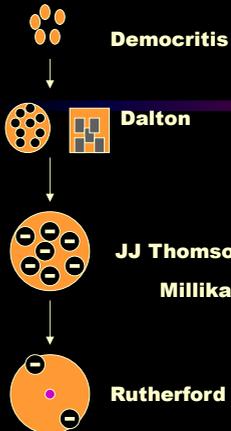


Atomic Structure

lecture 1: Early History of the Atomic Model

1-AtomicTheoryPart1

Evolution of Atomic Theory



Democritus (460 – 370 BC)

- Greek philosopher:
- Can matter be subdivided into fundamental particles?
- All matter can be broken down into indivisible *atomos*.

Democritus



Water



Iron

According to the early theory of atoms developed by Democritus, Water atoms would be round and flow over one another while iron atoms would be jagged and stay solidly together. This is not the modern view.

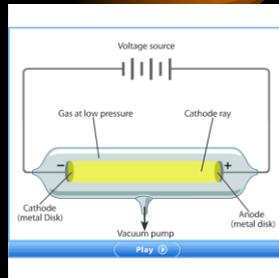
Dalton's Atomic Theory (1780)



- 1) Elements are made up of atoms
- 2) All atoms of one type are similar to one another and different from other types of atoms.
- 3) The **relative** number and arrangement of different types of atoms in a substance determines its identity.
- 4) Chemical change is a union, separation, or rearrangement of atoms to give new substances.
- 5) Only whole atoms can participate in or result from a chemical change, since atoms are indestructible during such changes.

Experiments to determine the structure of an atom

- **J. J. Thomson**– used Cathode ray tubes

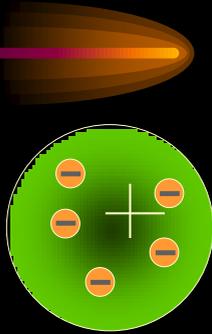


Thomson's Experiment

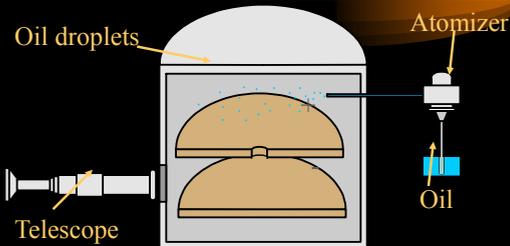
- added an electric field to a cathode ray tube (think of a neon sign that glows), he found that the moving pieces were negatively charged.
- identified the electron as a fundamental particle

J.J. Thomson's Model

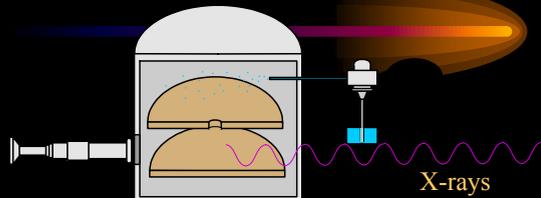
- the atom was like plum pudding.
- A bunch of positive stuff
- Electrons were embedded and could be removed.



Robert Millikan Experiment 1900



Millikan's Experiment



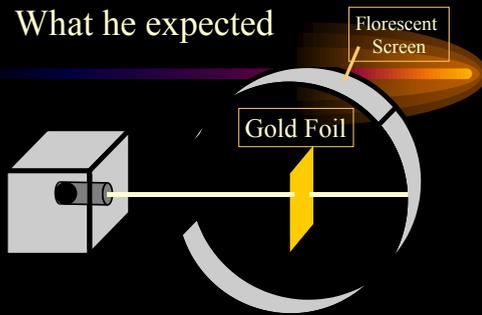
X-rays gave some electrons a charge and Millikan found that these drops would hover.

From the mass of the drop and the charge on the plates, he calculated the charge of an electron.

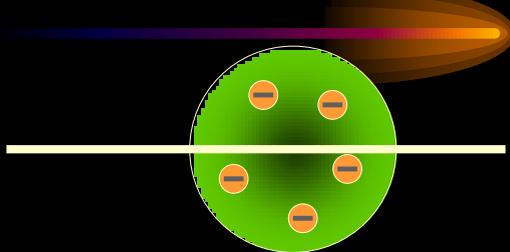
Rutherford's Experiment 1907

- Aimed alpha particles at gold foil by drilling a hole in a lead block.
- Since the mass is evenly distributed in gold atoms, alpha particles should go straight through.
- Used gold foil because it could be made atoms thin.

What he expected

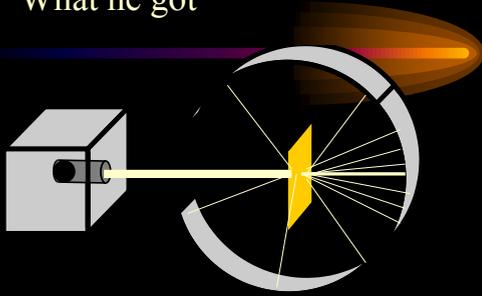


Particles would pass through



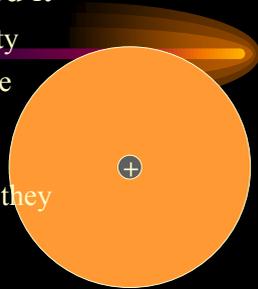
Because, he thought the mass was evenly distributed in the atom.

What he got

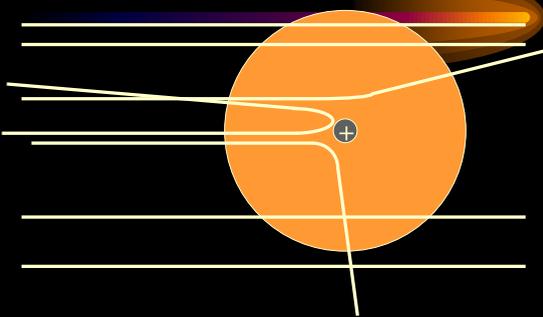


How he explained it

- Atom is mostly empty
- Small dense, positive piece at center.
- Alpha particles are deflected by it if they get close enough.



What Rutherford Observed



SO THERE MUST BE
A SMALL MASSIVE CENTER!!!

THE NUCLEUS

Summary

Democritus – concepts of atoms

Dalton – atoms have certain properties

- Elements are made of atoms
- All atoms of the same element are the same
- Every substance is identified by the combination of different atoms
- Only whole atoms can combine to form substances

JJ Thomson – atoms have electrons (cathode ray)

Millikan – proved electrons exist and have a charge of 1.6×10^{-19} coulombs (oil drop)

Rutherford – discovered the nucleus (gold foil)

1-AtomicTheoryPart1
