Secrets of the Periodic Table

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What information can we get from the Periodic table?

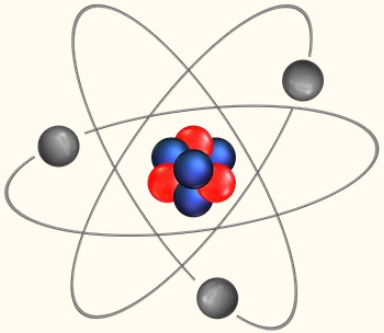
Hypothesis

We can get most of the information about elements from the periodic table, but we need skills to process the information.

Periods and groups

Period

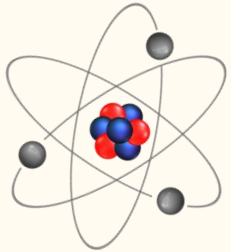
A period in the periodic table is a row of chemical elements. All elements in a row have the same number of electron shells. Energy levels also called electron shells are fixed distances from the nucleus of an atom where electrons are found. Electrons are small, negative particles in an atom, that move around the positive nucleus at the center.



Groups

Group, in chemistry is a set of chemical elements in the same vertical column of the periodic table. The elements in a group have similar electronic configuration of their atoms.

The number of electrons in the outer level shell of a atom determines its reactivity, or tendency to form chemical bonds with other atoms.



What is an element?

A chemical element, also called an element is any substance that cannot be decomposed into simpler substances by ordinary chemical processes.

There are 92 atoms and that equals 92 elements.

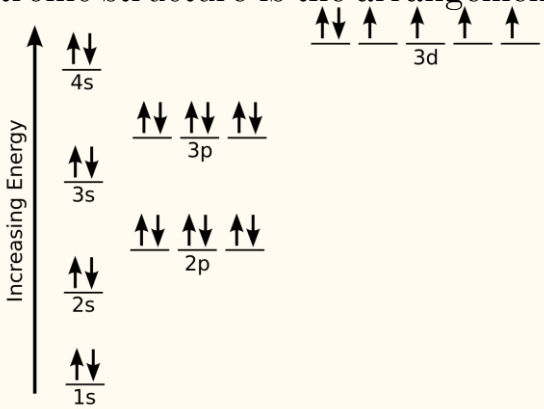
Synthetic elements are chemical elements that do not occur naturally on Earth. They are created by human manipulation of fundamental particles in a nuclear reactor, a particle accelerator, or the explosion of an atomic bomb. They are called "synthetic", "artificial", or "man-made". The synthetic elements are those with atomic numbers 93–118.

Atomic number & electron configuration

Atomic number, the number of a chemical element in the periodic system, whereby the elements are arranged in order of increasing number of protons in the nucleus. Accordingly, the number of protons, which is always equal to the number of electrons in the neutral atom, is also the atomic number.

Electron configurations

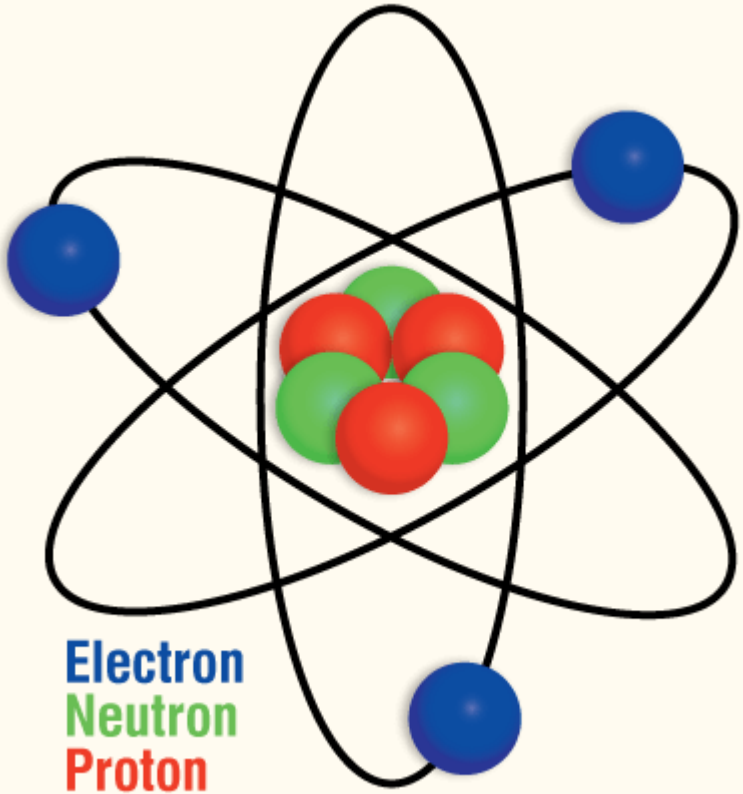
Electronic configuration, also called electronic structure is the arrangement of electrons in energy levels around an atomic nucleus.



