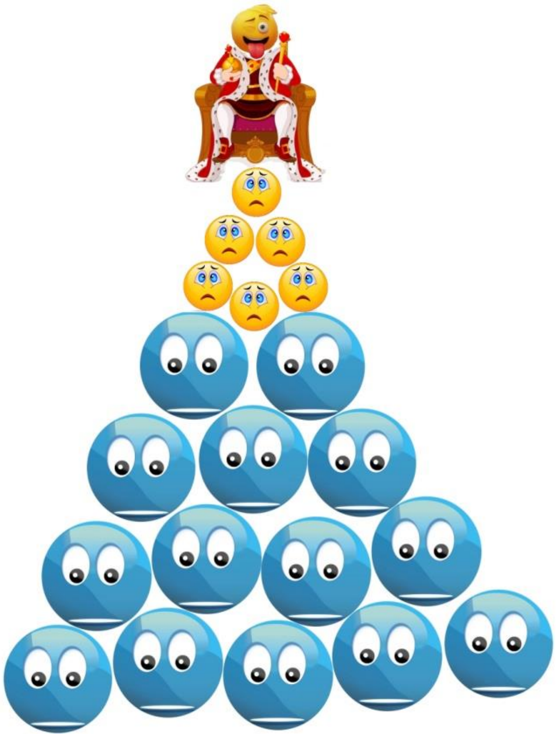
What determines the properties of chemical elements?

Science claims that the properties of elements are determined by the number of electrons in the outer orbit of atoms. That is, the addition of just one, insignificant (in a comparative sense) electron leads to the transformation of a metal into a non-metal, a non-metal into a halogen, a halogen into a noble gas, a noble gas back into a metal?! No qualitative changes in the structure of the atom, but only the addition of one electron?!



Let us consider how the chemical properties of elements are actually determined by the structure of their nuclei.
Our entire Universe is permeated with the smallest particles - fragments of the Big Bang and particles emitted by "modern" space objects. Let's call them **Uni** (from the words universal, united, Universal).
As mentioned above, the nuclei from all sides are subjected to the pressure of, which are then reflected from their surface. When reflected from an ideal sphere, they fly out symmetrically and evenly in all directions. There is no preferred direction. Thus, the space surrounding the sphere does not change at all, it is not disturbed, it is not indignant at its presence, it simply does not notice it. When reflected from real nuclei, the direction and density of the reflected particles depends on the shape of the nuclei. For example, Fig.1 schematically shows the reflection of particles **Uni** from a nucleus of three nucleons.

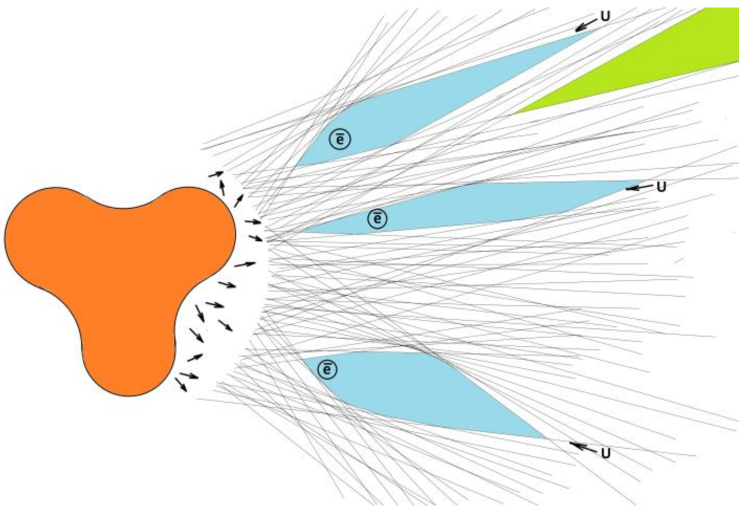


Fig.1

As you can see, the reflected particles "bypass" some areas (blue). Thus, if in these zones there is, say, an electron, then it, pushed from outside by **Uni**, will remain there in the indicated places (closer to the nucleus) as in a trap.
Doesn't this picture remind you of a picture of electron orbitals in atoms - the places where electrons are most likely to be?!

