

## Cycle 2 Chemistry I Lesson 1

### Evidence for Atoms: Dalton's Theory

#### Agenda:

#### LAB WEDNESDAY BE PREPARED

#### Vocab:

“Law of Definite Proportions”,

“Law of Multiple Proportions”,

“Law of Conservation of Mass”

**Note:** Dalton's Five Principles

Problems p. 78 1-5, H6



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### Atomic Theory

- The idea of an *atomic theory* is more than 2000 years old.
- Until recently, scientists had never seen evidence of atoms.
- The law of definite proportions, the law of conservation of mass and the law of multiple proportions support the current atomic theory.



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### Atomic Theory, *continued* The Law of Definite Proportions

- The **law of definite proportions** states that a chemical compound always contains the same elements in exactly the same proportions by weight or mass.
- The law of definite proportions also states that every molecule of a substance is made of the same number and types of atoms.



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### Atomic Theory, *continued*

#### The Law of Conservation of Mass

- The **law of conservation of mass** states that mass cannot be created or destroyed in ordinary chemical and physical changes.
- The mass of the reactants is equal to the mass of the products.



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## Law of Conservation of Mass



Hydrogen molecule  
 $3.348 \times 10^{-27}$  kg



Oxygen atom  
 $2.657 \times 10^{-26}$  kg



Water molecule  
 $2.992 \times 10^{-26}$  kg



+



Sulfur atom  
 $5.325 \times 10^{-26}$  kg



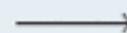
Oxygen molecule  
 $5.314 \times 10^{-26}$  kg



Sulfur dioxide molecule  
 $1.064 \times 10^{-25}$  kg

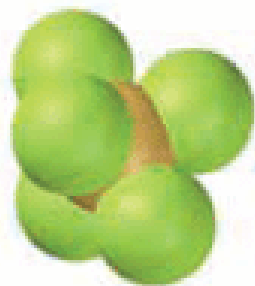


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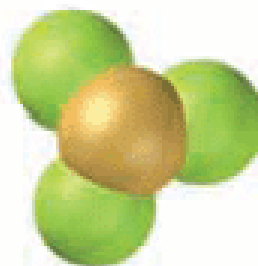




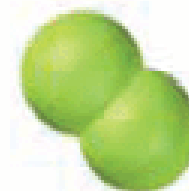
### Law of Conservation of Mass, *continued*



Phosphorus  
pentachloride molecule  
 $3.458 \times 10^{-25}$  kg



Phosphorus  
trichloride molecule  
 $2.280 \times 10^{-25}$  kg



Chlorine molecule  
 $1.177 \times 10^{-25}$  kg







### Atomic Theory, *continued* The Law of Multiple Proportions

- The **law of multiple proportions** states that when two elements combine to form two or more compounds, the mass of one element that combines with a given mass of the other is in the ratio of small whole numbers.





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### Law of Multiple Proportions

Name of compound	Description	As shown in figures	Formula	Mass O (g)	Mass N (g)	$\frac{\text{Mass O (g)}}{\text{Mass N (g)}}$
Nitrogen monoxide	colorless gas that reacts readily with oxygen		NO	16.00	14.01	$\frac{16.00 \text{ g O}}{14.01 \text{ g N}} = \frac{1.14 \text{ g O}}{1 \text{ g N}}$
Nitrogen dioxide	poisonous brown gas in smog		NO <sub>2</sub>	32.00	14.01	$\frac{32.00 \text{ g O}}{14.01 \text{ g N}} = \frac{2.28 \text{ g O}}{1 \text{ g N}}$





### Dalton's Atomic Theory

- In 1808, John Dalton developed an atomic theory.
- Dalton believed that a few kinds of atoms made up all matter.
- According to Dalton, elements are composed of only one kind of atom and compounds are made from two or more kinds of atoms.



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### Dalton's Atomic Theory , *continued* Dalton's Theory Contains Five Principles

1. All matter is composed of extremely small particles called *atoms*, which cannot be subdivided, created, or destroyed.
2. Atoms of a given element are identical in their physical and chemical properties.
3. Atoms of different elements differ in their physical and chemical properties.



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### Dalton's Atomic Theory , *continued*

### Dalton's Theory Contains Five Principles, *continued*

4. Atoms of different elements combine in simple, whole-number ratios to form compounds.
  5. In chemical reactions, atoms are combined, separated, or rearranged but never created, destroyed, or changed.
- Data gathered since Dalton's time shows that the first two principles are not true in all cases.



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