

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 _x | 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) $n = 3, l = 1, m_l = 1, m_s = -\frac{1}{2}$