When we talking about atomic weight, we are talking about average mass of the atom, counting all his isotopes. We call it **relative atomic mass A_r.**

The relative atomic mass $\mathbf{A_r}$ of an element is the average of the masses of the isotopes relative to the mass of 1/12 of an atom of carbon-12. We consider the mass of 1/12 of an carbon-12 as 1, the masses of the elements are multiples of that.

Because this mass is relative it does not have units.

Electron configuration

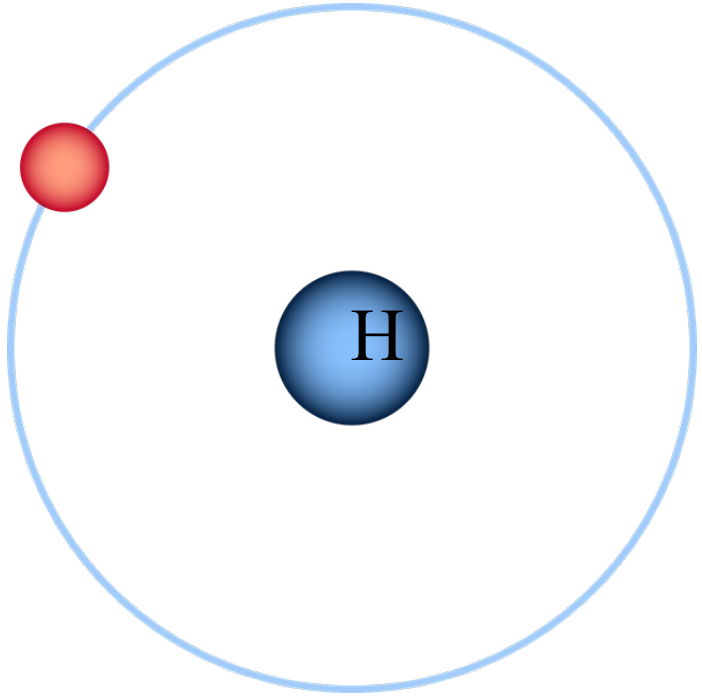
What are electrons?
Where are electrons in the atom?
What role do they play in elemental properties and can they be predicted based on the electron configuration of the atoms?

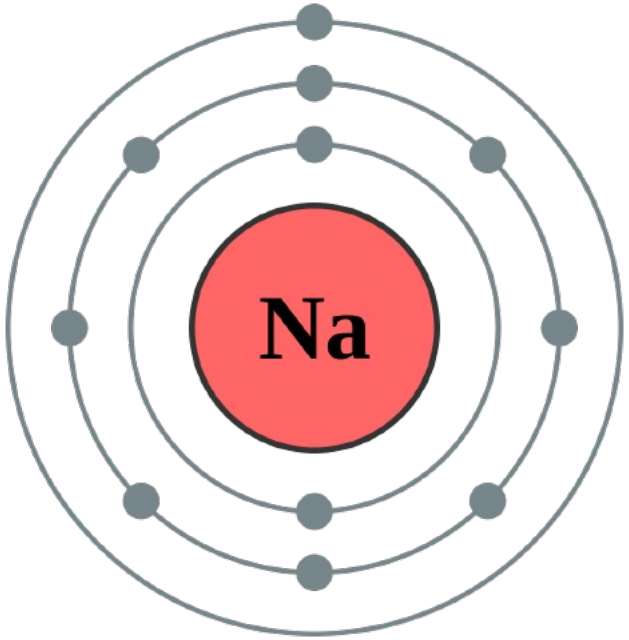
The electrons arrangement in the atoms define chemical properties of the elements.

Reminder: **element** is a substances where atoms have the same charge of the nucleus.

Models of an atoms are THEORY.

This theory will help us to explain and predict many properties of substances around us.





