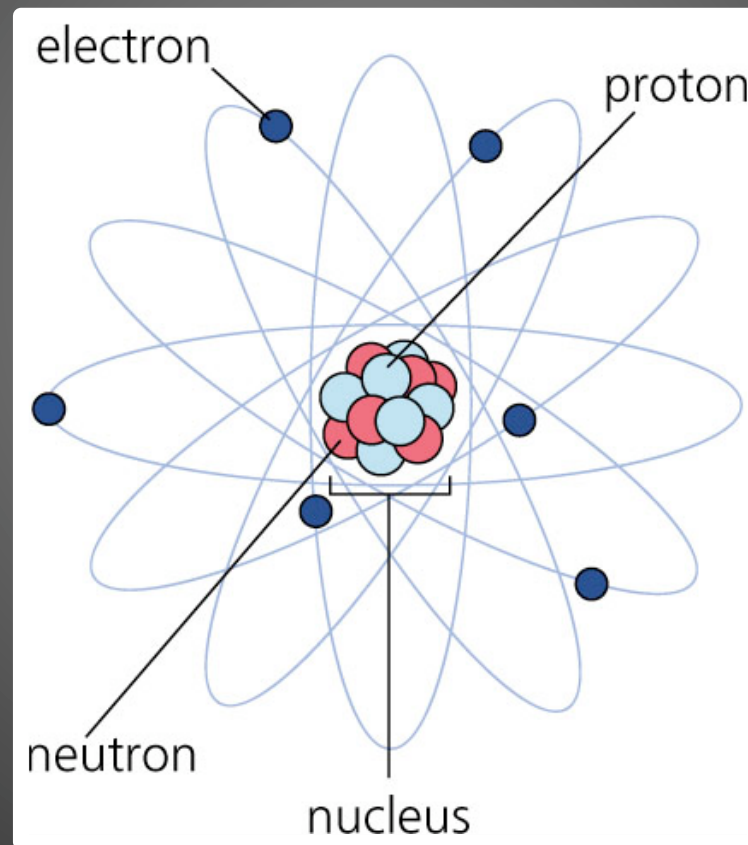


Chapter 4: The Structure of the Atom

Early Theories and Discoveries

Section 4.1 and 4.2

The Atom



Democritus

Greek Philosopher (460 – 370 B.C.)

- The first person to propose that matter was composed of tiny particles called atoms (from the Greek “atomos”)
- He believed that atoms could not be created, destroyed, or further divided.

John Dalton

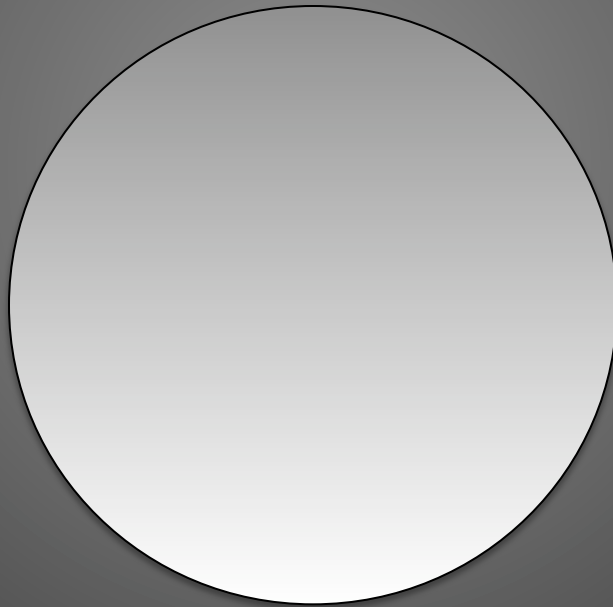
English Schoolteacher (1766 – 1844)

- “The Atomic Theory”
- Unlike Democritus, Dalton was able to perform experiments that allowed him to verify his theories.
- All atoms of a given element are identical.
- Atoms cannot be created, divided or destroyed.
(Conservation of Mass)
- Atoms combine in simple whole-number ratios to form compounds. (Law of Definite Proportions)

