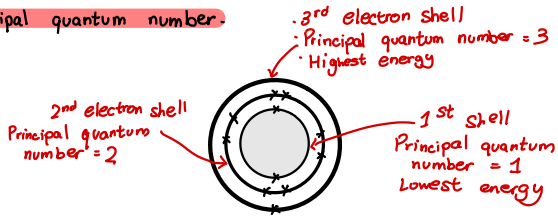
Electronic Structure

- Electrons move around the nucleus in regions of the atom called **shells or energy levels.**
- Each shell is given a number called the **principal quantum number.** The further a shell is from the nucleus, the higher its **energy** and the larger its **principal quantum number.**

! Forget the 2.8.8 rule learnt from GCSE!

- Maximum number of electrons on each shell = $2n^2$
  - First shell (n=1): $2(1)^2$ = 2 electrons
  - Second shell (n=2): $2(2)^2$ = 8 electrons
  - Third shell (n=3): $2(3)^2$ = 18 electrons
  - Fourth shell (n=4): $2(4)^2$ = 32 electrons



Sub-shells & Orbitals

→ An atomic orbital is a region around the nucleus that can hold up to **two electrons** with opposite spins.

- Two electrons in the same orbital must have opposite **up/down** spins.
- Not all electrons in a shell have the same energy. Why? Because of **sub-shells:**
- Shells are divided up into sub-shells and different electron shells have different numbers of sub-shells, which each have a different energy.

! A subshell is a subdivision of electron shells separated by electron orbitals.

·Google: In atomic theory and quantum mechanics, an atomic orbital is a mathematical function describing the location and wave-like behavior of an electron in an atom.

! Subshells have different numbers of orbitals which can each hold up to 2 electrons.

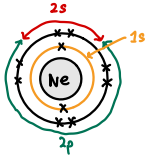
Sub-shell	Orbitals	Number of electrons stored
s	s	1 x 2 = 2
p	p p p	3 x 2 = 6
d	d d d d d	5 x 2 = 10
f	f f f f f f f	7 x 2 = 14

Shell	Sub-shell	Number of electrons
1st shell	1s	2 = 2
2nd shell	2s 2p	2 + 6 = 8
3rd shell	3s 3p 3d	2 + 6 + 10 = 18
4th shell	4s 4p 4d 4f	2 + 6 + 10 + 14 = 32

this does not mean 2 s sub-shells, it means ONE s sub-shell in the 2ND energy level

Electron Configuration

- The number of electrons that an atom or ion has, and how they are arranged, is called its **electron configuration.**
- Electron configurations can be shown in different ways.
- As an example for the configurations below, an atom of neon has 10 electrons: 2 electrons in the 1s sub-shell, 2 electrons in 2s sub-shell and 6 electrons in the 2p sub-shell.



1. Sub-shell notation

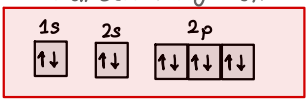
Neon electron configuration: $1s^2\ 2s^2\ 2p^6$

- Number of electrons
- Energy level (principal quantum number)
- Sub-shell

2. Arrows in boxes

- Each of the boxes represents one orbital (that can store 2 electrons).
- Each arrows represents one electron with their corresponding spins.

Neon electron configuration:



3. Energy level diagrams

- This one shows the energy of the electrons as well