Chemistry 112

Chapter 5 Quiz

Name: Solutions **Date:** _____

Part A - Multiple Choice **[16 pts]**

Identify the choice that best completes the statement or answers the question.

A 1. In Bohr's model of the atom, where are the electrons and protons located?
   a. The electrons move around the protons, which are at the center of the atom.
   b. The electrons and protons move throughout the atom.
   c. The electrons occupy fixed positions around the protons, which are at the center of the atom.
   d. The electrons and protons are located throughout the atom, but they are not free to move.

C 2. The principal quantum number indicates what property of an electron?
   a. position
   b. speed
   c. energy level
   d. electron cloud shape

B 3. How many energy sublevels are in the second principal energy level?
   a. 1
   b. 2 s+p
   c. 3
   d. 4

D 4. What is the maximum number of *f* orbitals in any single energy level in an atom?
   a. 1
   b. 3
   c. 5
   d. 7

D 5. What is the maximum number of electrons in the fourth principal energy level?
   a. 2
   b. 8
   c. 18
   d. 32
   s, p, d, f
   2 6 10 14

C 6. When an electron moves from a lower to a higher energy level, the electron ____.
   a. always doubles its energy
   b. absorbs a continuously variable amount of energy
   c. absorbs a quantum of energy
   d. moves closer to the nucleus

B 7. The letter "*p*" in the symbol $4p^3$ indicates the ____.
   a. spin of an electron
   b. orbital shape
   c. principle energy level
   d. speed of an electron

C 8. If the spin of one electron in an orbital is clockwise, what is the spin of the other electron in that orbital?
   a. zero
   b. clockwise
   c. counterclockwise
   d. both clockwise and counterclockwise

C 9. What types of atomic orbitals are in the third principal energy level?
   a. *s* and *p* only
   b. *p* and *d* only
   c. *s*, *p*, and *d* only
   d. *s*, *p*, *d*, and *f*

D 10. What is the next atomic orbital in the series 1*s*, 2*s*, 2*p*, 3*s*, 3*p*?
   a. 2*d*
   b. 3*d*
   c. 3*f*
   d. 4*s*

C 11. What is the number of electrons in the outermost energy level of an oxygen atom?
   a. 2
   b. 4
   c. 6
   d. 8

D 12. What is the electron configuration of potassium?
   a. $1s^2 2s^2 2p^2 3s^2 3p^2 4s^1$
   b. $1s^2 2s^2 2p^{10} 3s^2 3p^3$
   c. $1s^2 2s^2 3s^2 3p^6 3d^1$
   d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

A 13. If three electrons are available to fill three empty 2*p* atomic orbitals, how will the electrons be distributed in the three orbitals?
   a. one electron in each orbital
   b. two electrons in one orbital, one in another, none in the third
   c. three in one orbital, none in the other two
   d. Three electrons cannot fill three empty 2*p* atomic orbitals.

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C 14. How many unpaired electrons are in a sulfur atom (atomic number 16)?
   a. 0
   b. 1
   c. 2
   d. 3

[Ne] $3s^2 3p^4$

1↓ 1 1

A 15. Stable electron configurations are likely to contain ____.
   a. filled energy sublevels
   b. fewer electrons than unstable configurations
   c. unfilled *s* orbitals
   d. electrons with a clockwise spin

D 16. Which electron configuration of the 4*f* energy sublevel is the most stable?
   a. $4f^7$
   b. $4f$
   c. $4f^{13}$
   d. $4f^{14}$

Part C - Short Answer

1. Give the electron configuration for each of the following atoms: **[4 pts]**

Beryllium: $1s^2 2s^2$

Chlorine: $1s^2 2s^2 2p^6 3s^2 3p^5$

Selenium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

Chromium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ * s → d promotion

2. State the energy level and the number of valence electrons for each of the following: **[4 pts]**

Bromine: 4th 7 e^-

Strontium: 5th 2 e^-

Lead: 6th 4 e^-

Silicon: 3rd 4 e^-

3. Write the abbreviated electron configuration for each of the following elements: **[3 pts]**

Tin: $[Kr]\ 5s^2 4d^{10} 5p^2$

Titanium: $[Ar]\ 4s^2 3d^2$

Tellerium: $[Kr]\ 5s^2 4d^{10} 5p^4$

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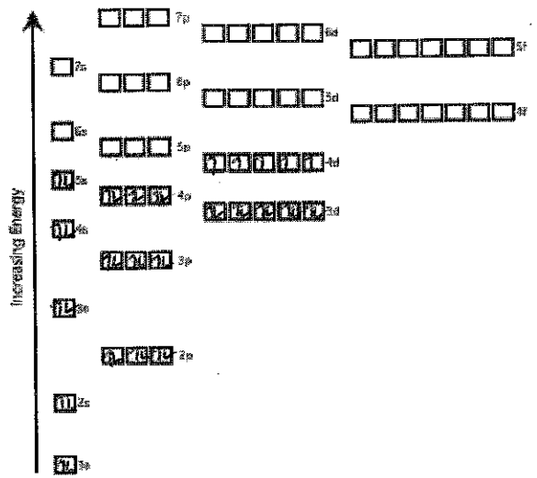
4. Fill in the Aufbau diagram for the element number 43: **[2pts]**



Part D - Essay

1. Describe the different principles that govern the building of an electron configuration. **[3 pts]**

Aufbau - lowest energy first

Pauli - 2 e^- per orbital, opposite spins

Hund - e^- enter orbitals in single file, double up if they have to

2. Tungsten has an unexpected electron configuration. Write both the expected and actual electron configurations of tungsten and explain why this happens. **[5 pts]**

Exp: $[Xe]\ 6s^2\ 4f^{14}\ 5d^4$

Actual: $[Xe]\ 6s^1\ 4f^{14}\ 5d^5$ s→d promotion

By giving $1e^-$ to the 5d, 6s loses some of its stability by 5d gains a lot more stability being exactly half filled

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