

Chemistry-Part 2 Notes

Chemical Bonding

A chemical bond is a force that holds two atoms together.

Why Bond?

-Makes atom more stable.

-Obtain Noble Gas Configuration (8 Valence electrons) through sharing, gaining, or losing valence electrons.

Ionic Bonds:

-Involves a metallic cation (positively charged) and a non-metallic anion (negatively charged).

-Metals are always written first.

-The number of electrons gained must equal the number of electrons lost.

Oxidation Numbers: The number of the transferred electrons from an atom to another atom. It is the same as a charge.

"How many electrons must be gained/lost for the atom to reach noble gas configuration?"

Valence Electron	1	2	3	4	5	6	7	8
Oxidation #	+1	+2	+3	+/- 4	-3	-2	-1	0

Example: What are the oxidation numbers for: F -1 Ca +2

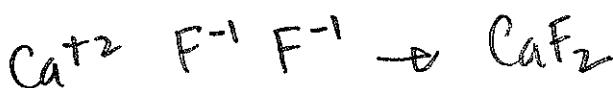
Forming Ionic Bonds:

-Oxidation Numbers: **MUST MATCH!** This tells you how many of each atom are needed to form the bond.

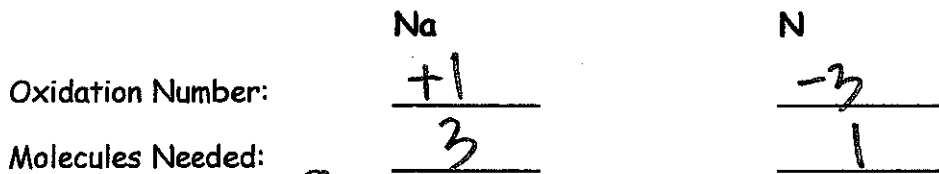
-In order for Fluorine and Calcium to bond, how many of each molecule do we need?

Oxidation Number:	$\frac{\text{F}}{-1}$		$\frac{\text{Ca}}{+2}$
Molecules Needed:	<u>2</u>		<u>1</u>

Show The Bond:

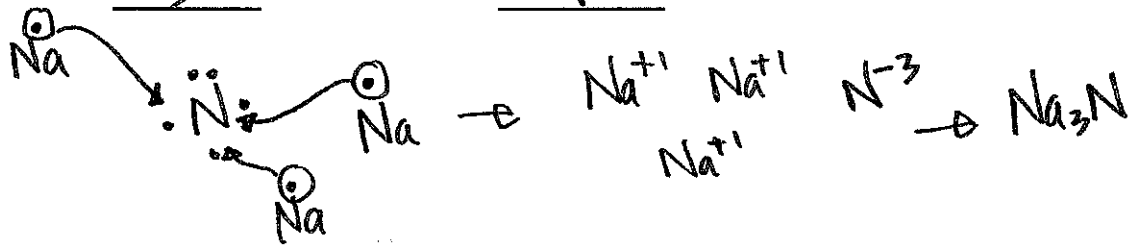


Another Example:



Molecules Needed:

Show The Bond:



Covalent Bonds:

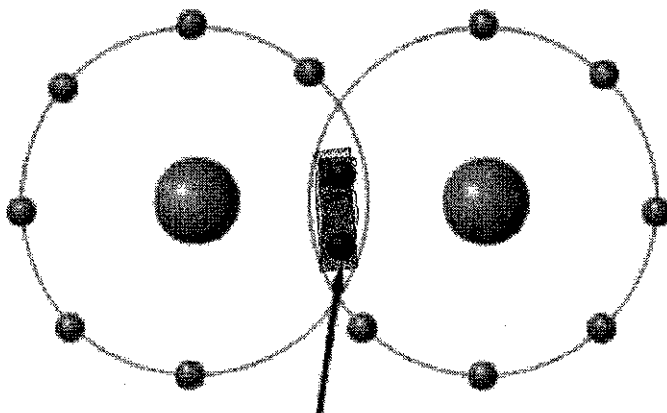
- Occur when both atoms need to gain electrons.
- Chemical bond resulting from the sharing of valence electrons (between two non-metals).
- Most covalent bonds are between non metals (exceptions Be and B)
- Generally occurs when elements are relatively close to each other on the Periodic Table.
- The shared e- are considered part of the complete outer energy levels of both atoms involved.
- Two atoms share an e- pair simultaneously.

Molecules are formed when 2 or more nonmetallic atoms bond covalently. All covalent compounds are also called molecular compounds.

