QUANTUM NUMBERS WORKSHEET

1. State the four quantum numbers, then explain the possible values they may have and what they actually represent.

n – Pricipal Quantum Number: represents the energy level the electron is in, linked to the periods of the periodic. Can be 1 to 7

l – Secondary Quantum Number/Orbital Shape Quantum number: represents the shape of the orbital- s, p, f, d. l is a range of n-1.

m_l – Magnetic quantum number: represents the number of orbits possible. M_l is a range of l.

m_s – Spin Quantum number: represents the electron and its spin. Two possibilities +1/2, -1/2

2. State the number of possible electrons described by the following quantum numbers

a. n = 3, l = 0 **2**
b. n = 3, l = 1 **6**
c. n = 3, l = 2, ml = -1 **2**
d. n = 5, l = 0, ml -2, ms -1/2 **Not possible**

3. Give the n and l values for the following orbitals

a. 1s **n=1 l = 0**
b. 3s **n=3 l =0**
c. 2p **n= 2 l= 1**
d. 4d **n= 4 l=2**
e. 5f **n= 5 l= 3**

4. What is the m_l values for the following types of orbitals?

a. s **m_l= 0**
b. p **m_l= -1, 0,1**
c. d **m_l= -2, -1, 0, 1, 2**
d. f **m_l= -3, -2, -1, 0, 1, 2, 3**

6. How many possible orbitals are there for n =

a. 4 **s-1, p-3, d-5, f-7= 16 orbitals**
b. 6 **9 orbitals**

7. Write the complete set of quantum numbers that represent the **valence electrons** for the following elements:

a. He **n=1, l= 0, ml= 0, ms=+1/2**
n=1, l= 0, ml= 0, ms=-1/2

b. V **n=4, l=0, ml= 0, ms= +1/2**
n=4, l=0, ml= 0, ms= -1/2

c. Ni **n=4, l=0, ml= 0, ms= +1/2**
n=4, l=0, ml= 0, ms= -1/2

d. Cu **n=4, l=0, ml= 0, ms= +1/2**
n=4, l=0, ml= 0, ms= -1/2

e. Br **n=4, l=0, ml = 0, ms= +1/2**
n=4, l=0, ml = 0, ms= -1/2
n=4, l=1, ml = -1, ms= +1/2
n=4, l=1, ml = 0, ms= +1/2
n=4, l=1, ml = 1, ms= +1/2
n=4, l=1, ml = -1, ms= -1/2
n=4, l=1, ml = 0, ms= -1/2

8. Write the electron configurations for the elements above.

He= $1s^2$
V [Ar] $4s^2 3d^3$
Ni [Ar] $4s^2 3d^8$
Cu [Ar] $4s^2 3d^9$
Br [Ar] $4s^2 3d^{10} 4p^5$

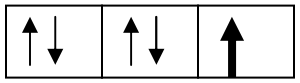
9. Without referring to a text, periodic table or handout, deduce the maximum number of electrons that can occupy an:
a. s orbital **_2__** b. the subshell of p orbitals **__6___** c. the subshell of d orbitals **_10__**

d. the subshell of f orbitals**__14__** e. the subshell of g orbitals**__18__**

10. How many electrons can inhabit all of the n=4 orbitals?
4s = 2
4p = 6
4d = 10
4f = 14
32 Total Electrons

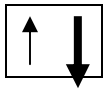
11. Fill in the blanks with the correct response:
    a. The number of orbitals with the quantum numbers n=3, l=2 and m_l = 0 is ___**1**___.
    b. The subshell with the quantum numbers n=4, l=2 is ___**d**__.
    c. The m_l values for a d orbital are ___**-2, -1, 0 , 1, 2**_____.
    d. The allowed values of l for the shell with n=2 are ____**0, 1**___.
    e. The allowed values of l for the shell with n=4 are ___**0, 1, 2, 3**___.
    f. The number of orbitals in a shell with n=3 is __**1+3+5=9 (*s, p, d*)**__.
    g. The number of orbitals with n=3 and l=1 is __**3**____.
    h. The maximum number of electrons with quantum numbers with n=3 and l=2 is __**10**__.
    i. When n=2, l can be __**0, 1**__.
    j. When n=2, the possible values for m_l are __**-1, 0, 1**____.
    k. The number of electrons with n=4, l=1 is __**6**__.
    l. The subshell with n=3 and l=1 is designated as the __***p* or -1, 0, 1**___ subshell.
    m. The lowest value of n for which a d subshell can occur is n=___**3**__.

12. Write the values for the quantum numbers for the **bold** electron in the following diagrams:
    a. 3p orbitals



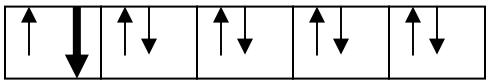
    a. n=3, l=1, m_l =1, m_s =+1/2

    b. 5s



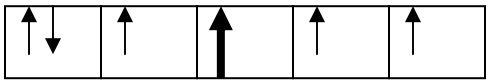
    b. **n=5, l=0, m_l =0, m_s = - 1/2**

    c. 4d orbitals



    c. n=4, l=2, m_l = - 2, m_s = - 1/2

    d. 3d orbitals



    d. n=3, l=2, m_l =0, m_s =+1/2

13. How many electrons can occupy any single subshell orbital? __**2**__

14. a. What is the value of ***l*** for a 4 f electron? **3**
    b. What is the orbital designation for an electron in the 3rd shell and p sublevel? **3p**
    c. What are the possible values of ml for a 5d electron? **2, 1, 0, -1, -2**
    d. What is the maximum number of electrons in the 3rd energy level? **18**
    e. How many orbitals have the following quantum numbers: n =4, l = 2, ml = -2? **1**
    f. How many electrons have the following quantum numbers: n =4, l = 2, ml = -2? **2**