Unit 6

Bonding and Nomenclature Notes

Grades

- Check infinite campus today!!!!!
- Any assignments not turned in by your class period on Thursday will not be accepted.
- Midterm grades are posted with replacement is possible (you can look at these during LEAD next week)
- Lab reports will be entered this week.

Inquiry

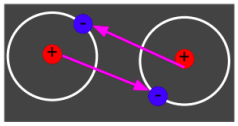
- Complete pages 3-5

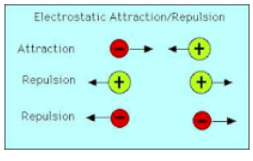
Lesson 1

Types of Bonds

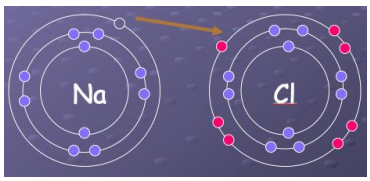
What is a bond?

- Force of attraction between two atoms.



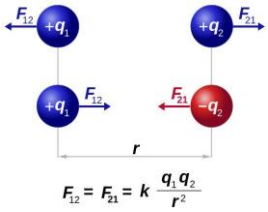


- Bonding involves only the valence electrons.



Columbic Attraction

- Remember - The closer two charges are, the stronger the force between them.



$$F_{12} = F_{21} = k\frac{q_1 q_2}{r^2}$$

What occurs when atoms bond?

- Atoms achieve a full valence shell of electrons (stable electron configuration)

Forming a Bond

- Energy is RELEASED spontaneously (Exothermic)
- Forms a stable compound

Breaking a Bond

- Energy is ABSORBED (endothermic)
- Stability DECREASES
- Ex) Moving two atoms apart requires the addition of ENERGY to overcome the attractive forces.

Three Types of Bonds

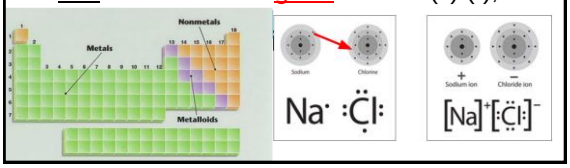
1. Ionic
2. Covalent
3. Metallic

Warm-up 1/8/2020

- NEW seats! DO NOT move the desks for any reason!!! They are arranged this way for a reason. Thanks! ☺
- LT: I can determine the type of chemical bond in each substance.
- Opener: Describe the difference between ionic and covalent bonds.

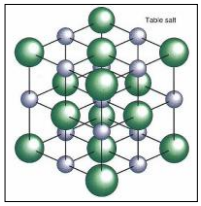
Ionic Bond

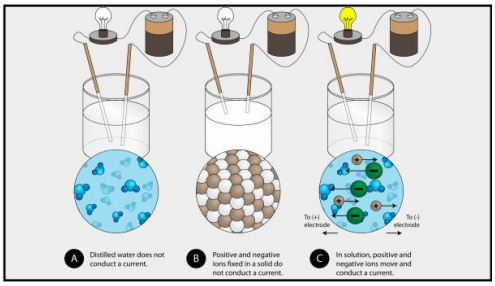
- Transfer of Electrons from Metal to Nonmetal to form a bond (electrostatic attraction)
- Due to large differences in electronegativities
- One atom loses electron(s) (+), **cation**, and the other atom gains electron(s) (-),



Properties of Ionic Compounds

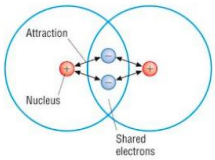
- Hard
- Crystalline structure
- HIGH melting/boiling point
- SOLUBLE in water
- Conduct electricity…
  only in solution.





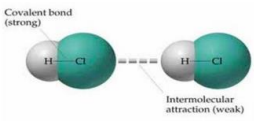
Covalent Bond

- SHARING of electrons between nonmetal & nonmetal due to similar electronegativities
- Forms molecular substances



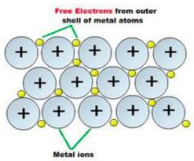
Properties of Covalent Compounds

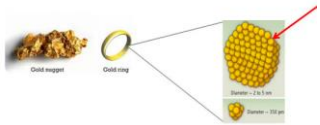
- Low melting and boiling points (due to weak attraction between molecules)
- Do not conduct electricity due to lack of charged particles (ions)



Metallic Bonds

- Between METAL atoms
- Sea of free flowing electrons
- EX) Au atoms in a gold ring





Properties of Metals

- High melting point and boiling point because bonds are strong
- Always capable of conducting electricity
- NOT soluble

Examples

Decide the type of bond for each the following and add to the examples section of your notes.

