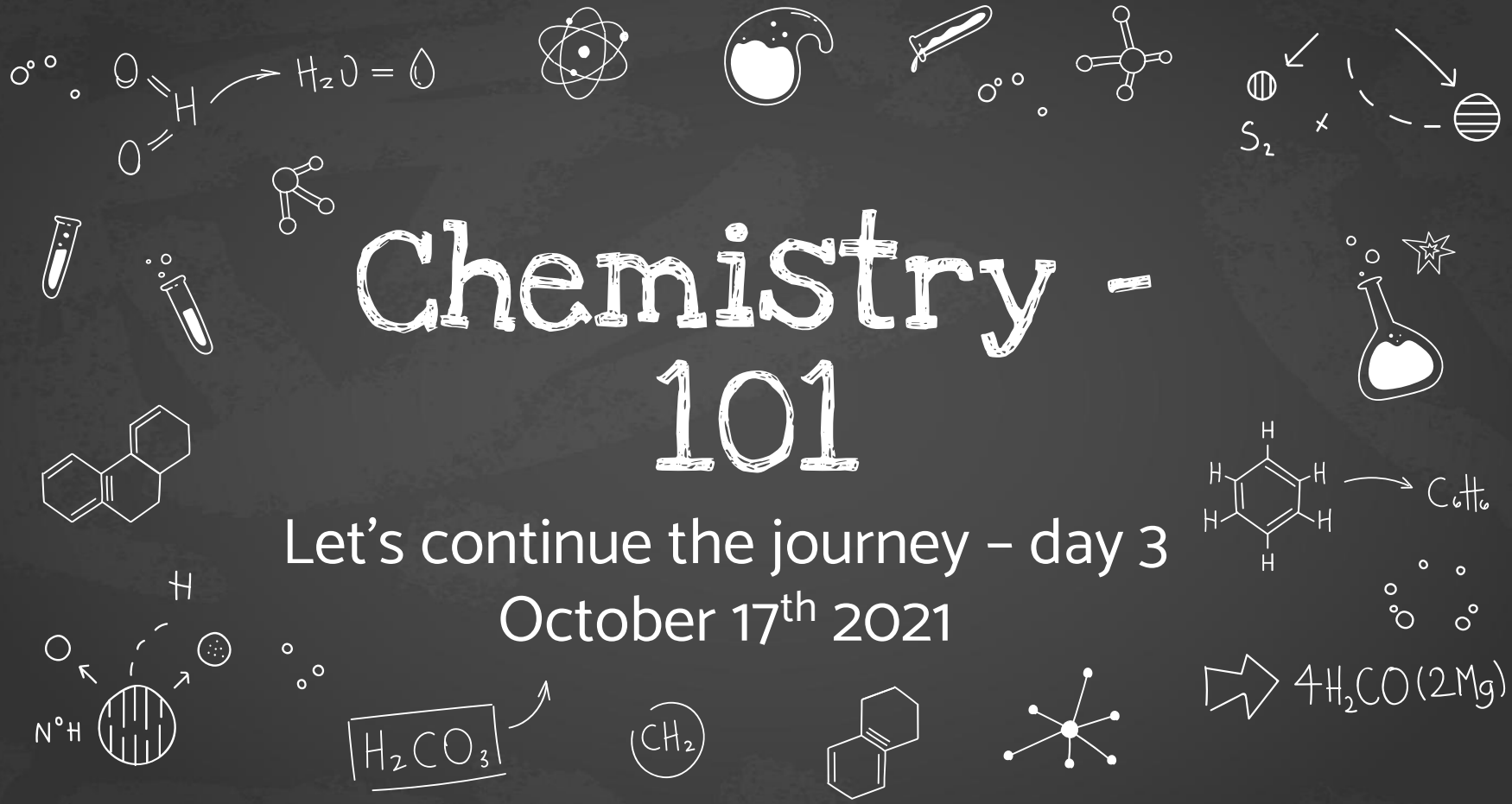
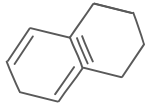


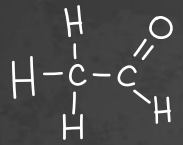
Chemistry - 101

Let's continue the journey – day 3

October 17th 2021

Electrons





$Ca^2(HO)$

Ng^3

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?

