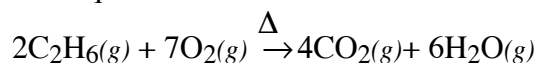




Name: _____

**STOICHIOMETRY
HONORS CHEMISTRY
TEXTBOOK PGS 102-115, 133-139**

1. Given an equation

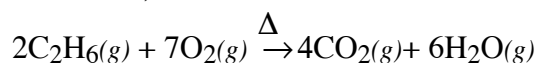


How many mol of CO_2 will be formed by the complete combustion of 6.6 mol C_2H_6 ?
0.0410 mol C_2H_6 ?

$$6.6 \text{ mol C}_2\text{H}_6 \left(\frac{4 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_6} \right) = 13 \text{ mol CO}_2$$

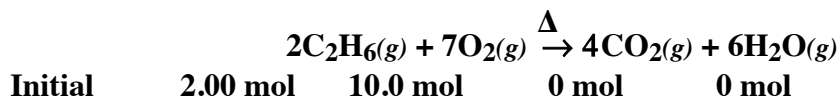
$$.0410 \text{ mol C}_2\text{H}_6 \left(\frac{4 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_6} \right) = 0.0820 \text{ mol CO}_2$$

2. In the reaction,



Determine the moles of CO_2 and H_2O formed when 2.00 moles of ethane are reacted with 10.0 moles of oxygen.

In the reaction the initial set of conditions is 2.00 moles of C_2H_6 and 10.0 moles of O_2 .



Next, the following table is completed

(mol C_2H_6) _o	(mol O_2) _{required}	(mol O_2) _o	Conclusion
2.00		10.0 mol	

To answer the next entry, (mol O_2)_{required}, the number of moles of O_2 which would completely react with 2.00 mol of C_2H_6 are calculated.

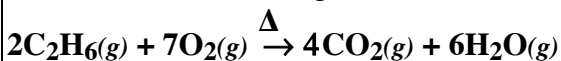
$$2.00 \text{ mol C}_2\text{H}_6 \left(\frac{7 \text{ mol O}_2}{2 \text{ mol C}_2\text{H}_6} \right) = 7.00 \text{ mol O}_2 \text{ required to react with 2.00 mol of C}_2\text{H}_6.$$

The next entry can now be made

(mol C_2H_6) _o	(mol O_2) _{required}	(mol O_2) _o	Conclusion
2.00	7.00	10.0 mol	

But 10.0 mol of O_2 are available.

3. Suppose in another example 15.0 mol of O₂ are combined with 5.00 mol of C₂H₆. Determine the moles of products formed and the moles of excess reactant remaining.



Initial **5.00 mol** **15.0 mol** **0 mol** **0 mol**

(mol C ₂ H ₆) _o	(mol O ₂) _{required}	(mol O ₂) _o	Conclusion
5.00		15.0 mol	

$$5.00 \text{ mol C}_2\text{H}_6 \left(\frac{7 \text{ mol O}_2}{2 \text{ mol C}_2\text{H}_6} \right) = 17.5 \text{ mol O}_2$$

(mol C ₂ H ₆) _o	(mol O ₂) _{required}	(mol O ₂) _o	Conclusion
5.00	17.5 mol	15.0 mol	O ₂ limiting, C ₂ H ₆ excess

In this case 5.00 moles of C₂H₆ require 17.5 mol of O₂ for complete reaction, however, only 15.0 moles of O₂ were available initially. There is not enough O₂ for complete reaction. The amount of O₂ is limiting. The second calculation determines the correct amount of CO₂ and H₂O formed.

$$15.0 \text{ mol O}_2 \left(\frac{4 \text{ mol CO}_2}{7 \text{ mol O}_2} \right) = 8.57 \text{ mol CO}_2$$

$$15.0 \text{ mol O}_2 \left(\frac{6 \text{ mol H}_2\text{O}}{7 \text{ mol O}_2} \right) = 12.9 \text{ mol H}_2\text{O}$$

$$15.0 \text{ mol O}_2 \left(\frac{2 \text{ mol C}_2\text{H}_6}{7 \text{ mol O}_2} \right) = 4.29 \text{ mol C}_2\text{H}_6$$

5.00 mol - 4.29 mol = 0.71 moles of C₂H₆ remain unreacted.

4. Calculate the mass of calcium nitride formed when 50.0 g of calcium react with 50.0 g of nitrogen according to the reaction.

