39. The number N of undecayed nuclei present at any time and the rate of decay R at that time are related by $R = \lambda N$, where λ is the disintegration constant. The disintegration constant is related to the half-life $T_{1/2}$ by $\lambda = (\ln 2)/T_{1/2}$, so $R = (N \ln 2)/T_{1/2}$ and $T_{1/2} = (N \ln 2)/R$. Since 15.0% by mass of the sample is ^{147}Sm, the number of ^{147}Sm nuclei present in the sample is

$$N = \frac{(0.150)(1.00\,\text{g})}{(147\,\text{u})(1.661 \times 10^{-24}\,\text{g/u})} = 6.143 \times 10^{20} \ .$$

Thus

$$T_{1/2} = \frac{(6.143 \times 10^{20}) \ln 2}{120\,\text{s}^{-1}} = 3.55 \times 10^{18}\,\text{s} = 1.12 \times 10^{11}\ \text{y} \ .$$