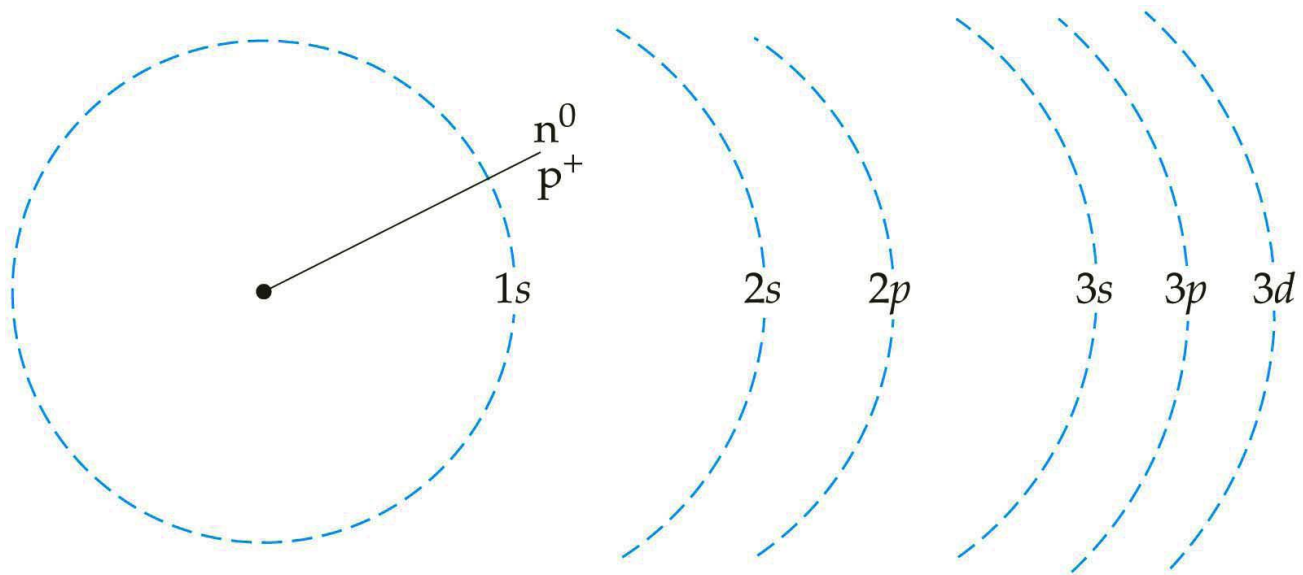


# Energy Levels and Sublevels

- Electrons occupy energy sublevels within each level.
- These sublevels are given the names: s, p, d, f.
- These names are in reference to the sharp, principal, diffuse, and fine lines in emission spectra.
- The number of sublevels in each level = the number of the main level.
- The first energy level has 1 sublevel: 1s
- The second energy level has 2 sublevels: 2s & 2p
- The third energy level has 3 sublevels: 3s, 3p, & 3d



- **Each sublevel can hold different number of electrons:**
  - s holds a maximum of 2 electrons.
  - p sublevel holds a maximum of 6 electrons.
  - d sublevel holds a maximum of 10 electrons.
  - f sublevel holds a maximum of 14 electrons