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Bohr's model

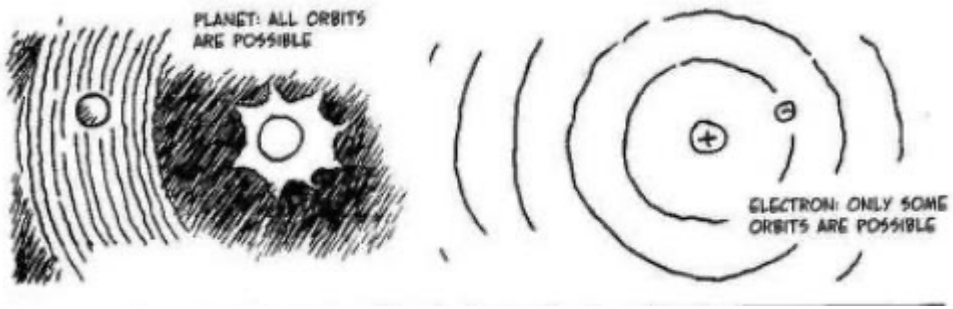
There are rules how electrons occupy its electron cloud (imagine that the cloud is a “city”).
They have shells, also called energy levels; 1, 2, 3….,7 (“streets”).
They have sublevels (“houses”), they are called 1s, 2s and 2p, 3s, 3p, 3d, 4s, 4p, 4d, 4f etc.

One s, three p, five d and seven f are orbitals (“rooms”), electrons occupy this orbitals.

The first rule: no more then two electrons per “room” (orbitals).

How electrons go to these different levels (shells), sublevels, orbitals.

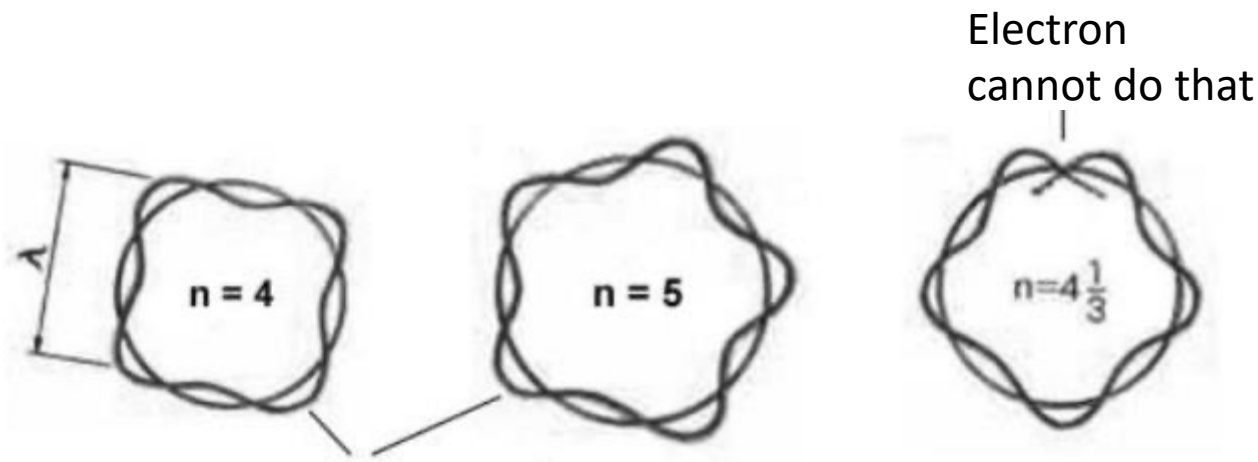
Electron has a mass, charge, spin and wavelength. Because it is not only particle, but a wave, the electron position is always uncertain. So the electron occupy not some orbit (like the planets do), but probabilistic cloud.



Electron must jump to an orbit with a whole number of wavelength. Only some orbits are possible. In any given atom, the electron can assume only certain discrete energy level (electron can occupy only certain “street”, “house”, “room”).

Planets can occupy any orbits. An electron must occupy an orbit around the nucleus that is consistent with the whole number of wavelength – n is a whole number.
The numbering starts from the nucleus.
We will call these orbits “shells”. Each shell has a number starting from the nucleus.
This number is called principal quantum number.

