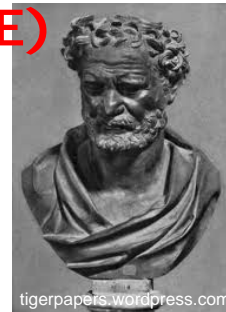


HISTORY OF THE ATOM

Democritus (Greece, 400s BCE)

- Nature's basic particle = "atom"
- Based on Greek word meaning "indivisible"
 - "atomos" = not cutting

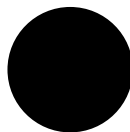


Aristotle (Greece, 300s BCE)

- Did NOT believe in atoms
- Ideas accepted for ~2000yrs

John Dalton (England, early 1800s)

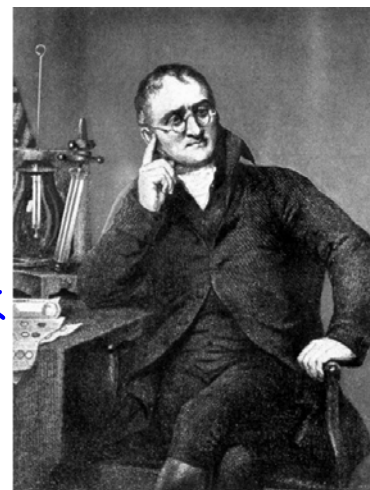
"billiard ball" model



Atomic Theory

- 1) All matter composed of atoms (I)
- 2) All atoms of same element are identical. (not true)

isotopes:
P same;
N not



Atoms of different elements are different.

Atomic Theory (cont'd)

- 3) Atoms cannot be created, destroyed or subdivided. (not true...think fission/fusion, synthetic elements)
- 4) Atoms of different elements combine in simple whole-number ratios to form compounds:
- Ex:** H₂O, not H_{7.97}O_{4.12}
- 5) In chemical reactions, atoms are combined, separated, or rearranged.

How Big is an Atom??

Fold your strip of paper in half crosswise (hamburger style). Cut in half. Repeat until you cannot cut anymore. How many times did you make cuts?

11" = .2794 m...must cut in half **36** times to reach the diameter of an atom:

$$\sim 4 \times 10^{-12} \text{ m}$$

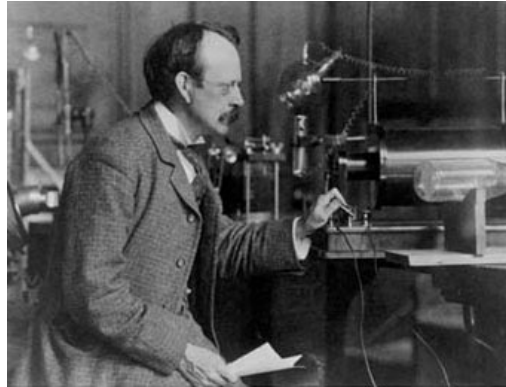
J.J. Thomson (England, late 1890s)

Cathode Ray Tube (CRT) expts.:

--Cathode ray was attracted to positive magnet

Atoms have **negative particles...ELECTRONS

--Since atoms are *neutral*, must also have **positive** particles...PROTONS

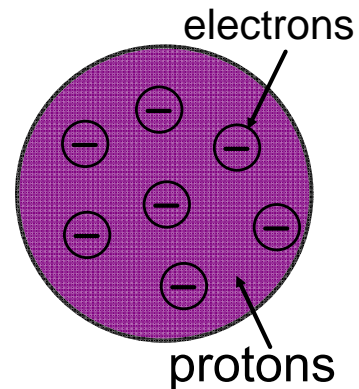


J.J. Thomson

--"Plum pudding" model

--Electrons much less massive than atoms

-->This and CRT results suggest protons



Rutherford (New Zealand, 1911)

Gold foil experiment:

- Positive alpha ⁽⁺⁾ particles emitted at high speeds
- Aimed at gold foil
- Expected to pass through, if atom is mostly empty space

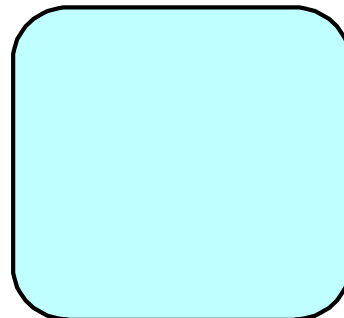


Rutherford

- However, he was SHOCKED, when 1 in 8000 particles were deflected

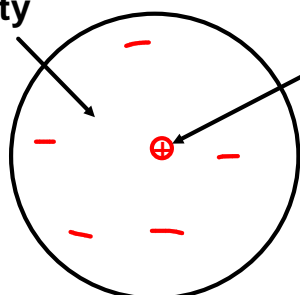
"As if firing a gun at a tissue and the shell came back at you!"

- Atoms must have a very small, densely packed center of + charge: **NUCLEUS**



Rutherford's Model: "Nuclear atom"

Electrons in
large, empty
space



Small, dense,
positive nucleus

If nucleus = marble, atom = football field

Chadwick (England 1932)

--Mass of p^+ not heavy enough to = mass of atom

--Another particle with no charge gives mass to nucleus: NEUTRON



Subatomic Particle Summary

Particle	Actual Mass (kg)	Mass Number	Symbol
Electron	9.11×10^{-31}	0	e^{-}
Proton	1.67×10^{-27}	1	p^{+}
Neutron	1.67×10^{-27}	1	n^{0}