

Section 4.1 Notes

The Development of Atomic Theory

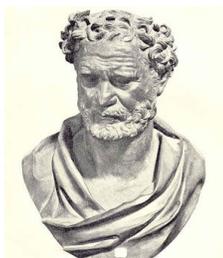
The Greeks



- 4 elements:
 - Fire: Hot & Dry
 - Earth: Dry & Cold
 - Water: Cold & Wet
 - Air: Wet & Hot

Democritus (4 BCE)

- Suggested the universe was made of indivisible units.
- Thought experiment: If you kept cutting something in half, you would get to a point that you could not cut it in half anymore. He called this substance "atomos" (which means "unable to be cut or divided")



The Alchemists



- “Fake Scientists”
- Tried to turn cheap metals into gold
- Discovered elements such as mercury and sulfur

“The First Chemist”
Robert Boyle (1627-1691)



- Science should be firmly grounded in experiments.
- An element is something that cannot be broken down into simpler substances.
- There are probably many elements.

A. Law of Conservation of Mass

- Mass can neither be created nor destroyed

B. Law of Definite Proportion (constant composition)

- ✦ A given compound always contains exactly the same proportion of elements by mass
- ✦ NaCl: 39.3% Na; 60.7% Cl
- ✦ H₂O: 11.1% H; 88.9% O

C. Law of Multiple Proportions

- When 2 elements form a series of compounds, the ratios of the masses of the second element that combine with 1 gram of the first element can always be reduced to whole numbers.
- Example:
 - H₂O * H₂O₂
 - 1 gram H, 8 grams O 1 gram H, 16 grams O

The Atom

John Dalton (1766-1844)



- Dalton's Atomic Theory
 1. Elements are made of tiny particles called atoms.
 2. All atoms of a given element are identical.
 3. The atoms of a given element are different from those of any other element.
 4. Atoms of one element can combine with atoms of other elements to form compounds. A given compound always has the same relative numbers and types of atoms.

The Atom

John Dalton (1766-1844)



- Dalton's Atomic Theory
- 5. Atoms are indivisible in chemical processes. That is, atoms are not created or destroyed in chemical reactions. A chemical reaction simply changes the way atoms are grouped together.

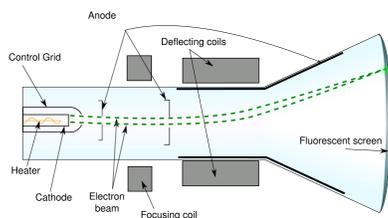
The Atom

J.J. Thomson (1856-1940)



- Discovered electrons using the cathode ray tube experiment
- With Lord Kelvin, he believed that the negative electrons were stuck in a positive sphere (Plum pudding model)

Cathode Ray Tube

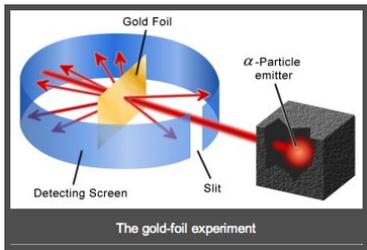


The Atom
Ernest Rutherford (1871-1937)



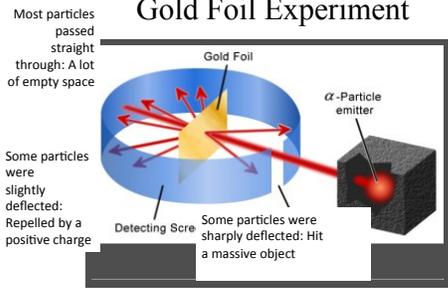
- Discovered the positively charged nucleus using the gold foil experiment. (The atom was mostly empty space, with a dense, positive center.)

The Atom
Gold Foil Experiment



The gold-foil experiment

The Atom
Gold Foil Experiment



Most particles passed straight through: A lot of empty space

Some particles were slightly deflected: Repelled by a positive charge

Some particles were sharply deflected: Hit a massive object