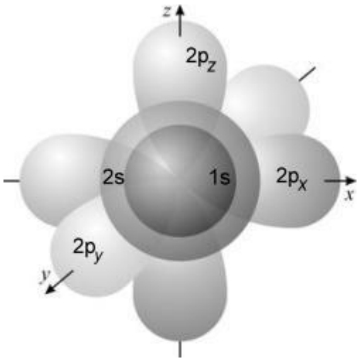


Fig.2

Note one more interesting area around the core (light green color). In this direction, the **Uni** are not reflected by the nucleus at all, and, therefore, other elementary particles or atoms of elements will be attracted from there to the nucleus.
However, this also applies to very narrow directions, shown by arrows from the **U** on the outside of the blue lagoons. These are the directions of the so-called valence bonds.
And not at all fly electrons around the nucleus in blurred orbits, and they do not jump from one orbit to another, emitting and absorbing quanta, but quietly splashing around in blue lagoons, arranged by a mighty nucleus and ubiquitous **Uni**.

Each of the chemical elements has only such inherent zones of the location of electrons and valence bonds. As a rule, the directions of these valence bonds "flow" from the tops of nuclear nucleons or the troughs between them (see Fig.1).
For example, in the shell of the oxygen nucleus there are two strongly protruding nucleons. If radius vectors are drawn from the center of the nucleus to these nucleons, then the angle between them will be **105** degrees. This is exactly the angle of valence bonds in a water molecule!

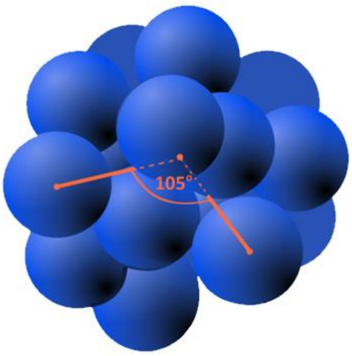


Fig.3

In the nucleus of a beryllium atom, a deep cavity and a sharp apex are on opposite sides of the nucleus. That is why the angle of valence bonds in **BeF_2** and **BeH_2** molecules is **180** degrees.

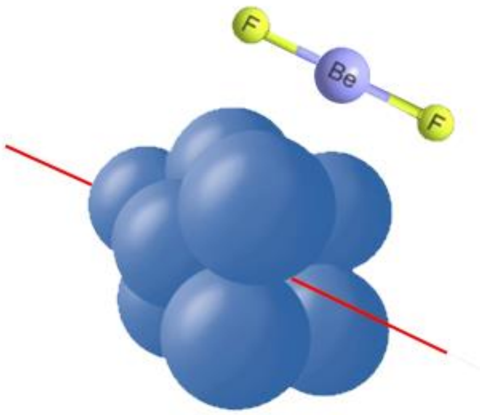


Fig.4

Ammonia **NH3** (Fig.5) has bond angles of **109** degrees, since the tetrahedral structure is clearly traced in the nitrogen nucleus. The nucleus of the nitrogen atom has the shape of a poppy head, at the base of which is a regular hexagon. In the Fig.5 core is inverted for clarity. If you draw dashed rays from the center of the nucleus to the three nucleons of the base, which form a regular triangle, the angle between these rays will be exactly **109** degrees! It is in the direction of these rays that the hydrogen atoms will be located.

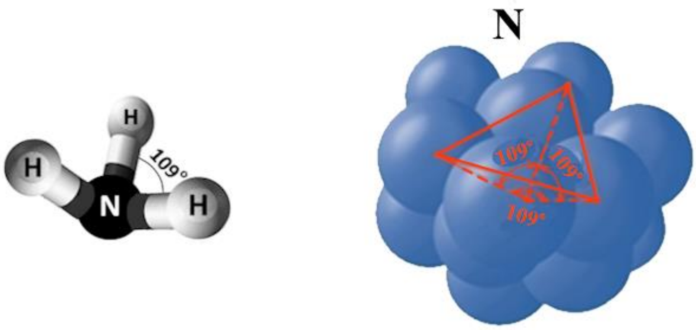


Fig.5

With the methane molecule, it is even more obvious. In view of the absolute symmetry and the ideal tetrahedral structure in the nucleus of the carbon atom, one more axe of bond with the hydrogen atom is simply added (Fig.6).

