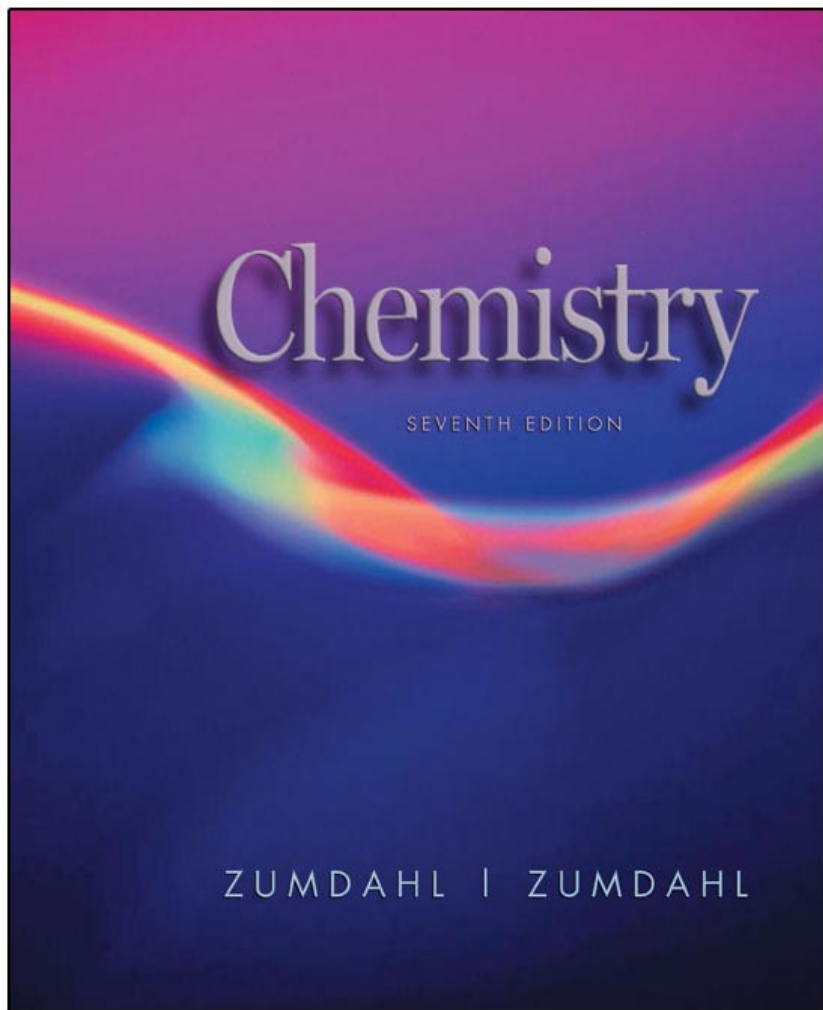




## 2.3 Dalton's Atomic Theory

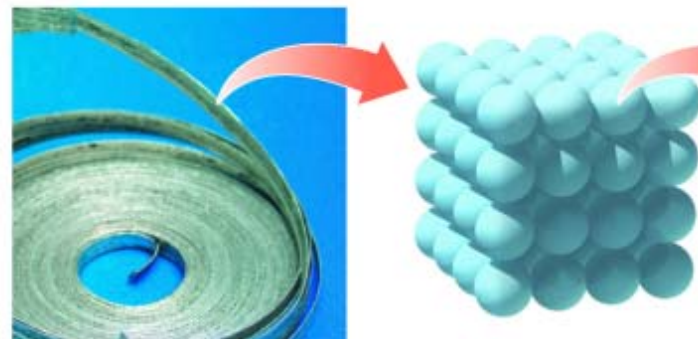
# Dalton's Atomic Theory

In **Dalton's Atomic Theory** (published in 1808), atoms

- are tiny particles of matter.
- of an element are similar and different from other elements.
- of two or more different elements combine to form compounds. A given compound always has the same relative numbers and types of atoms
- are rearranged to form new combinations in a chemical reaction.



John Dalton (1766-1844)



Lithium metal

Lithium atoms

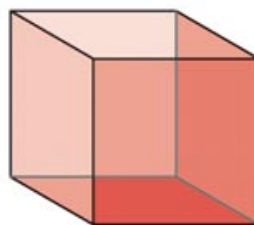
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# Representing Gay-Lussac's observation under the same Temp and Pressure conditions

