IYPT

INTERNATIONAL YEAR OF THE PERIODIC TABLE

Periodic Graphics

A collaboration between C&EN and Andy Brunning, author of the popular graphics blog *Compound Interest*

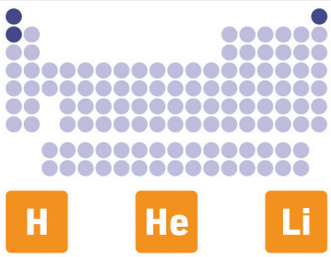
More online

To see more of Brunning's work, go to **compoundchem.com.** To see all of C&EN's Periodic Graphics, visit **cenm.ag/periodicgraphics.**

THE ORIGINS OF THE ELEMENTS

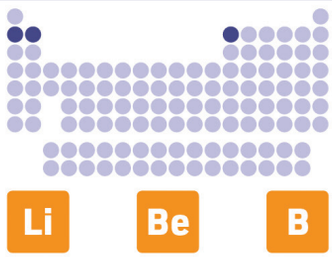
The 118 elements in the periodic table don't all have the same backstory. Here, we examine how different elements were created, according to physicists and chemists.

THE BIG BANG



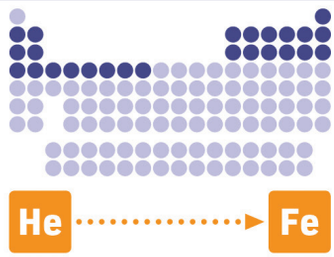
The lightest elements were made by nuclear reaction chains between 10 s and 20 min after the big bang. Hydrogen and helium in particular were made in large amounts.

COSMIC RAYS



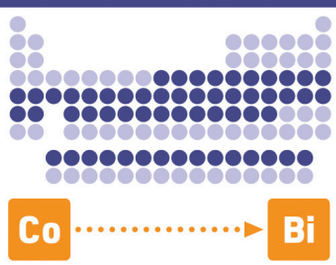
When cosmic rays in space hit the nuclei of elements like carbon or nitrogen, they cause those elements to fragment into lighter elements like lithium, beryllium, and boron.

FUSION IN STARS



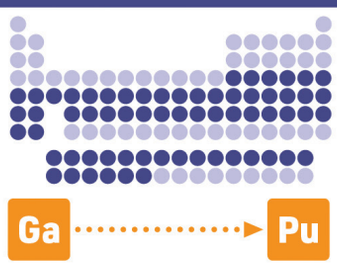
Fusion reactions inside stars generate the energy that stars radiate. They produce elements from helium up to iron. Creating heavier elements isn't possible through fusion.

THE S-PROCESS



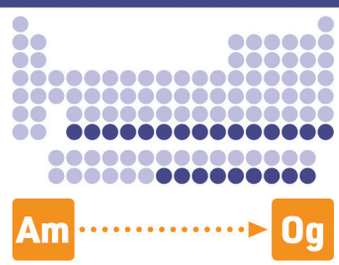
The slow neutron-capture process (s-process) occurs in aging stars over thousands of years. Atoms capture neutrons and undergo β decay to produce new element isotopes.

THE R-PROCESS



In the rapid neutron-capture process (r-process), atoms capture many neutrons at once and undergo β decay to form new element isotopes. It occurs in neutron star collisions.

SYNTHETIC ELEMENTS



The heaviest elements have been created artificially on Earth in nuclear reactors or particle accelerators. These elements are unstable and decay into lighter elements rapidly.

Note: Elements are highlighted where isotopes of that element are created by the process discussed. Not all isotopes created are stable.

PERIODIC GRAPHICS