Chemistry 6A Fall 2007

Dr. J. A. Mack

Monday

10/1/07

Exam 1: Friday 10/5/07 (here in lecture)

Bring a scamtron form 882 (100 question jobby-doo)

How many questions will be on the exam?

enough to keep you busy for 50 min

Some of you will finish early
Some of you will have just enough time
Some of you will not finish on time

As always, it depends upon you level of preparation…

Exam 1: Friday 10/5/07 (here in lecture)

What will be covered on the exam?

What do I need to bring?

- •Chapter 1-3 (all)
- •Chapter 4: (4.1-4.5 and 4.10)
- •Any thing from lab as well

Bring a Pencil, Eraser, Calculator and scamtron form 882

YOU NEED TO KNOW YOUR LAB SECTION NUMBER!

How should I prepare for the exam…

1. Get some sleep the night before.
2. Go over your quizzes.
3. look at your HW
4. look over additional HW problems
5. Focus on what you know first

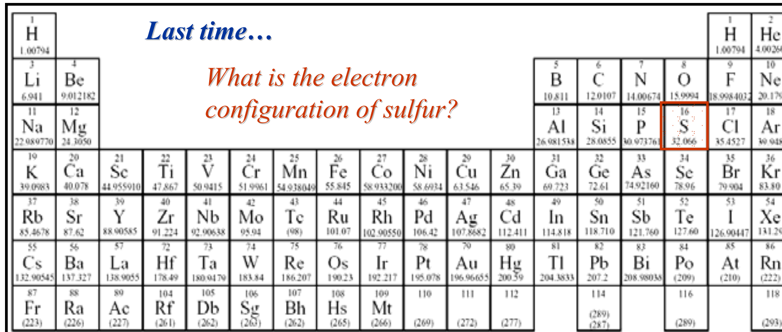
What should I not do…

1. Put off studying until Thursday night
2. Party Thursday night! ***(there will be plenty of time for that later)***
3. Snarf down 4 doughnuts and 3 red-bulls right before the exam!

There will be none of this…

Last time…

What is the electron configuration of sulfur?



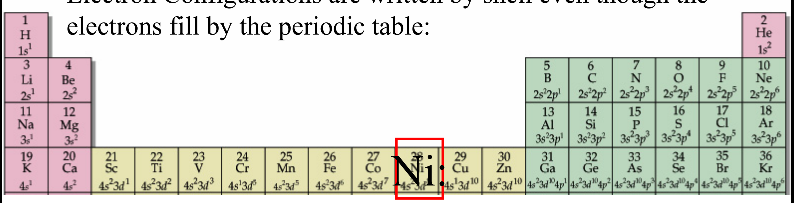
last electron to fill: $3p^4$

electron configuration:

$1s^2 \quad 2s^2 \quad 2p^6 \quad 3s^2 \quad 3p^4$

Last time…

Electron Configurations are written by shell even though the electrons fill by the periodic table:



last electron to fill: $3d^8$

electron configuration by filling: $1s^2 \quad 2s^2 \quad 2p^6 \quad 3s^2 \quad 3p^6 \quad 4s^2 \quad 3d^8$

[Ar]

electron configuration by shell: (write this way) $1s^2 \quad 2s^2 \quad 2p^6 \quad 3s^2 \quad 3p^6 \quad 4s^2 \quad 3d^8$

Core notation: [Ar] $3d^8 4s^2$

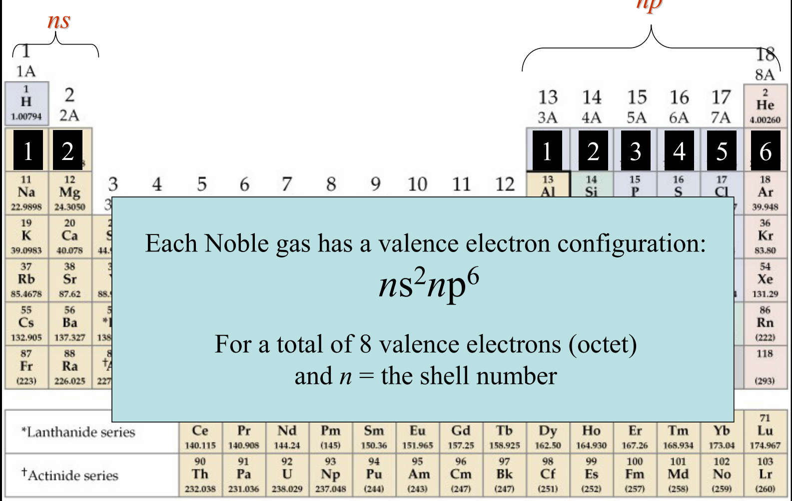
Chapter 4: Forces between particles

Learning Objectives

After completing this chapter, you should be able to:

