

Warm-Up

Reactions in Aqueous Solutions

**Lesson Objectives**

By the end of this lesson, you should be able to:

- Describe dissociation and **ionization**.
- Describe reactions in aqueous solutions, including the formation of a precipitate and the production of a gas.
- Distinguish between strong electrolytes, weak electrolytes, and **nonelectrolytes**.

Science Practice: Analyze and interpret information to classify electrolytes (into strong, weak, and nonelectrolytes).

**Words to Know**

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

 C aqueous

 A net ionic equation

 B dissociation

 F ionization

 D precipitate

 G electrolyte

 E hydration

A. the chemical equation for a reaction in an aqueous solution that represents only those species that participate in the reaction

B. the separation of an ionic compound into ions of opposite charge

C. a word describing a solution in which the solvent is water

D. a solid substance that does not dissolve in a solution

E. the process in which water molecules surround ions and help them stay in a solution

F. the formation of ions as a result of a chemical reaction

G. a compound that forms ions in an aqueous solution

Instruction

Reactions in Aqueous Solutions

Slide

1

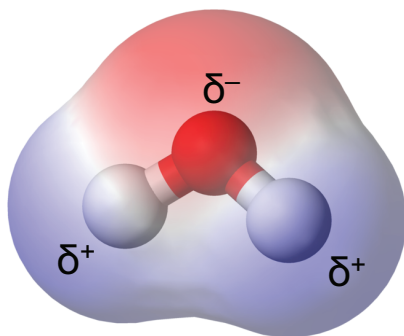
Lesson Question

What types of reactions can occur in a solution?

2

Polarity of Water

Water molecules possess a permanent **dipole** moment and are therefore described as polar.



δ^- = partial **negative**

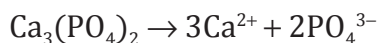
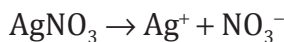
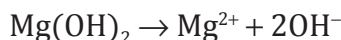
δ^+ = partial positive

Dissociation

Dissociation is the separation of an ionic compound into ions of opposite charge.

An **electrolyte** is a chemical compound that forms ions when dissolved in water, or any of the ions themselves.

- A substance that dissociates is an electrolyte.



Instruction

Reactions in Aqueous Solutions

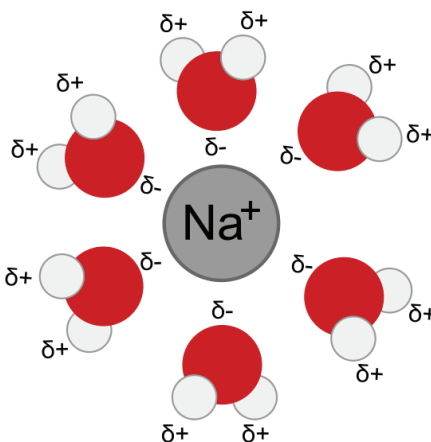
Slide

2

Hydration of Ions

Hydration is the process in which water **molecules** surround the ions and help them stay in solution.

- It is driven by the attraction between water **dipole** and ionic charges.
- Multiple water molecules surround each **ion**.
- **Charge** balance and attraction determine the water molecule number and orientation.



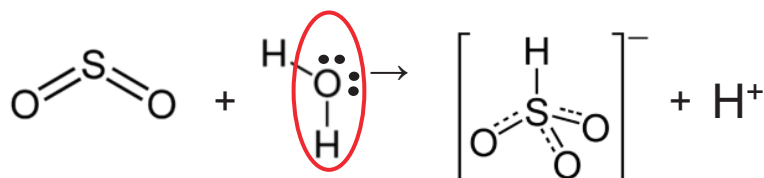
4

Ionization

Ionization is the formation of ions as a result of a chemical **reaction**.

Sulfur dioxide in water:

Circle the pair of ions which will be shared in the reaction.



Instruction

Reactions in Aqueous Solutions

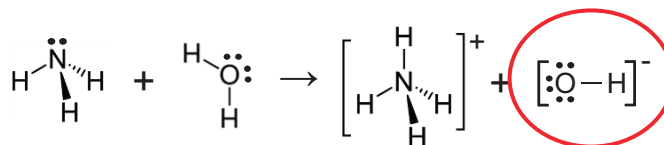
Slide

4

Ionization

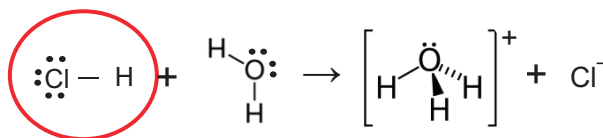
Ammonia in water:

Circle the ion left behind as a result of the chemical reaction.



Hydrochloric **acid** in water:

Circle the acid which gives up its hydrogen.



7

States of Matter in Chemical Reactions

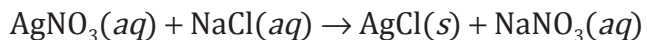
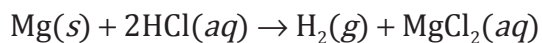
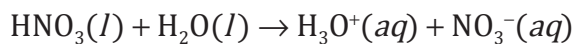
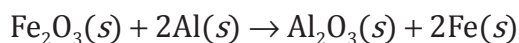
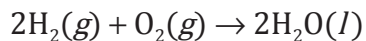
- State-of-matter indicators:

- (g): **gas**

- (l): liquid

- (s): **solid**

- (aq): aqueous/dissolved



- Aqueous** describes a solution in which the solvent is water.

