Principles of Chemistry
Quantum Numbers Practice Problems

Momentum

1. *Review: Which of the following shell and sub-shell combinations are not possible?*

   a. 3f *b. 4s* *c. 2d* *d. 4f*

2. List the subshell numbers (and the letters they represent) that are possible in the 5^{th} shell.

Magnetic

3. *Review: For each of the following subshells, indicate how many orbitals they can have.*
   a. p *b. s* *c. h* *d. f*

4. In each of the following orbitals, how many shapes/orientations are possible?

   a. s b. d c. p d. f

5. Draw the shape(s) of s, p, and d orbitals.

6. What <u>values</u> can m_ℓ (orientations) take for...

   a. A d(2) orbital?
   b. An s(0) orbital?

Electron Spin

7. *Review: Which of the following orbital groups has a capacity of 10 electrons?*

   a. 5s *b. 2p* *c. 4p* *d. 3d* *e. 6s*

8. How many electrons can be held in any specific orbital shape/orientation?

9. What is the maximum number of electrons that can occupy:
   a. a full set of d orbitals b. an s orbital c. n = 2 energy level

General Problems

10. For each of the following give the orbital designation (letter) and the possible m_ℓ values.

    a. $n = 3 \quad \ell = 2$
    b. $n = 4 \quad \ell = 3$
    c. $n = 5 \quad \ell = 1$

11. If the principal quantum number of an electron is n = 2, what are the allowed values for...

    a. Its ℓ quantum number?

    b. Its m_ℓ quantum number?

    c. Its m_s quantum number?

12. List all of the possible sets of the four quantum numbers if n = 3.

13. For the following sets of quantum numbers for electrons, indicate which set of 3 quantum numbers – n, ℓ, and m_ℓ - could not occur and state why.

    a. 3, 2, 2
    b. 2, 2, 2
    c. 2, 0, -1

14. List the possible sets of 4 quantum numbers when n = 2.

15. What is the maximum number of electrons that can occupy...

a. An n = 3 energy level / shell b. An n = 4 energy level / shell

16. Which of the following sets of quantum numbers are not possible?

a. $n = 3$ $\ell = 2$ $m_\ell = -3$ $m_s = ½$

b. $n = 2$ $\ell = 3$ $m_\ell = 0$ $m_s = - ½$

c. $n = 2$ $\ell = 1$ $m_\ell = 0$ $m_s = - ½$