

# Writing formulae and balancing equations

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The answers use the sample observations. Whatever you observe, work out the precipitate by swapping partners between the ions, then check the formula against the ion charges before you balance. Include state symbols in every equation and check that charge balances in ionic equations.

**Level:** Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-7

## Question 1 Formulae of the precipitates

Copper(II) hydroxide:  $\text{Cu}^{2+}$  and  $\text{OH}^-$  give  $\text{Cu}(\text{OH})_2$ . Iron(III) hydroxide:  $\text{Fe}^{3+}$  and  $\text{OH}^-$  give  $\text{Fe}(\text{OH})_3$ . Magnesium hydroxide:  $\text{Mg}(\text{OH})_2$ . Calcium carbonate:  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$  give  $\text{CaCO}_3$ .  
 **$\text{Cu}(\text{OH})_2$ ,  $\text{Fe}(\text{OH})_3$ ,  $\text{Mg}(\text{OH})_2$ ,  $\text{CaCO}_3$ .**

## Question 2 Copper equation

Two  $\text{OH}^-$  are needed for each  $\text{Cu}^{2+}$ , so  $2\text{NaOH}$  is used and sodium sulfate forms.



## Question 3 Iron ionic equation

$\text{FeCl}_3(\text{aq}) + 3\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s}) + 3\text{NaCl}(\text{aq})$ .  $\text{Na}^+$  and  $\text{Cl}^-$  are spectators. Charge:  $3+ + 3(1-) = 0$  on the right-hand side as well.



## Question 4 Spectator ions

The full equation is  $\text{MgSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$ .  $\text{Na}^+$  and  $\text{SO}_4^{2-}$  are unchanged, so they are the spectators.



## Question 5 No reaction

Swapping partners gives copper(II) chloride and iron(III) sulfate, and both are soluble, so all the ions stay in solution and nothing new forms.

**All possible products are soluble.**

## Question 6 Identify an unknown

A red-brown precipitate with hydroxide ions shows iron(III) ions, which form iron(III) hydroxide.

**Fe<sup>3+</sup> and Fe(OH)<sub>3</sub>.**

### **Question 7 Improving reliability**

Use equal volumes and a white background for all tubes, and clean the dropper between solutions so no contamination causes a false precipitate. Repeating each pair also checks consistency.

**Equal volumes, clean droppers and a white background.**