My goal for unit 6 is...

What steps will you take to achieve this goal?

Pages...	Due on...

Chemistry

Unit 6

Ionic Bonding

Name _____

Class Period _____

The UNIT 06 TEST is on

_____

UNIT 6 Table of Contents

Unit 6: Ionic Bonding Glossary

All of the following vocabulary words are relevant to the unit and are found on the Unit 6 Quizlet: bit.ly/37GK7Zy

Element - a substance that cannot be broken down into simpler substances by chemical means

Atom - the smallest individual unit of an element that still maintains the properties of that element

Compound - two or more atoms of different elements that are bonded due to attractive forces

Molecule - the smallest individual unit of a covalent compound that still maintains the properties of that compound

Valence electrons - the outermost electrons in an atom that are responsible for the ionic charge of the atom

Ion - a charged atom

Cation - a positively charged atom due to a loss of electrons

Anion - a negatively charged atom due to a gain of electrons

Polyatomic ion - a charged group of atoms. These atoms like to stick together, so you can never change their subscript numbers.

Formula Unit - the smallest individual unit of an ionic compound that still maintains the properties of that compound.

Octet rule - atoms want to have a full outer shell, so they will lose or gain electrons to achieve this goal. For most atoms, this means having eight electrons in its outer shell.

Chemical bond - the attractive forces that hold two atoms together (atoms must have charges - cation and anion)

Chemical formula - a way to represent the atoms that make up a compound. We use the chemical symbols of the elements and subscript numbers to indicate the number of atoms of each element.

Ionic bonds - chemical bonds that result due to a transfer of electrons between atoms. Between a cation and an anion.

Acids - hydrogen (H^+) containing compounds.

Bases - hydroxide (OH^-) containing compounds.

IUPAC - a global group of chemists who have created the rules we must follow in order to properly communicate chemical formulas and compound names

NOTES: Intro to Forming Ions Name _____

Chemistry Date _____ Hour ____

These notes go along with the EdPuzzle Video: Intro to Forming Ions

Unit 5 Review:

How to draw a Lewis Dot Symbol:

1. Draw the element symbol.
2. Figure out the number of valence electrons.
    a. *Look at the group number OR write out the e⁻ configuration*
3. Place dots (the electrons) around the element symbol one at a time.

Draw the Lewis dot symbol for fluorine:	Draw the structural formula for hydrogen monofluoride: (*aka hydrofluoric acid*)

Unit 5 Vocabulary:

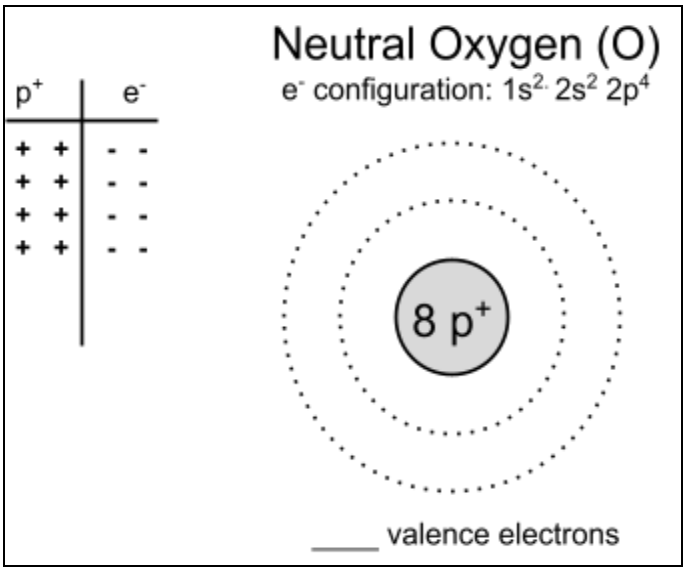
- **Valence electrons**: the number of f electrons in the _____ _____ _____.
- **Lone pair electrons:** electrons that ____ _____ participate in _____.
- **Single electrons:** electrons in an atom that are _____ _____ up. These are the electrons that will eventually _____ _____ with other atoms.
- **Bonding pair electrons:** a pair of electrons that _____ in a _____ bond. They are shared between two atoms, each atom contributing 1 electron each.
- **Molecule:** smallest unit of a substance that contains 2 _____ atoms (or more) _____ bonded.
- **Lewis Dot Symbol**: a model for a _____ atom that models the _____electrons as dots.
- **Lewis Dot Structure (Structural Formula):** a model that uses multiple Lewis Dot Symbols to represent the _____ of an _____ _____. Lone pair electrons are represented as _____ whereas bonding pair electrons are represented as _____.
- **Octet Rule:** all atoms in a covalent compound must have _____ valence electrons.
    - *Exceptions: Hydrogen only needs 2 ve- and there are other elements that are exceptions, but we will let you know.*
- **Covalent Bond:** two (or more) _____ atoms that are "_____" together by _____ their _____ electrons.

