Review for Midterm Quiz

1- Propagation of Error - You should know the fundamentals of propagating errors in a simple formula.

2- Weighted averages - you should know how to combine experimental results with the concept of weighted averages.

~~3- Millikan Oil Drop Experiment - you should understand the force law on an oil droplet, the concept of terminal velocity, and how one solves a for the velocity dependence of a force depending on velvety F(v).~~

~~4- Franck Hertz experiment - You should know how to determine the excited states of an atoms mercury, potassium, sodium. You should understand S and P states. You should understand basic singlet and triplet spin states. You should remember the energy level for a hydrogen-like atom E = - 13.6eV Z2/n2~~

5- Atomic Spectra - You should understand line spectra and black body spectra, The Wein Displacement Law, the Stephan Boltzmann Law. You should remember that E = hc/λ for a photon E(eV) = 1240nm-ev/ λ(nm) and 1/40 eV = kT at 300^{o}K. Review addition of angular momentum rules for Spin-Orbit Interaction, $\vec{J} = \vec{L} + \vec{S}$ and Spectroscopic notation $^{2S+1}L_J$ e.g. how 2 p-electron states add or the addition of a an s-electron and p-electron. What is the Na doublet?

6- Electron e/m ratio - You should be able to derive the expression for the e/m ratio of an electron traversing a constant magnetic field.

7- Electrons in solids - You should remember the general difference between metals, insulators, and semi-conductors in the energy-band picture of a crystal. You should understand the valence band, conduction band, and energy gap. You should remember the nominal energy gaps for metals, insulators, semi-conductors.

8- Electron charge by semiconductor method - You should remember that in a semiconductor the the flow of current from collector to emitter is given by I = Io (exp(qV/kT) - 1)~Io (exp(qV/kT) at 300^{o}K and how one finds q by measuring I(V). V is the base throttling voltage.

9- Photoelectric Effect - One should understand the the photoelectric equation, that the kinetic energy of an electron ejected when light is shone on a metals surface is KEe = hf - I, where I is the ionization energy of an electron trapped in the conduction band of a metal. If a retarding voltage V is applied to stop the most energetic electrons ejected from the surface we have KE_{max}= eV = hf - W where W is the work function of the metal. You should have some idea about what the values are for metallic work functions and how we determine h in such an experiment.

10- LEDs and finding h - You should remember that an LED is a PN junction diode that emits light according to U = hf where U is the annihilation energy of p and n charge carriers in the depletion zone. You should understand the simple picture of forward and reversed biasing of diodes. and the depletion region of a reverse biased diode. If the diode is forward biased with a voltage V the U = eV.

11- Hall Effect - You should understand the Hall effect and how it is used to determine the charge density of carries in a metal or semi-conductor. How is the Hall equation derived?

12- Electron Spin resonance - You should remember the energy of a dipole in a magnetic field U = -u*B. You should understand the resonance flipping condition for a free electron spins in a crossed magnetic and RF E&M fields, hf = g μ_B B. *Y*ou should understand how the g-factor is determined.
flipped and used to image slices with a DC and trim field.

13 - Demonstration of the Stephan Boltzmann Law - you should remember the Stephan-Boltzmann Law that E = ε σ T^4, and how we used the resistance- temperature relation and radiometer to confirm the power law. You should have some understanding of the emissivity ε of a surface varying from perfect reflector (ε =0) to black body radiator (ε =1). You should understand that the intensity of radiation on a surface drops off as 1/distance^2 .