IQ

- The Sun’s energy comes from:
- A. Burning hydrogen in the oxygen-rich atmosphere to form water
- B. Gravitational contraction
- C. Nuclear fusion of hydrogen to form helium
- D. The sun is carbon-rich (like coal) and is on fire.
IQ

- The correct answer is C, nuclear fusion.

- $E = mc^2$

- (See! I told you so!)
Normal stars like our sun will exhaust core hydrogen as a fuel in about 10 billion years. They will evolve internally and externally to become red giant stars.
This planetary nebula was once the atmosphere of a red giant star.

T

F.
• True!

• The atmospheres of red giant stars are driven away as a stellar wind that interacts with material previously ejected from the star, and the interstellar medium.

• These are all planetary nebulae.
Our sun will produce a stellar remnant called a white dwarf star. These “stellar ashes” explain how metals such as carbon and oxygen are produced.

- T
- F
• **T! It is true.**

• The central star of a planetary nebula is a white dwarf!

• After the nebula dissipates in a few hundred thousand years only the white dwarf is left.
A pulsar is a rotating magnetic neutron star, but not all neutron stars appear to be pulsars.

T
F
• **T. It is true!**

• If Earth lies in the polar beam created by the magnetic field we see radio, and occasionally optical and x-ray pulses (like these in the Crab Nebula) – a pulsar!

• The Crab Nebula is the remnant of a supernova explosion in 1054 that was recorded by the Anasazi of Chaco Canyon.
A second chance:

• A pulsar is a rapidly rotating neutron star, but not all neutron stars are pulsars, right?
• It is true!

• We see pulses only when the beam at the magnetic poles of a rapidly rotating neutron star sweeps across the Earth.
IQ

- Black holes are the densest stellar remnant.

- T
- F

A 10 solar mass black hole crosses the Milky Way 600km above the Earth – and yes, you are dead!
The answer is TRUE, of course.

White dwarfs, neutron stars and black holes are the three endpoints of stellar evolution. Every star will end up as one of these stellar remnants, depending upon the star’s original mass. Stars like the sun will form white dwarfs, stars about twice the mass of the sun will form neutron stars, and stars more massive than about 2.5 solar masses will end their lives as black holes.

The high Doppler Shift in the galaxy M87 shows that MASSIVE black holes exist in the cores of galaxies. How does the Doppler Shift provide this evidence?