SCIENCE FOUNDATIONS

Net ionic equations

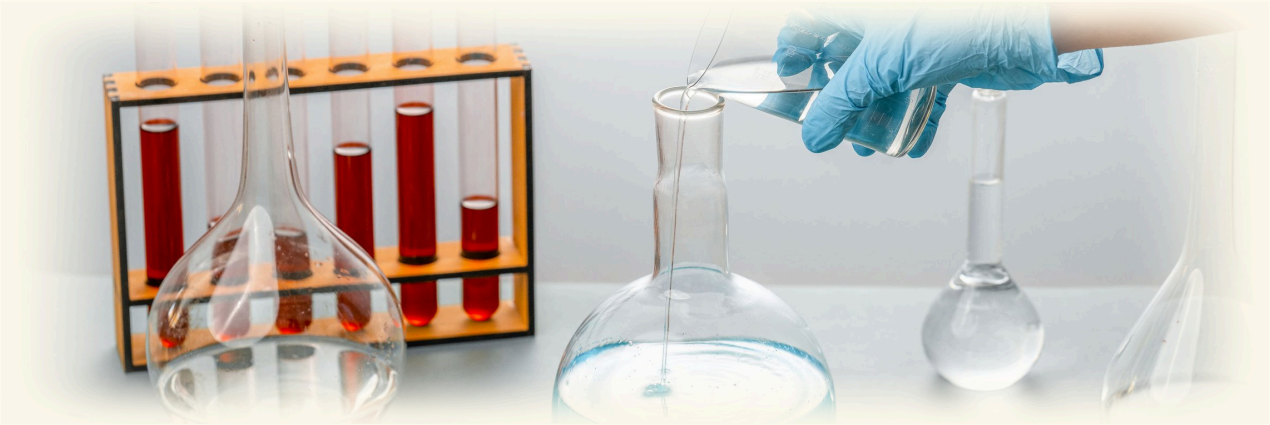
Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how a chemist strips a reaction down to only the particles that actually change, like the ones that form the white solid when two clear liquids are mixed. Most of the particles in the mixture just watch, floating around unchanged from start to finish. A water treatment worker testing for lead cares only about the particles that form the solid, not the ones that stay dissolved. Knowing net ionic equations tells you what really happens in a reaction, with the bystanders left out.



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Worked examples

EXAMPLE 1

Q Write the net ionic equation for $AgNO_3$ + NaCl -> AgCl + $NaNO_3$.

SOLUTION

Split soluble compounds: Ag+ + NO_3- + Na+ + Cl- -> AgCl solid + Na+ + NO_3-.

Solids, liquids, and gases are not split into ions.

Cancel spectators: Na+ and NO_3- appear on both sides.

What is left is the net ionic equation.

The result is Ag+ + Cl- -> AgCl.

EXAMPLE 2

Q Write the net ionic equation for HCl + NaOH -> NaCl + H_2O.

SOLUTION

Split soluble compounds: H+ + Cl- + Na+ + OH- -> Na+ + Cl- + H_2O liquid.

Cancel spectators: Na+ and Cl- appear on both sides.

What is left is the net ionic equation.

The result is H+ + OH- -> H_2O.

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Practice questions

1 **Write the net ionic equation for barium chloride and sodium sulfate reacting to form barium sulfate. Name the spectator ions you cancelled.**

- **A** $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$; spectators Ba^{2+} and SO_4^{2-}
- **B** $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$; spectators Na^+ and Cl^-
- **C** $Na^+ + Cl^- \rightarrow NaCl$; spectators Ba^{2+} and SO_4^{2-}
- **D** $Ba^{2+} + 2Cl^- \rightarrow BaCl_2$; spectators Na^+ and SO_4^{2-}

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2

Silver nitrate and sodium chloride react to form a white solid. Which compound is the precipitate?

A Silver chloride

B Sodium nitrate

C Silver nitrate

D Sodium chloride

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3 **Sulfuric acid and sodium hydroxide react. Give the net ionic equation and name the spectator ions you cancelled.**

- **A** $H^+ + OH^- \rightarrow H_2O$; spectators H^+ and OH^-
- **B** $Na^+ + SO_4^{2-} \rightarrow Na_2SO_4$; spectators H^+ and OH^-
- **C** $2H^+ + SO_4^{2-} \rightarrow H_2SO_4$; spectators Na^+ and OH^-
- **D** $H^+ + OH^- \rightarrow H_2O$; spectators Na^+ and SO_4^{2-}

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4 Write the full ionic equation for $HCl + KOH \rightarrow KCl + H_2O$.

- **A** $H^+ + Cl^- + K^+ + OH^- \rightarrow K^+ + Cl^- + H_2O$
- **B** $H^+ + OH^- \rightarrow H_2O$
- **C** $K^+ + Cl^- \rightarrow KCl$
- **D** $HCl + KOH \rightarrow KCl + H_2O$

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5 What does spectator ion mean?

- **A** An ion that forms a solid
- **B** An ion unchanged on both sides of the reaction
- **C** An ion that makes water
- **D** An ion that is split apart

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6

In an ionic equation, do you split a solid into ions?

A Yes

B No

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7

In an ionic equation, do you split a soluble compound into ions?

A Yes

B No

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8 **After cancelling the spectators, what is left in the net ionic equation?**

- **A** Only the spectator ions
- **B** All the ions
- **C** Only the ions that change
- **D** Only the solid

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9 **Lead nitrate and potassium iodide react to form lead iodide. Give the net ionic equation.**

- **A** $Pb2+ + 2I- \rightarrow PbI_2$
- **B** $Pb2+ + 2NO_3- \rightarrow Pb(NO_3)_2$
- **C** $K+ + I- \rightarrow KI$
- **D** $Pb2+ + I- \rightarrow PbI$

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10 **In a net ionic equation, is water split into ions? Explain.**

A Yes, it splits into H+ and OH-.

B No, it is a liquid.

C Yes, it splits into Na+ and Cl-.

D No, it is a gas.

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ANSWER KEY

1. $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$; spectators Na^+ and Cl^-

2. Silver chloride

3. $H^+ + OH^- \rightarrow H_2O$; spectators Na^+ and SO_4^{2-}

4. $H^+ + Cl^- + K^+ + OH^- \rightarrow K^+ + Cl^- + H_2O$

5. An ion unchanged on both sides of the reaction

6. No

7. Yes

8. Only the ions that change

9. $Pb^{2+} + 2I^- \rightarrow PbI_2$

10. No, it is a liquid.

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