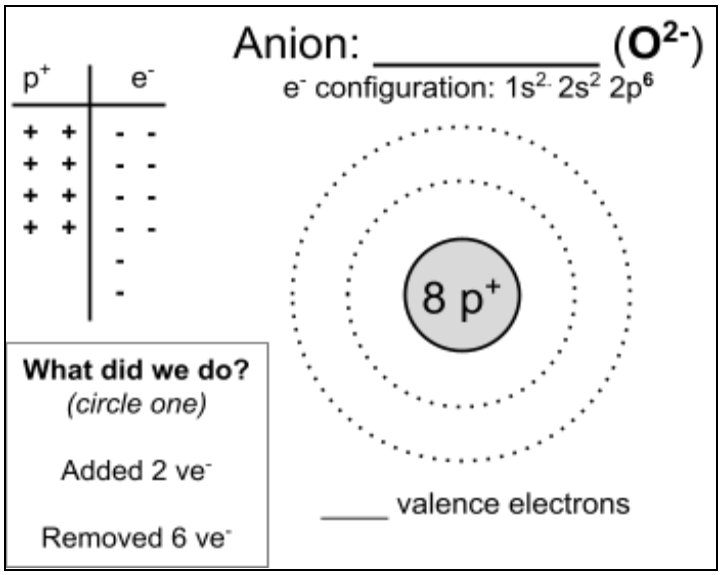
New Stuff!

- **Ions**: a _____ atom.
    - **Cation**: a _____ charged atom that has _____ electrons.
    - **Anion**: a _____ charged atoms that has _____ electrons.

Ionization of Oxygen:

** For the images below, draw in the electrons and fill in the blanks to match the images in the video. **



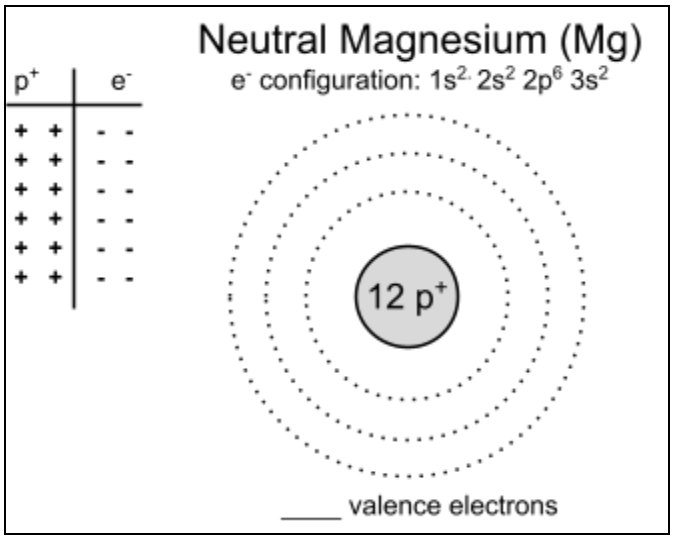


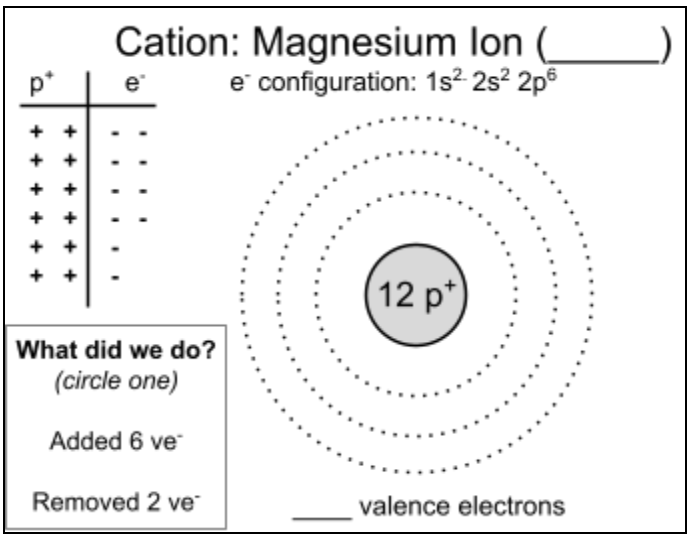
- We added ____ _____ to oxygen because we wanted to satisfy the _____ _____ when becoming an ion. We wanted oxygen to be more like a _____ _____. Adding 2 valence electrons is _____ than removing 6 valence electrons.

Ionization of Magnesium:

** For the images below, draw in the electrons and fill in the blanks to match the images in the video. **

- Remember, anytime you pluck an element from the periodic table, it will be naturally _____. Magnesium has _____ protons and therefore needs to have _____ electrons to "cancel out" their charges which makes the overall charge of the magnesium atom _____.

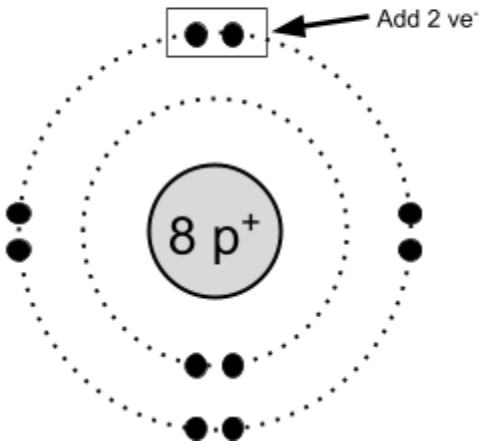




- Atoms are _____! So, when it comes to adding or removing valence electrons to form an ion, pick the _____ _____ or "_____" route.
- All atoms want to be like _____ _____! (aka, _____ valence shells of _____ valence electrons).
    - Reminder: Hydrogen is an exception to the octet rule, so it only needs 2 valence electrons.

