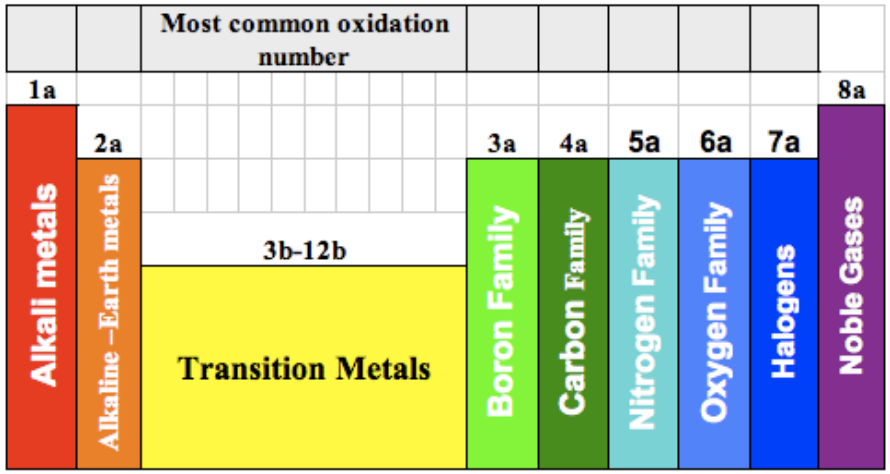
Science Number

To Bond or Not Bond That is the Question

Chp 14: Chemical Bonding
Complete the oxidation numbers for this chart



Name: _____ Pd_____ Sci Number:_____

Parent's signature of completion_____

Definitions: From the Book / or YOUR definition

Pg found	**Sect 1: Electrons & chemical bonding 352-355**
Chemical bonding	
Chemical bond	
Valence electrons	
	Sect 2: Types of Chemical Bonds Pg 356-365
Ionic bond	
ions	
Crystal lattice	
Covalent bond	
molecule	
Metallic bond	

Chapter Notes: *Strange but True! (page 350)*

1. A scientist discovered superglue by accident. What was he trying to develop? _____
_____
_____

2. When superglue is applied, it combines with _____ from the _____ to form _____.

Section 1: Electrons & Chemical Bonding (p 352-355)

3. Chemical _____ is the joining of atoms to form new substances. The _____ of these new substances are _____ from those of the original elements. A force of attraction that holds two atoms together is called a _____.

4. **True or False:** An atom's electrons are organized in energy levels or shells. The energy levels farther from the nucleus contain electrons that have more energy than electrons that are closer.

5. **True or False:** Valence electrons are the electrons in an atom's innermost energy level.

6. Look at figure 3 on page 354. What are the 3 hints for determining the # of valence electrons?

a. Groups 1 & 2: _____
b. Groups 3-12: _____
c. Groups 13-18:_____

7. Read the last paragraph on page 354. Do the noble gases form bonds?____ Why or why not?_____
_____

Therefore, the outermost energy level of an atom is considered full if it contains _____ electrons.

8. Which of the following does NOT describe how atoms can fill their outermost energy level?
   a. by sharing electrons with other atoms
   b. by losing electrons to other atoms
   c. by gaining electrons from other atoms
   d. by gaining kinetic energy from other atoms

9. Why is a helium atom stable with only 2 electrons in its outermost energy level? _____
_____
_____

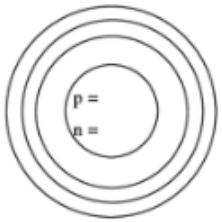
10. Copy the figure of fluorine (on the bottom of page 355) in the box →

Will fluorine form bonds? _____
Explain: _____
_____

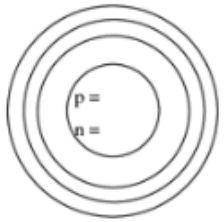
BOHR MODELS

Complete the following Bohr Models and fill in the blanks:

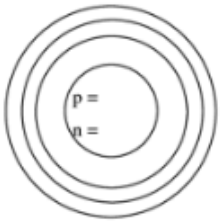
Hydrogen
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



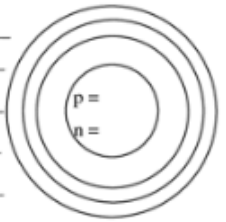
Carbon
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



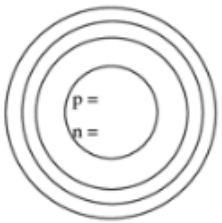
Phosphorous
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



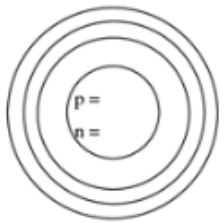
Chlorine
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



