Grade 10 Chemistry Review

For any neutral element:

- Number of Protons =
- Number of Electrons =
- Number of Neutrons =

Periods:

The _____ is the first row of the periodic table.

- These atoms have only one shell.
- It holds only 2 electrons

The _____ of the periodic table is the second row.

- These atoms have 2 shells.
- The first shell holds 2 electrons and the second shell holds 8 electrons.

The _____ of the periodic table is the third row.

- These atoms have 3 shells.
- The first shell holds 2 electrons, the second shell holds 8 electrons, and the third shell holds 8 electrons.

Chemical Families

- The periodic table is organized into families.
- Each family is a column on the periodic table.
- Chemical Families share similar properties.
- Looking at the Bohr diagrams of the atoms how are all the elements in a family similar?

Valence Electrons:

- They all have the same number of electrons in their outer shell.
- These are called _____

- It is the valence electrons that give atoms their characteristics and properties.
    - Reactivity
    - Stability

Chemical Families:

1. Alkali Metals (Group 1A)
2. Alkali Earth Metals (Group 2A)
3. Chalcogens (Group 6A)
4. Halogens (Group 7A)
5. Noble/Inert Gases (Group 8A)
6. Hydrogen

- Could be in two different columns or families so it gets its own.

The Big Goal:

The key to family stability or reactivity is how easy it is to get a _____.

- Either _____
- Or _____

Atoms want to gain or lose electrons to reach a full valence shell.

2 electrons in period 1

8 electrons in period 2 & 3

Lewis Dot Diagram:

First draw the Bohr Diagram for Chlorine:

Now draw the Lewis Dot diagram of Chlorine:

- If it gains electrons, draw the full valence shell around the chemical symbol in square brackets with the charge in the upper right corner.

- If the element loses electrons, draw the chemical symbol with an empty valence shell with the charge in the upper right corner.

  - Ion – _____
  - Cation – a _____ charged particle (_____ electrons)
    - Cats have paws ☺/ t looks like +
  - Anion – a _____ charged particle (_____ electrons)

Let's Practice: Fill in the Following Chart

Symbol	**Name**	**Atomic #**	**Atomic Mass**	**Protons**	**Neutrons**	**Electrons**
Li						
Mg						
Cl						
Ag						
Cu						
Br						

Element	Element symbol	Atomic number	Number of protons	Number of electrons	Period number	Number of shells	Electron dot diagram
aluminum							
silicon							
calcium							
	Li						
	B						
	P						

Element Name	Symbol	Cation/Anion	Electron dot diagram of the charged ion	Charge (eg. +1, +2, 0, -1, -2)	Ionic Symbol
Sulfur					
	O				
Potassium					
	Cl				
Neon					
Sodium					
	F				

Forming Compounds:

Atoms gain, lose, or share electrons to obtain full valence shells and become _____.

These atoms that have gained or lost electrons are called _____.

Where do the atoms get these extra electrons?

_____

The number of electrons present remains the same, but their arrangement changes when compounds form.

Metal atoms tend to _____ electrons, while non-metal atoms tend to _____ or _____ electrons.

Members of the noble gas family are chemically stable they do not react.

Ionic Bonds:

Bonds between a_____ and a _____

- between the left side of the periodic table and the right side

Ionic bonds result when electrons are transferred from metal atoms to non-metal atoms.

The metal atoms _____ electrons to become _____ ions, while the non-metal atoms _____ electrons to become _____ ions. The ions are held together by the attraction of opposite charges in an ionic bond.

Examples:

1. Na and Cl

2. Mg and F

3. Li and S

Characteristics of Ionic Compounds

1. They have relatively _____ melting points.

- the bond is strong because they are held together by the attraction of opposite charges

2. When melted or dissolved in water they conduct electricity. (An _____)

3. They _____ conduct electricity when solid.

Covalent Compounds:

- Bonds between two _____
- Covalent bonds result when non-metals _____ electrons.
- By overlapping their valence shells, the atoms share pairs of electrons.
- This increases the number of electrons in each atom's valence shell, so that the atoms appear to have full shells.

Examples:

1. Cl and Cl

Aside: This is called a diatomic molecule. When two identical atoms combine. There are a few elements on the periodic table that always come in this form. (Remember the clown??) The diatomic elements on the periodic table are:

H O F Br I N Cl

2. H and O

3. N and F

Characteristics of Covalent (Molecular) Compounds

1. They have relatively _____ melting points.
2. They _____ conduct electricity when solid or when dissolved in water. (A _____)

Intro to Bonding:

Watch this Crash Course video:
http://www.youtube.com/watch?v=a8LF7JEb0IA&list=PL8dPuuaLjXtPHzzYuWy6fYEaX9mQQ8oGr&index=24

Chemical Names:

Binary Ionic Compounds: These compounds will be composed of a _____and a _____. There will only be 2 different atoms in each compound.

1. Name the _____ first and then the anion
2. Name the _____ (metal) directly from the periodic table.
3. Name the _____ (non-metal) but drop the ending and end the name in "ide".

**These rules are only for Group 1, 2 and 13 metals. There will be another set of rules for the Transition Metals!!!

Chemical Formula	Name of Ionic Compound
1. H_2S	
2. NaCl	
3. $MgBr_2$	
4. KCl	
5. Na_2S	

Here are some examples of common roots (endings):

Cl → chlor - ide

F → fluori - ide

Br → brom - ide

O → ox - ide

I → iod - ide

N → nitr -ide

Activity #1:

1. MgS
2. KBr
3. Ba_3N_2
4. Al_2O_3
5. NaI
6. SrF_2
7. Li_2S
8. $RaCl_2$
9. CaO
10. AlP
11. K_2S
12. BiBr
13. Sr_3P_2
14. $BaCl_2$
15. NaBr
16. MgF_2
17. Na_2O
18. SrS
19. AlN

Binary Molecular Compounds:

These compounds will be composed of two _____.

There will only be 2 different atoms in each compound.

When naming these compounds you will need to know (and memorize) the Greek prefixes:

Number of Atoms	Prefix	Number of Atoms	Prefix
1	Mono	6	Hexa
2	Di	7	Hepta
3	Tri	8	Octa
4	Tetra	9	Nona
5	Penta	10	Deca

- *Note: when the addition of the Greek prefix places two vowels adjacent to one another, the "a" (or the "o") at the end of the Greek prefix is usually dropped; e.g., "nonaoxide" would be written as "nonoxide", and "monooxide" would be written as "monoxide". The "i" at the end of the prefixes "di-" and "tri-" are never dropped.*

The names of these compounds will take this form:

- prefix first _____ prefix second _____

Remember: the name must end in “ide”

- and if there is only one element named first “mono” is not included

Chemical Formula	Name of the Molecular Compound
1. N_2O	
2. NO_2	
3. IF_7	
4. N_2O_5	
5. XeF_2	

Activity #2 – Name the following Binary molecular (covalent) compounds

1) As_4O_{10}
2) BrO_3
3) BN
4) N_2O_3
5) NI_3
6) NO_2
7) XeF_4
8) PCl_3
9) CO
10) PCl_5
11) P_2O_5
12) S_2Cl_2
13) ICl_2
14) SO_2
15) P_4O_{10}
16) OF_2
17) ClO_2
18) SiO_2
19) BF_3

A Special case for Ionic Naming - Stock System

The Stock System is used only if the metal element in the compound may have more than one charge. Example: Iron can form ions that have a charge of 2+ or 3+.

In this system, the valence of the metal element is indicated by using a Roman numeral in parenthesis following the name for the metal.

Example: Iron (II) for a valence of 2+ and Iron (III) for a valence of 3+.

Example: Fe_2O_3

1. The non-metal ion, oxygen, has a charge of O^{2-}. As there are three oxide ions in the formula, the total negative charge in the compound is -2 x 3 = -6.
2. The positive ions must have a charge equal to the charge of negative ions to give the compound a net charge of zero. The charge on the ion must be +6 (? x 2 = +6).
3. Since there are two iron ions shown, the valence on the iron is +3. The name of the compound is iron (III) oxide.

Example: PbS_2

Total negative ions is 2- x 2 = 4-.

Therefore total positive ions must equal 4+ (? x 1 = 4+). Since there is only one lead ion, the valence on the lead is 4.

The name of the compound is lead (IV) sulfide.

Writing Chemical Names

Recall:

Ionic Compounds: (metal + non-metal) Name the metal. Name the non-metal ending in "ide".

Covalent Compounds: (non-metal + non-metal) First the prefix (not "mono") then the name of the first non-metal. Then, another prefix and the name of the second non-metal ending in "ide".

Name the following compounds: Be careful because the ionic and covalent compounds are mixed up!!