Anion: Oxide (O^{2-})

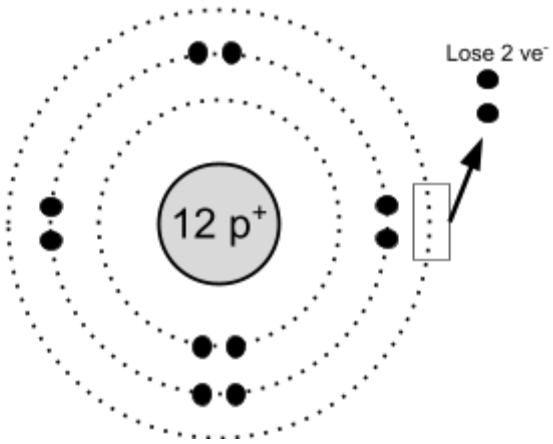
e^- configuration: $1s^2\ 2s^2\ 2p^6$



- Oxygen _____ _____valence electrons. This made the charge _____ and _____ up the energy shell to match 8 valence electrons. Notice how oxide's electron configuration is the same as neutral neon's.

Cation: Magnesium Ion (Mg^{2+})

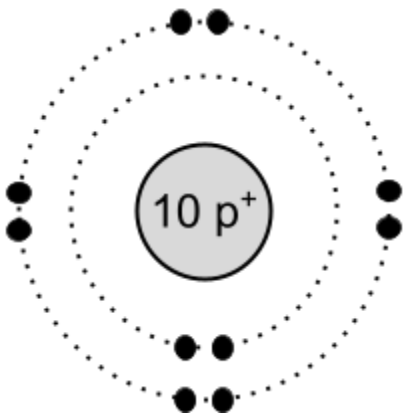
e^- configuration: $1s^2\ 2s^2\ 2p^6$



- Magnesium _____ _____valence electrons. This made the charge _____ and _____ the full energy shell underneath. Notice how the magnesium ion's electron configuration is the same as neutral neon's.

Neutral Neon (Ne)

e^- configuration: $1s^2\ 2s^2\ 2p^6$



NOTES: Ionic Compounds -- Writing Formulas Name:_____

Chemistry Date:_____Hour_____

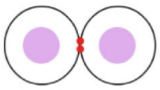
Review: *Use these SLIDES to fill out the notes: tinyurl.com/U6Topic1*

Chemical bonds: _____

Covalent Bonds (Unit 5)

Formed between ____ _____.

Electrons are _____ between the atoms.

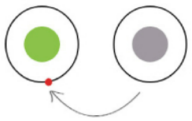


Ionic Bonds (Unit 6)

Formed between a _____ (typically _____)

and an _____ (typically _____).

Electrons are _____.



- 3 Types of Ions
  - Cations (____) form when electrons are _____.
  - Anions (____) form when electrons are _____.
  - Polyatomic Ions
    - They are _____ of atoms that are charged. *"poly" = many* *"atomic" = atoms*
    - They behave like normal _____ or _____.
    - You _____ change _____ _____! They are set in stone!!!!

Valence Electrons & Ions:

- The charge of an ion is based on its **valence electrons.**
  - How do we know how many valence electrons an atom has? What about transition metals?
    - Use the electron configuration
    - Use the _____ _____.
      - *Main group elements (groups 1A - 8A) have the same number of ve- as the group #.*
      - *Group 1A elements have 1 ve-* *Group 2 elements have 2 ve-* *Group 3A elements have 3 ve-....etc...*
    - _____ _____ don't have a set pattern. They can have _____ _____ _____.
  - How can we use this to determine the charge of an ion?
    - Use _____ _____ to determine the charge of an ion:
      - 3 ve^- or less → _____ ve- (become +) 5 ve^- or more → _____ ve- (become -)
      - 4 ve^- → _____ or _____ ve^- 8 ve^- → _____ They are happy!
  - How do we know the charge of a polyatomic ion?
    - It's _____ to us! It's on the _____ of our periodic tables.

Ionic Bonding:

- Ionic bonds form when _____.
- They typically occur between _____ and _____, but a _____ _____ can be substituted for either.
- Although they are made of _____ and _____ , ionic compounds are electrically neutral (0).
  - The total charge of the cations must _____ the total charge of the anions.

Predicting Formulas of Ionic Compounds

REMEMBER!

- *Metals _____ their valence electrons when forming a _____ .*
- *Nonmetals _____ electrons when forming an _____.*
- *Enough atoms of each element must be used in the formula so that the compound is electrically _____.*

Example #1 -- Potassium oxide

Draw the lewis dot structure of the atoms.	**O** **K**
In order to have a completely filled valence shell oxygen must *gain / lose* _____ electrons. These electrons must come from _____ because _____ _____.	**O** **K** **K** ➡ **O** **K** **K**
The total positive charge of the cations _____ the total negative charge of the anions. **IT'S NEUTRAL!**	If oxygen gains 2 electrons: O charge = _____ If each potassium loses 1 electron: K charge = _____
Write the chemical formula → → → → → → →	There are 2 potassiums and 1 oxygen. Always write the _____ FIRST!

