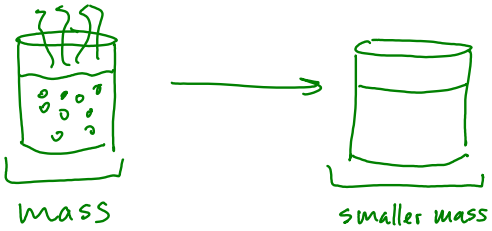
summary of observations

A few important laws… (what is a scientific law?)

Law of conservation of mass: in a chemical reaction, matter is neither created nor destroyed

Antoine Lavoisier, 1743-1794 (France)



deceptive loss of mass

Law of definite proportions: any sample of a **compound** will have the same proportions of elements

Two different samples of CO_2:

Sample 1: 25.6 g O; 9.6 g C $= \frac{2.67\ g\ O}{1\ g\ C}$

Sample 2: 21.6 g O; 8.10 g C $= \frac{2.67\ g\ O}{1\ g\ C}$

Law of multiple proportions: Different compounds of the same elements have whole number proportions of elements.

2 : 1 (H_2O) 1 : 1 (H_2O_2)

Water and hydrogen peroxide: both have H and O

Water: 0.136 g H for every 1 g O
Hydrogen peroxide: 0.0630 g H for every 1 g O

water has 2x as much H per g O as peroxide

how/why

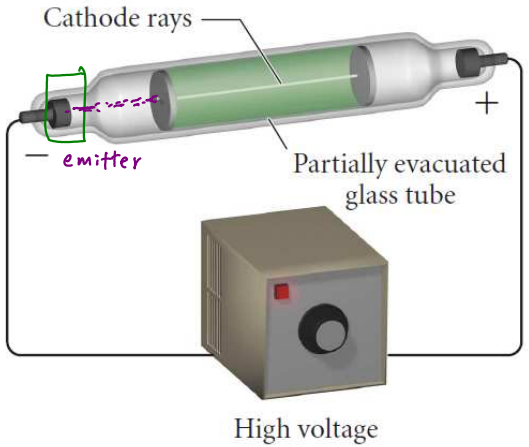
Atomic theory: John Dalton, 1808

1. Atoms = indestructible, smallest unit of element to retain identity
2. An element has all the same type of atoms
3. A compound contains atoms of 2 or more elements in a fixed ratio H_2O , H_2O_2

4. In a chemical reaction, atoms rearrange to form new substances

cons. of mass

J. J. Thomson, 1897: cathode ray tube

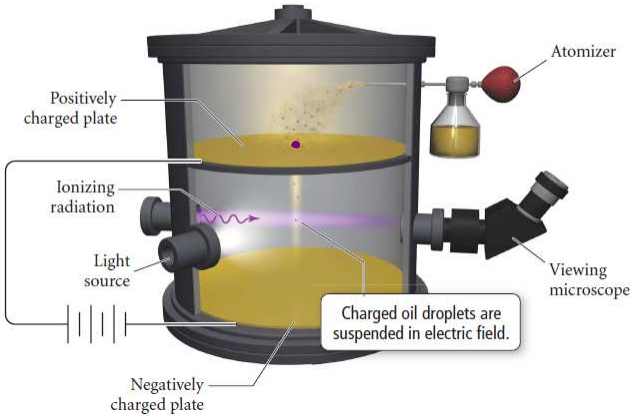


Cathode rays contain a single type of particle:

- Negatively charged
- The same from any element
- Calculated mass/charge ratio

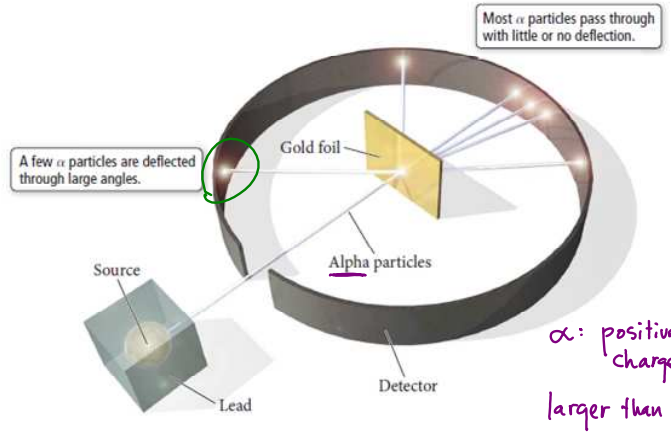
Thomson called it the **electron**.

Robert Millikan: 1909 Oil drop experiment

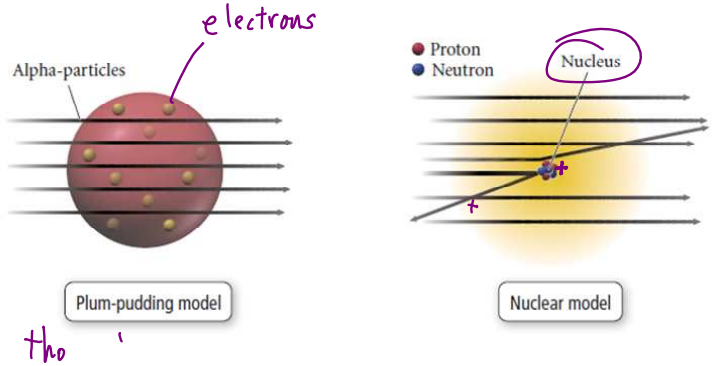


Charge of an electron: 1.602×10^{-19} coulombs (C)
Mass of an electron: 9.109×10^{-28} g

Ernest Rutherford: 1911 gold foil experiment



α: positively charged
larger than electrons



tho

Rutherford's nuclear model:

1. Most of atom's mass is in a tiny dense nucleus
2. Most of the volume is empty space, with tiny electrons around the nucleus
3. In a neutral atom, the number of protons (+) equals the number of electrons (−)