Name: _____ **Date:** _____

Quantum Number Practice Worksheet

1. Summarize:
   The principal quantum number, ***n***, can have the values of: 1 2 3 4 5 etc.
   The angular momentum quantum number, **l**, can have integer values from 0 to n-1.
   The magnetic quantum number, m_l, can have integer values from -l to +l.

2. When n = 3, **l** can have values of 0,1,2.
   For the 3d sublevel, **l** has a value of 2.

   When n = 4, **l** can have values of 0,1,2,3.
   For the 4p sublevel, **l** has a value of 1.

   When n = 2, **l** can have values of 0,1.
   For the 2s sublevel, **l** has a value of 0

3. Summarize:

orbital	s	p	d	f
value of **l**	0	1	2	3

4. There are five 4d orbitals. List the quantum numbers for each orbital.

n	**l**	m_l
4	2	-2
4	2	-1
4	2	0
4	2	1
4	2	2

5. Rank the following orbitals in order of increasing energy: 3s, 2s, 2p, 4s, 3p, 1s, and 3d.

   1s 2s 2p 3s 3p 4s 3d

6. How many orbitals in an atom can have the following quantum number or designation?

   a) 3p 3
   b) 4p 3
   c) $4p_x$ 1
   d) 6d 5
   e) 5d 5
   f) 5f 7
   g) ***n*** = 5 25
   h) 7s 1

7. Answer the following questions:

   a) The quantum number ***n*** describes the energy of an atomic orbital.
   b) The shape of an atomic orbital is given by the quantum number l
   d) The maximum number of orbitals that may be associated with the set of quantum numbers n=4 and **l** =3 is 7.
   e) The maximum number of orbitals that may be associated with the quantum number set n=3, **l** =2, and m_l = -2 is 1.
   f) When n=5, the possible values of **l** are 01234.
   g) The maximum number of orbitals that can be assigned to the n=4 shell is 16.

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8. (a) For n = 4, what are the possible values of l ? 0 1 2 3
   (b) For l = 3, what are the possible values of m_l ? -3 -2 -1 0 1 2 3

9. Give the values of n, l , m_l (a) for each orbital in the 4f sublevel, (b) for each orbital in the n = 2 shell.

n l m

A) 4 3 -3
4 3 -2
4 3 -1
4 3 0

n l m

4 3 1
4 3 2
4 3 3

n	l	m
2	0	0
2	1	-1

n l m

2 1 0
2 1 1

10. Which of the following sets of quantum numbers are allowed for an electron in an orbital of a hydrogen atom:

(a) n = 1, l = 1, m_l = 0 No
(b) n = 3, l = 0, m_l = 0 Yes 3s
(c) n = 4, l = 1, m_l = -1 Yes 4p
(d) n = 2, l = 1, m_l = 2 No

Write the designation for the sublevel to which the orbital belongs.

11. What is the maximum number of electrons that can occupy each of the following subshells:
   (a) 3d 10
   (b) 4s 2
   (c) 2p 6
   (d) 5f 14

12. What is the maximum number of electrons in an atom that can have the following quantum numbers:
   (a) n = 3 — 18
   (b) n = 4, l = 2 — 10
   (c) n = 4, l = 3, m_l = 2 — 2
   (d) n = 2, l = 1, m_l = 0, m_s = - ½ — 1

13. The quantum numbers listed below are for four different electrons in the same atom. Arrange them in order of increasing energy. Indicate whether any two have the same energy.
   (a) n = 4, l = 0, m_l = 0, m_s = ½
   (b) n = 3, l = 2, m_l = 1, m_s = ½
   (c) n = 3, l = 2, m_l = -2, m_s = -½
   (d) n = 3, l = 1, m_l = 1, m_s = -½

1) d
2) a
3) b or c
4) c or b

c + b have very similar energies, but not exactly the same.