Double-displacement reactions describe reactions in which two or more new products are formed from two molecular reactants. In double-displacement reactions, reactants exchange ions or elements to form products. At least one of the products will either separate from the reaction mixture (usually as a gas or solid) or form a stable covalent compound.

History

Explore the discoverer's biography, including general facts about his life and anecdotes regarding how he made this particular discovery. Also see other significant scientific discoveries built largely on this concept and other real-world applications in history that may not still be relevant.

Use/Application through History

Soap was synthesized by the Egyptians, Romans, and Chinese using potassium hydroxide (KOH). Each ancient civilization used unique procedures to synthesize KOH. The ancient Chinese made KOH using a double-replacement reaction.

Ancient Chinese people heated seashells and then mixed them with plant ash in water. The procedure is highlighted below.

(From unknown writer, Kao Gong Ji, ancient Chinese technology cyclopedia, as early as around 732 BCE)

Concept Definition

Study the primary definition of this concept, broken into general, basic, and advanced English definitions. Also see the mathematical definition and any requisite background information, such as conditions or previous definitions.

Basic

The common types of double-displacement reactions can be put into three calagories:

1. Precipitation reactions. Precipitation reactions occur when the exchange of ions results in an insoluble salt. Precipitation reactions can be predicted using a solubility table.

Examples:

2. Gas formation. Gas is released when an insoluble gas is formed during the reaction. Most binary covalent gas compounds are sufficiently insoluble (excluding HCl(g) and NH_3(g)).

Examples:

3. Double replacement reactions forming weak electrolytes.

1. Acid-Base Neutralization:

In double replacement reactions between acids and bases, hydrogen ions from acids and

hydronium ions from bases combine together to form water molecules. The anions from the acids and cations from the bases combine to form salts. If the salts are soluble in water, they will form ions in the water solution; if the salts are insoluble in water, they will appear as a precipitate.

Examples:

2. Weak electrolytes with no water as a product:

Examples:

Background Information

Basic Solubility Rule Table	4	5

Ion(s)

Solubility

Exception(s)

Alkali metals (IA)

Soluble

No exception

Soluble

No exception

,

Soluble

No exception

Halides:

Soluble

Salts of

Soluble

Insoluble for	,

and slightly soluble for

Insoluble

Alkali metals (IA),

Insoluble

Alkali metals (IA) and A	lkali earth metals(IIA),

Insoluble

Alkali metals (IA) ,

Insoluble

Alkali metals (IA) ,

Vocabulary

Learn important vocabulary for this concept, including words that might appear in assessments (tests, quizzes, homework, etc.) that indicate the use of this concept.

Important Vocabulary	**Term**	**Context**
Double Replacement Reactions		
-	Predict the product and calculate the mass of solid formed by the double replacement reaction be	

Neutralization Reaction
- Neutralization reactions are performed by adding acids into bases or vise versa.

Precipitation
- $CaCO_3$ (s) is the precipitate formed by bubbling CO_2 g

Weak Electrolyte
- Examples of weak electrolytes include: HC_2 H_3 O

Videos

Browse relevant videos from the Journal of Chemical Education's (JCE) Chemistry Comes Alive! library and other video sources.

Sodium Iodide with Mercury(II) Chloride

Reaction between sodium iodide (very pale yellow) and mercury(II) chloride (colorless), produces an mercury(II) iodide (orange) precipitate.

Chemical Equation:

Cadmium Nitrate and Sodium Sulfide

Water Gas with Burning Charcoal

Potassium Iodine with Mercury(II) Nitrat

Sodium Iodide and Lead(II) Nitrate

Adding very pale yellow sodium iodide to colorless lead(II) nitrate produces a yellow precipitate.

Solution A: 0.5 M sodium iodide (very pale yellow)
Solution B: 0.2 M lead(II) nitrate (colorless)
Precipitate: (yellow)
$Pb(NO_3)_2(aq) + 2\ NaI(aq) \rightarrow PbI_2(s) + 2\ NaNO_3(aq)$

Sodium Sulfide and Copper(II) Nitrate

Sodium sulfide and copper(II) nitrate

Sodium Sulfide and Lead(II) Nitrate

Sodium sulfide and lead(II) nitrate

Computer Animations

Experience computer simulators or animations that illustrate the concept discussed here. Many simulators or animations come with worksheets for use in class.

http://preparatorychemistry.com/neutralization_flash.htm
http://preparatorychemistry.com/precipitation_flash.htm
http://www.chem.arizona.edu/chemt/ido.html

Classroom Demonstations

Investigate lab procedures suitable for live classroom demonstrations or guided student exploration.

Demos **Double Replacement Demo**

Sample Problems

Explore sample problems from the JCE QBank and other sources.

Sample Problems

Works Cited

Review the works cited to write the researched parts of this page, such as the discover's biographical information and other areas.

Works Cited

"Chemistry-Dictionary.com." *Chemistry Dictionary / Glossary! Everyone's Online Source for Chemistry Terms and Definitions* . Chemistry-Dictionary.com. Web. 27 Oct. 2010. . (vocabulary definition)

Birk, James P. "Chemical Reactions." *Chemistry: Foundations and Applications*. Advameg, Inc., 2010. Web. 27 Oct. 2010. . (reaction type descriptions)

IUPAC. Compendium of Chemical Terminology, 2nd ed. (the "Gold Book"). Compiled by A. D. McNaught and A. Wilkinson. Blackwell Scientific Publications, Oxford (1997). XML on-line corrected version: http://goldbook.iupac.org (2006-) created by M. Nic, J. Jirat, B. Kosata; updates compiled by A. Jenkins. ISBN 0-9678550-9-8.