NAME: **HONORS CHEMISTRY**

SECTION: Jigsaw: Types of Chemical Bonds

The purpose of this activity is to compare and contrast the different types of chemical bonds. Students will work in expert groups to learn about one type of chemical bond, and then teach about that intermolecular attraction to the other students in their base groups. At the end of class, you should be able to determine the types of chemical bond that is present in a substance based on the classes of elements in the substance.

Base Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Our textbook defines a chemical bond as “a force that holds groups of two or more atoms together and makes them function as a unit.” Bond formation is an exothermic process. The energy required to break a bond—the bond dissociation energy, or just “bond energy”—is a measure of the strength of the bond.

As a group, develop an analogy for chemical bonds and write a brief description of your analogy here.

Split up into expert groups:

Expert Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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As a group, use the assigned reading to prepare a description of the chemical bond, an illustration of the type of bond, and answers to the key questions. Keep your answers brief and to the point! When you are done, return to your base groups. Base group members will take turns teaching about each type of bond. Then, group members will work together to complete the application questions.

**Expert Group 1: Ionic Bonding**

Illustration:

**Key Questions**

1. What types of elements are involved in the formation of an ionic bond?
2. What happens to the electrons when an ionic bond forms?

1. Give a real world example of a compound held together by ionic bonding
2. Are ionically bonded substances typically soluble in water?
3. Are ionic compounds electrolytes in water? (I.e., Will aqueous solutions containing ionic compounds conduct electricity?
4. Melting points: high medium low
5. Typical state of matter for ionic compounds:
6. Other relevant properties of ionic compounds:

**Expert Group 2: (Molecular) Covalent Bonding**

Illustration:

**Key Questions**

1. What types of elements are involved in the formation of a covalent bond?
2. What happens to the electrons when a covalent bond forms?

1. Give a real world example of a compound held together by covalent bonding.
2. Are covalently bonded substances typically soluble in water?
3. Are covalent compounds electrolytes in water? (I.e., Will aqueous solutions containing molecular covalent substances conduct electricity?)
4. What is the difference between a non-polar covalent bond and a polar covalent bond?
5. Melting points: high medium low
6. Typical state of matter for covalent substances:
7. Other relevant properties of covalent substances:

**Expert Group 3: Network Covalent Bonding**

Illustration:

**Key Questions**

1. What types of elements are involved in the formation of a network covalent bond?
2. What happens to the electrons when a network covalent bond forms?

1. Give a real world example of a substance held together by network covalent bonding.
2. Are network covalently bonded substances typically soluble in water?
3. Are network covalent substances electrolytes in water? (Will aqueous solutions containing network covalent substances conduct electricity?)
4. Melting points: high medium low
5. Typical state of matter for network covalent compounds:
6. Other relevant properties of network covalent compounds:

**Expert Group 4 Metallic Bonding**

Illustration:

**Key Questions**

1. What types of elements are involved in the formation of a metallic bond?
2. What happens to the electrons when a metallic bond forms?

1. Give a real world example of a substance held together by metallic bonding.
2. Are metallic substances typically soluble in water?
3. Describe the conductivity of metallic substances:
4. Melting points: high medium low
5. Typical state of matter for metals:
6. Other relevant properties of metallic substances:

**Application Questions**

As a group, decide whether the elements in the following substances are metals or non-metals. Predict the type of bonding that occurs in the substance: ionic, covalent or metallic. You may refer to a periodic table. (We haven’t yet discussed how we can use electronegativities to decide if a covalent bond is polar or non-polar)

|  |  |  |  |
| --- | --- | --- | --- |
| **Compound** | **Element 1**  **(metal or non-metal?)** | **Element 2**  **(metal or non-metal?)** | **Bond Type** |
| NO2 | N = non-metal | O = non-metal | covalent |
| NaCl |  |  |  |
| SCl2 |  |  |  |
| Ag |  |  |  |
| CaO |  |  |  |
| SF4 |  |  |  |
| K2O |  |  |  |
| Cu-Zn alloy |  |  |  |
| O2 |  |  |  |
| CuCl2 |  |  |  |
| CO2 |  |  |  |
| TiO2 |  |  |  |
| HF |  |  |  |
| Rb2S |  |  |  |