

(13.7) The CO₂ in the atmosphere is in exchange with carbon in living organisms, humus, dissolved organic compounds, and carbonate in the sea water, the latter being the main reservoir (88%) of all exchangeable carbon. The amount of such exchangeable carbon is estimated to be 7.9 g cm⁻² of the earth. When cosmic-ray produced ¹⁴C is mixed into this exchangeable carbon, what will the specific activity become?

First define the Bq, the production rate (Table 13.1) and the specific amount of carbon:

$$Bq := \text{sec}^{-1} \quad \text{Prodrate}_{min} := 17000 \cdot \text{m}^{-2} \cdot \text{sec}^{-1} \quad \text{AmountC} := 7.9 \cdot \text{gm} \cdot \text{cm}^{-2}$$

At equilibrium: Production rate = decay rate. For the maximum production rate:

$$A_{averagemin} := \frac{\text{Prodrate}_{min}}{\text{AmountC}} \quad A_{averagemin} = 215.19 \cdot \frac{\text{Bq}}{\text{kg}}$$

Repeat this calculation also for the maximum production rate

$$\text{Prodrate}_{max} := 25000 \cdot \text{m}^{-2} \cdot \text{sec}^{-1}$$

$$A_{averagemax} := \frac{\text{Prodrate}_{max}}{\text{AmountC}} \quad A_{averagemax} = 316.456 \cdot \frac{\text{Bq}}{\text{kg}}$$

Then compute the mean between max and min specific activities:

$$A_{averagemean} := \frac{A_{averagemin} + A_{averagemax}}{2} \quad A_{averagemean} = 266 \cdot \frac{\text{Bq}}{\text{kg}}$$