Mathematics 122

Quiz # 6 Name: Key

You must show your work to get full credit.

Here is a little more detail about carbon 14 dating which can be used to date organic samples that are not too old, say 20,000 years or less. Willard Libby won the 1960 Nobel prize in chemistry for working out the details of the method. out how to use the exponential decay of carbon 14, ^{14}C, can be used to date organic samples that

The method is based on the fact that ^{14}C has a half life of 5,730 years.

1. Give a formula for the percent of ^{14}C left in a sample after t years. *Hint:* Start by writing $P(t) = 100a^t$ for the percent after t years. Then use $P(5730) = 50$ to find a. Give the answer to 6 decimal place.

$P(5730) = 100a^{5730} = 50$ Percent left is $P(t) =$ $100(.999879)^t$

$a^{5730} = .5$

$a = (.5)^{\frac{1}{5730}} = .999879$

2. A sample taken from a shroud has only 85.66% of its original ^{14}C left. How old is it?[1]

Solve

$P(t) = 100(.999879)^t = 85.66$ Its age is 1279.13 years.

$(.999879)^t = .8566$

$t \ln(.999879) = \ln(.8566)$

$t = \frac{\ln(.8566)}{\ln(.999879)} = 1279.13$

[1]This is data from 1988 when radiocarbon dating was used to find the age of the Shroud of Turin.