

7 (a) State experimental evidence to suggest that the process of radioactive decay is

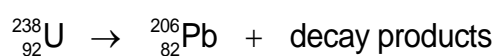
(i) random;

.....
 [1]

(ii) spontaneous.

.....
 [1]

(b) Uranium-238 decays into lead-206 by several stages. Lead-206 is a stable isotope. The overall decay can be represented by the following equation:



It is suggested that **all** of the decay products are alpha particles.

Use the equation to show that this cannot be correct.

[2]

(c) Technetium-99, ${}_{43}^{99}\text{Tc}$, decays to ruthenium-99, ${}_{44}^{99}\text{Ru}$.

The half-life of technetium-99 is 4.00×10^6 years. Ruthenium-99 is a stable nuclide.

(i) Write down the nuclear equation representing this decay. State also the name(s) of the products other than ruthenium-99 that is/are formed.

Equation:

Name(s) of additional product(s): [2]

- (ii) On the axes of Fig. 7.1, sketch a graph to show how the ratio

$$R = \frac{\text{number of ruthenium-99 nuclei}}{\text{number of technetium-99 nuclei}}$$

will change in a sample with time t .

Take $t = 0$ to be the instant of creation of ruthenium-99.

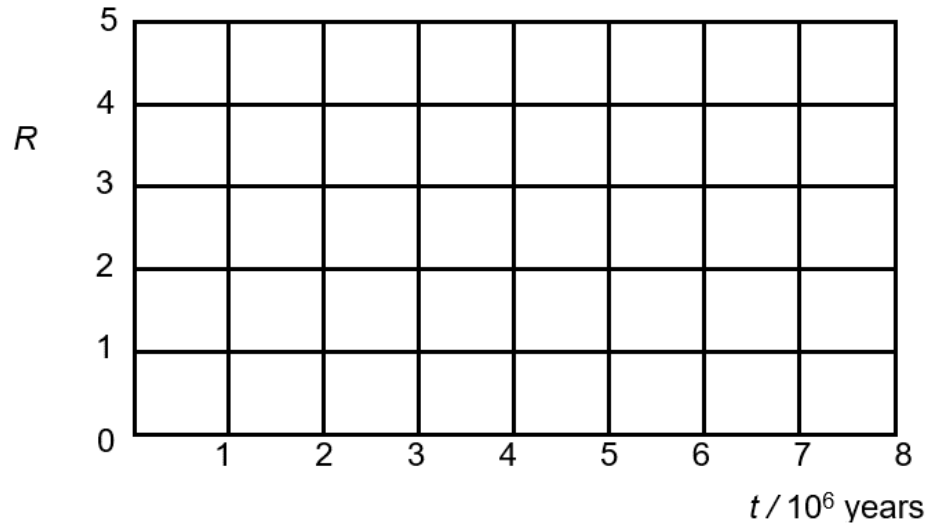


Fig. 7.1

[2]

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