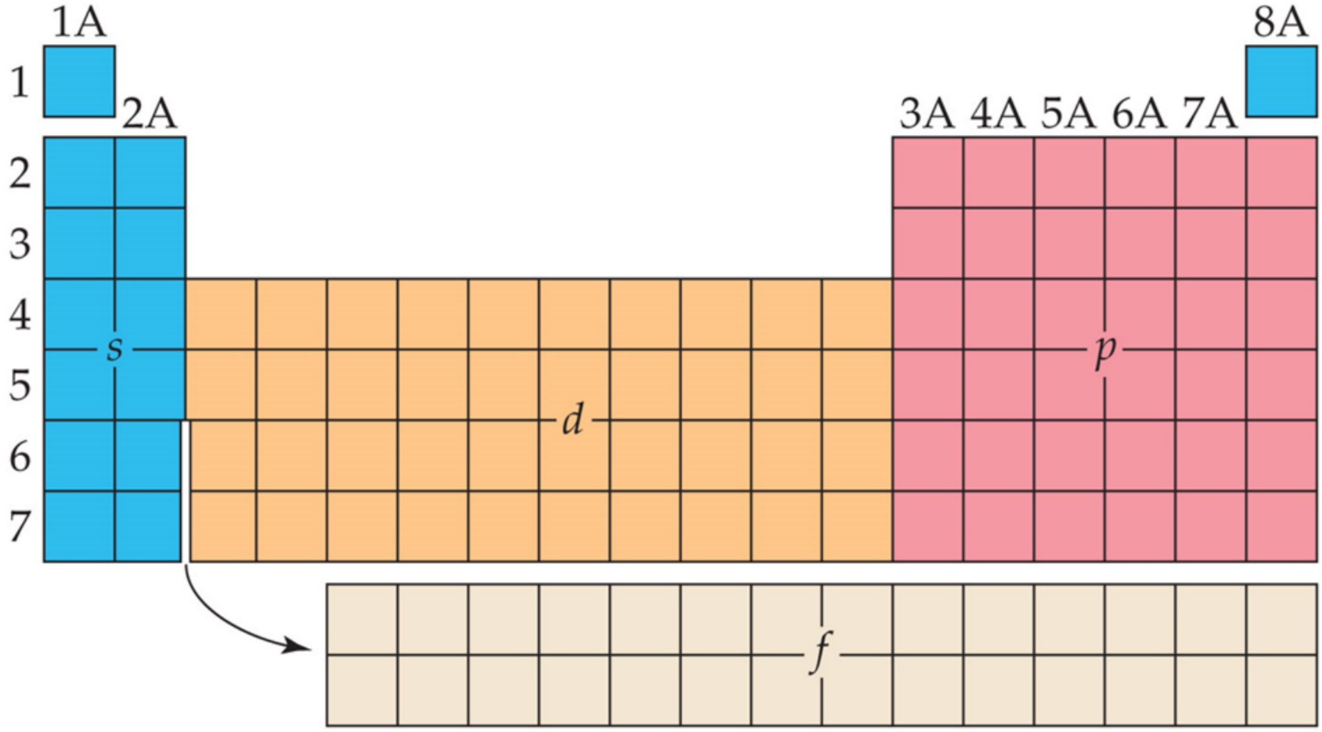
Lesson Overview
Electron Configurations

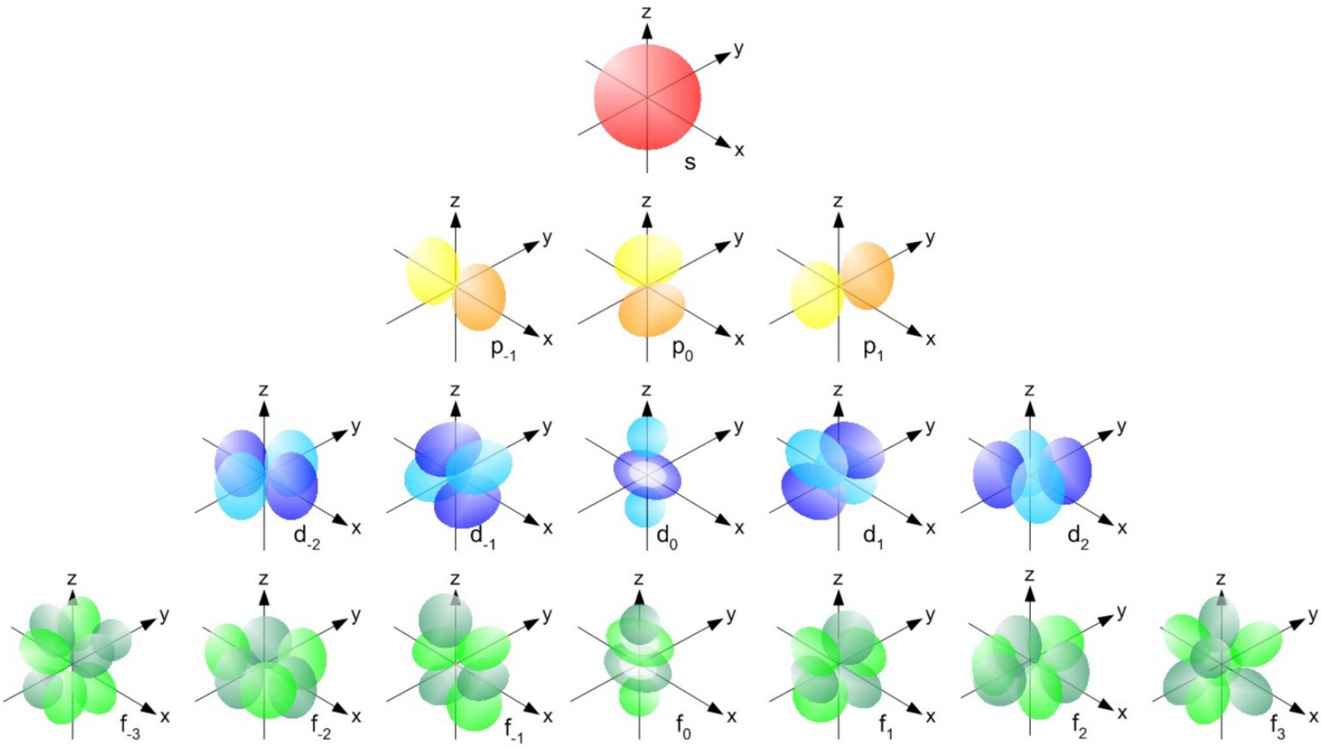
Objective: The student will be able to (1) derive electron configurations for neutral elements and (2) discuss the experiments used to validate these arrangements.

Lesson Outline:
I. Orbital Shapes (Review)
II. Electron Configurations
III. Photoelectron Spectroscopy

