Comparing alcohols by heating water

Edexcel GCSE Chemistry (1CH0) · Foundation and Higher

Answer on your own paper. Show your working where needed.

1. Compare the temperature changes

Equal masses of two fuels heat equal masses of water. With ethanol the water goes from 18.0 °C to 43.0 °C. With butan-1-ol it goes from 21.0 °C to 44.0 °C. Which fuel gives the larger rise in these trials? Show both calculations.

2. Measurements on the balance

A capped burner containing propan-1-ol has a mass of 91.37 g before heating. It is capped and cooled afterwards and has a mass of 90.79 g. Calculate the mass lost and explain why both measurements include the burner.

3. Conditions for a fair comparison

A teacher compares the rise when the same mass of each alcohol is burned to heat the same mass of water. One burner sits farther below the water container. Explain how this can affect the result. Give one other apparatus control.

4. A problem in one repeat

Four repeats with ethanol give temperature rises of 20.0, 20.4, 19.9 and 14.1 °C. A note says the draught shield fell during the last run. Decide which readings to use for a mean and calculate it to one decimal place.

5. Test a claim about the series

Under the same test conditions, mean rises for ethanol, propan-1-ol, butan-1-ol and pentan-1-ol are 14.8, 16.1, 18.2 and 17.9 °C. Sketch a bar chart and decide whether these means increase at every step in the series.

6. A deposit on the container

After one run, there is a black, sooty deposit on the bottom of the container. What does this suggest about the reaction? Explain one reason the temperature rise may differ from a run with complete combustion.

7. The same rise by two routes

In one apparatus, heating the same mass of water by 20.0 °C uses 0.78 g of ethanol or 0.65 g of propan-1-ol. Which fuel transferred more energy to the water per gram lost in this test? Explain.

8. Match the amounts of fuel (Higher)

A class wants to burn the same number of moles of each fuel. They plan to use 0.920 g of ethanol. Calculate the mass of butan-1-ol to use. The relative formula masses are 46.0 for ethanol and 74.0 for butan-1-ol.

9. Extra challenge · Check the ranking after two changes

A class heats equal masses of water. In an open container, 0.80 g of ethanol raises the temperature by 24 °C and 0.50 g of butan-1-ol raises it by 18 °C. On repeating only the ethanol trial with a lid, 0.75 g raises it by 28 °C.

Compare the temperature rise per gram for all three results. Explain which comparison is fair and how to test whether the lid caused the change.

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