

- 9 (a) Distinguish between a *nucleon*, a *nucleus* and a *nuclide*.

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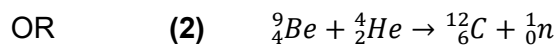
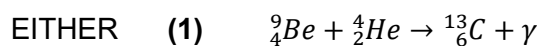
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[3]

- (b) When beryllium is bombarded with α -particles of energy 8.0×10^{-13} J, carbon atoms are produced, together with a very penetrating radiation. The nuclear reaction might be



- (i) Explain what is meant by ${}^{13}_6\text{C}$.

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[1]

- (ii) The energy of the penetrating radiation is found to be at least 8.8×10^{-12} J for each γ or ${}^1_0\text{n}$ produced. Explain whether equations (1) and (2) are valid.

nuclide	mass / u
${}^9_4\text{Be}$	9.0150
${}^4_2\text{He}$	4.0040
${}^{13}_6\text{C}$	13.0075

[4]

- (c) Fig. 9.1 gives the activity of Dubnium-268 measured over a period of 15 days.

Time / day	Activity / Bq
0	76 300
1	44 490
2	25 940
3	15 120
4	8 815
5	5 140
6	3 000
7	1 747
8	1 018
9	594
10	346
11	203
12	120
13	67
14	40
15	20

Fig. 9.1

- (i) 1. Explain what is meant by the term decay constant.

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 [1]

2. State the equation relating decay constant λ to half-life $t_{\frac{1}{2}}$.

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 [1]

- (ii) Without plotting a graph, deduce the half-life of Dubnium-268.

half-life of B = days [3]

- (iii) Suggest an appropriate graph to plot to deduce the half-life of Dubnium-268 and explain how the half-life can be deduced from the graph.

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[3]

- (iv) Explain why it is necessary to ensure that the readings are taken at the same time each day.

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[1]

- (v) Explain if the following statement is accurate:

“After 14 days, the activity of Dubnium-268 is 40 Bq. After 15 days, the activity is 20 Bq. The half-life of Dubnium-268 is therefore 1 day.”

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[3]

[Total: 20]