We can also visualize electron as a wave, beaming around the nucleus. Quantum mechanics tells us that the electron is always a “standing wave” that is it “goes around” the nucleus a whole number of wavelength, but never a fractional value.



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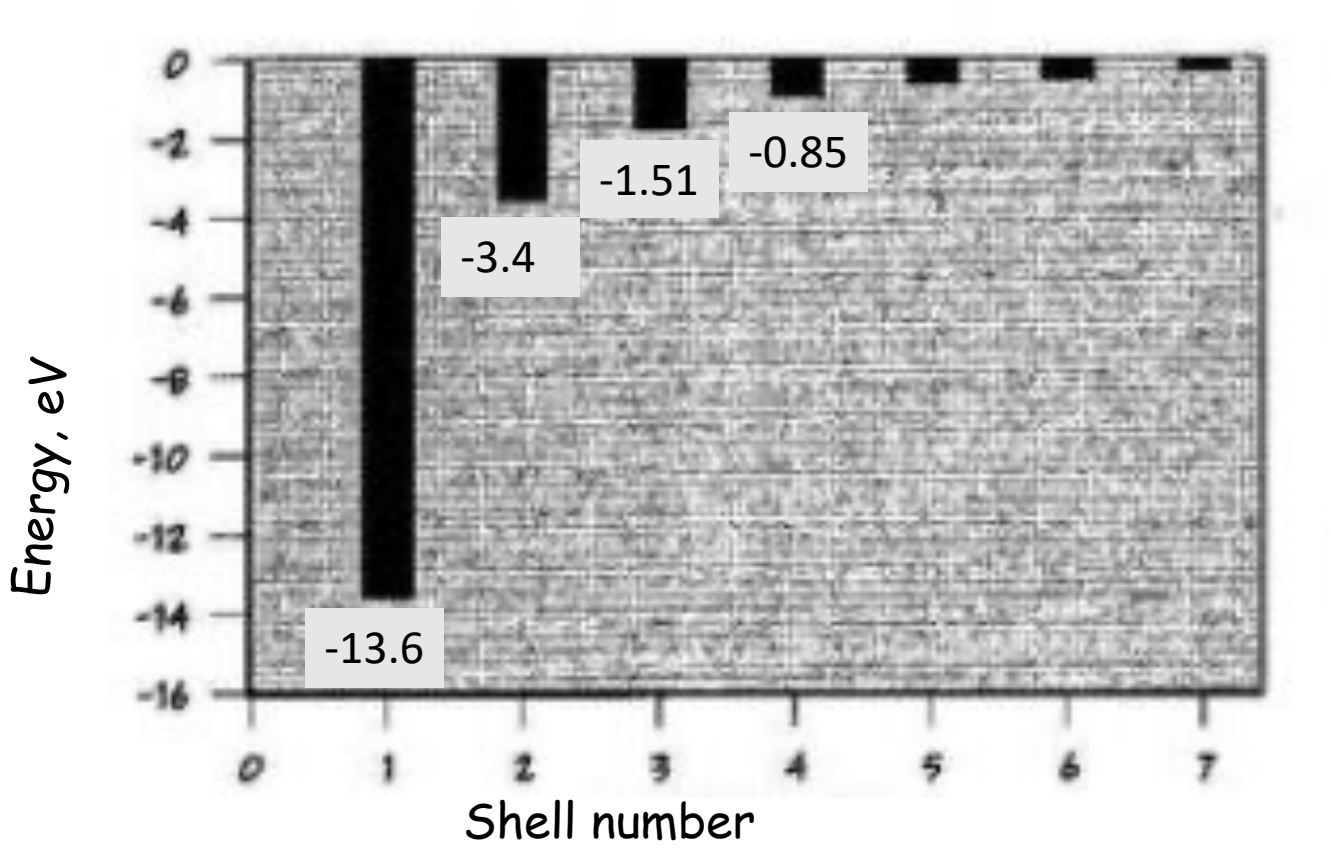
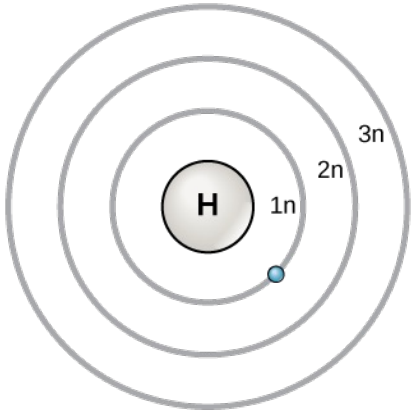
Electron’s energy (it is negative) in the energy levels(shells).



