

Chemistry Review – ANSWER KEY  
Electronic Nature of the Atom and Periodic Trends

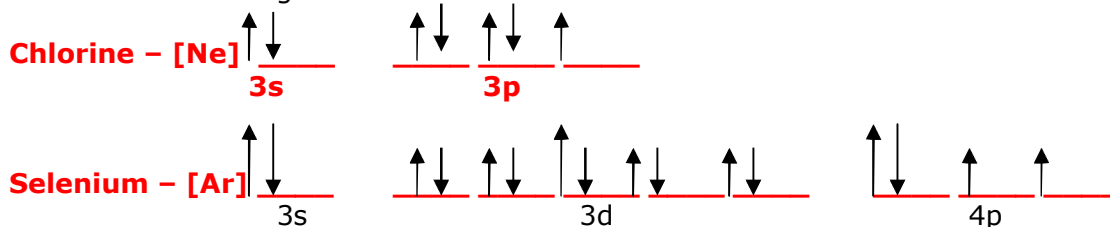
Answer the following:

- Consider  $n = 4$  principal energy level
  - What is the # of subshells in this energy level? **16**
  - What is the total # of orbitals in  $n = 4$  E.L.? **4 orbitals (s, p, d, f)**
- Quantum numbers – give the set of four QN for each electron in the 3s orbital in a sodium atom.  
**There is one electron in the 3s orbital in a sodium atom. For the one electron, the QN would be 3, 0, 0, +1/2**

- Give the electron configuration for a chlorine atom. Do the same for selenium atom. (Use the noble gas shortcut).

**Chlorine – [Ne] 3s<sup>2</sup> 3p<sup>5</sup>**  
**Selenium – [Ar] 4s<sup>2</sup> 3d<sup>10</sup> 4p<sup>4</sup>**

- Draw the orbital diagrams for each atom in # 3.



- For each pair choose the smaller atom or ion:

- Cu atom or Cu<sup>2+</sup> ion **Cu<sup>2+</sup> ion**
- Se atom or Se<sup>2-</sup> ion **Se atom**
- Cu<sup>+</sup> ion or Cu<sup>2+</sup> ion **Cu<sup>2+</sup> ion**

- Use only the periodic table, arrange these atoms in order of increasing first ionization energy: Al, Ar, Cl, Na, K, Si

**K Na Al Si Cl Ar**

- The blue line of strontium atom emission has a wavelength of 461 nm. What is the frequency of this light? What is the energy of a photon of this light?

$$\nu \text{ (frequency)} = 6.508 \times 10^{14} \text{ sec}^{-1}$$

$$\text{Energy} = 4.315 \times 10^{-21} \text{ Joules}$$

- The energy of a photon of light is  $4.34 \times 10^{-19}$  J. What is the wavelength and frequency of this light?

$$\lambda \text{ (wavelength)} = 4.583 \times 10^{-7} \text{ m (or 458 nm)}$$

$$\nu \text{ (frequency)} = 6.546 \times 10^{14} \text{ sec}^{-1}$$

9. What is the number of different orbitals in each of the subshells? How many maximum electrons can each subshell hold?
- |       |                             |                     |
|-------|-----------------------------|---------------------|
| a. 3d | <b>5 different orbitals</b> | <b>10 electrons</b> |
| b. 4f | <b>7 different orbitals</b> | <b>14 electrons</b> |
| c. 4p | <b>3 different orbitals</b> | <b>6 electrons</b>  |
| d. 5s | <b>1 orbital</b>            | <b>2 electrons</b>  |