STELLAR NUCLEOSYNTHESIS REACTIONS

Elements above 94 are manmade and are not included. The most important reactions in stellar nucleosynthesis: Hydrogen fusion.

When Helium is exhausted energy generated by Helium burning ceases, giving way to gravitational contraction of the core. We understand now why some elements like carbon, oxygen, silicon, and iron are common and the heaviest elements like gold, mercury, and uranium are so rare. Once these clouds became large enough, they were drawn together by gravity with enough force to actually cause the atomic nuclei to fuse, in a process called nuclear fusion. When the core of a star is hot enough, due to gravitational contraction, atoms are stripped off their electrons and collisions between atomic nuclei trigger nuclear reactions: the star establishes its hydrostatic equilibrium by radiating away some of the nuclear energy, hence its specific surface temperature. Evidence of nucleosynthesis in other stars has been discovered in S-Type stars by Merrill They were created in the stars. The difference in energy production of this cycle, compared to the protonâ€”proton chain reaction, is accounted for by the energy lost through neutrino emission. The lowest mass stars can only synthesize helium. Elements with odd numbers of protons are formed by other fusion pathways. The lightest after helium Li, Be, and B are rare, as they are poorly synthesized in stars, but otherwise lighter elements are more common than heavy ones, as are elements with even numbers of protons, over those with odd. Fusion inside stars transforms hydrogen into helium, heat, and radiation. In defense I want you to know that practically everyone, except for the astronomer researching stellar evolution, uses this loose meaning of "creation". All of the atoms in the universe began as hydrogen. Search Stellar nucleosynthesis Image: Abundances of the chemical elements in the Solar system. Helium fusion first begins when a star leaves the red giant branch after accumulating sufficient helium in its core to ignite it. Population II stars are poor in metals whereas Population I are 2 orders of magnitude richer. Magnesium plus helium produces silicon. All of the atoms on the Earth except hydrogen and most of the helium are recycled materialthey were not created on the Earth. I hope you did not mind. Massive red giants are also able to make small amounts of elements heavier than iron up to mercury and lead through a slower combination of neutrons with heavy nuclei but supernovae and merging neutron stars probably generate the majority of elements heavier than iron and nickel and certainly those heavier than lead up to uranium. Those atoms are rearranged to produce the vast variety of things around and in you. All the remainder are residuals of supernovae. The star enters a runaway phase leading to supernova explosion where heavier elements such as Uranium, Lead and Gold will be synthesised through a combinations of neutron capture and decay processes. The result of this fusion process is that the two one-proton atoms have now formed a single two-proton atom. However, a massive star reaches the stage of Iron synthesis and ends up with an Iron core. Elements heavier than iron are made in supernova explosions from the rapid combination of the abundant neutrons with heavy nuclei as well as from the merger of neutron stars. In chemical reactions, different atoms or combinations of atoms are said to be produced or created when a reaction takes place. For example, in the Earth section of the planets chapter , I said that oxygen was produced in the photosynthesis process of plants. It is also called "hydrogen burning", which should not be confused with the chemical combustion of hydrogen in an oxidizing atmosphere. In this way, the alpha process preferentially produces elements with even numbers of protons by the capture of helium nuclei. Gravity took over and eventually these atoms were pulled together into massive clouds gas in the vastness of space. There are two predominant processes by which stellar hydrogen fusion occurs: proton-proton chain and the carbon-nitrogen-oxygen CNO cycle. Hydrogen and helium and some lithium, boron, and beryllium were created when the universe was created. Despite the name, stars on a blue loop from the red giant branch are typically not blue in color, but are rather yellow giants, possibly Cepheid variables.