- H_2O
- KCl
- Ag (s)
- Na_2SO_4
- NO
- O_2
- Steel Alloy

Practice

- Pg 6-7 - Check
- Add vocabulary
- Page 8 together

Closure

- Explain why salt water conducts electricity, but sugar water does not

Lesson 2

Ionic Compounds

Thursday 1/9/2020

- LT: I can determine the type of chemical bond of each element based on the properties.
- Homework out on desk!
- Opener: Name 2 properties of each type of chemical bond.

Closure

- A solid substance was tested in the laboratory. The test results are 1) dissolves in water, 2) does not conduct electricity as a solid, 3) is an electrolyte. Based on these results, the solid substance could be ____

After the Quiz

- Plug in your chromebook
- Complete Lesson 2 – Type 1 in your notes

Ionic Compound Review

- Between metal and nonmetals
- Involve the transfer of electrons

Lewis Dot Diagrams for Ionic Compounds

- Draw ion dot diagrams next to each other making sure that:
  - The ion charges add up to zero

Ex)

Remember…

- Dot diagrams for positive ions (metals)

- Dot diagrams for negative ions (nonmetals)

Examples

- Dot diagram for NaCl
- Dot diagram for $CaCl_2$

Nomenclature – Part 1

- Rules:
  - Metal first, nonmetal second
  - Do not change the name of the metal, change the ending of the nonmetal to – ide
  - Use subscripts in the formula to indicate the number of each element needed to make a neutral compound

- Examples:

CaCl2	lithium iodide
Na3N	magnesium chloride
BeO	cesium oxide

Practice

- Page 11
- Add Vocabulary

Monday 1/13/2020

- Quiz Wednesday over Ionic compounds, Lewis Dot structure, and nomenclature.

WARM - UP

- Draw the LDS and write the name or formula.

1. Sodium oxide
2. Magnesium sulfide

Ionic Nomenclature – Part 2

Rules:

- All of Part 1 Rules
- Write a roman numeral to represent the charge of the transition metal
- Roman Numerals (I =1, II= 2, III= 3, IV = 4, V=5, VI=6, VII=7, VII=8, IX = 9, X =10)
- Exceptions, Ag and Zn do not get roman numerals because they only have one charge – Ag+ and Zn 2+ - Memorize these!

Examples:

$CoCl_3$ - cobalt (III) chloride	mangansese (IV) oxide – MnO_2
AgBr	lead (IV) sulfide
$TiCl_4$	zinc chloride

Ionic Nomenclature – Part 3

Rules:

- Rules for Type 1 and 2 apply
- Use parenthesis for poly atomic ions when using subscript
- Suffixes
  - ide = element
  - -ate and –ite = poly atomic ions
  - Keep polyatomic ion endings as listed

Examples:

$MgSO_4$ – Magnesium sulfate	ammonium nitrate – NH_4NO_3
LiCN	iron (III) nitrate
$NaHCO_3$	calcium hydroxide

Ionic Rules Summary

- Metal is always written first, then nonmetal
- Nonmetal element ending changed to –ide
- Polyatomic ion ending kept
- Transition metal must have roman numeral in () to indicate oxidation state

Practice

- Pages 11-13
- Add Vocabulary

Closure

- Draw the LDS and write the name or formula.

