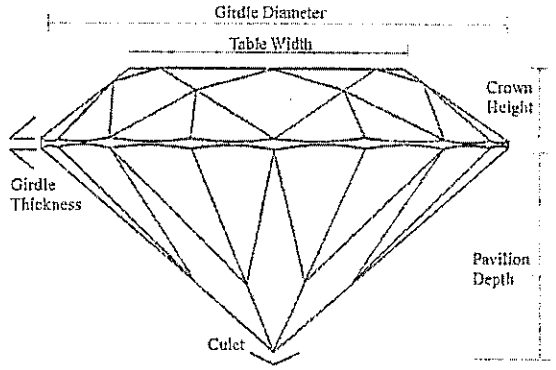
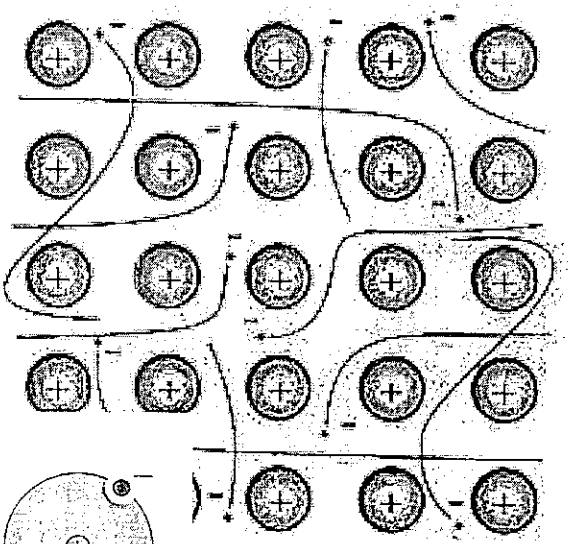
Bonding

Part 1





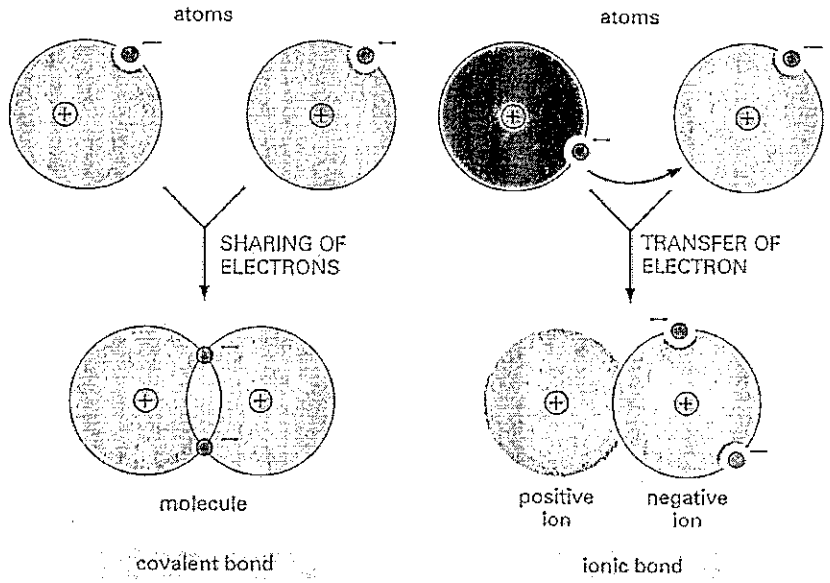
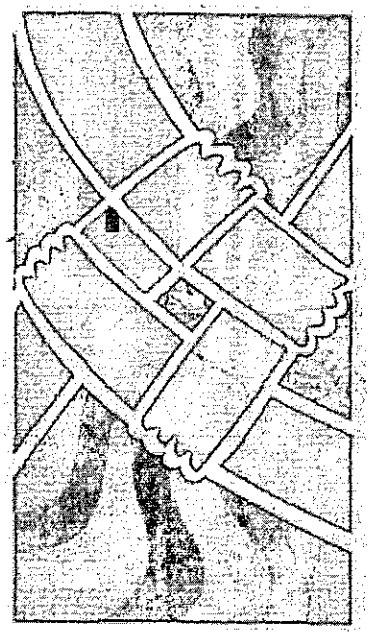


Figure 2.6 Essential Cell Biology, 2/e, (© 2004 Garland Science)



Name _____

Teacher _____

Regents Chemistry

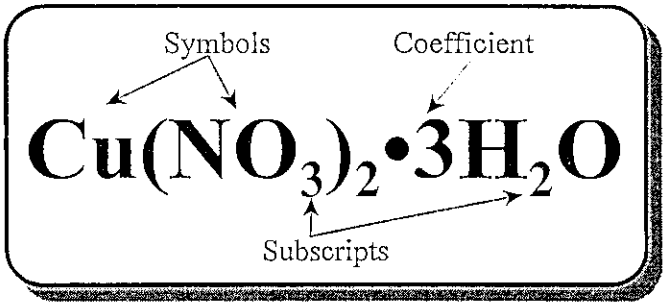
Bonding

- Explain and draw the difference between a single-covalent, double-covalent, and a triple-covalent bond.
- Determine and describe what it means for a bond to be a polar bond or a nonpolar bond, using charge symmetry.
- Determine and describe what it means for a molecule to be polar molecule or a nonpolar molecule, using charge symmetry.
- Describe what an intermolecular force of attraction is and how they affect properties such as solubility, melting point temperature, and boiling point temperature.
- Prioritize the types of intermolecular forces of attraction based on their strengths of attraction between molecules

