Exam Study Guide

Exam 1: March 9, 2006

Reading:

Chapter 13: All
Chapter 14: 14.1, 14.3, 14.6, 14.8, 14.9
Chapter 15: All except 15.7 and 15.8
Chapter 16: All except 16.5
Chapter 17: All except 17.6, 17.7, and 17.9

Topics/Concepts Covered:

Vibrations and Waves (Ch.13 and 14)

- Spring and pendulum
- Hooke's Law
- Restoring forces
- Equilibrium
- Simple Harmonic Motion
- Directions and magnitudes of forces, acceleration, displacement, etc
- Amplitude, frequency, period
- Kinetic energy, potential energy, total energy, conservation of energy (solving problems using this), effect of friction
- Plotting the relevant variables for the systems considered vs. time
- Damping
- General idea of waves
- Longitudinal vs. transverse waves
- Wavelength, frequency, wave or propagation speed for traveling waves
- Understanding the motion of individual pieces of the wave
- Mathematical description of traveling waves
- Superposition of waves
- Reflection of waves
- Sound
- Speed of sound, light, waves in general
- Doppler effect
- Standing waves
- Allowable frequencies of a fixed string
- Resonance

Electric Fields and Forces (Ch. 15)

- Nature of charge (likes repel, opposites attract, etc)
- Insulators vs. Conductors
- Charging/transfer of charge
- Forces between charges
    - Solving problems using Coulomb's Law
    - Superposition principle
- Electric fields: what is it, calculating, etc.
- Field lines
- Conductors in equilibrium

- Electric flux
- Gauss's law
- Atomic description of charge

Electric Potential Energy, Electric Potential, Capacitance (Ch. 16)

- Work and potential energy in electric fields
- Analogy with gravitational systems
- Electric potential/potential difference
- Uniform, constant electric fields
- Calculating the potential energy and potential for a system of point charges
- Equipotential surfaces and the potential on a charged conductor in equilibrium
- Batteries
- Capacitance
    - General idea
    - Parallel plate capacitor
    - Dielectrics and dielectric breakdown
    - Parallel and series combinations of capacitors
    - Energy stored in a capacitor

Current and Resistance (Ch.17)

- Current
- Drift velocity and relation to current
- Analogies for current flow and voltage
- Resistance
- Ohm's Law
- Ohmic vs non-Ohmic materials
- Resistivity
- Electrical energy and power

Equations

$F_{spring} = -kx$

$PE_{spring} = ½\ kx^2$

$T_{spring} = 2\pi\sqrt{(m/k)}$

$x(t) = A \cos(\omega t)$

$\omega = 2\ \pi\ f$

$v = \sqrt{(T/\mu)}$ (for a string)

$E = kq_1q_2/r^2$

flux = EA (E perp. to area)

flux = Q_{encl}/ε_o (Gauss's Law)

$\Delta V = V_b - V_a = \Delta PE/q$

$PE(r) = kq_1q_2/r$

$C = Q/\ \Delta V$

$E_{cap} = ½\ Q\ \Delta V$

$R = \Delta V\ /I = \rho\ L/A$

$f = 1/T$

$v(t) = -A\omega \sin(\omega t)$

$a(t) = -A\omega^2 \cos(\omega t)$

$T_{pendulum} = 2\pi\sqrt{(L/g)}$

$v = \lambda f$

$f_o = f_s(v+v_o)/(v-v_s)$

$F = kq_1q_2/r^2$

$E = F/q$

$\Delta PE = -W_{ab} = -qE\Delta x$

$V(r) = kq/r$

$W = -\ \Delta PE$

$C = \varepsilon_o A/d$

$C = kCo$

$P = IV$