Example #2 -- Magnesium nitride

Draw the lewis dot structure of the atoms.	**Mg** **N**
In order to have a completely filled valence shell magnesium must *gain* / *lose* _____ electrons. These electrons must go to _____ because _____ _____.	**Mg** **N** **Mg** **N** **Mg** ➡ **Mg** **N** **Mg** **N** **Mg**
The total positive charge of the cations _____ the total negative charge of the anions. **IT'S NEUTRAL!**	If each magnesium loses 2 electrons: Mg charge = _____ If each nitrogen gains 3 electrons: N charge = _____
Write the chemical formula → → → → → → →	There are 3 magnesiums and 2 nitrogen. Always write the _____ FIRST!

When writing **chemical formulas** for an ionic compound…

- the _____ is always listed first (_____ or _____)
- the _____ is listed second (_____ or _____)
- add _____ _____ if you need more than one atom of that ion
- use _____ and _____ _____ if you need more than one polyatomic ion

The overall charge of a chemical formula is _____!! **This means the total charge of the cation(s) must equal the total charge of the anion(s).**

Now you try!
Determine the charge for each ion and write the chemical formula. Be sure the total positive charge of the cations equals the total negative charge of the anions -- the final formula should be NEUTRAL in charge.

Ionic Compound	Cation Symbol	Cation Charge	Anion Symbol	Anion Charge	Total Ion Charge	Chemical Formula
Sodium fluoride	Na^+		F^-		+ _____ - _ =	
Magnesium chloride					+ _____ -	
Strontium chlorite			ClO_4^-		+ _____ -	
Lithium sulfide					+ _____ -	
Aluminum oxide					+ _____ -	
Ammonium chloride	NH_4^+				+ _____ -	
Calcium hydroxide			OH^-		+ _____ -	
Ammonium phosphate	NH_4^+		PO_4^{3-}		+ _____ -	
Lithium sulfate					+ _____ -	
Calcium phosphate			PO_4^{3-}		+ _____ -	

HINT: Anything that ends in "-ate" or "-ite" is a polyatomic ion….except hydroxide (OH-), cyanide (CN-), and ammonium (NH4+) these are also a polyatomics.

PRACTICE: Ionic Compounds -- Writing Formulas

Directions

- ***Fill in the charges for the ions listed inside the gray boxes.***
- *Combine the two ions in the box provided to create a neutral ionic formula.*
- *Be sure to use parentheses and subscript numbers when necessary.*

	A) Cl	B) N	C) OH^-	D) SO_4^{2-}	E) PO_4
1) Zn^{2+}	1A	1B	1C	1D	1E
2) NH_4	2A	2B	2C	2D	2E
3) Ca	3A	3B	3C	3D	3E
4) Fe^{3+}	4A	4B	4C	4D	4E
5) Fe^{2+}	5A	5B	5C	5D	5E
6) Th^{4+}	6A	6B	6C	6D	6E
7) Mn^{6+}	7A	7B	7C	7D	7E
8) V^{5+}	8A	8B	8C	8D	8E

Scratch work:

NOTES: Ionic Compounds -- Nomenclature Name:_____

Chemistry Date:_____Hour_____

So, what are the rules? When naming **ionic compounds…**

The _____ is always named first.

What if it is a **singular, elemental ion** or **polyatomic ion**?

-

- Examples: *Polyatomic Ion:* **$(NH_4)_2$**S *Singular Elemental Ion:* **Ba**F_2

What if it is a **transition metal**?

-

- Examples: **Mn**$(SO_4)_2$ **Fe**Br_3

The _____ is always named second!

What if it is a **singular, elemental ion**?

-

- Examples: Na**I** Au_2**O**

What if it is a **polyatomic ion**?

-

- Examples: *Polyatomic Ion:* Ni**SO_4** *Polyatomic Ion:* Al**$(NO_3)_3$**

PRACTICE: Ionic Compound - Nomenclature

Write the name for the following ionic compounds.

1) Rb_2CO_3 _____

2) CsCl _____

3) $FeSO_4$ _____

4) LiBr _____

5) $BaCl_2$ _____

6) $Sc(SCN)_3$ _____

7) $Zn_3(PO_4)_2$ _____

8) NH_4NO_3 _____

9) $Al(OH)_3$ _____

10) $CuCrO_4$ _____

11) $PbSO_3$ _____

12) $AgClO_3$ _____

13) $Sr(HCO_3)_2$ _____

14) Fe_2O_3 _____

15) MnO_2 _____

16) $NiSO_3$ _____

17) PtI_2 _____

18) $HgCl_2$ _____

19) $Mg(NO_2)_2$ _____

20) $Cr_2(SO_4)_3$ _____

21) $NaC_2H_3O_2$ _____

22) $NiBr_2$ _____

23) $Be(C_2O_4)_2$ _____

24) AuF_3 _____

Write the formula for the following ionic compounds. PAY ATTENTION TO SUFFIXES!

