Session 1 Worksheet

Vocab

Organic Chemistry: The study of carbon-containing molecules and their reactions

Organic Compounds: contain carbon atoms (there are exceptions)

What makes carbon so special?

- Ability of catenation (forming long chains of itself)

Inorganic Compounds: lack carbon atoms (again... exceptions)

Identify the organic compound below:

A. BF_3
B. CH_3COOH
C. Na_2CO_3
D. CO

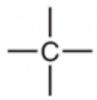
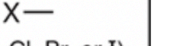
Isotopes Same element, different mass #

Number of Neutrons = 12 − 6 = 6	Number of Neutrons = 13 − 6 = 7	Number of Neutrons = 14 − 6 = 8
$^{12}_{6}C$	$^{13}_{6}C$	$^{14}_{6}C$

Valence Electrons: Electrons located in the outermost shell of an atom

The group number tells you how many valence electrons the element has in the valence shell

Bonding

Tetravalent	*Trivalent*	*Divalent*	*Monovalent*
			 (where X = F, Cl, Br, or I)
Carbon generally forms ***four*** bonds.	Nitrogen generally forms ***three*** bonds.	Oxygen generally forms ***two*** bonds.	Hydrogen and halogens generally form ***one*** bond.

Ionic Bonding:

Resulting from attraction of two oppositely charged ions - unequal sharing

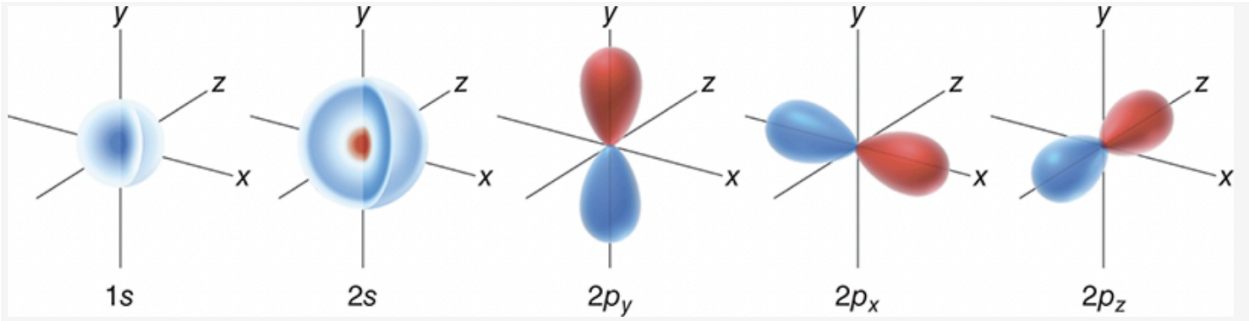
Covalent Bonding:

bond of 2 atoms sharing a pair of electrons

In the chart below, write down whether the bonding is ionic or covalent

Br_2	NaOH	CH_3	NaBr	$C(CH_3)_4$
covalent	Ionic	covalent	Ionic	Covalent

Electron Orbitals



Following these three principles:

Aufbau's:

- orbitals are filled lowest energy first

Pauli Exclusion:

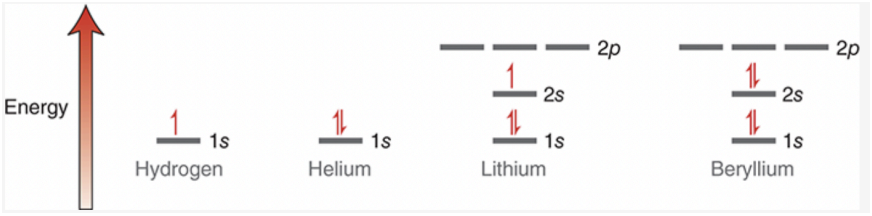
- max of 2 electrons in each orbital but only those of opposite spin

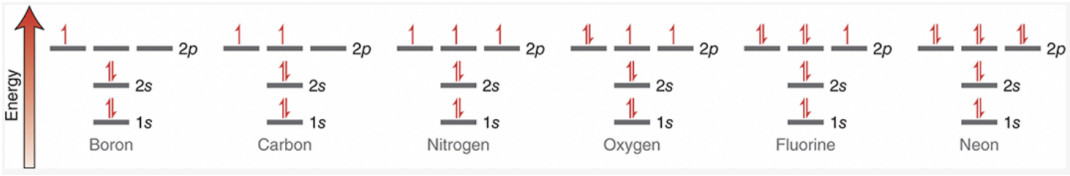
Hund's Rule:

- electrons are filled singly with the same spin before they are paired

* Except: Chromium, copper, and some transition metals *

Examples of these principles at play





Practice

Atom	Electron Configuration	Noble Gas Configuration
Ni	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$	$[Ar]\ 4s^2\ 3d^8$
Cl	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$	$[Ne]\ 3s^2\ 3p^5$
B	$1s^2\ 2s^2\ 2p^1$	$[He]\ 2s^2\ 2p^1$
K	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$	$[Ar]\ 4s^1$

Electron Configuration	Element
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$	Calcium
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$	Bromine
$1s^2 2s^2 2p^6 3s^2 3p^6$	Argon
$1s^2$	Helium

Draw the orbital diagrams for Sodium and Aluminum, both in full orbital diagrams and noble gas.

