12 (a) State what is meant by *radioactive decay*.

....

....

....

....[3]

(b) The variation with time t of the number N of undecayed nuclei in a sample of a radioactive isotope is shown in Fig. 12.1.
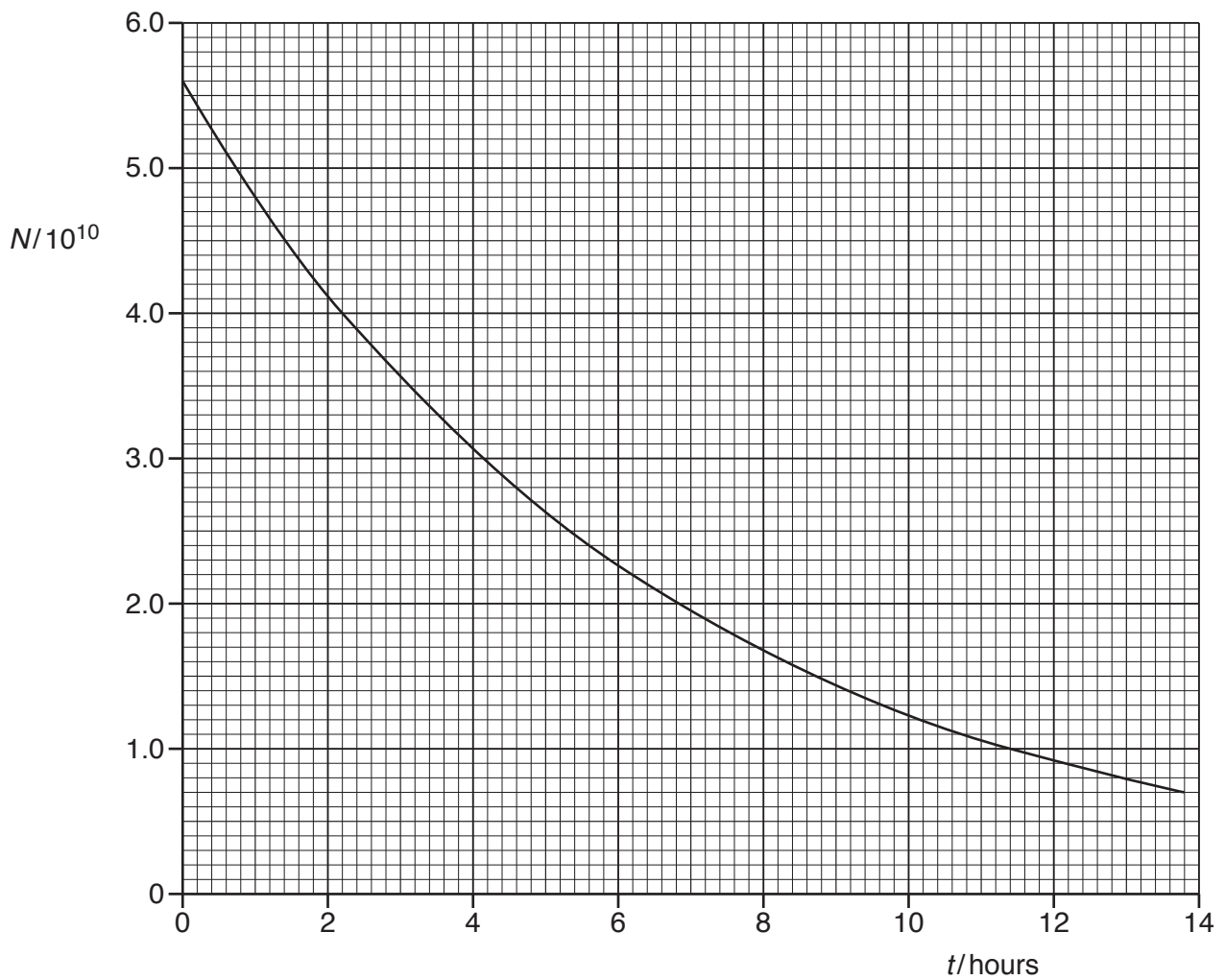

Fig. 12.1

(i) Use the gradient of the line in Fig. 12.1 to determine the activity, in Bq, of the sample at time $t = 4.0$ hours. Show your working.

activity = ... Bq [3]

(ii) Use your answer in **(i)** to show that the decay constant λ of the isotope is approximately $4 \times 10^{-5}\,s^{-1}$.

[2]

(c) A sample of a different radioactive isotope has an initial activity of $4.6 \times 10^3\,Bq$. The sample must be stored safely until its activity is reduced to $1.0 \times 10^3\,Bq$.

The decay constant of the isotope is $5.5 \times 10^{-7}\,s^{-1}$. The decay products are not radioactive.

Calculate the minimum time, in days, for which the sample must be stored.

time = ... days [3]

[Total: 11]

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