Electron Arrangement & The Periodic Table



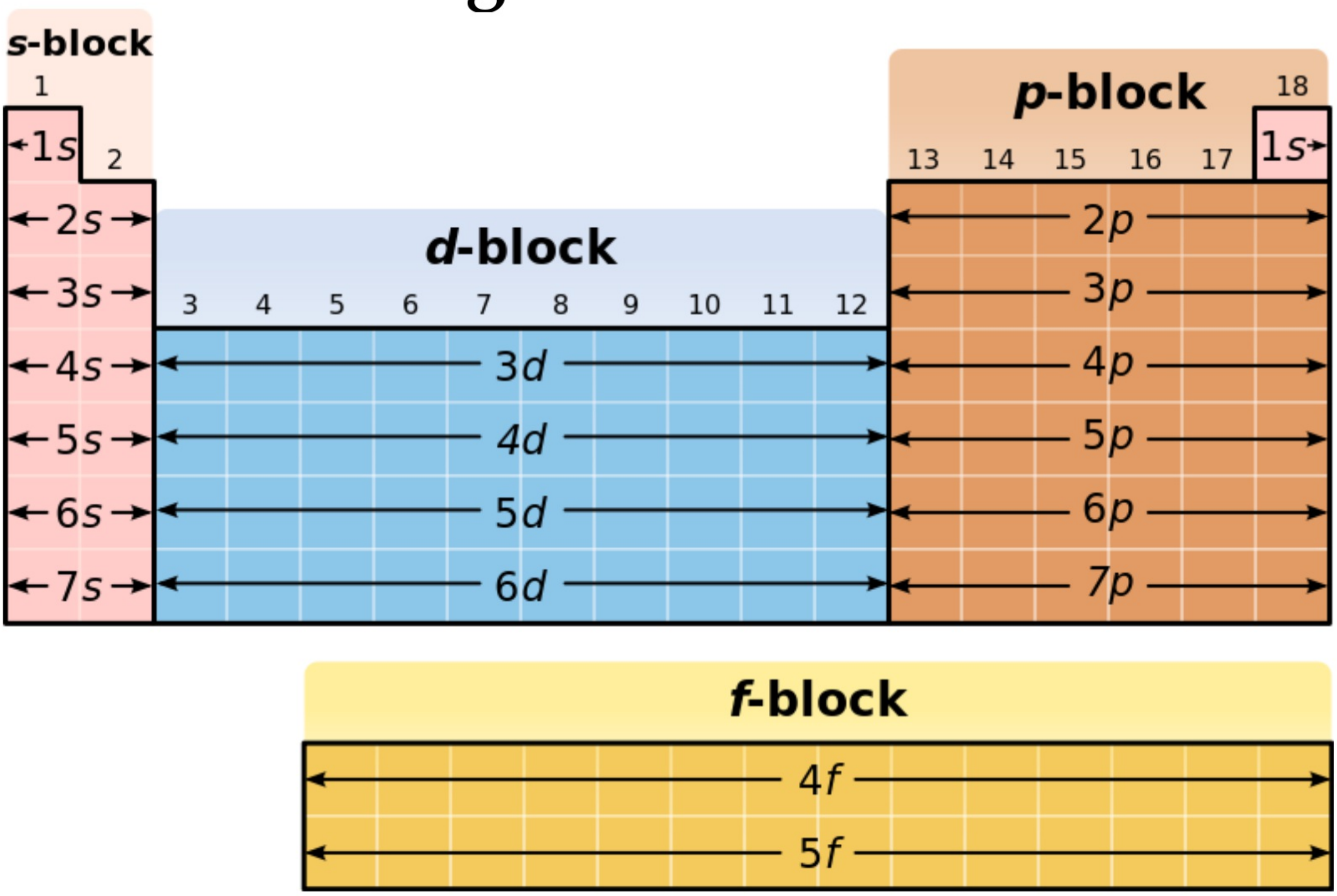
Orbital Shapes



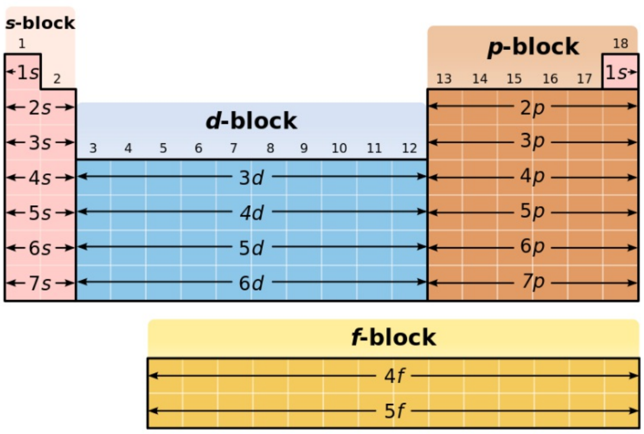
Electron Configurations

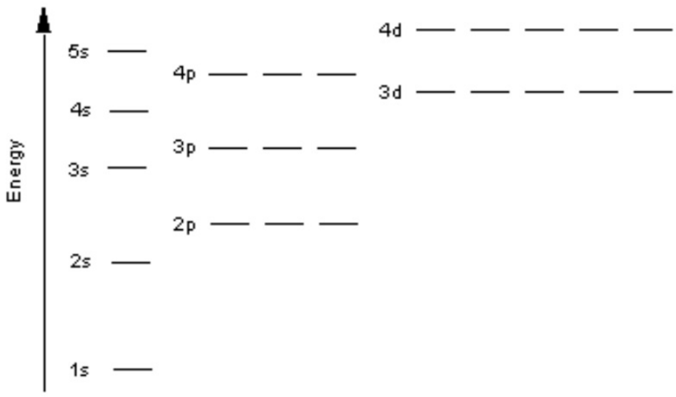
Element	Total Electrons	Orbital Diagram 1s	2s	2p			3s	Electron Configuration
Li	3	↑↓	↑					$1s^2 2s^1$
Be	4	↑↓	↑↓					$1s^2 2s^2$
B	5	↑↓	↑↓	↑				$1s^2 2s^2 2p^1$
C	6	↑↓	↑↓	↑	↑			$1s^2 2s^2 2p^2$
N	7	↑↓	↑↓	↑	↑	↑		$1s^2 2s^2 2p^3$
Ne	10	↑↓	↑↓	↑↓	↑↓	↑↓		$1s^2 2s^2 2p^6$
Na	11	↑↓	↑↓	↑↓	↑↓	↑↓	↑	$1s^2 2s^2 2p^6 3s^1$

