Warm-Up | Types of Reactions

Evidence of Reactions

Reaction of [ ] with water:

$2K + 2H_2O \rightarrow$ [ ] $+ H_2 +$ [ ]



+



→



Lesson Objectives

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

- Identify and characterize the types of reactions, including synthesis, decomposition, [ ], single replacement, and double replacement.
- Classify a reaction as [ ], decomposition, single replacement, double replacement, or combustion.
- Use the activity series to determine whether a single replacement reaction will occur.

Science Practice: Predict the products of a reaction using the activity series.

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Warm-Up | Types of Reactions

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.

_____ synthesis	A. a reaction of a substance with oxygen
_____ decomposition	B. a reaction in which two or more reactants combine to form a single product
_____ combustion	C. a reaction in which a single compound breaks down to form two or more new substances
_____ single replacement	D. a description of the relative reactivity of elements
_____ double replacement	E. a reaction in which one ion displaces another to form a new compound
_____ activity series	F. a reaction in which two ionic compounds exchange ions to form new products

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Lesson Question

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Types of Chemical Reactions

There are five main types of chemical reactions.

- **Synthesis**:
  - Reaction in which two or more reactants combine to form a single product.

    $A + B \rightarrow$ [ ]
- **Decomposition:**
  - Reaction in which a single [ ] breaks down to form two or more new substances.

    $AB \rightarrow$ [ ]
- **Combustion**:
  - Reaction of a substance with oxygen.

    $A + O2 \rightarrow$ [ ]

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Types of Chemical Reactions

There are five main types of chemical reactions.

- **Single replacement**:
  - Reaction in which one ion displaces another to form a new compound.

    $A + BC \rightarrow$ [ ]
- **Double replacement**:
  - Reaction in which two ionic compounds exchange [ ] to form new products.

    $AB + CD \rightarrow$ [ ]

Synthesis, Decomposition, and Combustion Reactions

Synthesis reaction:

$2Na + Cl_2 \rightarrow$ [ ]

$A + B \rightarrow$ [ ]

[ ] reaction:

$2H_2O \rightarrow 2H_2 + O_2$

$AB \rightarrow$ [ ]

Combustion reaction:

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$A + O_2 \rightarrow$ [ ] $+ H_2O$

If one of the reactants in a synthesis reaction is oxygen gas (O2), the reaction is also a combustion reaction.

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Synthesis, Decomposition, and Combustion Reactions

- Synthesis:
  - Multiple reactants form [ ] product.
- [ ]:
  - One reactant forms multiple products.
- Combustion:
  - Oxygen ([ ]) is involved as a reactant.
  - Products include the oxide(s) of the reactant.

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Single and Double Replacement Reactions

Single replacement:

$Fe_2O_3 + 2Al \rightarrow [Al_2O_3] + 2Fe$

$AB + C \rightarrow$ [ ]

$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$

$A + BC \rightarrow$ [ ]

Double replacement:

$Pb(NO_3)_2 + 2KI \rightarrow$ [ ] $+ 2KNO_3$

$AB + CD \rightarrow$ [ ]

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Single and Double Replacement Reactions

- Single replacement:
  - One reactant is an [ ]; one reactant is a [ ].
  - One product is an element; one product is a compound.
  - The [ ] element is part of the compound product.
- Double replacement:
  - Reactants and products are [ ] compounds.
  - The same ions are present in reactants and products.

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How to Predict Outcomes of Reactions

[ ]: description of the relative reactivity of elements

Li > K > Ba > Sr > Ca > Na > Mg > Al > Mn > Zn > Cr > Fe > Cd > Co > Ni > Sn > Pb > H > Sb > Bi > Cu > Ag > Pd > Hg > Pt > Au

[ ] > Cl_2 > Br_2 > [ ]

more reactive ← → less reactive

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Predictions Using the Activity Series

Which of the following reactions will take place?

$AgNO_3 + Cu \rightarrow$ or $Cu(NO_3)_2 + Ag \rightarrow$

- Identify the relative positions of metals in the activity series.

Li > K > Ba > Sr > Ca > Na > Mg > Al > Mn > Zn > Cr > Fe > Cd > Co > Ni > Sn > Pb > H > Sb > Bi > Cu > Ag > Pd > Hg > Pt > Au

  - Cu > Ag
  - Cu [ ] reactive than Ag

- Predict whether the reaction will occur.

  - If more reactive element is reactant, reaction will occur

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Summary | Types of Reactions

Lesson Question

What are the types of chemical reactions?

Answer

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Types of Chemical Reactions

- Synthesis: A + B → [ ]
  - Multiple reactants form one product.
- Decomposition: AB → A + B
  - One reactant forms multiple products.
- Combustion: A + [ ] → [ ] of A
  - An element or compound reacts with oxygen.
- Single replacement: AB + C → CB + A
  - One element replaces another in a [ ].
- [ ] replacement: AB + CD → AD + CB
  - Two ions replace each other.

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Summary | Types of Reactions

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The Activity Series

- The activity series describes the [ ] reactivity of elements.
- The activity series for metals is Li > K > Ba > Sr > Ca > Na > Mg > Al > Mn > Zn > Cr > Fe > Cd > Co > Ni > Sn > Pb > H > Sb > Bi > Cu > Ag > Pd > Hg > Pt > Au.
- The activity series for [ ] is F_2 > [ ] > Br_2 > I_2.
- The more reactive an element is, the more likely it is to form compounds, and the less [ ] it is as a pure element.
- The activity series can be used to predict the outcome of a single-replacement reaction.

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

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