eV – electron volt, one eV is the energy gained by one electron pushed by 1 volt.



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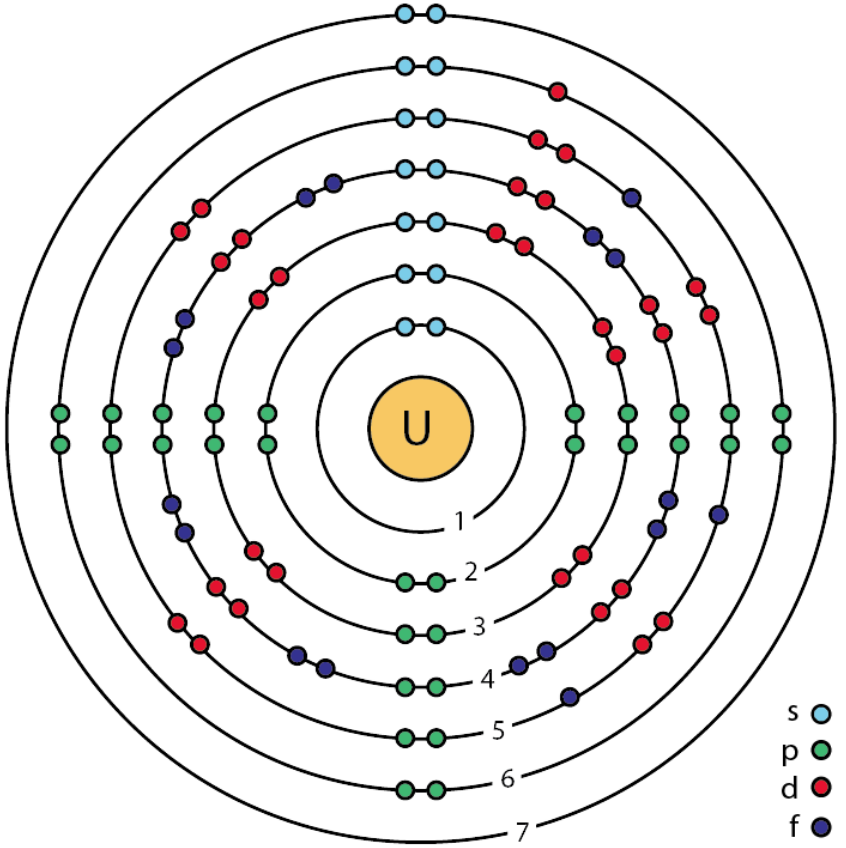

