Chem 106: Class/ Lab

Week 9

Sign in: Roster @ front of lab

Work with your fermentation partner(s) for today's experiment

Chemical Reactions / Stoichiometry

Take out your i-clicker

Question

Which of the following bonds is the most polar?

A) H—F B) H—Cl

C) H—Br D) $H—CH_3$

Answer

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A) H—F B) H—Cl

C) H—Br D) $H—CH_3$

What molecular shape is water?

a. Tetrahedral
b. Bent
c. Trigonal planar
d. Linear

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Which of these molecules has a linear molecule geometry?

a. CO_2
b. O_3
c. Both
d. Neither

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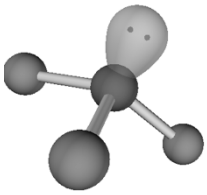
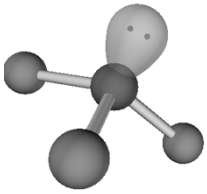
Which molecule could be represented with this diagram?



a. BH_3
b. CH_4
c. NH_3
d. NH_4^+

Which molecule could be represented with this diagram?



a. BH_3
b. CH_4
c. NH_3
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Chem 106: Class/ Lab

Week 9

Turn in Today

Moles & Molar Masses Weighing as a Way of Counting
(Course/ Lab Manual pp. 33-37)

Moles & Molar Masses II
Atoms / Compounds / Molecular Formulas
(Course/ Lab Manual pp. 38-39)

Today's experiment

Chemical Reactions / Stoichiometry

Have Course/ Lab Manual pp. 49 signed

(Course/ Lab Manual pp. 33-37)
Due today. One per Molview Team.

Chem 106/ Dr. Runey — Adapted from Workshop Chemistry

Name(s) _____

Moles & Molar Masses I
Weighing as a Way of Counting:
Marbles, Atoms, Molecules, People & Ants

An unknown number of marbles are in a sealed container. Knowing the mass of the empty container, the filled container, and the average mass of the marbles inside, it is possible to determine the total number of marbles in the container. A similar method is commonly and frequently used in everyday chemistry to count atoms and molecules, that is, by weighing them. Atoms and molecules cannot be seen nor counted directly, but by knowing their individual masses, they can be counted by weighing.

In the first Chem 106 experiment (Measurement), the average mass and volume of a marble in a set of five marbles, which were from a large batch of the same manufactured marbles, were determined. Three sets of student data are given below. Complete the table.

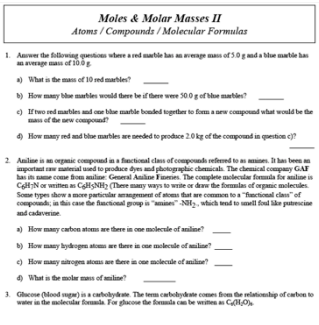
Total Mass of 5 marbles:

	g (grams)	g (grams)	g (grams)
Mass of beaker + marbles	148.36	147.03	148.31
− Mass of beaker	121.51	121.49	121.52
Mass of marbles			
Mass of 1 marble			

Applying the data: You have been assigned either sealed container A or B. Use the result from above mass calculation above and determine how many marbles are in your unknown container without opening it by using the average mass of one marble. The sealed container's tare weight (including tape) of A is 99.78 grams and B is 99.79 grams. Weigh the filled container and complete the Table.

Unknown Container	A or B (circle one)

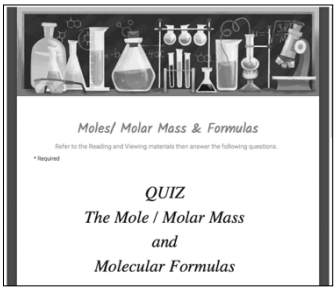
(Course/ Lab Manual pp. 38-39)
Due Today: Turn in one per Team or Individually



Moles & Molar Masses II
Atoms / Compounds / Molecular Formulas

1. Answer the following questions where a red marble has an average mass of 5.0 g and a blue marble has an average mass of 10.0 g.
   a) What is the mass of 10 red marbles? _____
   b) How many blue marbles would there be if there were 50.0 g of blue marbles? _____
   c) If two red marbles and one blue marble bonded together to form a new compound what would be the mass of the new compound? _____
   d) How many red and blue marbles are needed to produce 2.0 kg of the compound in question c)? _____
2. Aniline is an organic compound in a functional class of compounds referred to as amines. It has been an important raw material used to produce dyes and photographic chemicals. The chemical company GAF has its name come from aniline: General Aniline Fineries. The complete molecular formula for aniline is C_6H_7N or written as $C_6H_5NH_2$ (There many ways to write or draw the formulas of organic molecules. Some types show a more particular arrangement of atoms that are common to a "functional class" of compounds; in this case the functional group is "amines" $-NH_2$, which tend to smell foul like putrescine and cadaverine.
   a) How many carbon atoms are there in one molecule of aniline? ____
   b) How many hydrogen atoms are there in one molecule of aniline? ____
   c) How many nitrogen atoms are there in one molecule of aniline? ____
   d) What is the molar mass of aniline? _____
3. Glucose (blood sugar) is a carbohydrate. The term carbohydrate comes from the relationship of carbon to water in the molecular formula. For glucose the formula can be written as $C_6H_{12}O_6$.

