

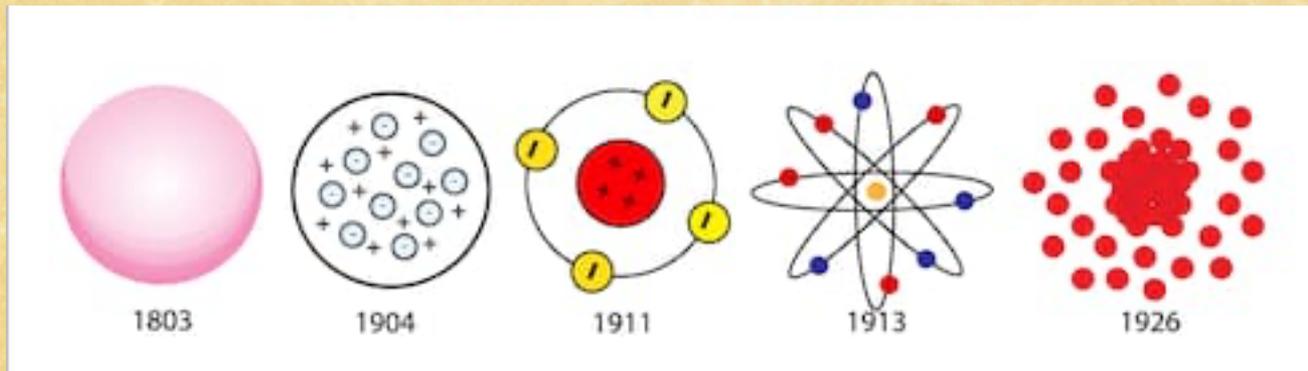
What are the Building Blocks of Matter?

Chapter 12 Lesson 1
Part 2

ByDesign Science, Level 6
By Allyssa Sharpe

Atomic Models

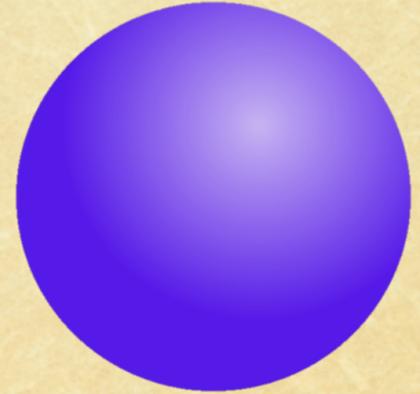
- ♦ As their understanding of the structure of atoms grew, scientists used models of atoms to illustrate what they learned.
- ♦ As new information was discovered, the existing models were refined or abandoned entirely, and new models were developed to reflect the new information.



Atomic Models

Dalton Model

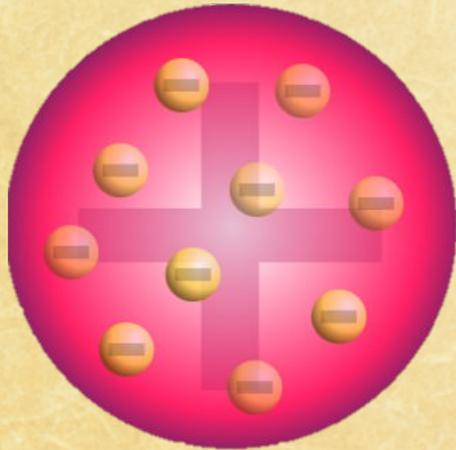
- ♦ John Dalton proposed that all matter was composed of atoms.
- ♦ Atoms of each element were identical in atomic mass and their properties.
- ♦ Dalton considered the atoms to be a solid unbreakable sphere.
- ♦ Because of this description, Dalton's atomic model is often referred to as the "billiard ball" model.



Atomic Models

Thomson Model (Blueberry Muffin Model)

- ◆ In the late nineteenth century, most scientists agreed on the existence of atoms.
- ◆ In experiments with hydrogen atoms, J. J. Thomas knew that atoms were electrically neutral.