Oxygen
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



Sodium
Symbol:_____
No. of Electrons: _____
Atomic Number: _____
Atomic Mass: _____
Oxidation Number: _____
Electron Configuration:



Lewis Dot Structures

Lewis dot diagrams are a simplified way to show how the electrons are arranged in their outer shell. These are the valence electrons. This is where the chemical bonding & reactions take place. Here are the steps to drawing a Lewis dot structure:

Example: Draw the Lewis dot structure for Nitrogen

1. Write the element symbol. N
2. Determine the # of valence electrons. 5
3. Draw that # of dots around the symbol! 

Draw the Lewis structures for each of the elements below:

H	Al	B	Ne	Kr
Cl	F	Ga	S	Li
C	Cs	He	Sr	P
Be	Si	Ba	Mg	As
K	Na	Ar	Br	O

ELECTRONS, SHELLS, AND IONS, OH MY!

Electron Math: So, you think you know electrons huh? Prove it! Follow the example below to complete the table. For each Lewis drawing, if an atom **loses** an electron, cross it out with a red pen/colored pencil. If an atom **gains** an electron, draw a green dot where it should be.

Atom	Total Electrons	Valence Electrons	Electrons gained or lost?	Oxidation Number	Ion	Lewis Dot Structure
Sodium	11	1	Wants to *lose 1*	1+	Na+	
Fluorine	9	7	Wants to *gain 1*	1-	F-	
Nitrogen						
Chlorine						
Silicon						
Carbon						
Neon						
Magnesium						

Section 2: Types of Chemical Bonds (p 356-365)

11. What do seashells, table salt, and plaster of Paris have in common?
_____
_____

12. An _____ bond is the force of attraction between oppositely charged _____. Ions are _____ particles that form during chemical changes when one or more valence electrons transfer from one atom to another.

13. In an ionic bond, electrons are either lost or gained. Complete the following:

If an atom loses electrons, it forms _____ ions.

If an atom gains electrons, it forms _____ ions.

14. Look at figures 6 & 7 on pages 357 & 358, then fill in the information below.

Sodium Atom	**Sodium ____ (Na^+)**	Forming Positive Ions	**Aluminum Atom**	**Aluminum Ion (Al^{+3})**
11+ protons	11+ protons		13+ _____	13+ protons
11- electrons	10- electrons		13- electrons	10- electrons
0 charge	1+ charge		0 charge	_____ charge

Chlorine Atom	**Chlorine ions (Cl^-)**	Forming _____ Ions	**Oxygen Atom**	**Oxygen Ion (_____)**
17+ _____	17+ protons		8+ protons	8+ protons
17- electrons	18- _____		8- electrons	10- electrons
0 charge	1- charge		____charge	_____charge

15. The ions that make up an ioic compound are bonded in a repeating 3-dimensional pattern called a _____. In ionic compounds, such as table salt, the ions in the crystal lattice are arranged as alternating positive and negative ions, forming a _____. Each ion is bordered on every side by an ion with the _____ charge.

16.What is a covalent bond? _____
_____

17. **True or False:** By sharing electrons in an ionic bond, each hydrogen atom has a full outermost energy level containing two electrons.

18. **True or False:** A molecule is a neutral group of atoms held together by covalent bonds.

19. Look at figure 12 on page, then draw both types of a water molecule in the boxes below.

Water Molecule	Lewis Electron-Dot Diagram

20. What does an electron-dot diagram show & why is it helpful?
_____
_____

21. All molecules are composed of at least two covalently bonded atoms. The simplest molecules, known as _____ molecules, consist of 2 atoms bonded together. Some elements are called diatomic elements because they are found in nature as diatomic molecules composed of the two atoms of the element.

22. Why is it that metals are malleable and can bend? Because they have a special type of bond called a metallic bond. A metallic bond is the force of attraction between a _____ charged metal ion and the _____ in a metal. Many properties of metals, such as conductivity, ductility, and malleability result from the freely moving electrons in the metal.

Ionic Bonding Basics

Element	# of Electrons	# of Valence Electrons	# of electrons gained or lost	Oxidation #
Sodium				
Chlorine				
Calcium				
Fluorine				
Aluminum				
Oxygen				
Potassium				

Types of bonds: Classify the following compounds as ionic (_____ +_____) or covalent (_____ + _____) or metallic (_____ + _____)

1. $CaCl_2$ _____	4. MgO _____	7. $FeCl_2$ _____
2. CO_2 _____	5. Aluminum Foil:_____	8. P_2O_5 _____
3. H_2O	6. NO_2	9. Cu_2

Drawing Ionic Bonding:

Ionic bonding occurs when a _____ transfers 1 or more electrons to a _____ in an effort to attain a stable octet of electrons. Complete these examples below:

