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 δ 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 $r_{\rm cm} = (3/4)L$. If the bat is set into small oscillations its period is 2 sec. What is the value of κ if the bat's mass is 3 kg and its length is 1 m?

Answer: κ 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: $\mathrm{Q} = 10\pi = 31.4$ and the oscillator is underdamped.