EMSE314--Fall 2003--Homework 3--Name: Changrong Li
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Problem 1

(b) $K.E. = h\nu - E^B - \phi$

Note: analyzing the kinetic energy of photoelectron provide important information about the atom in the substrate. FYI, an important analysis technique called XPS (X-ray Photoelectron Spectroscopy) was developed based on the photoelectric effect.

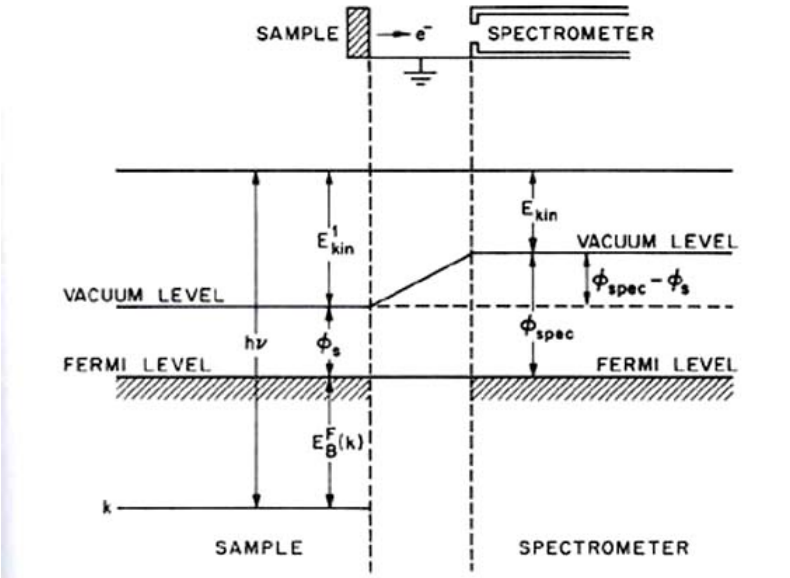

Figure 4-1 Schematic of the relevant energy levels for binding energy measurements. Note that the conducting specimen and spectrometer housing are in electrical contact and thus have common Fermi levels. The incoming photons, energy $h\nu$, create an electron of kinetic energy E'_{kin} relative to the vacuum level of the sample. The electron is detected by a spectrometer with a work function ϕ_{spec} so that the measured energy $E_{kin} = E'_{kin} - (\phi_{spec} - \phi_s)$.

(http://vulcan2.cwru.edu/classes/emse515/ is a good start)

Problem 2--"particle in a box"

- If $x \geq L$ or $x \leq 0$, $\psi(x) = 0$ since $V(x) = \infty$ but E can't be infinite. Because of this result and that wave function must be a continuous function, we have those boundary condition.
- From the condition that "the total probability of finding the particle is one', we can calculate constant *A*.
- *En* is a direct result of Schrödinger equation.
- Here the width of well is *L*, not *a* as shown in the textbook. The objective is to find out if you really read the textbook and think a little bit. It won't help if you just copy something from the text.
- "*Mathematical Methods for Physicists*" is a good reference.

Problem 3--"Heisenberg uncertainty principle"

$$E = h\nu = hc/\lambda \Rightarrow \Delta E = -\frac{h}{c\lambda^2}\Delta\lambda \quad (\text{not } \Delta E = hc/\Delta\lambda)$$

Finally, if you are interested in quantum mechanics, I recommend several papers. They are available at "*Reviews of Modern Physics* – March 1999(Volume 71, Issue 2)", or http://prola.aps.org/toc/RMP/v71/i2.