Vocabulary

- Anion
- Ion
- Octet Rule
- Asymmetrical Molecule
- Ionic Bond
- Polar Covalent Bond
- Cation
- Ion-Molecule
- Symmetrical Molecule
- Chemical Bond
- Lewis Dot Diagram
- Triple Covalent Bond
- Covalent Bond
- Metallic Bond
- Van der Waal's Forces
- Crystal LatticeMolecule
- Dipole-Dipole
- Multiple Covalent Bond
- Hydrogen Bond
- Nonpolar Covalent Bond
- Intermolecular Forces
- Octet

Interpreting Chemical Formulas



A chemical formula consists of chemical symbols, subscripts, and, in some cases, a coefficient. The chemical symbols show which elements are present in the compound. Subscripts are small numbers written to the lower right of the symbol to which they refer. In the formula to the right, there are three atoms of oxygen in each nitrate ion (NO_3^-) and two atoms of hydrogen in each molecule of water (H_2O). There is only one atom of copper, but a subscript of one (1) is never written. It is understood. Nitrate is a polyatomic ion. When there is more than one polyatomic ion, it is enclosed in parentheses, and the subscript is written outside to the lower right referring to everything inside. As a result, $Cu(NO_3)_2$ has two nitrogen and six oxygen atoms. Some materials such as copper II nitrate crystallize in such a way that they are attached to a fixed number of water molecules. These are called hydrated crystals. The number of molecules or formula units is shown by a large number called a coefficient. The coefficient is written to the left of the formula, and multiplies everything to the right of it. This means the formula above has a total of 6 hydrogen atoms. The formulas for the copper II nitrate and the water are separated by a dot. The number of atoms in the formula above is 18, because it shows 1 atom of copper, 2 atoms of nitrogen, 9 atoms of oxygen (6 from the nitrate plus 3 from the water), and 6 atoms of hydrogen.

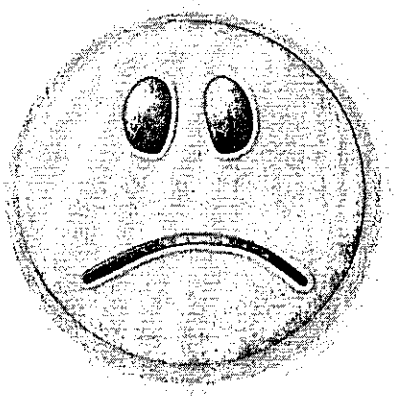
For each of the formulas below, determine the number and type of each of the atoms shown, and the total number of atoms.

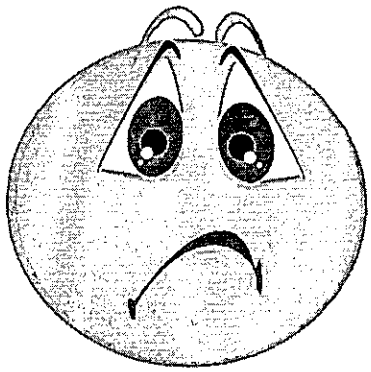
Example

$5(NH_4)_3PO_4$ ..... N = 15, H = 60, P = 5, O = 20, *TOTAL* = 100

1. $4NaHCO_3$ ..... _____
2. $15HCl$ ..... _____
3. $3Al_2O_3$ ..... _____
4. $6KNO_3$ ..... _____
5. $2N_2O_5$ ..... _____
6. $7Sn(NO_2)_4$ ..... _____
7. $4Mn_2(Cr_2O_7)_7$ ..... _____
8. $9Na_2SO_3$ ..... _____
9. $8Ba_3(PO_4)_2$ ..... _____
10. $5MgSO_4 \cdot 7H_2O$ ..... _____

Analogy:





These two faces are sad. Why?_____

_____

What can we do to make them happy? _____

_____

How would you describe these people? _____

Why?_____

A Sodium (Na) atom is sad. Draw the Lewis Dot diagram for Na.

Na

A Chlorine (Cl) atom is sad. Draw the Lewis Dot diagram for Cl.

Cl

How can we make Na and Cl happy?

Na Cl

1.) What is a chemical Bond?

_____

_____

2.) A chemical bond has _____ energy. After the chemical bond forms, the atoms have a _____ outer shell and are _____ (similar to noble gases).

3.) What happens to the energy when a bond is formed?_____

4.) What happens to the energy when a bond is broken? _____

5.) Define Electronegativity -

_____

_____

6.) Define the Octet Rule -

_____

Bonds Between Atoms

Ionic Bonds

- **Definition:** _____

  _____

- Draw the Bohr Models for Na and Cl.

