Unit 3 Study Guide, Part 2
Chemical Bonding - Covalent

Targets:

E5. *Describe how atoms are joined by chemical bonding.*

H9. *Demonstrate an understanding that energy can be found in chemical bonds and can be used when it is released from those bonds.*

Activity #1 – Introduction to Covalent Bonding

Open Chemical Bonding. Scroll down to the heading "Covalent Bonding".

1) *Fill in the blanks:* As opposed to _____ bonding in which a complete transfer of electrons occurs, _____ bonding occurs when two (or more) elements_____ electrons. Covalent bonding occurs because the atoms in the compound have a similar tendency for electrons (generally to_____ electrons). This most commonly occurs when two_____ bond together. Because both of the nonmetals will want to _____ electrons, the elements involved will share electrons in an effort to _____ their valence shells.

2) Continue reading and answer the following questions.

   a) How many valence electrons in one atom of hydrogen?

   b) How many valence electrons does hydrogen need to have a full first shell?

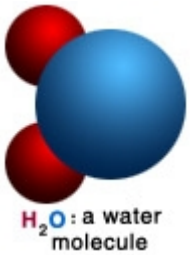
   c) How does the hydrogen atom "pick up" another electron?

   d) What compound does hydrogen form?

   e) How do hydrogen atoms make a covalent bond? Make sure you visit the simulation, Covalent bonding between hydrogen atoms, and describe/draw what you see.

3) Label the substances below as "ionic" or covalent".

NaCl crystal



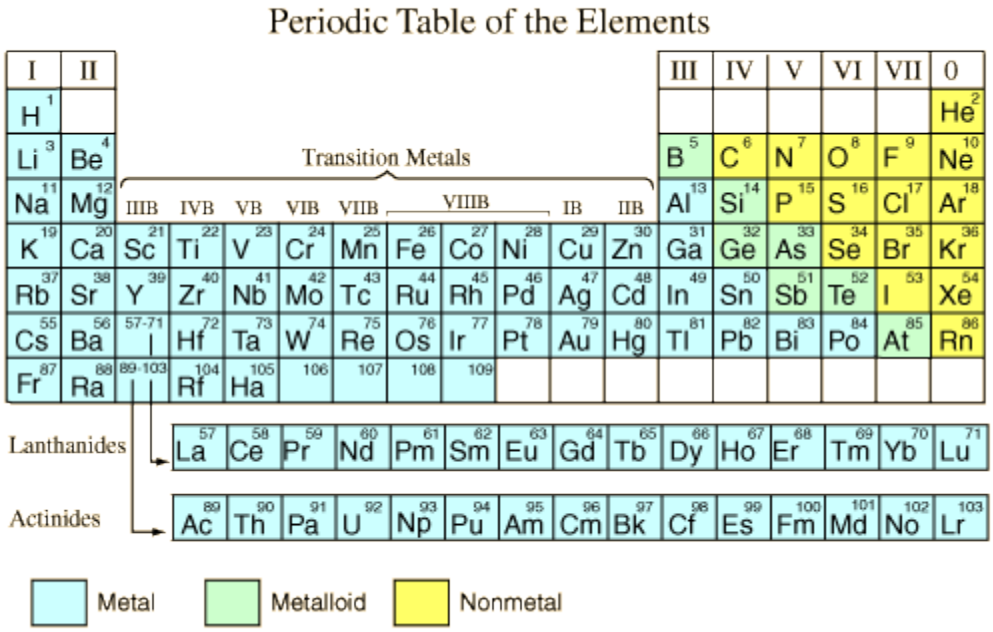
Activity #2 – Introduction to Lewis Structures

1) Go to Lewis Structures (electron dot diagrams). Fill in the chart.

Number of Valence Electrons	1		2		3	4	5	6	7	8
Example	Hydrogen	Group I (Alkali metals)	Helium	Group II (alkali earth metals)	Group III	Group IV	Group V	Group VI	Group VII (Halogens)	Group VIII except Helium (Noble Gases)
Lewis Structure (e- dot diagram)										

2) Write the Lewis Structure for an atom of each of the following elements. *Note* – you must look up the group # on the periodic table to do this. Check your answers here.

element	**Lewis Structure**	**element**	**Lewis Structure**	**element**	**Lewis Structure**	**element**	**Lewis Structure**
barium		sulfur		silcon		arsenic	
xenon		rubidium		indium		bromine	



Go to Covalent Bonding.