25) ammonium cyanide _____

26) tungsten (VI) nitride _____

27) cadmium (II) hypochlorite _____

28) sodium chromate _____

29) calcium acetate _____

30) potassium nitrate _____

31) magnesium hydroxide _____

32) aluminum sulfite _____

33) copper (I) selenide _____

34) lead (IV) dichromate _____

35) tin (IV) phosphide _____

36) potassium permanganate _____

37) sodium hydrogen carbonate _____

38) zinc (II) nitrate _____

39) vanadium (III) sulfide _____

40) ammonium perchlorate _____

41) copper (I) oxide _____

42) barium bromide _____

PRACTICE: Roman Numeral Nomenclature Name:_____

Chemistry Date:_____Hour_____

Read & Annotate this!
All metals, with the exception of Group 1, Group 2 and aluminum, require the use of roman numerals when writing the names of ionic compounds. This is because these elements exist as variable charges in their ionic form. The purpose of the roman numeral is to communicate the charge of the metal.

We will use roman numerals 1-7 only (I, II, III, IV, V, VI, VII)

1) Circle the elements that would require a roman numeral in their name.

Cu	K	C	Li	V	Zn	Al
Pb	Mg	Ni	Ag	N	Sn	Br
Ba	Co	Sr	Au	Mn	Cl	U

2) Determine the charge of the cation in the following ionic compounds.
   a) Gold (I) oxide — The charge of gold is _____.
   b) Nickel (II) nitrate — The charge of nickel is _____.
   c) Iron (III) sulfate — The charge of iron is _____.
   d) Chromium (VI) fluoride — The charge of chromium is _____.
   e) Manganese (IV) nitride — The charge of manganese is _____.

3) Now, write the formulas for the ionic compounds listed in #2.
   a) Gold (I) oxide — Formula:
   b) Nickel (II) nitrate — Formula:
   c) Iron (III) sulfate — Formula:
   d) Chromium (VI) fluoride — Formula:
   e) Manganese (IV) nitride — Formula:

4) Determine the charge of the cation in the following ionic compounds.
   a) TiO_2 — The charge of Ti is _____.
   b) Cu_2O_3 — The charge of Cu is _____.
   c) NiC_2O_4 — The charge of Ni is _____.
   d) $Fe_3(PO_4)_2$ — The charge of Fe is _____.
   e) W_2SO_3 — The charge of W is _____.

5) Now, write the names for the ionic compounds listed in #4.

a) TiO_2 Name:

b) Cu_2O_3 Name:

c) NiC_2O_4 Name:

d) $Fe_3(PO_4)_2$ Name:

e) W_2SO_3 Name:

6) Muskegium is a metal with the chemical symbol Mu. It exists with variable charges: Mu^{1+}, Mu^{4+} and Mu^{6+}. Write the names and formulas for all three of these ions when they form an ionic compound with the **phosphate ion**.

Muskegium ion	Formula	Name
Mu^{1+}		
Mu^{4+}		
Mu^{6+}		

7) Warriorium is a metal with the chemical symbol Wa. It exists with variable charges. Use the known ionic compounds containing warriorium to determine its possible ionic charges.

Known compounds:

a) WaO b) $Wa_2(Cr_2O_7)_3$ c) $Wa_3(PO_4)_2$

d) $WaBr_2$ e) $Wa(C_2H_3O_2)_4$ f) $Wa(SO_3)_2$

Warriorium's possible charges are: _____

Now, write the names of warriorium's known ionic compounds

a) _____ b) _____ c) _____

d) _____ e) _____ f) _____

8) Which of the following compounds is/are named incorrectly? Select all that apply & correct the incorrect formulas/names.

a) KNO_2 potassium (I) nitrite

b) FeN iron (I) nitride

c) $Ag(OH)_2$ silver hydroxide

d) $Zn(NO_3)_2$ zinc (II) nitrate

e) $BaCl_2$ barium (II) chloride

f) $HgSO_3$ mercury (II) sulfate

NOTES: Acids & Bases -- Intro & Nomenclature Name:_____

Chemistry Date:_____Hour_____

The last type of compound we will learn about are **acids** and **bases**. Technically, these are ionic compounds, but because of their unique properties they play a special role in chemistry. With this comes specific naming rules. We will learn more about their properties in future units, but for now, we just want to learn how to recognize them by their chemical formulas and learn their naming rules.

Acids are easy to recognize because they are compounds that contain _____ as their cation.

We write chemical formulas for acids just like any other type of ionic compound. When hydrogen is a cation, it is always H^+ (+1 charge) so the number of positive charges from the cation will equal the number of negative charges from the anion.

How do we name acids? Well, it depends on the type of acid compound you have! There are two types of acid compounds…

1) **Binary acids** - ONLY _____ ELEMENTS!

   - Made of _____ & another _____ ion.

   Naming Steps:
   - Use the _____ of the anion
   - Add the _____: "_____"
   - Add the _____: "_____"
   - Finish with the name with the word "_____"

   Examples: HBr H_2S H_3P

2) **Oxy-acids -** MORE THAN _____ ELEMENTS!

   - Made of _____(H) and a _____ anion that has _____(O)

   Naming rules: **NOTE: "hydro-" is not used!**

   - Use the polyatomic name & look at the **suffix.**
     - if it ends in "**-ate**" switch to "_____"
     - if it ends in "**-ite**" switch to "_____"
   - Finish with the name with the word "_____"

   Examples: HNO_2 H_2SO_4 H_3PO_4

Bases are easy to recognize because they are compounds that contain _____ as their anion. We already know how to name these -- just use the rules from ionic compounds! Some examples of bases include potassium hydroxide (KOH), sodium hydroxide (NaOH), and calcium hydroxide ($Ca(OH)_2$).

