Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_

**Bonding: Ionic or covalent?**

**Getting Started With Types of Compounds**There are two major classes of compounds typically encountered as part of an introductory course: ionic and covalent compounds. The concepts describing how these compounds are held together (bonds) can be developed as you progress through your studies. However, before you get to those concepts you must be able to quickly classify a compound into one class or the other. In other words, your ability to classify compounds will guide how you will think about bigger ideas.

Table 1 – Compounds that are considered…

|  |  |
| --- | --- |
| **Ionic** | **Covalent** |
| ZnCl2 | CCl4 |
| Na2O | P2O5 |
| Fe2O3 | N2O4 |
| CuI | NI3 |

1. The compound ZnCl2 is considered to be a (an) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compound.
2. The compound that contains nitrogen and oxygen is a (an) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compound.
3. Write the symbols for the elements that make up the compounds in Table 1, in their correct location on the periodic table.



1. What do you notice about the 2 elements in each ionic compound? What do you notice about the 2 elements in each covalent compound?
2. Classify each of the following as either ionic or covalent.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NaBr  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | SF6 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CrCl3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| CoBr2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | BaS | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CO2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| OF2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CsF2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | NO2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. Write a simple rule that will allow you to classify compounds as ionic or covalent on the basis of what you have learned.

**How do Atomic Properties Affect Bonding?**

1. Draw a “Bohr” diagram of the following atoms showing

Bohr diagram of a nitrogen atom:

energy levels, electrons, **AND indicating relative size**.

**Na Mg P Cl**

**EN**

**I.E**.

1. Use an arrow and write ‘increase’ or ‘decrease’ to show how electronegativity (EN) changes going from Na to Cl. Do the same for ionization energy (I.E.). Draw these arrows below the atom diagrams above.
2. Would an atom with electrons close to the nucleus or an atom with electrons far away from the nucleus be more likely to lose electrons?

 Gain electrons?

1. Considering **atomic radius, electronegativity, and ionization energy**, identify the atoms above that would be most likely to **lose** valence electrons. Explain your answer.
2. Considering **atomic radius, electronegativity, and ionization energy**, identify the atoms above that would be most likely to **gain** valence electrons. Explain why.
3. Determine the most likely charge for each ion after electrons are lost or gained to achieve a full valence energy level. Write the charge on the symbol below.

Na Mg P Cl

An ionic bond forms when an **atom that is likely to lose electrons** bonds with an **atom that is likely to gain eletrons.** The atom that loses electrons transfers electrons to the atom that gains electrons.

A covalent bond forms when **2 atoms that are likely to gain electrons bond together**. Because they are both likely to gain electrons they must share electrons.

1. Identify 2 atoms above that would likely combine by forming an **ionic bond**. Explain your choice.
2. Identify 2 atoms above that would likely combine by forming a **covalent bond**. Explain your choice.
3. Do your answers to (13) and (14) agree with the rule you wrote when answering (6)?

**There are actually 2 methods for determining whether a compound is ionic or covalent.**

* One method is using the metal / nonmetal rule, which states that when a metal atom bonds with a nonmetal atom an ionic bond is formed. And, when a two nonmetal atoms bond together a covalent bond is formed.
* The other method is using the difference in electronegativity values. The lower electronegativity is subtracted from the greater electronegativity and the difference determines whether a bond is ionic or covalent. The difference is compared to 1.7 to determine the bond type.

difference > 1.7 ionic bond
difference < 1.7 covalent bond

1. Use both methods and a Table of Electronegativity Values to complete the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element A | Element B | Type of bond based on metal / nonmetal | Difference in electronegativity | Type of bond based on difference in electronegativity |
| K | F |  |  |  |
| C | Br |  |  |  |
| Ca | O |  |  |  |
| I | Cl |  |  |  |
| Mg | P |  |  |  |
| Cu | N |  |  |  |

1. What do the results on this table tell you about the 2 methods for determining whether a bond is ionic or covalent?