1. Draw Lewis structures for simple molecules.
2. Relate ion charge to the nearest ideal gas element electron configuration.
3. Write and name the formulas for ionic compounds and covalent molecues.
4. Draw Lewis structures for molecules and polyatomic ions and apply VSEPR theory to predict molecular and ionic shapes.
5. Use electronegativities and the VSEPR model to determine the type of bonding and geometry of a compound and, if covalent, if the molecule is polar.
8. Relate melting points and boiling points of pure substances to the strengths and types of inter-particle forces present.

Electron Configurations of the Noble gasses:



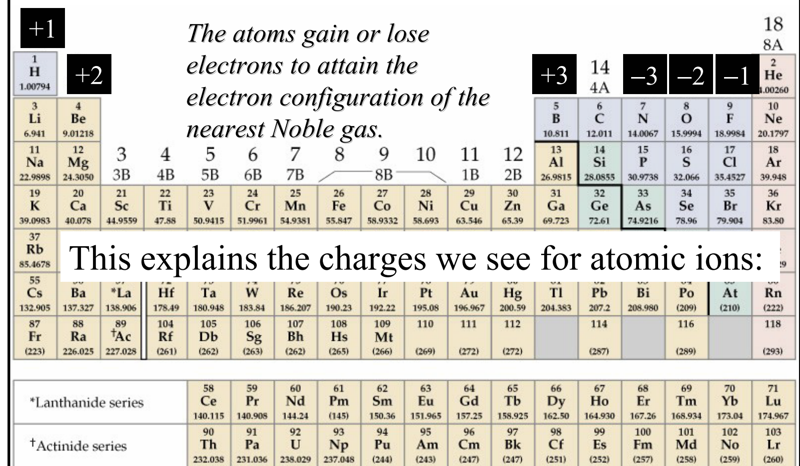
Each Noble gas has a valence electron configuration:

$$ns^2np^6$$

For a total of 8 valence electrons (octet) and n = the shell number

Electron Configurations of the Noble gasses:

The atoms gain or lose electrons to attain the electron configuration of the nearest Noble gas.



This explains the charges we see for atomic ions:

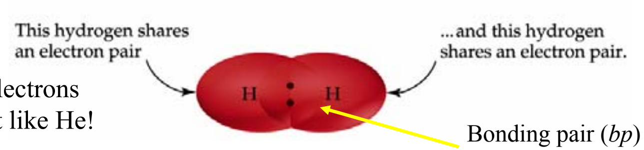
Covalent Bonds (Diatomic Molecules)

Covalent chemical bonds involve the sharing of a pair of valence electrons by two atoms.

Covalent bonds lead to stable molecules if they share electrons in such a way as to create a noble gas configuration for each atom.

(***octet:*** ns^2np^6)

Hydrogen gas (H_2) forms the simplest covalent bond in the diatomic hydrogen molecule.



2 electrons just like He!

Bonding pair (*bp*) of electrons

Lewis Theory: 1916-1919 - Lewis, Kossel, and Langmuir

Elements of the theory:

1. Valence electrons play a fundamental role in chemical bonding.
2. ***Ionic bonding*** involves the ***transfer*** of one or more electrons from one atom to another.
3. ***Covalent bonding*** involves ***sharing*** electrons between atoms.
4. Electrons are transferred or shared such that each atom gains an electron configuration of a noble gas (ns^2np^6), i.e. having 8 outer shell (valence) electrons.
5. This arrangement is called the ***octet rule***.

Exceptions to the octet rule do exist and will be explored later.

