

Errata: Please send additional errors to zsharp@unm.edu

Chapter 1. Answers 5c. This is the answer to 5b.

Chapter 2. Equation 2.12. Should read

$$K = \frac{(S^{18}\text{O}_3)^{1/3} ({}^{16}\text{O}_2)^{1/2}}{(S^{16}\text{O}_3)^{1/3} ({}^{18}\text{O}_2)^{1/2}} = \frac{(Q_2/Q_1)_{\text{SO}_3}^{1/3}}{(Q_2/Q_1)_{\text{O}_2}^{1/2}} = \frac{({}^{18}\text{O}/{}^{16}\text{O})_{\text{SO}_3}}{({}^{18}\text{O}/{}^{16}\text{O})_{\text{O}_2}}$$

Page 26: footnote 5. Should be dated July 28, not January 28

Page 26: 3<sup>rd</sup> new paragraph: Change “-428 and -55%” to “-428 and -55‰” (thanks to Jason Bellino)

Question 4: Change -0.57% to -0.57‰.

Question 5: Change -13.42% to -13.42‰

Question 7. should read “is valid when  $\delta_b$  is close to zero, but invalid if  $\delta_b$  is very”

Question 12:  ${}^{18}\text{O}{}^{16}\text{O}$  should be  ${}^{18}\text{O}/{}^{16}\text{O}$ . Also the 19.7% should be 19.7‰.

Answers. Question 2 In place of  $\delta^{18}\text{O}_{\text{SMOW}} = 0.970017 \delta^{18}\text{O}_{\text{PDB}} - 29.98$ , it should read  $\delta^{18}\text{O}_{\text{PDB}} = 0.970017 \delta^{18}\text{O}_{\text{SMOW}} - 29.98$ .

Chapter 3: Question 4. Data in table are in kcal, not kJ.

Chapter 4.

Fig. 4.3. Upper left of box should read  $\delta D = 8 \delta^{18}\text{O} + 10$ .

Problem set question 4a. The equation for water-water vapor should be amended as follows: The minus sign before the term  $\frac{b \times 10^3}{T}$  should be a plus sign.

The answer is 42% and 58%.

Question 5 answer: NBS-1 has delta value of -7.94 permil vs SMOW and thus -37.86 permil versus PDB not +22.73 permil (Note: if it were -7.94 vs PDB, then it would be +22.73).

Chapter 6. Page 124, Table 6.1

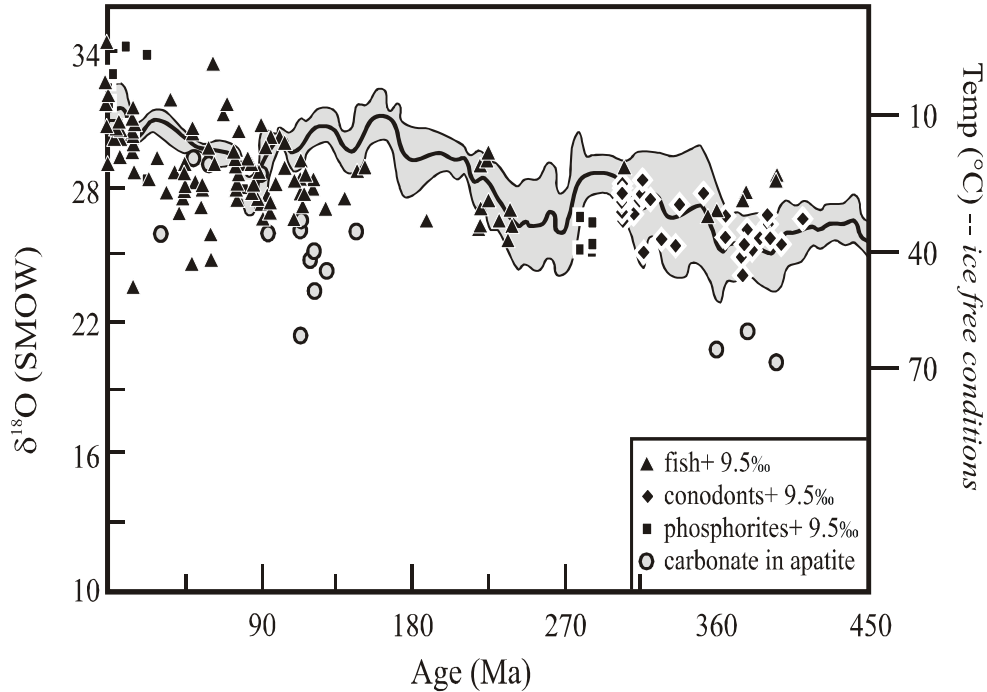
The equations for dolomite and siderite, given as  $4.23 + 6.65 \times 10^5/T^2$  and  $3.85 + 6.84 \times 10^5/T^2$ , respectively are the values of  $1000 \ln \alpha$ , not  $\alpha$ .