1. HgF_2
2. KCl
3. PF_5
4. KF
5. HCl
6. $SbCl_3$
7. As_4O_{10}
8. LiI
9. HBr
10. IF_5
11. CCl_4
12. Na_2O
13. IF_6
14. BaF_2
15. CO_2
16. MgO
17. Mg_3P_2
18. P_2O_5
19. Ca_3N_2
20. Li_2S

<u>Extra Practice for the Stock System:</u>

1) NiO
2) Sn_3N_2
3) $PbCl_4$
4) Pb_3P_2

Writing Formulas for Ionic Compounds using the Criss-Cross Method

Rule 1: Write the symbol of the **metallic** element **first**. The **nonmetal** is written **second.**

Rule 2: Place the ionic charge number (valence number) of one element at the base (as a subscript) of the other element.

Rule 3: If a subscript has a value of one, leave it out.

Examples

1) Beryllium and chlorine

2) Magnesium and sulfur

Ionic Compound Forming Questions:

1. Write formulas for the following compounds that are named using the Stock method. You will need to use the periodic table plus the table of combining capacity or valence.

Name	**Formula**
Magnesium nitride	
Lithium sulfide	
Strontium bromide	
Aluminum chloride	
Potassium phosphide	
Barium oxide	
Chromium (III) sulfide	
Tin (IV) nitride	
Tin (II) oxide	
Bismuth(V) fluoride	
Manganese(II) bromide	

Iron(III) chloride	
Lead(IV) oxide	

2. Name the following binary ionic compounds.

    a. These questions are straight forward with no metal ions with more than one possible valence.

Formula	**Name**
MgS	
KBr	
Ba_3N_2	
Al_2O_3	
NaI	
SrF_2	
Li_2S	
$SrCl_2$	
CaO	
AlP	

    b. These questions require the use of the Stock system for the names of metal ions with more than one possible charge.

Formula	**Name**
Cr_2S_3	
$FeBr_2$	
Pb_3N_2	
Co_2O_3	

CuI	
CuF_2	
CuS	
$CoCl_2$	
PbO	
CrP	

3. Write formulas for compounds formed from the following sets of ions.
    a. Li^{1+} and Cl^{1-}
    b. Ca^{2+} and O^{2-}
    c. Na^{1+} and S^{2-}
    d. Al^{3+} and I^{1-}
    e. Ba^{2+} and F^{1-}

4. Write formulas for compounds formed from the following elements.
    a. Sodium and bromine
    b. Potassium and oxygen
    c. Aluminum and sulfur
    d. Barium and chlorine
    e. Lithium and oxygen
    f. Silver and chlorine

5. Write formulas for the following compounds.

Name	**Formula**
Potassium chloride	
Sodium oxide	
Calcium bromide	
Magnesium oxide	
Aluminum fluoride	

Polyatomic Ions

- If you ever see an ending that does not end in –ide, you know you have a polyatomic ion (ex: _____)
- Polyatomic ions are ions (something that has a charge) that contains _____ _____
- You always look on your common ion chart to find the charges of these

Ex:

i) $NaNO_3$
ii) K_2CO_3
iii) $Mg(HS)_2$
iv) $AgNO_2$
v) $Pb(C_2H_3O_2)_4$

Ex:

i) calcium carbonate

ii) ammonium chloride
iii) iron(III) nitrate

iv) silver phosphate

Writing Ionic Formulas Involving Polyatomic Ions
Write the formulas for the following compounds

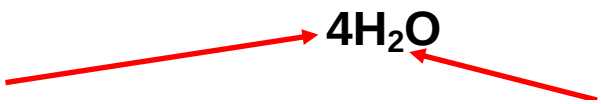
1. sodium chlorate
2. barium chlorate
3. sodium hydrogen carbonate
4. calcium nitrate
5. barium sulfate
6. aluminum chlorate
7. aluminum nitrate
8. aluminum nitrite
9. lithium phosphate
10. strontium phosphate
11. calcium acetate
12. aluminum sulfate
13. calcium carbonate
14. ammonium chloride
15. ammonium sulfide
16. ammonium sulfate
17. ammonium phosphate
18. copper(I) carbonate
19. iron(III) nitrate
20. silver phosphate

Write the names for the following binary ionic compounds:

1. $ZnSO_4$
2. $Al(NO_3)_3$
3. $(NH_4)_2SO_4$
4. $Zn(OH)_2$
5. HNO_3
6. $BaSO_4$
7. $Al(ClO_3)_3$
8. $AgNO_3$
9. $Ca(ClO_3)_2$
10. $CdSO_4$
11. Na_2SO_3
12. $BaCO_3$
13. $NaNO_2$
14. $SnSO_4$
15. $Sn(CO_3)_2$
16. $FeCO_3$
17. $NaC_2H_3O_2$
18. $Pb(NO_3)_4$
19. Cu_3PO_4
20. $Cu_3(PO_4)_2$