- Draw the Lewis Dot Diagrams for Na and Cl demonstrating the transfer of electrons.

- Calculate the electronegativity difference between Na and Cl.

Summary:

Directions: Determine the Electronegativity difference between these atoms. Then determine the type of bond.

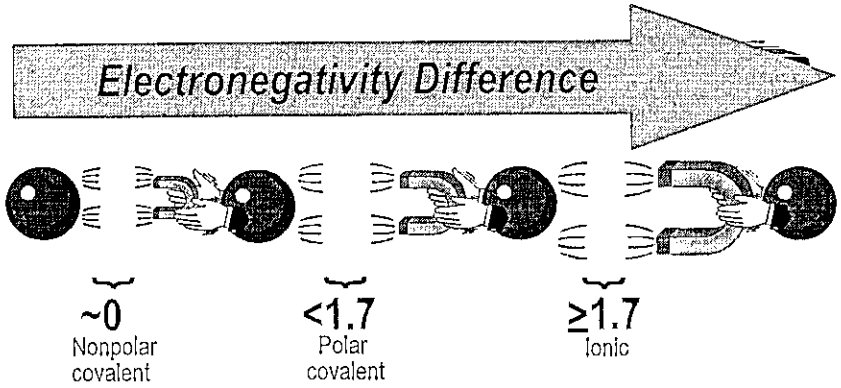
Ionic >1.7 Covalent<1.7

	Difference in electronegativity	Bond Type
Hydrogen and oxygen	_____	_____
Magnesium and Sulfur	_____	_____
Strontium and fluorine	_____	_____
Carbon and oxygen	_____	_____
Magnesium and nitrogen	_____	_____
Nitrogen and oxygen	_____	_____
Hydrogen and nitrogen	_____	_____
Lithium and oxygen	_____	_____
Oxygen and fluorine	_____	_____
Bromine and oxygen	_____	_____
Hydrogen and iodine	_____	_____
Magnesium and hydrogen	_____	_____

Properties of Ionic Bonds

Bond Type

When atoms combine, there is a tug of war over their valence electrons. The type of bond that forms depends on the outcome of the tug of war. The outcome of the tug of war is determined by the relative strengths of the forces exerted by the atoms. The electronegativity provides a measure of those forces. When the electronegativity difference is greater than or equal to 1.7, the atom with the greater electronegativity gains the electron, and an **ionic bond** is formed. Electronegativity differences below 1.7 result in covalent bonds or sharing. If the electronegativity difference is close to zero (<0.4), the atoms share equally and a **nonpolar bond** forms. Higher electronegativity differences (still below 1.7) result in unequal sharing or **polar bonds.**



Fill in the table below by looking up the electronegativities of the elements in each compound. Determine the electronegativity difference and the bond type.

Compound	Electronegativity		Electronegativity Difference	Bond Type Ionic, Polar covalent, Nonpolar covalent
	Metal (low)	Nonmetal (high)		
Example: NaBr	0.9	3.0	2.1	ionic
HCl				
H_2Te				
KI				
SO_2				
H_2O				
CS_2				
N_2O_5				
MgO				

TYPES OF CHEMICAL BONDS

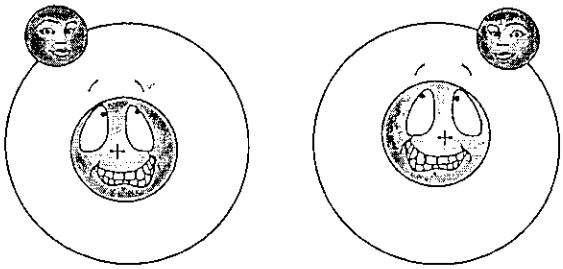
Name _____

Classify the following compounds as ionic (metal + nonmetal), covalent (nonmetal + nonmetal) or both (compound containing a polyatomic ion).

1. $CaCl_2$ _____
2. CO_2 _____
3. H_2O _____
4. $BaSO_4$ _____
5. K_2O _____
6. NaF _____
7. Na_2CO_3 _____
8. CH_4 _____
9. SO_3 _____
10. LiBr _____
11. MgO _____
12. NH_4Cl _____
13. HCl _____
14. KI _____
15. NaOH _____
16. NO_2 _____
17. $AlPO_4$ _____
18. $FeCl_3$ _____
19. P_2O_5 _____
20. N_2O_3 _____

How Bonds Form

The electrons of one atom are attracted to the protons of another. When atoms combine, there is a tug of war over the valence electrons. The combining atoms either lose, gain, or share electrons in such a way that they complete their outer shells. Whether atoms gain, lose, or share electrons depends how tightly they hold onto their own electrons and how strongly they pull on the electrons of another atom.

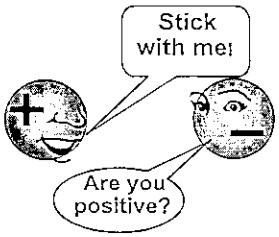


Answer the questions below based on the information above and on your knowledge of chemistry.