PRACTICE: Acids & Bases Nomenclature Name:_____

Chemistry Date:_____Hour_____

Directions: *Write the formula or name the following acids using the IUPAC rules. Then label the compound as an acid or a base.*

1) $HClO_4$ _____ *acid / base*
2) H_3PO_4 _____ *acid / base*
3) NaOH _____ *acid / base*
4) HCN _____ *acid / base*
5) HCl _____ *acid / base*
6) H_2SO_4 _____ *acid / base*
7) $Ca(OH)_2$ _____ *acid / base*
8) HNO_2 _____ *acid / base*
9) HI _____ *acid / base*
10) $Fe(OH)_2$ _____ *acid / base*
11) $HClO_2$ _____ *acid / base*
12) HC_2O_4 _____ *acid / base*
13) $Al(OH)_3$ _____ *acid / base*
14) $H_2Cr_2O_7$ _____ *acid / base*
15) $HMnO_4$ _____ *acid / base*
16) HSe_2 _____ *acid / base*
17) Acetic acid _____
18) Hydrophosphoric acid _____
19) Chloric acid _____
20) Hydrofluoric acid _____
21) Cobalt (II) hydroxide _____
22) Carbonic acid _____
23) Lithium hydroxide _____
24) Hydrobromic acid _____
25) Sulfurous acid _____
26) Magnesium hydroxide _____
27) Nitric acid _____
28) Nitrous acid _____
29) Chromic acid _____
30) Hypochlorous acid _____
31) Hydrosulfuric acid _____
32) Beryllium hydroxide _____

Mole Concept Review (and something new!)

Name:_____

Chemistry

Date:_____Hour_____

PART 1 -- Molar Mass REVIEW

Molar mass *is the mass (in grams) of one mole of a substance. We are familiar with determining molar mass of an element, but what if we have a compound? Can we still determine molar mass? Of course we can! Molar mass of a compound is calculated by adding the molar mass of each element in the compound. Determine the molar mass of the following compounds.*

1) What is the molar mass of AlF_3? _____

2) What is the molar mass of $Mg(OH)_2$? _____

3) What is the molar mass of gold (III) oxide? _____

PART 2 -- Mole-mass Calculations REVIEW

We can use molar mass as a ***conversion factor*** *(below) when converting between mass and moles. Use dimensional analysis to solve the following problems. Show your work, round your answer using significant figures, and include the proper unit.*

1 mol X = #g X

4) How many grams of $MgCl_2$ are there in a 4.62 mole sample of $MgCl_2$?

439.870 → 440 g $MgCl_2$

5) How many moles of KOH are there in a 5,255 gram sample of this compound?

93.6553 → 93.66 mol KOH

6) How many moles of lithium acetate are found in a 108 gram sample of this compound?

1.636611 → 1.64 mol $LiC_2H_3O_2$

PART 3 -- Mole-particle Calculations REVIEW

We can use Avogadro's number as a ***conversion factor*** *when converting between particles and moles. Remember, "particles" can be atoms, molecules, ions, etc. Since we're dealing with ionic compounds in this unit, the "particle" we're counting is called a* ***formula unit.*** *Use dimensional analysis to solve the following problems. Show your work, round your answer using significant figures and include the proper unit.*

$6.02x10^{23}$ particles = 1 mol X

7) How many formula units of $MgCl_2$ are there in a 4.62 mole sample of $MgCl_2$?

$2.78124x10^{24} \rightarrow 2.78x10^{24}$ formula units $MgCl_2$

8) How many moles of KOH are there in a $5.25x10^{23}$ formula unit sample of this compound?

0.872093 → 0.872 mol KOH

9) How many formula units of lithium acetate are found in a 108 gram sample of this compound ? *(2 steps)*

9.8524x10 ^{23} → 9.85x10 ^{23} formula units $LiC_2H_3O_2$

PART 4 -- Mole-mole Calculations **SOMETHING NEW**

*We can use a **mole ratio** as a **conversion factor** when converting between moles of one substance into moles of another substance. In the future, we will look at mole ratios between two different compounds, but for now, we will look at the mole ratios **within** a compound. The conversion factor (# mol X : # mol Y) will use the subscript numbers in a compound to look at the ratio of atoms. Here are two examples…*

- *The mole ratios for one mole of aluminum oxide (Al_2O_3) are:* **1 mol Al_2O_3 :2 mol Al atoms** *AND* **1 mol Al_2O_3 :3 mol O atoms**. *Notice the subscript numbers create the mole ratio.*
- *The mole ratios for one mole of aluminum sulfate [$Al_2(SO_4)_3$] are:* **1 mol $Al_2(SO_4)_3$: 2 mol Al atoms**, **1 mol $Al_2(SO_4)_3$:3 mol S atoms**, *AND* **1 mol $Al_2(SO_4)_3$:12 mol O atoms**. *Again, the subscript #s create the ratio.*

