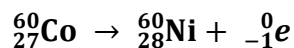**Marks
6**

- The isotope $^{60}_{27}\text{Co}$ undergoes radioactive decay to produce a stable isotope of nickel. Give the balanced equation for this decay process.

$$^{60}_{27}\text{Co} \rightarrow {}^{60}_{28}\text{Ni} + {}^{\ \ 0}_{-1}e$$

The half-life of ^{60}Co is 5 years. Calculate the value of the decay constant, λ, (in s^{-1}).

The decay constant, λ, is given by:

$$\lambda = \ln 2 \,/\, t_{1/2} = \ln 2 \,/\, (5 \times 365.25 \times 24 \times 60 \times 60 \text{ s}) = 4 \times 10^{-9} \text{ s}^{-1}$$
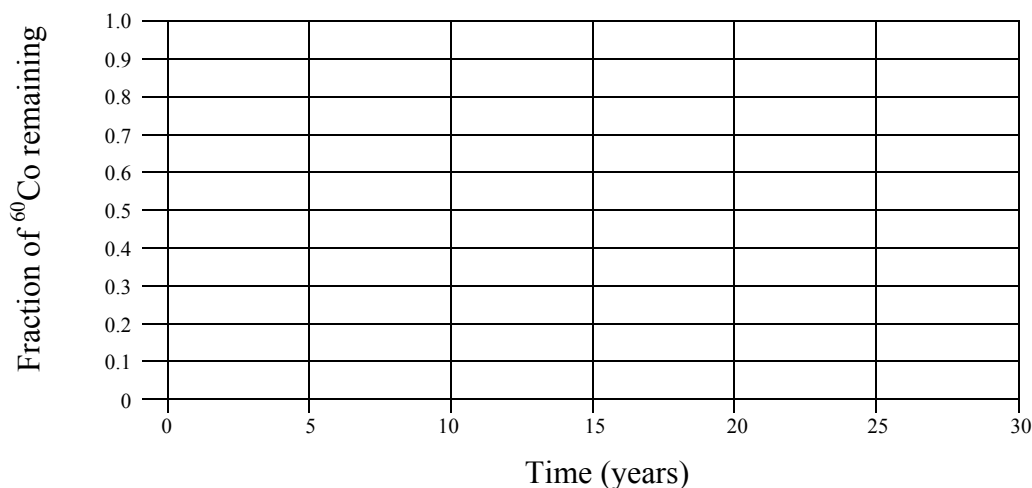
Answer: **4×10^{-9} s^{-1}**

What is the molar activity of ^{60}Co (in Bq mol^{-1})?

The molar activity, A, is given by $A = \lambda N_A$ where N_A is Avogadro's number. Hence:

$$A = (4 \times 10^{-9} \text{ s}^{-1}) \times (6.022 \times 10^{23} \text{ particles mol}^{-1})$$
$$= 3 \times 10^{15} \text{ particles s}^{-1} \text{ mol}^{-1} = 3 \times 10^{15} \text{ Bq mol}^{-1}$$

Answer: **3×10^{15} Bq mol^{-1}**

Complete the graph below.

Estimate from the graph the fraction of ^{60}Co remaining after 12 years.