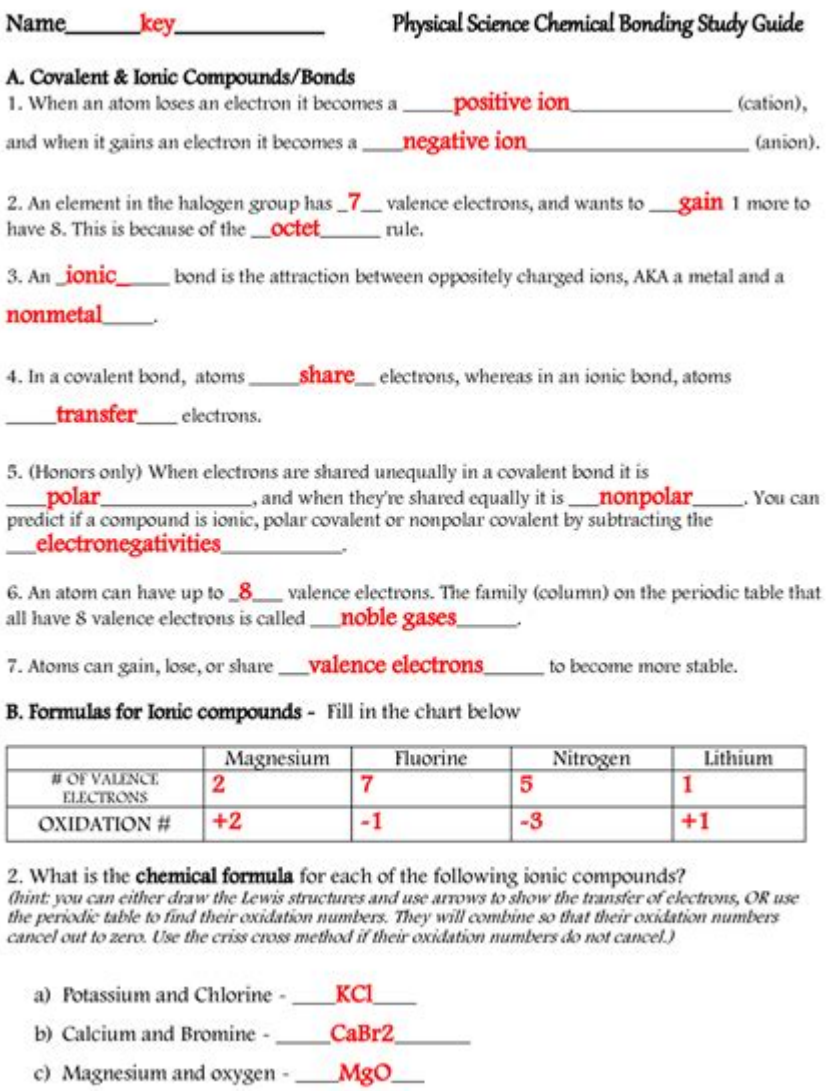
Chemical Bond Study Guide For Freshman



Name_____key_____ Physical Science Chemical Bonding Study Guide

A. Covalent & Ionic Compounds/Bonds

1. When an atom loses an electron it becomes a ____positive ion_____ (cation), and when it gains an electron it becomes a ____negative ion_____ (anion).

2. An element in the halogen group has _7__ valence electrons, and wants to ___gain 1 more to have 8. This is because of the __octet_____ rule.

3. An _ionic_____ bond is the attraction between oppositely charged ions, AKA a metal and a nonmetal_____.

4. In a covalent bond, atoms _____share__ electrons, whereas in an ionic bond, atoms _____transfer____ electrons.

5. (Honors only) When electrons are shared unequally in a covalent bond it is ____polar_____, and when they're shared equally it is ___nonpolar_____. You can predict if a compound is ionic, polar covalent or nonpolar covalent by subtracting the ___electronegativities_____.

6. An atom can have up to _8___ valence electrons. The family (column) on the periodic table that all have 8 valence electrons is called ___noble gases_____.

7. Atoms can gain, lose, or share ___valence electrons_____ to become more stable.

B. Formulas for Ionic compounds - Fill in the chart below

	Magnesium	Fluorine	Nitrogen	Lithium
# OF VALENCE ELECTRONS	2	7	5	1
OXIDATION #	+2	-1	-3	+1

2. What is the **chemical formula** for each of the following ionic compounds?
(hint: you can either draw the Lewis structures and use arrows to show the transfer of electrons, OR use the periodic table to find their oxidation numbers. They will combine so that their oxidation numbers cancel out to zero. Use the criss cross method if their oxidation numbers do not cancel.)

a) Potassium and Chlorine - ____KCl____
b) Calcium and Bromine - _____CaBr2_____
c) Magnesium and oxygen - ____MgO___

Chemical bond study guide for freshman is an essential resource for students embarking on their journey into the fascinating world of chemistry. Understanding chemical bonds lays the foundation for grasping more complex chemical interactions and reactions. This study guide will cover the types of chemical bonds, their characteristics, and their significance in the realm of chemistry. By the end of this guide, you will have a solid understanding of the fundamental concepts of chemical bonding.

What are Chemical Bonds?

