

tentamen Global Change A, 14-04-2009, 9-12 hrs, 16.0107

please write name and student number on each paper you hand in

1.

Consider a sample of 1 gram of modern natural Carbon.

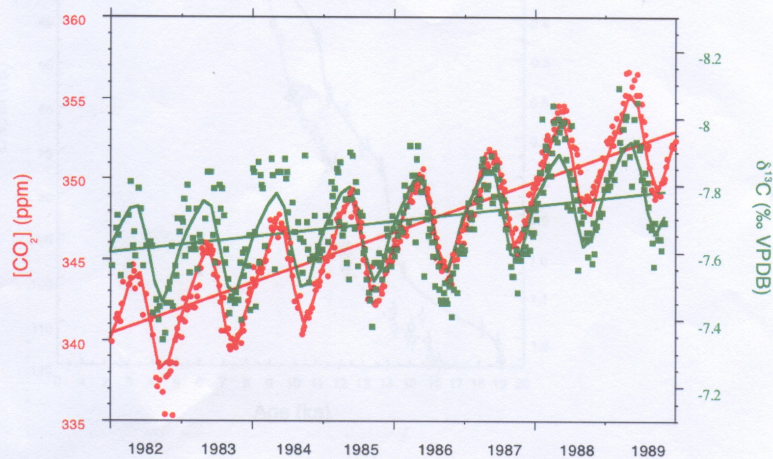
- calculate how much ^{14}C is left of this sample after 2000 years
- calculate how much ^{14}C is left of this sample after 1 million years
- calculate the number of ^{14}C atoms for a) and b)
- calculate the ^{14}C activities for a) and b)
- comment on the practical usefulness of case b)
- how many ^{14}C atoms of contamination would be needed to measure a sample of 50.000 years old as 40.000?

given: Avogadro's number = 6.023×10^{23} ; halflife ^{14}C = 5730 years

2.

In this graph measurements of the CO_2 concentration and its $^{13}\delta$ value are plotted for the 1980's.

- explain the annual trend in both
- explain the decadal trend in both
- are these data representative for the Northern or the Southern hemisphere? why?
- The atmosphere contains 700 Gt (Gigaton) of CO_2 . Assume that the fossil fuel injection into the atmosphere is 7 Gt per year. What can one conclude concerning CO_2 from these numbers and the plotted trend?



3.

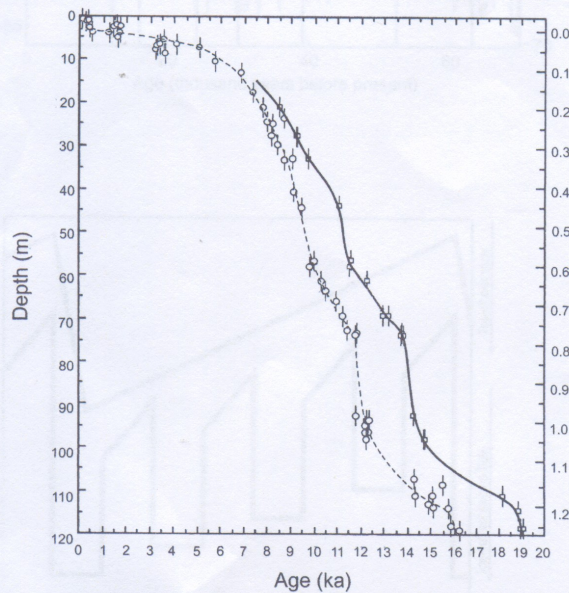
A water sample is measured as 15‰ enriched with respect to a secondary standard called SLAP (Standard Light Arctic Precipitation). This SLAP water has the following δ values with respect to the primary standard VSMOW: $^2\delta = -428.0\text{‰}$ and $^{18}\delta = -55.50\text{‰}$.

Calculate the $^2\delta$ and $^{18}\delta$ values for the water sample with respect to the primary standard VSMOW.

4.

The graph below shows the sea level rise at the end of the last glacial, as reconstructed from corals submerged off the Pacific coast. It shows 3 isotopic datasets: dating by ^{14}C , dating by U-isotopes, and ^{18}O .

- which curve shows the ^{14}C data, and which one the U data; why?
- the right-hand axis shows $^{18}\delta$ numbers; what do these numbers represent?
- when were times with a very large sea level rise (so-called mwp, melt water pulse)?
- what could be points of criticism (weak points) to this establishment of rapid sea level rise.



5.

The top figure shows the temperature history for Greenland as derived from ^{18}O from ice. It shows a variety of rapid climatic change events. The so-called Heinrich events (H0-H6) are indicated.

- what are Heinrich events, how are they caused
- what is special about H0
- what are the other, more frequent climatic change spikes
- the bottom figure shows a schematic attempt to explain these climate change events observed in greenland ice. Explain this schematic.

