Chem 108: Lab

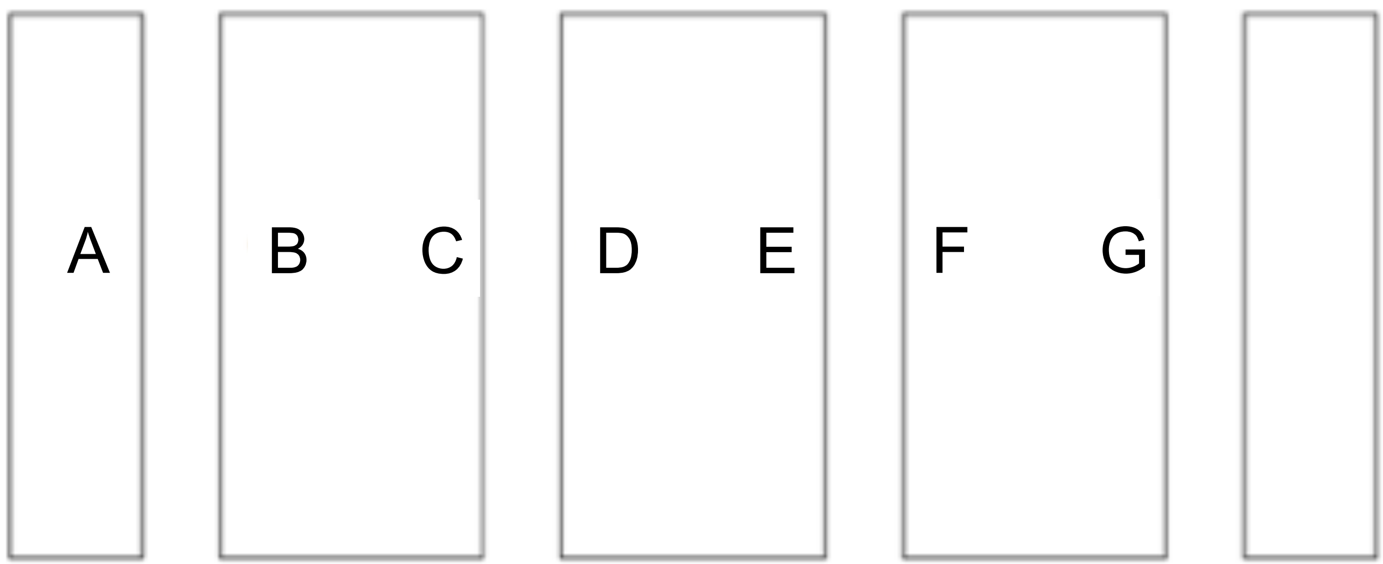
Week 8

Experiments:

What's My Formula?, Nomenclature & Molecular Modeling

Sign in; Sit with Group.

Front of Lab



Work with the groups from last week's lab.

What' s My Formula?

Your work group has 2 to 5 unknowns. Complete the experimental procedures and submit one complete report form the unknown worked on, with partner(s)' name(s) on the data form page & a complete set of clear calculations for each unknown with % Yield & Theoretical Yield Calculations (replacement for pg. 36)

Name: ______________________

Section: ______________________

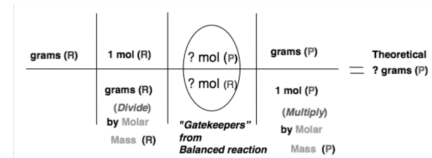
Report Form – What's My Formula

Unknown Number	
Mass, Evaporating Dish + Unknown	
Mass, Evaporating Dish	
Mass, Unknown	
Mass Evaporating Dish + Salt (Product), after heating	
Mass Evaporating Dish + Salt (Product), after 2[nd] heating	
Mass Salt (Product)	
% Salt (Product) Mass Salt (Product) / Mass Unknown x 100 =	
% Molar Mass Salt (Product) Closest from last week's 4 lab calculations	
Unknown Identification	

Calculations:

% Salt (Product) = Mass Salt (Product), after heating / Mass Unknown Sample x 100

Theoretical Yield:



% Yield = actual grams of Salt (Product) / "Theoretical " grams x 100

Have data signed before leaving.
Complete Report Forms
DUE Next Lab

DUE 25-Mar

Nomenclature
Names, Ions, Formulas

Complete Report Form pp. 109-114
1 form per lab group: With names of only those who contributed on the form.