H_2 Watch it here! 3) Draw the Lewis Structure for a a) H atom b) H_2 molecule	H_2 See an explanation. 4) Once the H atoms bond, how many electrons a) does each atom have? _____ b) are shared? _____ 5) Each atom is now stable like the noble gas _____.
HBr Watch it here! 6) Draw the Lewis Structure for a a) H atom b) Br atom c) HBr molecule	HBr See an explanation. 7) How many valence electrons necessary for a full shell for a) an H atom? _____ b) a Br atom? _____ 8) After bonding, how many electrons a) are shared by the H and Br? _____ b) does H have surrounding it? _____ c) does Br have surrounding it? _____
NH_3 Watch it here! 9) Draw the Lewis Structure for a) a N atom b) an H atom c) an NH_3 molecule	NH_3 See an explanation. 10) How many valence electrons necessary for a full shell for a) an H atom? _____ b) a N atom? _____ 11) After bonding, does each atom obey the octet rule?

Activity #3 –Lewis Structures for molecules (single bonds)

Open Dr. Gutow's Lewis Structure Tutorial. Follow the steps for each of the following compounds and fill in the diagrams and charts.

CH_4 Step 1

Atom	Number of Valence Electrons
Total	

CF_2Cl_2 Step 1

Atom	Number of Valence Electrons
Total	

CH_4 Step 2
Picture so Far:

CF_2Cl_2 Step2
Picture so Far:

Total Valence Electrons		Total Valence Electrons	
Used so Far		Used so Far	
Remaining		Remaining	

CH_4 Step 3
Why are you done after step 2 for this molecule?

CF_2Cl_2 Step 3
Picture so Far:

	Total Valence Electrons	
	Used so Far	
	Remaining	

CF_2Cl_2 Step 3
Why are you done after step 3 for this molecule?

Open Molecular Geometry and Bonding and choose "LEWIS STRUCTURES HAVING ONLY SINGLE BONDS – Quiz" from the list. These quizzes are randomly generated so everyone will have different questions. Enter the molecular formula given (example: NH_2O) and draw the correct Lewis Structure for each question. After you check your answers, you can hit the back button on your browser to see the Lewis Structures again.

question	molecular formula	Lewis Structure
1		
2		
3		

Activity #4 –Lewis Structures for molecules (multiple bonds)

Open Dr. Gutow's Lewis Structure Tutorial. Follow the steps for each of the following compounds and fill in the diagrams and charts.

SO_2 Step 1 **O_3 Step 1**

Atom	Number of Valence Electrons	Atom	Number of Valence Electrons
Total		Total	

SO_2 Step 2
Picture so Far:

O_3 Step 2
Picture so Far:

Total Valence Electrons		Total Valence Electrons	
Used so Far		Used so Far	
Remaining		Remaining	

SO_2 Step 3
Picture so Far:

O_3 Step 3
Picture so Far:

Total Valence Electrons		Total Valence Electrons	
Used so Far		Used so Far	
Remaining		Remaining	

SO_2 Step 4
Picture so Far:

O_3 Step 4
Picture so Far:

Total Valence Electrons		Total Valence Electrons	
Used so Far		Used so Far	
Remaining		Remaining	

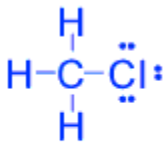
SO_2 Step 5
Picture so Far:

O_3 Step 5
Picture so Far:

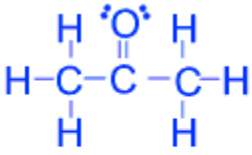
Total Valence Electrons		Total Valence Electrons	
Used so Far		Used so Far	
Remaining		Remaining	

Open Molecular Geometry and Bonding and choose "LEWIS STRUCTURES HAVING DOUBLE BONDS – Quiz" from the list. These quizzes are randomly generated so everyone will have different questions. Enter the molecular formula and draw the correct Lewis Structure for each question. After you check your answers, you can hit the back button on your browser to see the Lewis Structures again.

