Naming and Writing Formulas for Acids!

• 1\textsuperscript{st} – determine if the compound is an acid
  – a. If you are given a formula, is the first element \textbf{hydrogen}? If yes, it’s an ACID so follow the acid rules
  – b. If given the \textbf{name}, is the \textbf{word} acid in the name?

• Acid Naming Rules

• If the anion name ends in \textbf{–IDE}
  The acid name will be hydro\-------\textbf{ic acid}.

\textbf{Br}^{-1} \textbf{ends in ide}, the acid is HBr = hydro\textbf{bromic acid}
Naming Acids con’t

• The anion sulfate = $\text{SO}_4^{2-}$ ends in ATE
  Ending changes to -IC
  $\text{H}_2\text{SO}_4 = \text{Sulfuric acid}$

  The anion nitrite = $\text{NO}_2^{1-}$ ends in ITE
  Ending changes to -OUS
  $\text{HNO}_2 = \text{Nitrous acid}$
If anion is...

- ide $\rightarrow$ goes to hydro---------ic acid
- ate $\rightarrow$ goes to ---------ic acid
- ite $\rightarrow$ goes to ---------ous acid
Acid Formula Writing Rules

- Identify anion name and formula
- Identify anion charge
- **Balance** anion charge with equal number of hydrogens.
- Hydrogens **precede** the anion formula.
Formula Writing

• Chromic acid

• Work backwards!! Hmmm if it ends in ic – it used to end in ate!

• Anion = chromate  \( \text{CrO}_4^{2-} \)

• If charge is \( 2^- \) How many H’s balance it out?
  What ion does H form?  \( \text{H}^+ \)

\( \text{H}_2\text{CrO}_4 \)
Formula Writing

• Hydroiodic acid
• Work backwards!! Hmmm if it has hydro and ends in ic – it used to end in ide!
• Anion = iodide $I^{1-}$

• If charge is $1-$ How many H’s balance it out?
  HI
More formula writing...

• Phosphorous acid
• Work backwards!! Hmmm if it ends in ous – it used to end in ite!
• Anion = phosphite $\text{PO}_3^{3-}$

• If charge is $3^{-}$ How many H’s balance it out?
  $\text{H}_3\text{PO}_3$
Now your turn...

• Name these!
• $\text{H}_2\text{CO}_3$
• $\text{HNO}_3$
• HF
• $\text{HBrO}_2$
• Write formulas for:
• Hydrochloric acid
• Perchloric acid
• Sulfurous acid
Warm Up!

- When naming acids if the anion ends in -ide the acid name contains ________________
- ate the acid name ends in ________________
- ite the acid name ends in ________________

What determines the number of H\(^+\) atoms are needed for an acid?

How many H’s are needed in phosphoric acid?
Today’s Agenda

• (Last naming day!) How do we name and write formulas for molecular compounds?

• Review acid naming

• Name and write formulas for molecular compounds

• Practice!
Acid Practice

1. HCl
2. HNO₂
3. H₃PO₄
4. HCN
5. HIO₄
6. H₃PO₃

1. sulfurous acid
2. hydrosulfuric acid
3. chlorous acid
4. bromic acid
5. hydroselenic acid
6. chromic acid
Molecular Compounds!

1. Molecular compounds are made from two (or more) non-metals.

   a. Prefixes are used to denote the number of atoms in each element in the compound

<table>
<thead>
<tr>
<th>mono</th>
<th>penta</th>
<th>nona</th>
</tr>
</thead>
<tbody>
<tr>
<td>di</td>
<td>hexa</td>
<td>deca</td>
</tr>
<tr>
<td>tri</td>
<td>hepta</td>
<td>hendeca</td>
</tr>
<tr>
<td>tetra</td>
<td>octa</td>
<td>dodeca</td>
</tr>
</tbody>
</table>
Naming Rules

b. When there is only one atom of the first element in the compound, the prefix, “mono” should be omitted.

c. Change the ending of the last element to “ide”.