Name: ____________________

Section: __________

Report Form – Name, Ions, and Formula Activity

Name	Separated Ions	Formula
Sodium chloride	1 Na^{+} + 1 Cl^{-}	$NaCl$
Calcium chloride	1 Ca^{2+} + 2 Cl^{-}	$CaCl_2$
Lithium carbonate		
Barium hydroxide		
	__ K^{+} + __ SO_4^{2-}	
	__ NH_4^{+} + CO_3^{2-}	
		$FeBr_2$
		$Fe_2(SO_4)_3$
Copper(II) nitrate		
Tin(IV) fluoride		
	__ Al^{3+} + __ SO_3^{2-}	
		$Ca(NO_2)_2$
		$PbCl_4$
	__ Fe^{2+} + __ PO_4^{3-}	
		$HgBr_2$
Calcium acetate		
Cobalt(III) sulfate		

Bonds: Molecular Shapes: Molecular Modeling

Chem 108 / Dr. Rusay

Names: ________________________

Molecular Modeling Report Form

These pages replace the Molecular Model Lab, pp. 97-103, of the Chemistry 108 Experiments Lab Manual. Complete the following modeling related exercises and include the names of all group members, who contributed to the work, on the form.

The first column lists formulas for a number of compounds. The bonding type is to be determined for these compounds using differences in their respective electronegativity values (refer to the in class information). The second column is for the electronegativity difference, the absolute value of the difference in electronegativity between the 2 different atoms in the compound, $|EN_2 - EN_1|$. The third column is for the average electronegativity of the two atoms, $(EN_1 + EN_2)/2$.

Compound	$\|EN_1 - EN_2\|$	$\frac{EN_1 + EN_2}{2}$	Bonding Type
HF			
HCl			
HBr			
HI			
CsF			
NaF			
CaO			
BaO			
NH_3			
CH_4			
CCl_4			
H_2O			
N_2O			
SO_2			
H_2			
O_2			

http://molview.org

Have completed first & second pages checked before leaving lab.

Everyone is to complete their own form.

What's My Formula? Identificaton

Unknowns

$BaCl_2 \cdot 2H_2O$

$$BaCl_2 \cdot 2\,H_2O(s) \longrightarrow BaCl_2\,(s) + 2\,H_2O(g)$$

Unknown Sample — Salt

85.26%

$CaSO_4 \cdot 2H_2O$

$$CaSO_4 \cdot 2\,H_2O(s) \longrightarrow CaSO_4\,(s) + 2\,H_2O(g)$$

Unknown Sample — Salt

79.09%

$NaHCO_3$

$$2\,NaHCO_3(s) \longrightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

63.08%

Unknown Sample — Salt

$KHCO_3$

$$2\,KHCO_3(s) \longrightarrow K_2CO_3(s) + H_2O(g) + CO_2(g)$$

69.02%

Unknown Sample — Salt

Experimental Calculation:

% Salt = (*Mass sample - Mass after heating*) / *Mass sample x 100*

Comparison to Calculation(s) for a, b, c, d FROM last week:

% Salt =?*Molar Mass Salt* /?*Molar Mass Unknown Sample x 100*

Theoretical Mass Calculations for any Reaction

Reactants ⟷ Products

grams (Reactant) → **grams (Product)**

Moles

Molar Mass

grams (R)	**1 mol (R)**	? mol (P)	**grams (P)**	= **? grams (P)**
	grams (R)	? mol (R)	**1 mol (P)**	
	(Divide) **by Molar Mass (R)**	***"Gatekeepers" from Balanced reaction***	***(Multiply)*** **by Molar Mass (P)**	

What's My Formula?
% Yield (Example)

Heating 10.00 g of an unknown determined to be sodium bicarbonate and actually obtaining 5.98 g of sodium carbonate. What is the Percent Yield?

