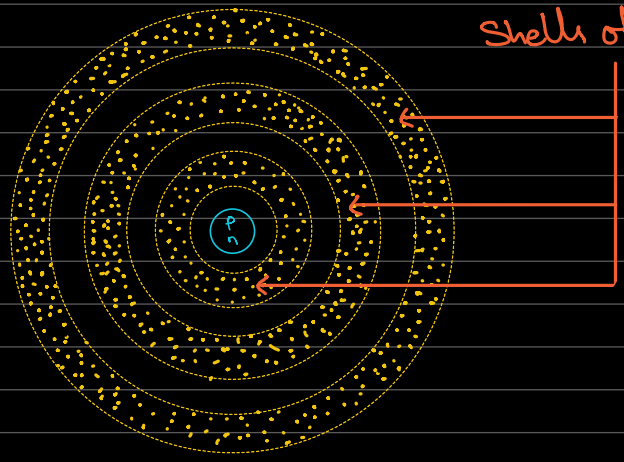
Atomic Structure: Energy Levels



As you go further from the nucleus, the energy levels increase

Bohr's Approach

- Elements (ie. metals) tend to change colour and release light energy when heated
  - ↳ Heating the element excites the electrons in the atom and causes them to jump from lower energy levels to higher energy levels
  - ↳ when the same element cools down, the electrons go back down to their initial energy levels, and in doing so, each electron releases a certain amount of energy. → These "certain amounts" are discrete packets of light/photons.

- And thus, the energy of the electron is quantised, ie. the electrons can only have discrete amounts of energy and nothing in between

Note: The distance between orbitals is the same for all elements.

↳ The discrete amount of energy gained or lost by each electron when jumping or dropping energy levels.

- The energy levels associated with different distances of the electron from the nucleus are called orbitals

- The main energy levels are numbered 1, 2, 3, 4, etc...
  - ↳ 1 being the lowest energy level (closest to the nucleus)

- Energy levels are also called "Principal Quantum Numbers"
  - ↳ 1st energy level → Principal Quantum Number 1

- Each main energy level consists of sublevels or subshells

1st energy level ⟶ Principal Quantum No. 1 ⟶ 1 sublevel
2nd energy level ⟶ Principal Quantum No. 2 ⟶ 2 sublevels
3rd energy level ⟶ Principal Quantum No. 3 ⟶ 3 sublevels

- The sublevels / subshells are labelled s, p, d, f, g, h... .
  (s, p: As; d: A2; f, g, h...: Not in syllabus)

  ↳ They originate from the "atomic spectra" of alkali metals
  → Scientists saw a series of lines, and gave them names.
  s → sharp, p → principal, d → diffuse, f → fundamental ... etc...

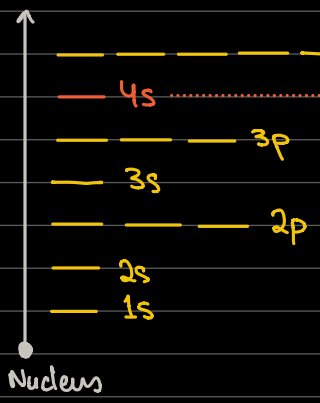
Energy Level	No. of Subshells	Name + Number of subshell(s)
1	1	1s
2	2	2s and 2p
3	3	3s, 3p, and 3d
4	4	4s, 4p, 4d, and 4f

- Each subshell consists of one or more orbitals
  ↳ each subshell contains an odd number of orbitals in which electrons are placed

Type of sublevel	No. of orbitals
s	1
p	3
d	5
f	7

- The total number of orbitals in a shell (Energy Level) $= n^2$ where n is the principal quantum number

Considering energy levels and orbitals together



→ Not everything is perfectly in order, because at further distances from the nucleus, there's some mixing between energy levels.