“GET A HALF-LIFE” RADIOACTIVE DATING

Background Information

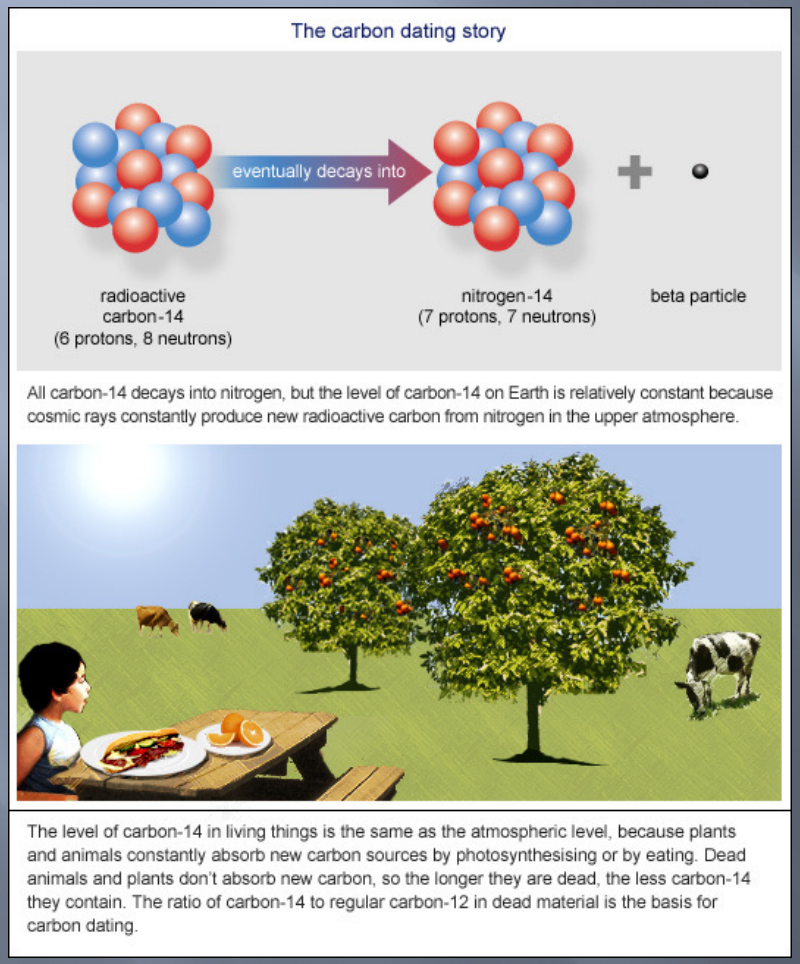
Scientists use a variety of methods to date ancient fossils, artifacts and rock. A popular method among is called **radiocarbon dating**. All living things on Earth are made up of a high percentage of an element called carbon.

Most carbon on Earth is not radioactive, but a very small percentage is. Thus, as living things take in carbon, they certainly will take up a small amount of radioactive carbon into their bodies.

Background Information (cont.)

- Radiocarbon dating is only effective for objects and fossils that are less than 50,000 years old. However, scientists can look at the decay of other elements in these objects allowing them to date them up to 2.2 billion years.
- These dating techniques are by no means perfect, but they are always improving, and they are the best methods that we have at this time.