Reading the Periodic Table



Cross - Comparison

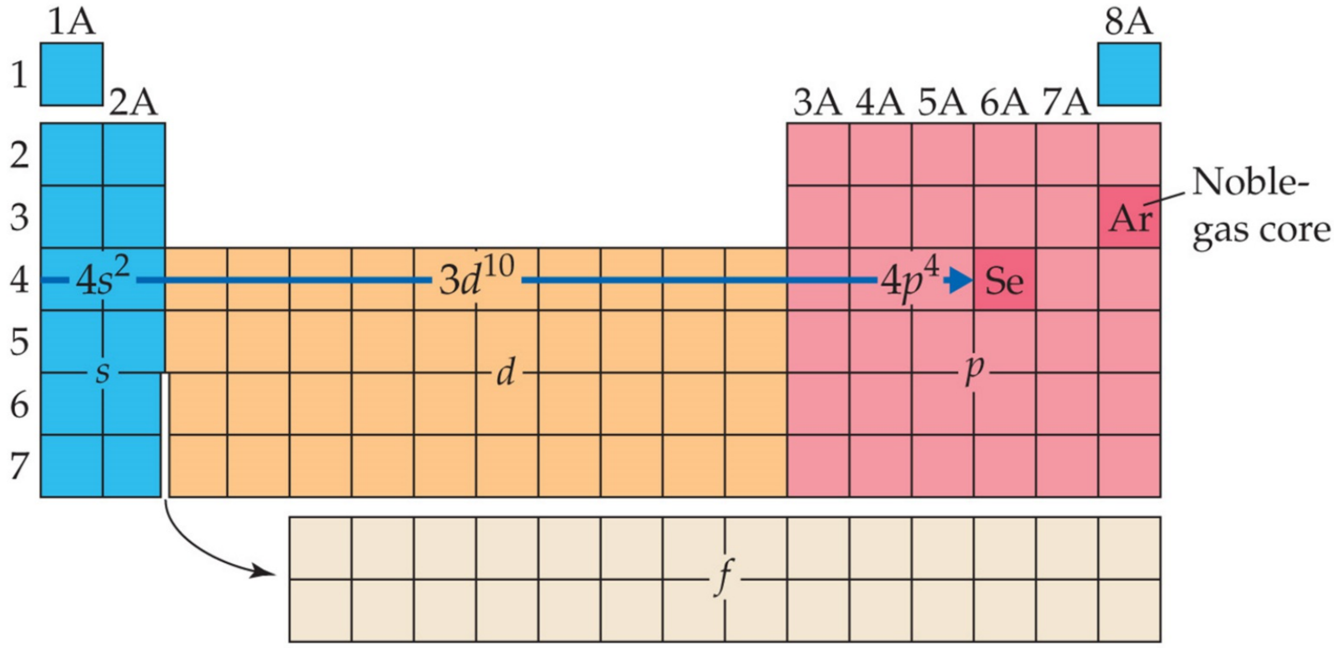




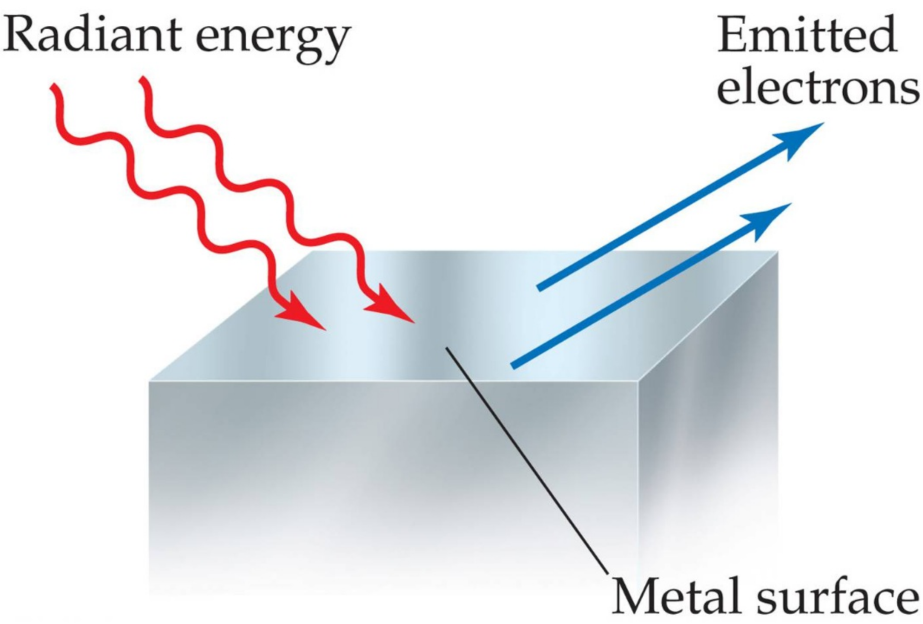
Energy level diagrams are not expected to be memorized.