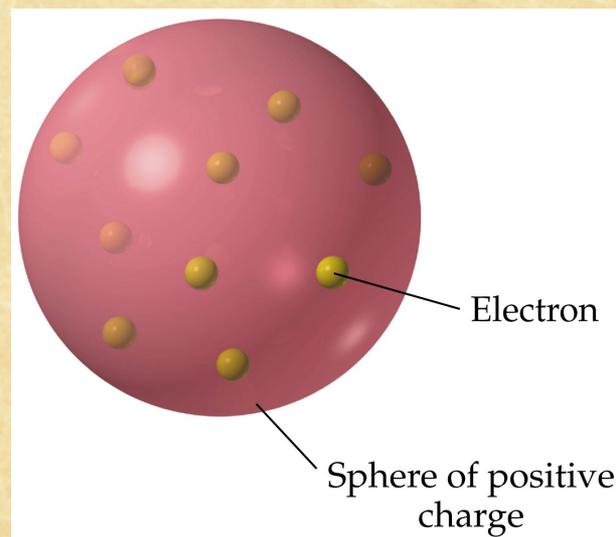


- ◆ However, he also knew that atoms contained particles of positive charged - protons.

Atomic Models

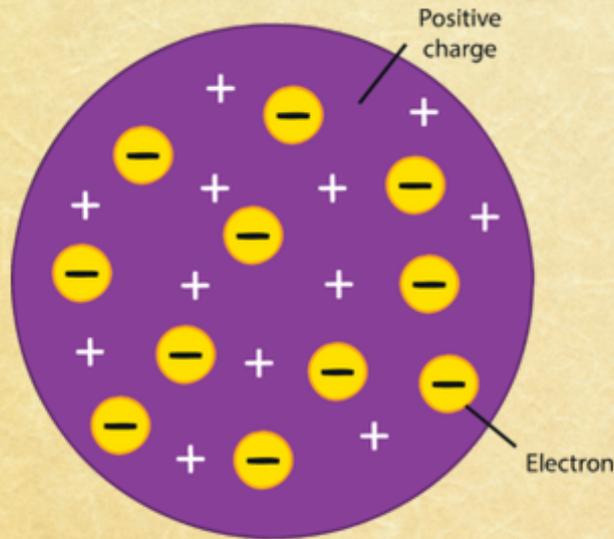
Thomson Model (Blueberry Muffin Model)

- ◆ In order to account for the mass of a hydrogen atom and maintain its neutral charge, Thomas realized that atoms must contain smaller, negatively charged particles.
- ◆ At this time, the structure of atoms was still very much unknown.
- ◆ Thomson's model of the atom can be compared to a blueberry muffin.



Atomic Models

Thomson Model (Blueberry Muffin Model)



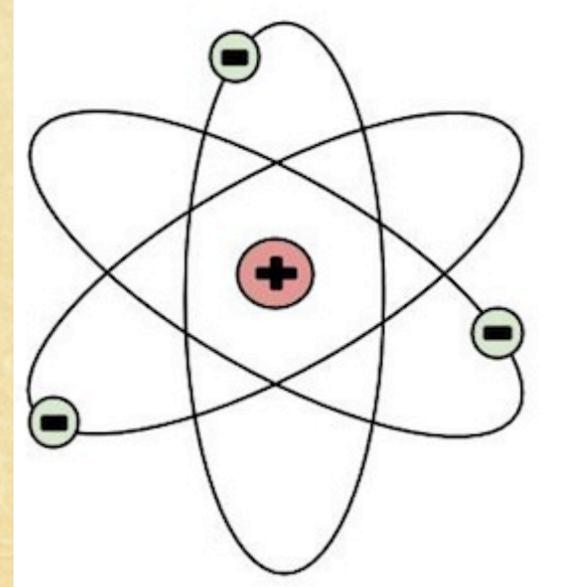
Plum pudding model

- ◆ According to his explanation, the negatively charged electrons were the "blueberries" suspended in the "muffin" of positive charges.
- ◆ His model was discredited upon the discovery of the nucleus of atoms.