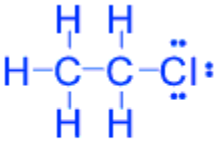
question	molecular formula	Lewis Structure
1		
2		
3		



Lewis Dot stucture for CH_3Cl



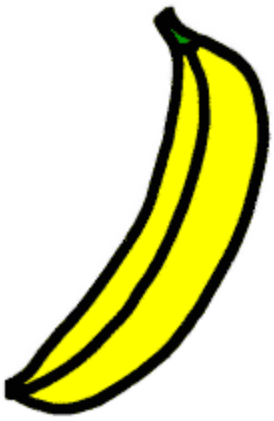
Lewis Dot stucture for CH_3COCH_3



Lewis Dot stucture for C_2H_5Cl

Open Molecular Geometry and Bonding and choose "LEWIS STRUCTURES INVOLVING TRIPLE BONDS – Quiz" from the list. These quizzes are randomly generated so everyone will have different questions. Enter the molecular formula and draw the correct Lewis Structure for each question. After you check your answers, you can hit the back button on your browser to see the Lewis Structures again.

question	molecular formula	Lewis Structure
1		
2		
3		



Name this compound:

$Ba(Na)_2$

answer: _____
(hahahahahahaha)

Can this be the formula of a real compound? Why or why not?

Activity #5 – Naming Covalent Compounds

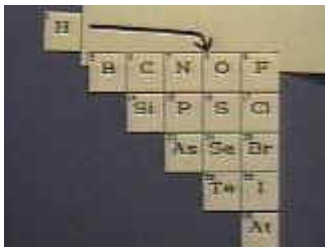
Open Naming Covalent Compounds.

Simple covalent compounds are generally named by using prefixes to indicate how many atoms of each element are shown in the formula. Also, the ending of the last (most negative) element is changed to -ide.

Fill in the chart:

1	
2	
3	
4	
5	
6	

1. When is the **mono-** prefix not used to show one atom of an element?
2. When do you drop the "o" and "a" endings of these prefixes?
3. How do you know which element to put first in the name?



4. Name the following compounds.
   a. PH_3 _____
   b. CO _____
   c. HI _____
   d. N_2O_3 _____
5. Open **Nomenclature**. What are the common names of:
   a. H_2O _____
   b. NH_3 _____
   c. CH_4 _____

Write the formulas for the following covalent compounds. Check your answers here.

1) antimony tribromide _____

2) hexaboron silicide _____

3) chlorine dioxide _____

4) hydrogen iodide _____

5) iodine pentafluoride _____

6) dinitrogen trioxide _____

7) ammonia _____

8) phosphorus triiodide _____

Write the names for the following covalent compounds. Check your answers here.

9) P_4S_5 _____

10) O_2 _____

11) SeF_6 _____

12) Si_2Br_6 _____

13) SCl_4 _____

14) CH_4 _____

15) B_2Si _____

16) NF_3 _____

Activity #6 – Comparing Properties of Ionic and Covalent Substances

Visit the web site, **Bonding by Analogy: Dog - Bone Bonds**, and write an explanation of each of the following types of bonding in terms of ATOMS & ELECTRONS not dog bones.

You may also visit these links as well (as sometimes the above is blocked by the school's filter):

Covalent Bonds
Ionic Bonds
Metallic Bonds

1. Ionic bonds

2. Covalent bonds

3. Polar Covalent bonds

4. Metallic bonds

Open Review Ionic and Covalent Compounds. Fill in the charts.

