

Name: \_\_\_\_\_

**These are the main concepts to know:**

**11.1 Simple Harmonic Motion**

- Know what Oscillates means
- Know what makes motion simple and harmonic
- Identify equilibrium, turning points, and displacement
- Know Hooke's Law and what it means
- Be able to draw a diagram of a spring, horizontally or vertically
- Know what Amplitude, Period, Frequency, Cycle represent and be able to label on a graph if possible

**11.2 Energy in the Simple Harmonic Oscillator**

- Know which formulas are potential and kinetic energy of a SHO
- Know the points at which and formulas for when either energy is maximized
- Use formulas for energy to solve for variables
- Know that the velocity depends on the position and is not consistent during motion

**11.3 The Period and Sinusoidal Nature of Simple Harmonic Motion**

- Be able to draw a diagram to show how harmonic motion is related to a circle
- Know that the maximum velocity can be calculated with the frequency and amplitude due to the circular motion
- Be able to solve, use, and graph the equations for displacement, velocity and acceleration of a SHO

**11.4 The Simple Pendulum**

- A pendulum, like a spring, can be represented using SHM
- Know why a pendulum is not technically SHM, but is approximated as such
- Know the angles for which this applies and why
- Be able to draw and/or label a diagram with a pendulum in motion
- Know that the period of a pendulum doesn't depend on the mass attached to it or the amplitude

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**11.5 Damped Harmonic Motion**

- There are four main types of motion and know what they are and how they are different
  - Regular
  - Underdamped
  - Critically Damped
  - Overdamped

**11.6 Forced Vibrations; Resonance**

- When a SHO is put into motion it vibrates at its natural frequency (letting go of a pendulum or spring)
- If there is an external force then it has forced vibration (pushing a spring with extra force)
- The natural frequency is called the resonant frequency
- Know what resonance is

**Problems:**

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**Problems Page 317 #1-35**

- (I) are easy problems
- (II) are medium/hard problems
- (III) are hard/very hard problems – often require abstraction or concepts

**Provided Equations:**

Hooke's Law: $F_s = -kx$	$PE = \frac{1}{2}kx^2$	$v = \pm v_{max}\sqrt{1 - \frac{x^2}{A^2}}$
$f = \frac{1}{T}$	$KE = \frac{1}{2}mv^2$	$v_{max} = A\sqrt{\frac{k}{m}}$
$x_{max} = A$	$E = PE + KE$	$a_{max} = A\frac{k}{m}$
$v_{max} = 2\pi Af$	$T_s = 2\pi\sqrt{\frac{m}{k}}$	$T_p = 2\pi\sqrt{\frac{L}{g}}$
$x(t) = A\cos(2\pi ft)$	$v(t) = -v_{max}\sin(2\pi ft)$	$a(t) = -a_{max}\cos(2\pi ft)$
$F_p = -mgsin\theta \approx -mg\theta$	$F_p = \frac{-gm}{L}\theta$	$\omega = 2\pi f$