CHAPTER 14 - OSCILLATIONS

Physics for scientists and engineers: A strategic approach; Randall Knight, 2nd ed.

14.1 Simple Harmonic Motion - The first part has basic definitions you need. Read the second part carefully and be sure you understand how the equations and the graphs relate. Try to do the examples yourself without looking at the solution.

14.2 Simple Harmonic Motion and Circular Motion - This section uses rotational variables that we will discuss in class on Monday. Equations 14.15 hopefully make sense to you. Appreciate that you need a 'phase constant' to express initial condition at t = 0, since velocity and position are not necessarily 0. Example 14.4 is a typical exam or homework question.

14.3 Energy in Simple Harmonic Motion - Read the entire section carefully. Think about the spring demo in today's class -- where is the velocity zero and where is it max -- and relate that to kinetic energy. Remember that energy is ALWAYS conserved; so what happens to the kinetic energy when the velocity is zero? Figure 14.10 has a lot of information in it -- take your time to review all the components and try to understand how amplitude (or any x-position), and potential energy relate.

14.4 The Dynamics of Simple Harmonic Motion – We will be looking at Hooke's Law in class and it would be beneficial for you to review this section (if you are unfamiliar with Hooke's Law, you might want to skim through section 10.4 as well). It is important to recognize the equivalency of F = ma and F =-kx. The worked-through examples in this part are good practice; be sure to try and understand these.

14.5 - Vertical Oscillations: This section shows why gravity does NOT influence the oscillation frequency. Example 14.7 is very useful. Make sure you can identify the equilibrium position of a vertical spring AND a vertical spring with a mass attached. What extra features are included in a vertical harmonic oscillator that are not considered in a horizontal harmonic oscillator?

14.6 - The Pendulum: Just read the first two pages and the 'tactics box 14.1'. Most important in this section are the expressions for period and angular frequency and examples 14.8 and 14.9.
Skip “The Physical Pendulum" section.

14.7 Damped Oscillations: Read this section carefully. Think about how the loss of energy is responsible for a DECREASE in the AMPLITUDE (and energy), but it has NO EFFECT on the FREQUENCY. Compare this idea to Figure 14.23; try to explain what the envelope of the amplitude is in your own words. Look carefully at equations 14.56 and 14.58 showing the equations underlying Fig. 14.23 and Fig. 14.24. Carefully look at “Energy in Damped Systems”. Make sure you understand the definition of the time constant, i.e., how the time constant relates to the amount of energy in a system AND the maximum displacement (amplitude). Look at Fig. 14.25 and work through the Example 14.11 “A damped pendulum”.

14.8 Driven Oscillations and Resonance – There is no math but the concept is important. Try to explain the collapse of the Tacoma Narrows Bridge in the video using the concepts of this section.