

Precipitation and Net Ionic Equations

Answer key with worked solutions

A. Solubility

1. Soluble or insoluble.

(a) **insoluble** (b) **soluble** (c) **insoluble** (d) **soluble** (e) **insoluble** (f) **soluble**

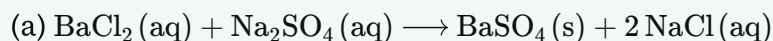
B. Predicting precipitates

2. Precipitates.

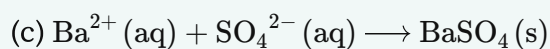
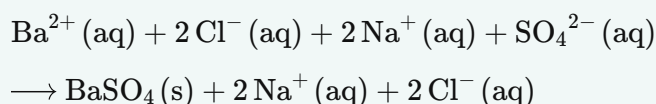
(a) **Yes**: calcium carbonate, CaCO_3 (white). (b) **No**: KNO_3 and NaOH are both soluble. (c) **Yes**: copper(II) hydroxide, $\text{Cu}(\text{OH})_2$ (blue). (d) **Yes**: silver iodide, AgI (yellow).

C. Writing equations

3. Barium chloride and sodium sulfate.

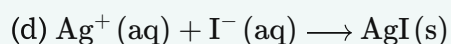
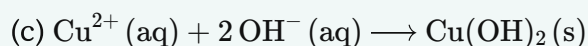
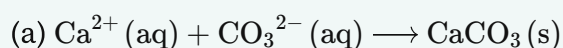


(b)



(d) Na^{+} and Cl^{-}

4. Net ionic equations.



5. Neutralization.

$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow \text{H}_2\text{O}(\text{l})$. Strong acids and strong bases are fully ionized, so the anion of the acid and the cation of the base are always **spectators**: the only real change is $\text{H}^+ + \text{OH}^-$ forming water.

D. Calculations

6. Sulfate concentration.

$$\begin{aligned}n(\text{BaSO}_4) &= \frac{0.466 \text{ g}}{233.39 \text{ g/mol}} \\&= 1.997 \times 10^{-3} \text{ mol}\end{aligned}$$

1 mol SO_4^{2-} gives 1 mol BaSO_4 , so $n(\text{SO}_4^{2-}) = 1.997 \times 10^{-3} \text{ mol}$.

$$\begin{aligned}c &= \frac{1.997 \times 10^{-3} \text{ mol}}{0.0500 \text{ L}} \\&= \mathbf{0.0399 \text{ mol/L}}\end{aligned}$$

7. Lead(II) iodide.

$$n(\text{I}^-) = 0.120 \text{ mol/L} \times 0.0200 \text{ L} = 2.40 \times 10^{-3} \text{ mol}$$

$\text{Pb}^{2+} + 2\text{I}^- \longrightarrow \text{PbI}_2$: 2 mol I^- give 1 mol PbI_2 , so $n(\text{PbI}_2) = 1.20 \times 10^{-3} \text{ mol}$.

$$\begin{aligned}m &= 1.20 \times 10^{-3} \text{ mol} \times 461.0 \frac{\text{g}}{\text{mol}} \\&= \mathbf{0.553 \text{ g}}\end{aligned}$$

E. Challenge

8. Purity of sodium chloride.

(a)

$$\begin{aligned} m(\text{Cl}) &= 0.717 \text{ g AgCl} \times \frac{35.45 \text{ g Cl}}{143.32 \text{ g AgCl}} \\ &= \mathbf{0.1773 \text{ g}} \end{aligned}$$

(b)

$$\begin{aligned} \% \text{Cl} &= \frac{0.1773 \text{ g}}{0.300 \text{ g}} \times 100\% \\ &= \mathbf{59.1\%} \end{aligned}$$

(c) Pure NaCl is $\frac{35.45 \text{ g/mol}}{58.44 \text{ g/mol}} \times 100\% = 60.66\%$ chlorine.

$$\begin{aligned} \text{purity} &= \frac{59.12\%}{60.66\%} \times 100\% \\ &= \mathbf{97.5\%} \end{aligned}$$