Atomic Models

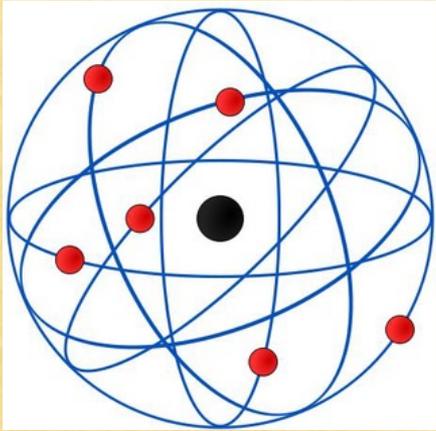
Rutherford Model

- ◆ In 1911, Ernest Rutherford, a student of Thomson's, published a model of the atom with a central, positively charged nucleus orbited by negatively charged electrons.
- ◆ Rutherford proposed that most of an atom is made up of empty space.



Atomic Models

Rutherford Model

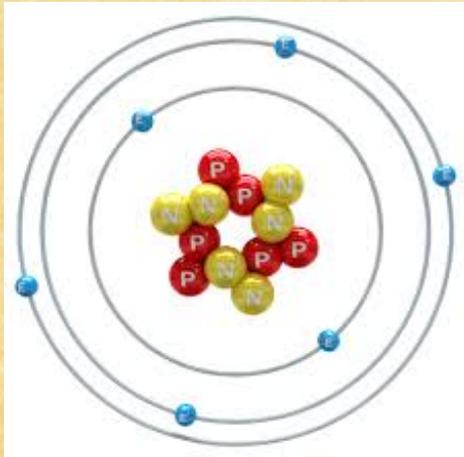


- ♦ The space between the nucleus and the electron cloud is quite large compared to the size of the nucleus and the atomic particles.
- ♦ In fact, over 99% of an atom's total volume is empty space.
- ♦ This is equivalent to a marble, representing the nucleus, in the center of a large football stadium with the rim of the stadium representing the path of the orbiting electrons.

Atomic Models

Solar System Model

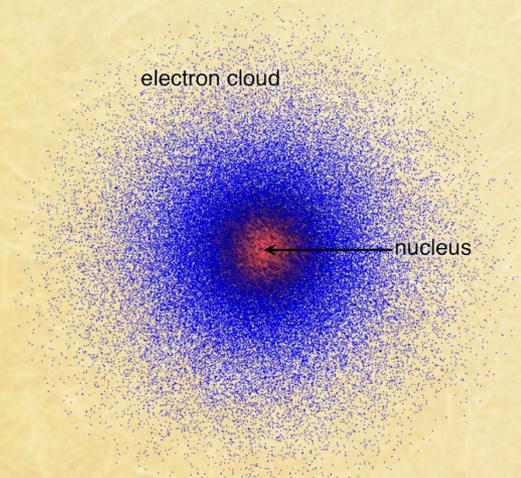
- ◆ Niels Bohr's experiments using Rutherford's atomic model led him to realize that electrons orbit the nucleus at specific distances.
- ◆ These distances depend on how much energy the electrons have.



- ◆ This model was compared to the model of our Solar System and is often referred to as the solar system model because electrons orbit the atom's central nucleus.

