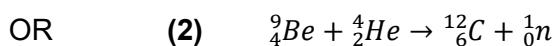
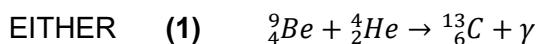


- 9 (a) Distinguish between a *nucleon*, a *nucleus* and a *nuclide*.

.....  
.....  
.....  
.....

[3]

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



- (i) Explain what is meant by  ${}^{13}_6C$ .

.....  
.....

[1]

- (ii) The energy of the penetrating radiation is found to be at least  $8.8 \times 10^{-12}$  J for each  $\gamma$  or  ${}^1_0n$  produced. Explain whether equations (1) and (2) are valid.

nuclide	mass / u
${}^9_4Be$	9.0150
${}^4_2He$	4.0040
${}^{13}_6C$	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.

.....

[1]

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

.....

[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.

.....

[3]

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

.....

[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]