min λ determines

lowest E_{photon} to kick out e^-

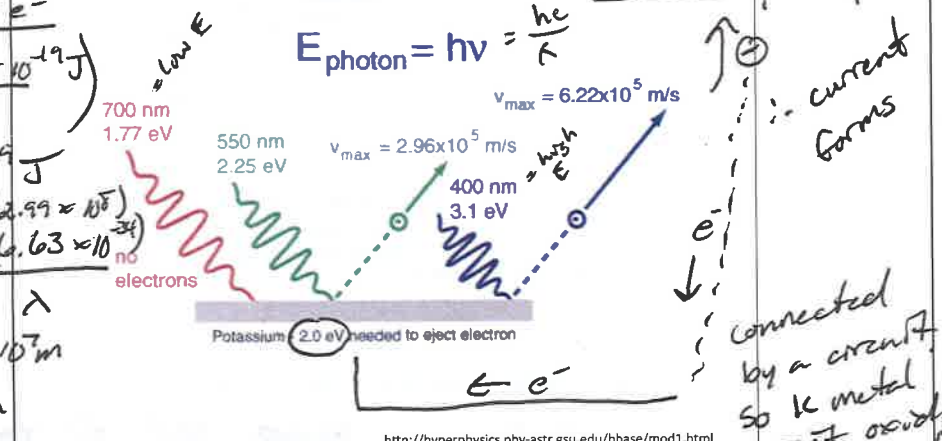
$2.0\ eV\left(\frac{1.6\times10^{-19}\ J}{1\ eV}\right) = 3.20\times10^{-19}\ J$

$3.2\times10^{-19}\ J = \frac{(2.99\times10^{8})(6.63\times10^{-34})}{\lambda}$

$\lambda = 6.18\times10^{-7}\ m = 618\ nm$

Photoelectric Effect

$E_{photon} = h\nu = \frac{hc}{\lambda}$



collected by (+) charged plate

∴ current forms

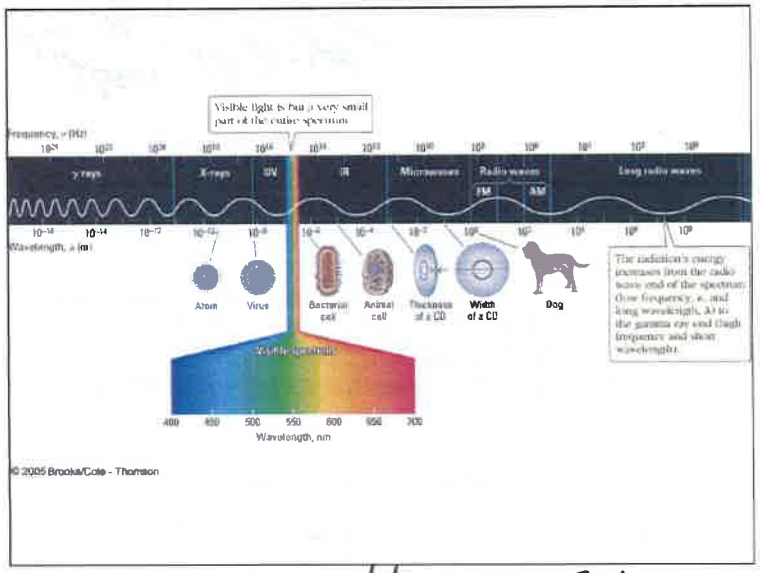
connected by a circuit so Ik metal isn't oxidized (ionized)