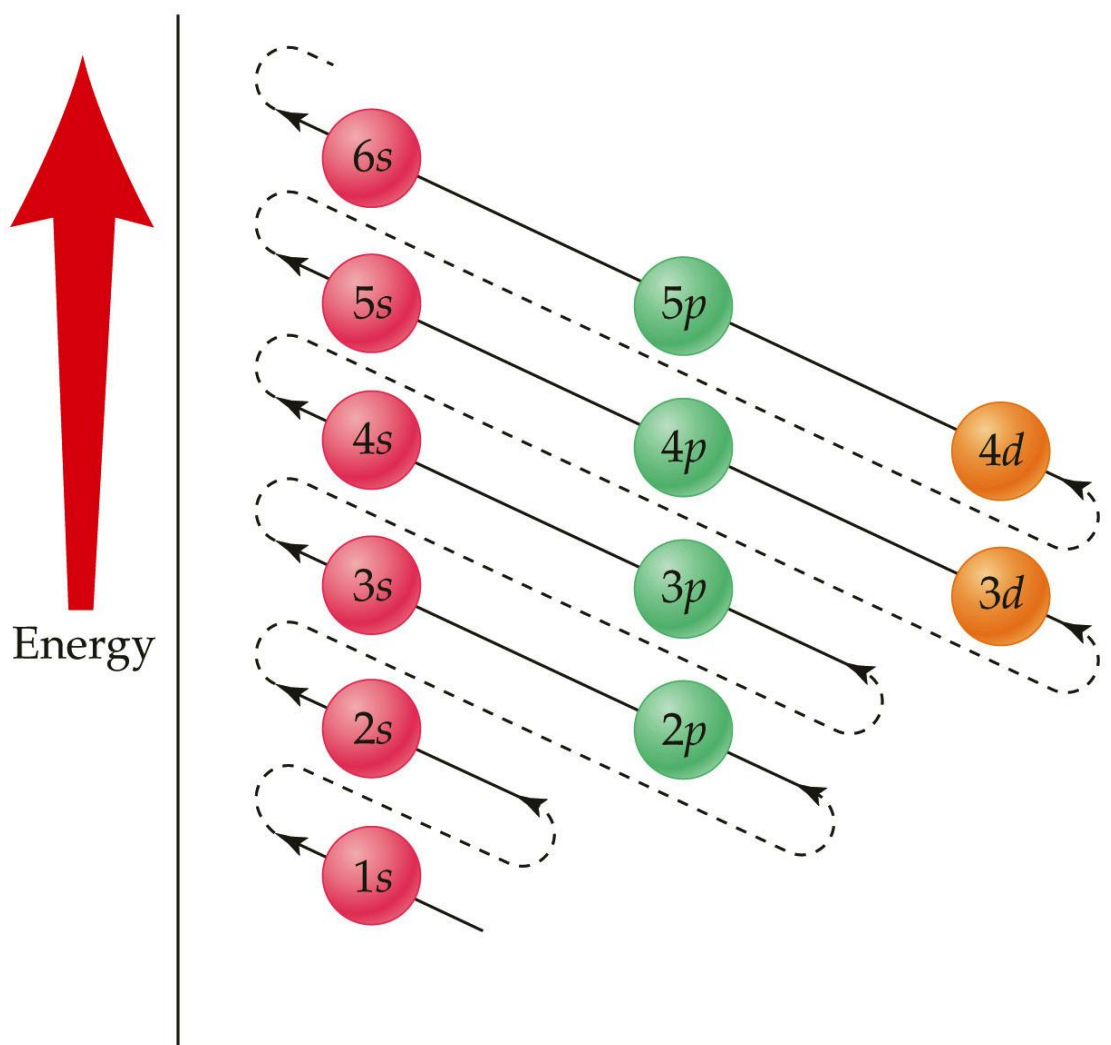
***Distribution of Electrons per Energy Level and Sublevel***

| ENERGY LEVEL | ENERGY SUBLEVEL | MAXIMUM ELECTRONS IN SUBLEVEL | MAXIMUM ELECTRONS IN ENERGY LEVEL |
|--------------|-----------------|-------------------------------|-----------------------------------|
| 1            | 1s              | 2e <sup>-</sup>               | 2e <sup>-</sup>                   |
| 2            | 2s              | 2e <sup>-</sup>               | 8e <sup>-</sup>                   |
|              | 2p              | 6e <sup>-</sup>               |                                   |
| 3            | 3s              | 2e <sup>-</sup>               | 18e <sup>-</sup>                  |
|              | 3p              | 6e <sup>-</sup>               |                                   |
|              | 3d              | 10e <sup>-</sup>              |                                   |
| 4            | 4s              | 2e <sup>-</sup>               | 32e <sup>-</sup>                  |
|              | 4p              | 6e <sup>-</sup>               |                                   |
|              | 4d              | 10e <sup>-</sup>              |                                   |
|              | 4f              | 14e <sup>-</sup>              |                                   |

- The first electrons fill the energy sublevel closest to the nucleus.
- Electrons continue filling each sublevel until it is full and start filling the next closest sublevel.

### ***Filling Diagram for Sublevels:***

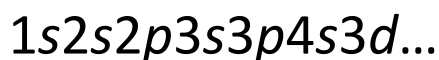
- The order does not strictly follow 1, 2, 3, etc.
- Using the figure we predict the order of sublevel filling.



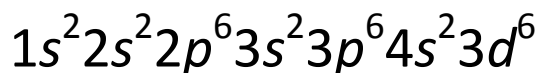
*Electron configuration*= shorthand writing of the location of electrons by sublevel.

- The sublevel is written followed by a superscript with the number of electrons in the sublevel.
- If the  $2p$  sublevel contains 2 electrons, it is written  $2p^2$
- The electron sublevels are arranged according to increasing energy.
- *Example*: Determine how many electrons are in the atom. Iron (Fe) has 26 electrons.

- Arrange the energy sublevels according to increasing energy (use the sublevel filling chart):



- Fill each sublevel with electrons until you have used all the electrons in the atom:



- The sum of the superscripts equals the atomic number of iron (26)