CHEM 260

Assignment 2

Due Monday 20th January 2003

4. The work function of silver is 4.6 eV. Calculate the kinetic energy of electrons emitted from a silver surface when it is irradiated with UV radiation with a wavelength of 212 nm.

5. In a photoelectron spectrometer a sample of Krypton gas is irradiated with monochromatic light of wavelength 584.33 Å. Electrons are detected with kinetic energy 7.22 eV. What is the ionization energy of Krypton? Give your answer in both eV and kJ mol^{-1}.

6. The ionization energy of Cs atoms in the gas phase is 3.89 eV. What is the wavelength (in nm) of light used to ionize Cs, if the ejected electrons have velocity 1.5 x 10^6 m/s?

7. The data below show how the kinetic energy of ejected electrons depends on the wavelength of the incident radiation for the photoelectron effect for lithium metal.

λ(nm)	100	200	300	400	500
kinetic energy (eV)	10.1	3.94	1.88	0.842	0.222

   Plot these data in an appropriate fashion to obtain Planck's constant h and the work function (ionization energy) for lithium metal.

8. Low Energy Electron Diffraction is a modern tool for surface analysis.[‡] Typical electron energies used are 10-200 eV. Why? (Calculate the electron wavelengths corresponding to these energies and compare with typical atomic spacings in crystals.)

9. Neutron Diffraction is another important tool in material science. Suppose you want to use it to study a crystal with atomic spacings of about 3 Å. What energy of neutrons would be required? (Simply calculate the energy of a neutron with this de Broglie wavelength.) Quote your answer in units of eV and J. Compare with the quantity ½kT, where $T = 300$ K. [#]

[‡] See http://www.uksaf.org/tech/leed.html for more information.

[#] Neutrons beams are created with high energies at nuclear reactors and particle accelerators. They must be thermalized before they are useful for diffraction experiments. See http://neutron.nrc-cnrc.gc.ca/brock.html