8.1

Sunday, November 01, 2009
12:20 PM

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

8.1 From (8.1),

$$\delta^{18}O(\text{‰}) = \left[\frac{\left(^{18}O/^{16}O\right)_{sample}}{\left(^{18}O/^{16}O\right)_{standard}} - 1\right] x10^3 = \left[\frac{0.0020150}{0.0020052} - 1\right] x10^3 = 4.9$$

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

Tuesday, November 17, 2009
1:46 PM

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

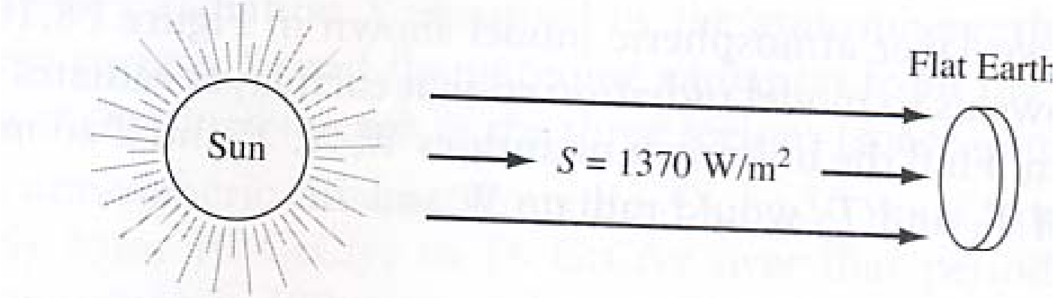
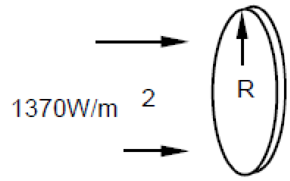


FIGURE P8.6

8.6 The flat earth!



$$E_{absorbed} = E_{radiated}$$

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

$$T = \left(\frac{S}{2\sigma}\right)^{1/4} = \left(\frac{1370 W/m^2}{2x5.67x10^{-8} W/m^2K^4}\right)^{1/4} = 331.5K \ - \ 273.1 = 58.4^\circ C$$

8.11

Tuesday, November 17, 2009
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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 kJ/kg as the latent heat of vaporization of water, along with the surface area of the Earth, which is about 5.1×10^{14} 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:

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

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