**PHOTOELECTRON SPECTROSCOPY**

**INTERACTIVE PERIODIC TABLE ANALYSIS**

**NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* What is photoelectron spectroscopy? How is it related to the photoelectric effect?
* How do PES ionization energies differ from successive ionization energies?

***Open the interactive PES periodic table (Relative number of electrons vs. Energy – Megajoules)*** (<http://www.chem.arizona.edu/chemt/Flash/photoelectron.html>).

* Compare and contrast the PES graphs for Hydrogen and Helium. Explain how to determine the total number of electrons for each atom from the graph. Explain why both electrons in the Helium atom have the same ionization energy (how does this compare to successive ionization energies). Explain the different ionization energies for each atom.
* Compare and contrast the PES graphs for Hydrogen and Lithium. Explain how to determine the total number of electrons from the graph. Explain the different energies for the electrons within the Lithium atom. Explain the different energies for the outer shell electrons in Hydrogen and Lithium.
* Compare and contrast the PES graphs for Helium and Lithium. Explain the energy differences for the 1s electrons of each atom.
* Compare and contrast the PES graphs for Beryllium and Boron. How many outer shell electrons in the Boron atom? Explain the ionization energy differences for the outer electrons in the Boron atom. How does this support the idea of modern quantum theory as opposed to the Bohr atomic model? Explain the ionization energy differences for the outer electrons of Boron and Beryllium.
* Compare and contrast the PES graphs for Lithium and Potassium. Explain the different ionization energies for the outermost electron in each. Explain the energy differences for the 1s electrons in each.
* Compare and contrast the PES graphs for Aluminum and Argon. Explain the energy differences for the outer s and p electrons within the Argon atom. Explain the energy differences for the outer s sublevel electrons in each atom. Explain the energy differences for the outer p sublevel electrons in each atom.
* Compare and contrast the PES graphs for Calcium and Scandium. How many outer electrons are in each atom? Explain the energy differences for the 4s and 3d electrons in scandium. Explain how this information supports the multiple oxidation numbers for many of the transition metals.
* What generalizations can be made about PES energies and shielding among different atoms? Among electrons within the same atom (multiple energy levels)?
* What generalizations can be made about PES energies and effective nuclear charge among different atoms? Among electrons within the same atom (multiple energy levels)?
* What generalizations can be made about PES energies among s and p electrons of the same principle energy level (same atom)? How does this relate to the Aufbau Principle?