

Chemistry 10030 - Chemistry in Our World

Atomic Theory

Timeline

- ≈400 B.C. Democritus (Greek) extends ideas of his teacher (Leucippus) and proposes all matter made of small particles, which he named “atomos”.
- 1661: Rober Boyle’s (English) “The Skeptical Chymist” is published, which included the concept of elements.
- 1777: Antoine Lavoisier (France) proposed idea that chemical compounds are composed of more than one element.
- 1789: Lavoisier publishes the first list of chemical elements.
- 1799: Proust proposes Law of Definite Proportions, which introduced the idea of reaction stoichiometry.
- 1803: Dalton publishes his atomic theory, including a table of relative atomic weights. The major ideas of this theory have remained relatively unchanged.
- 1818: Berzelius publishes list of molecular weights for over 2000 compounds.
- 1869: Mendeleev publishes a periodic table of elements, which is very similar to that used today.
- 1874: G. J. Stoney proposed electricity due to particles he called electrons.
- 1879: Sir William Crookes study of cathode rays indicates some properties of electrons.
- 1898: Wien identifies positive atomic particles, now known as protons.
- 1909: R. A. Millikan’s “oil drop” experiments give first measure of the mass and charge of electrons.
- 1911: Ernest Rutherford’s experiments lead him to postulate nucleus of atoms is very small, dense, and positively charged. Proposed electrons must be outside this nucleus.
- 1914: H. G. J. Moseley X-ray experiments of most elements lead him to postulate that the atomic number is equal to the number of protons.
- 1932: James Chadwick discovered the neutron.

Modern Atomic Theory

	Location	Relative mass	Relative Charge
proton	nucleus	≈1	+1
neutron	nucleus	≈1	0
electron	'outside' nucleus	≈0 ($\frac{1}{1600}$)	-1

Atomic Symbols

$\frac{\text{mass number}}{\text{atomic number}}$ Symbol Atomic Number = # protons, Mass Number = (# protons) + (# neutrons)

Example: ${}_{15}^{31}\text{P}$ Contains 15 protons, 16 neutrons, and 15 electrons.

30.974	← Average mass
P	← Elemental Symbol
15	← Atomic Number

Ions

- If an atom has more electrons than protons (gains e^{-}), it has a positive charge (cation).
- If an atom has less electrons than protons (loses e^{-}), it has a negative charge (anion).