1. What is the charge on a proton? _____
2. What is the charge on an electron? _____
3. Why do an atom's electrons revolve around its protons instead of drifting away? _____
4. Why are the electrons of one atom attracted to the protons of another? _____
5. What happens when two atoms get near each other that causes them to bond? _____
6. How are the elements sodium and chlorine classified? _____
7. What would happen during a tug of war between sodium and chlorine over each others outer electrons? Why?
8. How do sodium and chlorine combine? _____

Ionic Bonds

Ionic bonds are caused by the attraction between oppositely charged ions. Ions form as follows: The electrons of one atom are attracted to the protons of another. Metals hold onto electrons loosely while nonmetals hold onto electrons tightly. As a result, metals lose electrons and nonmetals gain electrons in such a way that they complete their outer shells. Atoms that gain or lose electrons become electrically charged. Metals become positively charged ions by losing electrons. Nonmetals become negatively charged ions by gaining electrons. Metal cations and nonmetal anions become ionically bonded because they are oppositely charged.



ION TALK

Answer the questions below based on your understanding of ionic bonds.

1. Draw Bohr-Rutherford diagrams of sodium and chlorine atoms showing the number of protons and neutrons, and the arrangement of electrons.

2. What will happen to sodium and chlorine when they combine (*HINT: Remember how metals and nonmetals combine.)* _____

3. Draw Bohr-Rutherford diagrams of sodium and chlorine atoms showing the changes in the arrangement of electrons after they combine.

4. What are the charges on the sodium ion and the chloride ion after they combine? (*HINT: Count the number of protons and electrons of each.)* _____

5. What are the oxidation states of sodium and chlorine? _____

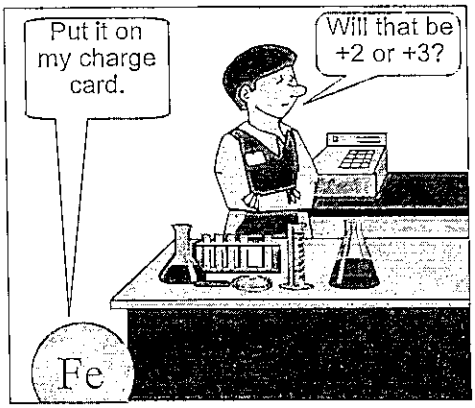
6. Why do sodium and chlorine become bonded? _____

_____

7. What is the total charge on a compound of sodium and chlorine? _____

Determining the Charge on a Metal Ion

Univalent metal ions, those with only one oxidation state, are named exactly the same as the element (Ba is named barium, and Ba^{+2} is also named barium), but polyvalent metal ions, those with multiple oxidation states, include a roman numeral in the name to indicate the oxidation state (Cu^{+1} is called copper I, while Cu^{+2} is called copper II). In order to name a compound, therefore, it is necessary to check on the *Periodic Table* to see if the metal ion has more than one oxidation state. If it does, it is necessary to figure out what the oxidation state is so the correct roman numeral can be included as part of the name. This can be done as in the following example based on the formula $Fe_2(S_2O_3)_3$.



When ions go shopping

$Fe_2(S_2O_3)_3$

	ion	Fe	S_2O_3	
STEP 5	subscript	2	3	STEP 1
	oxidation state	+3	–2	TOTAL STEP 2
	total	+6	–6	= 0

STEP 4 STEP 3

Prepare a table as above.

Step 1: List the subscripts for the metal and the nonmetal ions.

Step 2: Look up the oxidation state of the nonmetal ion on the *Periodic Table*.

Step 3: Multiply the oxidation state of the nonmetal by its subscript to get the total charge.

Step 4: Determine the total charge of the metal ions by calculating the number which, when added to the total charge of the nonmetal ion, gives the compound a total charge of zero.

Step 5: Divide the total charge of the metal ions by the subscript of the metal to get the oxidation state.

Using the procedures described above and to the left, determine the oxidation states of the metals in each of the compounds listed below.

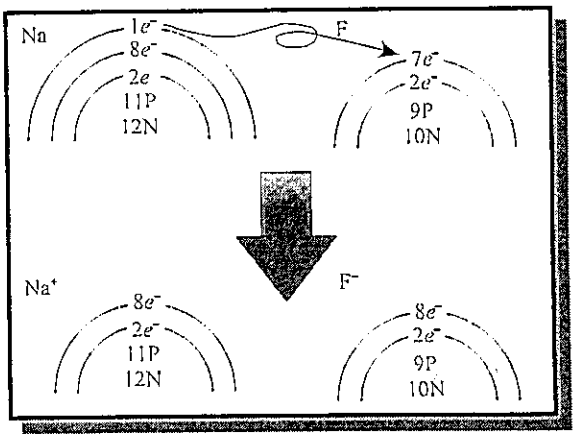
1. $BaCl_2$ ..... _____
2. PbO_2 ..... _____
3. $MnCl_7$ ..... _____
4. $Cr_3(PO_4)_2$ ... _____
5. $Al_2(SO_4)_3$ ... _____
6. Sn_3P_4 ..... _____
7. $Ca(NO_3)_2$ ... _____
8. Cu_2S ..... _____
9. FeO ..... _____
10. $Fe_2(SO_4)_3$ ... _____

