6 **(a)** State what is meant by nuclear fusion.

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……

……[2]

(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

$$^{9}_{4}\text{Be} + ^{4}_{2}\text{He} \rightarrow ^{13}_{6}\text{C} + \gamma$$

(i) Explain what is meant by $^{13}_{6}\text{C}$ in relation to carbon-12.

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…… [2]

(ii) The energy of the penetrating radiation is found to be at least 8.8×10^{-12} J for each γ produced.

Data for the nuclei in the reaction are given in Table 6.1.

Table 6.1

nuclide	rest mass/ u
$^{9}_{4}\text{Be}$	9.0150
$^{4}_{2}\text{He}$	4.0010
$^{13}_{6}\text{C}$	13.0075

1. Calculate the initial rest mass energy of reactants.

initial rest mass energy = …… J [2]

2. Calculate the final rest mass energy of products.

final rest mass energy = …… J [1]

3. Determine the energy released from the reaction.

energy released = …… J [2]

4. Based on **b(ii)3.**, explain why the nuclear equation suggested in **(b)** cannot be valid.

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…… [1]

[Total: 10]