Neutrons

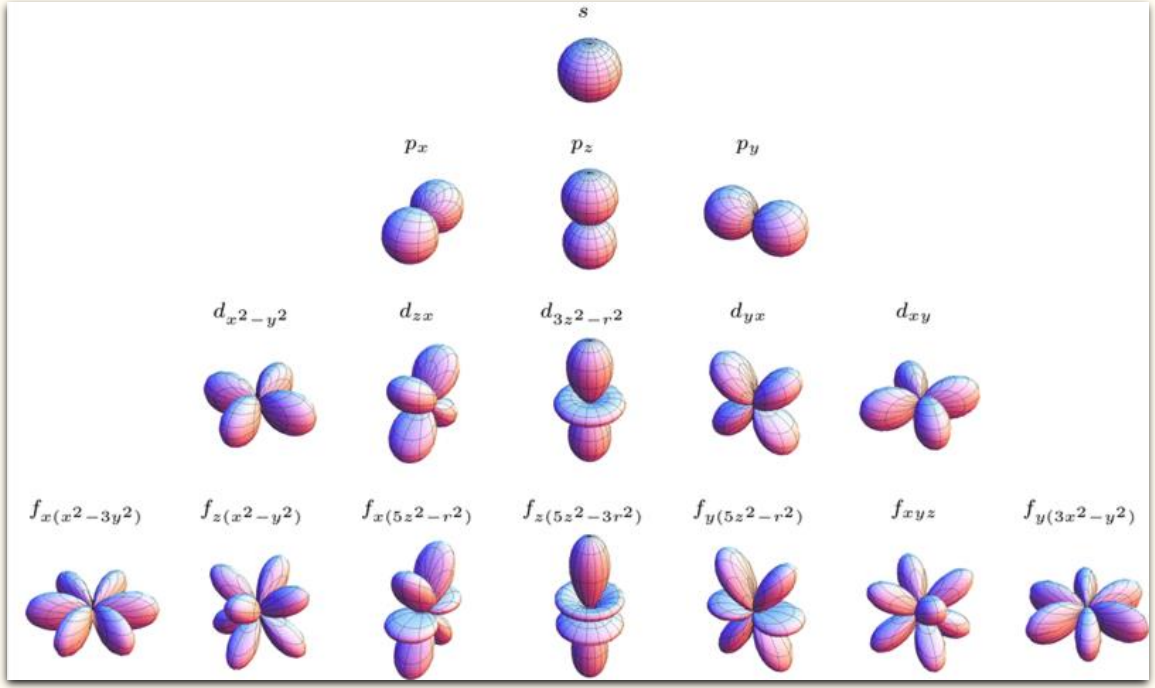
An elementary particle without an electrical charge; one of the building blocks of the nucleus of the atom. A neutron has about the same mass as a proton.

To find how many neutrons are in one element you have to subtract protons from atomic mass.



Electron orbitals

Atomic orbital is a mathematical function describing the location and wave-like behavior of an electron in an atom. This function can be used to calculate the probability of finding any electron of an atom in any specific region around the atom's nucleus.



Grouping

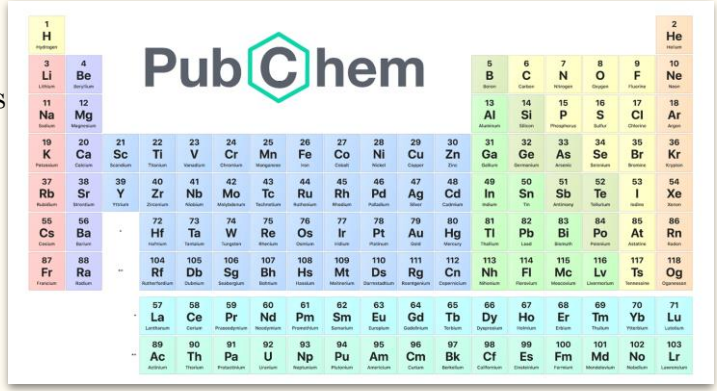
Elements are typically classified as either a metal or nonmetal. Metal elements are usually good conductors of electricity and heat. The subgroups within the metals are based on the similar characteristics and chemical properties of these collections.

The **alkali metals** make up most of Group 1, the table's first column. Shiny and soft enough to cut with a knife, these metals start with lithium and end with francium. They are also extremely reactive and will even explode on contact with water, so chemists store them in oils or inert gases. Hydrogen, with its single electron, also lives in Group 1, but the gas is considered a nonmetal.

The **alkaline-earth metals** make up Group 2 of the periodic table, from beryllium through radium. Each of these elements has two electrons in its outermost energy level, which makes the alkaline earths reactive enough that they're rarely found alone in nature. But they're not as reactive as the alkali metals. Their chemical reactions typically occur more slowly and produce less heat compared to the alkali metals.

Transition metals - Groups 3 through 12 represent the rest of the transition metals. Hard but malleable, shiny, and possessing good conductivity, these elements are what you typically think of when you hear the word metal.

Basic metals - Group 13 to Group 17. These elements have some of the classic characteristics of the transition metals, but they tend to be softer and conduct more poorly than other transition metals. Many periodic tables will feature a bolded "staircase" line below the diagonal connecting boron with astatine.