Mrs. Kornelsen

Balancing Chemical Reactions



Coefficient - _____

_____

_____

_____

_____

Subscript - _____

_____

_____

_____

_____

If a BLT sandwich at a restaurant is served with:

2 slices of toast 3 slices of bacon 1 tomato slice 1 piece of lettuce 1 dollop of mayonnaise

1. If I have 3 BLT sandwiches how many pieces of toast do I have?
2. If I have 4 BLT sandwiches how many pieces of bacon do I have?
3. How many BLT sandwiches can I make with 4 slices of toast, 5 slices of bacon, 2 slices of tomato and 1 piece of lettuce?
4. Write the 'chemical equation' necessary to form 3 sandwiches.

1. Write a list of elements on each side of the equation 2. Total the number of elements on each side. 3. Add coefficents to balance one element at a time. 4. Start with one that has more on the reactant side and less on the product side. 5. Once you change a coefficient recalculate how many of the elements you have. 6. Go back and forth until all the atoms balance.	$Na + Cl_2 \rightarrow NaCl$ $K + O_2 \rightarrow K_2O$ $H_2 + O_2 \rightarrow H_2O$ $H_2 + Cl_2 \rightarrow HCl$ $N_2 + H_2 \rightarrow NH_3$ $Al + Br_2 \rightarrow AlBr_3$ $CH_4 + O_2 \rightarrow CO_2 + H_2O$ $CO + O_2 \rightarrow CO_2$

Remember you can only change the coefficient, not the subscripts!

Mrs. Kornelsen

Conservation of Mass

The reason that equations always balance is because of the Law of Conservation of Mass. It simply states that we ca not create or destroy matter. Whatever we start with we have to finish with that much. If we begin with 10 oxygen atoms we must end with 10 oxygen atoms.

Balancing Equations Practice:

1. $Na + O_2 \longrightarrow Na_2O$

2. $K + Cl_2 \longrightarrow KCl$

3. $Na + H_2O \longrightarrow NaOH + H_2$

4. $P_4 + O_2 \longrightarrow P_4O_{10}$

5. $CH_4 + O_2 \longrightarrow CO_2 + H_2O$

6. $MnO_2 + HCl \longrightarrow MnCl_2 + H_2O + Cl_2$

7. $C_3H_6 + O_2 \longrightarrow CO_2 + H_2O$

8. $CaCO_3 \longrightarrow CaO + CO_2$

9. $F_2 + LiCl \longrightarrow LiF + Cl_2$

10. $Zn + HCl \longrightarrow ZnCl_2 + H_2$

Another Balancing Equations Sheet!

1) ____ $AlBr_3$ + ____ K → ____ KBr + ____ Al

2) ____ FeO + ____ PdF_2 → ____ FeF_2 + ____ PdO

3) ____ P_4 + ____ Br_2 → ____ PBr_3

4) ____ LiCl + ____ Br_2 → ____ LiBr + ____ Cl_2

5) ____ $PbBr_2$ + ____ HCl → ____ HBr + ____ $PbCl_2$

6) ____ $CoBr_3$ + ____ $CaSO_4$ → ____ $CaBr_2$ + ____ $Co_2(SO_4)_3$

7) ____ Na_3P + ____ CaF_2 → ____ NaF + ____ Ca_3P_2

8) ____ Mn + ____ HI → ____ H_2 + ____ MnI_3

9) ____ Li_3PO_4 + ____ NaBr → ____ Na_3PO_4 + ____ LiBr

10) ____ CaF_2 + ____ Li_2SO_4 → ____ $CaSO_4$ + ____ LiF

11) ____ HBr + ____ $Mg(OH)_2$ → ____ $MgBr_2$ + ____ H_2O

12) ____ $LiNO_3$ + ____ $CaBr_2$ → ____ $Ca(NO_3)_2$ + ____ LiBr

13) ____ $AgNO_3$ + ____ Li → ____ $LiNO_3$ + ____ Ag

14) ____ $Si(OH)_4$ + ____ NaBr → ____ $SiBr_4$ + ____ NaOH

15) ____ NaCN + ____ $CuCO_3$ → ____ Na_2CO_3 + ____ $Cu(CN)_2$

Classifying Chemical Reactions

In total we have 5 types of reactions to learn:

1. Single replacement

2. Double replacement

3. Synthesis

4. Decomposition

5. Combustion

Balance the following equations and state the reaction type.

