

## Balancing Nuclear Equations

When balancing nuclear equations, the sums of the atomic and mass numbers must be the same on both sides of the equation. In some cases one of the symbols in the list below will be used to complete the equation. If a new element is formed, you may need to refer to a periodic table to determine the symbol that accompanies an atomic number. The first two equations have been balanced for you.

Alpha particle	$\alpha$	${}^4_2\text{He}$	Beta particle	$\beta$	${}^0_{-1}e$
Gamma ray	$\gamma$	${}^0_0\gamma$	Proton	$p$	${}^1_1\text{H}$
Neutron	$n$	${}^1_0n$	Positron	$\beta^+$	${}^0_{+1}e$

1.  ${}^{27}_{12}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0n$
2.  ${}^{63}_{29}\text{Cu} + {}^2_1\text{H} \rightarrow 2 {}^1_0n + {}^{63}_{30}\text{Zn}$
3.  ${}^{65}_{30}\text{Ca} \rightarrow {}^{65}_{29}\text{Sc} + \underline{\hspace{2cm}}$
4.  ${}^9_4\text{Be} + {}^4_2\text{He} \rightarrow {}^{12}_6\text{C} + \underline{\hspace{2cm}}$
5.  ${}^{31}_{15}\text{P} + {}^2_1\text{H} \rightarrow {}^{32}_{15}\text{P} + \underline{\hspace{2cm}}$
6.  ${}^{37}_{17}\text{Cl} + \underline{\hspace{2cm}} \rightarrow {}^{35}_{16}\text{S} + {}^4_2\text{He}$
7.  ${}^{30}_{15}\text{P} + \underline{\hspace{2cm}} \rightarrow {}^{30}_{14}\text{Si} + {}^1_1\text{H}$
8.  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^1_1\text{H} + \underline{\hspace{2cm}}$
9.  ${}^{11}_6\text{C} \rightarrow {}^0_{+1}e + \underline{\hspace{2cm}}$
10.  ${}^{63}_{29}\text{Cu} + {}^2_1\text{H} \rightarrow {}^{64}_{30}\text{Zn} + \underline{\hspace{2cm}}$
11.  ${}^2_1\text{H} + \underline{\hspace{2cm}} \rightarrow {}^1_1\text{H} + {}^1_0n$
12.  ${}^{31}_{15}\text{P} + {}^1_1\text{H} \rightarrow {}^{28}_{14}\text{Si} + \underline{\hspace{2cm}}$
13.  ${}^{14}_7\text{N} + \underline{\hspace{2cm}} \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}$
14.  ${}^{239}_{94}\text{Pu} + {}^1_1\text{H} \rightarrow {}^1_0n + \underline{\hspace{2cm}}$
15.  ${}^{63}_{29}\text{Cu} + {}^1_1\text{H} \rightarrow {}^{38}_{17}\text{Cl} + {}^1_0n + \underline{\hspace{2cm}}$
16.  ${}^{63}_{29}\text{Cu} + {}^2_1\text{H} \rightarrow {}^{64}_{29}\text{Cu} + \underline{\hspace{2cm}}$

17.  ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{95}_{42}\text{Mo} + \underline{\hspace{2cm}} + 2 {}^1_0\text{n}$
18.  ${}^6_3\text{Li} + {}^1_0\text{n} \rightarrow {}^4_2\text{He} + \underline{\hspace{2cm}}$
19.  ${}^6_3\text{Li} + {}^2_1\text{H} \rightarrow {}^7_4\text{Be} + \underline{\hspace{2cm}}$
20.  ${}^{121}_{51}\text{Sb} + {}^1_0\text{n} \rightarrow {}^{122}_{51}\text{Sb} + \underline{\hspace{2cm}}$
21.  ${}^{214}_{82}\text{Pb} \rightarrow {}^0_{-1}\text{e} + \underline{\hspace{2cm}}$
22.  ${}^{63}_{29}\text{Cu} + {}^2_1\text{H} \rightarrow {}^3_1\text{H} + \underline{\hspace{2cm}}$
23.  ${}^{14}_7\text{N} + \underline{\hspace{2cm}} \rightarrow {}^{14}_6\text{C} + {}^1_1\text{H}$
24.  ${}^6_3\text{Li} + {}^1_1\text{H} \rightarrow {}^4_2\text{He} + \underline{\hspace{2cm}}$
25.  $\underline{\hspace{2cm}} \rightarrow {}^{237}_{93}\text{Np} + {}^4_2\text{He}$
26.  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^3_2\text{He} + \underline{\hspace{2cm}}$
27.  ${}^{28}_{14}\text{Si} + {}^2_1\text{D} \rightarrow {}^{29}_{14}\text{Si} + \underline{\hspace{2cm}}$
28.  ${}^9_4\text{Be} + {}^4_2\text{He} \rightarrow {}^6_3\text{Li} + \underline{\hspace{2cm}}$
29.  ${}^{59}_{27}\text{Co} + {}^1_0\text{n} \rightarrow {}^{60}_{27}\text{Co} + \underline{\hspace{2cm}}$
30.  ${}^{40}_{18}\text{Ar} + {}^2_1\text{H} \rightarrow {}^{41}_{18}\text{Ar} + \underline{\hspace{2cm}}$
31.  ${}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^1_1\text{H} + \underline{\hspace{2cm}}$
32.  ${}^{18}_9\text{F} \rightarrow {}^{18}_8\text{O} + \underline{\hspace{2cm}}$
33.  ${}^9_4\text{Be} + {}^4_2\text{He} \rightarrow {}^{12}_6\text{C} + \underline{\hspace{2cm}}$
34.  ${}^{239}_{92}\text{U} \rightarrow {}^0_{-1}\text{e} + \underline{\hspace{2cm}}$
35.  ${}^{32}_{16}\text{S} + {}^1_0\text{n} \rightarrow {}^1_1\text{H} + \underline{\hspace{2cm}}$
36.  ${}^{239}_{94}\text{Pu} + 2 {}^1_0\text{n} \rightarrow {}^0_{-1}\text{e} + \underline{\hspace{2cm}}$
37.  ${}^{237}_{89}\text{Ac} \rightarrow {}^0_{-1}\text{e} + \underline{\hspace{2cm}}$
38.  ${}^{237}_{90}\text{Th} \rightarrow {}^{233}_{88}\text{Ra} + \underline{\hspace{2cm}}$
39.  ${}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + \underline{\hspace{2cm}}$
40.  ${}^{231}_{90}\text{Th} \rightarrow {}^{231}_{91}\text{Pa} + \underline{\hspace{2cm}}$