



Types of Reactions

Video Workbook with Dr. B.

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Identifying the type of chemical reaction is essential for predicting the products of chem rxns.

To be successful:

- Watch the video [Types of Chemical Reactions](#).
- Do the 20 practice problems and check your work! Watch the video if you're stuck.
- Practice with the other types of reactions.

Once you can classify reactions, move to the guide on [Predicting the Products of Chemical Reactions](#).

 [Types of Chemical Reactions](#)

Important!

- Often reactions can be classified as more than one type.
- There are some reactions you may be unable to classify.

Five Major Types of Reactions

Combination (Synthesis) – two or more substances react to form one substance.	$A + B \rightarrow AB$ $\text{Fe}(s) + \text{S}(s) \rightarrow \text{FeS}(s)$
Decomposition – a compound is broken down into two or more substances.	$AB \rightarrow A + B$ $2\text{H}_2\text{O}(l) \rightarrow 2\text{H}_2(g) + \text{O}_2(g)$
Single Replacement – atoms in one compound take the place of atoms in another compound.	$A + BC \rightarrow AB + C$ $\text{Cl}_2(g) + 2\text{KBr}(aq) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(g)$
Double Replacement – Metal cations switch places.	$AB + XY \rightarrow AY + XB$ $\text{Pb}(\text{NO}_3)_2(aq) + 2\text{KI}(aq) \rightarrow \text{PbI}_2(s) + 2\text{KNO}_3(aq)$
Combustion (organic) – when a substance combines with oxygen (O_2). All products are combined with O_2 . CO_2 and H_2O are formed.	$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Energy}$
Combustion (general) – When Oxygen gas (O_2) combines with a substance.	$4\text{Fe}(s) + 3\text{O}_2(g) \rightarrow 2\text{Fe}_2\text{O}_3(s)$ $\text{CH}_4(g) + \text{O}_2(g) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(g)$

Remember, some reactions may be classified as more than one type!



Practice Five Main Reaction Types

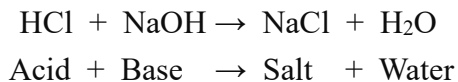
- | | |
|---|---|
| 1. $\text{Zn} + \text{AgNO}_3 \rightarrow \text{Ag} + \text{Zn}(\text{NO}_3)_2$ | 11. $\text{C}_6\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ |
| 2. $\text{C}_2\text{H}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ | 12. $\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{KNO}_3 + \text{PbI}_2 (s)$ |
| 3. $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$ | 13. $\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$ |
| 4. $\text{CaCl}_2 + \text{Na}_3\text{PO}_4 \rightarrow$
$\text{Ca}_3(\text{PO}_4)_2 (s) + \text{NaCl}$ | 14. $\text{Cu} + \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}$ |
| 5. $\text{NaBr} + \text{Cl}_2 \rightarrow \text{NaCl} + \text{Br}_2$ | 15. $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ |
| 6. $\text{Pb}(\text{OH})_2 + \text{HCl} \rightarrow \text{PbCl}_2 (s) + \text{H}_2\text{O}$ | 16. $\text{CaCl}_2 + \text{Na}_2\text{CO}_3$
$\rightarrow \text{CaCO}_3 (s) + \text{NaCl}$ |
| 7. $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$ | 17. $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ |
| 8. $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}$ | 18. $\text{C}_2\text{H}_2 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ |
| 9. $\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$ | 19. $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ |
| 10. $\text{Cu}(\text{NO}_3)_2 \rightarrow \text{CuO} + \text{NO}_2 + \text{O}_2$ | 20. $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow$
$\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$ |

