

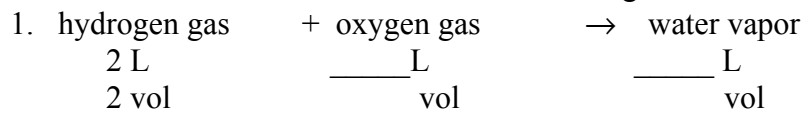
**Part A:** Read in your *Modern Chemistry* text book on pages 65-67 to fill in the requested information.

- 1) **400 B.C. Democritus**-- A Greek philosopher who thought that everything was made up of atoms or "atomos" in Greek. What does "atomos" mean? \_\_\_\_\_
- 2) **Soon after- Aristotle**-- A Greek philosopher who did not believe in atoms. How did Aristotle describe the makeup of matter? \_\_\_\_\_
- 3) **1800's:** Scientists start to do actual experiments
  - a) **Law of Conservation of Mass:** mass is neither created nor destroyed in chemical reactions.  
Total mass of reactants = Total mass of products
    1. What equipment in the 1800's allowed scientists to determine this law? \_\_\_\_\_
    2. Knowing that matter is made up of atoms, what has to happen to atoms in a chemical reaction to keep mass conserved? \_\_\_\_\_
  - b) **Law of Definite Proportions:** The mass ratio of the elements of a compound is always the same.
    1. For the compound, sodium chloride, the mass ratio of the elements is always:  
\_\_\_\_\_ % is Na and \_\_\_\_\_ % is Cl (See book.)
    2. Thus, if you had a 100 g sample of sodium chloride, how many grams of each element would you have? \_\_\_\_\_ g Na and \_\_\_\_\_ g Cl
    3. What if you had a 15 g sample of sodium chloride? \_\_\_\_\_ g Na and \_\_\_\_\_ g Cl
    4. Knowing that matter is made up of atoms, what does this law suggest about every compound?
  - c) **Law of Multiple Proportions:** It is possible to have 2 different compounds that are made up of the same elements, but they have different mass ratios of those elements. More specifically, the mass ratio of the elements of one compound is a multiple of the mass ratio of the other.
    1. There are two compounds containing carbon and oxygen. Fill in the mass ratios for each:  
*Carbon dioxide:* 1 g of C and \_\_\_\_\_ g of oxygen (See book.)  
*Carbon monoxide:* 1 g of C and \_\_\_\_\_ g of oxygen
    2. Thus, if carbon monoxide has a formula of CO, what is the formula of carbon dioxide? \_\_\_\_\_
    3. Water and hydrogen peroxide both contain only hydrogen and oxygen. The mass ratios of each are as follows: *Water:* 1 g H and 8 g of O  
*Hydrogen peroxide:* 1 g H and 16 g O  
Knowing that water has the formula H<sub>2</sub>O, what is the formula for hydrogen peroxide? \_\_\_\_\_
- 4) **1808- John Dalton:** Developed a theory to explain the laws above. Fill in the statements that make up his Atomic Theory.
  - a) All matter is made up of \_\_\_\_\_
  - b) Atoms of a given element are \_\_\_\_\_ in size, mass and other properties. Atoms of different elements are \_\_\_\_\_ in size, mass, and other properties.
  - c) Atoms cannot be \_\_\_\_\_
  - d) Atoms of different elements combine in \_\_\_\_\_.
  - e) In chemical reactions, atoms are \_\_\_\_\_.

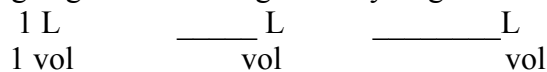
**Part B:** Read in your text book on pages 333-334 and fill in the requested information.

5) **1808- Gay Lussac--** A French balloonist that did lots of experiments with gases.

a) Fill in the data that he collected for the following reactions:



2. hydrogen gas + chlorine gas → hydrogen chloride gas



b) What did Gay-Lussac conclude based on his data about gases?

6) **1811—Amedeo Avogadro--** Italian scientist—his law eventually leads to the concept of the MOLE!!!

a) Using Gay-Lussac's data, Avogadro came up with his law (hypothesis) that stated---

b) Though Avogadro's law seems relatively intuitive today, Avogadro's law was not quickly accepted by the scientific community. This is partly because it conflicted with John Dalton's view that elements had to exist as single atoms. For example, Dalton thought that hydrogen and oxygen gases were made up of single atoms. Thus, he came up with the reaction below for the formation of water. (Notice how his predicted volumes of gases conflict with actual experimental data.)

*How Dalton wrote the reaction for the formation of water:*  $H(g) + O(g) \rightarrow HO(g)$

*Volumes of gases that would be predicted assuming Dalton's formulas:* 1 L      1 L      1 L

*Volumes of gases determined by experiment:* 2 L      1 L      2 L

c) The conflict can be resolved if one allows for the existence of diatomic elements. Fill in the simplest formulas for the substances in these reactions while staying consistent with Avogadro's law and experimental volumes.

1. Hydrogen gas + chlorine gas → hydrogen chloride gas



2. hydrogen gas + oxygen gas → water vapor (hydrogen oxide)



d) Once Avogadro's Law was accepted, this led to the determination of the relative masses of gases. We will explore this concept next. Fill in the notes from the class discussion here: