**Worksheet - Chapter 7 – Chemical Bonding**

**Due:**

**Section A: Fill In The Blanks.**

**Some important new terms from Chapter 7 are listed below. Fill in the blanks in the following paragraphs with terms from the list. Each term is to be used only once.**

bond energy formal charge polar bond

bond length ionic bonding polyatomic ion

bonding electrons Lewis dot representation resonance

chemical bonding Lewis formula single bond

covalent bonding lone pairs triple bond

dipole moment nonpolar bond valence electrons

double bond octet rule

In compounds and other groups of atoms, atoms are held together by attractive forces referred to as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. There are two kinds of chemical bonding. When one or more electrons is transferred from on atom to another, the atoms are held together by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When atoms share pairs of electrons, they are held together by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Chemical bonding is illustrated in very simplified form by representing each atom by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a technique developed by G.N. Lewis. In these representations, the dots represent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, electrons in the highest occupied energy level.

A monatomic ion is a single atom with a charge. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a group of atoms that has a charge. A covalent bond may be formed by sharing one, two, or three pairs of electrons. If one pair of electrons is shared, the bond is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If two pairs of electrons are shared, the bond is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If three pairs of electrons are shared, the bond is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The length of a line between two atoms that are bonded together is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The energy released when the bond is formed is its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The bonding in a molecule or a polyatomic ion can be illustrated by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, based upon the Lewis dot representations used for individual atoms. One of the fundamental principles for drawing Lewis formulas is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which refers to the very stable eight valence electron configurations of the noble gases.

The electrons represented by dots in Lewis formulas are either \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, shared between the bonded atoms, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, so called because they are associated with only one of the atoms. Sometimes two or more Lewis formulas together are used to represent the structure of a substance. These diagrams are known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ structures. Choosing the most likely structure for a group of atoms can be aided by calculating the hypothetical charge on an atom in the molecule or polyatomic ion, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Covalent bonds are of two types, depending upon the electronegativities of the atoms bonding. Unless the electronegativities are the same, or very close to the same, the two bonded atoms do not share the bonding electrons equally; the bond is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, meaning that the distribution of electrons is not equal or uneven. If the electronegativities are about the same, the electrons are shared more or less equally; the bond is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The more complete name for polar bond is polar covalent bond – it is still a covalent bond. A polar bond has a dipole, resulting from the separation of positive and negative charges. The degree of polarity of a molecule can be expressed by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, , which is directly related to the distance separating the charges and the magnitude of the charge.

**Section B: Short Answer.**

***Instructions: Answer with a word, a phrase, a formula, or a number with units as necessary.***

1. The Lewis dot representation of an atom of calcium is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. The Lewis dot representation of an atom of phosphorous is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. The Lewis dot representation for any halogen atom (represent it as X) is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. The formula of the ionic compound of magnesium and oxygen is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

5. The formula of the ionic compound of rubidium and sulfur is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

6. The formula of the ionic compound of calcium and nitrogen is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

7. In the formation of a covalent bond, the principal “attractive force” is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

8. In the formation of a covalent bond, the principal “repulsive forces” are due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

9. When two atoms combine to form a stable chemical bond, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the bonded pair of atoms is lower than that of the isolated atoms.

10. When two atoms are joined by a single bond, they share \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons.

11. When two atoms are joined by a double bond, they share \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons.

12. Which of the following molecules would be described as diatomic: He, H2, Cl2, HCl, CS2, NH3, H2O, S8, P4?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

13. Which of the molecules in Question 12 would be described as homonuclear? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Which as heteronuclear? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. A single bond is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (longer/shorter) and its energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (greater/less) than a triple bond.

15. When the bonding pair of electrons in a covalent bond is equally shared between the two atoms, the bond is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; when one atom attracts the shared pair of electrons more strongly than the other, the bond is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

16. A covalent bond is polar if the two atoms involved differ significantly in their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ values.

17. In which are the covalent bonds more polar, CH4 or CF4? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18. Consider a series of bonds in which carbon is bonded to another second period element: C-O, C-F, C-N, and C-C. Place these bonds in order of decreasing polar (ionic) character: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Each of the following compounds or ions obeys the octet rule. Apply the relationship *S=N-A* to each of them and draw the Lewis formula; draw each Lewis formula using only dots and again using dashes to represent bonding electrons. Question 19 is completed as an example.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Compound or Ion** | **N** | **A** | **S**  **(S = N-A)** | **Lewis Formula (using only dots)** | **Lewis Formula**  **(using dashes to represent bonding electrons)** |
| 19. | CH4 | 16 | 8 | 16 – 8  = 8 | 1.jpg | 1.gif |
| 20. | CCl4 |  |  |  |  |  |
| 21. | NH3 |  |  |  |  |  |
| 22. | NH4**+** |  |  |  |  |  |
| 23. | CH3Cl |  |  |  |  |  |
| 24. | CS2 |  |  |  |  |  |
| 25. | PF3 |  |  |  |  |  |
| 26. | SO42- |  |  |  |  |  |
| 27. | HCN (C is  the central atom) |  |  |  |  |  |
| 28. | C2H2 |  |  |  |  |  |
| 29. | N2H4 |  |  |  |  |  |

**End of Worksheet**