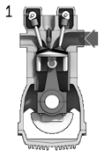
http://chemconnections.org/general/chem106/Mole-Quiz.html



DUE: Today before midnight

Today's experiment

Types of Chemical Reactions



- ✿Combination (Synthesis)
- ✿Decomposition
- ✿Single Displacement
- ✿Double Displacement
- ✿Combustion: Oxidation-Reduction
- ✿Biological Reactions: Enzyme Catalysts

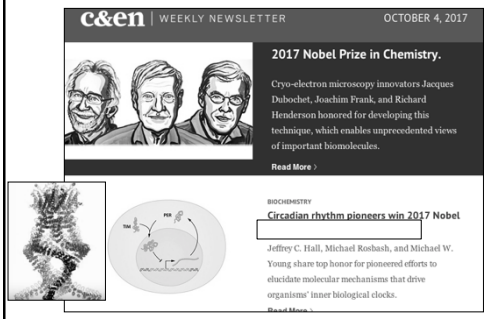
Example: Fermentation

http://www.piney.com/BabNinkasi.html)

General Chemical Reactions

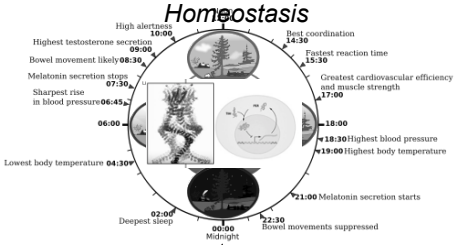
http://chemconnections.org/general/movies/rxn-types.mov

https://www.youtube.com/watch?v=OKRJ73Ro5jw



https://www.youtube.com/watch?v=rL14uLbSLLc

Human Circadian Rhythm Oscillating Reactions & Homeostasis



Begin Here
(1 cycle 24 hour Clock)

Chemical Reactions

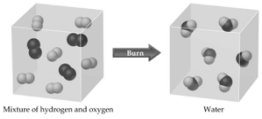
Lab Manual pp. 47-51
Complete all of the procedures/reactions for parts A-D; record your observations in Lab Manual; have stamped before leaving lab today.

Part A: *Synthesis* (*Combination) Reaction*
Part B: *Decomposition Reactions*
Part C: *Single Replacement Reactions*
Part D: *Double Replacement Reactions*

All pages are to be completed and turned in next week.

Chemical Reactions

- Combination (Synthesis)
- A + B ⟶ C
- $H_{2\,(g)} + O_{2\,(g)} \longrightarrow H_2O_{\,(g)}$



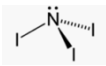
Balancing/ Stoichiometry (Conservation of Atoms):

$2\ H_{2\,(g)} + O_{2\,(g)} \longrightarrow \underline{2}\ H_2O_{\,(g)}$

https://www.youtube.com/watch?v=a6qGIMqDKwA

Chemical Reactions

- Decomposition
- A ⟶ B + C
- $2\ NI_{3\,(s)} \longrightarrow N_{2\,(g)} + 3\ I_{2\,(s)}$



Nitrogen Triiodide

Chemical Reactions

- Single Displacement
- AB + C⟶CB + A
- Example:
  - $HCl_{\,(aq)} + Mg_{\,(s)} \longrightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$
  - Balanced Equation: ?

$2\ HCl_{\,(aq)} + Mg_{\,(s)} \longrightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$

Name $HCl_{(aq)}$? Hydrochloric acid

Single Displacement

Formation of Silver Crystals

$Cu_{(s)} + 2\ AgNO_{3(aq)} \longrightarrow 2\ Ag_{(s)} + Cu(NO_3)_{2\,(aq)}$

Chemical Reactions

- Double Displacement
- AB + CD⟶AD + CB
- Example:
  - A solution of sodium phosphate reacts with a solution of silver nitrate to produce aqueous sodium nitrate and a precipitate of silver phosphate.
  - Balanced equation: ?

$Na_3PO_{4\,(aq)} + 3\ AgNO_{3\,(aq)} \longrightarrow Ag_3PO_{4\,(s)} + 3\ NaNO_{3\,(aq)}$

Double Displacement

Predict the products:

$H_2SO_4(aq) + NaOH(aq) \rightarrow$

$H_2SO_4(aq) + NaOH(aq) \rightarrow H_2O(l) + Na_2SO_4(aq)$

Balance the equation:

$H_2SO_4(aq) + 2\ NaOH(aq) \rightarrow 2\ H_2O(l) + Na_2SO_4(aq)$

Chemical Equations

- *Combustion:*

$$C_8H_{18(l)} + O_{2(g)} \longrightarrow CO_{2(g)} + H_2O_{(l)}$$

✿*Oxygen reacts with octane to produce carbon dioxide and water.*

✿*Reminder: the equation must balance:*

✿ $\mathbf{2}\ C_8H_{18(l)} + \mathbf{25}\ O_{2(g)} \longrightarrow \mathbf{16}\ CO_{2(g)} + \mathbf{18}\ H_2O_{(l)}$