Know how to "read" the periodic table.

Electron Configuration for Selenium



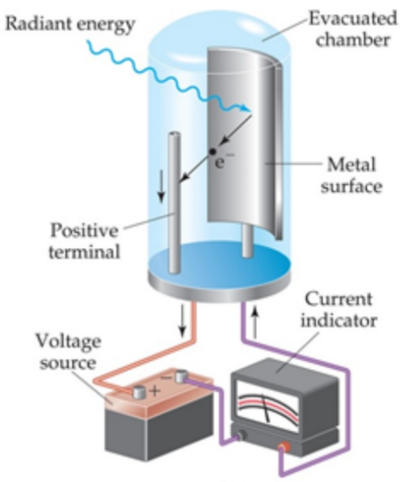
The Photoelectric Effect



Photoelectron Spectroscopy
(PES)

Remember that in Chemistry, spectroscopy is a technique that is used to detect what type, and/or what amount, of a chemical substance might be in a chemical sample.

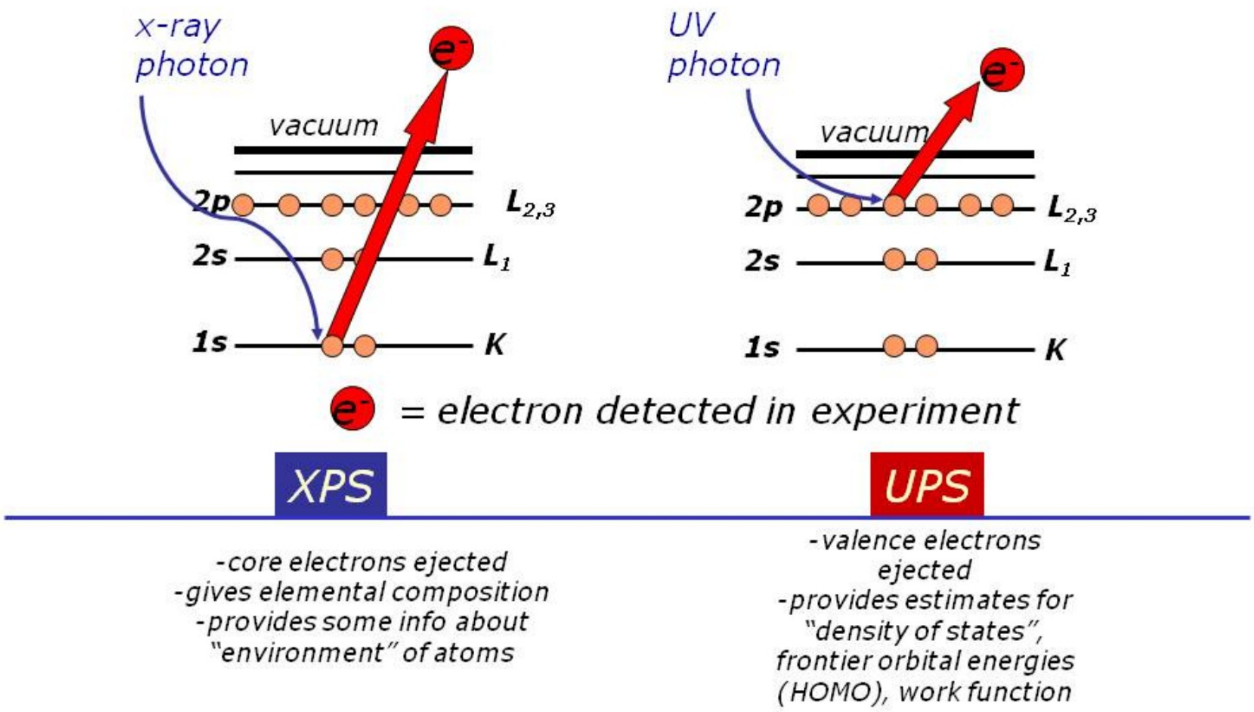
PES uses the principals of the photoelectric effect to determine the number of electrons and where they are located in the electronic cloud.



