Chemistry 221 Worksheet 4c Notes

**1. Balance: C11H24 + O2 → CO2 + H2O**

**How many moles of water are produced if four moles of C11H24 are consumed?**

C11H24 + 17 O2 **→** 11 CO2 + 12 H2O

4 moles of C11H24  = 48 moles H2O

**2. Balance: Li + O2 → Li2O**

**How many moles of Li2O are produced if eight moles of Li are consumed?**

2 Li + O2 **→** Li2O

Or

4 Li + O2 **→** 2 Li2O

8 moles of Li  = 4 moles Li2O

**3. Determine the mass percent composition of lithium sulfate.**

Li2SO4 = 109.94 g/mol

2 Li = 2 \* 6.941 g/mol = 13.88 g/mol

1 S = 32.06 g/mol

4 O = 64.00 g/mol

% Li = (100 %) = 12.63 %

% S = (100 %) = 29.16 %

% O = (100 %) = 58.21 %

**4. Given the following reaction: C3H8 + 5 O2 → 3 CO2 + 4 H2O**

**How many grams of CO2 (g) are produced from 88.22 g of propane?**

**C3H8 + 5 O2 → 3 CO2 + 4 H2O**

88.22 g \_\_\_\_\_\_\_ g

↓ Step 1 ↑ Step 3

\_\_\_\_\_\_ mol → \_\_\_\_\_\_ mol

Step 2

Step 1:

88.22 g C3H8  = 2.000 mol propane

Step 2:

2.000 mol propane  = 6.000 mol CO2

Step 3:

6.000 mol CO2  = 264.1 g CO2

**5. A student combusts 250.0 grams of octane, C8H18 (l), in an excess amount of oxygen. How many grams of carbon dioxide are produced?**

Unbalanced:

C8H18 (l) + O2 (g) → CO2 (g) + H2O (g) (1)

Balanced:

C8H18 (l) +  O2 (g) → 8 CO2 (g) + 9 H2O (g) (2)

or

2 C8H18 (l) + 25 O2 (g) → 16 CO2 (g) + 18 H2O (g) (3)

I use: C8H18 (l) +  O2 (g) → 8 CO2 (g) + 9 H2O (g)

250.0 g \_\_\_\_\_\_\_ g

↓ Step 1 ↑ Step 3

\_\_\_\_\_\_ mol → \_\_\_\_\_\_ mol

Step 2

Step 1: Calculate the number of moles of octane that react

250.0 g C8H18  = 2.189 mol C8H18

Note: The molar mass of C8H18 is 114.23 g/mol (8 carbons and 18 hydrogens)

Step 2: Calculate the number of moles of CO2 produced

2.189 mol C8H18  = 17.51 mol CO2

Note: Reaction (2) was used. Reaction (3) could have been used to give the same result.

Step 3: Calculate the number of grams of carbon dioxide that are produced

17.51 mol CO2  = 770.6 g CO2

Note: The molar mass of CO2 is 44.01 g/mol (1 carbon and 2 oxygens)

**6. What is the mass percent compositions of the elements in octane?**

C8H18 = 114.23 g/mol

C8 is 8 \* 12.011 g/mol = 96.09 g/mol

H18 is 18 \* 1.0079 g/mol = 18.14 g/mol

% C = (100%) = 84.12 %

% H = (100%) = 15.88 %

**7. 95.6 g of arachidic acid (molar mass = 312.53 g/mol) are burned in oxygen gas to give 269 g CO2 and 110 g H2O. What is arachidic acid's empirical and molecular formulas?**

Carbon: 269 g x (12.011 ÷ 44.0098) = 73.4 g  
Hydrogen: 110 g x (2.016 ÷ 18.0152) = 12.31 g  
Oxygen: 95.6 - (73.4 + 12.31) = 9.88 g

Carbon: 73.4 g ÷ 12.011 g/mol = 6.11 mol  
Hydrogen: 12.31 g ÷ 1.008 g/mol = 12.21 mol  
Oxygen: 9.88 g ÷ 15.999 g/mol = 0.617 mol

C6.11H12.21O0.617

Divide by the smallest:

Carbon: 6.11 ÷ 0.617 = 9.9  
Hydrogen: 12.21 ÷ 0.617 = 19.8  
Oxygen: 0.617 ÷ 0.617 = 1

C9.9H19.8O1

Rounded:

C10H20O1

C10H20O1 (The empirical formula) (Molar Mass = 156 g/mol)

C20H40O2 (The molecular formula) (Molar Mass = 312 g/mol)