- EX. H_2O water Cl_2 chlorine gas O_2 oxygen gas
 CO_2 carbon dioxide gas CH_4 methane gas NH_3 ammonia

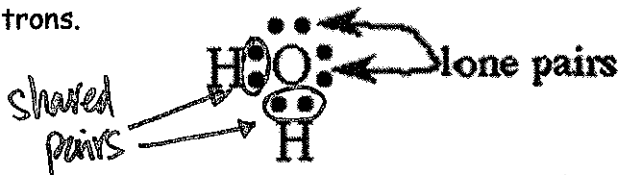
Electrons:

-Bonding pair (shared pair): Pair of valence electrons shared between 2 atoms. (Represented by a pair of dots or a line in the Lewis (electron dot) structure).



Shared Electrons

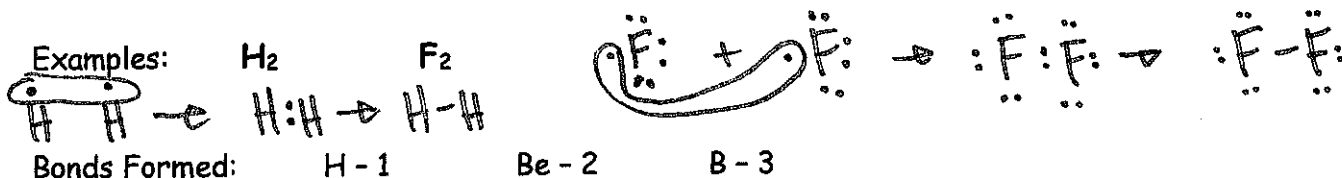
- Lone Pair - Unshared pair of electrons.



Diatomic Elements:

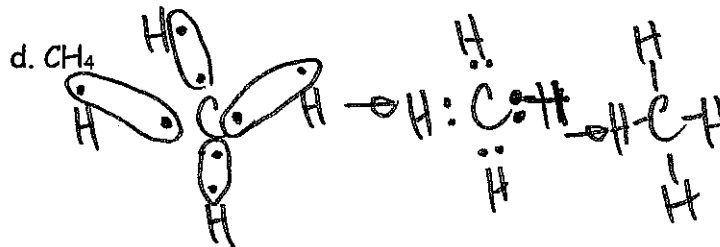
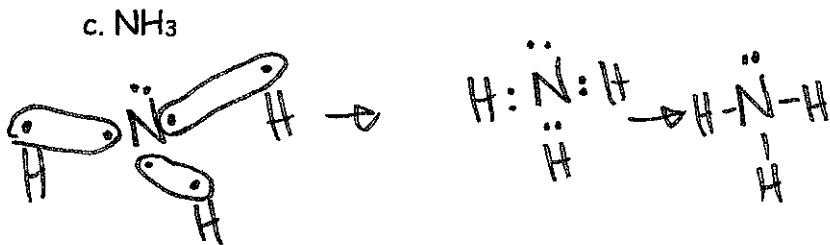
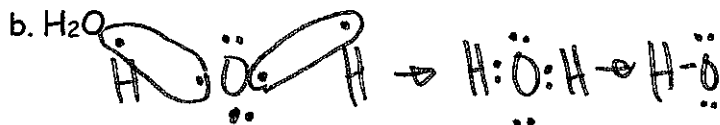
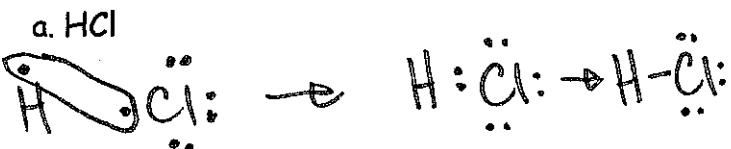
- Diatomic elements are all gases, form molecules because they don't have full valence shells on their own.

- Include: bromine (Br₂), hydrogen (H₂), oxygen (O₂), nitrogen (N₂), chlorine (Cl₂), iodine (I₂), fluorine (F₂).

