

# Quantum Number Practice Worksheet

1. Summarize:

The principal quantum number,  $n$ , can have the values of: \_\_\_\_\_, etc.

The angular momentum quantum number,  $l$ , can have integer values from \_\_\_\_\_ to \_\_\_\_\_. The magnetic quantum number,  $m_l$ , can have integer values from \_\_\_\_\_ to \_\_\_\_\_.

2. When  $n = 3$ ,  $l$  can have values of \_\_\_\_\_. For the 3d sublevel,  $l$  has a value of \_\_\_\_\_.

When  $n = 4$ ,  $l$  can have values of \_\_\_\_\_. For the 4p sublevel,  $l$  has a value of \_\_\_\_\_.

When  $n = 2$ ,  $l$  can have values of \_\_\_\_\_. For the 2s sublevel,  $l$  has a value of \_\_\_\_\_.

3. Summarize:

orbital	s	p	d	f
value of $l$				

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

$n$	$l$	$m_l$

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

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

a) 3p

e) 5d

b) 4p

f) 5f

$n =$

c) 4p<sub>x</sub>

g) 5

d) 6d

h) 7s

7. Answer the following questions:

a) The quantum number  $n$  describes the \_\_\_\_\_ of an atomic orbital.

b) The shape of an atomic orbital is given by the quantum number \_\_\_\_\_.

d) The maximum number of orbitals that may be associated with the set of quantum numbers  $n=4$  and  $l=3$  is \_\_\_\_\_.

e) The maximum number of orbitals that may be associated with the quantum number set  $n=3$ ,  $l=2$ , and  $m_l = -2$  is \_\_\_\_\_.

f) When  $n=5$ , the possible values of  $l$  are \_\_\_\_\_.

g) The maximum number of orbitals that can be assigned to the  $n=4$  shell is \_\_\_\_\_.

8. (a) For  $n = 4$ , what are the possible values of  $l$  ?  
 (b) For  $l = 3$ , what are the possible values of  $m_l$  ?
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.
10. Which of the following sets of quantum numbers are allowed for an electron in an orbital of a hydrogen atom:
- (a)  $n = 1, l = 1, m_l = 0$
  - (b)  $n = 3, l = 0, m_l = 0$
  - (c)  $n = 4, l = 1, m_l = -1$
  - (d)  $n = 2, l = 1, m_l = 2$

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
  - (b) 4s
  - (c) 2p
  - (d) 5f
12. What is the maximum number of electrons in an atom that can have the following quantum numbers:
- (a)  $n = 3$
  - (b)  $n = 4, l = 2$
  - (c)  $n = 4, l = 3, m_l = 2$
  - (d)  $n = 2, l = 1, m_l = 0, m_s = -\frac{1}{2}$
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)  $n = 4, l = 0, m_l = 0, m_s = \frac{1}{2}$
  - (b)  $n = 3, l = 2, m_l = 1, m_s = \frac{1}{2}$
  - (c)  $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$
  - (d)  $n = 3, l = 1, m_l = 1, m_s = -\frac{1}{2}$