1. Sodium nitrate
2. Fe_2O_3

Tuesday 1/14/2020

***Quiz Wednesday

Lesson 3

Covalent Compounds

Bonds

- Share electrons between nonmetals
  - Share 2 electrons – single bond
  - Share 4 electrons – double bond
  - Share 6 electrons – triple bond

Lewis Dot Structure (Diagram)

- Make sure all elements get a full valence shell

Covalent Nomenclature – Part 4

Rules:

- Least electronegative nonmetal 1st
- 2nd nonmetal ending changed to –ide
- Add prefix to show the number of that element – except the first element never gets mono-

Number	Prefix	Number	Prefix
1	Mono-	6	Hexa-
2	Di-	7	Hepta-
3	Tri-	8	Octa-
4	Tetra-	9	Nona-
5	Penta-	10	Deca-

Examples

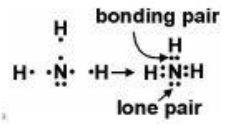
PCl_3	nitrogen trioxide
H_2Se	silicon dioxide
NO	carbon tetrafluoride

Practice

- Pages 1Add Vocabulary

Types of electron pairs

BONDING PAIRS: Form Bonds



Molecular Polarity Depends on:

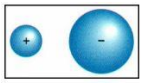
1. Bond Polarity
2. Shape of molecule (Symmetrical vs. non-symmetrical)

Bond Polarity

- Description of the sharing of electrons in a bond - even or uneven
- Based on an element's electronegativity

Ionic

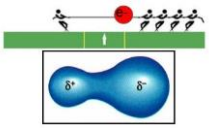
- Due to large differences in electronegativity, electrons are not shared, but transferred.



Polar Covalent

- Unequal sharing of electrons
- Electronegativity difference between atoms greater than 0.5
- One atom is slightly negative and one atom is slightly positive.
- This is known as a dipole

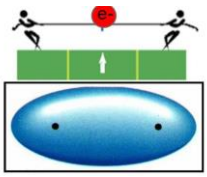
Ex) HF



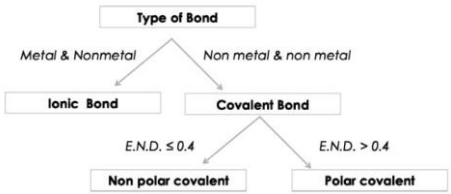
Nonpolar Covalent

- Equal sharing of electrons
- Electronegativity difference between atoms is 0.0-0.4
- Usually between identical atoms

Ex) H_2



How to determine the type of bond?



Examples

- NaS
- CBr
- OF
- **USE Table S**

Practice

- Pages 8-9
- Add vocabulary

Shape of molecules caused by: VSEPR

- Valence Shell Electron Pair Repulsion
- Valence electrons are arranged as far from one another as possible to minimize the repulsion between them
  (Like charges repel each other)

Polar Molecules

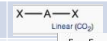
- A molecule is polar if it:
  – Contains POLAR BONDS
  – Is ASYMMETRICAL (not symmetrical)

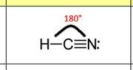
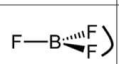
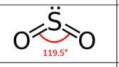
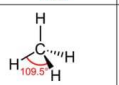
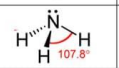
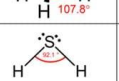
***** If there are LONE PAIRS on the central atom, then the molecule is automatically POLAR

Non Polar Molecules

- A molecule is nonpolar if it:
  – Contains only NONPOLAR BONDS
  – Is SYMMETRICAL

Molecular Geometry

Shape Name	AXE	3D Shape	Bond Angle	Polarity
Linear	AX_2E_0		180°	
Bent	AX_2E_1 AX_2E_2		120° 109.5°	Always Polar
Trigonal Planar	AX_3E_0		120°	
Trigonal Pyramidal	AX_3E_1		107°	Always Polar
Tetrahedral	AX_4E_0		109.5°	
Trigonal Bipyramidal	AX_5E_0		90°, 120°, 180°	

Geometric Type	Design	Description
Linear		Two atoms symmetrically distributed around the center atom. Results in a bond angle of **exactly 180°**.
Trigonal planar		Three atoms symmetrically distributed around the central atom without any lone pairs on the central. All of the atoms lie in the same plane. Results in a bond angle of **exactly 120°**.
Bent		Two atoms symmetrically distributed around the central atom with a lone pair on the central atom. Results in a bond angle **slightly less than 120°**.
Tetrahedral		Four outer atoms symmetrically distributed around the central atom. Forms a regular tetrahedron. Results in a bond angle **exactly 109.5°**.
Trigonal pyramidal		Three outer atoms symmetrically distributed around the central atom with one lone pair on the central atom. Results in a bond angle **slightly less than 109.5°**.
Bent		Two outer atoms symmetrically distributed around the central atom with two lone pairs on the central atom. Results in a bond angle **slightly less than 109.5°**.

