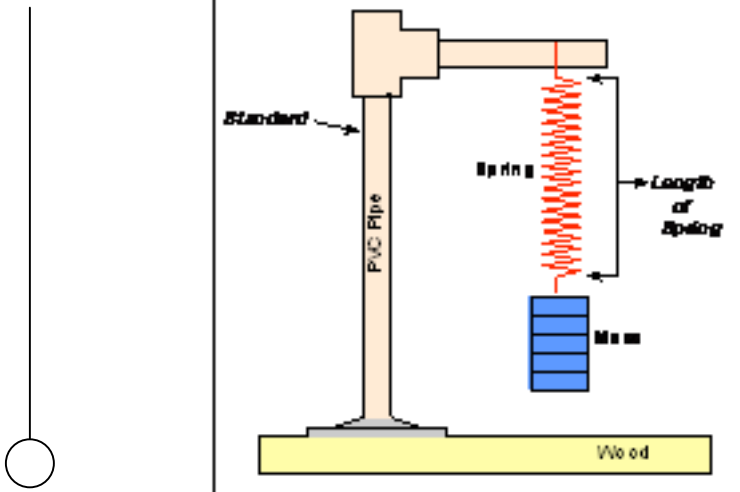


Simple Harmonic Motion

<p>Vibrations</p> <p>Simple Harmonic Motion</p> <p>linear restoring force</p> <p>frequency/period/angular frequency</p> <p>oscillation/cycle/vibration</p> <p>equilibrium (rest) position</p> <p>Amplitude (linear/angular)</p> <p>axis of symmetry</p> <p>equations/limitations</p> <p>simple pendulum</p> <p>Mode</p> <p>transverse</p> <p>longitudinal (translational)</p> <p>rarefaction/compression</p> <p>torsional (rotational)</p> <p>Resonance (phase)</p> <p>Damping</p>	 <p>The diagram on the left shows a simple pendulum consisting of a vertical string attached to a horizontal support, with a small circle representing the bob at the end. The diagram on the right is titled 'Measuring Elasticity of a Spring'. It shows a laboratory setup where a red coiled spring is suspended from a horizontal support. A blue rectangular mass is attached to the bottom of the spring. Labels include: 'Standard' pointing to a vertical PVC pipe, 'PVC Pipe' on the pipe itself, 'Spring' pointing to the coiled spring, 'Length of Spring' with a bracket indicating the height of the spring, 'Mass' pointing to the blue block, and 'Wood' pointing to the base of the stand.</p>
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$$T = 2\pi\sqrt{\frac{l}{g}} \quad \omega = 2\pi f \quad \therefore \omega = \quad \text{for a pendulum}$$

for springs

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

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

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 $t = 6.5$ s.
4. A spring system has an equation $v = 0.5 \text{ m/s} \sin(6t + 0.25)$.
 - 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.