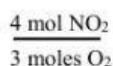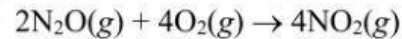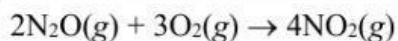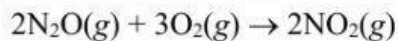CHAPTER 9 REVIEW

Stoichiometry

SECTION 1: Introduction to Stoichiometry

1. _____ The coefficients in a chemical equation represent the
   (a) masses in grams of all reactants and products.
   (b) relative number of moles of reactants and products.
   (c) number of atoms of each element in each compound in a reaction.
   (d) number of valence electrons involved in a reaction.

2. _____ Which of the following would not be studied within the topic of stoichiometry?
   (a) the mole ratio of Al to Cl in the compound aluminum chloride
   (b) the mass of carbon produced when a known mass of sucrose decomposes
   (c) the number of moles of hydrogen that will react with a known quantity of oxygen
   (d) the amount of energy required to break the ionic bonds in CaF_2

3. _____ A balanced chemical equation allows you to determine the
   (a) mole ratio of any two substances in the reaction.
   (b) energy released in the reaction.
   (c) electron configuration of all elements in the reaction.
   (d) reaction mechanism involved in the reaction.

4. _____ The relative number of moles of hydrogen to moles of oxygen that react to form water represents a(n)
   (a) reaction sequence.
   (b) bond energy.
   (c) mole ratio.
   (d) element proportion.

5. Given the reaction represented by the following unbalanced equation:
   $N_2O(g) + O_2(g) \rightarrow NO_2(g)$

   a. Which of Balanced equation is correct?

$2N_2O(g) + 3O_2(g) \rightarrow 2NO_2(g)$	$2N_2O(g) + 3O_2(g) \rightarrow 4NO_2(g)$	$2N_2O(g) + 4O_2(g) \rightarrow 4NO_2(g)$
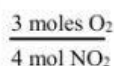
$\dfrac{4 \text{ mol } NO_2}{3 \text{ moles } O_2}$ $\dfrac{3 \text{ moles } O_2}{4 \text{ mol } NO_2}$ b. What is the mole ratio of NO_2 to O_2?

   c. If 20.0 mol of NO_2 form, how many moles of O_2 must have been consumed?

_____   d. Twice as many moles of NO_2 form as moles of N_2O are consumed. True or False?

_____   e. Twice as many grams of NO_2 form as grams of N_2O are consumed. True or False?

6. Given the following equation: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

_____   a. Determine to one decimal place the molar mass of each substance and express each mass in grams per mole.

_____

_____

b. Select the mole ratios for the equation above.

$\dfrac{1 \text{ mol } N_2}{2 \text{ moles } NH_3}$	$\dfrac{1 \text{ mol } N_2}{1 \text{ moles } H_2}$	$\dfrac{2 \text{ mol } NH_3}{1 \text{ moles } N_2}$	$\dfrac{1 \text{ mol } N_2}{3 \text{ moles } H_2}$
$\dfrac{3 \text{ mol } H_2}{1 \text{ moles } N_2}$	$\dfrac{3 \text{ mol } H_2}{2 \text{ moles } NH_3}$	$\dfrac{2 \text{ mol } NH_3}{3 \text{ moles } H_2}$	$\dfrac{2 \text{ mol } H_2}{3 \text{ moles } NH_3}$

7. Given the following equation: $4NH_3(g) + 6NO(g) \rightarrow 5N_2(g) + 6H_2O(g)$

a. What is the mole ratio of NO to H_2O? $\dfrac{6 \text{ mol NO}}{6 \text{ moles } H_2O}$ $\dfrac{6 \text{ moles } H_2O}{6 \text{ mol NO}}$ $\dfrac{6 \text{ moles } H_2O}{5 \text{ mol } N_2}$

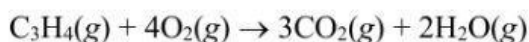b. What is the mole ratio of NO to NH_3? $\dfrac{4 \text{ moles } NH_3}{6 \text{ mol NO}}$ $\dfrac{6 \text{ mol NO}}{4 \text{ moles } NH_3}$ $\dfrac{6 \text{ mol NO}}{5 \text{ mol } N_2}$

c. If 0.240 mol of NH_3 react according to the above equation, how many moles of NO will be consumed?

8. Propyne gas can be used as a fuel. The combustion reaction of propyne can be represented by the following equation:

$$C_3H_4(g) + 4O_2(g) \rightarrow 3CO_2(g) + 2H_2O(g)$$

a. Select all the possible mole ratios in this system.

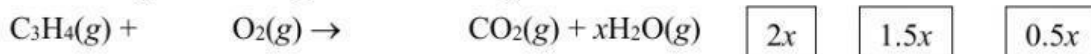| $\dfrac{1 \text{ mol } C_3H_4}{4 \text{ moles } O_2}$	$\dfrac{4 \text{ moles } O_2}{1 \text{ mol } C_3H_4}$	$\dfrac{2 \text{ moles } H_2O}{4 \text{ mol } C_3H_4}$	$\dfrac{1 \text{ mol } C_3H_4}{3 \text{ moles } CO_2}$	$\dfrac{3 \text{ moles } CO_2}{1 \text{ mol } C_3H_4}$
$\dfrac{2 \text{ moles } CO_2}{1 \text{ moles } H_2O}$	$\dfrac{1 \text{ mol } C_3H_4}{2 \text{ moles } H_2O}$	$\dfrac{2 \text{ moles } H_2O}{1 \text{ mol } C_3H_4}$	$\dfrac{4 \text{ moles } O_2}{3 \text{ moles } CO_2}$	$\dfrac{3 \text{ moles } CO_2}{4 \text{ moles } O_2}$
$\dfrac{4 \text{ moles } O_2}{2 \text{ moles } H_2O}$	$\dfrac{2 \text{ moles } H_2O}{4 \text{ moles } O_2}$	$\dfrac{2 \text{ mol } C_3H_4}{2 \text{ moles } H_2O}$	$\dfrac{2 \text{ moles } H_2O}{3 \text{ moles } CO_2}$	$\dfrac{3 \text{ moles } CO_2}{2 \text{ moles } H_2O}$

b. Suppose that x moles of water form in the above reaction. The other three mole quantities (*not* in order) are $2x$, $1.5x$, and $0.5x$. Drag and drop these quantities to their respective components in the equation above.

$C_3H_4(g) + $ _____ $O_2(g) \rightarrow$ _____ $CO_2(g) + xH_2O(g)$ $\boxed{2x}$ $\boxed{1.5x}$ $\boxed{0.5x}$