First calculate the **theoretical yield**. *(Adaptation of your calculations last week.)*
It considers in the calculation that everything went perfectly, and is based on the assumption of 100% accuracy. *% Yield is actual; based on reality.*

$$2\ NaHCO_3(s) \longrightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

Reactant = 10.00 g
Molar Mass = 84.00 g/mol

Product = ? g (Theoretical)
Molar Mass = 105.99 g/mol

$$2\ mol\ NaHCO_3(s) : 1\ mol\ Na_2CO_3(s)$$

Theoretical Mass Calculations
Reactants ⟷ Products

grams (Reactant) $\xrightarrow[\text{Molar Mass}]{\text{Moles}}$ grams (Product)

"Mole Gatekeepers" from Balanced reaction

10.00 grams ($NaHCO_3$)	1 mol ($NaHCO_3$)	? mol (Na_2CO_3)	105.99 grams (Na_2CO_3)	= ? Theoretical grams (Na_2CO_3)
	84.00 grams ($NaHCO_3$)	? mol ($NaHCO_3$)	1 mol (Na_2CO_3)	

(*Divide*) by Molar Mass ($NaHCO_3$)

(*Multiply*) by Molar Mass (Na_2CO_3)

$$2\ NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

Theoretical Mass Calculations
Reactants ⟷ Products

$$2\ NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

"Mole Gatekeepers" from Balanced reaction

10.00 grams ($NaHCO_3$)	**1 mol ($NaHCO_3$)**	1 mol (Na_2CO_3)	**105.99 grams (Na_2CO_3)**	=	**6.31 grams (Na_2CO_3)**
	84.00 grams ($NaHCO_3$)	2 mol ($NaHCO_3$)	**1 mol (Na_2CO_3)**		

(*Divide*) by Molar Mass ($NaHCO_3$)

(*Multiply*) by Molar Mass (Na_2CO_3)

What's My Formula?

"% Yield" is used to measure the efficiency (similar to "accuracy") of any reaction in yielding "product(s)" (on the right of an equation) versus the calculated (theoretical) amount of the product based on the amount of "reactant(s)" (from the left of the equation) using the relative number of moles of each in a balanced chemical equation.

% Yield =
actual grams of product / theoretical (calculated) grams of product
x 100

For example, heating 10.00 g of sodium bicarbonate and actually obtaining 5.98 g of sodium carbonate. After calculating the theoretical yield:

$$2\ NaHCO_3(s) \longrightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

$$2\ mol\ NaHCO_3(s) : 1\ mol\ Na_2CO_3(s)$$

Reactant = 10.00 g
Molar Mass = 84.00 g/mol

Product = 6.31 g (Theoretical)
Molar Mass = 105.99 g/mol

% Yield = 5.98 g (actual) / 6.31g (theoretical) x 100
= ***94.6%***

QUESTION

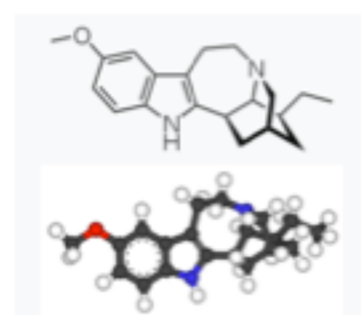
- A synthetic reaction produced 2.45g of Ibogaine, $C_{20}H_{26}N_2O$, a natural product with strong promise in treating heroin addiction, the calculated theoretical yield was 3.05g, what is the % yield?

