

(5.7) One may assume that when ^{238}U was formed at the genesis an equal amount of ^{235}U was formed. Today the amount of ^{238}U is 138 times the amount of ^{235}U . How long time ago did the genesis occur according to this assumption?

Half-lives from Fig. 14.1:

$$t_{235} := 7.038 \cdot 10^8 \cdot \text{yr} \quad t_{238} := 4.468 \cdot 10^9 \cdot \text{yr}$$

$$\lambda_{235} := \frac{\ln(2)}{t_{235}} \quad \lambda_{238} := \frac{\ln(2)}{t_{238}} \quad \text{Eqn. (5.62)}$$

Eqn. (5.58) gives:

$$N_{235} = N_{0235} e^{-\lambda_{235} t} \quad \text{and} \quad N_{238} = N_{0238} e^{-\lambda_{238} t} \quad \text{hence:} \quad \frac{N_{238}}{N_{235}} = \frac{N_{0238}}{N_{0235}} \cdot \frac{e^{-\lambda_{238} t}}{e^{-\lambda_{235} t}}$$

but we know that: $\frac{N_{238}}{N_{235}} = \frac{138}{1}$ and assume that $\frac{N_{0238}}{N_{0235}} = 1$

Using these data we get:

$$\frac{138}{1} = \frac{1}{1} \cdot \frac{e^{-\lambda_{238} t}}{e^{-\lambda_{235} t}} \quad \text{or} \quad 138 = e^{t(\lambda_{235} - \lambda_{238})}$$

$$t := \frac{\ln(138)}{\lambda_{238} - \lambda_{235}} \quad t = -1.874 \cdot 10^{17} \cdot \text{sec} \quad t = -5.938 \cdot 10^9 \cdot \text{yr} \quad (\text{years ago})$$