

Splitting crude oil into alkanes and alkenes

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Use this marking guide to score your paper out of 20. Award marks for method, balanced equations and correct units, and give credit for a correct alternative wording. Do not penalise an answer for British or American spelling.

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

Question 1 Separating crude oil (3 marks)

- a. Different **boiling points**.
- b. Bitumen has very long molecules and a very high boiling point, so it condenses at the hot bottom of the column.

Marking: a. 1 mark. b. 1 mark for long molecules or high boiling point, 1 mark for condensing in the hottest part.

Question 2 Formulae of hydrocarbons (2 marks)

- a. **C₁₂H₂₆**.
- b. **Propene, C₃H₆**.

Marking: 1 mark for each correct formula; name and formula both needed in b.

Question 3 Combustion of butane (3 marks)

- a. **2C₄H₁₀ + 13O₂ → 8CO₂ + 10H₂O**.
- b. **Carbon monoxide**.

Marking: a. 1 mark for correct formulae, 1 mark for balancing. b. 1 mark.

Question 4 Bromine water results (3 marks)

- a. **Liquid Y**.
- b. Alkenes have a C=C double bond. Bromine adds across it, so the orange bromine is used up and the solution becomes colourless. Liquid X is saturated and does not react.

Marking: a. 1 mark. b. 1 mark for C=C double bond, 1 mark for bromine adding so the colour is lost.

Question 5 Cracking (3 marks)

- a. **C₅H₁₀** (carbons 15 – 10 = 5; hydrogens 32 – 22 = 10).

- b. A catalyst such as aluminium oxide, or a temperature of about 550 °C.
- c. To make shorter alkanes for fuel and alkenes for plastics, because the demand exceeds the supply from distillation.

Marking: 1 mark each.

Question 6 Methane combustion calculation (2 marks)

$M(\text{CH}_4) = 16$; $n = 8.0 \div 16 = 0.50 \text{ mol}$. CO_2 forms 1 : 1, so 0.50 mol; $M = 44$. Mass = $0.50 \times 44 = \mathbf{22 \text{ g}}$.

Marking: 1 mark for 0.50 mol, 1 mark for the final mass with unit.

Question 7 Explain fraction properties (2 marks)

Petrol molecules are short, with weak forces between them, so petrol evaporates easily and mixes with air. The long molecules of fuel oil give a high boiling point and low volatility, so fuel oil is harder to ignite.

Marking: 1 mark for shorter chain, 1 mark for evaporating more easily.

Question 8 Saturated or unsaturated (2 marks)

Saturated: only single C-C bonds, the maximum number of hydrogens, for example ethane.

Unsaturated: at least one C=C double bond, for example ethene.

Marking: 1 mark for each correct explanation with example.