Ancheta	
2010	
Name:	

Date: _____ Period: _____ Seat No.:____

Why and how atoms combine

A. Lewis diagrams

When atoms combine, only electrons in the outer (valence) shell are involved. We can represent these valence electrons with Lewis diagrams. Lewis diagrams for the first 20 elements are shown below.

IA	IIA	IIIA	IVA	VA	VIA	VIIA	0

To write Lewis diagrams:

1. Write the element symbol. Around this draw dots – one for each valence electron.

2. The dots should be spread over four sides. Dots are not paired until all sides have at least one dot.

3. It does not matter on which side dots are placed. For example, hydrogen can be drawn four ways:

4. The number of valence electrons is equal to the group number. For example, hydrogen is in group IA (group 1) and it has one valence electron. Neon is in 0 (group 8) and it has 8 valence electrons. The only exception is He which is in group 8 but has 2 valence electrons.

Q1 – Write Lewis diagrams for a) Ne, b) Sb (Z=51), c) Rb, d) a neutral atom with 9 total electrons

c)

a)

d)

Q2 – Write all possible variations of the Lewis diagram for phosphorus.

b)

B. The Octet Rule

The noble gasses do not react with other elements. In other words, noble gasses are very stable. Let's look at the electron configuration of noble gasses (note: K is the name given to shell 1, L to 2, etc.)

Element		Shell (periods)				
	1	2	3	4	5	6
He	2					
Ne	2	8				
Ar	2	8	8			
Kr	2	8	18	8		
Xe	2	8	18	18	8	
Rn	2	8	18	32	18	8

The Octet rule and ion formation

As stated, when atoms form ions they seek an electron configuration like that of the <u>nearest</u> noble gas. Nearest refers to the number of <u>representative</u> elements between an element and a noble gas. For example Br is 1 space removed from Kr, but 7 spaces removed from Ar (see your periodic table). So, Br would gain 1 electron to form Br⁻. Similarly, Mg would lose 2 electrons to become Mg²⁺.

Q3–Complete the chart:	Br	Р	Ne	Al	Ca
Nearest Noble gas (spaces removed)	Kr (1)				
Resulting ion	Br-				

Q3- Write the ions that each of the following atoms would likely to form: F O S Li

Most Noble gasses have 8 electrons in their outer shell. This is a stable conformation.

Octet Rule: When atoms form ions or combine in compounds they obtain electron configurations of the nearest noble gas (usually this means that there will be 8 outer electrons).

Kr

Ion: charged particle

Q4 – Draw an F- ion and Ne atom. How do they compare?

F-

	Ne	
l		

C. Types of bonds

:

There are two main types of bonds: ionic and covalent. Ionic bonding occurs between metals and non-metals. Covalent bonding occurs between two non-metals (When two metals combine an alloy, a mixture, is formed).

Na^+	+	Cl	= Ionic	Н	+	0	= Covalent
(metal)		(non metal)		(non metal)		(non metal)	

To name ionic compound, you simply write the name of the metal then write the name of the non-metal + - ide. To name the covalent compound (or molecular compounds), you need to write the prefixes for both nonmetals then add - ide to the second atom except do not write "mono" for the first non-metal atom.

Example:	Ionic compound	LiCl – Lithium Chloride
	Molecular (Covalent) compound	CO ₂ - Carbon dioxide

Q5 – Identify each compound as ionic or covalent then write the compound name.

MgO	 3
CaCl2	 4
SO ₂	 5
PbCl ₂	 6
CCl4	 7
CH4	 8
KI	 9
H ₂ 0	 10

Greek Prefixes				
1	Mono			
2	Di			
3	Tri			
4	Tetra			
5	Penta			
6	Hexa			
7	Hepta			
8	Octa			
9	nona			
10	deca			

i. Ionic bonding illustrated

The formation of a positive ion is always coupled with the formation of a negative ion. For example, when Na combines with Cl, the Na becomes positive and the Cl becomes negative. The positive and negative ions are then attracted to each other. There are three ways to illustrate this:

B-R diagram (Bohr – Rutherford)

Lewis Diagram

Chemical Equation

Q6 - Use all three methods (chemical reaction equation, B-R diagrams, and Lewis diagrams) to show how bonds form between: Mg + O (follow the octet rule)

B-R diagram (Bohr – Rutherford)

Lewis Diagram

Chemical Equation

ii. Covalent bonding illustrated

Covalent bonding occurs between two non-metals. Covalent bonding is different from ionic bonding because electrons are shared instead of transferred. Yet, covalent bonding still follows the octet rule. Let's look at the bond that is formed between H and F.