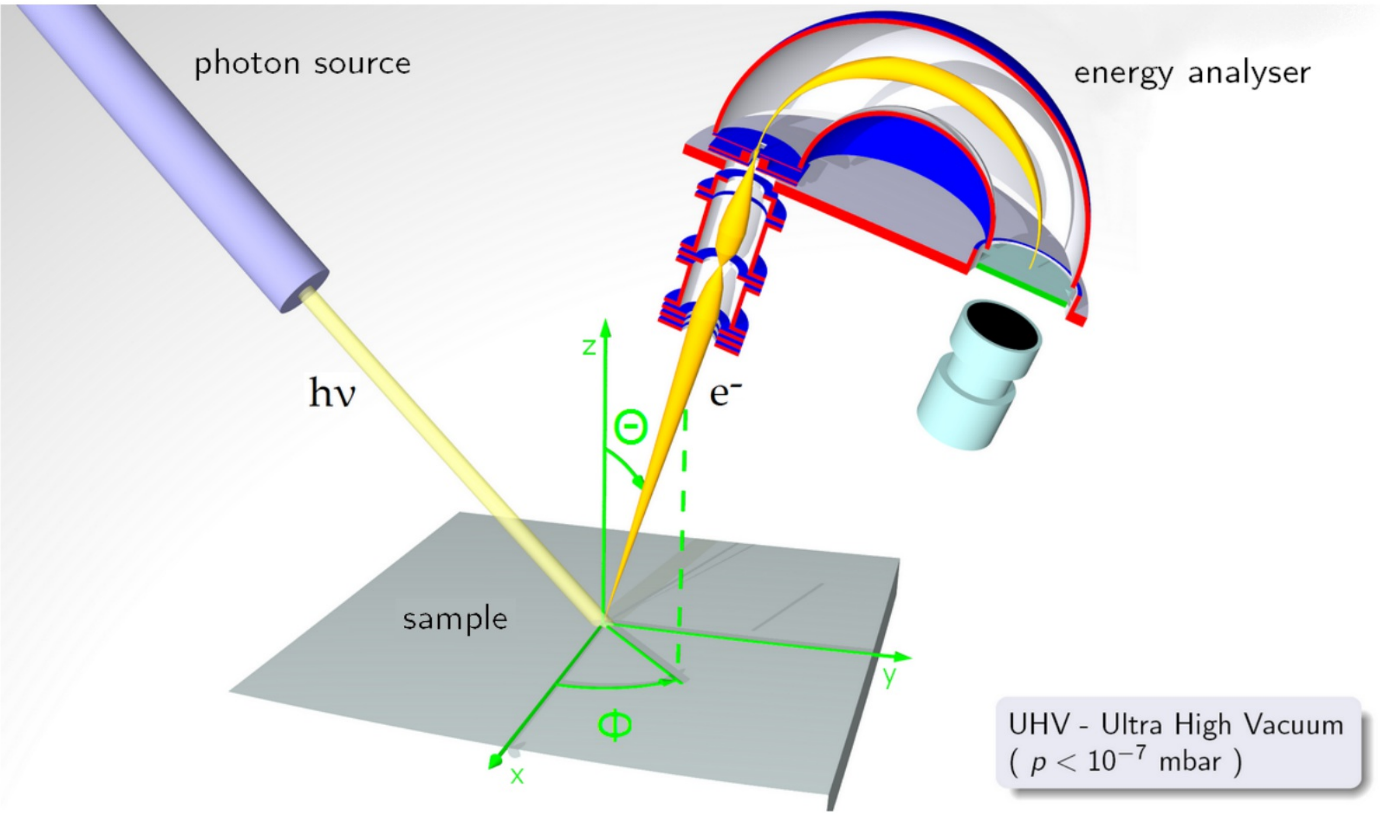
PES is the literal photographic evidence for electron configurations!

Types of PES

The electron of study can be selected by changing the type of electromagnetic radiation.

