

Lesson 9- Complete and incomplete combustion

Chemistry- Key Stage 3

Energetics

Miss Charlton



Task

Compare the two types of hand warmers and highlight the comparative language that you use.

	Reusable hand warmer	Single use hand warmer
Maximum temperature (°C)	30	50
Temperature after 5 hours (°C)	15	45
Cost of each hand warmer	£8	£1



Task

Compare the two types of combustion and highlight the comparative language that you use.

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	Complete combustion	Incomplete combustion
Oxygen supply	Good	Poor
Products	Carbon dioxide and water	Carbon monoxide, carbon and water
Colour of flame	Blue	Orange
Soot produced	No	Yes
Energy released	High (1,500°C)	Low (500°C)



Complete the task

Pollutant	When/how is it produced?	Problems it causes
Carbon dioxide	During complete combustion	Increases global warming
Carbon monoxide		
Soot/carbon		
Nitrogen dioxide		
Sulphur dioxide		



Answers



Compare the two types of hand warmers (6 marks)

- **Both** hand warmers employ exothermic reactions, so there is an increase in temperature when they are used.
- The disposable hand warmer reaches a **20°C higher** maximum temperature than the reusable one, and it is **3 times warmer** 5 hours later. Therefore, it stays **warmer for longer**.
- The disposable hand warmer is **8 times cheaper** than the reusable one, but cannot be used again. After 8 uses, the reusable one would become **better** value for money.



Compare the two types of combustion (6 marks)

- **Both** complete and incomplete combustion are burning reactions.
- **Similarly** they both require oxygen and so are oxidation reactions and both release heat, so are exothermic.
- **However**, complete combustion uses **more** oxygen and releases **3x more** heat **than** incomplete combustion does, because more of the carbon and hydrogen is oxidised.
- The flame is blue, **whereas** incomplete combustion has a yellow flame.
- The waste products are different – incomplete combustion produces toxic carbon monoxide and carbon **whilst** complete combustion produces carbon dioxide and water.



Environmental effects of pollutants

Pollutant	When/how is it produced?	Problems it causes
Carbon dioxide	Complete combustion	Increases global warming
Carbon monoxide	Incomplete combustion	Binds to red bloods cells making them unable to carry oxygen, so it is poisonous.
Soot/carbon	Incomplete combustion	Global dimming and lung disease
Nitrogen dioxide	Sulphur in fossil fuels reacting with oxygen in the air	Dissolves in clouds to form acid rain
Sulphur dioxide	Nitrogen in the air reacting with oxygen in hot engines	Dissolves in clouds to form acid rain