Name _____

Date _____ Period _____

Losing and Gaining Electrons

Atoms gain or lose electrons in such a way that they complete their outer shells. An outer shell can never have more than 8 electrons. The first shell is small, so it can only hold 2 electrons. All other shells are complete when they are the outer shell if they contain 8 electrons. An arrangement of 8 electrons in an outer shell is called a stable octet. Elements with a complete outer shell are inert. They don't gain or lose electrons. Neutral atoms are atoms that have not gained or lost electrons. Their number of electrons and protons are equal, so their the net charge is zero. **Ions** are charged atoms or groups of atoms. They are formed when atoms gain or lose electrons. Since the number of protons and electrons is not equal after electrons have been gained or lost, there is a net charge. Examples include: F^{-1} – 10 electrons, 9 protons; and Na^{+1} – 10 electrons, 11 protons. As a general rule, atoms with fewer than four electrons in their outer shells behave like losers and form ions with a positive charge, while atoms with more than four electrons in their outer shells behave like gainers and form ions with a negative charge.



Determine the charge on ions of each of the elements listed in the table below by filling in the table based on the examples provided using sodium and fluorine.

Element	Atom				Ion				Number of Electrons lost/gained
	Electron Configuration	Number of Electrons	Number of Protons	Charge	Electron Configuration	Number of Electrons	Number of Protons	Charge	
Na	2-8-1	11	11	0	2-8	10	11	+1	1 lost
F	2-7	9	9	0	2-8	10	9	–1	1 gained
Ca									
O									
Al									
Cl									
Mg									
N									
S									
Cu									
C									

Drawing Structures

Directions: Draw the Lewis Dot structures.

Atoms

O F Na Ca Sr

Ions

Al^{3+} O F Na Ca Sr

Directions: Draw the Lewis Dot structures for these Ionic Compounds.

1. Sodium and fluorine

2. Calcium and oxygen

3. Calcium and fluorine

4. Sodium and oxygen

5. Aluminum and fluorine

6. Aluminum and oxygen

Drawing Structures

Directions: Determine the type of bonds

Al and F_____ Na and Br_____ N and O_____

C and O_____ O and H _____ P and Se_____

Ba and Se_____ Na and P_____ Sr and Sb_____

Directions: Draw the Lewis Dots structures.

Atoms

S Br K Mg Cs

Ions

Al^{3+} S Br K Mg Cs

Directions: Draw the Lewis Dot structures for these Ionic Compounds.

1. Cesium and bromine

2. Magnesium and Sulfur

3. Aluminum and sulfur

Electron-Dot Structures - Ionic Compounds

1. NaI

2. CaF_2

3. $AlCl_3$

4. Na_2S

5. BaO

6. K_3P

7. RbBr

Lewis Dot Diagrams for Binary Ionic Compounds

Work in pairs. Before you begin, decide who will be the 'metal' and who will be the 'nonmetal'. For each compound listed, students should construct the Lewis dot diagram for their element (metal or nonmetal). As these elements bond, they become ions. Work together to construct the Dot Diagrams for each compound listed below.

1. KCl

2. $CaCl_2$

3. Na_2O

4. Figure this one out on your own. How many of each atom do you need to make an ionic compound made up of Calcium and Fluorine? Construct and draw the dot diagram.

Name _____ Date _____ Chemistry Regents

Drawing Lewis Diagrams for Ionic Bonds

Chemical formula	Compound name	Electronegativity difference	Lewis Dot Diagram
$CaCl_2$			
KF			
Rb_2S			
SrF_2			
CsI			
	Sodium bromide		
$MgCl_2$			
	Barium oxide		
	Barium sulfide		
	Potassium selenide		

Name _____

Date _____ Period _____

More Names and Formulas!

Write the correct name of the compound on the space provided for each of the formulas listed below.

1. $SnCl_4$ — 1. _____
2. $Ca(ClO_3)_2$ — 2. _____
3. NH_4NO_2 — 3. _____
4. $Pb(SO_4)_2$ — 4. _____
5. N_2O_5 — 5. _____
6. MnF_7 — 6. _____
7. $Mg(HCO_3)_2$ — 7. _____
8. $AgBr$ — 8. _____
9. NaI — 9. _____
10. $Ni(CH_3COO)_2$ — 10. _____

Write the correct formula on the space provided for each of the compounds listed below.

11. Iron III sulfite — 11. _____
12. Potassium chlorate — 12. _____
13. Zinc acetate — 13. _____
14. Aluminum hydride — 14. _____
15. Nickel II sulfide — 15. _____
16. Carbon IV oxide — 16. _____
17. Copper I sulfite — 17. _____
18. Calcium bromide — 18. _____
19. Silver sulfide — 19. _____
20. Tin IV phosphate — 20. _____

Using the Stock System

The **stock system** is a set of rules for naming compounds of metals and non metals. The metal always comes first in the name and the formula. Monatomic metal ions, those consisting of only one type of atom, come in two varieties – univalent and polyvalent. For univalent metal ions, those having only one oxidation state, the name of the ion is exactly the same as that of the element that formed it. As a result, both Na and Na^+ are called sodium. For polyvalent metal ions, those having multiple oxidation states, a roman numeral indicates the oxidation state. As a result, Fe^{+2} is called iron II, while Fe^{+3} is called iron III. Polyatomic metal ions, those consisting of more than one type of element such as NH_4^+, ammonium, are found on *Table E*.