Semimetals - They form the staircase that represents the gradual transition from metals to nonmetals. These elements sometimes behave as semiconductors (B, Si, Ge) rather than as conductors. Metalloids are also called "semimetals".

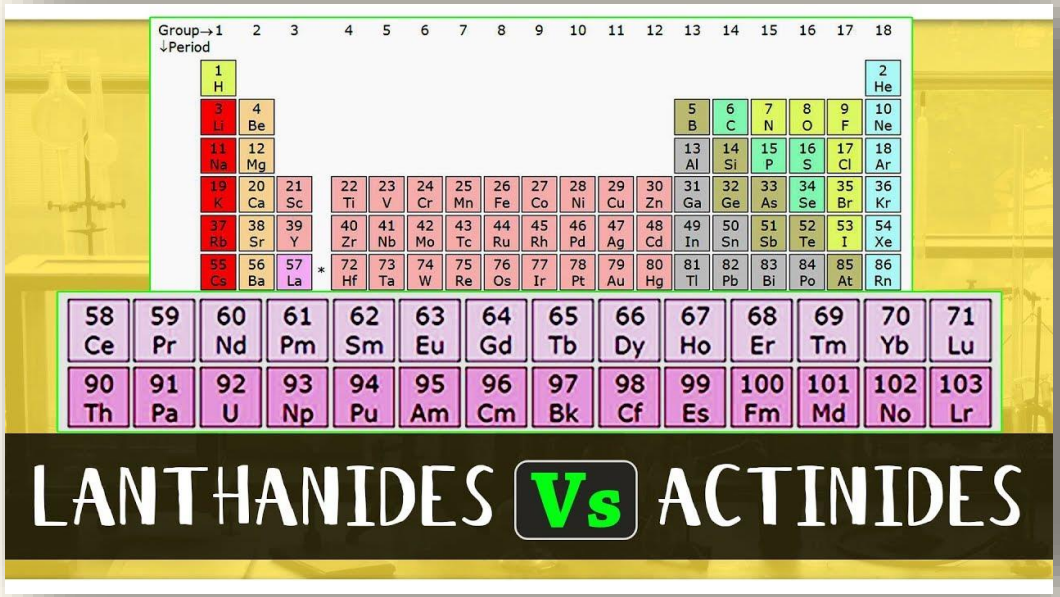
Nonmetals - Everything else to the upper right of the staircase — plus hydrogen,stranded way back in Group 1 — is a nonmetal.

Halogen - The top four elements of Group 17, from fluorine through astatine represent one of two subsets of the nonmetals. The halogens are quite chemically reactive and tend to pair up with alkali metals to produce various types of salt.

Noble gas - Colorless, odorless and almost completely unreactive, the inert, or noble gases round out the table in Group 18.

Lanthanides and Actinides

The reason why Lanthanides and Actinides are located at the bottom of the periodic table is because of their properties and in the block in which electrons fill up. The lanthanides include elements 58 to 71 (fill out the 4f subshell) and the actinides include elements 89 to 103 (fill out the 5f subshell).



The Experiment

Materials

Metals & Nonmetals
&
Semimetals

- Iron
- Sulfur
- Boron
- Light bulb
- 2 Wires
- Battery

Procedure

1. We first create a circuit using the light bulb and the 2 wires
2. We take the iron and attach the 2 wire to it
3. We do the same for boron and sulfur
4. We see the results

Hypothesis

The metals will conduct electricity while nonmetals won't. Semimetals will conduct just a little.

Hypothesis support

We think the light bulb will shine brightly with iron but will not shine with sulfur.

The iron belongs into the metals group which automatically makes it a conductor. Sulfur will not make the light bulb shine at all because it belongs into the non metals group. Boron is a semimetal and i think this will make the light bulb shine duly.

Variables that may affect the outcome

- Voltage of light bulb will affect the brightness
- How well the circuit is built

Circuit - Conductors, insulators and semiconductors

Conclusion

Our hypothesis was correct. Sulfur did not conduct electricity, just like we predicted. Iron on the other hand did conduct electricity. Boron conducted just a very little amount of electricity, almost like we predicted.

Final conclusion

Using only the Periodic Table, we can get a lot of information not only about the discovered elements, but also predict the properties of new, as yet unknown elements:

1. Relative atomic mass
2. The number of protons, electrons, neutrons
3. Electronegativity
4. The number of electronic levels.
5. The number of electrons at the outer level.
6. Oxidation number, highest and lowest oxidation number.
7. Number of possible bonds
8. Physical and chemical properties.

Final conclusion

Using the Periodic Table, we can describe the unknown element 119

1. The period number is 8 (element 118 is the last one in period 7). This means that the 119th element has 8 electron shells.

2. The group number is 1. This is the 1st element in period 8. It means that element 119 is very similar to K or Li (alkali metals) and has the electronic configuration 7s2 7p6 8s1.

3. Atomic number 119. This means that the number of protons is 119, the number of electrons is also 119.

We cannot determine the number of neutrons. We don't know the atomic mass of element 119, but ... If the atomic number of element 118 is 294, that means element 119 can have an atomic mass of 296 and 177 neutrons.

Thank you