Examples

- Determine the molecular polarity and shape of CCl_4

Step 1: Draw LDS

Step 2: Determine AXE

Step 3: Shape

Step 4: Polarity

Example

- Determine the molecular polarity and shape of H_2S

Practice

- Pages 19-20
- Add Vocabulary
- Molecular Model Sets

Review

Compound	LDS	Shape Name	Polarity
H_2Se			
CH_2Cl_2			

Properties Review

Polar

- Soluble in other polar compounds - water
- Insoluble in nonpolar compounds – oil
- NEVER conduct electricity

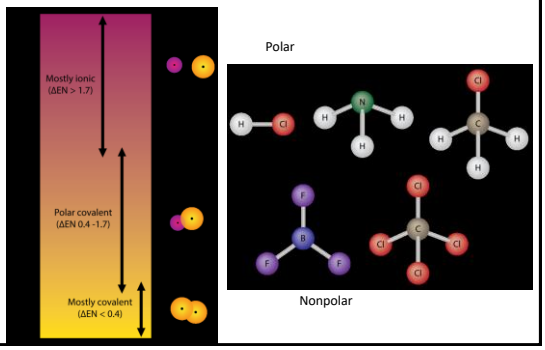
Nonpolar

- Insoluble in polar compounds – water
- Soluble in other nonpolar compounds – oil
- NEVER conduct electricity

Lesson 4

Intermolecular Forces

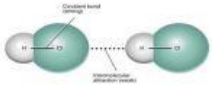
Polarity Review



What forces hold molecules together?

INTERMOLECULAR FORCES: (IMF's)

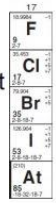
Weak forces of attraction **BETWEEN** molecules (covalent compounds)



Dispersion

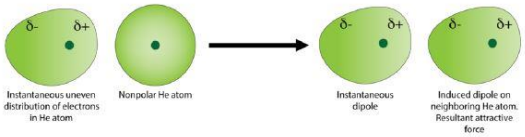
- Weakest IMF
- Occurs between Nonpolar molecules
- Explains how nonpolar molecules can exist solid and liquid phase





Dispersion

- All molecules have dispersion
- Due to random movement of electrons
- Dispersion increases as the molecule size increases

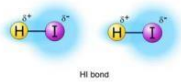


Dipole-Dipole

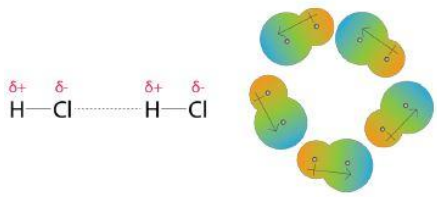
Between polar covalent molecules

Partial negative end of dipole attracted to partial positive end of another dipole

Greater polarity = Stronger IMF

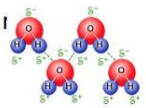


Dipole-Dipole

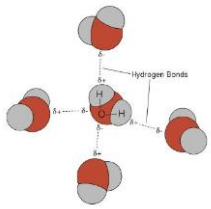


Hydrogen Bonding

- Extreme Dipole due to most electronegative elements
- **STRONGEST IMF**
- Occurs between hydrogen of one r and F, O or N in another
- "H bonding is FON"



Hydrogen Bonding



IMF effects Melting & Boiling Point

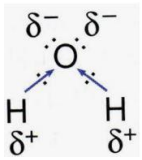
- The stronger the intermolecular force the greater the melting and boiling point of a substance

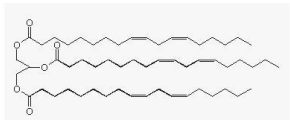
Other effects of IMFs

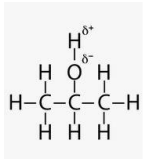
- Surface tension
- Viscosity
- Solubility
- Evaporation

Practice

- Page 21-22
- Add Vocabulary
- Pre-Lab







Melting Point