$3\text{Ca}(s) + \text{N}_2(g) \rightarrow \text{Ca}_3\text{N}_2(s)$			
Solution:			
$50 \text{ g Ca} \left(\frac{1 \text{ mol Ca}}{40.1 \text{ g}} \right) = 1.25 \text{ mol Ca}$			
$50 \text{ g N}_2 \left(\frac{1 \text{ mol N}_2}{28.0 \text{ g}} \right) = 1.79 \text{ mol N}_2$			
initial	$3\text{Ca}(s)$ 1.25 mol	+ $\text{N}_2(g)$ 1.79 mol	\rightarrow $\text{Ca}_3\text{N}_2(s)$ 0 mol
$(\text{mol Ca})_o$	$(\text{mol N}_2)_{\text{required}}$	$(\text{mol N}_2)_o$	Conclusion
1.25	0.417 mol	1.79 mol Ca limiting	N ₂ excess,
$1.25 \text{ mol Ca} \left(\frac{1 \text{ mol N}_2}{3 \text{ mol Ca}} \right) = 0.417 \text{ mol N}_2$ $1.25 \text{ mol Ca} \left(\frac{1 \text{ mol Ca}_3\text{N}_2}{3 \text{ mol Ca}} \right) = 0.417 \text{ mol Ca}_3\text{N}_2$ $0.417 \text{ mol Ca}_3\text{N}_2 \left(\frac{148 \text{ g Ca}_3\text{N}_2}{1 \text{ mol Ca}_3\text{N}_2} \right) = 61.7 \text{ g Ca}_3\text{N}_2 \text{ formed}$			

5. How many moles of C₂H₆, assuming excess oxygen, are required to form 3.7 mol H₂O?

$$3.7 \text{ mol H}_2\text{O} \left(\frac{2 \text{ mol C}_2\text{H}_6}{6 \text{ mol H}_2\text{O}} \right) = 1.2 \text{ mol C}_2\text{H}_6$$

6. Define the terms *concentration* and *molarity*.

Concentration is a measure of the relative amount of solute per unit amount of solution.

Molarity is one expression of concentration. It is defined as the quotient of moles of solute and volume of solution.

$$\text{molarity} = \frac{\text{moles solute}}{\text{Liter solution}}$$

7. Calculate the molarity of a solution contain 0.875 mole NaCl in 1 liter? in 500 ml; in 100 ml; in 6 liters?

Solution:

The definition of molarity is $\frac{\text{moles solute}}{\text{Liter solution}}$, to calculate the molarity of these solutions, substitute the appropriate numbers.

$$\frac{0.875 \text{ moles NaCl}}{1 \text{ Liter solution}} = 0.875 \text{ M NaCl}$$

$$\frac{0.875 \text{ moles NaCl}}{0.5 \text{ Liter solution}} = 1.75 \text{ M NaCl}$$

$$\frac{0.875 \text{ moles NaCl}}{0.1 \text{ Liter solution}} = 8.75 \text{ M NaCl}$$

$$\frac{0.875 \text{ moles NaCl}}{6 \text{ Liter solution}} = 0.146 \text{ M NaCl}$$

8. Calculate the volume of 0.500 M $\text{Cu}(\text{NO}_3)_2$ needed to prepare 250 mLs of a 0.0400 M $\text{Cu}(\text{NO}_3)_2$ solution.

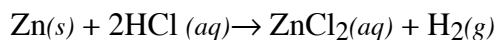
$$M_c V_c = M_d V_d$$

$$V_c = \frac{M_d V_d}{M_c}$$

$$V_c = \frac{0.0400 \text{ M} \cdot 250 \text{ mLs}}{0.500 \text{ M}}$$

$$V_c = 20.0 \text{ mLs of concentrated solution}$$

9. How many mLs of 0.450 M HCl are required to completely react with 2.50 g of Zn?



$$2.50 \text{ g Zn} \left(\frac{1 \text{ mol}}{65.4 \text{ g}} \right) = 0.0382 \text{ mol Zn}$$

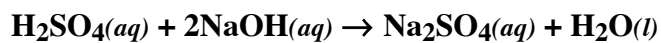
$$0.0382 \text{ mol Zn} \left(\frac{2 \text{ mol HCl}}{1 \text{ mol Zn}} \right) = 0.0764 \text{ mol HCl}$$

A solution of 0.450 M HCl contains $\frac{0.450 \text{ mol HCl}}{1 \text{ L solution}}$, therefore

$$0.0764 \text{ mol HCl} \left(\frac{1 \text{ L solution}}{0.450 \text{ mol HCl}} \right) = 0.170 \text{ L or } 170. \text{ mLs of the HCl solution}$$

10. Calculate the molarity of sulfuric acid in a 20.00 mL sample which is neutralized by 18.50 mLs of 0.750 M NaOH.

The important reaction is



$$0.01850 \text{ L} \left(\frac{0.750 \text{ mol}}{1 \text{ L}} \right) = 0.0139 \text{ mol NaOH}$$

$$0.0139 \text{ mol NaOH} \left(\frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} \right) = 0.00695 \text{ mol H}_2\text{SO}_4$$

$$\frac{0.00695 \text{ mol H}_2\text{SO}_4}{0.020 \text{ L}} = 0.347 \text{ M H}_2\text{SO}_4$$