1. K + F
2. Na + O
3. Mg + I

Drawing Covalent Bonding:

Covalent bonding occurs when 2 or more _____ SHARE electrons, attempting to attain a stable octet of electrons. Complete these examples below:

1. H + H -> H_2
2. O + O -> O_2
3. C + O_2 -> CO_2

Use the following rules to draw each ionic compound:

1. Write the symbol for each element.
2. Use _____ to create each Lewis structure.
3. Draw an arrow(s) to show the transfer of electrons and move the dots to the new location.
4. Decide if you need additional elements.
5. Determine the charge for each ion and write the formula.
6. Make sure the sum of the oxidation numbers is zero & write the chemical formula.
7. Use crayons or colored pencils to color in the electrons once you remove them.

(1) Potassium + Fluorine	(2) Magnesium + Iodine	(3) Sodium + Oxygen
(4) Sodium + Chlorine	(5) Calcium + Chlorine	(6) Aluminum + Chlorine

Chapter 14 Outline – Chemical Bonding

Section 1: Electrons & Chemical Bonding *(page 352)*

1. Atoms Combine through Chemical Bonding *(page 352)*

- **Chemical** _____ is the joining of atoms to form _____ substances. The properties of these new substances are _____ from those of the _____ elements.
- A force of attraction that holds two atoms together is called a **chemical bond**. … chemical bonds involve the _____ in the atoms.

2. Electron Number & Organization *(page 352)*

- The 1st energy level is the closest to the nucleus & can hold up to _____ electrons.
- Electrons will enter the 2nd energy level only after the first level is _____. The 2nd energy level can hold up to _____ electrons.
- The 3rd energy level can hold up to _____ electrons.

Outer-Level Electrons are the _____ to _____

- Most atoms form bonds using only the electrons in their outermost energy level…. called _____ **electrons.**

Valence Electrons & the Periodic Table

- Elements in a group often have similar _____, including the number of electrons in the outermost energy level of their atoms. The number of valence electrons for many elements is related to the _____ number.

3. To Bond or Not to Bond *(page 354)*

- Atoms of the _____, or inert, gases (group _____) do not normally form chemical bonds.
- The outermost energy level of an atom is considered to be _____ if it contains ____ electrons.

Atoms Bond to Have a _____ Outermost Level

- An atom that has _____ than 8 valence electrons is _____ reactive, or more likely to form bonds, than an atom with 8 valence electrons.
- Atoms bond by _____, _____, or _____ electrons in order to have a filled outermost energy level with 8 valence electrons.

Section 2: Types of Chemical Bonds *(page 356)*

4. Ionic Bonds *(page 356)*

- An **ionic bond** is the force of attraction between oppositely _____ _____.
- **Ions** are charged particles that form during chemical changes when one or more valence electrons _____ from one atom to another.

Atoms that _____ Electrons Form _____ Ions

- The atoms that lose electrons form ions that have fewer electrons than protons. The positive charges outnumber the negative charges in the ions. Thus, the ions that are formed when atoms lose electrons have an overall positive charge.
- Atoms of most metals have _____ electrons in their outer energy level.
- When metal atoms bond with other atoms, the metal atoms tend to _____ these valence electrons and form positive ions.

The Energy of Losing Electrons

- Removing electrons from atoms of metals requires only a _____ amount of energy, so metal atoms lose electrons _____.
- In fact, the energy needed to remove electrons from atoms of elements in Groups 1 & 2 is so low that these elements react very easily & can be found only as _____ in nature.

Atoms that _____ Electrons Form _____ Ions

- Atoms that gain electrons from other atoms during chemical reactions form ions that have more electrons than protons. The negative charges outnumber the positive charges, giving each of these ions an overall negative charge.
- Only a few electrons are needed to fill the outer level, so atoms of _____ tend to _____ electrons from other atoms.

The Energy of Gaining Electrons

- The more easily an atom gains an electron, the more _____ an atom gives off.

Ions Bond to Form a _____ _____

- The ions that make up an ionic compound are bonded in a repeating 3D pattern called a **crystal lattice.**
- In ionic compounds, such as _____, the ions in the crystal lattice are arranged as alternating positive & negative ions, forming a solid.
- Each ion is bordered on every side by an ion with the opposite charge.

5. Covalent Bonds *(page 360)*

- A **covalent bond** is the force of attraction between the nuclei of atoms & the electrons _____ by the atoms.
- When two atoms of nonmetals bond, too much energy is required for either atom to lose an electron, so _____ ions are formed.
- Rather than _____ electrons to complete their outermost energy levels, two nonmetal atoms bond by sharing electrons with one another.

Covalently Bonded Atoms Make Up _____

- A **molecule** is a _____ group of atoms held together by _____ bonds.

