FIREWORK BANGS, CRACKLES & WHISTLES

The colours of fireworks get a lot of attention when it comes to explaining the chemistry behind them. However, there's also a lot of chemistry behind the assorted noises that fireworks make. Here, we take a brief look at what causes the bangs, crackles and whistles in fireworks displays.

FIREWORK BANGS

OXIDISER *e.g.* $KClO_3$ + **SULFUR** *or antimony sulfide* + **METAL** *usually Al*

These are produced by the ignition of an explosive mixture of compounds; usually an oxidiser (potassium chlorate or potassium perchlorate), sulfur, and aluminium. They produce a flash of light and a loud bang, so are often referred to as 'flash and sound' mixtures.

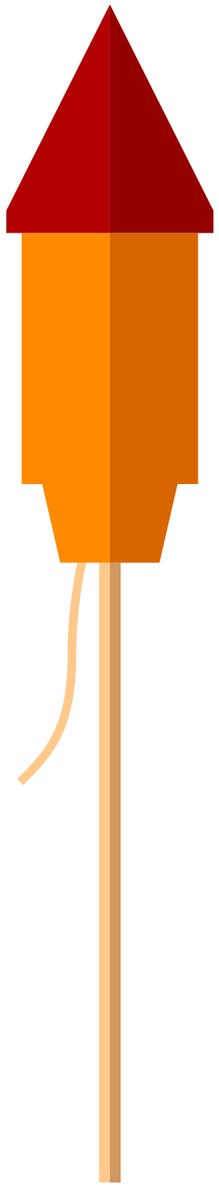
Compacted, confined gunpowder also produces a large bang.

CRACKLING FIREWORKS

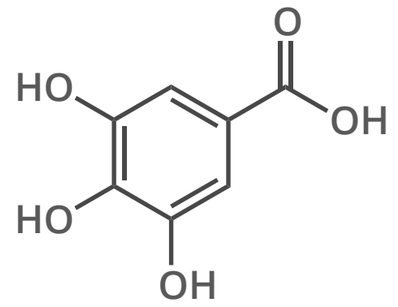
Pb_3O_4 Bi_2O_3 $(BiO)_2CO_3$

L TO R: LEAD TETROXIDE, BISMUTH TRIOXIDE, BISMUTH SUBCARBONATE

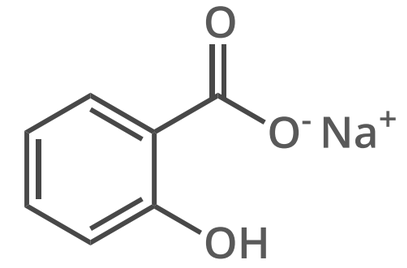
Crackling fireworks were originally made using lead tetroxide mixed with magnalium (an aluminium-magnesium alloy). The mixture is divided into small granules; their rapid combustion produces the crackling effect. Due to lead's toxicity, bismuth compounds are now more commonly used.



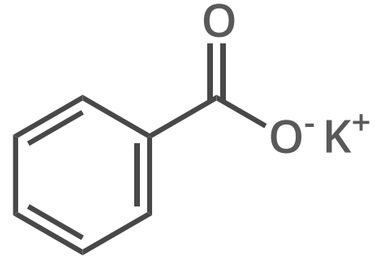
WHISTLING FIREWORKS



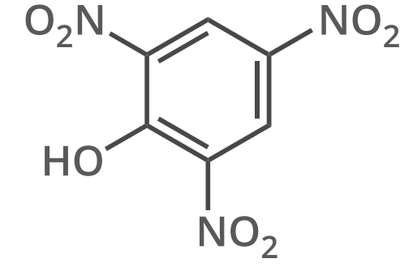
GALLIC ACID



SODIUM SALICYLATE



POTASSIUM BENZOATE



PICRIC ACID

Fireworks owe their whistle to aromatic organic compounds such as those shown. These are mixed with oxidisers, (e.g potassium perchlorate), and tightly packed into a tube. Small explosions caused by the aromatic compounds lead to oscillations in the gases created by the burning mixture. This creates a standing wave in the tube, producing a whistle effect.