

# CAIE Chemistry A-level

## 1: Atomic Structure Definitions

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



## Definitions and Concepts for CAIE Chemistry A-level

### Atomic Structure

**Atomic nucleus:** A collection of subatomic particles in the centre of an atom. It is positively charged and composed of protons and neutrons with one or more electrons orbiting it.

**Atomic/Proton number:** The number of protons found in the nucleus of an atom of a particular element.

**d-block:** The block of elements in the middle of the periodic table. Most d-block elements are transition metals. Elements in the d block have their outer electron in the d orbital.

**Electron:** Negatively charged subatomic particles that orbit the nucleus at various energy levels. Relative mass of  $1/2000$ .

**Electron configuration:** The arrangement of electrons into orbitals and energy levels around the nucleus of an atom/ion. E.g. Ca:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ .

**Electron subshell:** Divisions of electron shells that have slightly different energy levels. The subshells have different numbers of orbitals which can each hold up to two electrons. The first four types of sub-shell are s, p, d and f.

**First ionisation energy:** The energy required to remove 1 mole of electrons from 1 mole of gaseous atoms to form 1 mole of gaseous  $1^+$  ions. For example,  $Mg_{(g)} \rightarrow Mg^+_{(g)} + e^-$ .

**Free radicals:** A species with an unpaired electron. These are represented in mechanisms by a single dot, e.g.  $Cl \cdot$ .

**Ground state:** The lowest allowed energy of an atom, molecule or ion. Where all the electrons are in their lowest energy configuration.

**Ion:** Formed when an atom/molecule loses or gains electrons. This gives it an overall charge - a positive charge if it has lost at least one electron and a negative charge if it has gained at least one electron.

**Isotope:** Atoms of the same element with the same number of protons but different numbers of neutrons in the nucleus, e.g.  $^{35}Cl$  and  $^{37}Cl$ .

**Mass number/Nucleon number:** The sum of the number of protons and neutrons in the nucleus of an atom.





**Neutron:** Neutral subatomic particle present in the nucleus of the atom. Relative mass of 1.

**Orbital:** A cloud of negative charge that can hold up to two electrons. Different orbitals have different shapes.

**p orbital:** A dumbbell-shaped region in which up to two electrons can be found. There are three p orbitals at right angles to each other, so in total, the p subshell can hold up to 6 electrons.

**Principle quantum number:** A number corresponding to the energy level of an electron.

**Proton:** Positively charged subatomic particle present in the nucleus of the atom. Relative mass of 1.

**s orbital:** Spherical and symmetrical regions around the nucleus, which can each hold up to two electrons.

**Second ionisation energy:** The energy required to remove 1 mole of electrons from each ion in 1 mole of gaseous  $1+$  ions to form 1 mole of gaseous  $2+$  ions (could be asked for any successive ionisation energy).

**Shell:** The energy level that an orbital is in around the nucleus of an atom. The shell closest to the nucleus is the first shell. The outermost shell that is occupied by electrons is the valence shell.

**Subatomic particles:** Subatomic particles are particles that are smaller than an atom, like neutrons, protons and electrons.

**Third ionisation energy:** The energy required to remove 1 mole of electrons from each ion in 1 mole of gaseous  $2+$  ions to form 1 mole of gaseous  $3+$  ions (could be asked for any successive ionisation energy).