$$a_{n+1} - a_n = 0n$$

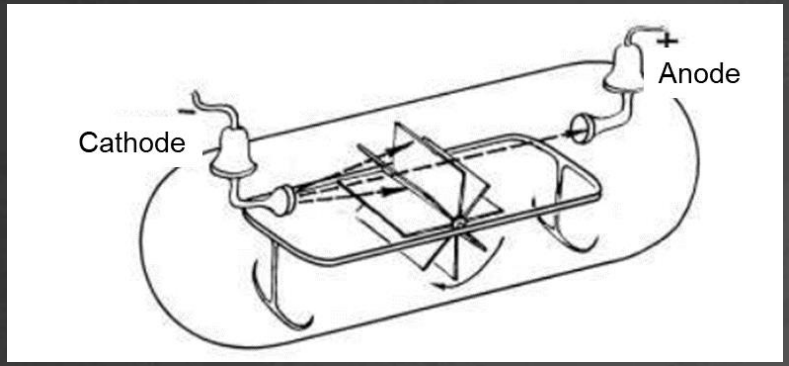
We will be only talking about MODELS of the electron shells of atoms

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

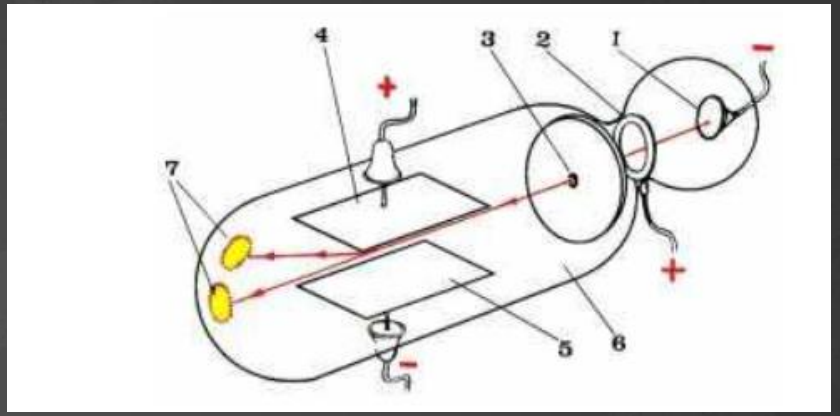
The basis of the atomic structure is the force of attraction between the negative electrons and the positive nucleus. It is governed by