- Precipitate** is a solid or solid phase separated from a solution.

Instruction

Reactions in Aqueous Solutions

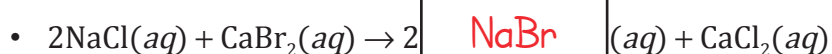
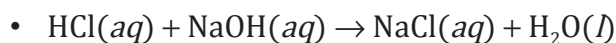
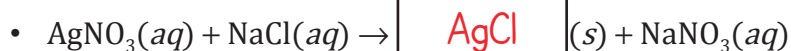
Slide

9

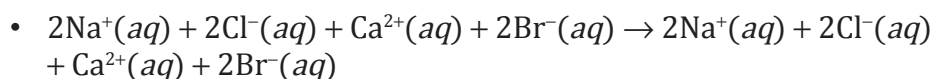
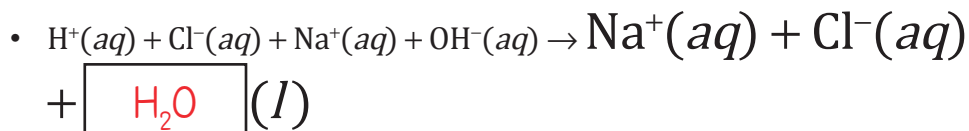
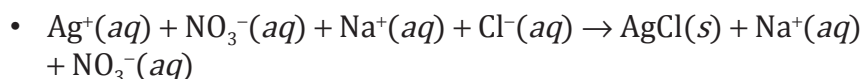
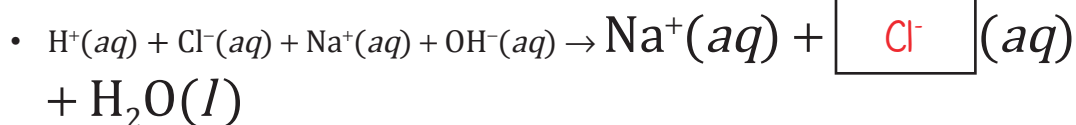
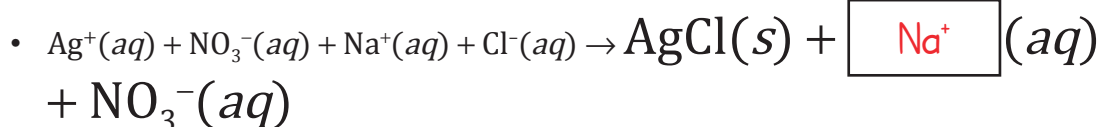
Double-Displacement Reactions

A double-displacement reaction occurs when **ions** switch places between two ionic compounds.

- Examples:



- Representing ions in solution:

**Net Ionic Equations**

Silver (aqueous) and chlorine ion (aqueous) makes silver chloride (solid).

In another example, the hydrogen ion (aqueous) and hydroxide form **water** in its liquid form.

Instruction

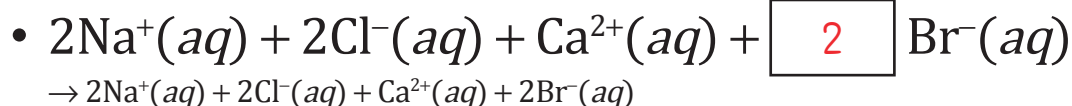
Reactions in Aqueous Solutions

Slide

9

Net Ionic Equations

A net ionic equation is a **chemical** equation that shows only the ions that undergo reaction.

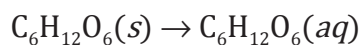
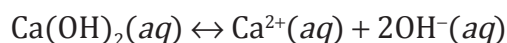
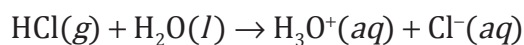
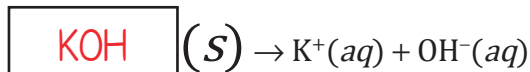


- No net ionic equation means that no **reaction** occurs.

12

Types of Electrolytes

- Strong electrolyte: dissociates or **ionizes** completely in water
 - Conducts electricity extremely well
- Weak electrolyte: partially dissociates or ionizes in water
 - Conducts **electricity** poorly
- Nonelectrolyte: does not dissociate or ionize in water
 - Does not conduct electricity



Summary

Reactions in Aqueous Solutions

?

Lesson Question

What types of reactions can occur in a solution?

✓

Answer

(Sample answer) The reactions which occur in a solution are dissociation, ionization, displacement, double displacement, and precipitation.

Slide

2

Dissociation and Ionization

- Dissociation involves the separation of an ionic **compound** into its constituent ions when it dissolves in water.
- During dissociation, water molecules surround the ions and help them stay in solution (hydration).
- Ionization occurs when a **covalent** compound reacts with water molecules to form ions in solution.
- Ionization is common in acids and some bases.

Products of Reactions

- A **precipitate** is a solid that forms as a result of a reaction in solution.
- A **double-displacement** reaction that does not produce a precipitate, a gas, or a pure liquid is not considered to proceed.
- A net ionic equation shows only the ions that are involved in a reaction.

Slide

2

Electrolytes

- Strong electrolytes dissociate or ionize completely.
- Strong electrolytes conduct electricity very well because of their high ion **concentrations**.
- Weak electrolytes only partially dissociate or ionize.
- Weak electrolytes conduct electricity poorly because of their low ion concentrations.
- Nonelectrolytes do not dissociate or ionize in water.
- Nonelectrolytes do not conduct **electricity**.

Use this space to write any questions or thoughts about this lesson.