

Announcements – Lecture VI – Tuesday, May 26th

- 1. First Lab:** Today, 1:30-4:30, ISB 155
- 2. Second Lab:** Thursday, May 28th, ISB 155 (A-C)
- 3. Exam I:** Friday, May 29th – In Class



Quiz 4

Class #: _____

Last Name: _____

Sr: 87.62 Cu: 63.55 S: 32.07 O: 16.00 N = 6.023x10²³ mol⁻¹

- a) How many moles of Sr are there in a sample that contains 1.10×10^{22} strontium atoms

$$\frac{1.10 \times 10^{22} \text{ atoms Sr}}{6.023 \times 10^{23} \text{ atoms}} \times \frac{1 \text{ mol}}{1} = 0.0183 \text{ mol Sr}$$

- b) How many moles of Cu_2SO_4 are present in 1.39 grams of this compound?

$$\begin{aligned} \text{Cu}_2\text{SO}_4 &: 2(63.55) + 32.07 + 4(16.00) \\ &= 223.17 \text{ g} \cdot \text{mol}^{-1} \end{aligned}$$

$$\frac{1.39 \text{ g Cu}_2\text{SO}_4}{223.17 \text{ g}} \times \frac{1 \text{ mol}}{1} = 6.23 \times 10^{-3} \text{ mol Cu}_2\text{SO}_4$$

3.2 Stoichiometry and Compound Formulas

b) Percent Composition

Express the formula C_4H_{10} (butane) in terms of % weight of each component

$$\begin{aligned}C_4H_{10} &: 4(C) + 10(H) \\ &4(12.01) + 10(1.01) \\ &48.04 + 10.10 = 58.14 \text{ g.mol}^{-1}\end{aligned}$$

1 mol of C_4H_{10} weighs 58.14g
of which 48.04g is C and 10.10g is H.

$$C: \left(\frac{48.04\text{g}}{58.14\text{g}} \right) 100 = 82.63\% \text{ by weight}$$

$$H: \left(\frac{10.10\text{g}}{58.14\text{g}} \right) 100 = 17.37\% \text{ by weight}$$

% Composition by weight

3.2 Stoichiometry and Compound Formulas

c) Empirical Formulas from Percent Composition

Butane is 82.63% C and 17.37% H by weight. Can we determine the formula of Butane from this (can we go back!)

	C	H
a) Assume a 100g sample.	82.63g	17.37g
b) Convert grams to moles.	$\frac{82.63\text{g}}{12.01\text{g}\cdot\text{mol}^{-1}}$	$\frac{17.37\text{g}}{1.01\text{g}\cdot\text{mol}^{-1}}$
	6.88 mol	17.20 mol
c) Divide each by smallest mol value.	$\frac{6.88\text{ mol}}{6.88\text{ mol}}$	$\frac{17.20\text{ mol}}{6.88\text{ mol}}$
	1.00	2.50
d) Convert to whole integer	2	5

C_2H_5 ; What's gone wrong?

3.2 Stoichiometry and Compound Formulas

c) Empirical Formula

C_2H_4 ... C_4H_{10} ... C_6H_{14} ... C_8H_{18} ... $C_{10}H_{22}$ etc
All of these are 82.63% C and 17.37% H by weight.

? What is the simplest difference between each of them

% Composition \rightarrow Formula ... gives the smallest whole number ratio ...
called the EMPIRICAL FORMULA

Need one more piece of information to determine the actual formula.

3.2 Stoichiometry and Compound Formulas

d) Determining Molecular Formulas

C: 12.01 H: 1.01
O: 16.01

3.2d Molecular Formula – Example_1

An insect repellent, is found to be 62.58% C, 9.63% H and 27.79% O. Using Mass Spectrometry its molar mass is determined to be 230.30 g.mol⁻¹. What is the molecular formula of this insect repellent.