The nonmetal always comes last in the name and in the formula. For monatomic nonmetal ions, delete the last part of the elements name and add "IDE". Thus the element sulfur (S) forms the ion sulfIDE (S^{-2}). Polyatomic nonmetal ions, such as SO_4^{-2} (sulfate) or OH^- (hydroxide) are found on *Table E*.

To write the name from the formula, it is necessary to first check the *Periodic Table* to see if the metal is polyvalent. If it is, you need to figure out the oxidation state of the metal by checking to see which one will make the sum of the oxidation states in the compound add up to zero. To write the formulas from the name, you need to look up the oxidation states of the ions, and apply the crossover rule.

Using the rules above, write the names for the compounds listed below on the left and the formulas for the compounds listed below on the right.

Writing Names		Writing Formulas	
1. NaCl	_____	11. iron III oxide	_____
2. $CuSO_4$	_____	12. chromium III carbonate	_____
3. $(NH_4)_2S$	_____	13. calcium sulfide	_____
4. BaO	_____	14. lead II arsenide	_____
5. LiF	_____	15. ammonium nitrate	_____
6. $Sn(NO_3)_4$	_____	16. potassium oxalate	_____
7. K_3N	_____	17. aluminum acetate	_____
8. $HgBr_2$	_____	18. cesium thiosulfate	_____
9. CaI_2	_____	19. strontium phosphide	_____
10. $Mg_3(PO_4)_2$	_____	20. tin IV oxide	_____

Name_____ **Formula Worksheet # 1**

Section 1 - Do Now: Name the following compounds:

NaF _____ CaS_____

$SrCO_3$_____ $Al(OH)_3$_____

Section 2 – Name the following compounds with multiple oxidation states

a. CuS _____
b. Cu_2S _____
c. $Au(OH)_3$_____

Section 3 – Write the formulas for the following compounds:

1. Aluminum sulfide _____ 2. Magnesium oxide_____

3. Potassium chloride _____ 4. Strontium fluoride _____

5. Cobalt (III) chloride _____ 6. Mercury (I) sulfite _____

Compound Worksheet # 2

Names in group_____ _____

_____ _____

Section 1: Directions – Calculate the number of atoms in each of the following compounds and then name the compound.

Compound	# of atoms	Name
$MgCl_2$	Mg = 1, Cl = 2	**Magnesium chloride**
sample	Total = 3	
Al_2O_3		
$CaCl_2$		
$Li_2Cr_2O_7$		
$Sr(NO_2)_2$		
$(NH_4)_2S_2O_3$		

Section 2: Directions – Write the name of the following compounds in the spaces provided

a. MnO_____

b. Mn_2O_7_____

c. $Ni(NO_3)_3$_____

d. $CoCO_3$_____

e. $Ir(SO_4)_2$_____

f. $Ti(OH)_3$_____

Section 3: Directions – For each of the compounds below, write the correct formula using the IUPAC system in the space provided.

1. Sodium nitrate _____

2. Lithium carbonate_____

3. Cesium phosphate _____

4. Boron bromide_____

5. Ammonium nitride _____

6. Tin (IV) fluoride_____

7. Copper (II) bromide _____

8. Iron (III) iodide _____

9. Manganese (IV) sulfate _____

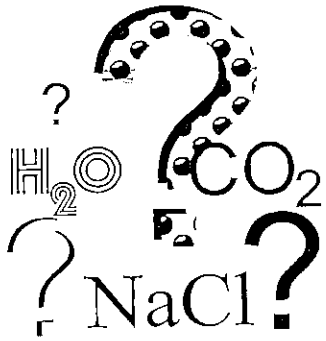
10. Nickel (III) oxalate_____

Chemistry: Form WS4.3.1A

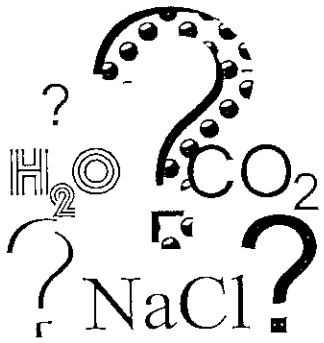
Name _____

BONDING

Date _____ Period _____



Naming Compounds



Write the correct name of the compound on the space provided for each of the formulas listed below.