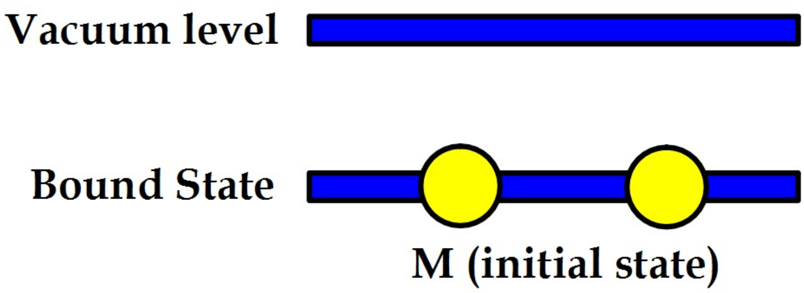


Photoelectron Spectrometer



Photoelectron Spectrometer
The Process

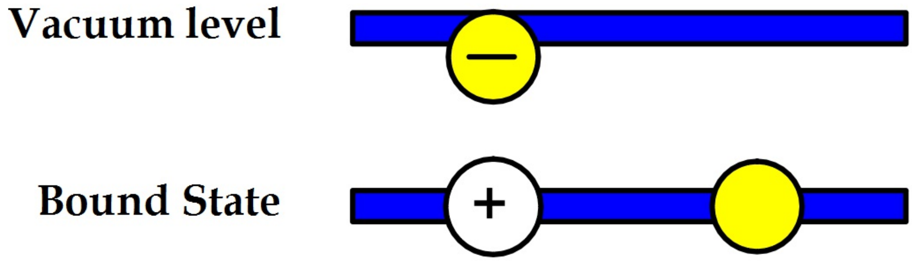
Step 1:
Initially, two electrons are bound to the molecule (or atom, represented by the letter "M"). This is called the initial state.



Photoelectron Spectrometer
The Process

Step 2:

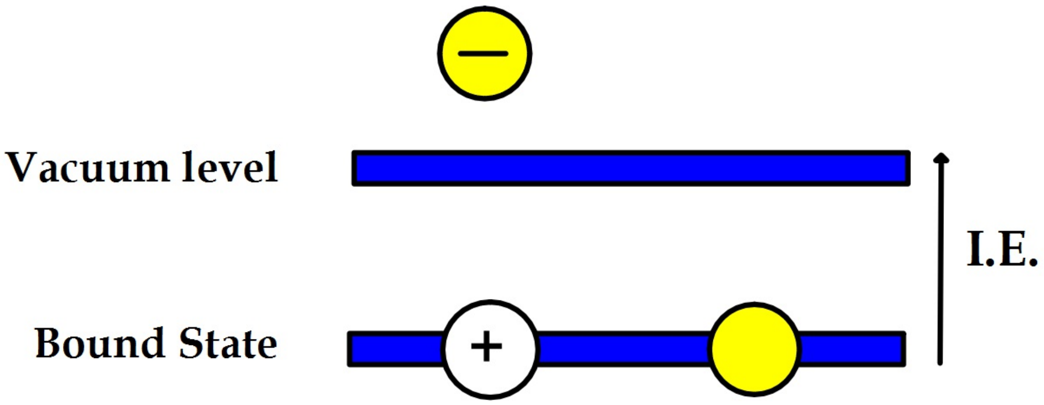
After energy strikes the metal surface, an electron moves to the next level, called the vacuum level. Given that the electron has left a "hole" in the molecule, there is now a plus charge on the molecule.



Photoelectron Spectrometer
The Process

Step 3:

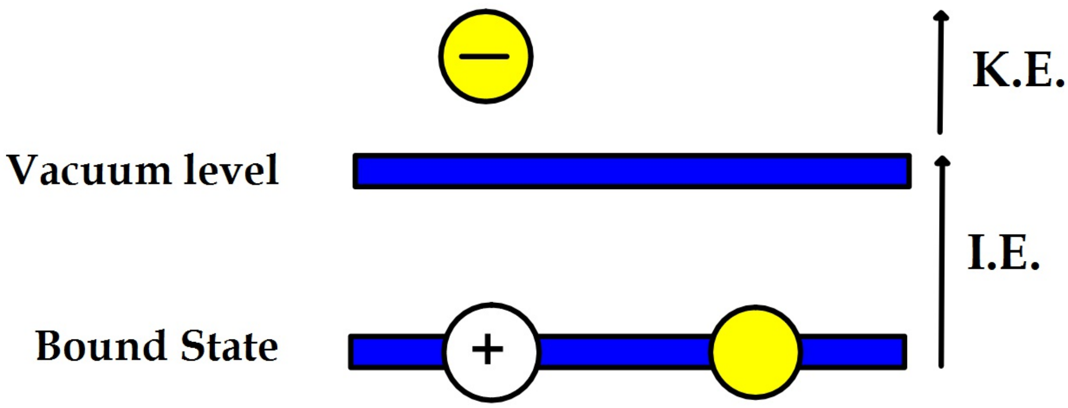
The energy required to move the electron from the bound state to the vacuum level is known as the ionization energy (I.E.). It is possible, as is shown here, for the electron to move past the vacuum level.



