Complete vs Incomplete Combustion

10SCIE - Fire & Fuels

Finn LeSueur

2019

Learning Outcomes

- Describe the differences between complete and incomplete combustion
- Explain the disadvantages and dangers of incomplete combustion
- Write a word equation for complete combustion
- Write a balanced chemical equation for complete combustion

Complete Combustion

- Occurs when there is excess oxygen
- methane + oxygen → carbon dioxide + water + energy
- $CH_4 + 2O_2 \rightarrow CO_2 + H_2O + energy$
- Carbon dioxide and water is produced
- Flame is blue (high energy produced)

Incomplete Combustion

- Occurs when there is not enough oxygen
- methane + oxygen → carbon monoxide + carbon dioxide + water + energy
- $4CH_4 + 7O_2 \rightarrow 2CO + 2CO_2 + water + energy$
- Carbon monoxide is also produced
- Flame is orange (low energy produced)

Carbon Dioxide

Carbon dioxide contributes to global warming by trapping heat in Earth's atmosphere.

Carbon Monoxide

Carbon Monoxide binds to your red blood cells more strongly than oxygen, causing less oxygen to be carried and for you to suffocate.

	Complete	Incomplete
Oxygen	Excess	Limited
Products	water, carbon dioxide	water, carbon monoxide
Flame	Blue	Orange
Smoke	No	Yes
Energy	High	Low
Environmental Impact	Carbon dioxide contributes to global warming	Carbon monoxide is deadly

---

Investigation

- AIM – to investigate the energy released during complete and incomplete combustion
- METHOD (draw diagram)
- RESULTS (draw table)
- GRAPH
- DISCUSSION

---

1. Use an orange flame to heat 100mL water
2. Record the start temperature
3. Record the temperature every 30seconds for five minutes
4. Repeat using a blue flame
5. Graph results
6. Describe the energy release by both types of combustion

- Bunsen
- Tripod

- Gauze pad
- 250mL beaker
- Water
- Thermometer
- Timer

Conclusion

1. What is the reason the flame has less heat in incomplete combustion?
2. What type of energy does the energy convert into after heat (in the water)?
3. Did all of the energy go into the water? Explain your answer.
4. What changes would you make to this experiment to make it more reliable or valid? (think control variables)