

Splitting crude oil into alkanes and alkenes

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

These model answers show the calculations, the reasoning from the observations and the safety logic. Use them to check that your graph, your rates and your conclusion about unsaturation match the sample data.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE C7

Question 1 Plot the data

Time on the x axis, 0 to 10 min; volume on the y axis, 0 to 30 cm³; plot the five points and the origin. The line rises **steeply at first and then gradually flattens**, because less paraffin reaches the hot catalyst as the experiment goes on.

Question 2 Average rate

Rate = volume ÷ time = 28 cm³ ÷ 10 min = **2.8 cm³/min**.

Question 3 Rate between two times

2 to 6 min: (18 – 4) ÷ 4 = **3.5 cm³/min**. 8 to 10 min: (28 – 24) ÷ 2 = **2.0 cm³/min**. The rate has **fallen**, as the paraffin on the mineral wool is used up.

Question 4 Meaning of the bromine result

The gas decolourises bromine water, so it contains **alkene molecules with C=C double bonds** (unsaturated). The liquid paraffin is a **control**: it stays orange, so the alkene was made during cracking and was not already present.

Question 5 Write an equation

Carbon left: 16 – 8 = 8, so each alkene has 4 carbons. Hydrogen left: 34 – 18 = 16, so each has 8 hydrogens. **C₁₆H₃₄ → C₈H₁₈ + 2C₄H₈**; the alkene is **butene**.

Question 6 Safety step

When the tube cools, the gas inside contracts and its pressure falls. Water would be **sucked back** into the hot glass tube and crack it. Removing the delivery tube first prevents this.

Question 7 Why discard the first tube

The first tube mostly holds the **air** that was in the apparatus, which would dilute the product.

It also contains vapour of paraffin that has not been cracked, so the test would be unreliable.

Question 8 Better gas measurement

Use a **gas syringe** for exact volumes and repeat the experiment at least three times to calculate a mean. Keep the heating of the aluminium oxide constant by using the same flame setting.