Bellringer

The following is a quote by Democritus (c. 460–c. 370 BCE). Paraphrase this quote in your own words in your science journal.

“Color exists by convention, sweet by convention, bitter by convention; in reality nothing exists but atoms and the void.”

What do you know about Democritus? And why are his thoughts important?
Objectives

- **Describe** some of the experiments that led to the current atomic theory.

- **Compare** the different models of the atom.

- **Explain** how the atomic theory has changed as scientists have discovered new information about the atom.
The atomic theory continues to change over time. Scientists have created different models of what the atom looks like to correspond with newly discovered information about the atom.

A Look Back in Time
Both were Greek philosophers.

**Democritus**

- Around 440 BCE he had an idea that if you keep cutting a piece of something in half you would eventually end up with a particle that could not be cut.
- He called this particle an atom.
- He is correct. Matter is made of particles, which we call atoms.
- An **atom** is the smallest particle into which an element can be divided and still be the same substance.
Democritus vs Aristotle

Aristotle

- disagreed with Democritus’s ideas.
- He believed that you could never end up with a particle that could not be cut.

- He had a very strong influence with people and society.
- People believed in Aristotle.
Dalton’s Atomic Theory Based on Experiments

**Dalton’s Theory**  John Dalton published his atomic theory in late 1803.  
• His theory stated that  
  1. all substances are made of atoms. Atoms are small particles that cannot be created, divided, or destroyed.  
  2. Atoms of the same element are exactly alike, and atoms of different elements are different.  
  3. Atoms join with other atoms to make new substances.
• Proved that Dalton wasn’t Quite Correct and that atoms can be divided into smaller parts. Thus the atomic theory was then changed to describe the atom more correctly.

• **Negatively Charged Particles** In 1897, Thomson experimented with a cathode-ray tube like the one shown on the next slide. He discovered negatively charged particles that are now known as electrons.

• **Plum Pudding Model** After learning that atoms contain electrons, Thomson proposed a new model of the atom. Thomson thought that electrons were mixed throughout an atom, like plums in a pudding.
Section 1 Development of the Atomic Theory

Thomson’s Cathode-Ray Tube Experiment

(a) Almost all gas was removed from the glass tube.

(b) An invisible beam was produced when the tube was connected to a source of electrical energy.

(c) Metal plates could be charged to change the path of the beam.

(d) When the plates were not charged, the beam made a glowing spot here.

(e) When the plates were charged, the beam produced a glowing spot here after being pulled toward the positively charged plate.
• **Negatively Charged Particles**  In 1909, Ernest Rutherford designed a new experiment called the Gold Foil Experiment where he aimed a beam of small, positively charged particles at a thin sheet of gold foil. The next slide shows his experiment.
Rutherford’s Gold-Foil Experiment

A few particles bounced straight back.

Some particles were slightly deflected from a straight path.

Most of the particles passed straight through the gold foil.

An element such as radium produced the particles.

Lead stopped all of the positive particles except for a small stream aimed at a gold-foil target.
Far from the Nucleus

• particles were expected to pass right through the gold foil in a straight line.
• particles were deflected.
• Atomic theory was revised again.
• Rutherford proposed that in the center of the atom is a tiny, dense, positively charged particle he called the nucleus and it is surrounded by negatively charged electrons.
• He proved that Thompson’s Plum Pudding Model was incorrect.
• **Bohr’s Electron Levels** In 1913, Niels Bohr proposed that electrons move around the nucleus in certain paths, or energy levels.

• Known as the Bohr’s Model

• These electrons can jump from path to path meaning there are no direct path these electrons will follow.
• **James Chadwick** in 1932 he discovered the particle neutron that has no charge in the nucleus.

**Schrodinger and Heisenberg**
- Further explained electron behavior.
- Electrons have no definite path in the electron cloud.
- The electron cloud is the region where electrons are likely to be found.
Section 1  Development of the Atomic Theory

Comparing Models of the Atom

Click below to watch the Visual Concept.

Visual Concept

You may stop the video at any time by pressing the Esc key.