

8.1

Sunday, November 01, 2009
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- 8.1 Suppose an ocean sediment sample shows $(^{18}\text{O}/^{16}\text{O}) = 0.0020150$. Using the VSMOW for seawater, what is the value of $\delta^{18}\text{O}$? Is this a sign of more or less glaciation at the time the sediment was deposited?

8.1 From (8.1),

$$\delta^{18}\text{O}(\text{‰}) = \left[\frac{\left(\frac{^{18}\text{O}}{^{16}\text{O}} \right)_{\text{sample}}}{\left(\frac{^{18}\text{O}}{^{16}\text{O}} \right)_{\text{standard}}} - 1 \right] \times 10^3 = \left[\frac{0.0020150}{0.0020052} - 1 \right] \times 10^3 = 4.9$$

Since the sample has more ^{18}O in it, there would be more glaciation since ice selectively accumulates ^{16}O , increasing the concentration of ^{18}O left behind in seawater.

8.6

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Suppose earth is really flat with same T everywhere. As a perfect black body, what is the temperature?

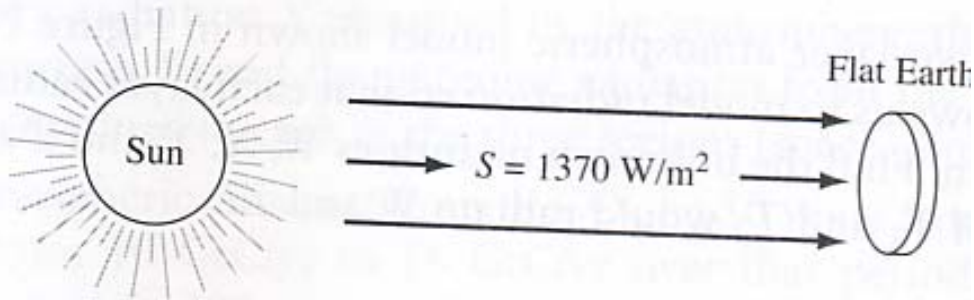
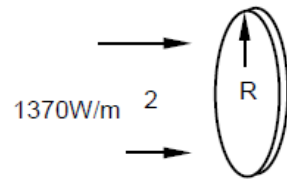


FIGURE P8.6

8.6 The flat earth!



$$E_{\text{absorbed}} = E_{\text{radiated}}$$

$$S\pi R^2 = \sigma T^4 A = \sigma T^4 (2\pi R^2)$$

$$T = \left(\frac{S}{2\sigma} \right)^{\frac{1}{4}} = \left(\frac{1370\text{W/m}^2}{2 \times 5.67 \times 10^{-8}\text{W/m}^2\text{K}^4} \right)^{\frac{1}{4}} = 331.5\text{K} - 273.1 = 58.4^\circ\text{C}$$

8.11

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8.11 In Figure 8.12, the average rate at which energy is used to evaporate water is given as 78 W/m^2 . Using $2,465 \text{ kJ/kg}$ as the latent heat of vaporization of water, along with the surface area of the Earth, which is about $5.1 \times 10^{14} \text{ m}^2$, estimate the total world annual precipitation in m^3/yr (which is equal to the total water evaporated). Averaged over the globe, what is the average annual precipitation in meters of water?

8.11 Hydrologic cycle:

$$\text{evaporation} = \frac{78 \text{ W/m}^2 \times 5.1 \times 10^{14} \text{ m}^2 \times \frac{1 \text{ J/s}}{\text{W}} \times 3600 \frac{\text{s}}{\text{hr}} \times 24 \frac{\text{hr}}{\text{d}} \times 365 \frac{\text{d}}{\text{yr}}}{2465 \text{ kJ/kg} \times 10^3 \text{ kg/m}^3 \times 10^3 \text{ J/kJ}} = 5.1 \times 10^{14} \text{ m}^3$$

Averaged over the globe, with area $5.1 \times 10^{14} \text{ m}^2$, annual precipitation is very close to 1 m