Problem 1 due Monday Feb 19

1. Given the mass balance equations:

$$M_O \delta_O + M_i \delta_i = \text{constant}$$

$$\Delta M_i / A_O = \Delta(\text{Sea level})$$

a particular $\delta^{18}O$ paleotemperature curve (Shackleton, 1974, linear curve fit to <u>Uvigerina</u> data):

$$T = 16.9 - 4.0(\delta_c - \delta_w)$$

assuming that:

the mean $\delta^{18}O$ of glacial ice was -30 to -40 ‰

and given that:

$M_O = 1.4 \times 10^{21}$ kg @ an average density of 1.03 g/cm^3

$A_O = 361 \times 10^6$ km^2

the mean salinity of the ocean today is 34.7‰

sea level was 120m lower during the last glacial maximum

The isotopic composition of interglacial benthic carbonate is 3.5‰
The isotopic composition of glacial benthic carbonate is 5.1‰

Calculate:

a. The salinity of the glacial ocean.

b. The change in mean deep ocean temperature during the last glacial maximum, and how sensitive it is to your assumption about the isotopic composition of glacial ice.