OCR
Oxford Cambridge and RSA

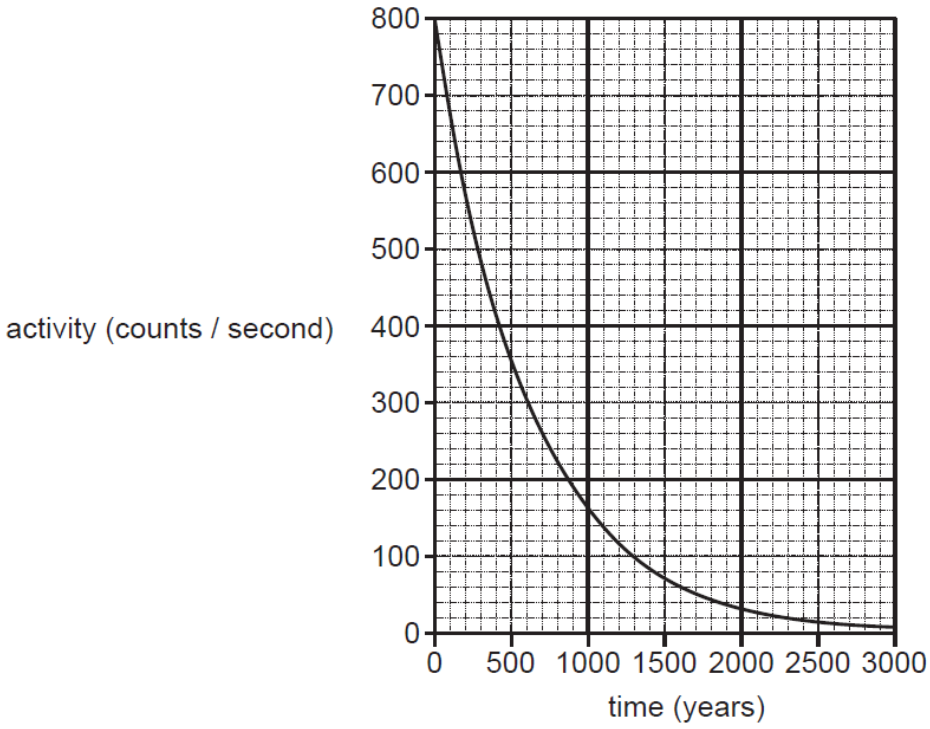
GCSE Physics B (Twenty First Century Science)

J259/04 Depth in physics (Higher Tier)

Question Set 8

1 This question is about the radioactive isotope americium-241, which is found in smoke detectors.

The graph shows how the activity of a sample of americium-241, with an initial activity of 800 counts per second, would change with time



(a) Use the graph to obtain an estimate of the half-life of americium-241.
Show your working on the graph.

Half-life = ... years **[2]**

(b) Americium-241 decays by emitting alpha-particles.

A smoke detector is not a hazard in your house. They usually last 10 years.

Explain why a smoke detector should be disposed of carefully when it no longer works **[4]**

(c) In schools, the decay of radioactive isotopes such as americium-241 can be modelled by a game rolling many dice. Each dice has 1 chance in 6 of showing a 'six' each time.

In a typical game, **100** dice are rolled onto a table.

The number showing six spots on the top are removed and counted.

The remaining dice are rolled again, and the process continued.

The results are put into a table. The following is an example for one game.

Roll number	1	2	3	4	5	6	7
Number of sixes	18	13	12	9	6	7	5
Number of dice remaining	82	69	57	48	42	35	30

Each ‘roll number’ stands for an equal interval of time.

(i) What does the number of dice remaining at any roll stand for? **[1]**

(ii) What does the number of sixes taken out in any roll stand for? **[1]**

(iii) Explain why the data in this table suggest that the half-life is about 4 ‘rolls’ but that it’s not possible to be exact. **[3]**

Total Marks for Question Set 8: 11

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