Balancing Nuclear Equations

In a balanced nuclear equation, the sum of the mass numbers and the sum of the atomic numbers for the nuclei of the reactant and the products must be equal.

MASS NUMBERS

Total = 251 = 251

$$^{251}_{98}\text{Cf} \longrightarrow {}^{247}_{96}\text{Cm} + {}^{4}_{2}\text{He}$$

Total = 98 = 98

ATOMIC NUMBERS

The Law of Conservation of Mass Number and the Law of Conservation of Charge allows us to predict products in a nuclear reaction.

Guide to Completing a Nuclear Equation

STEP 1
Write the incomplete nuclear equation.

STEP 2
Determine the missing mass number.

STEP 3
Determine the missing atomic number.

STEP 4
Determine the symbol of the new nucleus.

STEP 5
Complete the nuclear equation.

Example: $^{241}_{95}\text{Am} \rightarrow ? + {}^{4}_{2}\text{He}$

STEP 1 Write the incomplete nuclear equation.

$$^{241}_{95}\text{Am} \rightarrow ? + {}^{4}_{2}\text{He}$$

STEP 2 **Determine the missing mass number.**

241 = ? + 4
241 − 4 = ?
241 − 4 = 237 (mass number of new nucleus)

STEP 3 **Determine the missing atomic number.**

95 = ? + 2
95 − 2 = ?
95 − 2 = 93 (atomic number of new nucleus)

STEP 4 **Determine the symbol of the new nucleus.**

The element that has atomic number 93 is neptunium, Np. $^{237}_{93}\text{Np}$

STEP 5 **Complete the nuclear equation.**

$$^{241}_{95}\text{Am} \rightarrow {}^{237}_{93}\text{Np} + {}^{4}_{2}\text{He}$$