Chemical bonds are the forces that hold atoms together in a molecule. They are formed when atoms interact and share or transfer electrons in their outer shells. Understanding these bonds is critical as they determine the properties of substances and the nature of chemical reactions.

Types of Chemical Bonds

There are three primary types of chemical bonds:

- **Ionic Bonds**
- **Covalent Bonds**
- **Metallic Bonds**

Each type of bond has unique characteristics and plays a crucial role in the behavior of different compounds.

Ionic Bonds

Ionic bonds are formed when one atom transfers electrons to another atom, resulting in the formation of charged ions. This type of bond typically occurs between metals and non-metals.

Characteristics of Ionic Bonds

- **Formation of Ions:** Metals tend to lose electrons, becoming positively charged cations, while non-metals gain electrons, becoming negatively charged anions.
- **Electrostatic Attraction:** The oppositely charged ions attract each other, forming a strong ionic bond.
- **High Melting and Boiling Points:** Ionic compounds generally have high melting and boiling points due to the strong forces of attraction between ions.
- **Solubility:** Many ionic compounds are soluble in water, and they conduct electricity when dissolved in water or melted.

Examples of Ionic Compounds

Some common examples of ionic compounds include:

- Sodium Chloride (NaCl)
- Potassium Iodide (KI)
- Calcium Fluoride (CaF_2)

Covalent Bonds

Covalent bonds are formed when two atoms share one or more pairs of electrons. This type of bond usually occurs between non-metal atoms.

Characteristics of Covalent Bonds

- **Electron Sharing:** Atoms share electrons to achieve a full outer shell, resulting in a stable molecule.
- **Single, Double, and Triple Bonds:** Depending on the number of shared electron pairs, covalent bonds can be classified as single (one pair), double (two pairs), or triple (three pairs).
- **Lower Melting and Boiling Points:** Covalent compounds typically have lower melting and boiling points compared to ionic compounds.
- **Varied Solubility:** Covalent compounds can be soluble or insoluble in water, depending on their polarity.

Examples of Covalent Compounds

Common examples of covalent compounds include:

- Water (H_2O)

- Carbon Dioxide (CO_2)
- Methane (CH_4)

Metallic Bonds

Metallic bonds occur between metal atoms, where electrons are not shared or transferred but instead form a "sea of electrons" that are free to move around.

Characteristics of Metallic Bonds

- **Electron Sea Model:** Electrons are delocalized and move freely around the positively charged metal ions, which contributes to the conductivity of metals.
- **High Ductility and Malleability:** Metals can be drawn into wires (ductility) or hammered into sheets (malleability) due to the flexibility of the metallic bond.
- **High Conductivity:** Metals are excellent conductors of heat and electricity due to the mobility of the electrons.
- **Shiny Appearance:** Metallic bonds give metals their characteristic luster.

Examples of Metallic Compounds

Some examples of metals with metallic bonding include:

- Copper (Cu)
- Iron (Fe)
- Gold (Au)

Comparing the Types of Bonds

Understanding the differences between ionic, covalent, and metallic bonds can help students predict the properties of substances based on their bonding type. Here's a quick comparison:

Property	Ionic Bonds	Covalent Bonds	Metallic Bonds
Formation	Transfer of electrons	Sharing of electrons	Delocalized electrons
Type of Elements	Metals and Non-metals	Non-metals	Metals
Melting/Boiling Points	High	Low to Moderate	Variable
Electrical Conductivity	Conductive when dissolved	Generally non-conductive	Conductive

Conclusion

In summary, the **chemical bond study guide for freshman** provides a comprehensive overview of ionic,

covalent, and metallic bonds. Understanding these concepts is crucial for any aspiring chemist, as they serve as the foundation for further studies in chemistry and related fields. By familiarizing yourself with the characteristics, examples, and differences between these types of bonds, you will be well-equipped to tackle more complex topics in chemistry with confidence. As you continue your studies, remember that the nature of chemical bonds not only influences the behavior of substances but also plays a vital role in our everyday lives. Happy studying!

Frequently Asked Questions

What is a chemical bond?

A chemical bond is a lasting attraction between atoms that enables the formation of chemical compounds. It involves the sharing or transfer of electrons.

What are the main types of chemical bonds?

The main types of chemical bonds are ionic bonds, covalent bonds, and metallic bonds.

How does an ionic bond form?

An ionic bond forms when one atom donates an electron to another atom, resulting in oppositely charged ions that attract each other.

What is a covalent bond?

A covalent bond is formed when two atoms share one or more pairs of electrons, allowing each atom to attain a stable electron configuration.

What is the significance of electronegativity in chemical bonding?

Electronegativity refers to the ability of an atom to attract electrons in a bond. It determines the type of bond formed (ionic or covalent) and the polarity of the bond.

What is a polar covalent bond?

A polar covalent bond is a type of covalent bond where the electrons are shared unequally between two atoms, resulting in a molecule with a slight charge difference.

What role do valence electrons play in bonding?

Valence electrons are the outermost electrons of an atom and are involved in forming chemical bonds; they determine an atom's reactivity and ability to bond with other atoms.

What is the difference between a single, double, and triple bond?

A single bond involves one pair of shared electrons, a double bond involves two pairs, and a triple bond involves three pairs of shared electrons between two atoms.

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