Unit 6b
Moles!

Name .....
Period .....

SKILLS

1. COUNT NUMBER OF MOLES IN A MOLECULE
2. CALCULATE GRAM FORMULA MASS
3. CONVERT GRAMS TO MOLES
4. CONVERT MOLES TO GRAMS
5. EMPIRICAL FORMULAS AND MOLECULAR FORMULAS
6. FIND AN EMPIRICAL FORMULA FROM % COMPOSITION
7. CALCULATE % COMPOSITION
8. CALCULATE % COMPOSITION OF A HYDRATE

Vocabulary: **Due: Test**

Word	Definition
Mole	
Gram Formula Mass	
Molecular Formula	
Empirical formula	
Percent Composition	
Hydrate	
Chemical Formula	
Ternary Compound	
Conversion Factor	

Unit 6 Resources:

SCAN ME

Skill 1: Counting Numbers of Atoms in Molecules

Counting moles of atoms in a formula:

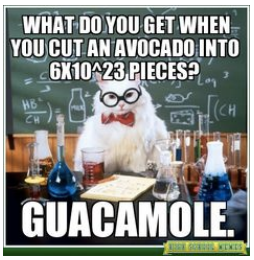
$Sr(NO_3)_2$

Sr=_____ N=_____ O=_____

Compound	Number of atoms of Each element
NaCl	**Na =** _____ **Cl =** _____
$CaCl_2 \cdot 3H_2O$	**Ca =** _____ **Cl =** _____ **H=**_____ **0=**_____
NaOH	**Na =** _____ **O =** _____ **H =** _____
$Ba(NO_3)_2$	**Ba =** _____ **N =** _____ **O =** _____

Skill 2: Calculating GFM of Atoms and Molecules

Molecules are too small a unit to count in chemistry. We use the unit called the mole to count in chemistry. It is just a number to represent a _____.



- One mole is equal to 6.02×10^{23} atoms;
- One Mole of chicken wings means 6.02×10^{23} chicken wings

How did you determine the identity of your sample?

_____

_____

- ☐ One mole (_____) of an element is _____ to the atomic mass of that element in grams.
- ☐ Look up the atomic mass of the element and place the unit, _____ (g/mole), after the number!
- ☐ Round to the tenths places!

Find the GFM:
- ☐ Chlorine (Cl): _____
- ☐ Copper (Cu) _____

Gram Formula Mass of Compounds is the sum of the GFM of the elements of the atoms in the compound.

H_2O:

$BeCrO_4$:
$NaNO_3$:

Calculate the GFM and determine the name of the compound:

1) $BaBr_2$

2) $ScF_3 \cdot 2H_2O$

3) NaOH

4) NaCl

5) $KHSO_4$

6) $Ca(OH)_2$

Skill 3A: Using Dimensional Analysis:

Example 1:
Chemistry is 40minutes long…. how many seconds long is it?

Steps to Conversion Success!
1) Identify a given number and unit
2) Identify target unit
3) Create a conversion factor
4) Multiply
5) Solve

Target Unit: _____

Conversion Factor:

Example 2: Calendar
The school year is 180 days long…how many months is it?

Example 3: Measurement

How many meters is a 5 Km race? (1000m in one 1Km)

Skill 3: Gram to Mole Conversion:

- ☐ **Step 1:** Calculate the GFM of the compound given.
- ☐ **Step 2:** Set up your conversion factor or use periodic table formula!

Remember:
$Given * Conversion\ Factor$

$$\#\ of\ moles = \frac{given\ mass}{gfm}$$

How many moles of CO_2 are in 44.0 g?

1) How many moles are in 39 grams of LiF?

Step 1: GFM:	Step 2: # moles:

2) How many moles are in 148 grams of Potassium Chloride?

Step 1: GFM:	Step 2: # moles:

USE TABLE T FORMULA!!!

3) How many moles are in 49 grams of H_2SO_4?

Step 1: GFM:	Step 2: # moles:

4) How many moles are in168 grams of KOH?

Step 1: GFM	Step 2: # moles:

Skill 4: Mole to Gram Conversion!

- ☐ **Step 1:** Calculate the GFM of the compound given.
- ☐ **Step 2**: Set up your conversion factor!

Remember: The units should cancel out, leaving only grams!!

How many grams of KOH are in 4.5 moles?

1) How many grams are present in .5 moles of $CuSO_4$?

Step 1: GFM:	Step 2: # grams:

2) How many grams are present in .75 mol SO_2?

Step 1: GFM: 64.1 g/mol	Step 2: # grams:

USE TABLE T FORMULA!!!

3) How many grams are present in 3.15 mol of K_3PO_4?

