**Study Guide for Unit 2 Test**

Students should be able to:

1. Describe the location and charge of the proton, neutron and electron.
2. Define atomic number, mass number, nucleus, atom, molecule, isotope, ion.
3. Find the atomic number, mass number of most abundant isotope, number of electrons, number of protons, and number of neutrons of an atom or ion (when given a periodic table)
4. Differentiate between cations and anions. Write symbols for cations and anions.
5. Describe the atomic models of Dalton, Thomson, Rutherford, Bohr,
6. Describe Thomson’s cathode ray tube experiment. What subatomic particle did he discover?
7. Describe Rutherford’s gold foil experiment and explain how it advanced the atomic model.
8. Define average atomic mass. Be able to solve for the average atomic mass when given the masses of the isotopes as well as the percent abundance.
9. Explain how Bohr used the bright line spectrum of hydrogen (and other elements) to develop his atomic model. How is the bright line spectrum (atomic emission spectrum) useful for chemists.
10. Define energy level. Explain that the energy levels represent different distances from the nucleus.
11. Differentiate between the ground state and the excited state of an atom.
12. Explain how electrons become excited and what happens when they return to the ground state.
13. Describe a photon as a discrete unit of electromagnetic radiation.
14. Define/explain wavelength, frequency, and velocity of waves. Give the units of each measurement and know the symbol for each.
15. Explain what is meant by the “electromagnetic spectrum”. Name the different types of electromagnetic radiation from longest wavelengths to shortest wavelengths, lowest to highest frequency, and lowest to highest energy.
16. Know the colors of light in the visible spectrum in order of longest to shortest wavelength (ROYGBIV)
17. Know the names of the energy levels (1-7) and sublevels (s,p,d,f), and know the shape of the s, p and d sublevels.
18. Explain what is meant by orbital “overlap”. Know where it occurs – which elements are affected?
19. Determine the quantum numbers for a given electron
20. Be able to write electron configurations, orbital notations, and Lewis structures (electron dot diagrams) for elements 1-56.
21. Know what valence electrons are. Be able to predict how many valence electrons an element has based on its position on the periodic table.
22. Use the periodic table to help write electron configurations and electron dot diagrams for elements.
23. Know where the s,p,d, and f sections of the periodic table are located.
24. State the Heisenberg Uncertainty Principle, the Aufbau Principle, Hund’s Rule, and the Pauli Exclusion Principle. Apply these rules when writing electron configurations.
25. Recognize electron configurations for atoms in the excited state.
26. Recognize that groups of atoms/ ions can be in an isoelectronic series (understand what this means).
27. Explain why elements in an isoelectronic series are different sizes even though they have the same number of electrons.
28. Know how to write electron configurations and orbital notations for cations and anions.

\*\*\* Look over and study all notes, homework assignments, and worksheets from this unit!!\*\*\*

Some more practice:

1. Use a periodic table to complete the following chart.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Chemical symbol  (isotope format) | Number of  Protons | Number of  Electrons | Number of  Neutrons | m Mass  Nu Number |
| 131 I- |  |  |  |  |
|  | 55 | 55 |  |  |
| 88Sr+2 |  |  |  |  |

1. Samples of an unknown element X were collected and the following data was collected. Use the information presented in the data table to answer the following questions.

|  |  |  |
| --- | --- | --- |
| Isotope X | Atomic Mass of Isotope | Percent abundance |
| X – 38 | 37.910 | 9.67% |
| X – 39 | 39.100 | 78.68% |
| X – 40 | 40.001 | 11.34% |
| X – 41 | 41.200 | 0.31% |

1. What is the most common isotope of element X?
2. Calculate the average atomic mass of element X. Show your work.
3. Use your periodic table to identify element X based on its average atomic mass. (What is the closest element to your calculated average?)
4. What is the atomic number of this element?
5. A certain violet light has a wavelength of 413 nm. A red light has a wavelength of 790 nm.
   1. Which color of light has the highest frequency?
   2. Which color of light has photons with the highest energy?
6. Write orbital notations, electron configurations, electron dot structures, and the quantum numbers for the last electron added for the following elements – do not use shorthand method unless indicated.
   1. sulfur
   2. vanadium
   3. silver (may use noble gas configuration)
   4. barium (may use noble gas configuration)
7. Use the electron configuration below to answer the following questions:

1s22s22p63s23p64s23d7

* 1. What element is represented by the electron configuration?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. What does the number 3 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. What do the letters s,p and d represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  4. What do the superscripts represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Look at the following clues. Identify the elements described:
   1. Contains a full second energy level \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Contains the first d electron \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Contains seven electrons in its fourth energy level \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Contains only two electrons in its fifth energy level \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. Contains five electrons in its 3d orbitals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   6. Has its outermost electron in 7s1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Use the symbol below to answer the following questions:

249Cf

* 1. What element in represented by the above element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. What does the 249 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. How many protons does this element have? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  4. How many electrons does this element have? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  5. How many neutrons does this atom have? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Determine which elements are represented by the following configurations, and if they are in the ground or excited state:
   1. 1s22s22p63s23p63d1
   2. b. 1s22s22p63s23p64s23d5
2. Write full electron configurations for the following ions:
   1. Strontium ion
   2. Nitride ion
3. Name three particles that have the following electron configuration. What is a name given to particles that have the same electron configurations?

1s22s22p63s23p6

11. What are the quantum numbers for the last electron placed in carbon?

12. What are the quantum numbers for the last electron placed in magnesium?