*How can we calculate using a mole ratio? Let's say we have 25.0 g of lithium nitrate ($LiNO_3$). How could we determine the number of **oxygen atoms** present? Here is the dimensional analysis setup using a mole ratio as a conversion factor:*

$$25.0\ g\ LiNO_3 \left(\frac{1\ mol\ LiNO_3}{68.95\ g\ LiNO_3}\right)\left(\frac{3\ mol\ O}{1\ mol\ LiNO_3}\right)\left(\frac{6.02x10^{23}\ atoms\ O}{1\ mol\ O}\right) = 6.55x10^{23}\ atoms\ O$$

*This was a 3-step problem: **g → mol**, **mol → mol**, then **mol → atoms**. The mole ratio was created by using the subscript numbers in the chemical formula!*

10) What is the mass of chlorine atoms in 14.75 mol of calcium perchlorate, $Ca(ClO_4)_2$? *(2 steps)*

1045.775 → 1046 g Cl

11) How many oxygen atoms are there in 160. g of oxalic acid, $H_2C_2O_4$? *(3 steps)*

4.278987x10^{23} → 4.28x10^{23} atoms O

12) A sample of copper (II) sulfate contains $1.75x10^{21}$ atoms of copper. What is the mass of the copper (II) sulfate sample? *(3 steps)*

0.4640116 → 0.464 g CuSO4

Mole Concept - Additional Mixed Practice Name:_____

Chemistry Date:_____Hour_____

Solve the following questions. Include all work, units, and the appropriate number of significant figures.

Conversion factors: ***1 mol X = MM g X*** ***1 mol X = 6.02x10^{23} particles X*** ***# mol X : # mol Y***

1) Consider a sample of lithium nitride. What is the chemical formula? _____

   a) How many grams of nitride are in 2.2 moles of lithium nitride?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

30.822 → 31 grams of N

   b) If a sample of lithium nitride contains 0.987x10^{23} molecules of lithium nitride, how many grams of lithium are present?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

3.41351 → 3.41 g Li

   c) How many moles of nitride are in a sample of lithium nitride that contains 5.5 moles of lithium?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

1.833333 → 1.8 moles of N

Conversion factors: ***1 mol X = MM g X*** ***1 mol X = 6.02x10^{23} particles X*** ***# mol X : # mol Y***

2) Consider a sample of sulfuric acid. What is the chemical formula? _____

   a) How many grams of oxygen are in 5.40x10^{24} molecules of sulfuric acid?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

574.08637 → 574 g O

   b) In sulfuric acid, how many moles of hydrogen are there if there are 4.4 moles of sulfur present?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

No rounding required: 8.8 mol H

   c) If there are 64 grams of sulfate present in a sample of sulfuric acid, how many ions of sulfate are present?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

4.0104x10^{23} → 4.01x10^{23} ions SO4^{2-}

Conversion factors: ***1 mol X = MM g X*** ***1 mol X = 6.02x10^{23} particles X*** ***# mol X : # mol Y***

3) Consider a sample of copper (III) oxide. What is the chemical formula? _____

   a) If given 4 mol of oxygen in a sample of copper (III) oxide, how many grams of copper are present?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

169.46667 → 200 g Cu

   b) There are 7.801x10^{23} ions of copper in copper (III) oxide. How many grams of copper are there?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

82.351088 → 82.35 g Cu

   c) If 6 grams of copper (III) oxide are present, how many moles of the compound are there?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

0.0342 → 0.03 mol Cu_2O_3

Conversion factors: ***1 mol X = MM g X*** ***1 mol X = 6.02x10^{23} particles X*** ***# mol X : # mol Y***

4) Consider a sample of the base barium hydroxide. What is the chemical formula? _____

   a) How many moles of hydroxide are present in 3.2 x10^{25} molecules of barium hydroxide?
      i) `How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

*10*6.312292 → 110 moles of OH

   b) In a sample of barium hydroxide there are 51 grams of hydrogen. How many grams of barium are present? *Hint: this problem requires 4 STEPS!*

*34*67.24257 → 3,500 g Ba

   c) If given a sample that contains 8.723 x10^{23} ions of hydroxide, how many molecules of barium hydroxide are present?
      i) How many steps does this conversion require? (*circle one*) *1 step* *2 steps* *3 steps*

4.3615x10^{23} → 4.432x10^{23} molecules Ba(OH$_2$

Unit 6 Review Guide

Name _____

Chemistry

Date _____ Hour _____

Directions: *For each question, read the statement and select the best response. Write the letter of your answer on the line preceding the question.*