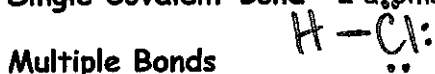


Group 4A: 4 (14) Group 5A: 3 (15) Group 6A: 2 (16) Group 7A: 1 (17)

Examples:

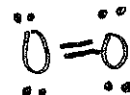


Single Covalent Bond - 2 atoms share one pair of electrons; 2 electrons total Ex: HCl

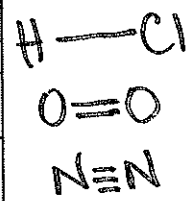


Multiple Bonds

- Double Covalent Bond - 2 atoms share two pairs of electrons; 4 electrons total Ex: O₂
- Triple Covalent Bond - 2 atoms share three pairs of electrons; 6 electrons total Ex: N₂



TYPE OF BOND	BOND LENGTH	BOND STRENGTH	BOND DISSOCIATION ENERGY
Single Bond	Longest	Weakest	Lowest
Double Bond	Shorter	Stronger	Higher
Triple Bond	Shortest	Strongest	Highest



Atoms and Isotopes Practice

Subatomic Particles

Three fundamental particles of the atom are the proton, neutron, and electron. At the center of each atom lies the atomic nucleus which consists of proton and neutron. The atomic number refers to the number of protons in the nucleus. All atoms of the same element have the same number of protons, hence, the same atomic number.

Isotopes are atoms that have the same number of protons but a different number of neutrons. An isotope is identified by its atomic mass number, which is the total number of protons and neutrons in the nucleus. A carbon isotope that has 6 protons and neutrons is identified as carbon-12, where 12 is the atomic mass number. A carbon isotope having 6 protons and 8 neutrons, on the other hand is carbon-14.

1. Complete the table.

ISOTOPE	ELECTRONS	NUMBER OF PROTONS	NEUTRONS
Hydrogen-1	1	1	0
Chlorine-36	17	17	19
Nitrogen-14	7	7	7
Potassium-40	19	19	21
Arsenic-75	33	33	42
Gold-197	79	79	118

2. An atom contains 29 protons and 34 neutrons. How many electrons does this atom have and what is its atomic number?

Electrons 29 Atomic Number 29

3. The atomic masses of two isotopes of Cobalt are 59 and 60. If Cobalt has 27 electrons, what is the number of protons and neutrons in each isotope?

Cobalt-59 # protons 27 # Neutrons 32
 Cobalt-60 # protons 27 # Neutrons 33

4. One isotope of lead has 82 protons and 124 neutrons in its nucleus. What is the number of protons in the nucleus of **any other** isotope of lead?

82 protons

5. To become a negative ion, an atom has to gain an electron, while to become a positive ion an atom has to lose an electron. (lose / gain)

6. The subatomic particle with a negative charge is a(n) electron (proton/electron/neutron)

7. The # of protons in the nucleus of an atom is also known as the atomic number (mass/ number/ weight/ charge)

8. Uranium-235 and Uranium-238 are considered isotopes of one another. How are they similar and how are they different?

They will have the same number of protons (92) but different number of neutrons.

Ionic Bonds Practice

1. Fill in the missing information on the chart.

Element	# of Protons	# of Electrons	# of Valence Electrons
sodium	11	11	1
chlorine	17	17	7
beryllium	4	4	2
fluorine	9	9	7
lithium	3	3	1
oxygen	8	8	6
phosphorus	15	15	5

2. For each of the following ionic bonds:

- Write the symbols for each element.
- Draw a Lewis Dot structure for the valence shell of each element.
- Draw an arrow (or more if needed) to show the transfer of electrons to the new element.
- Write the charges on the ions.
- Write the resulting chemical formula.

