

Chapter 6

Part A Study Guide - Ionic Bonding

A. Bonding Basics

- The three types of strong bonds are: ionic, covalent, & metallic.
- The type of bond formed between atoms has most to do with the difference in their electronegativities.
 - Non-polar covalent bonds form when the difference in electronegativities between atoms is less than 0.4. In this type of bond, electrons are shared equally.
 - Polar covalent bonds form when the difference in electronegativities between atoms is between 0.4 & 2.0. In this type of bond, electrons are shared unequally.
 - Ionic bonds form when the difference in electronegativities between atoms is greater than 2.0. In this type of bond, electrons are transferred.
 - When two atoms have a difference in electronegativity of 1.7 the bond is equally ionic and covalent in nature.
- Generally speaking:
 - ionic bonds form between a(n) metal & a(n) non-metal,
 - covalent bonds form between two non-metals, and
 - metallic bonds form between two metals.
- Define valence electrons: Valence electrons are those electrons in the outermost shell surrounding an atomic nucleus.
 - How is the Roman numeral of a group on the periodic table related to the number of valence electrons? Roman numerals for main-group elements are the number of valence electrons for the elements of that group.
 - What is an octet? A full valence shell – usually 8 electrons
 - What is a full valence shell? A completely filled s sublevel in the first energy level, completely s & p sublevels in higher energy levels.
 - Define the term isoelectronic: “having the same number of electrons as”

B. Ionic Bonds

- An ionic bond is defined as an electrostatic attraction between oppositely charged particles (ions).
- What is the electrostatic force? The attractive force between oppositely charged particles and/or the repulsive force between like charged particles.
 - How is the electrostatic force related to ionic bonding? Electrostatic force is the force that holds ions together.
 - How does the electrostatic force vary over a distance? It's stronger over short distances & weaker over longer distances.
- Name three important properties of ionic compounds
high melting point, conduct electricity in liquid phase, hard / brittle
- Anions tend to form from non-metals when they steal electrons from metals.
- Cations tend to form from metals when they lose electrons to non-metals.
- An ion with a 1^+ charge has had one electrons stolen.
- An ion with a 3^- charge has stolen three electrons.
- Elements from group VIA tend to form ions with a -2 charge.

Chapter 6

Part A Study Guide - Ionic Bonding

- Another name for the charge of an ion is its oxidation state. Many transition metals have multiple oxidation states. A(n) Roman numeral is added to the ion's name to indicate this value.
- The names of monatomic anions end with ide.
- In an ionic compound the total charges of the cations and total charges of the anions must be equal to account for the transfer of all electrons.
- What does "(IV)" mean when written in a compound's name? the cation has a charge (oxidation state) of +4
- What does the octet rule say? atoms, gain, lose or share electrons to achieve a full valence shell
- How many electrons does hydrogen have when it has a complete octet? 2 (like other atoms that only fill the first energy level)

C. Lewis Structures

- In a Lewis structure, there may be no more than 8 dots around an atomic symbol.
- In the Lewis structure for N, there are 2 paired electrons and 3 bonding sites.

Draw Lewis dot diagrams for each of the following:



D. Writing Formulas*

Write names for the following:

- $\text{Mn}(\text{OH})_5$ manganese (V) hydroxide
- FeCO_3 iron (II) carbonate
- Na_2SO_4 sodium sulfate
- Li_3P lithium phosphide

E. Naming Substances*

Next to each chemical name write the correct empirical formula for each of the following:

- Titanium (IV) iodide TiI_4
- Nickel (II) fluoride NiF_2
- Iron (III) bromide FeBr_3
- Sodium dihydrogen phosphate NaH_2PO_4
- Manganese (VII) oxalate $\text{Mn}_2(\text{C}_2\text{O}_4)_7$
- Sodium hydroxide NaOH
- Silver nitrate AgNO_3
- Lithium hydroxide LiOH

*** (Be sure you can do these!)**

F. Metallic Bonds

- Define a metallic bond A bond that occurs between the mobile electrons of metal atoms and the nuclei of those atoms – a lattice of atoms in which the valence electrons are shared in one large “sea of electrons”
- The model used to describe the sharing of electrons in metallic bonds is referred to as the “sea of electrons” model.
- Name three important properties of metallic substances

Chapter 6

Part A Study Guide - Ionic Bonding

Name: _____

Date: _____ Per: _____

_____ malleable _____, _____ ductile _____, _____ conductive _____

12. How do the terms “delocalized” and “highly mobile” relate to metallic bonding? _____ They are both terms to describe the behavior of electrons in metallic bonding. _____