John Dalton

English Schoolteacher (1766 – 1844)

Dalton's Model of the Atom:



J.J. Thomson

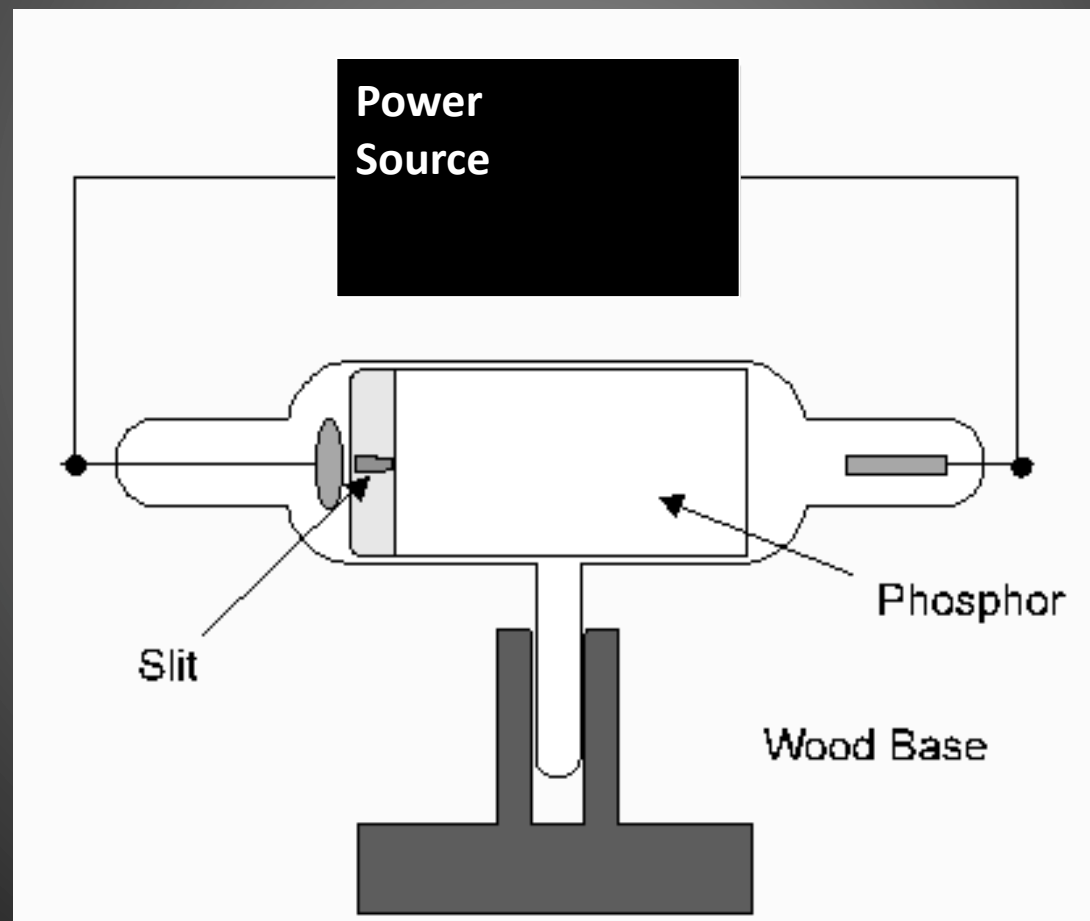
English Physicist (1856 – 1940)

- Credited for discovery of the electron. (1897)
- Began a series of cathode ray tube experiments to determine the ratio of charge to mass.
- Concluded that atoms were divisible into smaller subatomic particles.
- Developed the “Plum Pudding” Model of the atom. (Today we would call this the chocolate chip cookie model.)