Coulomb's law: $F = K (q_1 q_2)/r^2$

Electrons and protons

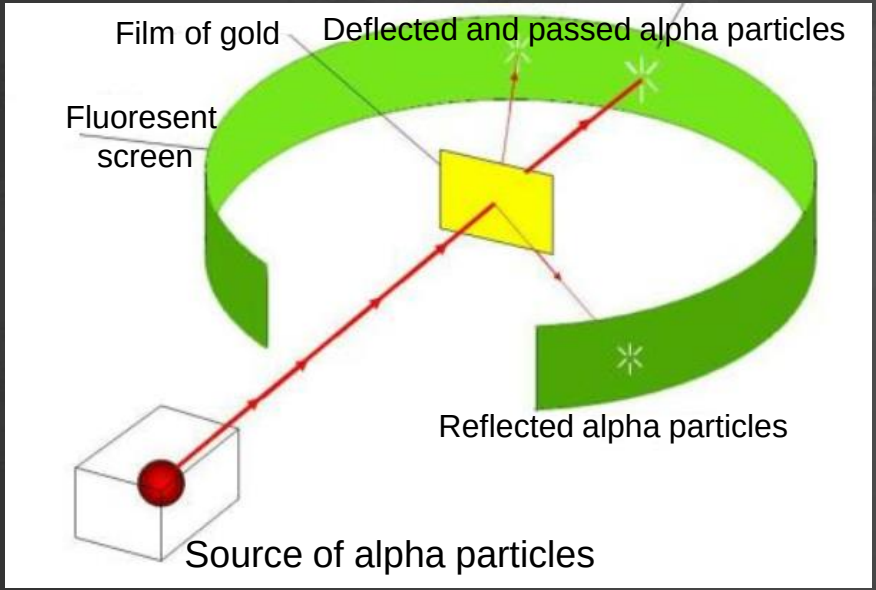


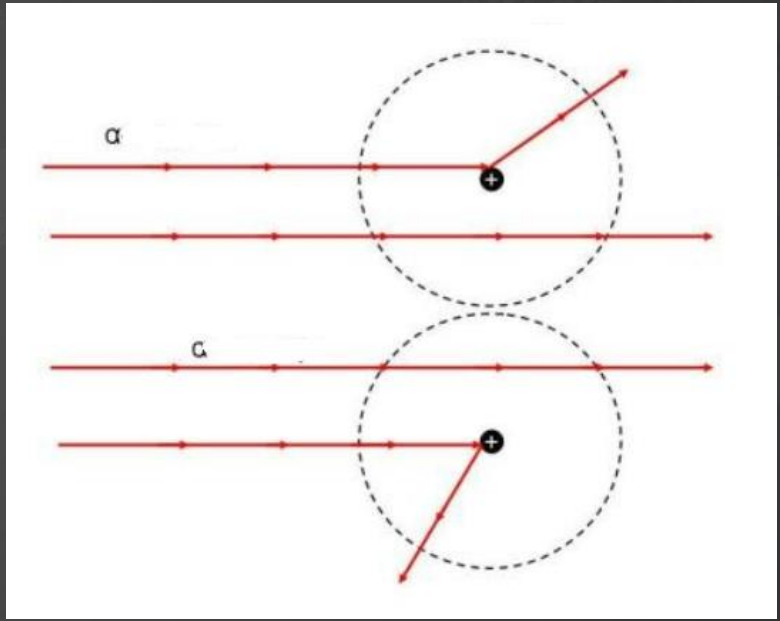
Discharge tube (cathode ray)



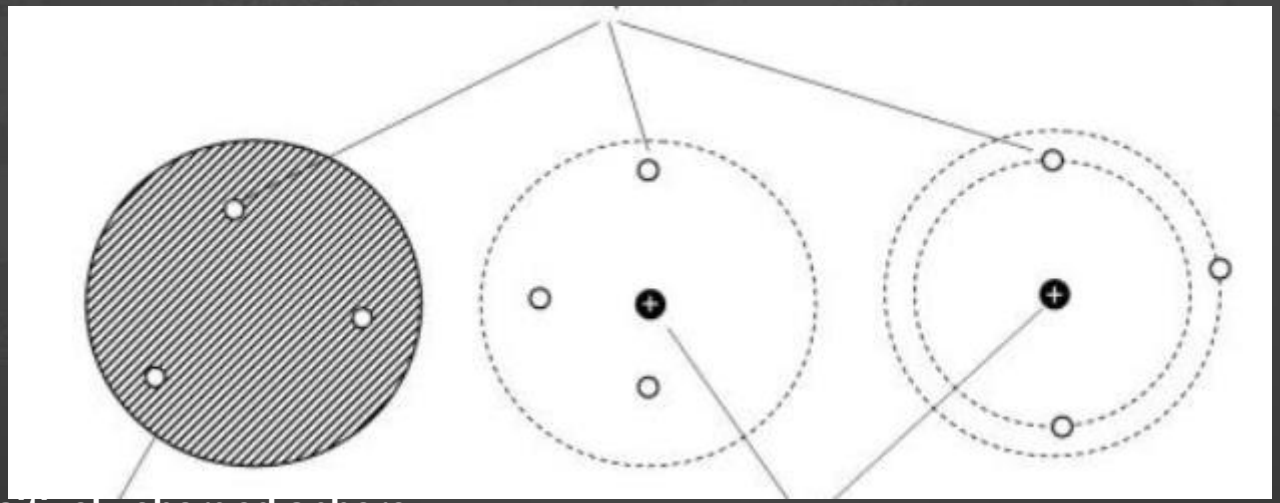
Thomson's cathode ray tube
1 – cathode; 2 – anode; 3 – hole; 4 and 5 – electrodes to bend the rays; 6 – phosphorescent coating, 7 – phosphorescent spots.

