

Chem E-1a
Friday Review Problems
Chapter 7: The Electronic Structure of Atoms

1. Light having a wavelength of 2.50×10^{-7} m strikes the surface of a piece of chromium metal, causing electrons with a *minimum* deBroglie wavelength of 1.80×10^{-9} m to be emitted from the surface of the metal via the photoelectric effect. Determine the photoelectric binding energy of chromium metal.
(Note: Mass of an electron = 9.109×10^{-31} kg)

2. A hydrogen atom in an excited state has its electron in a $4p_x$ orbital.
- a) The excited electron undergoes a transition into a $2s$ orbital. Calculate the energy *and* the wavelength of light emitted by this process.
- b) Calculate the energy required to completely remove the electron from a ground-state hydrogen atom.

3. For each of the orbitals in parts (a) through (d):

- i) Provide the n and l quantum numbers.
- ii) List all the orbitals in the subshell which share the same n and l quantum numbers.
- iii) Indicate the total number of nodes, the number of radial nodes, and the number of angular nodes in the orbital. Describe the location/orientation of each angular node with respect to the x , y , and z axes.
- iv) Draw the shape of the orbital with respect to the Cartesian axes, and clearly indicate the location of all nodes.

a) 3s

b) $2p_z$

3. (cont.)

c) $4d_{yz}$

d) $3d_{z^2}$

4. Write the ground-state electron configuration for the following atoms, and determine the number of unpaired electrons in each atom. (Use the noble gas abbreviations.)

a) N

b) Mg

c) Fe

d) Br

e) Pb