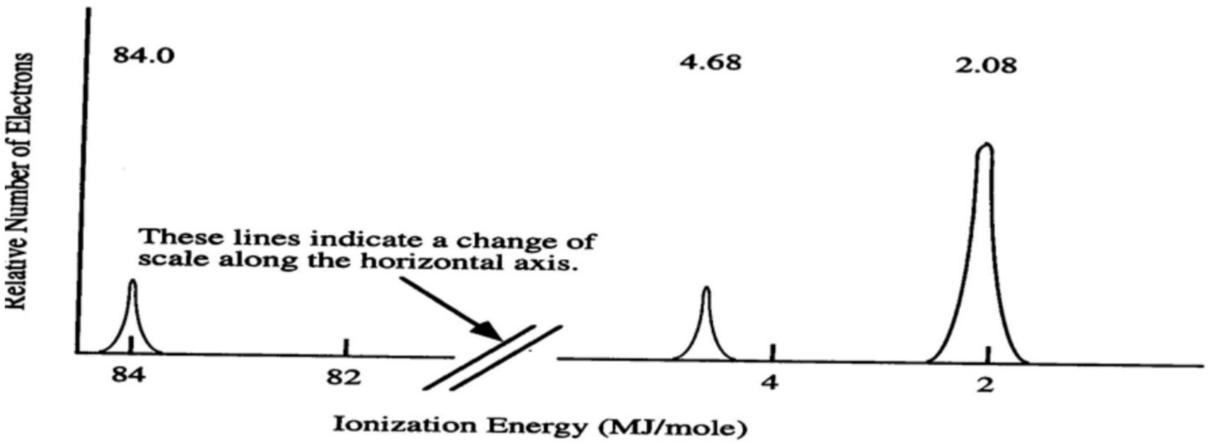
Photoelectron Spectrometer
The Process

Step 4:

Assuming that the electron does move past the vacuum level, the extra energy is in the formed of kinetic energy (K.E.). The metal is now M+ (a positively-charged metal, or atom) plus an ionized, or free, electron.



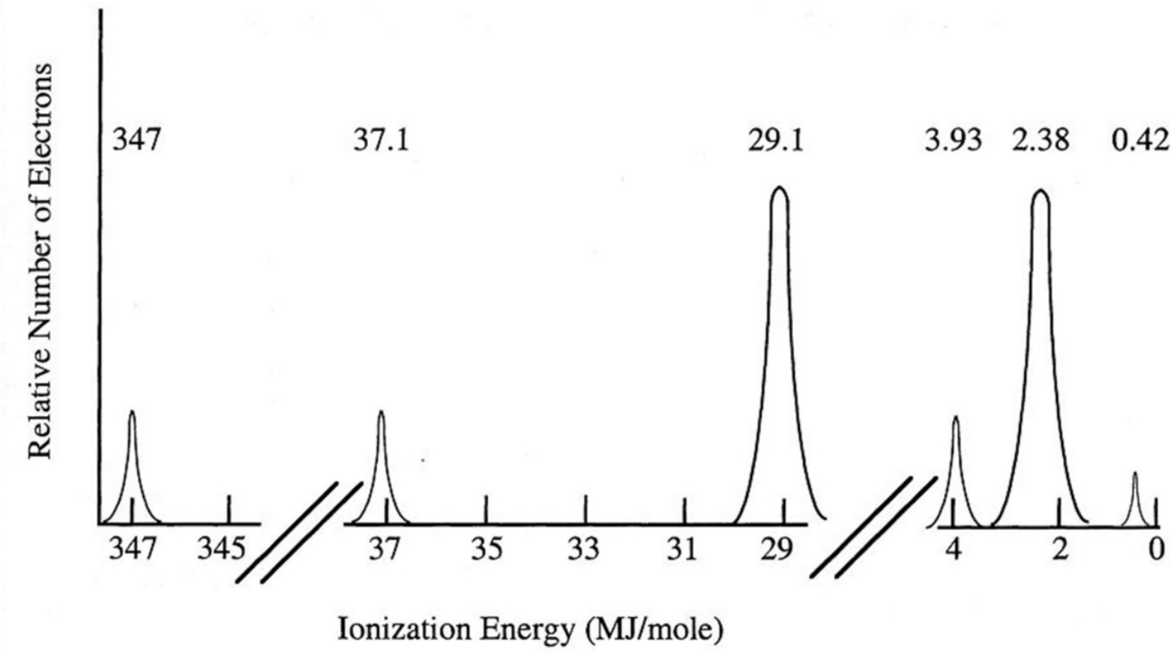
Example #1



If there are peaks to the left of the peak of interest, then you must assume that sublevel is complete.

discuss x and y axis labeling, numbering

Example #2



Determine the electron configuration and identity.