Carbon Dating



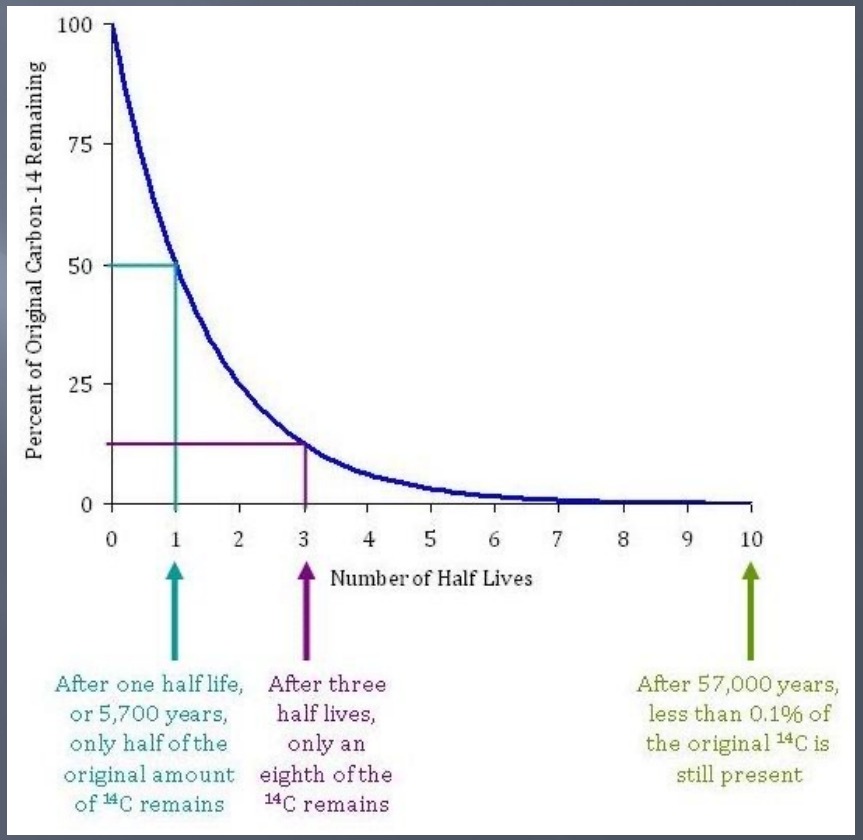
- The organisms stop taking in carbon after they die. The carbon in their bodies at the time of their death will remain in their bodies until they decompose, or if they become fossilized, then forever.

http://www.abc.net.au/science/articles/2010/12/09/3088319.htm

Radioactive Carbon

- Radioactive carbon decays at a known rate. This allows scientists to look at the amount of decay in a fossil's radioactive carbon and determine a relative date.

http://www.esrl.noaa.gov/gmd/outreach/isotopes/decay.html



The Basics of Carbon Dating

- Carbon-14 (or ^{14}C) is also known as radiocarbon, because it is the only carbon isotope that is **radioactive**.
- Possibly most famous for its use in *radiocarbon dating* of archeological artifacts ranging from mummies to cave drawings
- However, it plays a crucial role in studying **fossil fuel carbon dioxide emissions** as well.

Fossil Fuels and Dating

- Fossil fuels are millions of years old, therefore all of the radiocarbon initially present has decayed away, leaving no ^{14}C in this ancient organic matter.
- All other atmospheric carbon dioxide comes from young sources–namely land-use changes and exchange with the ocean and terrestrial biosphere. This makes ^{14}C an ideal tracer of carbon dioxide coming from the combustion of fossil fuels.
- Scientists can use ^{14}C measurements to determine the age of carbon dioxide collected in air samples, and from this can calculate what proportion of the carbon dioxide in the sample comes from fossil fuels.

Experimental Procedure

1. Copy the Data Chart to record your observations.
2. Put the coins in the bag. Close the bag securely and shake the bag.
3. Now spill the coins out on the table in front of you. Do not lose any!
4. Gather and count all the coins that are heads. Put them aside. In the Data Chart record this number of coins in the column Coins Removed. Now subtract and calculate the number remaining and put that number in the Coins Remaining column.
5. Now collect the coin that were tails and put them back in the bag. Close the bag and shake!
6. Repeat steps 3, 4, and 5 until you have run out of coins to put back in the bag

Modeling Radioactive Decay

Trial #	Number of Coins Removed	Number of Coins Remaining
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Discussion Questions

1. Explain what each coin represents.
2. Note how many times you had to toss the coins before they were all used up. Did you find a pattern? What does the bar graph show?
3. If you repeated this experiment again, do you think you would get the same or different results? Why?
4. Explain why this experiment was useful in replicating a model of radioactive decay.
5. Why were the coins a good way to model half-lives? Would the model work as well if we used 1000 coins?
6. How does this relate to fossil fuels?
7. Why do we categorize fossil fuels as nonrenewable energy resources?