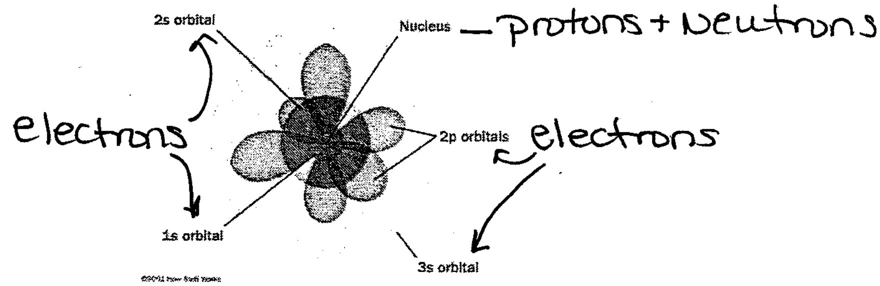
Name Key date 2013 period____

Chemical Bonding Worksheet

Fill in the blanks with the word that best completes the sentence or answers the question.

General Information

The smallest particle of matter that retains its chemical properties is called an (1.) atom.
Atoms are composed of three atomic particles. These are called protons, (2.) Neutrons, and (3.) electrons.
Neutral atoms have equal numbers of (4.) electron and (5.) Protons.
Look at the diagram of an atom below. Each of the orbitals can contain 2 electrons. The 1s orbital is the only orbital in the first electron shell so the first shell can only hold 2 electrons. In the second electron shell there is one 2s and three 2p orbitals so the second electron shell can hold a total of 8 electrons. **Label** on the diagram shown below where you would find the (6.) electrons, (7.) protons, and (8.) neutrons.

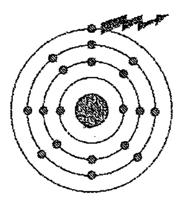


Metallic Bonds

One chemical bonding mechanism is the *metallic bond.* In the metallic bond, an atom achieves a more stable configuration by sharing the electrons in its outer shell with many other atoms. Metallic bonds prevail in elements in which the valence electrons are not tightly bound with the nucleus, namely metals. In this type of bond, each atom in a metal crystal contributes all the (9.) electrons in its valence shell to all other atoms in the crystal.

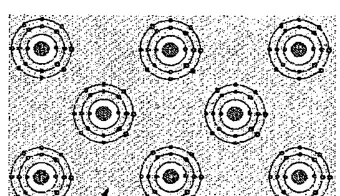
Another way of looking at this mechanism is to imagine that the valence electrons are not closely associated with individual (10.) atoms, but instead move around amongst the atoms within the crystal. Therefore, the individual atoms can "slip" over one another yet remain firmly held together by the electrostatic forces exerted by the electrons. (Electrostatic forces are those due to the charges on the nucleus and the surrounding electrons.) Note this configuration in the diagrams below. This is why most metals can be hammered into thin sheets which is the property called (11.) malleability or drawn into thin wires (12.) ductile. When an electrical potential difference (electrical potential is the difference in electrical charge that allows electricity to flow) is applied, the electrons move freely between atoms, and causes a flow of electrical (13.) current.

Other simple examples include potassium (K).



Potassium (2:8:8:1)

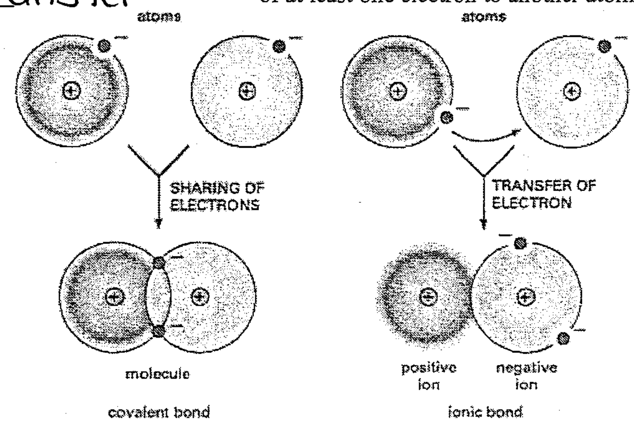
Potassium atoms lose the outermost electron and form a metallic bond.



Sea of free electrons – All valence electrons from metal atoms form the "sea of electrons"

Covalent Bonds vs Ionic Bonds

Ionic and Covalent bonds are often compared and contrasted. Below is a diagram showing examples of each of these type of bonds. The main difference is that in covalent bonds there is a (14.) Sharing of the electrons whereas in ionic bonds there has been a (15.) transfer of at least one electron to another atom.



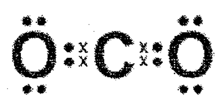
Covalent Bonds

Covalent chemical bonds involve the (16.) Sharing of a pair of valence electrons by two atoms, in contrast to the transfer of electrons in ionic bonds. Such bonds lead to stable molecules if they share electrons in such a way as to create a noble gas configuration for each atom.

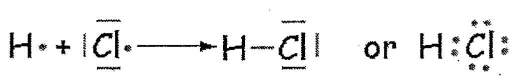
Hydrogen gas forms the simplest covalent bond. The halogens such as chlorine also exist as diatomic gases by forming covalent bonds. The nitrogen and oxygen which makes up the bulk of the atmosphere also exhibits covalent bonding in forming diatomic molecules.

Covalent bonding can be visualized with the aid of Lewis (dot) diagrams. Lewis diagrams show only the valence electrons around the chemical symbol for an element. There is an example of a Lewis (dot) diagram below in the diagram showing a hydrogen molecule and a water molecule. Note the (17.) Valence electrons are the only ones shown in the dot diagrams.

Drawing the Dot Structure for Carbon Dioxide



The carbon atom starts out with 4 outer shell electrons, and each oxygen atom starts out with 6 (as shown above). In order for each atom to end up with an octet (8 electrons in the outer shell), these 16 electrons must arrange themselves as shown in the Lewis dot structure above, resulting in two double bonds around the central carbon atom.



Drawing the Dot Structure for Hydrogen Chloride

The electrons spend more time around the Chlorine atom than the Hydrogen atom making the Chlorine side of the molecule have a negative charge and the Hydrogen side of the atom have a positive charge.

Polar vs Nonpolar Covalent Bonds

Covalent bonds in which the sharing of the electron pair is (18.) unequal, with the electrons spending more time around the more nonmetallic atom, are called polar covalent bonds. In such a bond there is a charge separation with one atom being slightly more positive and the other more negative.