Basic Principles of Carbon Dating

Radiocarbon (carbon 14) is an isotope of the element carbon that is unstable and weakly radioactive. The stable isotopes are carbon 12 and carbon 13.

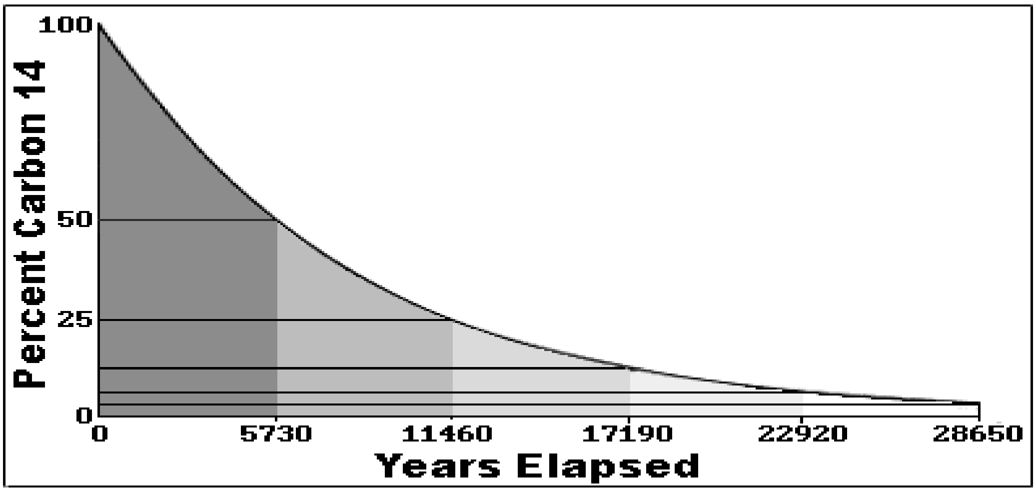
Carbon 14 is continually being formed in the upper atmosphere by the effect of cosmic ray neutrons on nitrogen 14 atoms. It is rapidly oxidized in air to form carbon dioxide and enters the global carbon cycle.

Plants and animals assimilate **carbon 14** from carbon dioxide throughout their lifetimes. When they die, they stop exchanging carbon with the biosphere and their carbon 14 content then starts to decrease at a rate determined by the law of radioactive decay which is a half-life of 5,730 years.

Radiocarbon dating is essentially a method designed to measure residual radioactivity.

All carbon atoms consist of 6 protons in their atomic nucleus, but there are three main varieties... [+]

Unlike carbon-12 and carbon-13, carbon-14, with six protons but eight neutrons in its nucleus, is inherently unstable. With a half-life of 5,730 years, carbon-14 atoms will decay into nitrogen-14, emitting an electron and an anti-electron neutrino when the decay occurs. Any carbon-14 atoms that were created prior to the formation of Earth would have all decayed away long ago, leaving none of them behind.



True Science Should Include ALL Evidence.

To ignore the science and history of the Bible is insanity. Radiocarbon dating overlooks the fact that before the Flood there was no carbon 14 in the atmosphere, which supports the evolutionary hypothesis of millions of years.
The secular, scientific community has twisted Thomas Jefferson's meaning of his "Separation of Church and State" letter into where "religion" has no business interfering in government! **The True interpretation is opposite, it is for religious freedom from government interference**

WIKIPEDIA: "**Separation of church and state**" is a metaphor paraphrased from Thomas Jefferson and used by others in discussions regarding the Establishment Clause and Free Exercise Clause of the First Amendment to the United States Constitution which reads: "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof..."
The principle is paraphrased from Thomas Jefferson's "separation between Church & State." It has been used to express the understandings of the intent and function of this amendment, which allows freedom of religion. It is generally traced to a January 1, 1802, letter by Jefferson, addressed to the Danbury Baptist Association in Connecticut, and published in a Massachusetts newspaper.

https://www.physlink.com/education/askexperts/ae403.cfm

Carbon 14 (C14) is an isotope of carbon with 8 neutrons instead of the more common 6 neutrons. It is unstable, and scientists know that it radioactively decays by electron emission to Nitrogen 14, with a half life of 5730 years. This means that given a statistically large sample of carbon 14, we know that if we sit it in a box, go away, and come back in 5730 years, half of it will still be carbon 14, and the other half will have decayed.

Or in other words, if we have a box, and we don't know how old it is but we know it started with 100 carbon 14 atoms, and we open it and find only 50 carbon 14 atoms and some other stuff, we could say, 'Aha! It must be 1 carbon 14 half-life (or 5730 years) old.' This is the basic idea behind carbon dating.

So in the real world, looking at a sample like say a bone dug up by an archaeologist, how do we know how much carbon 14 we started with? That's actually kind of cool. It's a semi-long story, so bear with me. In the atmosphere, cosmic rays smash into normal carbon 12 atoms (in atmospheric carbon dioxide), and create carbon 14 isotopes. This process is constantly occurring, and has been for a very long time, so there is a fairly constant ratio of carbon 14 atoms to carbon 12 atoms in the atmosphere. Now living plants 'breathe' CO_2 indiscriminately (they don't care about isotopes one way or the other), and so (while they are living) they have the same ratio of carbon 14 in them as the atmosphere. Animals, including humans, consume plants a lot (and animals that consume plants), and thus they also tend to have the same ratio of carbon 14 to carbon 12 atoms. This equilibrium persists in living organisms as long as they continue living, but when they die, they no longer 'breathe' or eat new 14 carbon isotopes Now it's fairly simple to determine how many total carbon atoms should be in a sample given its weight and chemical makeup. And given the fact that the ratio of carbon 14 to carbon 12 in living organisms is approximately 1 : $1.35\text{x}10^{-12}$, we can figure out how many carbon 14 atoms were in the sample when it ceased to replenish it's supply.

In actually measuring these quantities, we take advantage of the fact that the rate of decay (how many radioactive emissions occur per unit time) is dependent on how many atoms there are in a sample (this criteria leads to an exponential decay rate). We have devices to measure the radioactivity of a sample, and the ratio described above translates into a rate of 15.6 decays/min per gram of carbon in a living sample. And if you play with the exponential decay equations, you can come up with the nice formula $(1/2)^n$=(current decay rate)/(initial decay rate), where n is the number of half lives that have passed. Voila, now you can tell how old a sample of organic matter is.

Some notes:

1) Obviously, this technique only works for dead organic material.

2) This technique is best for dating items which died between on the order of 1000 to on the order of 1,000,000 years ago. Carbon 14 dating is not great for dating things like a year old because if much less than 1 half-life has passed, barely any of the carbon 14 has decayed, and it is difficult to measure the difference in rates and know with certainty the time involved. On the other hand, if tons of half-lives have passed, there is almost none of the sample carbon 14 left, and it is really hard to measure accurately how much is left. Since physics can't predict exactly when a given atom will decay, we rely on statistical methods in dealing with radioactivity, and while this is an excellent method for a bazillion atoms, it fails when we don't have good sample sizes. However it is possible, when dating very old rocks for instance, to use longer lived isotopes for dating on a longer time scale.

3) The assumption we based this on (that the ratio of carbon 14 in the atmosphere and thus in living organisms is constant) is a decent one for ballpark figures, but this method will not be able to give results accurate to, say, a couple of minutes.