Unit 2 Review Questions

1. Write full electron configurations for these ions:
   a. \( \text{Li}^+ \)
   b. \( \text{N}^{3-} \)
   c. \( \text{Sn}^{2+} \)
   d. \( \text{S}^2- \)

2. Identify the following atoms and write the Noble gas configurations for each.
   a. \( 1s^22s^2 \)
   b. \( 1s^22s^22p^63s^23p^5 \)

3. How does the size of an atom change when the atom is converted to (a) an anion and (b) a cation? Draw examples to help explain your answer.

4. On the basis of their position in the periodic table, select the atom with the larger radius in each of the following pairs:
   a. Na, Cs
   b. Be, Ba
   c. N, Sb

5. Explain which of these ions is larger and why, \( \text{K}^+ \) or \( \text{Ca}^{2+} \)? What about \( \text{Ca}^{2+} \) and \( \text{Ba}^{2+} \)?

6. List these ions in increasing ionic radius: \( \text{N}^{3-}, \text{Na}^+, \text{F}^-, \text{Mg}^{2+}, \text{O}^{2-} \)

7. Explain the term electron affinity and explain the trend within groups and periods.

8. Arrange the elements in each of these groups in order of increasing electron affinity:
   a. Li, Na, K
   b. F, Cl, Br, I

9. What is ionization energy and explain the trends on the periodic table.
10. How is an orbital different from an orbit? Explain.

11. Explain the difference among the terms energy level, subshell, and orbital.

12. Compare and contrast 1s and 2s orbitals. Compare and contrast 2s and 2p orbitals.

13. In going across a row of the periodic table, protons and electrons are being added and atomic radius generally decreases (fluorine is smaller than lithium, for example). In going down a column of the periodic table, protons and electrons are also being added, but the atomic radius generally increases (iodine is larger than fluorine, for example). Explain why this is true.

14. How is the electron cloud model of the atom fundamentally different from the Bohr model?

15. Define the following rules used when filling electron orbitals
   a. Aufbau Principle
   b. Hund’s Rule
   c. Pauli’s Exclusion Principle
**Answers:**

1.
   a. \(1s^2\)
   b. \(1s^22s^22p^6\)
   c. \([\text{Kr}]\ 5s^24d^{10}\)
   d. \(1s^22s^22p^63s^23p^6\)

2.
   a. Be \([\text{He}]\ 2s^2\)
   b. Cl \([\text{Ne}]\ 3s^23p^5\)

3. Anion gets bigger (drawing shows electrons being added to outer level),
   Cation gets smaller (drawing shows electrons removed from outer level)

4. Cs, Ba, Sb

5. \(K^+\) is larger since it has less protons than \(Ca^{2+}\) (has same number of electrons)
   \(Ba^{2+}\) is larger since it is farther down the periodic table (has energy levels)

6. 

7. Electron Affinity is the ability for atoms to gain an electron. It increases as you go left to right
   across a period and from bottom to top in a group. **F is the highest.**

8. a) K, Na, Li
   b) I, Br, Cl, F
9. It is the energy needed to remove an electron from an atom. It increases as you go bottom to top and from left to right across a period. **F is the highest**

10. An orbital is a probability “cloud” and is 3 dimensional. An orbit is a ring around a nucleus and is 2-dimensional. Locations of electrons in orbits are predictable and while electron locations in orbitals are *not* predictable.

11. Energy level can be broken down into orbitals with different shapes. The higher the energy level the more orbitals available. A subshell is a piece of an orbital.

12. 1s and 2s – Both are spherical in shape but are on different energy levels (2s is higher)

   2s and 2p – Are on the same energy level but have different shapes

13. Get smaller as you go across because there is an effective nuclear charge that is increasing on the electrons pulling the electron in. It gets bigger as you go down the periodic table because the outer electrons are shielded from the nucleus by inner electrons.

14. Electron cloud model contains unpredictable *orbitals* that are 3-dimensional while the Bohr model has predictable *orbits* that are 2-dimensional.

15. **Aufbau Principle** – Fill lowest energy level and subshell first. Fill left to right, top to bottom

    **Hund’s Rule** – One electron in a subshell before adding second electron (orbital boxes and arrows)

    **Pauli’s Exclusion Principle** – 2 electrons max in a subshell (electron pairs, orientations) and occupy different spaces in the orbital.