Rutherford's experiment



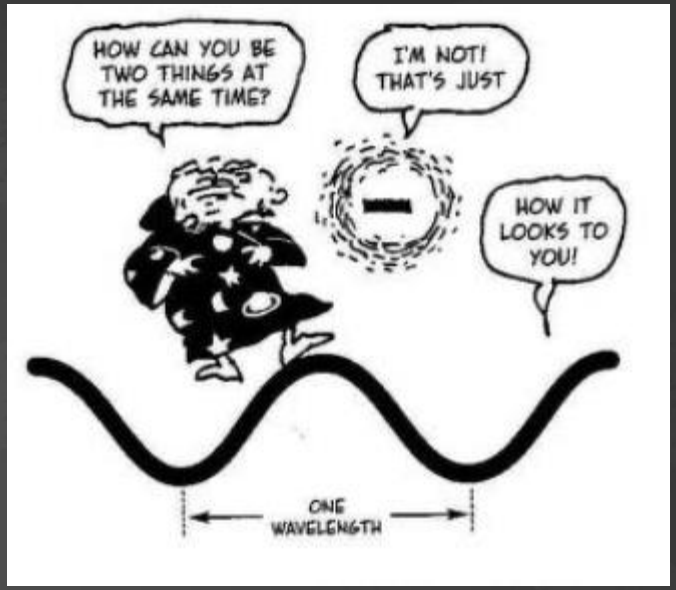


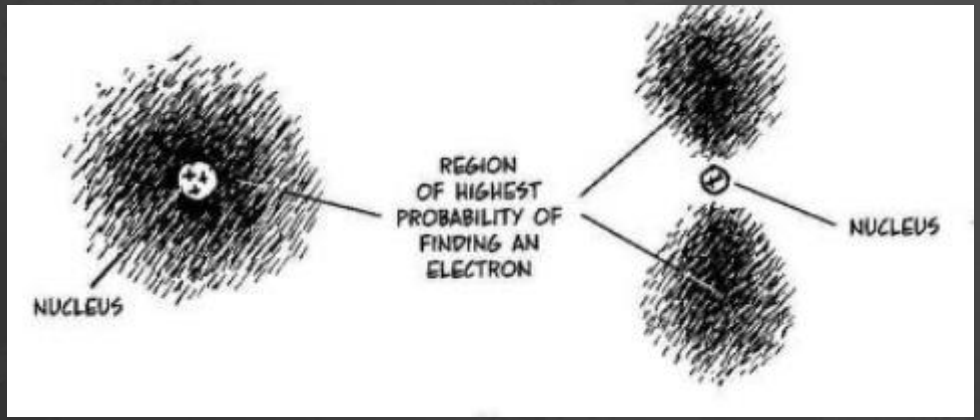
Atomic models



Electrons obey the bizarre rules of **quantum mechanics**

An electron is both a particle like a marble (it has mass, charge, spin) and a wave (it has a wavelength) as a beam of light

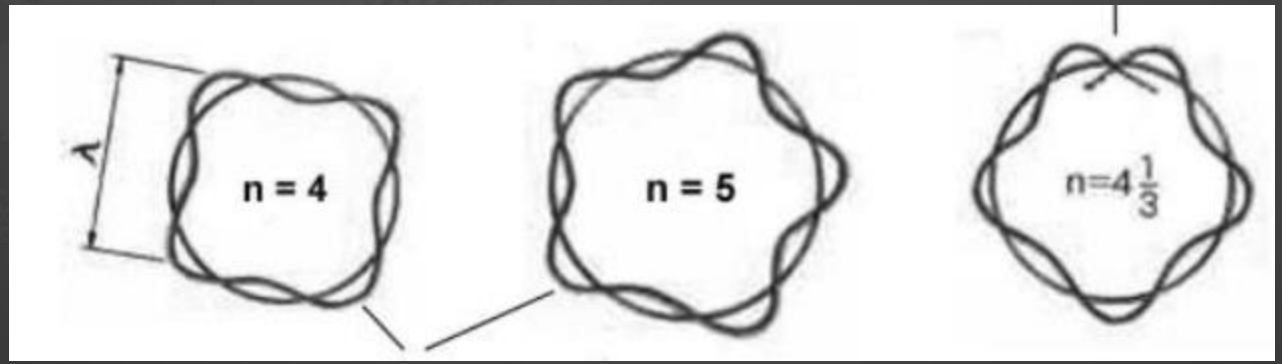




An electron inhabits a "probability cloud" with the densest parts of the cloud being where the electron is likeliest to "be" - if it can be said to be anywhere, which it can't exactly