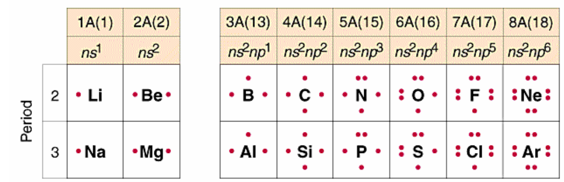
Lewis Theory: 1916-1919 - Lewis, Kossel, and Langmuir

Elements of the theory:

1. Valence electrons play a fundamental role in chemical bonding.
2. ***Ionic bonding*** involves the ***transfer*** of one or more electrons from one atom to another.
3. ***Covalent bonding*** involves ***sharing*** electrons between atoms.
4. Electrons are transferred or shared such that each atom gains an electron configuration of a noble gas (ns^2np^6), i.e. having 8 outer shell (valence) electrons.
5. This arrangement is called the ***octet rule***.

Exceptions to the octet rule do exist and will be explored later.

Lewis Symbols represent the resulting structures that accommodate the octet rule.

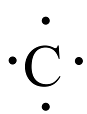


In a Lewis symbol, an element is surrounded by up to ***8 dots***.
The elemental symbol represents the nucleus and the dots represent the valence electrons.

Draw the Lewis dot representations for the following element:

Element	electron configuration	# of valence electrons
carbon	$1s^22s^22p^2$	4 ($2s^22p^2$)

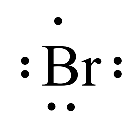
Lewis Symbol:



Draw the Lewis dot representations for the following element:

Element	electron configuration	# of valence electrons
Bromine	$[Ar]3d^{10}4s^24p^5$	7 ($4s^24p^5$)

Lewis Symbol:



Drawing Lewis Structures:

Since hydrogen has only one electron in its valence, it satisfies the ***octet rule*** with a ***duet***.

H-atom: H·

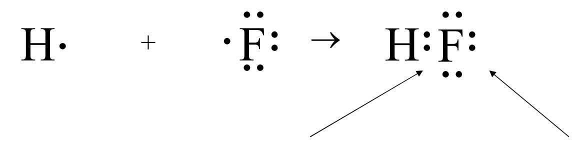
H_2 molecule: H:H

H–H

The "dash" represents a ***bonding pair*** (*bp*) of electrons.

When other covalent species form, there are additional electron pairs that do not participate in bonding.

These are called "***lone pairs***" (*lp*)



one *bonding pair* & three *lone pairs* (octet)

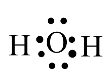
hydrogen fluoride: HF H–F

"single bond"

Example: H_2O (water)

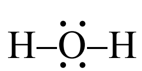
Each hydrogen atom has one electron (1 dot)
The oxygen atom has six electrons (6 dots)

Since H can only have one bond, O must be in the center:



Now connect the atoms to achieve octets (duet for H).

2 (bp)



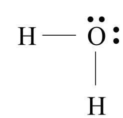
2 (lp)

Example: H_2O (water)

Since H can only have one bond, O must be in the center:

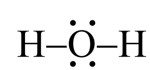
You can also draw the structure this way:

2 (bp)

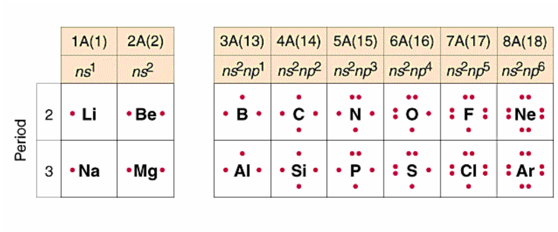


The flat *Lewis dot* structures will be the same when represented in 3-D!

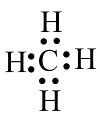
2 (lp)

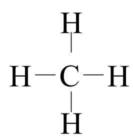


CH_4



Since hydrogen (H) can only form one bond, carbon (C) must be in the center



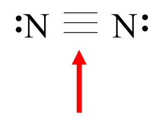


4 bp

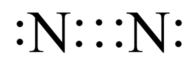
0 lp

N_2

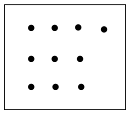
Each nitrogen atom needs 8 electrons to complete an octet…
But each nitrogen has only 5 valence electrons!
As a result, the electrons must be shared.



Triple bond!



There are 10 electrons available



N_2 needs 16 electrons (2×8)

Therefore 6 electrons must be shared (16–10)

The rest are lone pairs that complete the octet.