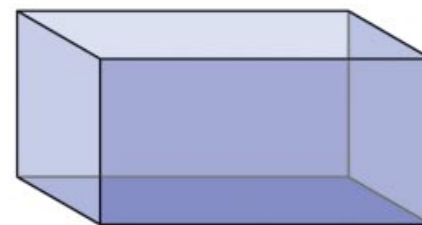


2 volumes hydrogen

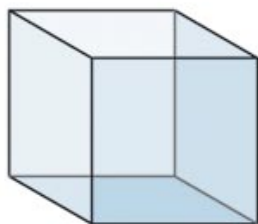
+



combines with 1 volume oxygen

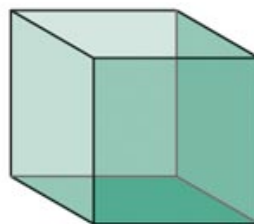


to form 2 volumes gaseous water

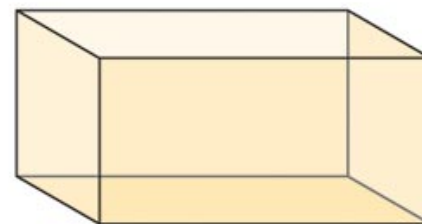


1 volume hydrogen

+



combines with 1 volume chlorine

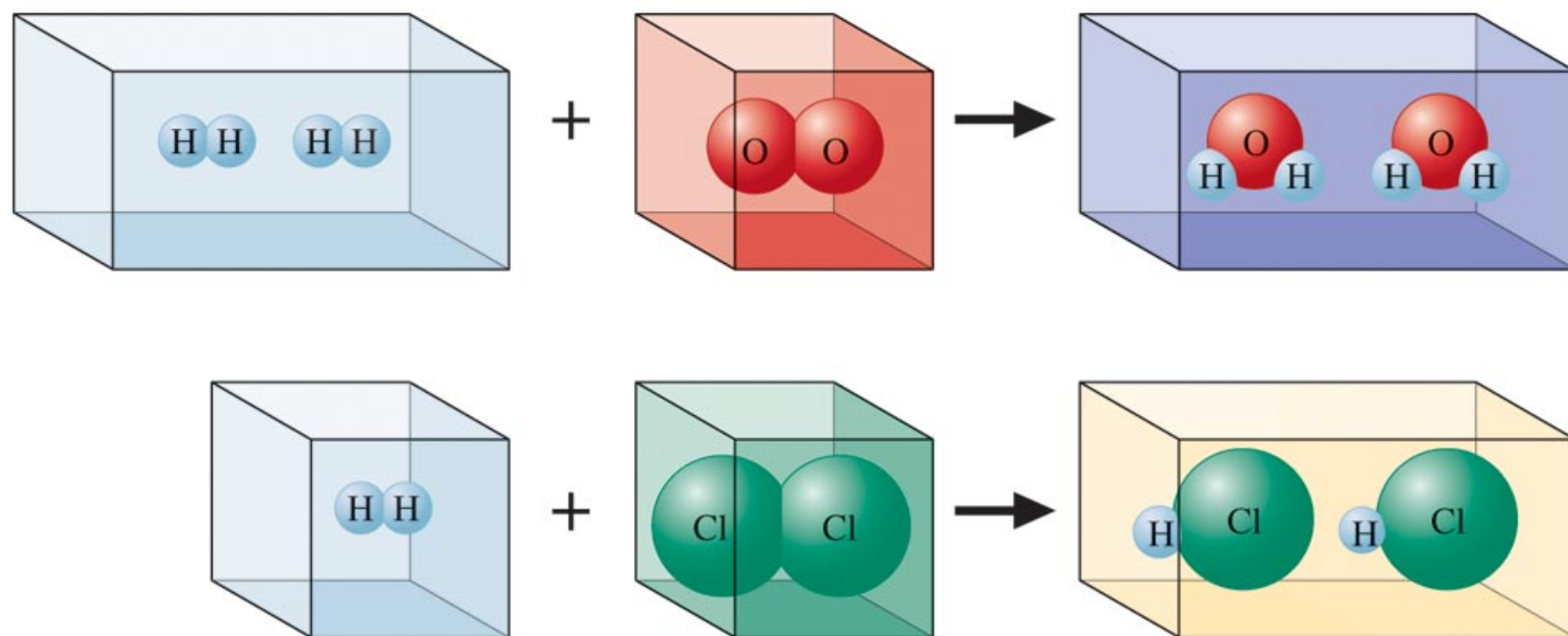


to form 2 volumes hydrogen chloride

# Avogadro's Hypothesis (1811)

- At the same temperature and pressure, equal volumes of different gases contain the same number of particles.
  - 5 liters of oxygen
  - 5 liters of nitrogen
  - Same number of particles!

# Representing Gay-Lussac's Results of combining gases at the molecular level



# QUESTION

One key point in Dalton's atomic theory was "Chemical reactions involve reorganization of the atoms—changes in the way they are bound together." Put that idea with the common phrase "you are what you eat." Now, which of the following best describes the connection between eating pizza and John Dalton's atomic theory?

# QUESTION (continued)

1. Many of the components that make up pizza will soon become part of your body, but you won't look like a pizza because the components will be broken into new fragments and later reassembled differently.
2. Many of the components that make up pizza will soon become part of your cells, but you won't actually look like a pizza because the atoms in pizza change identities when the pizza is digested.
3. The way the atoms in pizza are bound together is not affected by digestion—once inside you, the atoms in compounds remain connected. There are proteins, fats, and carbohydrates in pizza. The atoms in those compounds remain connected that way as they become part of your cells.

# ANSWER

**Choice 1** explains that you are what you eat because the “what” is actually made up of atoms that are not destroyed during digestion. Many of the atoms in compounds that are found in pizza become rearranged with new connections and may become part of your cellular makeup.

# Fundamental Chemical Laws

- Law of conservation of mass
- Law of definite proportion
- Law of multiple proportions

N and O are two elements form a series of compounds, NO and NO<sub>3</sub> (N=14, O=16).

1. Calculate the mass% of N and O in NO, N% and O%

- A. N%=47%, O%=53%
- B. N%=14%, O%=16%
- C. N%=53%, O%=47%

2. Calculate the mass% of N and O in NO<sub>3</sub>, N% and O%

- A. N%=23%, O%=77%
- B. N%=14%, O=48%
- C. N%=47%, O=53%

N and O are two elements form a series of compounds, NO and  $\text{NO}_3$  (N=14, O=16)

1. Calculate the mass of Oxygen that combines with 1 g of Nitrogen to form NO

- A. 2.2g
- B. 1.0g
- C. 1.1g

2. Calculate the mass of Oxygen that combines with 1 g of Nitrogen to form  $\text{NO}_3$

- A. 1.0g
- B. 3.3g
- C. 1.1g

N and O are two elements form a series of compounds, NO and NO<sub>3</sub> (N=14, O=16)

- Show how these data illustrate the law of multiple proportion?