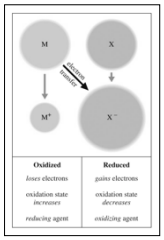
Carbon is oxidized: looses 4 electrons
Oxygen is reduced: gains 2 electrons

Combustion Products
Formulas & Multiple Proportions

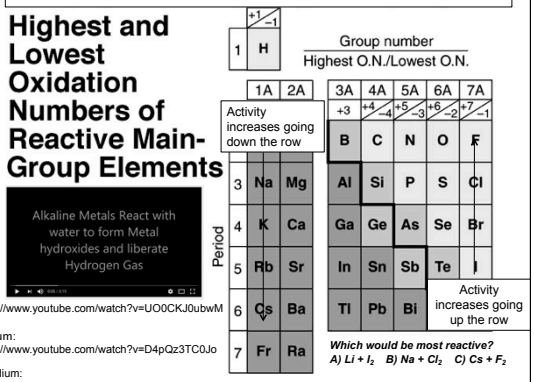
http://chemconnections.org/general/movies/multiple-proportions.MOV

Oxidation-Reduction Reactions "Redox"

- **Oxidation** is the loss of electrons.
- **Reduction** is the gain of electrons.
- The reactions occur together. One does not occur without the other.
- The terms are used relative to the change in the **oxidation state** or **oxidation number** of the reactant(s).



Highest and Lowest Oxidation Numbers of Reactive Main-Group Elements

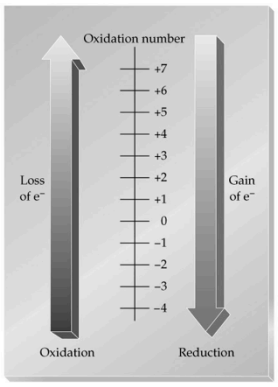


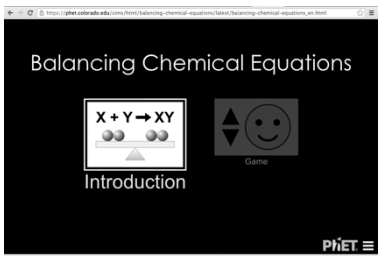
https://www.youtube.com/watch?v=UO0CKJ0ubwM

Cesium:
https://www.youtube.com/watch?v=D4pQz3TC0Jo

Rubidium:
https://www.youtube.com/watch?v=iP6CRZdDu6o

Which would be most reactive?
A) $Li + I_2$ B) $Na + Cl_2$ C) $Cs + F_2$





Adapted from *Workshop Chemistry*

Name(s) _____

Chemical Reactions & Balancing Chemical Equations
Stoichiometry: Conserving Moles, Molecules & Mass

- Reactions, Balancing, Stoichiometry Worksheet (Course/ Lab Manual pp. 65-67) Due next week.
- Either work collaboratively and turn in one per partnership or work individually.
- The Mole / Molar Mass and Molecular Formula On-line Quiz DUE Today 11:59PM.
- Prepare answers to the following questions for next week.

QUESTION

The electrolysis of water is the reverse of the synthesis of water. Which equation best represents the change that takes place when water is electrolyzed?

A) $H_2O(l) \rightarrow H_2O(g)$
B) $H_2O(g) \rightarrow H_2O(l)$
C) $2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$
D) $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(l)$

QUESTION

Ammonium nitrate, when heated, decomposes into nitrogen gas, oxygen gas, and water vapor. It may be explosive. What is the sum of the coefficients in the balanced equation using smallest integer coefficients?

A) 3 **B) 5** **C) 7** **D) 9**

https://www.youtube.com/watch?v=c5orJHRHbX0 (2013)

$\_\_\ NH_4NO_3\ (s) \longrightarrow \_\_\ N_2\ (g) + \_\_\ O_2\ (g) + \_\_\ H_2O\ (g)$

QUESTION

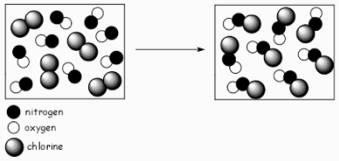
Determine the coefficient for O_2 when the following equation is balanced in standard form (smallest whole number integers)

$C_4H_{10}(g) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$

A) 4
B) 8
C) 10
D) 13
E) 20

QUESTION

Consider the molecular view of reactants converted to a product in the boxes shown below:



Which balanced equation best represents this reaction?

A) $NO + Cl_2 \rightarrow Cl_2NO$
B) $2\ NO + Cl_2 \rightarrow 2\ ClNO$
C) $N_2 + O_2 + Cl_2 \rightarrow 2\ ClNO$
D) $NO + Cl \rightarrow ClNO$