J.J. Thomson

English Physicist (1856 – 1940)

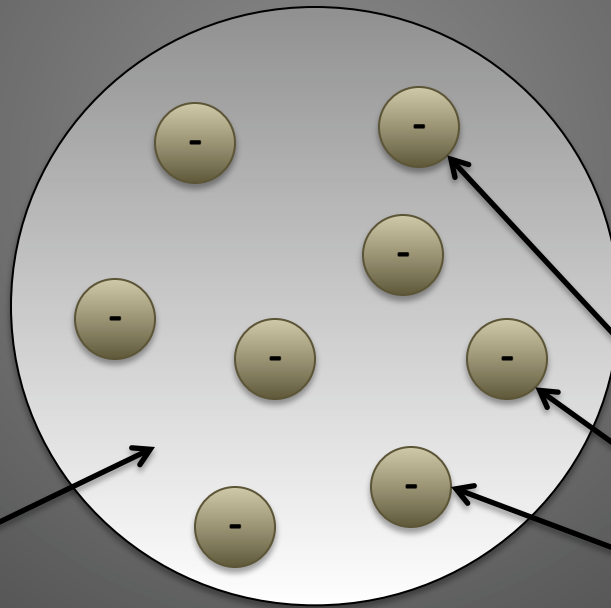
Crooke's Tube Demonstration



J.J. Thomson

English Physicist (1856 – 1940)

Thomson's Model of the Atom:



Positively Charged Matter

Negatively Charged Electrons

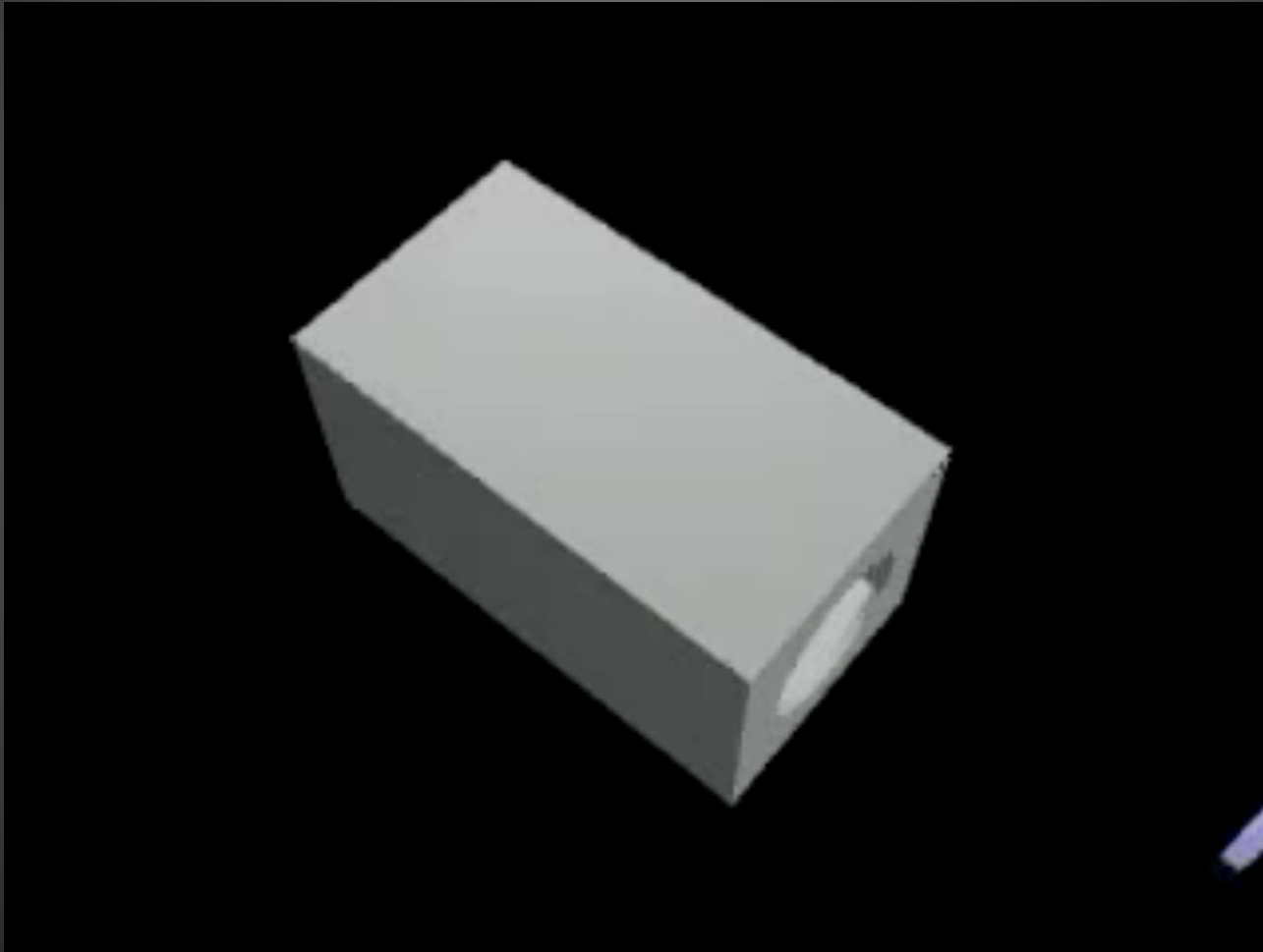
Ernest Rutherford

New Zealand born Physicist (1871 – 1937)

- Designed and conducted an experiment to see if alpha particles would pass through a thin sheet of gold foil.
- Rutherford expected a few of the alpha particles to be slightly deflected due to the presence of electrons.
- Instead, Rutherford observed a few deflect at very sharp angles.

Ernest Rutherford

New Zealand born Physicist (1871 – 1937)



Ernest Rutherford

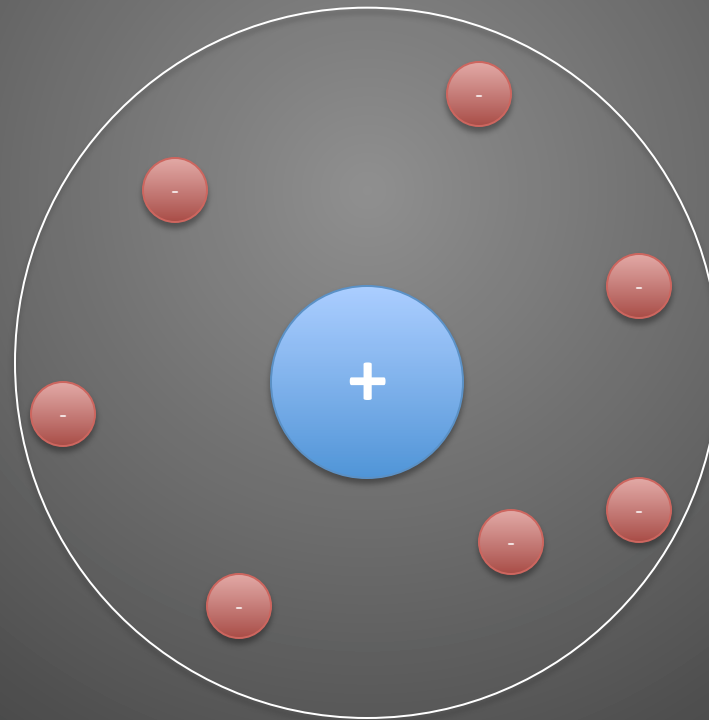
New Zealand born Physicist (1871 – 1937)

- Established, the presence of a tiny, dense region, which he called the nucleus located in the center of the atom and containing all the atom's positive charge. (Discovered Proton)
- He concluded that electrons were located outside the nucleus and that the atom was mostly empty space.

Ernest Rutherford

New Zealand born Physicist (1871 – 1937)

Rutherford's Model of the Atom:



James Chadwick

English Physicist (1891 – 1974)

- Discovery of the neutron. (1932)
- The weight of atoms did not check out when working with isotopes of the same element.

Properties of Subatomic Particles

Particle	Symbol	Location	Relative charge	Relative mass	Actual mass
Electron	e^-	Outside nucleus	1-	0	9.11×10^{-28}
Proton	p^+	In nucleus	1+	1	1.673×10^{-24}
Neutron	n^0	In nucleus	0	1	1.675×10^{-24}