$Mg + O_2 \rightarrow MgO$ _____

$FeCl_3 + CuS \rightarrow Fe_2S_3 + CuCl_2$ _____

$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ _____

$Mg(NO_3)_2 + K_3PO_4 \rightarrow Mg_3(PO_4)_2 + KNO_3$ _____

$Cu + O_2 \rightarrow Cu_2O$ _____

Completing Chemical Reactions

Rules for solving product prediction problems

1. ***Identify the type of reaction***
   On the left side of the arrow you will find:
   - ***a.*** Combustion: hydrocarbon (C_xH_y or $C_xH_yO_z$) + oxygen
   - ***b.*** Synthesis: 2 elements
   - ***c.*** Decomposition: 1 compound
   - ***d.*** Single replacement: 1 element + 1 compound
   - ***e.*** Double replacement: 2 compounds

2. ***Complete the products***
   - ***a.*** Combustion: **always** $CO_2 + H_2O$
   - ***b.*** Synthesis: Combine the 2 elements to create the new compound. Use the charges to build your new compound. Don't worry about subscripts on the left of the arrow; the charges will give you your new subscripts.
   - ***c.*** Decomposition: the products are the elements that make up the compound. If the non-metal is a diatomic, don't forget to add the subscript "2" e.g. $2NaCl \rightarrow 2Na + Cl_2$. If one component is a polyatomic ion, don't split it up. E.g. $NaSO_4 \rightarrow Na + SO_4^{2-}$
   - ***d.*** Single Replacement: if the element is a metal replace the metal in the compound. If th4 element is anon-metal, replace the non-metal in the compound. Use charges to build the new compound. Careful for diatomics!!
   - ***e.*** Double Replacement: Switch the metals. Use charges to build the new compounds.

3. ***Balance the Equation***
   Balancing the equation will solve the arithmetic differences caused by the criss-cross.

Diagram:

Chemical Reactions Practice Problems

Write correct formulas for the products in these decomposition reactions.

1) $NiCl_2$ --->

2) Ag_2O --->

3) FeO_3 --->

4) ZnO_2 --->

5) Cs_2O --->

Write correct formulas for the products in these double replacement reactions.

1) $Ca(OH)_2 + H_3PO_4$ --->

2) $K_2CO_3 + BaCl_2$ --->

3) $Cd_3(PO_4)_2 + (NH_4)_2S$ --->

4) $Co(OH)_3 + HNO_3$ --->

5) $AgNO_3 + KCl$ --->

6) $Na_2CO_3 + H_2SO_4$ --->

7) $Al(OH)_3 + HC_2H_3O_2$ --->

Write correct formulas for the products in these synthesis reactions.

1) $Mg + O_2$ --->

2) $Na + O_2$ --->

3) $Ga + O_2$ --->

4) $O_2 + H_2$ --->

5) $Ba + O_2$ --->

6) $Be + O_2$ --->

7) $Al + S$ --->

Write correct formulas for the products in these single replacement reactions.

1) $MgCl_2 + O_2$ --->

2) $Na_2S + O_2$ --->

3) $Ga + K_2O$ --->

4) $CaBr_2 + Cl_2$ --->

5) $CuO + F_2$ --->

6) $Na + Li_2O$ --->

7) $AgCl + K$ --->

Write correct formulas for the products in these combustion reactions.

1) $C_2H_4 + O_2$ --->

2) $C_8H_{16} + O_2$ --->

3) $CH_4 + O_2$ --->

4) $C_5H_{12} + O_2$ --->

Name the type of reaction, complete the products and balance.

_____ $Zn + HCl \rightarrow$

_____ $CuCl_2 + HNO_3 \rightarrow$

_____ $CS_2 + F_2 \rightarrow$

_____ $CH_4 + O_2 \rightarrow$

_____ $Cl_2 + Ag \rightarrow$

_____ $Li_2O \rightarrow$

Turn the following word equations into chemical formula equations, balance, and name the type of reaction.

Sodium plus oxygen reacts to form sodium oxide.

Methane (CH_4) reacts with oxygen to form carbon dioxide and water.

Potassium sulfite decomposes to form potassium sulfide and oxygen.

Potassium oxide plus magnesium chloride react together to create magnesium oxide and potassium chloride.