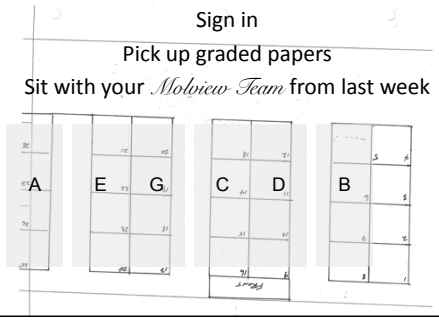
Chem 106: Lab

Week 8

Sign in

Pick up graded papers

Sit with your *Molview Team* from last week



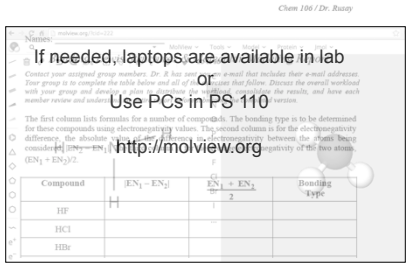
Chem 106: Class/ Lab

Week 8

Three activities must be accomplished today:

1. *Turn in:* Course/ Lab Manual pp. 53-58; one set with everyone's name who contributed on the pages
2. Start Fermentation Today: **in pairs**; Course/ Lab Manual pp. 41-42; pg. 46) Record sucrose amount page 46
3. Complete pages 33 & 34. Have stamped before leaving. (Completed pages 33-37 due Next Week)

(Course/ Lab Manual pp. 53-58)
Turn in one per group with everyone's name who contributed on the first page.



If needed, laptops are available in lab
or
Use PCs in PS 110
http://molview.org

Review & Turn in
Due End of Lab Today

Prepare Answers to the following Questions for Next Week

Which of the following bonds is the most polar?

A) H—F B) H—Cl

C) H—Br D) $H—CH_3$

In which of the compounds below is the δ^+ for H the greatest (highest difference in e.n.)?

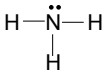
A) CH_4
B) NH_3
C) SiH_4
D) H_2O

What molecular shape is water?

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

What is the **electronic** geometry of NH_3?

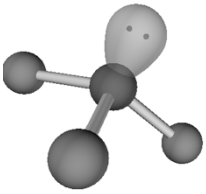
a. Linear
b. Trigonal Planar
c. Tetrahedral
d. Trigonal Pyramidal



Which of these molecules has a linear molecule geometry?

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

Which molecule could be represented with this diagram?



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

What is the **molecular** geometry of H_2S?

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

(Course/ Lab Manual pp. 41-42; 46)
Chemical Reactions: Fermentation
Start Today: in pairs
http://www.piney.com/BabNinkasi.html

A 3900-year-old clay tablet, which was found in Iraq between the Tigris and Euphrates rivers, had a Sumerian poem (*http://www.piney.com/BabNinkasi.html*) honoring Ninkasi, the patron goddess of brewing. It contains the oldest surviving beer recipe, describing the fermentation of the carbohydrates found in bread, *bappir*, made from barley, honey, dates and sweet aromatic herbs. The global availability of carbohydrates and native microbes (yeasts) has led to the production of many different types of beers, ales, wines, and fruit based alcoholic beverages in many countries throughout the world. [*The bottle on the left was found in Eugene, Oregon, ... But, it dates only to 2016.*]

In this experiment you will ferment a carbohydrate, sucrose (table sugar), using bakers yeast. The reaction is:

$$C_{12}H_{22}O_{11} + H_2O \rightarrow 4\,C_2H_5OH + 4\,CO_2$$

sucrose *ethanol*

This process will require about two weeks to get maximum alcohol production.

(Course/ Lab Manual pp. 41-42; 46)
Start Today: in pairs
Record sucrose amount page 46,
Have initialed before leaving lab

Procedure

Preparation of the Reactants

Weigh out about 25 g of sucrose (table sugar) and record the mass to 0.01g. Dissolve it in about 200 mL of deionized water in your 500 mL flask, add a pinch of yeast nutrient and some yeast. The exact amount of yeast is not important; one good sized scoop on the end of your scoopula is about right. Use a fermentation tube provided by the stockroom. Stopper the flask with a one hole stopper. Put about 150 mL of deionized water into your 250 mL flask. Insert the longer piece of plastic tubing through one hole of the two—hole stopper so that when the flask is stoppered the plastic tubing almost touches the bottom of the flask. See Figure 1. Put a label with your names on one flask and store the apparatus as directed to ferment for two weeks.

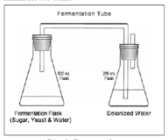


Figure 1—Fermentation Setup

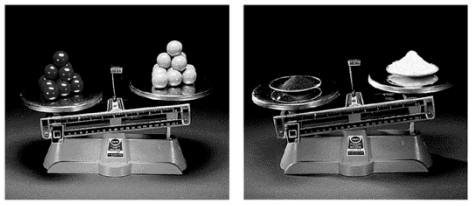
The Mole / Molar Mass
and
Molecular Formulas

Avogadro's Number
&
The Mole
Avogadro's number equals 1 mole
….which equals
6.022×10^{23} "units of anything"

How many molecules are there in one half mole of oxygen?

3.011×10^{23} molecules of oxygen

Counting by Weighing



A B

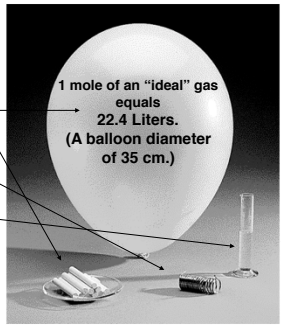
12 red marbles @ 7g each = 84g 55.85g Fe = 6.022×10^{23} atoms Fe
12 yellow marbles @ 4g each=48g 32.07g S = 6.022×10^{23} atoms S

Consult the Periodic Table

Relative Masses of 1 Mole

$CaCO_3$
Name?
100.09 g
Oxygen
32.00 g
Copper
63.55 g
Water
18.02 g

What is the volume of 1 mole of water?



