

Carbon dating and radio-active decay

The 'How stuff works' website at <http://science.howstuffworks.com/carbon-14.htm> has several pages of useful information about carbon dating and also a video clip which centres around 'Kennewick man'.

A skull found in a lake in Kennewick in the U.S.A. started a forensic investigation. The search for further bones revealed a pelvic bone with a stone-age spear head embedded in it suggesting that the skeleton was much older than it appeared. A sample of bone was analysed to find the proportion of Carbon 14 remaining in order to date the skeleton. The results were surprising. <http://videos.howstuffworks.com/hsw/24471-the-earliest-immigrants-kennewick-man-video.htm>



How could you set up a TI-Nspire so that you could use it to:-

- ❖ find the percentage of carbon-14 atoms remaining in specimens of different ages or
- ❖ find the age of a specimen if you knew the percentage of carbon-14 atoms remaining
- ❖ **Carbon 14 has a half life of approximately 5700 years.**

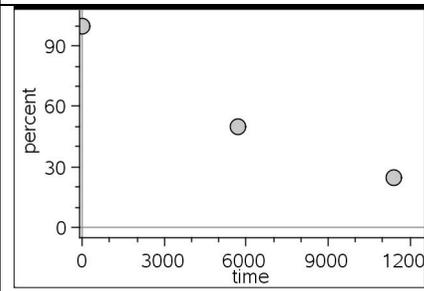
1. Set up the spreadsheet

- From the home menu select '6 New document' then '3: Add lists and spreadsheets'
- Enter the data into columns; press 'enter' after each item. Use the arrow keys to move to the top of the next column.

	A time	B percent	C
1	0	100	
2	5700	50	
3	11400	25	
4			

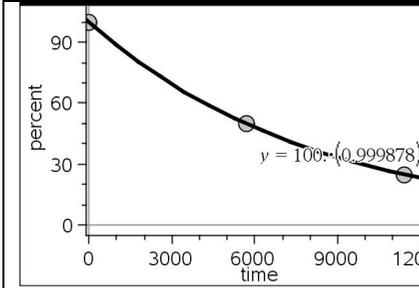
2. Insert a 'Data & Statistics' page

- (5 from the home menu)
- from menu 2 select 'Add X variable' and select 'time'
- from menu 2 select 'Add Y variable' and select percent
- This will give you a Scatterplot.



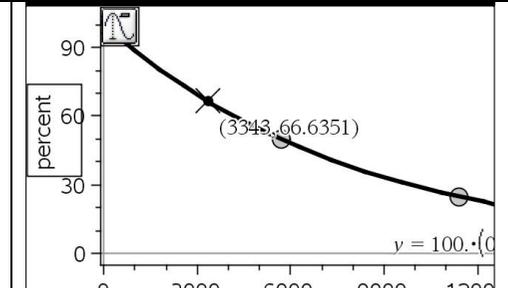
3. Fit a curve to the data

- From menu 4 choose 'regression' and select 'show exponential'
- Don't be put off by the term 'exponential' or the equation shown. What you want is a curve that is a good fit to the points. You may prefer to drag the equation out of the way.



4. Reading from the graph

- To read off values from the graph go to menu 4 and 'Graph Trace'. You can grab the point and move it along the graph so that you can read values from the graph.
- You can go beyond the values shown or zoom in for greater accuracy by going to menu 5 and 'window settings'



Investigating radioactive decay

TI-Nspire gives the equation for the carbon dating graph as $y = 100 * (0.999878)^x$

The constant 0.999878 must be linked to the half life of 5700 but how?

Below are some figures for half lives which could help with the investigation.

isotope	Half-life	isotope	Half-life
Strontium 90	28 years	Tritium (Hydrogen 3)	12 years
Cobalt 60	5 years	Curium 242	163 days (approx 1/2 year)
Caesium 137	30 years	Curium 243	35 years
Thorium 232	14 years	Curium 244	18 years
Ruthenium 106	1 year	Antimony 125	2 years

Try collecting the data in a table using a 'Lists & Spreadsheet' page

isotope	halflife	constant

Can you suggest a formula connecting the half-life and the constant?

Test your rule by

- creating a scatterplot and selecting menu 4 and 4: plot function
- Enter your function and see if it fits.