

$$^{235}\text{U} : \quad 0.72\% \quad 7.04 \times 10^8 \text{ yr}$$

$$^{238}\text{U} : \quad 99.28\% \quad 4.47 \times 10^9 \text{ yr}$$

given: $t = \text{age of earth} = 4.54 \times 10^9 \text{ yr}$.
what were the abundances when earth was formed?

Look at decay of each:

$$N_{235} = N_{235}(0) \cdot \left(\frac{1}{2}\right)^{t/7.04 \times 10^8}$$

$$N_{238} = N_{238}(0) \cdot \left(\frac{1}{2}\right)^{t/4.47 \times 10^9}$$

The problem is asking for

$$\frac{N_{235}(0)}{N_{\text{total}}(0)} \quad \text{and} \quad \frac{N_{238}(0)}{N_{\text{total}}(0)} \quad \text{where} \quad N_{\text{total}}(0) = N_{235}(0) + N_{238}(0).$$

[The rest involves algebra that is more complex than we would

The other information we have is see on the lined.]

$$N_{235} = (0.72\%) N_{\text{total}}$$

$$N_{238} = (99.28\%) N_{\text{total}}, \quad \text{where}$$

$$N_{\text{total}} = N_{235} + N_{238}$$

$$\begin{aligned} \therefore N_{235}(0) &= N_{235} \cdot 2^{t/7.04 \times 10^8} \\ &= (0.72\%) N_{\text{total}} \cdot 2^{4.54 \times 10^9 / 7.04 \times 10^8} \\ &= (0.72\%) N_{\text{total}} \cdot 87.4 = 0.629 N_{\text{total}} \end{aligned}$$

$$\begin{aligned} N_{238}(0) &= N_{238} \cdot 2^{t/4.47 \times 10^9} \\ &= (99.28\%) N_{\text{total}} \cdot 2^{4.54 \times 10^9 / 4.47 \times 10^9} \\ &= (99.28\%) N_{\text{total}} \cdot 2.02 = 2.01 N_{\text{total}} \end{aligned}$$

$$N_{\text{total}}(0) = (0.629 + 2.01) N_{\text{total}} = 2.64 N_{\text{total}}$$

Thus

$$\frac{N_{235}(0)}{N_{\text{total}}(0)} = \frac{0.629 N_{\text{total}}}{2.64 N_{\text{total}}} = 23.9\%$$

$$\frac{N_{238}(0)}{N_{\text{total}}(0)} = \frac{2.01 N_{\text{total}}}{2.64 N_{\text{total}}} = 76.1\%$$