Atomic Models

Electron Cloud Model

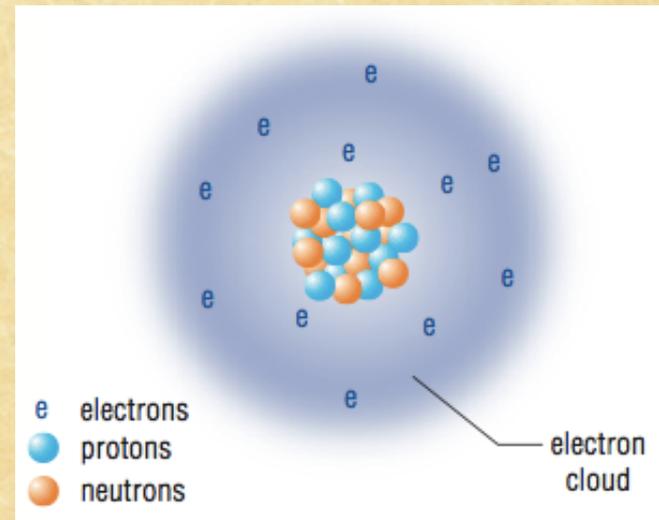


- ◆ Erwin Schrodinger refined the atomic model to consider that we cannot expertly know where an electron will be at any given moment.
- ◆ He was able to determine at which level of energy an electron might be located.
- ◆ The likely locations of the electrons were represented by a collection of dots resembling a cloud.

Atomic Models

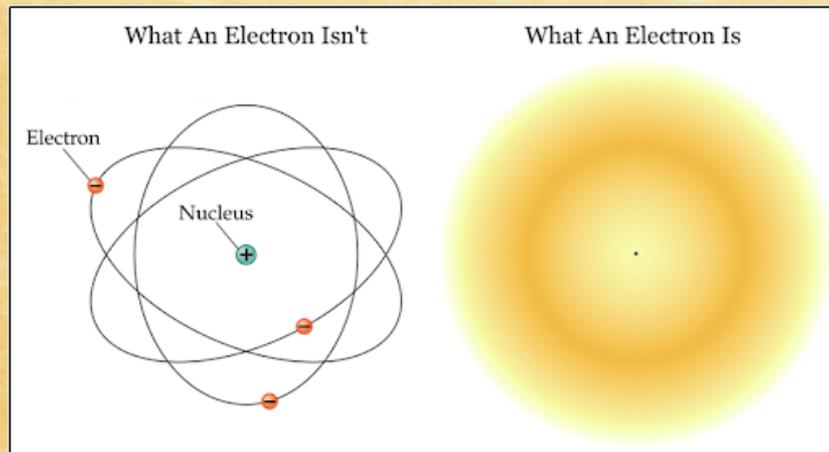
Electron Cloud Model

- ◆ The amount of energy an electron has determines where in the electron cloud it is most likely to be found.
- ◆ As an electron gains energy, the distance it orbits from the nucleus increases.
- ◆ As it loses energy, the distance between it and the nucleus decreases.



The Electron Clouds

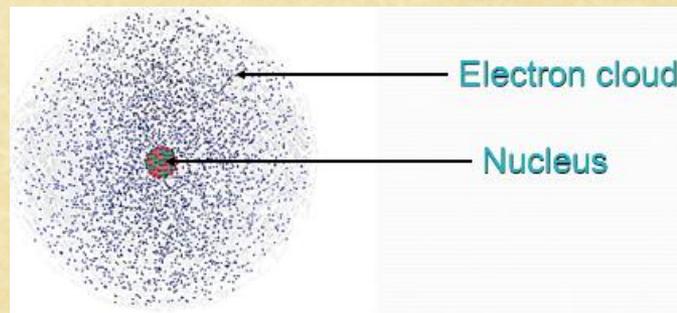
- ◆ Unlike protons and neutrons that stay inside the atom's nucleus, electrons move very quickly in specific electron clouds or levels around the nucleus.
- ◆ The electron clouds are like planetary orbits around the Sun in our Solar System.



- ◆ The amount of energy an electron has determines the path it takes in its orbit.

The Electron Clouds

- ◆ Electrons with the same levels of energy are most likely to be found in the same electron level around the nucleus.



- ◆ As an electron gains energy, the distance it orbits from the nucleus also increases.
- ◆ The electron cloud provides a visual of where the electrons orbit, but they do not have fixed movements like the planets.

What Atoms Look Like

