9 Polonium-211 ($^{211}_{84}$Po) decays by alpha emission to form a stable isotope of lead (Pb).

(a) Complete the equation for this decay.

$$^{211}_{84}\text{Po} \rightarrow \overset{\cdots\cdots}{\cdots\cdots}\text{Pb} + \overset{\cdots\cdots}{\cdots\cdots}\alpha$$

[2]

(b) The variation with time t of the number of unstable nuclei N in a sample of polonium-211 is shown in Fig. 9.1.

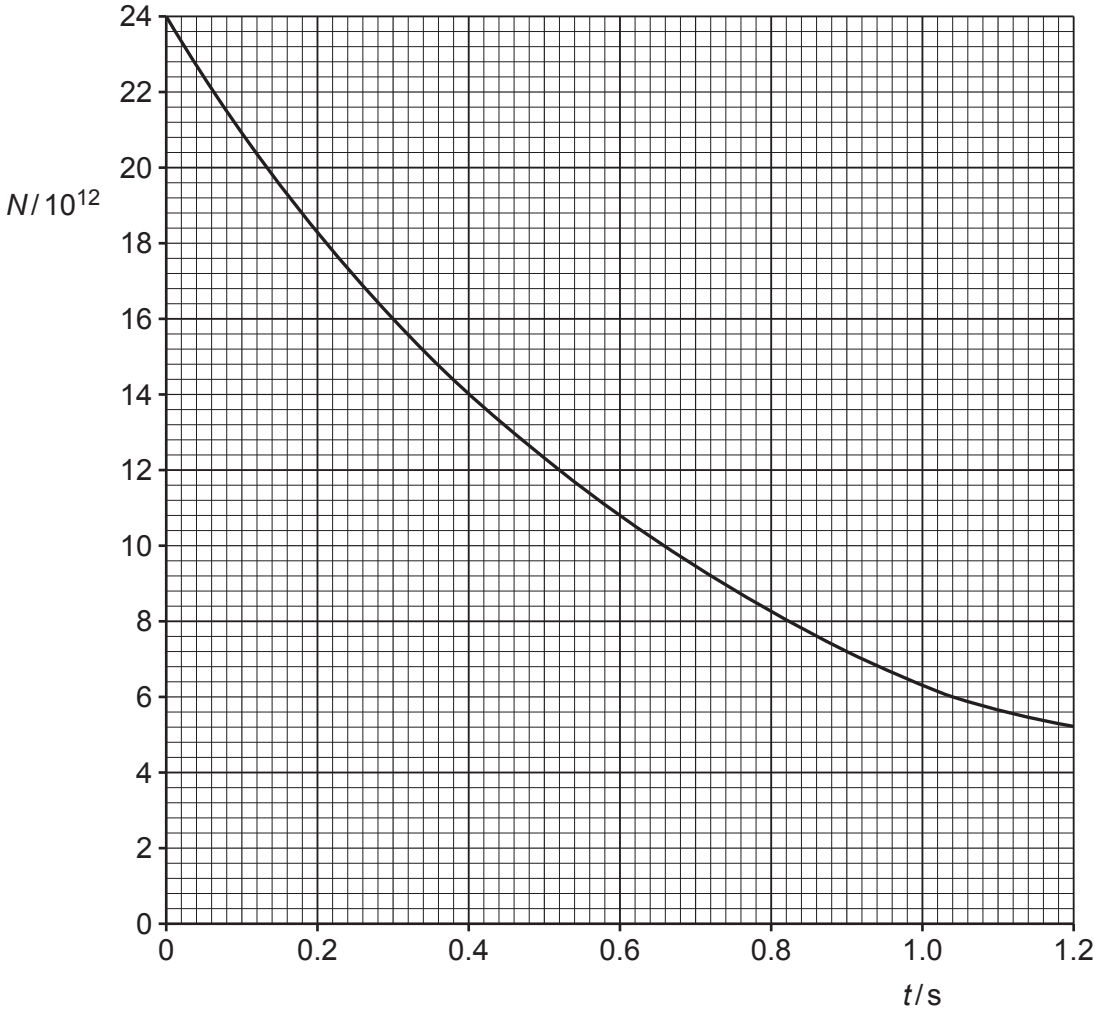

Fig. 9.1

At time t = 0, the sample contains only polonium-211.

(i) Use Fig. 9.1 to determine the decay constant λ of polonium-211. Give a unit with your answer.

λ = ... unit ..... [2]

(ii) Use your answer in **(b)(i)** to calculate the activity at time $t = 0$ of the sample of polonium-211.

activity = ... Bq [1]

(iii) On Fig. 9.1, sketch a line to show the variation with t of the number of lead nuclei in the sample. [2]

(c) Each decay releases an alpha particle with energy 6900 keV.

(i) Calculate, in J, the total amount of energy given to alpha particles that are emitted between time $t = 0.30$ s and time $t = 0.90$ s.

energy = ... J [3]

(ii) Suggest why the total amount of energy released by the decay process between time $t = 0.30$ s and time $t = 0.90$ s is greater than your answer in **(c)(i)**.

.....

.....

..... [1]

[Total: 11]