Electron configurations to describe and communicate the arrangement of electrons around the nucleus of atoms.

Steps for determining electron configurations:

1. Identify how many electrons are in the atom or in ion.

   Example: Carbon has 6 electrons, Al^{3+} has 10 electrons.

2. Determine the principal energy level (*n*) of the atom

   n = 2 for carbon (it is in the second period), n=3 aluminum (it is in the third period).

3. Determine the number of sublevels.

   - For the principal energy level (n) there are sublevels (l= 0, 1, 2, 3, n-1).
   - Example: for n = 4, l = 0,1,2,3
   - Each sublevel has a letter name as:

l = 0	l = 1	l = 2	l = 3	l =4
S	P	d	f	g

   - Maximum electrons in each subshell:

S	P	d	f	g
2	6	10	14	18

4. Assign electrons to the sublevels as: $nl^{\#e}$ follow the order of the subshells (aufbau rule = building-up principle) in the periodic table: Move from top to the bottom periods (rows) in order & from left to right of each period (row).

Aufbau Parodic Table																		
n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1S																	1S
2	2S												2p					
3	3S												3p					
4	4S		3d										4p					
5	5S		4d										5p					
6	6S		4f	5d									6p					
7	7S		5f	6d														

In order as: 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p…

- *1s* will be filled first, with the maximum of 2 electrons.
- *2s* will be filled next, with the maximum of 2 electrons.
- *2p* will be filled next, with the maximum of 6 electrons.
- *Continue until no* any electrons left.

Example: write electron configuration for titanium (Ti) atom.

- Look at the periodic table, atomic number is 22. (For a normal atom, atomic number gives number of electrons).
- Follow the subshells order (aufbau rule):
  n = 22

  $_{22}Ti$: $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $4s^2$, $3d^2$

Also, an abbreviated method for electron configurations is to use the Core Electrons (Noble Gas Core) for presentation of electron configuration:

- Choose the nearest noble gas to the element in your question.
- Use square brackets [ ] around the chemical symbol of the noble gas.
- Continue to write remaining subshell after the noble gas core.

An Example: Write electron configuration for potassium atom.

Solution:

- The nearest noble gas element to the potassium is argon (Ar).
- The electron configuration for argon is:
  Ar: $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$
- The electron configuration for potassium is:

  K: $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^1$

- As we see Potassium has an argon core plus $4s^1$
- The abbreviated electron configuration for potassium is:
  K: [Ar] $4s^1$

An Example: Write electron configurations for vanadium atom and vanadium ion (V^{3+}).

Answer:

$$V: \quad [Ar]\ 4s^2, 3d^3$$

$$V^{3+}: [Ar]3d^2$$

Special rule:

In general, electrons are removed from the valence-shell *s* orbitals before they are removed from valence *d* orbitals when transition metals are ionized.