLE PENDULUM

1 Calculate the length of the Second's pendulum at a place where g = 9.8 m/s^2
[0.99 m]

2 Compute the acceleration due to gravity on the surface of the moon where a simple pendulum 1.5 m long makes 100 vibrations in 605 seconds
[g_m = 1.617 m/s^2]

3 Find the length of the second's pendulum on the planet Jupiter, where the value of 'g' is 2.63 times that of the 'g' on the surface of Earth.   [L = 0.226 m]

4 A simple pendulum completes 4 vibrations in 8 seconds on the surface of the Earth. Find the period on the surface of the moon where the acceleration due to gravity is one-sixth that of Earth.   [4.9 seconds]

5 Calculate the length of a simple pendulum whose frequency of vibration f = 0.5 vib/sec.   [0.993m]

6 The pendulum on a cuckoo clock is 5.0 cm long. What is its frequency?
[g = 9.8 m/s^2 Ans f = 2.28 Hz]