

2 • Atoms and Elements

STUDY LIST

The Development of the Atomic Theory:

I can:

- State the four “signpost scientists”, their experiments, what they added to the atomic theory, and the name of their model.
- Define the three theories that Dalton explained in terms of atoms:
 - Law of Conservation of Matter
 - Law of Definite/Constant Proportions
 - Law of Multiple Proportions
- Give examples and solve calculation problems related to each of the three theories.
- Sketch a cathode ray tube as demonstrated in class and state how J.J. Thomson’s experiments led to the idea that atoms have positive and negative parts, the negative parts are all the same, and the negative parts (called electrons) have a certain charge/mass ratio.
- Define cathode rays.
- State the factors that determine how much a moving charged particle will be deflected by an electric or magnetic field.
- Explain Millikan’s oil drop experiment & how it added to the atomic theory.
- Sketch the set-up used by Ernest Rutherford (the gold-foil experiment), show what he observed, and explain how these observations led to the idea that most of the mass of the atom is concentrated into a tiny, amazingly massive, positively-charged nucleus.

Parts of the Atom:

- State the three particles that make up an atom, their symbol, their charge, their mass, and their location.
- State the number of protons, neutrons, and electrons in any atom or ion.
- Explain that isotopes are two atoms with the same atomic number (number of protons) but different mass numbers (number of nucleons—protons + neutrons).
- Represent the nucleus with isotopic notation, such as: ${}_{86}^{220}\text{Rn}$
- Recognize when two nuclei are isotopes of each other.

Molar Mass Calculations:

- Calculate the isotopic mass of an atom given the resting mass of protons and neutrons.
- Explain that a mole of any element is actually made up of various isotopes in a constant percentage abundance.
- Calculate the average atomic mass of an element using the percent abundance and mass of each isotope.
- Calculate the percent abundance of isotopes given the average atomic mass and isotopic masses of an element.

The Families of the Periodic Table:

- List the common families of the periodic table and recognize to which family any element belongs.
- Recognize metals, non-metals, and metalloids (semi-metals) on the periodic table.
- State and define the terms conductivity, malleability, ductility, and brittleness.
- State some element facts such as which elements are too radioactive to exist, which is the largest non-radioactive element, which element has the greatest density, and which element has the highest melting point.
- Explain how Dmitri Mendeleev put together the periodic table and why we give him credit for the table even though others were working along the same lines.
- List the three elements that Mendeleev predicted and where they are located on the periodic table.

A Little Nuclear Chemistry:

- State that Henri Becquerel discovered radioactivity and Marie Curie studied it.
- List the three “Becquerel rays” (alpha, beta, and gamma) and state why alpha particles were the perfect tool for Ernest Rutherford to study the structure of atoms.
- State that the alpha particle is the same as a helium nucleus, a beta particle is a high-speed electron, and a gamma ray is a high-energy form of light.