B-R diagram (Bohr – Rutherford)

Lewis Diagram

Chemical Equation

Q7 - Use all three methods (chemical reaction equation, B-R diagrams, and Lewis diagrams) to show how bonds form between: 2 H + O to form water $H_2O(follow$ the octet rule)

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B-R diagram (Bohr – Rutherford)		
Lewis Diagram		
Chemical Equation		

Q8 - Draw Lewis dot diagrams to represent the following compounds CCl4, HCl, H2O, H2

Lewis Diagram – CCl₄

Lewis Diagram

Lewis Diagram

Lewis Diagram

Homework:

I. Ionic Compounds NAMING BINARY COMPOUNDS

A. Name the following ionic compounds.

1. $BaCl_2$	
2. NaF	
3. Ag_2O	
4. CuBr	
5. $CuBr_2$	
6. FeO	
7. Fe_2O_3	
8. MgS	
9. Al_2O_3	
10. CaI ₂	
11. K ₂ S	
12. $CrCl_2$	
13. CrCl	
14. CaO	
15. Ba ₃ P ₂	
16. Hg_2I_2	
17. Na ₂ O	
18. BeS	
19. MnO	
20. Mn_2O_3	

B. WRITING BINARY FORMULAS

Write the formulas for the compounds formed from the following Ions.

1. Na^{+1} , Cl^{-1}	
2. Ba^{+2} , F^{-1}	
3. K^{+1} , S^{-2}	
4. Li+1, Br-1	
5. Al^{+3} , Cl^{-1}	
6. Zn^{+2} , S^{-2} 7. Ag^{+2} , P^{-3} 8. Mg^{+2} , P^{-3}	
7. Ag^{+2} , P^{-3}	
8. Mg^{+2} , P^{-3}	
9. Ni^{+2} , O^{-2}	
10. Ni^{+3} , O^{-2}	
11. Fe^{+2} , O^{-2}	
12. Fe^{+3} , O^{-2}	
13. Cr^{+2} , S^{-2}	
13. Cr^{+2} , S^{-2} 14. Cr^{+3} , S^{-2}	
15. Cu^{+1} , Cl^{-1}	
16. Cu^{+2} , Cl^{-1}	
17. Pb^{+4} , O^{-2}	
18. Pb ⁺⁴ , O ⁻² 19. Mn ⁺² , Br ⁻¹	
19. Mn^{+2} , Br^{-1}	
20. Mn^{+4} , Br^{-1}	

II. Covalent (molecular) Compounds NAMING BINARY COMPOUNDS

A. Name the following molecular (covalent) compounds.

1. CO	
2. CO ₂	
3. NH ₃	
4. CH ₄	
5. C_2H_6	
6. C_4H_{10}	
7. SO ₂	
8. O ₃	
9. SF ₆	
10. SiO ₂	

III. **Polyatomic Ions**

A. List of Polyatomic Ions: NH⁺¹

NH ₄	
OH ⁻¹	
NO ₃ $^{-1}$ SO ₄ $^{-2}$ CO ₃ $^{-2}$ HCO ₃ $^{-1}$ PO ₄ $^{-3}$	
SO_4 ⁻²	
CO_3^{-2}	
HCO_3^{-1}	
PO_4^{-3}	

B. NAMING IONIC COMPOUNDS WITH POLYATOMIC IONS.

- 1. NH₄Cl
- _____ _____ 2. $LiNO_3$
- 3. Ca SO_4 _____
- 4. NaHCO₃
- _____ 5. K₃PO₄