

Chapter 18

- 1) What is Coulomb's law?
- 2) The equation  $F = k \frac{|q_1||q_2|}{r^2}$  gives us the *magnitude* of the force between two charges. How do we determine the *direction* of the force? What happens when we have more than two charges acting on each other?
- 3) What is the electric field? Is it a vector or scalar quantity? How do we find the electric field *due to* a particle knowing the force *on* a test particle?
- 4) What is the direction of the E-field due to a positively charged particle? Due to a negatively charged particle?
- 5) What is a parallel plate capacitor? What is the direction of the E-field between its plates? What is the expression for the E-field?
- 6) What does it mean when charge is distributed uniformly on a line/surface/volume? How do we express linear/surface/volume charge densities?
- 7) How are charges distributed in an insulator? How are charges distributed in a conductor? Why?
- 8) What is the electric flux? What is the direction of an area vector? In the equation for the electric flux, what angle do we refer to?
- 9) What is Gauss' law? How do we apply it inside/outside an insulator/conductor? What is a Gaussian surface? How do we use symmetry situations (spherical/cylindrical/planar)?

Chapter 19

- 1) What is the electric potential energy? Is it a vector or a scalar? What does that mean? Why don't we write the charges in absolute value?
- 2) What is the electric potential? Is it a vector or a scalar? What does that mean? (Compare with the E-field.) Why don't we write the charge in absolute value? What is the potential due to a positive/negative charge?
- 3) What is an equipotential surface/line? How are equipotential surfaces and electric field lines "related" to each other?
- 4) How do we get the E-field at a point knowing the potential at that point?
- 5) What is the charge of a capacitor? What is capacitance?
- 6) What are capacitors used for? What do they store? How do they do that?

Chapter 20

- 1) Is the electromotive force a force? What is it? What are its units?
- 2) What is Ohm's law?
- 3) What is current?
- 4) What is resistance? What does resistance depend on? What is resistivity? What is it a property of? How does it change with temperature?
- 5) What is alternating current? How is it different from direct current? How do the voltage and current vary? What is the power in AC? What are the rms values for voltage and current?
- 6) How do resistors "add" in series? In parallel? How do we recognize a series connection? A parallel connection? What is the same in a series connection? In a parallel connection?
- 7) How do we find the equivalent resistance in a "complicated" resistive circuit?
- 8) What is an internal resistance? How do we deal with it?
- 9) What is Kirchhoff's junction rule? Practice applying it!
- 10) What is Kirchhoff's loop rule? Practice applying it! How do we pick the direction for the current through a circuit branch? How do we know if the direction picked was correct?
- 11) How do capacitors "add" in series? In parallel? What is the same in a series capacitor connection? What is the same in a parallel capacitor connection?
- 12) How does a capacitor get charged through a resistor? How does it get discharged? How do we recognize which equation goes with charging or discharging? What is time constant? What are its units?

## Chapter 21

- 1) What are magnetic field lines? What are their directions for a permanent magnet? What are the units for magnetic fields?
- 2) What requirements does a charged particle in a magnetic field have to meet so that a magnetic force acts on it?
- 3) What is the magnetic force on a charged particle? What is its direction? Practice the right hand rule! (Place your fingers in the direction of the velocity, bend fingers in the direction of the B-field, and the thumb will show the direction of the force.)
- 4) What path does a charged particle take in a B-field (think of the e/m lab)?
- 5) What is the force ON a current-carrying wire DUE to an EXTERNAL magnetic field? What is the direction of the force? Practice the right hand rule! (Place your fingers in the direction of the current, bend fingers in the direction of the B-field, and the thumb will show the direction of the force.)
- 6) What happens to a loop of wire in a magnetic field?

- 7) A current-carrying wire PRODUCES a current. What is its direction? Practice the right hand rule! (For a long straight wire: place your thumb in the direction of the current flow, curl your fingers in the direction of the B-field. Remember that the B-field is always TANGENTIAL to the circular path at each point along the path. For a loop: wrap your hand around the loop, with the fingers in the direction of the current flow. Your thumb will show the direction of the B-field INSIDE the loop.)
- 8) What is the B-field DUE to an infinitely long, straight wire?
- 9) What is the B-field at the center of a circular loop? Inside a solenoid?
- 10) What is Ampere's law? How do we apply it? How do we pick the amperian loop? What role does the right hand rule have in this situation?

## Chapter 22

- 1) What is "motional emf?" Know the way it was derived (loop of current in the B-field; a conducting rod moving perpendicularly to the B-field, etc.)
- 2) What is the expression of the magnetic flux? Which vectors is the angle in the equation between?
- 3) What is Faraday's law of electromagnetic induction? Why the minus sign? What can change with time in that equation?
- 4) What is Lenz's law?
- 5) What are the steps in finding the direction for the induced current through a loop in a changing magnetic flux?
- 6) What are mutual inductance and self-inductance?
- 7) What is the emf due to self-inductance?

