6 (a) The table shows how the activity of a sample of plutonium-238 varies with time.

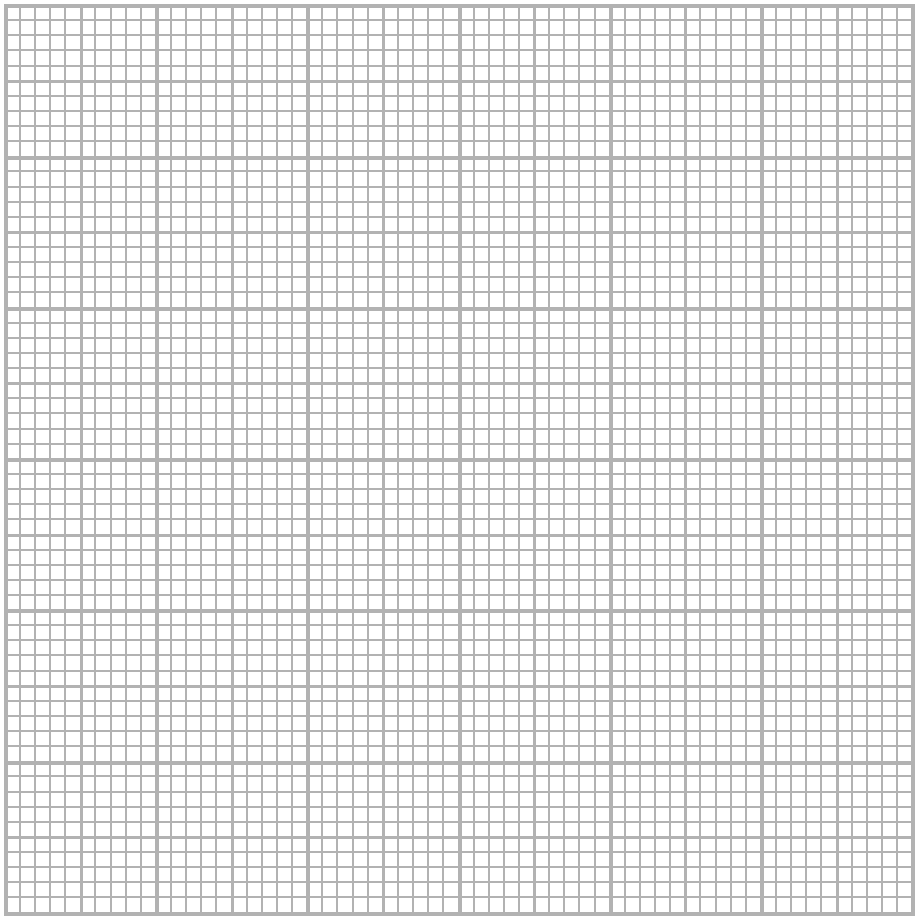
Time in years	0	50	100	150	200	250
Activity in Bq	980	660	450	305	205	140

(i) Plot a graph of activity (*y*-axis) against time (*x*-axis).

(4)

(ii) Draw the curve of best fit.

(1)



(iii) Use your graph to find the half-life of plutonium-238.

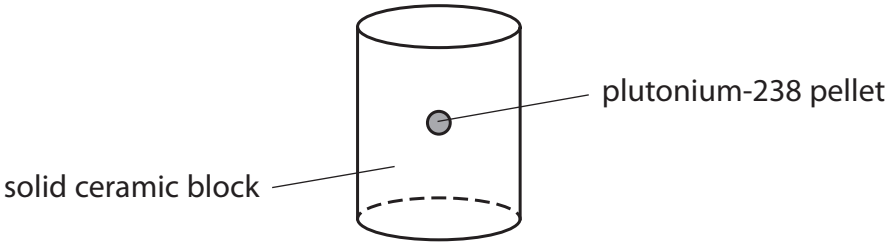
Show your working.

(2)

half-life = ... years

(b) Plutonium-238 transfers thermal energy as it decays. This energy is used to power heater units in spacecraft.

The diagram shows a module from a heater unit.



(i) Plutonium-238 transfers thermal energy at a rate of 0.56 W for every gram of plutonium.

Calculate the rate of thermal energy output from a pellet of plutonium-238 with mass 2.7 g.

(1)

rate of thermal energy output = ... W

(ii) When plutonium-238 decays, it only emits alpha particles.

Explain why a technician can hold a module from the heater unit safely in their hand.

(2)

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(c) A space probe called Cassini was sent to the planet Saturn on a mission that lasted several years.

Plutonium-238 was used to generate electricity on Cassini.

Explain why it was important to use plutonium-238 rather than another isotope with a shorter half-life.

(2)

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(Total for Question 6 = 12 marks)