



# Explosives

Photo: Senior Airman Christopher Hubenthal. Public domain image.

## C3.4

write word equations and balanced chemical equations for simple chemical reactions

## C3.8

identify simple ionic compounds, simple compounds involving polyatomic ions, molecular compounds, & acids, using the periodic table & a list of the most common polyatomic ions, & write the formulae

## Low Explosives

Low explosives are combustible substances that do not explode but rather deflagrate (decompose very rapidly). Most low explosives are used as propellants for guns and rockets. They typically decompose at rates up to 400 m/s.

### Gunpowder

The first explosive was black powder (often called gunpowder), invented in China. It was first used for rockets and fireworks rather than guns. Black powder is actually a mixture rather than a compound.

A simple, commonly cited, chemical equation for the combustion of black powder is:

potassium nitrate + sulfur + carbon → potassium sulfide + nitrogen + carbon dioxide

\_\_\_\_\_ skeleton

\_\_\_\_\_ balanced

A more accurate, but still simplified, equation is:

\_\_\_\_\_ word



\_\_\_\_\_ skeleton

\_\_\_\_\_ balanced

## High Explosives

High explosives are used in mining, demolitions, and military weapons. Their decomposition rates are typically 1000 – 9000 m/s. High explosives are divided into three types (primary, secondary, and tertiary) depending on their sensitivity to shock, friction, and heat.

- **Primary explosives** are very sensitive to shock, friction, and heat.
- **Secondary explosives** are less sensitive. They are also called **base explosives**.
- **Tertiary explosives** are so insensitive that they cannot be detonated by primary explosives. They are also called **blasting agents**.

## Nitroglycerin

A staple of Western films, nitroglycerine is a very sensitive liquid explosive. Even dropping a vial of nitroglycerin can be enough of a shock to trigger an explosion. Nitroglycerin is a primary explosive.

nitroglycerin → carbon dioxide + water + nitrogen + oxygen

word

$C_3H_5(NO_3)_3 \rightarrow$

skeleton

balanced

## TNT

TNT is a more powerful explosive, used in mining and demolitions (as well as most bombs and explosive shells). TNT is a secondary explosive.

trinitrotoluene → carbon monoxide + hydrogen + nitrogen + carbon

word

$C_6H_2(NO_2)_3CH_3 \rightarrow$

skeleton

balanced

## PETN

PETN (a plastic explosive) is  $C(CH_2ONO_2)_4$ . It decomposes into carbon monoxide, water, carbon dioxide, and nitrogen.

word

skeleton

balanced

## Ammonium nitrate

One of the most common industrial explosives is ammonium nitrate. Ammonium nitrate is a tertiary explosive. Depending on the temperature, it will decompose in two different reactions:

ammonium nitrate → nitrous oxide + water + heat

word

$NH_4NO_3 \rightarrow N_2O + H_2O$

skeleton

balanced

ammonium nitrate → nitrogen + water + oxygen + heat

word

skeleton

balanced

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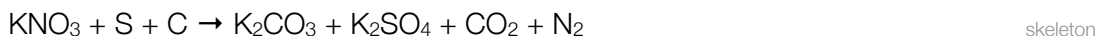
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A more accurate, but still simplified, equation is:

potassium nitrate + sulfur + carbon →  
potassium carbonate + potassium sulfate + carbon dioxide + nitrogen

word



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skeleton



balanced

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word



skeleton



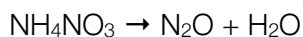
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word



skeleton



balanced

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