

## How Does Carbon Dating Work?

Carbon dating, also called Carbon-14 dating, is a process for determining the age of organic materials that are up to 50,000 years old. Items which can be dated this way include bone, cloth, wood and plant fibers that were the result of human activities, as well as human and animal remains. Carbon-14 is a radioactive isotope of Carbon that decays away at a steady rate; other, more stable forms of carbon do not decay away.

Carbon-14 is a naturally occurring isotope that has its origins in the cosmic rays that constantly penetrate the earth's atmosphere. When one of these rays collides with another atom in the atmosphere, it creates another kind of cosmic ray called an energetic neutron. When an energetic neutron collides with a Nitrogen-14 atom, the Nitrogen-14 atom becomes a Carbon-14 atom and a Hydrogen atom. This newly formed Carbon-14 atom is radioactive. The length of time that it takes for the amount of radiation in radioactive isotopes to decrease by half is called a half-life. Carbon-14 has a half-life of 5,700 years.

In the earth's atmosphere, Carbon-14 combines with oxygen to

form carbon dioxide, which is absorbed by plants through the process of photosynthesis. People then ingest Carbon-14 by eating plants. There is almost always the same ratio of normal Carbon (Carbon-12) to Carbon-14 in the air at all times; for every one Carbon-14 atom there are about a trillion Carbon-12 atoms. Though Carbon-14 atoms are constantly decaying, they are also constantly being replaced by the same process described above. Every living organism on the planet has the same percentage of Carbon-14 atoms in it.

But when a living organism dies, it no longer takes in new Carbon, and the Carbon-14 continues to decay as it always does, and is not replaced. While the amount of Carbon-12 in a deceased organism remains the same, the amount of Carbon-14 decreases by half every 5,700 years. So by comparing the ratio of Carbon-12 to Carbon-14 in an archeological or paleontological find, it is possible to determine the age of the organism (how long ago it died) with a great deal of accuracy.



\_\_\_\_\_ 1. Which of the following items could you use carbon dating to determine the age of?

- A. A machine
- B. A dinosaur
- C. A rock

\_\_\_\_\_ 2. What is the half-life of Carbon-14?

- A. 5,700 years
- B. 50,000 years

\_\_\_\_\_ 3. Where does Carbon-14 come from?

- A. cosmic rays
- B. Nitrogen-14
- C. cosmic rays that have undergone several specific collisions in the earth's atmosphere.

\_\_\_\_\_ 4. True or False: You have Carbon-14 inside your body right now.

\_\_\_\_\_ 5. Choose the correct ending to this sentence: Carbon-14 atoms are constantly decaying:

- A. So you have less and less inside of you all the time.
- B. But in living organisms they are also constantly being replaced.

\_\_\_\_\_ 6. Carbon dating is accurate for organic matter up to how old?

- A. 5,700 years
- B. 50,000 years

7. Briefly explain how and why carbon dating works.

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