1.	$NaCl$	1. _____
2.	NH_4CH_3COO	2. _____
3.	K_2SO_4	3. _____
4.	$Fe_2(SO_4)_3$	4. _____
5.	CuO	5. _____
6.	$Al_2(CO_3)_3$	6. _____
7.	$CuBr$	7. _____
8.	FeO	8. _____
9.	MgS	9. _____
10.	$Ba_3(PO_4)_2$	10. _____
11.	H_2S	11. _____
12.	FeF_3	12. _____
13.	KI	13. _____
14.	$LiNO_3$	14. _____
15.	BaO	15. _____
16.	$AgNO_3$	16. _____
17.	KOH	17. _____
18.	$(NH_4)_2CO_3$	18. _____
19.	$Zn(OH)_2$	19. _____
20.	Fe_2S_3	20. _____

Chemistry: Form WS4.2.1A

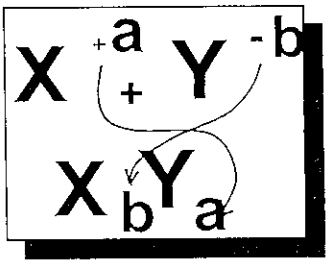
Name _____

BONDING

Date _____ Period ____

Writing Formulas by Crossing Over

The quickest way to determine the formula of a compound of two elements or polyatomic ions is to use the *Cross-Over Rule*. Look up the oxidation state of each element or ion and reduce to lowest terms. Then cross over the oxidation states without the sign to find the subscripts as shown in the diagram to the right.



Using the Cross-Over Rule, determine the formula for compounds of the elements and polyatomic ions below, and write your answer in the answer space.

_____ 1. NH_4 and Cl

_____ 2. Ba and Br

_____ 3. Al and C

_____ 4. Na and O

_____ 5. K and PO_4

_____ 6. Ca and F

_____ 7. Li and N

_____ 8. Ba and CO_3

_____ 9. Al and SO_4

_____ 10. Mg and NO_3

_____ 11. Li and S

_____ 12. Na and SO_4

_____ 13. Ca and HCO_3

_____ 14. Ag and CH_3COO

_____ 15. Zn and OH

Answer the questions below by circling the number of the correct response

1. What is the correct formula for a compound of Li and F? (1) LiF (2) Li_2F (3) LiF_2 (4) Li_2F_3

2. What is the correct formula for a compound of Mg and Cl? (1) MgCl (2) Mg_2Cl (3) $MgCl_2$ (4) Mg_2Cl_3

3. What is the correct formula for a compound of Al and O? (1) AlO (2) Al_2O (3) Al_3O_2 (4) Al_2O_3

4. What is the correct formula for a compound of Ca and Br? (1) CaBr (2) Ca_2Br (3) $CaBr_2$ (4) Ca_2Br_3

5. What is the correct formula for a compound of Al and P? (1) AlP (2) Al_2P (3) AlP_2 (4) Al_2P_3

6. Which is the formula for the compound that forms when magnesium bonds with phosphorus?
   (1) Mg_2P (3) Mg_2P_3
   (2) MgP_2 (4) Mg_3P_2

Answer the questions below by circling the number of the correct response

1. What is the correct formula for copper II nitrate? (1) $Cu(NO_3)_2$ (2) Cu_3N_2 (3) Cu_2NO_3 (4) Cu_2N_3

2. What is the correct name for BaO? (1) barium oxide (2) barium oxygen (3) barium II oxide (4) barium oxalate

3. The formula for zinc hydroxide is (1) $Zn(OH)_2$, (2) $ZnOH_2$, (3) ZnH_2, (4) Zn_2H.

4. The formula for ammonium carbonate is (1) $(NH_3)_2(CO_4)_3$, (2) $NH_2(CO_3)_4$, (3) $(NH_4)_3CO$, (4) $(NH_4)_2CO_3$.

5. The formula for iron II sulfide is (1) $Fe_2(SO_4)_3$, (2) FeS, (3) Fe_2S_3 (4) $FeSO_4$.

6. The name of the compound $CuCO_3$ is (1) copper II carbonate, (2) copper I carbonate, (3) copper III carbonate, (4) copper oxide.

7. The formula for barium nitrate is (1) Ba_3NO_2, (2) Ba_3N_2, (3) $Ba(NO_3)_2$, (4) BaN.

8. The name of the compound H_2S is (1) hydrogen II sulfate, (2) hydrogen sulfate, (3) helium I sulfide, (4) hydrogen sulfide.

9. Which is the compound whose formula is P_2O_5?
   1 potassium (III) oxide
   2 potassium (V) oxide
   3 phosphorus (III) oxide
   4 phosphorus (V) oxide

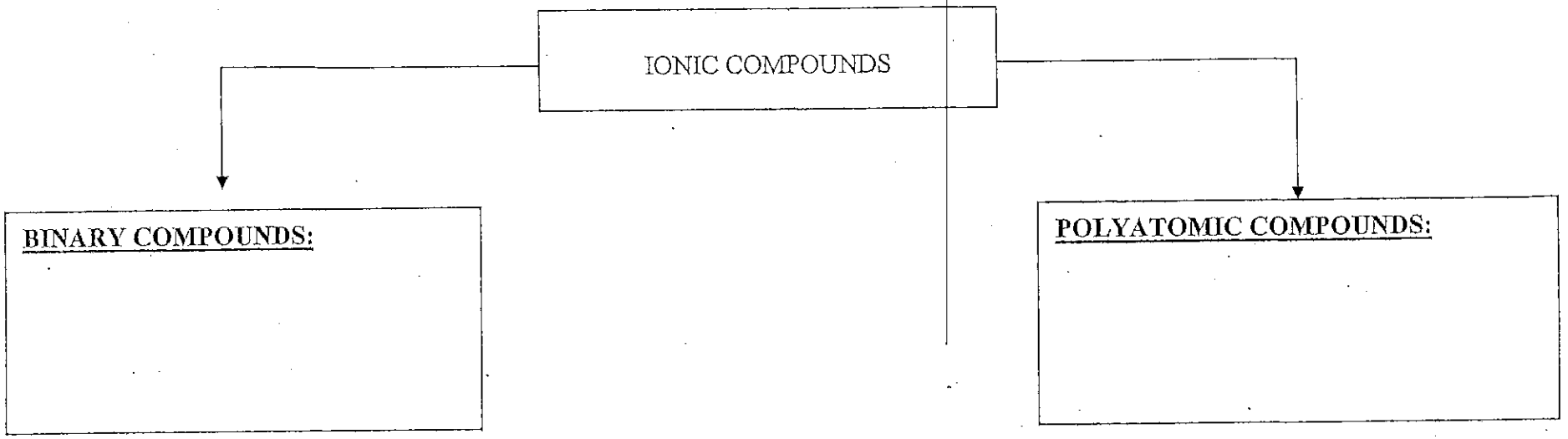
Naming Chemical Compounds #2

Directions: Write the name of each of the following compounds using the Roman Numeral notation for oxidation states.

1. _____ $CuNO_3$
2. _____ $Cu(NO_3)_2$
3. _____ HgO
4. _____ Hg_2O
5. _____ $Cr_2(SO_4)_3$
6. _____ $CrSO_4$
7. _____ $NiPO_4$
8. _____ $Ni_3(PO_4)_2$
9. _____ $CuCl_2$
10. _____ $CuCl$
11. _____ $AuCl$
12. _____ $AuCl_3$
13. _____ $Sr(CN)_2$
14. _____ K_2CrO_4
15. _____ $LiNO_2$
16. _____ $BeCr_2O_7$
17. _____ $Na_2S_2O_3$
18. _____ LiI
19. _____ BeS
20. _____ Rb_2O

Name _____ Date _____ Chemistry Regents

Guidelines to Chemical Formula Writing



Examples:

1) Sodium sulfide

2) Aluminum chloride

3) magnesium nitride

4) iron (II) fluoride

5) lead (IV) iodide

Examples:

1) Calcium nitrate

2) hydrogen sulfate

3) aluminum hudroxide

4) copper (I) nitrate

5) tin (II) phosphate

Name_____ Ionic Bonding Practice Date_____

Ms. Tintella Regents Chemistry

1. Explain, in terms of valence electrons, why the bonding in magnesium oxide, MgO, is similar to the bonding in barium chloride, $BaCl_2$.

2. Base your answer to the following question on the information below.

Carbon has three naturally occurring isotopes, C-12, C-13, and C-14. Diamond and graphite are familiar forms of solid carbon. Diamond is one of the hardest substances known, while graphite is a very soft substance. Diamond has a rigid network of bonded atoms. Graphite has atoms bonded in thin layers that are held together by weak forces.

Recent experiments have produced new forms of solid carbon called fullerenes. One fullerene, C_{60}, is a spherical, cagelike molecule of carbon.

State, in terms of the arrangement of atoms, the difference in hardness between diamond and graphite.

3. Base your answer to the following question on the information below.

In a laboratory investigation, magnesium reacts with hydrochloric acid to produce hydrogen gas and magnesium chloride. This reaction is represented by the unbalanced equation below.

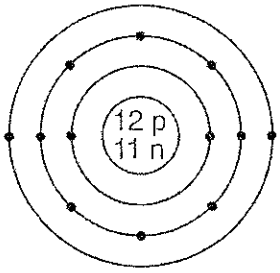
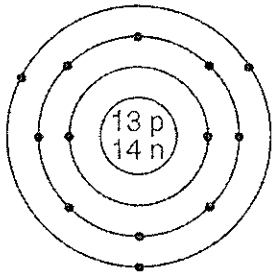
$$Mg(s) + HCl(aq) \rightarrow H_2(g) + MgCl_2(aq)$$

State, in terms of the relative activity of elements, why this reaction is spontaneous.

4. Base your answer to the following question on the information below.

Atomic Diagrams of Magnesium and Aluminum

Key
• = electron

Element	Lewis Electron-Dot Diagram	Electron-Shell Diagram
magnesium	Mg:	
aluminum	Al:	

Explain why Lewis electron-dot diagrams are generally more suitable than electron-shell diagrams for illustrating chemical bonding.

5. An unknown solid was tested and showed the properties listed below:

Properties
high melting point
soluble in water
conductor of electricity when dissolved in water
non-conductor of electricity as a solid
hard surface

a State the type of bonding you would expect of this substance.

b Explain why this substance conducts electricity when dissolved in water.

c Explain why it is hard.