

Chapter 4 Atomic Structure

Summary

4.1 Studying Atoms

- The ancient Greek philosopher Democritus believed that all matter consisted of extremely small particles that could not be divided.
- Aristotle did not think there was a limit to the number of times matter could be divided.

➡ **Dalton proposed the theory that all matter is made up of individual particles called atoms, which cannot be divided.**

- Dalton developed this theory to explain why the elements in a compound always join in the same way.
- In Dalton's model, the atom looks like a solid sphere.

➡ **Thomson's experiments provided the first evidence that atoms are made of even smaller particles.**

- In Thomson's model, electrons are scattered evenly in a positive mass of matter.

➡ **According to Rutherford's model, all of an atom's positive charge is concentrated in its nucleus.**

- The **nucleus** is a dense, positively charged mass located in the center of the atom.

4.2 The Structure of an Atom

➡ **Protons, electrons, and neutrons are subatomic particles.**

- A **proton** is a positively charged subatomic particle that is found in the nucleus of an atom. It has a charge of $1+$.
- An **electron** is a negatively charged subatomic particle that is found in the space outside the nucleus. It has a charge of $1-$. The mass of about 2000 electrons would equal the mass of a proton.
- A **neutron** is a neutral subatomic particle that is found in the nucleus of an atom. It has a mass almost equal to that of a proton.

➡ **Protons, electrons, and neutrons can be distinguished by mass, charge, and location in an atom.**

➡ **Atoms of different elements have different numbers of protons.**

- The **atomic number** of an element equals the number of protons in an atom of that element.
- The **mass number** of an atom is the sum of the protons and neutrons in the nucleus of that atom.

➡ **Isotopes of an element have the same atomic number but different mass numbers because they have different numbers of neutrons.**

- **Isotopes** are atoms of the same element that have different numbers of neutrons and different mass numbers.
- It is hard to notice any differences in the properties of different isotopes of an element.

4.3 Modern Atomic Theory

➡ **An electron in an atom can move from one energy level to another when the atom gains or loses energy.**

- The possible energies that electrons in an atom can have are called **energy levels**.

➡ **Scientists use the electron cloud model to describe the possible locations of electrons around the nucleus.**

➡ **An electron cloud is a good approximation of how electrons behave in their orbitals.**

- An **electron cloud** is a visual model of the most likely locations for electrons in an atom.
- The electron cloud is denser where the chances of finding an electron are high.
- An **orbital** is a region of space around the nucleus where an electron is likely to be found.

➡ **The most stable electron configuration is the one in which the electrons are in orbitals with the lowest possible energies.**

- A configuration is an arrangement of objects in a given space.
- An **electron configuration** is the arrangement of electrons in the orbitals of an atom.
- When all the electrons in an atom have the lowest possible energies, the atom is said to be in its **ground state**.