\[
N_2O_7 \quad - \quad 2 \text{ nitrogens and } 7 \text{ oxygens}
\]

prefix for 2 is di
prefix for 7 is hepta

Dinitrogen heptaoxide
Examples for Naming

- CO$_2$ - 1 carbon, 2 oxygens
  since there is only one carbon and it’s the first element, we DO NOT need a prefix.
  the prefix for 2 is di
  Carbon Dioxide

- EXTRA

- P$_4$S$_{10}$ – 4 phosphorous, 10 sulfurs
  the prefix for 4 is tetra
  the prefix for 10 is deca
  Tetraphosphorous decasulfide
Molecular Compound Formula Rules

• Prefixes are used to denote the number of atoms in each element in the compound.

• Example:
• Nitrogen monoxide - one nitrogen (no prefix) and one oxygen (mono = 1) \( \text{NO} \)
• Dinitrogen trioxide – two nitrogens (di = 2) and three oxygens (three=3) \( \text{N}_2\text{O}_3 \)
Try These!

- Name these
  - PF$_3$
  - SO$_3$
  - ICl
- Write formulas for these
  - Dinitrogen monoxide
  - Bromine pentafluoride
  - Boron tribromide
Warm Up!

• Acid Naming
  HCl
  $\text{H}_2\text{SO}_4$
  HNO$_2$
• Molecular Formula Writing
  Nitrogen dioxide
  Trisulfur pentoxide
  Dihydrogen
Today’s Agenda

• What is the difference between an ionic compound, molecular compound, and acid?

• Distinguish different types of compounds.

• Review!!
Mixed Review – 1st ID Ionic, Acid, Molecular

1. HIO$_4$
2. H$_3$PO$_3$
3. PF$_3$
4. SCl$_5$
5. Zn(NO$_3$)$_2$
6. Fe$_2$(SO$_4$)$_3$

A. chlorous acid
B. bromic acid
C. hydroselenic acid
D. dinitrogen monoxide
E. Boron tribromide
F. Nickel(II) nitrate
G. Cobalt (III) oxide
Warm Up!

• What is the charge on Cu in Cu$_2$O?
• What is the charge on Ti in TiPO$_4$?
• What is the charge on Ni in NiCl$_2$?

• How would you find the molecular mass of these compounds?
• What is the molecular mass of NiCl$_2$?
Todays Agenda

• How can we use ratios to experimentally determine chemical formulas?

• Quiz!

• Using ratios to solve word problems.

• Atomic mass and molecular mass and how they relate to actual mass.

• **Homework:** Prelab setup in notebook and prelab practice problems. Background info due Tues. Problems due Wed.
Ratios

• A ratio is just a comparison of two different things.

• Example: if there are 15 females and 20 males in a group (total __35__).

• The ratio would be 15/20 or 15:20.

• If there were 7 black labs and 12 golden labs in a doggy daycare, what’s the ratio of black to goldens? __7/12__ or __7:12__
Ratio Problems

• If there are 50 total candies, 22 chocolate santas and 28 candy canes, what is the ratio of santas to candy canes? $\frac{22}{28}$

• If there were 75 total candies with the same ratio, how many santas would there be?

22 santas out of 50 total – $\frac{22}{50}$

$\frac{22}{50} = \frac{x}{75}$

$\frac{22}{50} = \frac{x}{75}$

$x = 33$ santas
Try these

• The ratio of Kate's stickers to Jenny's stickers is 7:4. Kate has 21 stickers. How many stickers does Jenny have?

• Chef Robert’s secret recipe requires 7 eggs for every 2 cups of flour. How many eggs will he need if he uses 8 cups of flour?
Warm Up!

- Ammonia is a compound consisting of a 1 : 3 ratio of nitrogen and hydrogen atoms.
- (a) If a sample of ammonia contains 1563 nitrogen atoms, how many atoms of hydrogen are present?
- (b) If a sample of ammonia contains 1425 hydrogen atoms, how many nitrogen atoms are present?
Today’s Agenda

• How can we determine the chemical formula by monitoring a reaction and solving ratio’s?