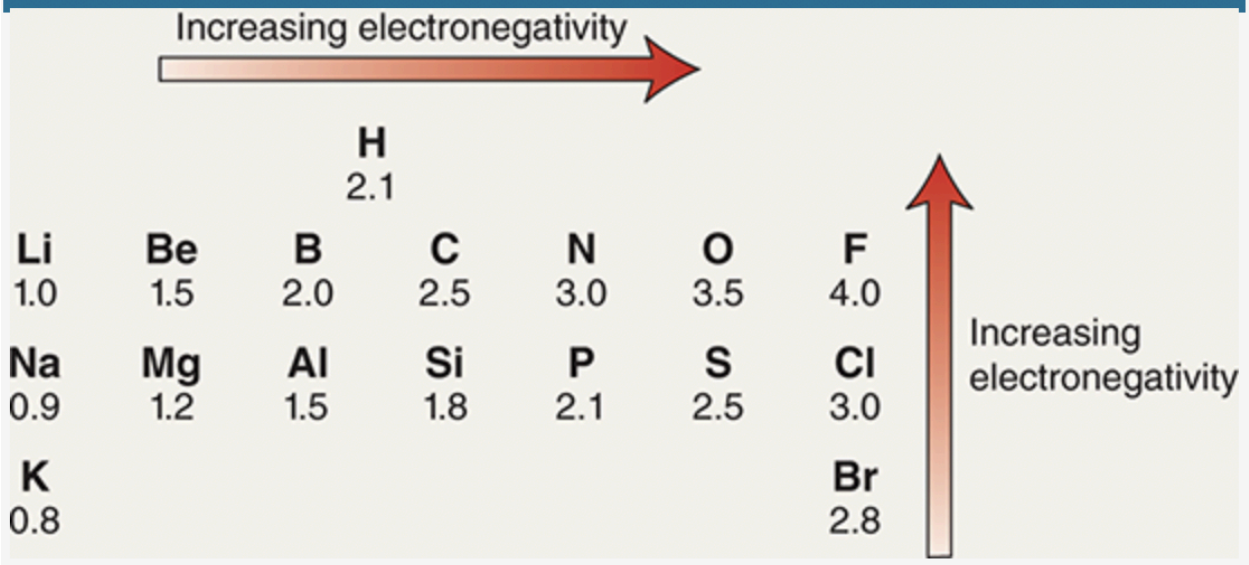
Na ↿⇂ (1s) ↿⇂ (2s) ↿⇂ ↿⇂ ↿⇂ (2p) 1 (3s) or [Ne] 1 (3s)

Al ↿⇂ (1s) ↿⇂ (2s) ↿⇂ ↿⇂ ↿⇂ (2p) ↿⇂ (3s) 1 (3p) or [Ne] ↿⇂ (3s) 1 (3p)

Electronegativity

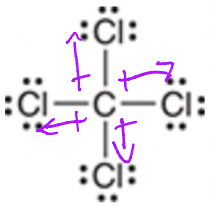
TABLE 1.1

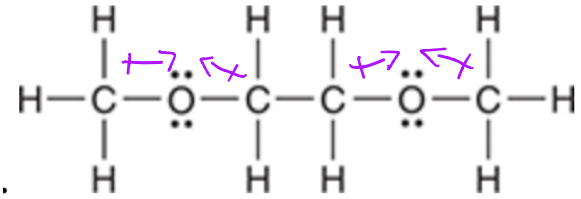
ELECTRONEGATIVITY VALUES OF SOME COMMON ELEMENTS

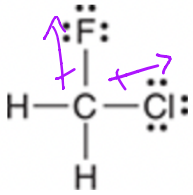


Induction causes the formation of partial positive and partial negative charges, symbolized by δ^+ and δ^-

Label the inductive charges: use ↗ to indicate direction







Heterolysis:

- The movement of electrons to the more electronegative atom
- forms ions

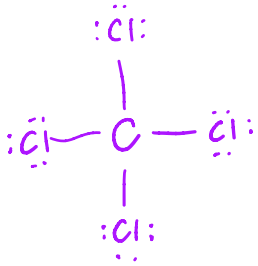
Homolysis:

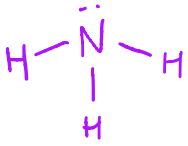
- Ions are equally strong, so the bond (electrons) is split evenly
- forms super reactive compounds called radicals

Lewis Structures

Draw the Lewis structures of:

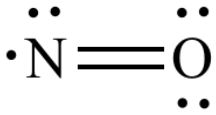
CCl_4 NH_3 Dihydrogen Monoxide



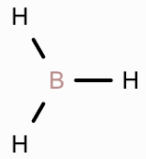


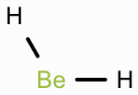
Common exceptions to the octet rule

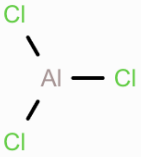
1. Free radical (odd number of electrons)



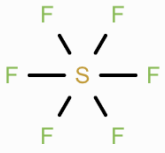
2. Incomplete octets

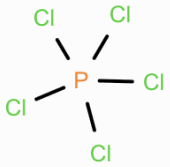






3. Overfilled octets

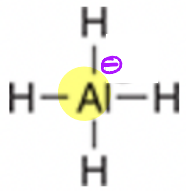




Formal Charge

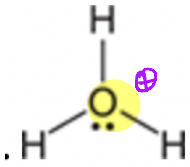
Formal Charge = # valence e⁻ - ½ bond e⁻ - non-bonded valence e⁻

Find the formal charge of the central atom:



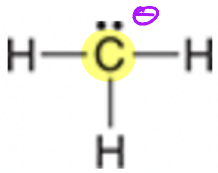
FC = 3 − 8(½) − 0

FC = −1



FC = 6 − 6(½) − 2

FC = 1



FC = 4 − 6(½) − 2

FC = −1