Balancing chemical equations

1. Count the oxygen atoms represented by $3CO_2$. Explain your count.

Each CO_2 has two oxygen atoms. Three units have $3 \times 2 = 6$ oxygen atoms.

2. Count the hydrogen atoms represented by $2NH_3$. Explain your count.

Each NH_3 has three hydrogen atoms. Two units represent 6 hydrogen atoms.

3. Explain why changing H_2O to H_2O_2 cannot balance an equation for making water.

A subscript change alters the formula. H_2O_2 is hydrogen peroxide rather than water.

4. Balance $Mg + O_2 \rightarrow MgO$. Verify the atom counts.

$2Mg + O_2 \rightarrow 2MgO$. Each side has two magnesium and two oxygen atoms.

5. Balance $Al + Cl_2 \rightarrow AlCl_3$ using the smallest whole-number coefficients.

$2Al + 3Cl_2 \rightarrow 2AlCl_3$. Each side has two aluminium and six chlorine atoms.

Worked solutions · Questions 6–10

6. Balance $N_2 + H_2 \rightarrow NH_3$. Verify the hydrogen atom count.

$N_2 + 3H_2 \rightarrow 2NH_3$. There are six hydrogen atoms on each side.

7. Balance $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$. Verify hydrogen and oxygen.

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$. Both sides have four H atoms and two O atoms.

8. Balance $Fe_2O_3 + CO \rightarrow Fe + CO_2$. Verify the oxygen count.

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$. Each side has six oxygen atoms.

9. Balance $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$. Explain how you obtained the oxygen coefficient.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$. Products contain 6 + 4 = 10 O atoms, requiring $5O_2$.

10. Balance $Al + HCl \rightarrow AlCl_3 + H_2$. Verify all three elements.

$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$. Each side has 2 Al, 6 Cl and 6 H atoms.