1) _____Which type of chemical bonding results in ions placed in fixed positions in a three-dimensional lattice?
   a) Ionic b) Covalent c) Metallic d) Coordinate
2) _____ Which of the following compounds contain the Mn^{3+} cation?
   a) MnS b) $MnBr_2$ c) Mn_2O_3 d) MnO
3) _____ Which compound, when combined with fluorine is most likely to form an ionic compound?
   a) Lithium b) Carbon c) Phosphorus d) Chlorine
4) _____ In the compound Fe, the iron has a charge of +2. How is this compound properly named?
   a) Iron (I) oxide b) Iron (II) oxide c) Iron (II) oxide d) Iron oxide
5) _____ In the compound $Mn(Cr_2O_7)_2$, the ionic charge on the manganese cation is ___.
   a) Mn^{1+} b) Mn^{4+} c) Mn^{2+} d) Mn^{3+}
6) _____ Nickel (II) hydroxide has the formula $Ni(OH)_2$. In this formula, there is 1 Ni^{2+} for every 2 hydroxide ions.
   a) True b) False
7) _____ An element gains two electrons to form a complete outer level. As a result, this ion will have a charge of :
   a) 1+ b) 2+ c) 2- d) 1-
8) _____ When dissolved in water, acids produce ___ ions.
   a) Al^{3+} b) OH^{1-} c) H^{1+} d) N^{3-}
9) _____ Suppose that the hypothetical compound X(OH)2 exits. What other compound could exist?
   a) X_2O b) XSO_4 c) $X(ClO_4)_3$ d) XBr
10) _____What is the molar mass of calcium oxide, CaO?
   a) 74.93 g/mol b) 56.08 g/mol c) 28.01 g/mol d) 67.99 g/mol
11) _____ What is the molar mass of zinc (II) phosphate, $Zn_3(PO_4)_2$?
   a) 386.17 g/mol b) 255.33 g/mol c) 320.72 g/mol d) 160.36 g/mol
12) _____ Which of the following compounds is NOT a base?
   a) KOH b) KNO_3 c) LiOH d) $Sr(OH)_2$
13) _____ Which of the following compounds is NOT an acid?
   a) HCl b) H_2SO_4 c) H_3PO_4 d) C_2H_6
14) _____ Which of the following compounds will require Roman numerals in its name?
   a) BaS b) HF c) TiO_2 d) $Ca(NO_3)_2$
15) _____ Which of the following compounds will NOT require Roman numerals in its name?
   a) $ZnSO_4$ b) $Mn(OH)_4$ c) $Ca(NO_3)_2$ d) CuO
16) _____ What is the ionic charge on zinc in the compound $ZnSO_3$?
   a) 1+ b) 2+ c) 3+ d) 2-
17) _____ What is the correct formula for nitrous acid?
   a) HNO_2 b) H_3N c) HNO_3 d) HNO
18) _____ How is the compound HSCN correctly named?
   a) Hydrogen monothiocyanate c) Thiocyanic acid
   b) Hydrogen thiocyanate d) Cyanic acid
19) _____ What is the molar mass of oxalic acid, $H_2C_2O_4$?
   a) 90.04 g/mol b) 77.02 g/mol c) 122.04 g/mol d) 170.08 g/mol

20) _____ Calculate the moles of cadmium (II) nitrate, $Cd(NO_3)_2$, in 5.10 grams of cadmium (II) nitrate.
a) 1210 moles b) 0.0216 moles c) 889 moles d) 0.0292 moles

21) _____ Calculate the grams of perchloric acid, HClO4, in 9.04 moles of perchloric acid.
a) 0.0900 grams b) 908 grams c) 5.44×10^{24} grams d) 1.50×10^{-23} grams

22) _____ How many grams of nitrogen are in 15.2 grams of copper (II) nitride, Cu_3N_2?
a) 0.0695 grams b) 0.139 grams c) 1.95 grams d) 0.974 grams

23) _____ How many formula units of calcium chloride, $CaCl_2$, are in 0.460 grams of calcium chloride?
a) 111 formula units
b) 2.50×1021 formula units.
c) 0.00414 formula units
d) 2.77×1023 formula units

24) _____ What is the mass, in grams, of 1 formula unit of sodium hydrogen carbonate, $NaHCO_3$?
a) 1.40×10^{-22} grams b) 6.02×10^{23} grams c) 84.01 grams d. 5.06×10^{25} grams

25) _____ How many atoms of oxygen are in 32 grams of lithium nitrate, $LiNO_3$?
a) 0.464 atoms b) 8.38×10^{23} atoms c) 8.38×10^{23} atoms d) 6.02×10^{23} atoms

Directions: *Write the correct compound name or formula in the table below. Spelling counts!*

Q#	*Compound Name*	*Chemical Formula*	*Q#*	*Compound Name*	*Chemical Formula*
26		*$HClO_3$*	*27*	*Barium sulfide*	
28		*$Ti(OH)_4$*	*29*	*Silver (I) oxide*	
30		*Na_2S*	*31*	*Hydrochloric acid*	
32		*$Ba(OH)_2$*	*33*	*Sulfuric acid*	
34		*$Ti(HCO_3)_3$*	*35*	*Barium phosphate*	
36		*CoP*	*37*	*Calcium sulfate*	
38		*$Ni(OH)_2$*	*39*	*Ammonium hydroxide*	
40		*KNO_3*	*41*	*Copper (II) dichromate*	
42		*FeN*	*43*	*Sodium hydroxide*	
44		*$Sr_3(PO_4)_2$*	*45*	*Calcium hydroxide*	
46		*$Cr(OH)_6$*	*47*	*Permanganic acid*	
48		*$ZnSO_4$*	*49*	*Manganese (IV) hydroxide*	
50		*$K_2Cr_2O_7$*	*51*	*Sodium hypochlorite*	
52		*H_3PO_{4a}*	*53*	*Cobalt (II) nitrate*	

**Want extra practice? Write down the charge of the CATION for each substance provided in the chart above.*

***Even more practice? Circle the acids and box the bases in the chart above.*