

Fireworks: the art and science

Education in Chemistry

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Fireworks rely fundamentally on two processes: the combustion of the gunpowder and the metallic compounds contained in the stars releasing coloured light. Both can be understood within the confines of the GCSE combined science course.

How fireworks work

1. The firework contains gunpowder, which is a mixture of different chemicals. One of the chemicals is potassium nitrate. It reacts with sulfur (S) and carbon (C) to produce nitrogen gas, potassium sulfide and carbon dioxide. Write a word equation for this reaction.
2. Use ionic charges to derive the formulas for potassium nitrate and potassium sulfide.
3. Construct a balanced symbol equation for this reaction.
4. The reaction is a combustion reaction which requires oxygen. When potassium nitrate is heated, it produces potassium nitrite (KNO_2) and oxygen gas. Write a word and symbol equation for this reaction.
5. This reaction is called a thermal decomposition reaction. Use the information above to fully explain why this reaction is a thermal decomposition.
6. 10.0 g of potassium nitrate is heated until it fully decomposes. What mass of oxygen is produced? Give your answer to three significant figures.
7. GCSE chemistry only: at room temperature, what volume will that oxygen occupy? Give your answer to two significant figures.

Flame colours

1. From memory, state the flame colours for compounds containing:
 - a. Lithium
 - b. Sodium
 - c. Potassium
 - d. Calcium
 - e. Copper
2. Making reference to how fireworks are made, explain why you cannot always identify what metal compounds are in a firework just by looking at the colour produced.