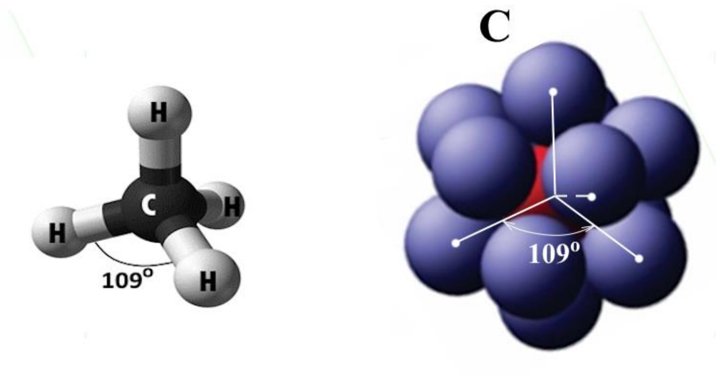
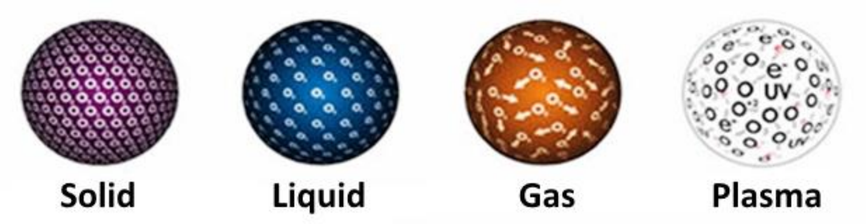


Fig.6

This is how the morphology of nuclei determines their properties and relationships.

Aggregate states of matter



We are told that when heated, due to the intensification of the chaotic movement of atoms, the bonds between them are broken, and the solid goes into a liquid state, and then into a gaseous state.

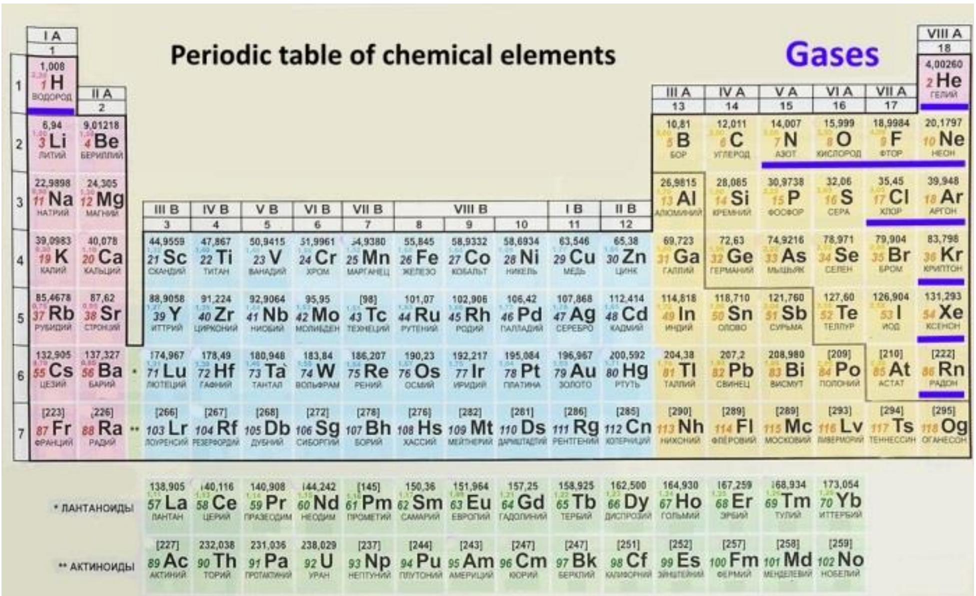
In fact, when heated, infrared photons from a heat source penetrate into the nuclei.

These particles from the inside, as it were, push the nucleons apart, leveling the surface of the nucleus, thereby eliminating the surface inhomogeneities, due to which interatomic bonds are realized (Fig.1). This occurs similarly to the process of inflating a balloon, when its shape approaches spherical with each portion of air. Interatomic bonds become more unstable as a result of which atoms begin to vibrate.

Not interatomic bonds are broken due to the movement of atoms, but the movements of atoms are caused by the weakening of bonds!

At a certain temperature, all bodies turn into steam. The physical differences between steam and gas are only in the temperature of the substance, because gases remain gases even at low temperatures. But, after all, many elements have the sphericity of the nucleus no worse than that of gases and, nevertheless, are not gases.

It seems to me that apart from this there must be one more difference between gases and other elements. Look, out of **118** elements of the periodic table, only **11** are gases. Moreover, among the top ten elements there are as many as **6** gases!