Overview of Useful Unit Conversions

$1\ eV = 1.602\times10^{-19}\ J$

$1\ eV = 9.648\times10^{4}\ J\ mol^{-1}$

$10\ eV = 9.648\times10^{5}\ J\ mol^{-1} = 0.9648\ MJ\ mol^{-1}$



· use x-rays in lab, enough E to kick out valence & core e^-

Overview of Photoelectron Spectroscopy

- Bombard an element or a molecule with high energy electromagnetic radiation of known wavelength ($E_{photon} = h\nu = hc/\lambda$)
  - UV light
  - X-ray light
- Measure the kinetic energy (E_k) of the electrons ejected from the element or molecule
  - Measurement devices are used that direct the negatively charged electron through a magnetic field to determine its kinetic energy
- Determine the binding energy (E_b) of the ejected electron using the principle of conservation of energy.
  - $E_k = h\nu - E_b$
- The values of binding energy found reveal information about the elements present and the orbitals from which the electrons were ejected
  - Lower binding energies are seen for valence electrons, higher binding energies are seen for core electrons
  - For molecules, correlation tables are available to identify the atomic composition of a molecule based on the binding energies of the photoelectrons observed

Binding E (E_b)

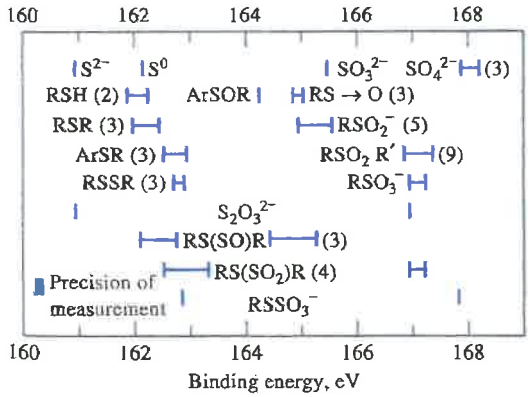
$E_k = h\nu - E_b$

Ic metre (measured) photon E (E_{phot})

E_b = amount E required to kick out e^-

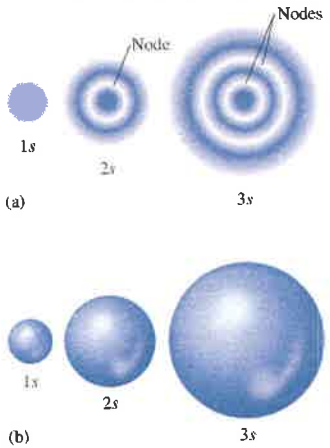
= core e^- = ↑ binding Energy ↓ e^- Energy

Sulfur 2p Binding Energies

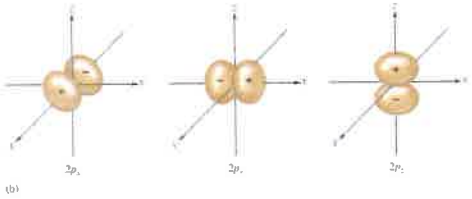


Skoog, Holler, Crouch, "Principles of Instrumental Analysis," 6th Ed. p 597.

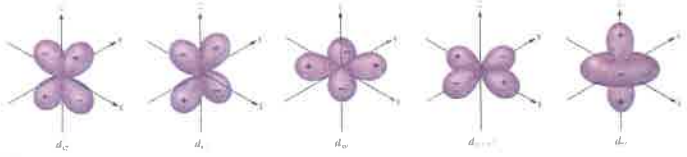
s-orbitals (l = 0)



p-orbitals (l = 1)



d-orbitals (l = 2)



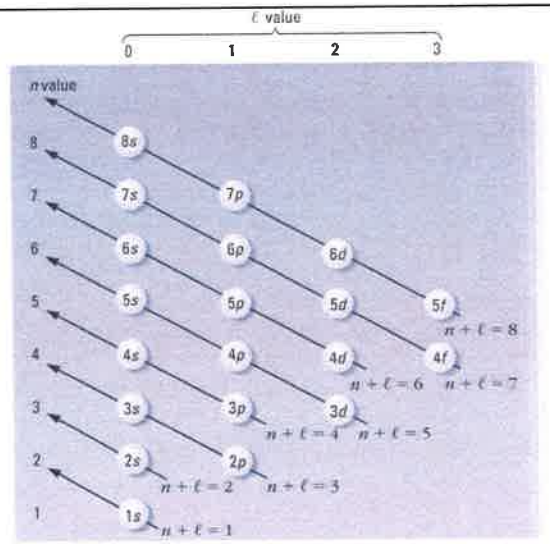


Fig. 7-15, p.300