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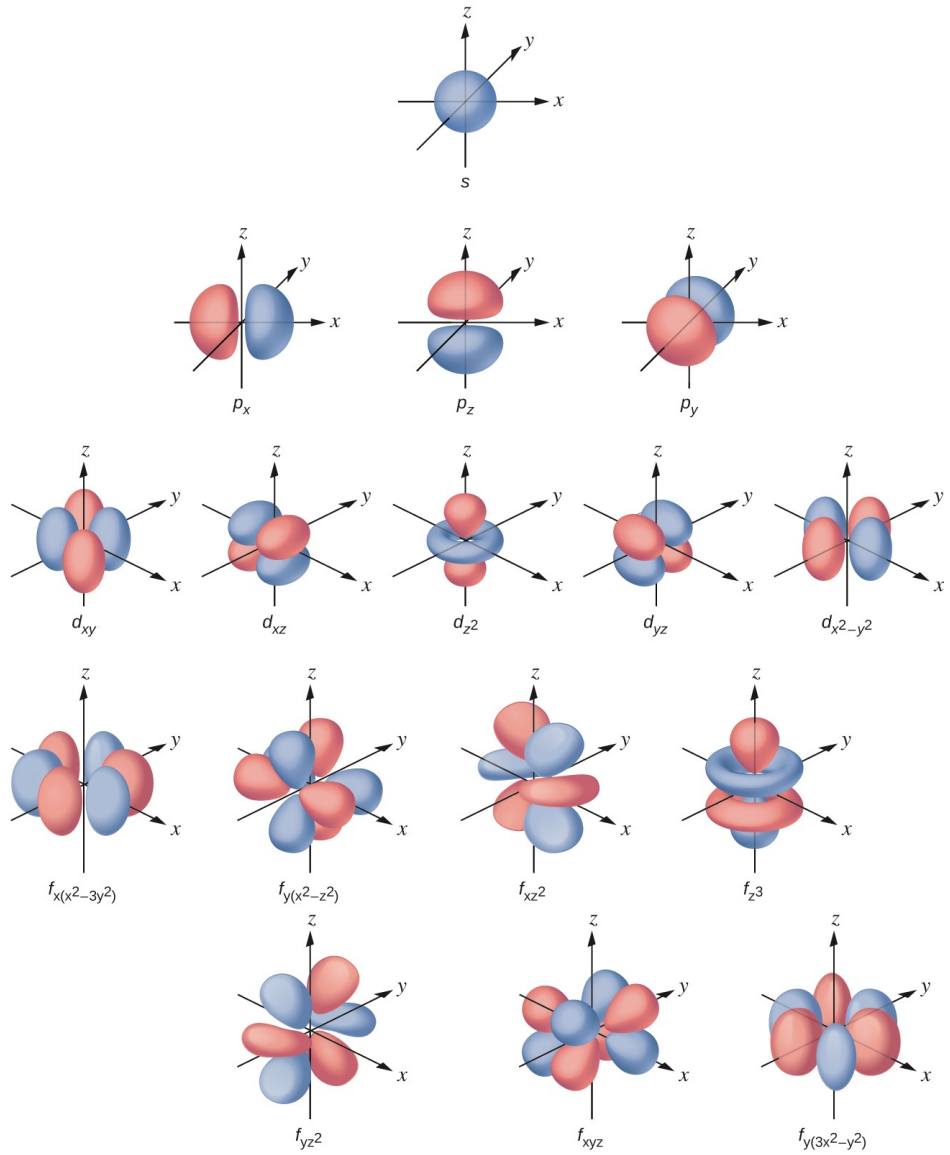
s, p, d and f - sublevels



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s, p, d and f orbitals describe 95% probability that we find electrons there. In other words, an orbital is a region in which there is high probability of finding an electron.

The number of orbitals in each energy level.

Shells (levels)	Sub-levels			
	s	p	d	f
1	1			
2	1	3		
3	1	3	5	
4	1	3	5	7

Main energy level number	1	2	3	4	5
Maximum number of electrons	2	8	18	32	50

The number of electrons is equal to the number of protons.
Electrons inhabit the closest to the nucleus shells and orbitals.
Each shell and each orbital can hold just a certain number of electrons.
The maximum number of electrons that each shell can have is $2n^2$
n is the main energy level number (principal quantum number)

Energy level	Sublevels				Number of electrons			
					s	p	d	f
1	1s				2			
2	2s	2p			2	6		
3	3s	3p	3d		2	6	10	
4	4s	4p	4d	4f	2	6	10	14

First we fill the lowest energy levels. We completely fill level 1, then level 2. Then we jump to level 3 and fill it with 8 electrons, then the electrons go to the 4^{th} level. This scheme works smoothly up to element number 20 (Ca).