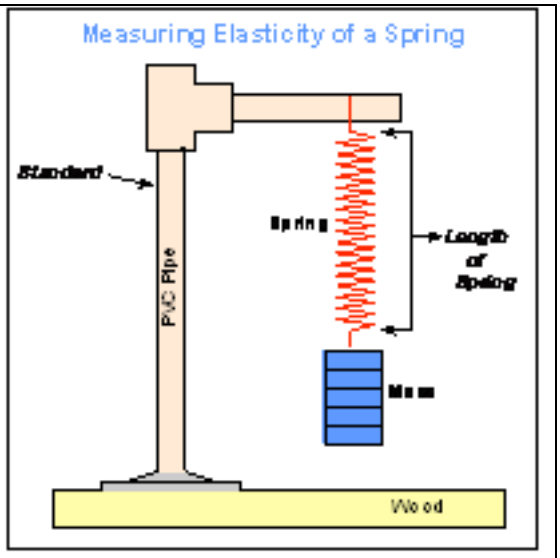
Simple Harmonic Motion

Vibrations Simple Harmonic Motion linear restoring force frequency/period/angular frequency oscillation/cycle/vibration equilibrium (rest) position Amplitude (linear/angular) axis of symmetry equations/limitations simple pendulum Mode transverse longitudinal (translational) rarefaction/compression torsional (rotational) Resonance (phase) Damping	 

$T = 2\pi\sqrt{\frac{l}{g}}$ $\omega = 2\pi f$ $\therefore\ \omega =$ for a pendulum

for springs

$T = 2\pi\sqrt{\frac{m}{k}}$ $\therefore\ \omega =$ for a mass-spring system

$x = A\cos(\omega t)$ $(\omega t + \phi)$

Chap 13 p 418 problems #23, 27, 28, 31, 35, 54

1. A spring has a 150-g mass hanging from it and creates an oscillation of 5 cycles in 3.7 s. a) What is the spring constant? b) What is the angular frequency? c) If the amplitude is 5.0 cm, write the equation for v as a function of time. d) How fast is the mass moving when it is 3 cm below the equilibrium position and moving upward?

2. A spring has a spring constant of 12.00 N/m. It has 500. g hung from the spring.
    a. What is the elongation (Δx) of the spring when the weight is placed on it?
    b. The spring is then lifted 20. cm and released. What is the period of the resulting motion?
    c. What is the angular frequency?
    d. Assuming that the system is released from the top of the motion at t = 0 s, write the equations for x(t), v(t), and a(t). ϕ and B will also be 0.
    e. What will be the masses position, velocity, and acceleration at t = 2.0 s? at t = 0.64 s?

3. pendulum
    a. What is the length of a pendulum (whose mass is 100. g) that has a period of 2.00 s?
    b. If it is pulled back 10° and released (t = 0 s), what is its period?
    c. Write x(t), v(t), and a(t) where ϕ and B are 0.
    d. Find x, v, and a at t = 4.0 s and t = 6.5s.

4. A spring system has an equation v = 0.5 m/s sin (6t +0.25).
    a. What is the amplitude of the motion?
    b. The period?
    c. Draw the graph (sketch it here) or show your graph from your calculator to get the instructor's signature.