35. (a) We assume that the chlorine in the sample had the naturally occurring isotopic mixture, so the average mass number was 35.453, as given in Appendix F. Then, the mass of ^{226}Ra was

$$m = \frac{226}{226 + 2(35.453)}(0.10\,\text{g}) = 76.1 \times 10^{-3}\ \text{g} .$$

The mass of a ^{226}Ra nucleus is $(226\,\text{u})(1.661 \times 10^{-24}\,\text{g/u}) = 3.75 \times 10^{-22}\,\text{g}$, so the number of ^{226}Ra nuclei present was $N = (76.1 \times 10^{-3}\,\text{g})/(3.75 \times 10^{-22}\,\text{g}) = 2.03 \times 10^{20}$.

(b) The decay rate is given by $R = N\lambda = (N\ \ln 2)/T_{1/2}$, where λ is the disintegration constant, $T_{1/2}$ is the half-life, and N is the number of nuclei. The relationship $\lambda = (\ln 2)/T_{1/2}$ is used. Thus,

$$R = \frac{(2.03 \times 10^{20}) \ln 2}{(1600\,\text{y})(3.156 \times 10^{7}\,\text{s/y})} = 2.79 \times 10^{9}\ \text{s}^{-1} .$$