

CHAPTER 6

ELECTRON STRUCTURE AND THE PERIODIC TABLE

ELECTRONS ARE IN ORBITALS (a maximum of 2e in each orbital)

ORBITALS ARE IN SUBSHELLS

and SUBSHELLS ARE IN SHELLS

SUBSHELLS

LETTER OF SUBSHELL	NUMBER OF ORBITALS	MAXIMUM NUMBER OF ELECTRONS
s	1	
p	3	
d	5	
f	7	

The shapes of the s and p orbitals is shown on p 136 in Dewey

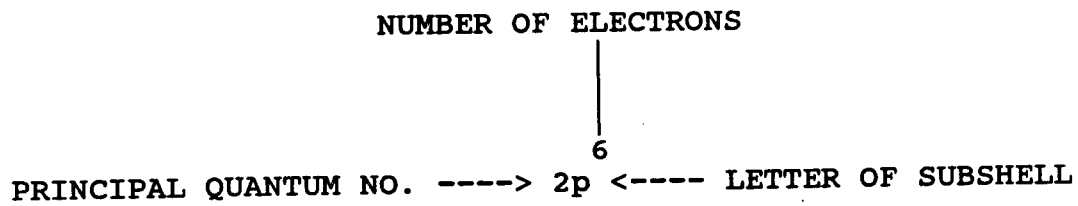
Spectroscopists identified the lines in the spectra of elements with letters

SHELLS

LETTER OF SHELL	PRINCIPAL QUANTUM NO.	
K	1	
L	2	
M	3	increasing distance from the nucleus
N	4	

The larger the value of the principal quantum number the further the electrons are from the nucleus

DESIGNATION OF SUBSHELLS



SIX ELECTRONS IN THE p SUBSHELL OF THE L SHELL

3d⁴

4p³

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Electrons spin either clockwise or counter clockwise on their axis

Arrows are sometime used to represent electrons and their spin (Alt 24 and Alt 25)

↑ and ↓

The Pauli Exclusion Principle states that:

1. no more than two electrons can occupy an orbital
2. when two electrons occupy an orbital their spins must be opposite, and they are said to be paired

Paired electrons can be represented as

↑↓

Subshells are filled in order of increasing energy, starting with the 1s subshell

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ELECTRON CONFIGURATION

H $1s^1$

He $1s^2$

Li $1s^2 2s^1$

Be $1s^2 2s^2$

B $1s^2 2s^2 2p^1$

C $1s^2 2s^2 2p^2$

N $1s^2 2s^2 2p^3$

O $1s^2 2s^2 2p^4$

F $1s^2 2s^2 2p^5$

Ne $1s^2 2s^2 2p^6$

Na

Mg

Subshells are filled according to increasing energy:

$1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d$

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DEWEY Figure 6.13 page 144

	1A	2A								3A	4A	5A	6A	7A	8A
1	1s														1s
2	2s									B			2p		Ne
3	3s									Al			3p		Ar
4	4s	Sc				3d				Zn	Ga		4p		Kr
5	5s	Y				4d				Cd	In		5p		Xe
6	6s	Lu				5d				Hg	Tl		6p		Rn
7	7s					6d									

La							4f							
Ac							5f							

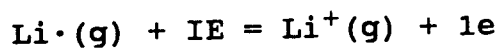
2s															
3s													3p		
4s													3p		
5s													4p		
6s													4p		
7s													5p		
													5p		
													6p		
													6p		

TRENDS IN THE PERIODIC TABLE

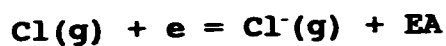
ATOMIC SIZE Figure 6.14 DEWEY page 155

ION SIZE Figure 6.15 page 156

IONIZATION ENERGY (IE) is the energy required to remove an electron from an atom in the gaseous state



ELECTRON AFFINITY is the energy change resulting when gaseous atoms gain an electron



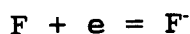
THE OCTET RULE AND THE FORMATION OF IONS

Dewey Section 6.8 page 150 The octet rule and formation of ions

OXIDATION is the loss of electrons

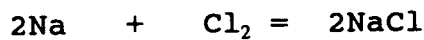


REDUCTION is the gain of electrons



Oxidizing agent (oxidant) is an electron acceptor, it causes another substance to be oxidized

Reducing agent (reductant) is an electron donor, it causes another substance to be reduced



Which element is the strongest oxidant?

Which element is the strongest reductant?

41. ELECTRON CONFIGURATION

1. Give the maximum number of electrons in the following shells
 - a. N shell
 - b. L shell
 - c. K shell
2. Give the maximum number of electrons in an orbital.
3. Give the number of orbitals in the following subshells
 - a. s subshell
 - b. p subshell
 - c. d subshell
 - d. f subshell
4. Give the maximum number of electrons in the following subshells.
 - a. s subshell
 - b. p subshell
 - c. d subshell
 - d. f subshell
5. Describe the shape of
 - a. an s orbital
 - b. a p orbital
 - c. a p subshell
6. Give the symbol for
 - a. 2 electrons in the p subshell of the M shell
 - b. 5 electrons in the d subshell of the N shell
 - c. 2 electrons in the s subshell of the K shell
7. For fluorine give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

8. For carbon give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

9. For sulfur give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

10. For aluminum give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

11. For nitrogen give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

12. For sodium give
 - a. the electron configuration
 - b. the electron dot formula
 - c. the number of electrons in the outer shell
 - d. the number of unpaired electrons in the atom

51. PROPERTIES OF THE ELEMENTS

A. From their position in the periodic table indicate which element is more metallic.

1. K or Ca
2. Na or Al
3. Al or S
4. Mg or P
5. P or As

B. From their position in the periodic table indicate which element has the higher ionization energy?

1. K or Ca
2. Na or Al
3. Al or S
4. Mg or P
5. P or As
6. F or O
7. O or N

C. Which element has the highest ionization energy

B. From their position in the periodic table indicate which element has the higher ionization energy?

1. O or F
2. Na or Mg
3. Na or K