This cycle is now understood as being the first part of a larger process, the CNO-cycle, and the main reactions in this part of the cycle (CNO-I) are:[15]

$$^{12}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{13}_{7}\mathrm{N} + \gamma + 1.95\ \mathrm{MeV}$$

$$^{13}_{7}\mathrm{N} \rightarrow {}^{13}_{6}\mathrm{C} + e^{+} + \nu_e + 1.20\ \mathrm{MeV}$$ (half-life of 9.965 minutes[16])

$$^{13}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{14}_{7}\mathrm{N} + \gamma + 7.54\ \mathrm{MeV}$$

$$^{14}_{7}\mathrm{N} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{15}_{8}\mathrm{O} + \gamma + 7.35\ \mathrm{MeV}$$

$$^{15}_{8}\mathrm{O} \rightarrow {}^{15}_{7}\mathrm{N} + e^{+} + \nu_e + 1.73\ \mathrm{MeV}$$ (half-life of 122.24 seconds[16])

$$^{15}_{7}\mathrm{N} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{12}_{6}\mathrm{C} + {}^{4}_{2}\mathrm{He} + 4.96\ \mathrm{MeV}$$

where the carbon-12 nucleus used in the first reaction is regenerated in the last reaction. After the two positrons emitted annihilate with two ambient electrons producing an additional 2.04 MeV, the total energy released in one cycle is 26.73 MeV; in some texts, authors are erroneously including the positron annihilation energy in with the beta-decay Q-value and then neglecting the equal amount of energy released by annihilation, leading to possible confusion. All values are calculated with reference to the Atomic Mass Evaluation 2003.[17]

The limiting (slowest) reaction in the CNO-I cycle is the proton capture on $^{14}_{7}\mathrm{N}$. In 2006 it was experimentally measured down to stellar energies, revising the calculated age of globular clusters by around 1 billion years.[18]

The neutrinos emitted in beta decay will have a spectrum of energy ranges, because although momentum is conserved, the momentum can be shared in any way between the positron and neutrino, with either emitted at rest and the other taking away the full energy, or anything in between, so long as all the energy from the Q-value is used. The total momentum received by the positron and the neutrino is not great enough to cause a significant recoil of the much heavier daughter nucleus[a] and hence, its contribution to kinetic energy of the products, for the precision of values given here, can be neglected. Thus the neutrino emitted during the decay of nitrogen-13 can have an energy from zero up to 1.20 MeV, and the neutrino emitted during the decay of oxygen-15 can have an energy from zero up to 1.73 MeV. On average, about 1.7 MeV of the total energy output is taken away by neutrinos for each loop of the cycle, leaving about 25 MeV available for producing luminosity.[19]

CNO-II

In a minor branch of the above reaction, occurring in the Sun's core 0.04% of the time, the final reaction involving $^{15}_{7}\mathrm{N}$ shown above does not produce carbon-12 and an alpha particle, but instead produces oxygen-16 and a photon and continues

$$^{15}_{7}\mathrm{N} \rightarrow {}^{16}_{8}\mathrm{O} \rightarrow {}^{17}_{9}\mathrm{F} \rightarrow {}^{17}_{8}\mathrm{O} \rightarrow {}^{14}_{7}\mathrm{N} \rightarrow {}^{15}_{8}\mathrm{O} \rightarrow {}^{15}_{7}\mathrm{N}$$

In detail: