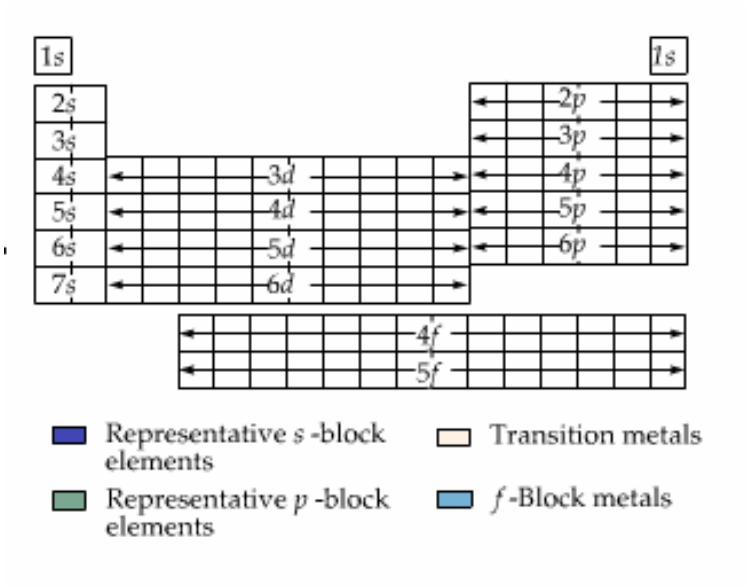
Chapter 6.5 – 6.6 Electronic Structure Lecture Worksheet

The periodic table is arranged in order to increasing atomic number and provides a vast amount of information about the elements.

Electronic Structure



The periodic table is broken down into blocks that explain the valence electron structure of the elements

Three quantum numbers describe an orbital

1. The number in front of the letter tells us the size of the orbital. Orbitals hold electrons.
2. The s, p d, and f tell us the shape of the orbital that holds the electrons
3. The magnetic quantum number determines the orbital's orientation in space. It is not shown on the Periodic Table.

1. The principal quantum number, *n*, can have positive integer values. (1, 2, 3, . . .). The principal quantum number determines the size of the orbital. The larger the value of *n*, the larger the orbital.

2. The second or azimuthal quantum number, *l*, can have integer values from 0 to *n*–1. The value of *l* determines the shape of the orbital. Each value of *l* has a letter associated with it to designate orbital shape.

Value of *l*	0	1	2	3
Letter used	*s*	*p*	*d*	*f*

3. The magnetic quantum number, m_l, can have integer values from $-l$ through $+l$. The magnetic quantum number determines the orbital's orientation in space.

Each value of *n* defines an electron shell. Within a shell, each value of *l* defines a subshell. Within a subshell, each value of m_l defines an individual orbital.

TABLE 6.2 Relationship Among Values of *n*, *l*, and m_l through *n* = 4

n	Possible Values of *l*	Subshell Designation	Possible Values of m_l	Number of Orbitals in Subshell	Total Number of Orbitals in Shell
1	0	1 *s*	0	1	1
2	0	2 *s*	0	1	
	1	2 *p*	1, 0, −1	3	4
3	0	3 *s*	0	1	
	1	3 *p*	1, 0, −1	3	
	2	3 *d*	2, 1, 0, −1, −2	5	9
4	0	4 *s*	0	1	
	1	4 *p*	1, 0, −1	3	
	2	4 *d*	2, 1, 0, −1, −2	5	
	3	4 *f*	3, 2, 1, 0, −1, −2, −3	7	16

Chapter 6.5 – 6.6 Electronic Structure Practice problems

Atomic Orbitals

Directions: Answer the following questions using information obtained from the lecture and the Chapter Summary Guide.

1. For $l = 2$, what are the possible values of m_l?

Online Text

- 2, 1, 0, -1, -2
- 1, 0, -1
- 1, 0
- 2
- 2, 1, 0

2. How many different m_l values are possible for $l = 3$, an f orbital?

Online Text

- 3
- 2
- 5
- 1
- 7

3. How many orbitals are there in the 4p subshell?

Online Text

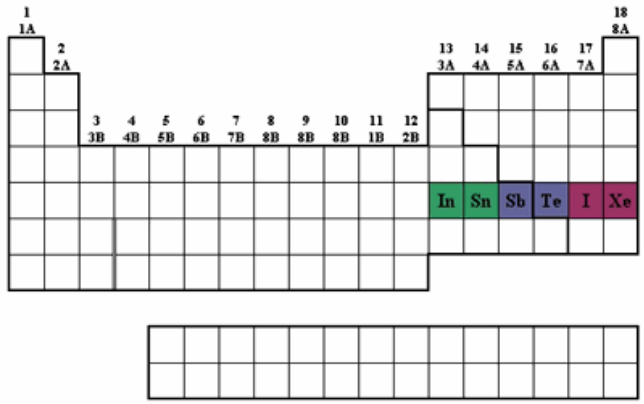
- 3
- 4
- 1
- 2
- 5

4. What is the maximum number of electrons that can occupy the subshell 3d?

Online Text

- 1
- 5
- 2
- 3
- 6
- 10

5. Which subshell is highlighted in the periodic table below?



- 4*p*
- 5*p*
- 5*d*
- 5*s*

6. Which one of the following represents an *incorrect* set of quantum numbers for an electron in an atom (arranged as n, l, m_l, and m_s)?

Online Text

- 5, 4, -3, 1/2
- 1, 0, 0, 1/2
- 3, 3, 3, 1/2
- 2, 1, -1, -1/2

7. For the hydrogen atom, which is highest in energy--the 2*s*, the 3*s*, or 2*p* orbital?

Online Text

- 2*s*
- 3*s*
- 2*p*

8. For n= 4, what are the possible values of l?

Online Text

- 1, 2, 3, 4
- 0, 1, 2, 3, 4, 5
- 0, 1, 2, 3, 4
- 0, 1, 2, 3
- 1, 2, 3

9. Which of the following sets is *not* an acceptable set of quantum numbers?

Online Text

- $n = 7, l = 3, m_l = +3$
- $n = 1, l = 0, m_l = 0$
- $n = 3, l = 1, m_l = -3$
- $n = 2, l = 1, m_l = +1$
- $n = 2, l = 1, m_l = -1$

10. How many electrons populate the (complete) second electron shell in the ground state of atomic argon?

Online Text

- 6
- 18
- 36
- 2
- 8