Answers

1. Single Displacement <https://youtu.be/gute0fU67a0>
2. Combustion <https://youtu.be/4AMgIY61aAc>
3. Combination <https://youtu.be/Qwu8WzQcCWE>
4. Double Displacement (also Precipitation rxn) <https://youtu.be/ZbS768qPR-0>
5. Single Displacement <https://youtu.be/kx0XWmxtYBI>
6. Double Displacement (and Neutralization rxn) <https://youtu.be/eZFzYnqcG7Q>
7. Single Displacement <https://youtu.be/21NzniyEjfo>
8. Combination (and Combustion) <https://youtu.be/KHzes1Q2s8c>
9. Single Displacement <https://youtu.be/159kCEwgSHA>
10. Decomposition <https://youtu.be/WBqtkQociIQ>
11. Combustion (organic) <https://youtu.be/UhATDgDgaaE>
12. Double Displacement (also precipitation rxn) <https://youtu.be/lvbm8Tt2JGo>
13. Combination https://youtu.be/OPTXli_F7sA
14. Single Displacement <https://youtu.be/mbiFfvUISug>
15. Organic Combustion <https://youtu.be/MoQ6srqVdnM>
16. Double Displacement (also precipitation rxn) <https://youtu.be/1Etp8S2T0Xs>
17. Decomposition <https://youtu.be/6qK5nAmhKm0>
18. Organic Combustion <https://youtu.be/QBFciRT213g>
19. Single Displacement <https://youtu.be/MRPHF0q4KaI>
20. See video: <https://youtu.be/IKJ2bnX8ZNg>

Neutralization Reactions

Double Displacement reactions involving an acid and a base are called Neutralization.



Neutralization reactions are a type of Double Displacement reaction.

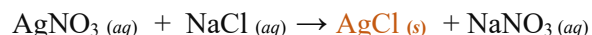
Common Acids: HCl, HF, HBr, H₂SO₄, HNO₃, HClO₄, H₃PO₄, CH₃COOH
Common Bases: NaOH, KOH, Ca(OH)₂, Mg(OH)₂, NH₄OH



Precipitation Reactions

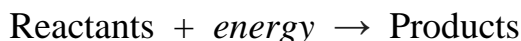
Double Displacement reactions that result in the formation of a solid (s) are also called Precipitation Reactions. This is because the solid precipitate falls to the bottom of the test-tube.

The key is the (s) in the reaction. That is the precipitate.



Endothermic & Exothermic Reactions

Endothermic Reactions take in energy (usually heat).



Exothermic Reactions give off energy (usually heat).

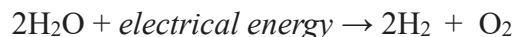


In general, Combustion and Neutralization reactions are exothermic and give off heat.

In general, Decomposition reactions are endothermic and take in heat.

Endo/Exo Rxn Practice

Write the type or reaction and classify as endothermic or exothermic.



Answers

1. Organic Combustion, exothermic.
2. This is photosynthesis (it doesn't neatly fit in our categories): It is endothermic.
3. Double Displacement / Neutralization, exothermic
4. Decomposition, endothermic
5. Decomposition, endothermic.

Reduction – Oxidation Reactions (Redox)

For more advanced courses you may be asked to identify if a reaction is Redox.

If there are changes in the oxidation states on elements from reactants → products the reaction is Redox.

[Is it Redox?](#)

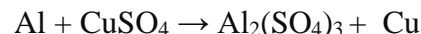
Single Displacement & Combustion reactions are *almost always* redox. Neutralization and Double Displacement reactions are *typically not* Redox rxns.

Predicting Products of Chemical Reactions

If you can identify the type of reactions, you can often predict the products. For example:



We can it has the pattern for a single displacement reaction. The Al will replace the Cu. Therefore:



View my Guide on [Predicting the Products of Chemical Reactions](#). for more help.

If your time is extremely limited, watch these videos:

Types of Chemical Reactions: <https://youtu.be/ddY2RQ3ziLo>

Finding Ionic Charge: <https://youtu.be/N4N1Njh7nCo>

Criss-Cross Method for Formula Writing: <https://youtu.be/77LVxv05XKE>

Using the Solubility Table and Chart: <https://youtu.be/snxoegzVnWw>

Using the Activity Series: https://youtu.be/IS3_BAfQT54

Predicting the Products of Chemical Reactions: <https://youtu.be/TeXWuTMLe9M>

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