Molar Mass

- A substance's **molar mass** is the mass in grams of one mole of the element or compound. (Equals the formula weight: atomic or molecular weight in grams)

Molar Mass CO_2 = ?

C = 12.01 grams per mole (g/mol)
O = 16.00 grams per mole (g/mol)
CO_2 = 44.01 grams per mole (g/mol)
12.01 + 2(16.00) = 44.01

Calculate the molar mass of potassium phosphate.

What do you need ?

1) Formula of potassium phosphate: K_3PO_4

2) Atomic Weights K = 39.10, P = 30.97, O = 16.00
(molar mass)

3(39.10) + 30.97 + 4(16.00) = **212.27** g/mol

Calculate the mass in grams of 4.00 moles of sulfur.

What do you need ?

Atomic Weight sulfur (S) = 32.07
(molar mass) = 32.07 g/mol

4 mol $_{sulfur}$ x 32.07 g/mol $_{sulfur}$ = **128.3** g

Percent Composition

- Mass percent of an element:

$$\text{mass \%} = \frac{\text{mass of element in compound}}{\text{mass of compound}} \times 100\%$$

- For iron in (Fe_2O_3), iron (III) oxide = ?

$$\text{mass \% Fe} = \frac{111.69}{159.69} \times 100\% = 69.94\%$$

Which iron ore would you buy: one high in Fe_2O_3 or one high in FeO, Iron (II) oxide?

55.84 / 71.84 x 100 = 77.7%

Percent Composition

Calculate the percentage composition for all the elements in an alkaloid with the molecular formula $C_{10}H_{14}N_2$.

What do you need ?

Molar mass $C_{10}H_{14}N_2$

C = 12.01, H = 1.01, N = 14.01

10(12.01) + 14(1.01) + 2(14.01) = 162.26 g/mol

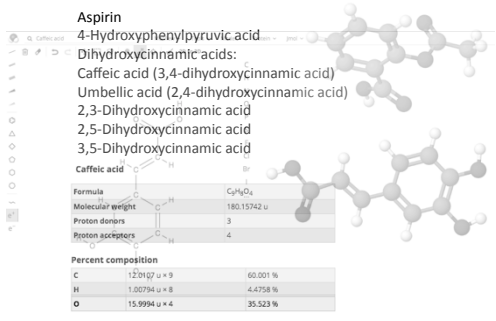
120.1g/mol 14.14 g/mol 28.02 g/mol

120.1/ 162.26 x 100 =	14.14 / 162.26 x 100 =	28.02 / 162.26 x 100 =
74.02%	8.71%	17.27%

Compounds with the Same Formula

[eg. $C_9H_8O_4$]

Aspirin
4-Hydroxyphenylpyruvic acid
Dihydroxycinnamic acids:
Caffeic acid (3,4-dihydroxycinnamic acid)
Umbellic acid (2,4-dihydroxycinnamic acid)
2,3-Dihydroxycinnamic acid
2,5-Dihydroxycinnamic acid
3,5-Dihydroxycinnamic acid



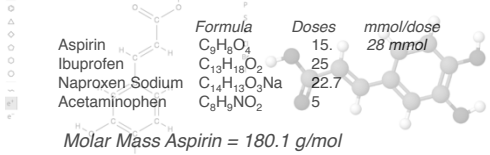
Complete Table on separate page & attach to Molar Masses I

Molar Comparisons of Analgesics

Calculate Moles : Doses (mmol/dose)

Which analgesic has the most biologically active ingredient based on millimoles per dose (*mmol/dose*)?

5.0 g of each would produce the following number of doses:



	Formula	*Doses*	*mmol/dose*
Aspirin	$C_9H_8O_4$	15.	*28 mmol*
Ibuprofen	$C_{13}H_{18}O_2$	25	
Naproxen Sodium	$C_{14}H_{13}O_3Na$	22.7	
Acetaminophen	$C_8H_9NO_2$	5	

Molar Mass Aspirin = 180.1 g/mol

5.0 g / *180.1 g/mol = 0.028 mol = 28 mmol*

(Course/ Lab Manual pp. 33-37)
Your Molview Team is to, complete pages 33 & 34 in lab today. Have stamped before leaving. Completed pages due Next Week: One per Team.

Chem 106/ Dr. Rusay — 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.

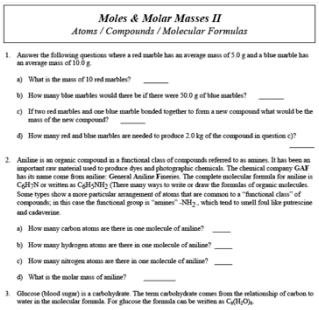
Total Mass of 5 marbles:

	g (grams)	*g (grams)*	*g (grams)*
Mass of beaker + marbles	148.36	147.63	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)

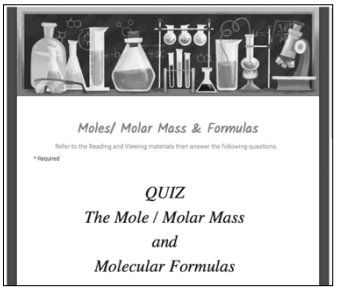
(Course/ Lab Manual pp. 38-39)
Due Next Week: Turn in one per Team or Individually



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 cadeverine.
   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 $C_6(H_2O)_6$.

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



Moles/ Molar Mass & Formulas

Refer to the Reading and Viewing materials then answer the following questions.

* Required

QUIZ
The Mole / Molar Mass
and
Molecular Formulas

DUE: 9-Oct