Step 1: GFM: 212.3 g/mol	Step 2: # grams:

Skill 5: Molecular and Empirical Formulas

- **Empirical Formulas are formulas, which show the _____ _____ _____ of elements in a compound.**

- **Ionic compounds are ALWAYS empirical formulas in lowest terms:**
  Ex: MgO

- Covalent compounds (molecules formed between TWO _____-_____) are NOT always in lowest terms.
  Ex. H_2O_2

- **Molecular formulas show the _____ number of each nonmetal present.**

Molecular: H_2O_2 → → → Empirical: HO
Divide by GCF

Molecular Formula	Empirical Formula	Molecular Formula	Empirical Formula
H_20		H_4O_4	
$C_6H_{12}O_6$		C_3H_9	
N_2O_4		P_4O_{10}	
SiH_4		C_5H_{12}	
B_4H_{10}		$Fe(CO)_3$ (Careful!)	

Below is a list of formulas. Write the empirical formula (if not already empirical) and identify the type of substance & type of bonds inside the substance.

	Formula	Empirical formula (simplest ratio)	Type of Substance (ionic or covalent)	Type of Bonds (ionic and/or covalent)	Electrons are… (shared and/or transferred)
a.	C_4H_{10}				
b.	C_3H_6				
c.	N_2O_4				
d.	Na_2SO_4				
e.	C_6H_{10}				
f.	Al_2O_3				
g.	NH_4NO_3				
h.	$C_{11}H_{22}O_{11}$				
i.	$K_2S_2O_3$				
j.	S_2O_4				

Skill 6: Calculating Molecular Formula from the Empirical Formula

How to Calculating the Molecular formula:

- ☐ Calculate GFM of the empirical formula
- ☐ Divide the Molecular Mass (GFM) by the empirical mass to get the **multiplier**.
- ☐ Multiply the subscripts of the empirical formula by the **multiplier**; these numbers become the subscripts of your new compound.

a. The empirical formula of a compound is NO_2 and its molecular mass is 92g. What is the molecular formula of this compound?

GFM of Empirical Formula	Multiplier	Molecular Formula

b. The empirical formula of a compound is CH_2 and it's molecular mass is 70 g. What is the molecular formula of this compound?

GFM of Empirical Formula	Multiplier	Molecular Formula

c. A compound has an empirical formula of P_2O_3 and a molar mass of 220.0 g/mol. Determine its molecular formula.

GFM of Empirical Formula	Multiplier	Molecular Formula

d. A compound has an empirical formula of HO and a molecular mass (GFM) of 34 g/mole. What is the molecular formula?

GFM of Empirical Formula	Multiplier	Molecular Formula

e. A Compound has an empirical formula of $C_{10}H_7O_2$ and a molecular mass (GFM) of 328g/mole. What is the molecular formula?

GFM of Empirical Formula	Multiplier	Molecular Formula

Skill 7: Calculate Percent Composition

Formula for Percent Composition on the Reference Table:

HF	**$BaCl_2$**	**$Mg(CN)_2$**
GFM:	GFM:	GFM:
% H = % F =	% Ba = % Cl =	% Mg = % C = % N =

Determine the percent by mass of the given element in the following compounds.

a. % O in $Fe_2(SO_4)_3$ (GFM = 400.g)

b. % H in H_2O (GFM = 18 g)

c. % O in $CuSO_4$ (GFM = 159.6 g)

d. % P in $(NH_4)_3PO_4$ (GFM = 149 g)

Skill 8: Calculate % Error For Hydrates

- ☐ Hydrates: _____ compounds that have certain number of moles of _____ trapped in the _____ structure of 1 mole of the hydrate.

  Ex: $CuSO_4 \bullet 2H_2O$

- ☐ Please Remember: The "●" DOES NOT mean to multiply!!

- ☐ **Actually Means:** Two moles of water are trapped for every one mole of $CaSO_4$.

- ☐ **Anhydrous**_____

Calculate the GFM	
1) $CuSO_4 \bullet 5\ H_20$	2) $MgSO_4 \bullet 4\ H_20$

Find the % Composition of a Hydrate:

Please Note: Part: Water**.** Whole: Entire Compound, including water.

a. $Na_2CO_3 \bullet 10H_2O$

b. $MgSO_4 \bullet 7H_2O$

Short Answer:

Base your answer to the following question on A hydrate is a compound with water molecules incorporated into its crystal structure. In an experiment to find the percent by mass of water in a hydrated compound, the following data were recorded:

Mass of the crucible: **24.7g**
Mass of crystals and crucible: **40.2g**
Mass of crystals and crucible after heating: **37.5g**

What is the percent by mass of water in the sample?