Recovering Decays From Two Nuclear Totals

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A simulation keeps a record of the parent nuclei and their resulting heavy nuclei. It excludes the emitted particles from the record. Each alpha decay lowers the recorded mass-number sum by four and the atomic-number sum by two. Each beta-minus decay leaves the mass-number sum unchanged and increases the atomic-number sum by one. Only these two decay types occur.

Sum over the recorded nuclei	**Before**	**After**
Mass numbers	400	388
Atomic numbers	160	156

1 How many alpha decays are needed to explain the mass-number change?

(1) 1

(2) 2

(3) 3

(4) 4

2 Use the atomic-number sum to calculate the number of beta-minus decays. [1]

Answer and work

3 A student says the atomic-number change by itself determines how many alpha decays occurred. Give a different event combination that would cause the same atomic-number change. [1]

Answer and work

In a later window the mass-number sum does not change. The atomic-number sum increases by three.

4 Identify how many of each decay type occurred in the later window. Explain how the two records constrain the result. [1]

Answer and work