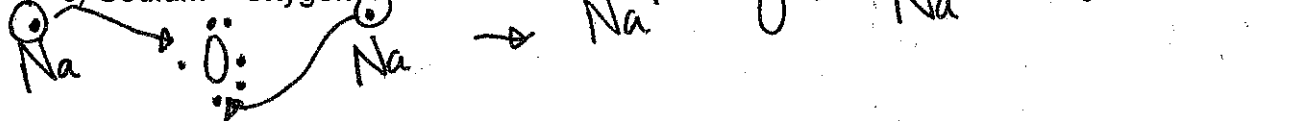
a) Sodium + Chlorine



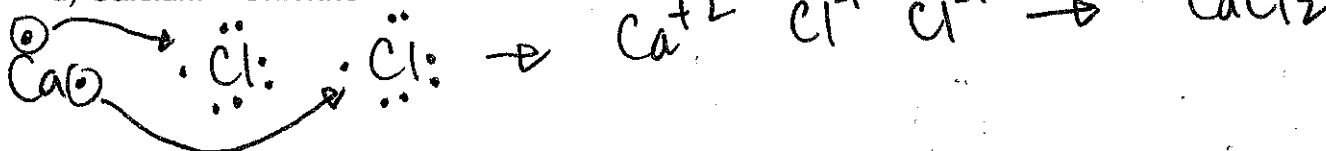
b) Magnesium + Iodine



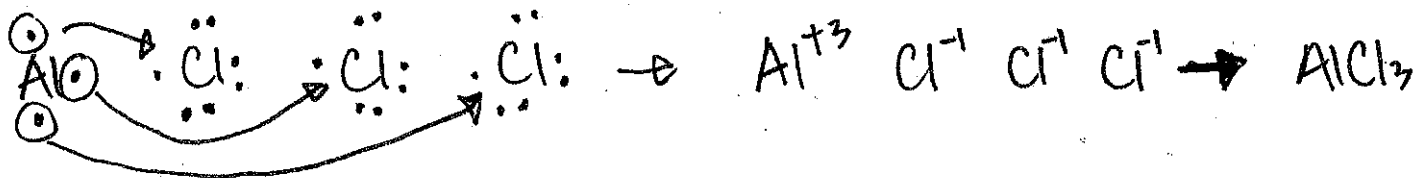
c) Sodium + Oxygen



d) Calcium + Chlorine



e) Aluminum + Chlorine



Covalent Bond Practice

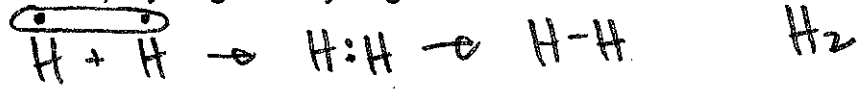
1. Fill in the missing information on the chart.

Element	# of Protons	# of Electrons	# of Valence Electrons	# of electrons to fill outer shell
carbon	6	6	4	4
hydrogen	1	1	1	1
chlorine	17	17	7	1
helium	2	2	2	0
phosphorus	15	15	5	3
oxygen	8	8	6	2
sulfur	16	16	6	2
nitrogen	7	7	5	3

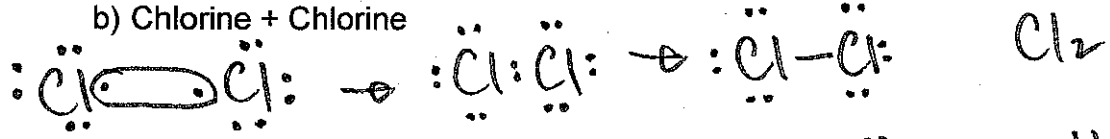
2. For each of the following covalent bonds:

- Write the symbols for each element.
- Draw a Lewis Dot structure for the valence shell of each element.
- Rearrange the electrons to pair up electrons from each atom.
- Draw circles to show the sharing of electrons between each pair of atoms
- Draw the bond structure using chemical symbols and lines. Use one line for each pair of electrons that is shared.
- Write the chemical formula for each molecule.

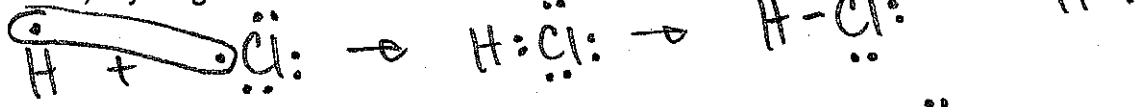
a) Hydrogen + Hydrogen



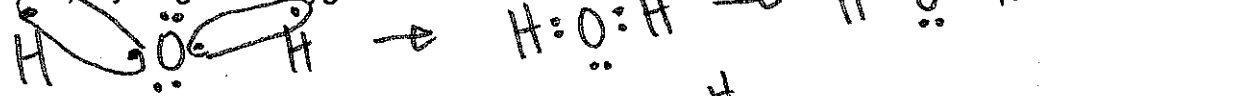
b) Chlorine + Chlorine



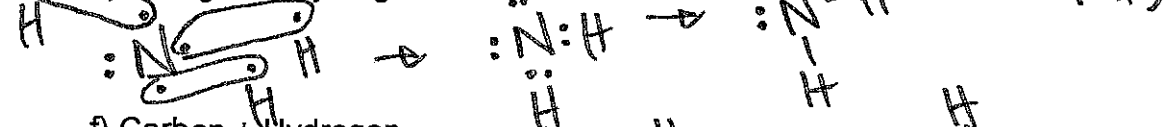
c) Hydrogen + Chlorine



d) Hydrogen + Oxygen



e) Nitrogen + Hydrogen



f) Carbon + Hydrogen