Figure 6.3 is in cm.

Chapter 6, pg 131. Fortunately, molluscs-especially belemnites, and brachiopods-tend to precipitate their carbonate shells in oxygen isotope equilibrium with ambient waters...."

(comma added after belemnites to make it clear that brachiopods are not molluscs.

Chapter 7, page 149. CO<sub>2</sub> release rate is 30 billion metric tons, not 'trillion'.  
Figure 8.3. The units on the X-axis are wrong. The correct figure is



An  
answer to question 6.2. The full answer is as follows:

Answer: a) From the definition  $\delta = \left( \frac{R_x - R_{std}}{R_{std}} \right) \times 1000$ , we have

$$\delta = \left( \frac{\frac{V(46sa) - V(46st)}{V(44sa) - V(44st)}}{\frac{V(46st)}{V(44st)}} \right) \times 1000 = \left( \frac{\frac{5986.587 - 5750.977}{4116.429 - 4032.853}}{\frac{5750.977}{4032.853}} \right) 1000 = 19.84\% \text{ for the}$$

water vs. the reference gas. Similarly, for the carbonate, the  $\delta^{18}O$  value is 17.38‰.

Plugging this into eq 6.4,  $t(^{\circ}C) = 16.9 - 4.2(\delta_c - \delta_w) + 0.13(\delta_c - \delta_w)^2$ , gives 28°C.

b. To convert from once scale to another, we use equation 2.3

$$\delta_{X-B} = \delta_{X-A} + \delta_{A-B} + 0.001\delta_{X-A}\delta_{A-B}. \text{ So on the PDB scale, } \delta^{18}O_{\text{carbonate}} = -19.64 + 17.38$$

+ 0.001(-19.64)(17.38) = -2.60‰ vs PDB. To convert to the SMOW scale we use the equation  $\delta^{18}O_{SMOW} = 1.03091(\delta^{18}O_{PDB}) + 30.91 = 28.22 \text{ ‰ vs SMOW}$ .

These values are the  $\delta^{18}O$  values of the  $CO_2$  gas. To determine the  $\delta^{18}O$  values of the carbonate and water, we need to use the  $\alpha$  values associated with these fractionations.

For acid liberated  $CO_2$  from carbonate at  $25^\circ C$ , we have  $\alpha_{CO_2\text{-carbonate}} = 1.01025$ . The  $\delta^{18}O$  value of the carbonate is -12.76 on the PDB scale. Similarly, for an  $\alpha_{CO_2\text{-H}_2O}$  value of 1.0412 at  $25^\circ C$ , the  $\delta^{18}O$  value of water is -39.75 ‰ on the PDB scale. From the

equation  $1000 \ln \alpha_{\text{calcite-water}} = \frac{2.78 \times 10^6}{T^2} - 2.89$ , the final answer is  $28.22^\circ C$ .

Chapter 9, pg. 206. 2<sup>nd</sup> line from bottom of page. Should read ‘removing  $O_2$  by reaction with copper’ instead of ‘copper oxide’.

Chapter 11, page 268. Ref. Fischer *et al.* should be:

Fischer, T.P., Hilton, D.R., Zimmer, M.M., Shaw, A.M., Sharp, Z.D., Walker, J.A. (2002) Subduction and recycling of nitrogen along the Central American margin. *Science*, 297, 1154-1157.

Figure. 11.10. Should read ‘carbonaceous chondrites’, not ‘carboniferous chondrites’

Chapter 12: Equation 12.3  $\delta_i$  is not defined. It should be  $\delta_{\text{initial rock}}$ . Another formulation of this equation would be

$$\delta_{\text{initial rock}} = \delta_{\text{final rock}} - 1000 \ln \alpha_{\text{rock-fluid}} (1 - x).$$

In this formulation, the  $\delta^{18}O$  values of the initial and final rock are measured, and  $x$  can be determined.