Chapter 13:

What are the period and frequency of oscillation of a mass of 1 kg on a spring with \( k = 4 \) N/m?
Answer: \( T = \pi \) sec, \( f = (1/\pi) \) Hz.

A mass on a spring is pulled out to \( x = A/2 \) and released with an initial velocity. If \( A = 1 \) cm and \( \omega = 1 \) rad/s, what is the phase \( \delta \) and what is \( v_x(0) \)?
Answer: Taking a solution of the form
\[
x(t) = A \cos[\omega t + \delta],
\]
we find \( \delta = 1.05 \) rad, and \( v_x(0) = -0.865 \) cm/s.
What is the acceleration \( a_x(0) \) of the mass on spring in the example above?
Answer: \(-0.5 \) cm/s\(^2\).

A baseball bat is hung as a physical pendulum about the grip end. Its rotational inertia about that end is \( I = \kappa ML^2 \) and its center of mass is at \( r_{cm} = (3/4)L \). If the bat is set into small oscillations its period is 2 sec. What is the value of \( \kappa \) if the bat’s mass is 3 kg and its length is 1 m?
Answer: \( \kappa \) will be 0.76.
If an oscillator has $K/E = 1/7$, what position is it at, at that moment?
Answer: $x = \pm 0.926A$.

An oscillator has $E = 10$ J and in one cycle it loses 2 J of energy. What is $Q$, and what kind of damping does the oscillator experience?
Answer: $Q = 10\pi = 31.4$ and the oscillator is under-damped.