SCIENCE FOUNDATIONS

Types of chemical reactions

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how a chemist predicts what comes out of a reaction before mixing anything, like knowing that rust forms when iron joins with oxygen, or that baking soda fizzes when it meets vinegar. A mechanic knows that a battery acid spill needs a base, a substance that cancels out an acid, to neutralise it, because that is the type of reaction it will run. A firefighter chooses an extinguisher by knowing what kind of reaction is burning. Knowing the types of chemical reactions tells you how to sort a new reaction into a family you already understand, so you can predict what it will make.



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Rule

Types of chemical reactions: synthesis is many reactants joining into one product. Decomposition is one reactant splitting into many products. Single displacement is one element taking the place of another in a compound.

Double displacement is two compounds swapping partners. Combustion is a substance reacting with oxygen to give carbon dioxide and water. Count the reactants and products, then match the pattern.

Worked examples

EXAMPLE 1

Q Classify: $2Mg + O_2 \rightarrow 2MgO$.

SOLUTION

Count reactants: two substances join.

Count products: one substance forms.

Match the pattern: many to one means synthesis.

The result is synthesis.

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EXAMPLE 2

Q Classify: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$.

SOLUTION

Watch zinc: it takes the place of copper in the compound.

One element replaces another, so it is not double displacement.

Match the pattern: single displacement.

The result is single displacement.

Practice questions

1 Classify $2Na + Cl_2 \rightarrow 2NaCl$.

- **A** Synthesis
- **B** Decomposition
- **C** Single displacement
- **D** Double displacement

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2 What is the single displacement pattern?

- A One element takes the place of another in a compound
- B Many reactants join into one product
- C One reactant splits into many products
- D Two compounds swap partners

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3 Classify $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$.

- A Single displacement
- B Double displacement
- C Synthesis
- D Decomposition

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4 Which of these is a single displacement reaction?

A $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

B $2Na + Cl_2 \rightarrow 2NaCl$

C $H_2CO_3 \rightarrow H_2O + CO_2$

D $HCl + NaOH \rightarrow NaCl + H_2O$

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5 Classify $CaCO_3 \rightarrow CaO + CO_2$

A Decomposition

B Synthesis

C Single displacement

D Double displacement

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6

Classify $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

A Double displacement

B Single displacement

C Synthesis

D Decomposition

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7

Classify $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.

A Combustion

B Synthesis

C Decomposition

D Single displacement

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8 What is the synthesis pattern?

- A Many reactants to one product
- B One reactant to many products
- C One element replaces another
- D Two compounds swap partners

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9 What is the decomposition pattern?

- A One reactant to many products
- B Many reactants to one product
- C One element replaces another
- D Two compounds swap partners

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10

What is the combustion pattern?

A. A substance reacts with oxygen to give carbon dioxide and water

B. Many reactants join into one product

C. One reactant splits into many products

D. Two compounds swap partners

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ANSWER KEY

1. Synthesis

2. One element takes the place of another in a compound

3. Single displacement

4. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

5. Decomposition

6. Double displacement

7. Combustion

8. Many reactants to one product

9. One reactant to many products

10. A substance reacts with oxygen to give carbon dioxide and water

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