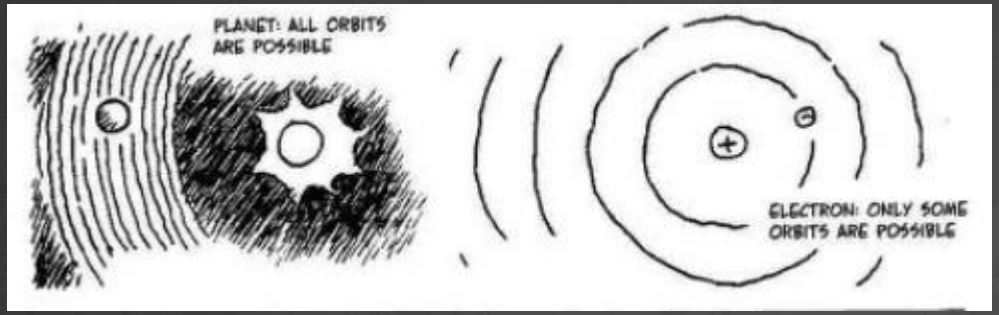
We can also visualize electron as a wave, beaming around the nucleus. Quantum mechanics tells us that the electron is always a "standing wave" that is it "goes around" the nucleus a whole number of wavelength, but never a fractional value.

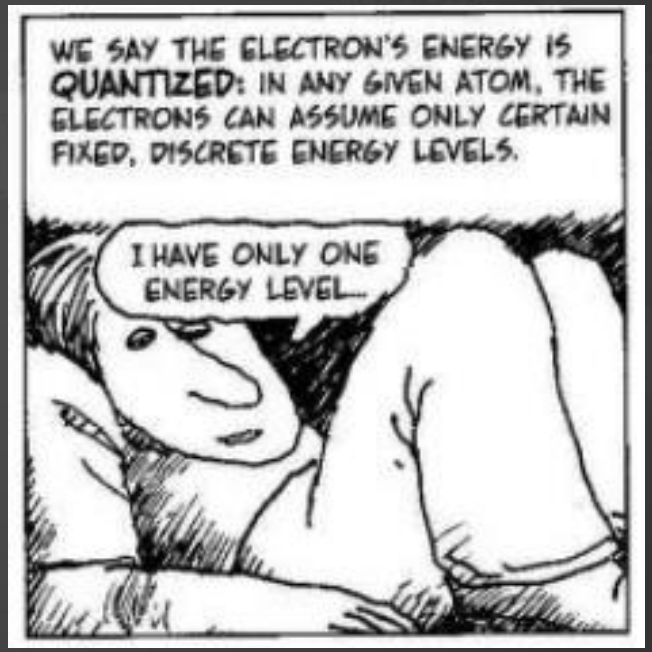
Never



OK

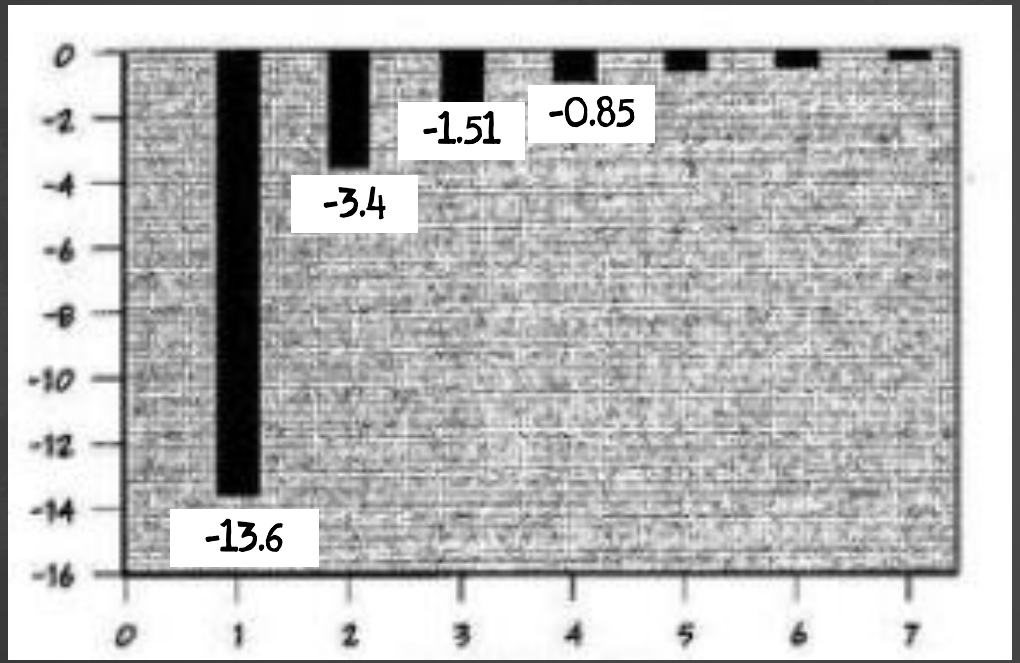
The Bohr Model is a **planetary model** in which the negatively charged electrons orbit a small, positively charged nucleus similar to the planets orbiting the sun.