A Molecule is the _____ Particle of a _____ Compound

The Simplest Molecules

- The simplest molecules, known as _____ molecules, consist of 2 atoms bonded together.
- Examples: _____, _____, _____

More-Complex Molecules

- _____, _____, & even proteins in the cells of your body are examples of complex molecules.
- _____ atoms are the basis of many of these complex molecules.

6. Metallic Bonds *(page 363)*

- A **metallic bond** is the force of attraction between a positively charged _____ _____ & the _____ in a metal.

Electrons _____ Throughout a Metal

- … the metal atoms get so close to one another that their outermost energy levels overlap. This allows their valence electrons to move throughout the metal from the energy level of one atom to the energy levels of the atoms nearby.
- However, the negative charges (electrons) in the metal are _____ to move about. You can think of a metal as being made up of positive metal ions with enough valence electrons "swimming" about to keep the ions together and to cancel the charge of the ions,

Explaining Metallic Properties

Metals have a fairly high _____ because the metal atoms are closely packed. But because the atoms can be rearranged, metals can be _____ into useful forms.

Pg 13: Fill in the Blank Review Questions:

1. When _____are formed, electrons are transferred between atoms
2. Atoms covalently bonded together form a _____
3. Charged particles that form when atoms transfer electrons are called _____
4. A _____ is a three-dimensional pattern formed from alternating positive and negative ions.
5. A force of attraction that holds two atoms together is called _____

Multiple Choice (we will be grading these) Circle your choice

6. The number of _____ is most important in determining how an atom will bond.
   a. protons b. neutrons c. electrons in the innermost energy level
   d. electrons in the outermost energy level
7. Which type of element is most likely to gain electrons when it forms bonds?
   a. metal b. metalloid c. nonmetal d. noble gas
8. Why do atoms have no charge (so they are neutral) ?
   a. The number of protons is equal to the number of neutrons.
   b. The number of electrons is equal to the number of neutrons.
   c. The number of protons is equal to the number of electrons.
   d. There is an equal number of neutrons, protons, and electrons.
9. Which of the following elements does not exist as a diatomic molecule?
   a. oxygen b. argon c. nitrogen d. iodine
10. ___ are formed by atoms losing electrons:
    a. Negative ions b. Positive ions c. Elements d. Compounds
11. Which of the following is NOT a metallic property?
    a. a hard and brittle texture b. high density
    c. the ability to be flattened and shaped d. the ability to conduct electricity
12. Which element has a full outermost energy level containing only two electrons? a. oxygen (O) b. hydrogen (H) c. fluorine (F) d. helium (He)
13. Which of the following describes what happens when an atom becomes an ion with a 2^- charge?
    a. The atom gains 2 protons. b. The atom loses 2 protons.
    c. The atom gains 2 electrons. d. The atom loses 2 electrons.
14. The properties of ductility and malleability are associated with which type of bonds? a. ionic b. covalent c. metallic d. None of these
15. In which area of the periodic table do you find elements whose atoms easily gain electrons?
    a. across the top two rows b. across the bottom row
    c. on the right side d. on the left side
16. What type of element tends to lose electrons when it forms bonds?
    a. metal b. metalloid c. nonmetal d. noble gas
17. Which pair of atoms can form an ionic bond?
    a. sodium (Na) and potassium (K) b. potassium (K) and fluorine (F)
    c. fluorine (F) and chlorine (Cl) d. sodium (Na) and neon (Ne)

Teach a parent : Chapter review:

Explain what a valence electron is AND how they are involved with the bonding process. Use the periodic table to show your folks how many electrons are available for bonding.

Help your parent become an expert !

Be sure they write what they have learned from your teaching

Parent Response

1. _____ I'm not sure my child really understands, therefore, I don't either. Please work with him/her and let's try again.
2. _____ The concept was explained thoroughly with effective examples he/she created. "By golly, I think they've got it!"
3. _____ WOW! My child did an exceptional job! It was logically explained, therefore I caught on immediately and feel confident about teaching it to others.

Parent Signature:_____ Date: _____

Today's concept is in 3 parts: Explain the different types of bonding:

1. Covalent 2. Ionic 3. Metallic

AND Explain HOW each bond takes place.

Help your parent become an expert !

Be sure they write what they have learned from your teaching

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1. _____ I'm not sure my child really understands, therefore, I don't either. Please work with him/her and let's try again.
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Parent Signature:_____ Date: _____

THIS IS ESSENTIAL FOR FULL CREDIT:

Mom or Dad Comments: Please explain how your student taught you this concept and * what you learned in 3-5 sentences! * This is critical for them to receive full points

_____
_____
_____
_____
_____
_____
_____
_____
_____

Page For Additional Notes

Chapter 14 Vocab Review