• Discuss math problems relevant to lab.
• Check pre-lab - discuss background information and procedures.
• Start the lab!
Lab Experiment

• Use masses that WE measure to determine the chemical formula.

• Remember that each element has a MASS associated with it! Read this from the periodic table!

• These masses are related to mass that we can measure with balances.
Equation

\[ M_B = AM_B \times \text{number of B atoms} \]

\[ M_A = AM_A \times \text{number of A atoms} \]

Given \( AB_x \) Find \( x! \)

\( M_B = 0.3 \)
\( M_A = 0.25 \)
\( AM_B = 40 \)
\( AM_A = 66 \)
The Experiment

• Know $M_A$ and we will find $M_{ABx}$
  – How will we find $M_{Bx}$?

$$M_{ABx} - M_A = M_{Bx}$$

• Use atomic masses to find $x$!

If we make 0.57g of $M_{ABx}$ and we started with 0.25g of $M_A$, ($AM_A = 58.6$, $AM_B = 25.1$), what is $x$? If the charge on B is -1 what is the charge on the A ion?

$AB_3$, $A^{3+}$
Warm Up!

• What are the two types of bonds?

• What are two criteria for forming an ionic compound?

• What type of ions do metals form?

• Give one example of an ionic compound, an acid, and a molecular compound.
Today’s Agenda

• Welcome back!

• Review naming and properties of ionic compounds.

• Properties of metal compounds

• Ionic vs. covalent bonds

• Homework: Ch 7 (section 2 & 4) - 81, 82, 83, 87, 89, 91, 93, 94 and Ch 8 – 78-86 evens
Review!

• Name these
  1) FeCl₃  2) Ag₃AsO₄  3) Ba(OH)₂  4) H₂O  
  5) H₃PO₃

• Write the formulas for these compounds
  6) aluminum iodide  7) ammonium phosphate
  8) nitric acid  9) hydrogen sulfide

• Separate the ions, give their names and charges and name the compound. Change the anion into the acid and name that acid.

10) MgCO₃
Ionic Compounds

• Ionic compounds are made from ions with **opposite** charge.

• Cations are formed from **metals**. Their charge is called their **oxidation** state (or number).

• The oxidation state of Mn in MnCl₂ is **+2**. (What you made in lab!)
Properties of Ionic Compounds

• Melting point, boiling point, and hardness of these crystals depend on how they organize themselves in a solid crystal

• _____ melting and boiling points, hard crystals

• Conduction of electricity depends on how easily these_______can move around. Salt crystals ________allow for ions to move!

  High

  ions
do not
Electrolytes

- When ionic compounds are __________ or if they are __________ in a solution, they can conduct an electric current.

Electrolytes! Our bodies run using electrical signals and salt pumps, so we NEED electrolytes! If you sweat a lot or are sick and do not replenish your “salt” ions, you get sick because you throw off your body’s normal processes!
Metallic Compounds

• Compounds make only of metals, NOT ionic!

• Bonding of metals are similar to ionic compounds because they are based on the attraction of particles.

• 8 – 12 metal atoms closely surround each metal atom in a lattice.
Electron Sea Model

• Electrons are not directly attached to any metal atom but are __delocalized__.  

• Metals are ______ conductors of electricity because their electrons can _____ flow throughout the metallic solid structure.
Properties of Metals

• High boiling points and melting points.
• Durable, malleable, and ductile.

• _____________________ conductivity – delocalized electrons move heat and move as part of an electric current.

Thermal and electrical

• _____________________ – transition metals are harder and stronger than alkali metals because of an increase in electrons.

Hardness and strength
Alloys

• Metal alloys – mixture of elements that have metallic properties.

Steel – increased strength because of the mixture of iron and carbon or Mn, Cr, V, W.

• **Substitutional** alloys – some of the atoms are replaced by other atoms of similar size (sterling silver)

• **Interstitial** alloys – small holes in a metallic crystal are filled with smaller atoms (steel)
Review Questions

• What are the properties of ionic compounds?
• What are the properties of metallic compounds?

• What is the electron sea model?

• Explain the difference between substitutional and interstitial alloys.