

# Atomic Theory Timeline

Scientific knowledge  
builds on past research  
and experimentation.

The atomic theory has changed  
over time as new technologies  
have become available.





# Democritus

400 B.C.

## Information

Democritus, a philosopher in ancient Greece, began the search for a description of matter. He questioned whether matter could be divided into smaller and smaller pieces forever until eventually the smallest possible piece would be obtained. He believed that the smallest possible piece of matter was indivisible. He named the smallest piece of matter “atomos,” meaning “not to be cut.” To Democritus, atoms were small, hard particles that were all made of the same material, but were formed into different shapes and sizes.

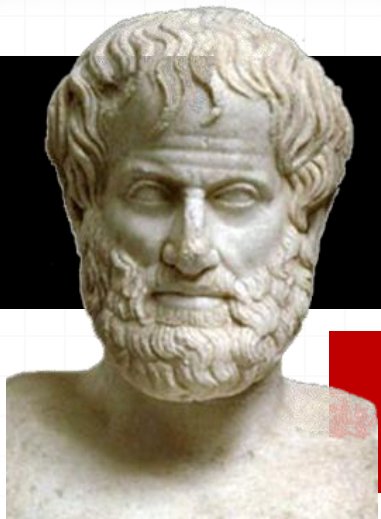
## Atomic Model



## Analogy

Legos





# Aristotle

300 B.C. to Early 1800's

## Information

In ancient Greece, the popular philosopher Aristotle declared that all matter was made of only four elements: fire, air, water and earth. He also believed that matter had just four properties: hot, cold, dry and wet.

## Atomic "Model"



## "Analogy"

Death to the field of Chemistry for 2000 years!





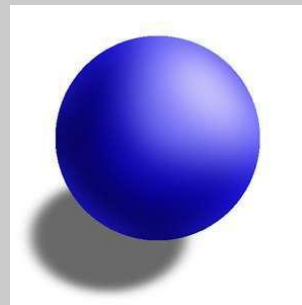
# Dalton

1803

## Information

In the early 1800s, the English Chemist John Dalton performed a number of experiments that eventually led to the acceptance of the idea of atoms. He formulated the first atomic theory since the “death of chemistry” that occurred during the prior 2000 years. Dalton theorized that all matter is made of atoms. Atoms are too small to see, “uncuttable,” and indestructible. All atoms of a given element are exactly alike and atoms of different elements are different.

## Atomic Model



## Analogy

Billiard ball





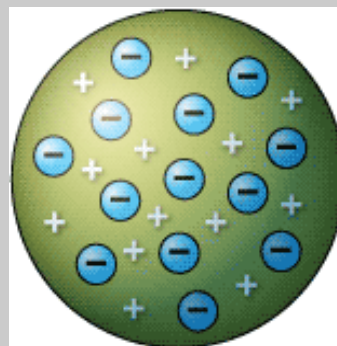
# Thomson

1897

## Information

In 1897, the English scientist named J.J. Thomson provided the first hint that an atom is made of even smaller particles. He discovered the presence of a negative particle in the atom – the electron. He proposed a model of the atom that is sometimes called the “Plum Pudding” model. His theory was that atoms are made from a positively charged substance with negatively charged electrons scattered about, like raisins in a pudding or chocolate chips in a cookie.

## Atomic Model



## Analogy

Chocolate Chip  
Cookie





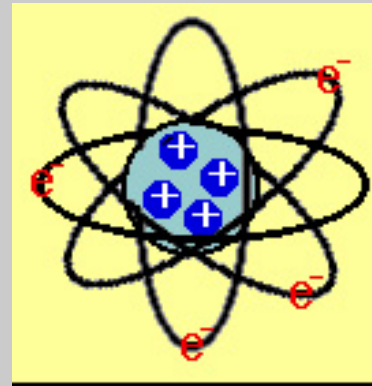
# Rutherford

1908

## Information

In 1908, the English physicist Ernest Rutherford performed an experiment using positively charged particles fired at gold foil. Through his experiment, he proved that atoms are not a “pudding” filled with a positively charged material. He theorized that atoms have a small, dense, positively charged center, which he called the “nucleus”. He said that nucleus is tiny compared to the atom as a whole, because the atom is mostly open space! He concluded that the negatively charged particles are scattered outside the nucleus at a distance.

## Atomic Model

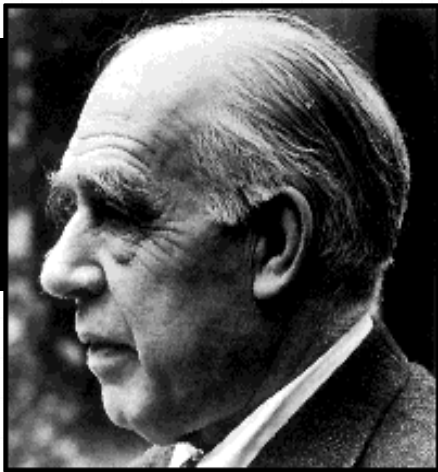


## Analogy

Cherry with a Pit







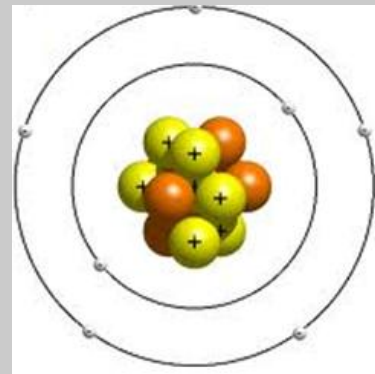
# Bohr

1913

## Information

In 1913, the Danish scientist Niels Bohr proposed an improvement. He built on the concept that the mass of an atom is contained mostly in the nucleus. He also theorized that electrons move in definite orbits around the nucleus, much like planets circle the sun. These orbits, or energy levels, are located at certain distances from the nucleus.

## Atomic Model



## Analogy

### Solar System



Solar System

# Modern Cloud Theory

20<sup>th</sup> Century



## Scientists

## Information

## Atomic Model

## Analogy

**Schrodinger, Heisenberg, Einstein and many other scientists**

According to today's atomic theory, electrons do not orbit the nucleus in neat planet-like orbits but move at high speeds in an electron cloud around the nucleus.

In the electron cloud, electrons whirl around the nucleus billions of times in one second. They are not moving around in random patterns; an electron's location depends upon how much energy the electron has.