Definitions	
For the Quiz questions below, write the definition in your notes, then check the first answer pull down box for the correct answer, and the second pull down box for the second half of the definition.	
...in terms of electrons	**...types of elements**
Covalent bonding	Covalent bonding
Polar covalent bonding	Polar covalent bonding
Non polar covalent bonding	Non polar covalent bonding
Ionic bonding	Ionic bonding

Compound	Type and bonding	Graphic Image
For the Quiz questions below, click on the graphic for the molecular structure, then write in your notes the name of the type of bonding (ionic, polar, non-polar), and then the electron definition. Finally check the first answer pull down box for the correct answer.		
Iodine I_2		Graphic
Hydrochloric Acid HCl		Graphic
Oxygen O_2		Graphic
Magnesium Oxide MgO		Graphic
Water H_2O		Graphic
Sodium Fluoride NaF		Graphic
Hydrogen H_2		Graphic
Methane CH_4		Graphic
iron(III) oxide Fe_2O_3		Graphic
Magnesium Nitride Mg_3N_2		Graphic
Ethane C_2H_6		Graphic

Carbon Monoxide CO		Graphic
Carbon Dioxide CO_2		Graphic

Open Ionic & Molecular Compounds. Fill in the table.

Table: Comparing ionic and molecular compounds.

	Molecular compounds	Ionic compounds
smallest particles		
origin of bonding		
forces between particles		
elements present		
metallic elements present		
electrical conductivity		
state at room temperature		
melting and boiling points		
other names		

Activity #7 Review

Open Lewis Dot Structures (Multiple Choice). Read the directions and do 8 problems. Write the formula and correct Lewis Dot Structure in the table.

formula	*Lewis Dot Structure*

Open Classifying Compounds Quiz. These quizzes are randomly generated so you must write out the questions and the answers. Feel free to summarize the question rather than writing it word-for-word.

1.

2.

3.

4.

5.

6.

Check your answers and then take another randomly generated quiz.

1.

2.

3.

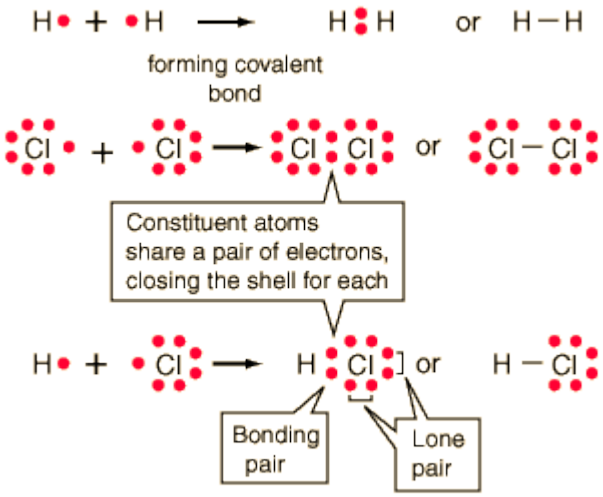
4.

5.

6.

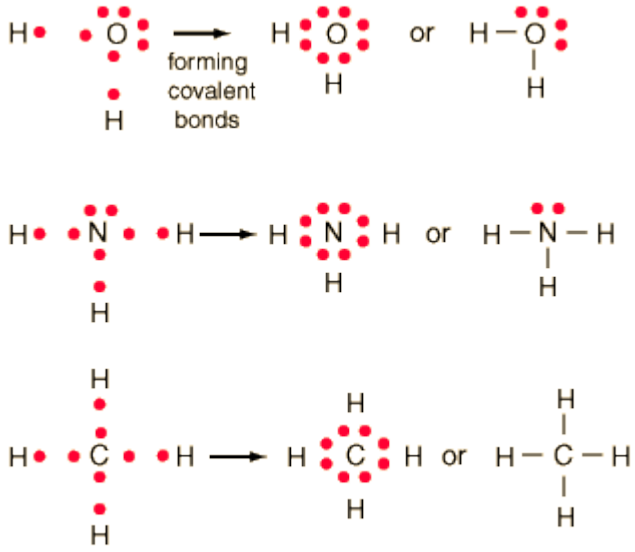
Addendum – More on Lewis Structures (just read!)

In the idealized covalent bond, two atoms share a pair of electrons, closing the shell for each of them.



The atoms share a pair of electrons, and that pair is referred to as a bonding pair. The pairs of electrons which do not participate in the bond have traditionally been called "lone pairs". A single bond can be represented by the two dots of the bonding pair, or by a single line which represents that pair. The single line representation for a bond is commonly used in drawing Lewis structures for molecules.

For multiple single bonds, the procedure is similar that for a single bond.



The Lewis diagrams can also help visualize double and triple bonds.