

## **BASIC CONCEPTS & QUESTIONS for EXAMS**

**[NOTE YOU SHOULD ALSO BE FAMILIAR WITH ALL NEW TERMS/DEFINITIONS AS WELL]**

### **CH 15 Concepts**

Rules for Electric charge interaction (like vs unlike)  
Methods of charge transfer (how do you create a net charge?)  
Conservation of electric charge  
Conductors vs insulators  
Electric Force (magnitude and direction between charges) [ is Coulombs Law]  
Electric Field (magnitude and direction in the space around a charge)

### **CH 16 Concepts**

Electric Potential (both in general and in the form of absolute potential for a point charge)  
Electric Potential Difference (note sign for direction: low to high potential vs high to low potential)  
Electric Potential Energy (and connection to operation of a Capacitor)  
Work done on electric charges (relation to potential energy)  
Capacitance (and the process of charging a capacitor)  
Physical properties of capacitor (dependence on device dimensions)

### **CH 17 Concepts**

Current  
Resistance  
Resistivity  
Physical properties of capacitors and resistors (dependence on dimensions of device)  
Ohms Law  
Electric Power (applications for devices: hair dryers, light bulbs, etc.)

### **CH 18 Concepts**

Kirchoff's Junction and Loop rules  
Why does adding resistors in series increase the resistance?  
Why does adding resistors in parallel decrease the resistance?  
What fundamental conservation principles are behind Kirchoffs circuit rules?

### **CH 19 & 20 Concepts**

What is the origin of magnetism?  
Why does a moving charge experience a force in a magnetic field when a stationary charge does not?  
Why does the direction of the current matter when determining the force on a current carrying wire?

What do the magnetic field lines around a bar magnet look like?  
Why is the magnetic force a maximum when the current carrying wire is perpendicular to the magnetic field?  
How does an electric motor work (think also of energy conversion here)?  
How does an electric generator work (think also of energy conversion here)?  
Why use a solenoid instead of a bunch of straight wires to produce a magnetic field?  
In the environment of the Earth, will current carrying wires "always" experience some magnetic force?  
What is meant by magnetic "flux"?  
What is being "induced" in Faraday's law of magnetic induction?  
What is the importance of Lenz's law?  
What is the importance of the word "change" when describing electromagnetic effects (i.e., what is doing the changing)?  
What is an electromagnet?

### **CH 13 Concepts**

Hooke's Law and restoring forces  
Simple Harmonic Motion (SHM) or Simple Harmonic Oscillator  
Elastic (spring) potential energy  
Constants of the motion (m,k) vs quantities that vary sinusoidally (x, F, v, a)  
how are the period, frequency, and angular frequency of SHM related  
transverse vs longitudinal waves  
definition and properties of a wave  
how are wavelength and frequency related?  
how is the speed of a wave related to frequency and wavelength and the properties of the medium in which it travels?  
reflection, interference, and resonance (standing waves)  
constructive vs destructive interference

### **CH 14 Concepts**

how does a sound wave propagate in air?  
Intensity ( $\text{W/m}^2$ ) vs Intensity level (dB) for sound  
doppler effect and redshifts vs blueshifts  
compare and contrast standing waves for strings and pipes (air columns)

### **CH 21 Concepts**

how to produce an EM wave  
how do EM waves propagate  
properties of the EM spectrum (and the EM wave types: radio, visible, etc.)

## **CH 22 Concepts**

Law of Reflection

Normal to surface

Snell's Law of Refraction

Principle of reversibility for light rays

Index of refraction

Constancy of frequency for a wave vs speed change in a new medium

Dispersion

Total internal reflection (fiber optics as example)

## **CH 23 Concepts**

Know the conditions for the 7 image formation situations for mirrors and lenses

- 1) Flat mirror
- 2) Concave mirror with real image
- 3) Concave mirror with virtual image
- 4) Convex mirror with virtual image
- 5) Convex lens with real image
- 6) Convex lens with virtual image
- 7) Concave lens with virtual image

Sign conventions for  $p, q, f$  for mirrors and lenses

Simple definition of an "aberration" for mirror or lens

## **CH 24 Concepts**

Conditions for interference of waves, destructive vs constructive

Single slit diffraction

Double slit diffraction

Diffraction grating

"order" number for maxima

In all diffraction cases recognize the dependence on wavelength and size of the obstacle or slit

## **CH 29 & 30 Concepts**

Basic structure and components of the nucleus

Nuclear binding energy and the binding energy per nucleon

Strong force and 4 fundamental forces in nature

isotopes

Radioactive decay processes: alpha, beta, gamma

Half-life and decay constant

neutrino

Natural decay schemes: parent and daughter nuclei

Q value for energy of reaction

Rest mass and rest energy related to the mass defect for reactions

Biologic damage by radiation

Nuclear fission

Nuclear fusion

Basic principles behind a fission reactor

Basic principles behind a fusion reactor

Chain reaction

Magnetic confinement vs inertial confinement  
plasma