## Chapter 23

- 1) How does a resistor behave in an AC circuit? What do we know about the voltage and current through a resistor in an AC circuit? How do we draw V and I sinusoidally? As phasors?
- 2) How does a capacitor behave in an AC circuit? What do we know about the voltage and current through a capacitor in an AC circuit? How do we draw V and I sinusoidally? As phasors? What is the capacitive reactance?
- 3) How does an inductor behave in an AC circuit? What do we know about the voltage and current through an inductor in an AC circuit? How do we draw V and I sinusoidally? As phasors? What is the inductive reactance?
- 4) What is the impedance of a series RLC circuit?
- 5) What is resonance? What is the resonant frequency?

## Chapter 24

1) What is polarization of light? Is sunlight polarized or not? What happens to sunlight when it passes through one polarizer? How much of its intensity goes through the polarizer? How much of its intensity passes through a second polarizer tilted at an angle  $\theta$  with respect to the first polarizer?

## Chapter 25

1) What is a real image? What is a virtual image? What is always true of real/virtual images in terms of their orientation?

2) What are the two types of spherical mirrors?

3) What "makes sense" in terms of mirrors? That is, on what side of the mirror *do we expect* to see the object? The image? Then on which side of the mirror are the object distance, image distance, radius, and focal length positive? Negative? Make a table. On which side of the mirror will the image be real? Virtual?

4) What are the 3 main beams that we draw in ray diagrams? Practice drawing them.

5) How do we find images by drawing ray diagrams? Practice them.

6) What is the mirror equation?

7) What is the lateral magnification equation?

## Chapter 26

1) What is the index of refraction?

2) What is Snell's Law?

3) What is total internal reflection? How is it related to the index of refraction? How can we determine the critical angle for total internal reflection?

4) What are the two "basic" types of thin lenses? How many foci do lenses have? Which focus goes with which surface?

5) What "makes sense" in terms of lenses? That is, on what side of the lens *do we expect* to see the object? The image? Then on which side of the lens are the object distance, image distance, radius, and focal length positive? Negative? Make a table. On which side of the lens will the image be real? Virtual?

6) What are the 3 main beams that we draw in ray diagrams? Practice drawing them.

7) How do we find images by drawing ray diagrams? Practice them.

8) What is the thin lens equation?

- 9) What is the lateral magnification equation?
- 10) How do lenses work in combination?
- 11) What is refractive power? How does the human eye work? What are near point and far point? What is nearsightedness? Farsightedness?

## Chapter 27

- 1) What is constructive interference? Destructive interference? What phase difference makes all the difference between constructive and destructive interference?
- 2) What is Young's Interference Experiment? What is its importance? What is the equation for bright fringes? What is the equation for dark fringes? How would you draw a sketch of the intensity of the interference pattern?
- 3) Does the wavelength of light in a medium depend on the index of refraction of the medium? Does the frequency of light in a medium depend on the index of refraction of the medium?
- 4) What is path length difference? Try to understand the three coordinate systems in which one can view a sine wave, and how to go between them.
- 5) Can there be a phase change upon reflection? If yes, what are the conditions and by how much could the phase change? Can there be a phase change upon refraction? If yes, what are the conditions and by how much could the phase change?
- 6) What are the three ways in which the phase difference between two waves can change?
- 7) The thin film interference equations in the textbook are specific for certain situations. You need to be able to derive them for different situations. For thin films, you'll usually have to combine two different phase changes - one due to reflection, and the other due to different path lengths through which the two waves travel. This is the thing that gives students the biggest headache in this chapter.
- 8) What is diffraction?
- 9) What is diffraction by a single slit? What is the equation for the dark fringes? Bright fringes? How do these equations differ from the interference equations?
- 10) What is the intensity in single-slit diffraction? How would you draw a sketch of it?
- 11) What is a diffraction grating? What is the equation for the maxima? Minima?

## Chapter 28

- 1) What is time dilation? Which is the proper time? The dilated time?
- 2) What is length contraction? Which is the proper length? The contracted length?
- 3) What is relativistic momentum? Relativistic energy?

## Chapter 29

- 1) What is the energy of a photon?
- 2) What is the photoelectric effect? What is the equation associated with it?
- 3) What is the magnitude of the photon momentum?
- 4) What is the Compton effect? What is the equation associated with it?
- 5) What is the De Broglie wavelength?
- 6) What is the Heisenberg Uncertainty Principle? What equations are associated with it?

### General Comments

The major concepts this semester have been electricity (Coulomb's law, Gauss' law), magnetism (Ampere's law, induced emf, induced magnetic fields, Faraday's law), circuits, geometrical optics, interference, diffraction, and relativity. This statement is loaded, but it should give you a start in your review.