

Index Card, 10/25

The universe is mostly H and He, yet we humans are made up mostly of H and O (H₂O), with a little C and other elements mixed in. The universe has existed for about 14 billion years, allowing all of those atoms to go through many cycles of stars.

Which of the following objects **could** the atoms of your body once been inside of? Which of the following objects **must** the atoms of your body once have been inside of?

white dwarf	1 solar mass star	AGB star
supernova	black hole	neutron star
protostar	Main Seq. star	a planet (not Earth)

10/30/12

Ast 309N (47760)

1

Cosmic Recycling

Stars form out of interstellar clouds, then begin their journey of element synthesis. At the ends of their lives, both low and high-mass stars expel some of their material, including some freshly made atoms heavier than He. However, some types of stars represent “sinks” in which atoms remain locked up forever and are never released.

The answers to the questions posed here depend on whether you are talking about, say, the H atoms in our bodies, or the O (or C or Ca, etc.).

10/30/12

Ast 309N (47760)

3

Stellar Recycling and “Chemical” Enrichment

- Stars make heavy elements.
- They send them into space:
 - stellar winds
 - planetary nebulae
 - supernova explosions



- Lower-mass stars make C, N, He, and some trans-iron elements.
- High-mass stars make O and other “alpha” nuclei, iron & heavier elements.

10/23/12

The Heavier Elements: C, O, etc.

Must have been inside some kind of star, because that’s where thermonuclear fusion occurs. It could have been an AGB star (C made by the triple-alpha process) or supernova (O and most heavier elements).

Could have been inside several other kinds of stars, as long as they are a type of star that ultimately throws off some of its mass. This includes protostars and Main Sequence stars because all stars go through these phases. They could have been inside a 1 M_⊙ star.

Could not have been inside a white dwarf, neutron star, black hole, or non-Earth planet, because once inside these objects, the atoms can never escape.

10/30/12

Ast 309N (47760)

4