SCIENCE FOUNDATIONS

Neutralization

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how an antacid tablet calms heartburn and how a gardener sweetens acidic soil with lime, because an acid and a base cancel each other out. A beekeeper soothes a sting with a mild base, and a cook squeezes lemon on fish to cut the richness, both working on the same acid-base idea. A farmer tests soil pH before deciding how much lime to spread. Knowing neutralization tells you how to bring something too acidic or too basic back toward the middle.



Rule

Neutralization: an acid plus a base makes a salt plus water.

The hydrogen ions from the acid and the hydroxide ions from the base combine to make water, and the remaining ions make the salt.

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Worked examples

EXAMPLE 1

Q Write the reaction of HCl with NaOH.

SOLUTION

Write the reactants:

HCl + NaOH.

Pair the ions: Na+ with Cl- makes the salt NaCl.

Add water:

H+ + OH- -> H_2O.

The result is HCl + NaOH -> NaCl + H_2O.

EXAMPLE 2

Q Write the reaction of H_2SO_4 with 2KOH.

SOLUTION

Write the reactants:

H_2SO_4 + 2KOH.

Pair the ions: 2K+ with SO_4 2- makes K_2SO_4.

Add water:

2H+ + 2OH- -> $2H_2O$.

The result is H_2SO_4 + 2KOH -> K_2SO_4 + $2H_2O$.

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Practice questions

1 **Write the full balanced reaction of HBr with NaOH. Name the salt formed.**

- **A** $HBr + NaOH \rightarrow NaBr + H_2O$; salt is sodium chloride
- **B** $HBr + KOH \rightarrow KBr + H_2O$; salt is sodium bromide
- **C** $HBr + NaOH \rightarrow NaBr + H_2O$; salt is sodium bromide
- **D** $HBr + NaOH \rightarrow NaBr + H_2O$; salt is potassium bromide

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2

Sulfuric acid reacts with sodium hydroxide. What are the products?

A Sodium sulfate and water

B Sodium sulfate and hydrogen

C Sulfuric acid and water

D Sodium hydroxide and oxygen

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3 **Write the full balanced reaction of $2HNO_3$ with $Ca(OH)_2$. Name the salt formed.**

A. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; salt is calcium nitrate

B. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; salt is calcium chloride

C. $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$; salt is calcium nitrate

D. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; salt is potassium nitrate

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4 **Write the balanced reaction of H_2SO_4 with KOH. Name the salt formed.**

A. $H_2SO_4 + KOH \rightarrow K_2SO_4 + H_2O$; salt is potassium sulfate

B. $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$; salt is potassium sulfate

C. $2H_2SO_4 + KOH \rightarrow K_2SO_4 + 2H_2O$; salt is potassium sulfate

D. $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + H_2O$; salt is potassium sulfide

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5 Acid plus base makes what?

- A A salt and water
- B An acid and a base
- C A gas and a solid
- D Only water

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6 What ions combine to make water in neutralization?

- A Na+ and Cl-
- B H+ and OH-
- C H+ and Cl-
- D Na+ and OH-

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7 What does an antacid do?

A It makes stomach acid stronger.

B It turns acid into a base.

C It neutralizes stomach acid.

D It stops digestion.

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8 What is the pH of a fully neutralized mixture?

A Near 1

B Near 14

C Near 0

D Near 7

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9 **In the reaction HCl + NaOH -> NaCl + H_2O, which reactant is the base?**

A HCl

B NaOH

C NaCl

D H_2O

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10 **Is neutralization a type of double displacement reaction?**

A Yes

B No

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ANSWER KEY

1. HBr + NaOH -> NaBr + H_2O; salt is sodium bromide

2. Sodium sulfate and water

3. $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$; salt is calcium nitrate

4. $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$; salt is potassium sulfate

5. A salt and water

6. H+ and OH-

7. It neutralizes stomach acid.

8. Near 7

9. NaOH

10. Yes

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