It is clear, you say, gases, after all, lungs. But what about heavy gases, say, radon, which is heavier than lead? It's all about free space, the void between the "inner core" and the shell of the nucleus.

In the second period of the periodic table, gases begin immediately after carbon, inside the spherical shell of the nucleus of which there is one nucleon. The following gases: **nitrogen**, **oxygen** - have the one and same nucleon inside the shell, but for him alone there is too much space, emptiness inside the shell. This is shown very schematically in the Fig.8.

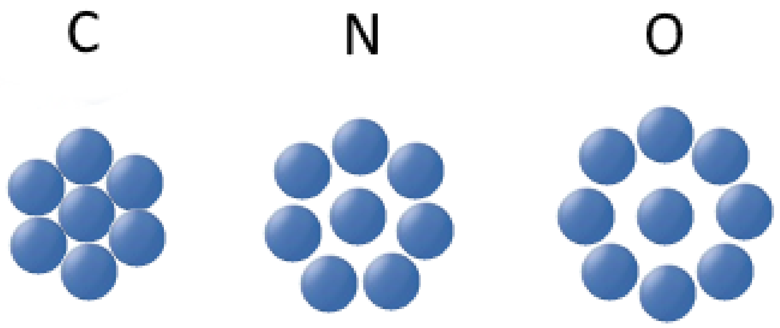


Fig.7

Uni are reflected from the inner nucleus and fly out of the shell each time in a different way, thereby changing the position of the bonding zones (Fig.1). This is because the inner nucleus, thanks to the emptiness around it, is mobile. It does not cling to the shell nucleons, but, like a ball in a jingle bell, flies around the entire nucleus under the nonequilibrium action of **Uni**. This is shown very schematically in the Fig.8.

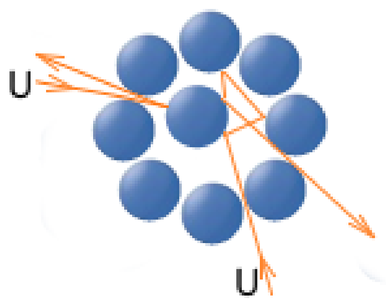
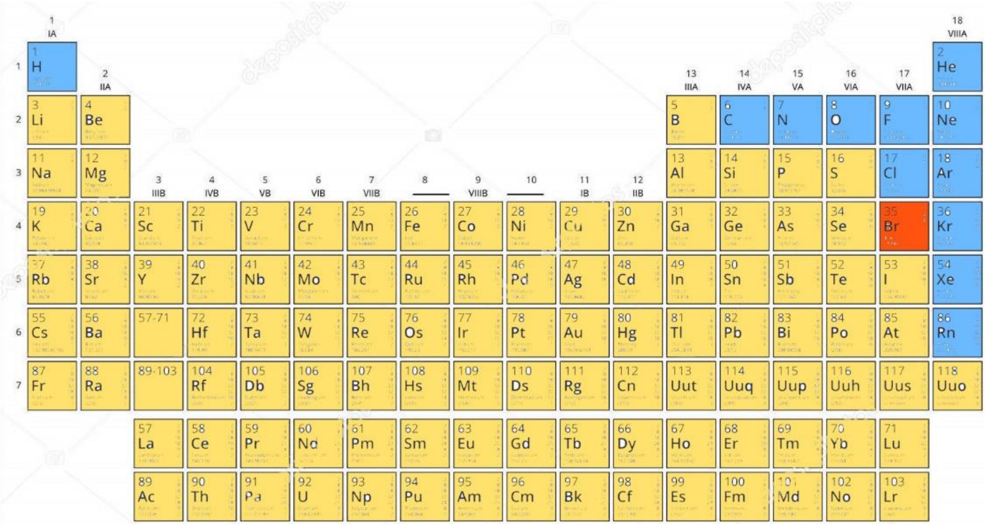


Fig.8

Most elements of the periodic table are metals that do not have a free inner nucleus as such, and all nucleons are tightly packed. This contributes to strong interatomic bonds (Fig.8).

Fig.8

And only one element, bromine, is liquid at room temperature. And it is located just between solid (yellow) and gas (blue)!



The nucleus of the bromine atom, just like other liquids, has a structure somewhere between the structure of solid elements and gases. Its inner core is not as densely packed as that of metals, but does not have much freedom of movement like that of gases. And therefore it makes minor fluctuations, which do not destroy the crystalline bonds in solids, but only make them more plastic - “liquid”.