A) 19.7% B) 39.4% C) 80.3% D) 160.6%

$C_{20}H_{26}N_2O$

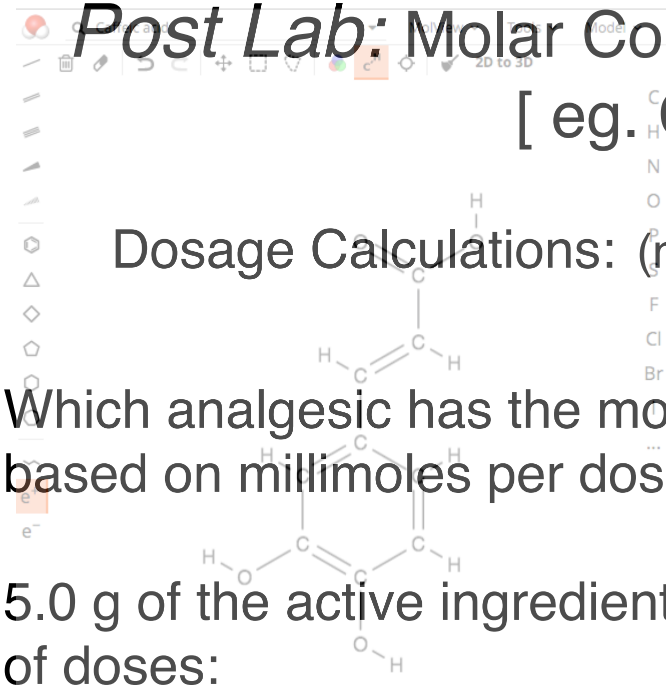
(Ibogaine)

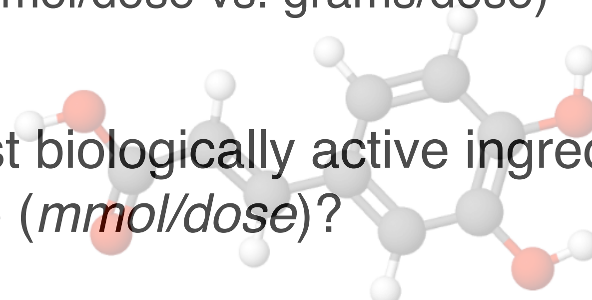
Tabernanthe iboga



Post Lab: Molar Comparisons of Analgesics

[eg. $C_9H_8O_4$]





Dosage Calculations: (mmol/dose vs. grams/dose)

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

5.0 g of the active ingredient would produce the following number of doses:

	Formula	*Doses*	*mmol/dose*
Aspirin	$C_9H_8O_4$	15.0	*1.8 mmol/dose*
Ibuprofen	$C_{13}H_{18}O_2$	25.0	?
Naproxen Sodium	$C_{14}H_{13}O_3Na$	22.7	?
Acetaminophen	$C_8H_9NO_2$	5.0	?

Molar Mass Aspirin = 180.1 g/mol

5.0 g */ 180.1 g/mol = 0.028 mol/*15 doses *= 1.8 mmol/dose*

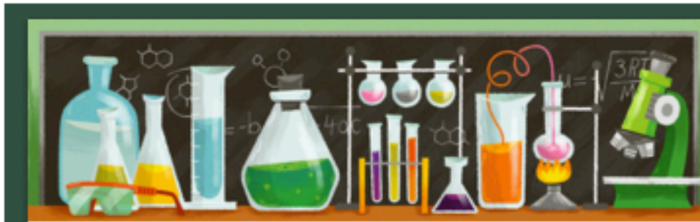
Molar Comparisons of Analgesics

Calculate Moles : Doses (mmol/dose)

Post Lab:

Must submit Individually
From calendar link

DUE
Next Lab



What's My Formula?

Post Lab

* Required

Name: Last, First *

DVC Id *

Post Lab:
Molar Comparisons of Analgesics

Calculating 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	$C_9H_8O_4$	15.0	?
Ibuprofen	$C_{13}H_{18}O_2$	25.0	?
Naproxen Sodium	$C_{14}H_{13}O_3Na$	22.7	?
Acetaminophen	$C_8H_9NO_2$	5.0	?

Molar Mass Aspirin = 180.1 g/mol
5.0 g / *180.1 g/mol = 0.028 mol/* 15 doses *= 1.8 mmol/dose*