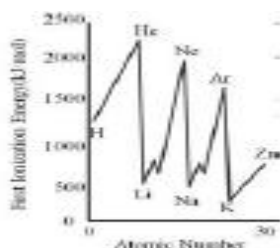


Atomic structure -2

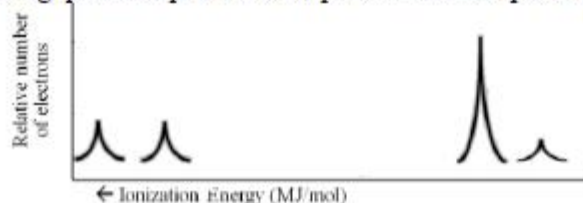
Atomic Theory II Worksheet

- 1) Which colour of light has the highest frequency: red or green?
- 2) Which colour of light has the longest wavelength: green or violet?
- 3) Hydrogen emits light with a wavelength of 410 nm. Find the frequency of this light
- 4) A radio station broadcasts at a frequency of 1310 kHz. What is the wavelength of this radio signal in nm?
- 5) Use two analogies to describe quantized change.
- 6) Use two analogies to describe continuous change.
- 7) Can prolonged exposure to highly intense infrared light cause electrons to be ejected from a clean metal surface? Explain.
- 8) Explain how Einstein was able to use experimental evidence related to the photoelectric effect to conclude that quantized energy must be contained by individual particles.
- 9) The following questions pertain to the element potassium.
 - a. Write the equation for the first ionization of potassium.
 - b. Draw the shell model that represents the potassium atom.
 - c. Identify the electron that has the lowest ionization energy in the shell model that you drew.
 - d. Use Coulomb's Law to explain why this electron has the lowest ionization energy.
 - e. Use the 'shielding effect' to explain why this electron has the lowest ionization energy.
- 10) Why is the first ionization energy for lithium less than that of neon? (Discuss both atoms in your response.)



- 11) The following questions pertain to the element aluminum.
- Draw a photoelectron spectrum for aluminum, which includes all of the peaks but does not include exact ionization energies.
 - Label each peak with numbers and letters that indicate its associated shell and subshell.
 - Indicate the number of electrons that are contained within each sublevel on your photoelectron spectrum for aluminum.
 - Which subshell contains the electron with the lowest ionization energy? Justify your answer.

- 12) The following questions pertain to the photoelectronic spectrum below.



- Identify the element that would produce the above spectrum.
 - Label each peak with numbers and letters that indicate its associated shell and subshell.
 - Indicate the number of electrons that are contained within each sublevel on the photoelectron spectrum.
 - Which subshell contains the highest energy electron(s)? Justify your answer.
 - Which subshell contains the lowest energy electron(s)? Justify your answer.
- 13) Photoelectron spectrometry (PES) data indicates that the ionization energy for an electron in the 2s orbital of calcium is 42.7 MJ/mol and the ionization energy for an electron in the 3s orbital of calcium is only 4.65 MJ/mol. Provide an explanation that accounts for this data.
- 14) Describe the modifications to the Bohr model that are required due to the experimental PES data that was provided in the lecture.