

Introduction to atoms and atomic theory

Feb ____, 2024

When we learned about KMT, we had talked about “particles” that make up all matter. These particles are called **atoms** (and also molecules). How do we know what the **atom** looks like and what it is made of?

Our understanding of the atom has come from the work of many men and women in different countries. The chart on back of this page mentions some of their most important discoveries. As early as 2,500 years ago, Greek thinkers (Democritus and Leucippus) proposed that all matter was made of tiny particles that cannot be divided further. They called these “atomos”. Almost 2,000 years later, other scientists were able to add more information to our understanding of the atom.

See chart on back →

What are atoms and what are they made of?

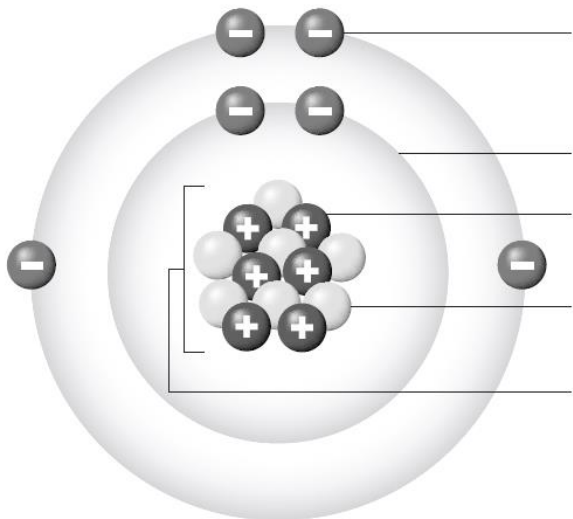
Today, we know that an **atom** is the smallest particle of an element that still has the identity and properties of the element. (We will talk about elements soon!)

Atoms are made up of _____ (particles that are smaller than atoms).

Three subatomic particles make up all atoms.

- _____
- _____
- _____

Parts of the atom:



Video: [How Small Is An Atom? Spoiler: Very Small. - YouTube](#)

A HISTORY OF THE ATOM: THEORIES AND MODELS

How have our ideas about atoms changed over the years? This graphic looks at atomic models and how they developed.

SOLID SPHERE MODEL



JOHN DALTON



1803

Dalton drew upon the Ancient Greek idea of atoms (the word 'atom' comes from the Greek 'atomos' meaning indivisible). His theory stated that atoms are indivisible, those of a given element are identical, and compounds are combinations of different types of atoms.

+ RECOGNISED ATOMS OF A PARTICULAR ELEMENT DIFFER FROM OTHER ELEMENTS

- ATOMS AREN'T INDIVISIBLE - THEY'RE COMPOSED FROM SUBATOMIC PARTICLES

PLUM PUDDING MODEL



J.J. THOMSON



1904

Thomson discovered electrons (which he called 'corpuscles') in atoms in 1897, for which he won a Nobel Prize. He subsequently produced the 'plum pudding' model of the atom. It shows the atom as composed of electrons scattered throughout a spherical cloud of positive charge.

+ RECOGNISED ELECTRONS AS COMPONENTS OF ATOMS

- NO NUCLEUS, DIDN'T EXPLAIN LATER EXPERIMENTAL OBSERVATIONS

NUCLEAR MODEL



ERNEST RUTHERFORD



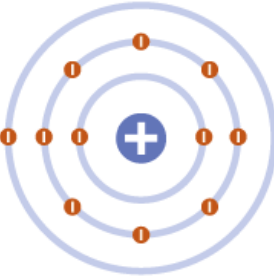
1911

Rutherford fired positively charged alpha particles at a thin sheet of gold foil. Most passed through with little deflection, but some deflected at large angles. This was only possible if the atom was mostly empty space, with the positive charge concentrated in the centre: the nucleus.

+ REALISED POSITIVE CHARGE WAS LOCALISED IN THE NUCLEUS OF AN ATOM

- DID NOT EXPLAIN WHY ELECTRONS REMAIN IN ORBIT AROUND THE NUCLEUS

PLANETARY MODEL



NIELS BOHR



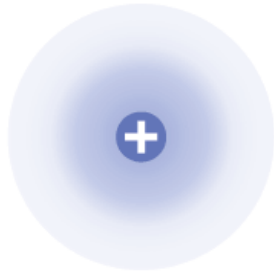
1913

Bohr modified Rutherford's model of the atom by stating that electrons moved around the nucleus in orbits of fixed sizes and energies. Electron energy in this model was quantised; electrons could not occupy values of energy between the fixed energy levels.

+ PROPOSED STABLE ELECTRON ORBITS; EXPLAINED THE EMISSION SPECTRA OF SOME ELEMENTS

- MOVING ELECTRONS SHOULD EMIT ENERGY AND COLLAPSE INTO THE NUCLEUS. MODEL DID NOT WORK WELL FOR HEAVIER ATOMS

QUANTUM MODEL



ERWIN SCHRÖDINGER



1926

Schrödinger stated that electrons do not move in set paths around the nucleus, but in waves. It is impossible to know the exact location of the electrons; instead, we have 'clouds of probability' called orbitals, in which we are more likely to find an electron.

+ SHOWS ELECTRONS DON'T MOVE AROUND THE NUCLEUS IN ORBITS, BUT IN CLOUDS WHERE THEIR POSITION IS UNCERTAIN

+ STILL WIDELY ACCEPTED AS THE MOST ACCURATE MODEL OF THE ATOM



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