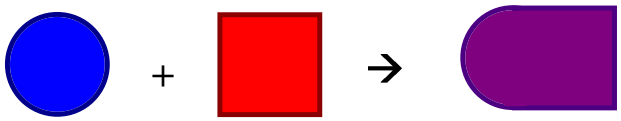
CHEMISTRY

# SYNTHESIS AND DECOMPOSITION

## Synthesis Reactions

In a ***synthesis reaction***, two or more elements or compounds come together to form a new substance. The general equation is:

**A + B → AB (*marriage*)**



**2 Na + $Cl_2$ → 2 NaCl**

## Predicting Products of Synthesis Reactions

There are different patterns that develop in synthesis reactions that will help you identify the product.

**1)** metal + non-metal → binary compound

$2K + Cl_2 \rightarrow 2KCl$

**2)** metal + oxygen → a metal oxide

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

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## Predicting Products of Synthesis Reactions (Cont)

**3)** metal oxide + carbon dioxide → a carbonate

**MgO** + $CO_2$ → $MgCO_3$

**4)** non-metal oxide + water → acid

$\mathbf{N_2O_3}$ + $H_2O$ → $2HNO_2$

**5)** metal oxide + water → base

$Na_2O$ + $H_2O$ → $2NaOH$

Sometimes it is difficult to predict the product in a synthesis reaction because there is more than one possibility.

**Ex:**

C + $O_2$ → $CO_2$

2C + $O_2$ → 2CO

In a situation like this, the only way to know for sure which products you have to perform the experiment and test your results.

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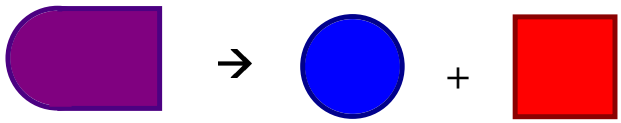
## Decomposition Reactions

In a ***decomposition reaction***, one compound will break apart to form two smaller compounds or elements. The general equation is:

**AB** → **A** + **B** (***divorce***)



**$2H_2O$** → **$2H_2$** + **$O_2$**

## Predicting Products of Decomposition Reactions

There are different patterns that develop in decomposition reactions that will help you identify the products.

**1)** Binary compound → Element A + Element B

$2NaCl \rightarrow 2Na + Cl_2$

**2)** A carbonate → oxide + carbon dioxide

$MgCO_3 \rightarrow MgO + CO_2$

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## Predicting Products of Decomposition Reactions (Cont)

**3)** A chlorate → Binary salt + Oxygen gas

$2KClO_3 \rightarrow 2KCl + 3O_2$

**4)** Acid → non-metal oxide + water

$2HNO_3 \rightarrow 2NO + H_2O$

**5)** Base → metal oxide + water

$\mathbf{2NaOH} \rightarrow Na_2O + H_2O$

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# SYNTHESIS AND DECOMPOSITION

## Types of Chemical Reactions: Synthesis and Decomposition

For each of the chemical reactions are listed below, complete the following:

- 🕮 The type of chemical reaction (synthesis or decomposition)
- ✎ Balance the skeletal equation

1. Joseph Priestley discovered oxygen gas by chemically breaking down mercury (II) oxide.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____HgO → _____ Hg + _____ $O_2$
2. Sulphur burns in oxygen to produce sulphur dioxide.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____$S_8$ + _____$O_2$ → _____ $SO_2$
3. Over a period of time, iron reacts chemically with oxygen to produce rust (iron (III) oxide).
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____Fe + _____$O_2$ → _____ $Fe_2O_3$
4. Table salt can be chemically broken down to produce sodium metal and chlorine gas.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____NaCl → _____ Na + _____$Cl_2$
5. Sodium Iodide → Sodium + Iodine
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____NaI → _____ Na + _____$I_2$
6. Copper ore is broken down to remove the copper metal.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____CuO → _____ Cu + _____$O_2$
7. Barbecue charcoal undergoes incomplete combustion to produce carbon monoxide.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____C + _____$O_2$ → _____ CO
8. Molten lye → sodium metal + oxygen gas + hydrogen gas
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____NaOH → _____ Na + _____$O_2$ + _____$H_2$
9. Freshly cut lithium reacts with nitrogen from the air.
   - 🕮 Reaction type: _____
   - ✎ Balance the skeletal equation: _____Li + _____$N_2$ → _____ $Li_3N$
10. When magnesium metal is burned it reacts with oxygen to produce a bright light and new substance that is magnesium oxide.
    - 🕮 Reaction type: _____
    - ✎ Write and balance the skeletal equation: _____ + _____ → _____