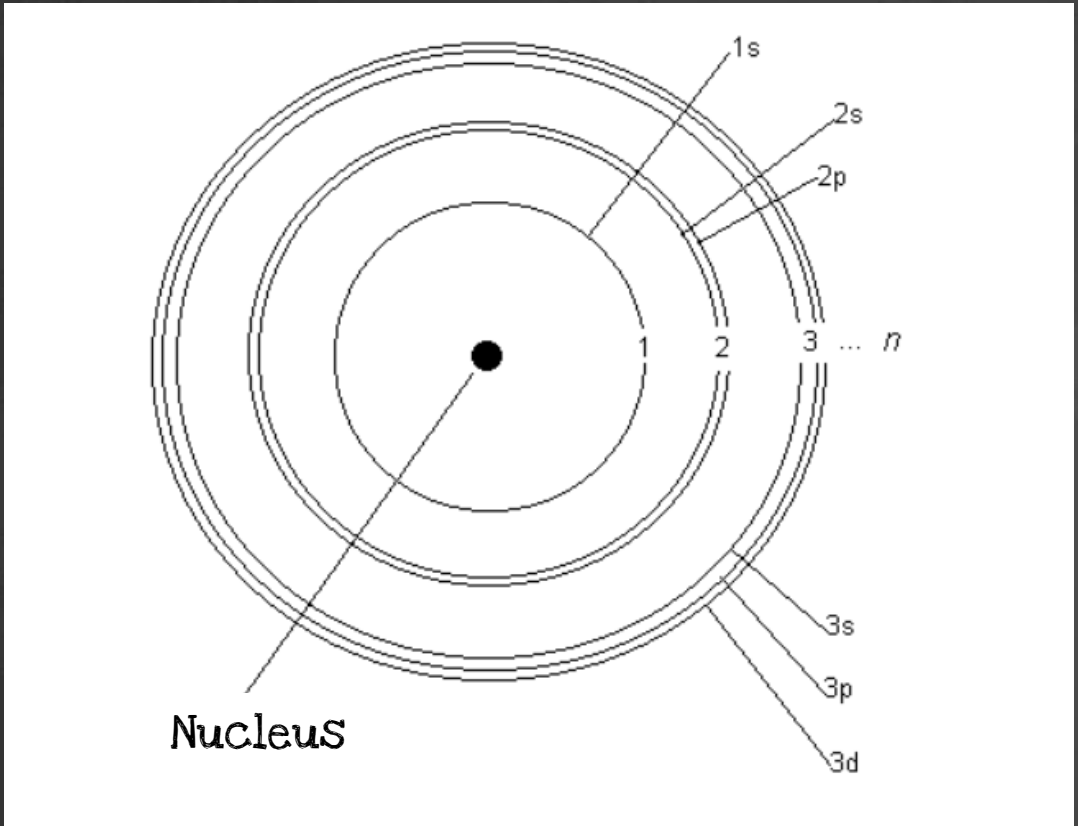




An electron must occupy an orbit around the nucleus that is consistent with the whole number of wavelength - n is a whole number.
The numbering starts from the nucleus.
We will call these orbits "shells". Each shell has a number starting from the nucleus. This number is called **principal quantum number**.

Electron's energy in each shell





Shells consist of electron configurations that are close in energy and are called "orbitals". You can think of these orbitals as energy sublevels.

Different sublevels are called s, p, d, and f, and each orbital can hold **up to two electrons**

- 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 $2n^2$**

Shells and subshells

- The number of subshells within any level is equal n (the shell number)

Shell number (n)	Sub-shell
1	s
2	s, p
3	s, p, d
4	s, p, d, f

Sub-shell	Number of orbitals	Maximum number of electrons
s	1	2
p	3	6
d	5	10
f	7	14