	C	H	O
a)	62.58	9.63	27.79
b)	$62.58/12.01$ 5.21 mol	$9.63/1.01$ 9.53 mol	$27.79/16.00$ 1.74 mol
c)	$\frac{5.21}{1.74}$ 2.99	$\frac{9.53}{1.74}$ 5.48	$\frac{1.74}{1.74}$ 1.00
d) x2	5.98 6	10.96 11	2.00 2



$$C_6H_{11}O_2:$$

$$6(12.01) + 11(1.01) + 2(16.00)$$

$$= 115.15 \text{ g.mol}^{-1}$$

$$\frac{230.30}{115.15} = 2$$

Empirical Formula: $C_6H_{11}O_2$

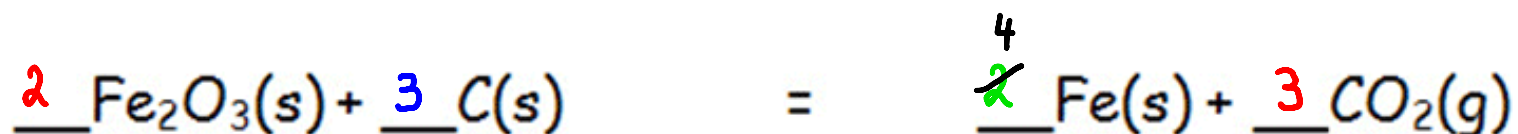
Molecular Formula: $C_{12}H_{22}O_4$

3.3 Stoichiometry and Chemical Reactions

b) Balancing Chemical Equations

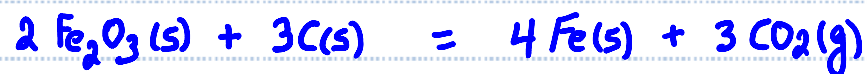
3.3b Balancing – Example_1

Balance the following chemical equation:



Reactants						✓
Fe	2	2	4	4	4	
O	3	3	6	6	6	
C	1	1	1	1	3	

Products						✓
Fe	1	2	2	4	4	
O	2	2	6	6	6	
C	1	1	3	3	3	

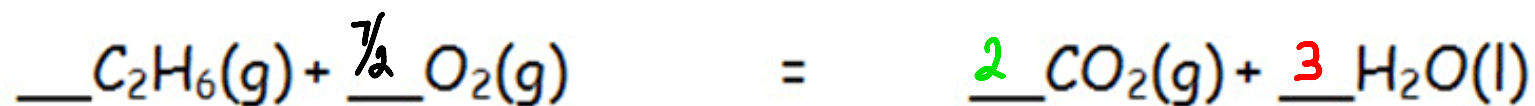


3.3 Stoichiometry and Chemical Reactions

b) Balancing Chemical Equations

3.3b Balancing – Example_2

Balance the following chemical equation:

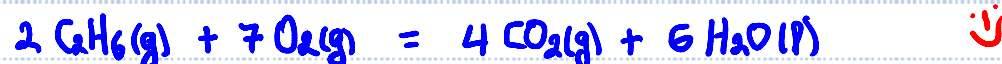


Reactants					✓
C		2	2	2	
H	6	6	6	6	
O	2	2	2	7	

Products					✓
C	1	2	2	2	
H	2	2	6	6	
O	3	5	7	7	



"Convert to the smallest whole integer values"



3.3 Stoichiometry and Chemical Reactions

b) Balancing Chemical Equations

3.3b Balancing – Example_3

Balance the following chemical equation:



What is taking you so long?



3.3 Stoichiometry and Chemical Reactions

b) Balancing Chemical Equations

3.3b Balancing – Example_3

Balance the following chemical equation:



Reactants					
Ag	1	2	2		
NO ₃	1	2	2		
K	2	2	2		
CrO ₄	1	1	1		

Products					
Ag	2	2	2		
NO ₃	1	1	2		
K	1	1	2		
CrO ₄	1	1	1		

