19 In 2023, a small capsule of caesium-137 was lost when being transported from a mine in Western Australia.

The activity of the caesium in the capsule was 19 GBq.

(a) (i) Show that the decay constant for caesium-137 is about $7.3 \times 10^{-10}\,s^{-1}$.

half-life of caesium-137 = 30.1 years
1 year = 3.15×10^{7} s

(2)

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(ii) Calculate the mass of caesium in the capsule.

(3)

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Mass of caesium = ...

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(iii) Calculate the activity of the caesium in the capsule after 2 years.

(2)

Activity after 2 years = ...

(b) The capsule was found after 14 days.

Calculate the total energy, in J, released from the capsule in 14 days.

activity of caesium in capsule = 19 GBq
energy released in each decay of caesium-137 = 1.17 MeV
1 day = 86 400 s

(3)

Total energy released in 14 days = ... J

(Total for Question 19 = 10 marks)