GCSE Combined Science: Fractional Distillation & Petrochemicals

AQA Specification 5.7.1.2

		Clu33.	Date:	
	l: Key Terminology			
Match t	the terms with their definitions.			
1. F	Fractional Distillation	A. Industry prod	icing chemicals from petroleum	
2. F	Fraction	B. Process of var	orising then condensing a liquid	
3. P	Petrochemical	C. Separating cr	de oil using boiling points	
4. D	Distillation	D. Chemical deri	ved from petroleum	
5. F	Feedstock	E. Group of hydr	ocarbons with similar boiling points	
6. P	Petrochemical Industry	F. Raw material t	or industrial processes	
Δnswei	rs: 1 , 2 , 3 , 4 , 5 , 6			
Part 2	2: Gap Fill			
Comple	ete using words from the box.			
Word	Bank: boiling, carbon, condensation	n, distillation, evaporatio	n, fractions, fuels, petrochemical, refinery, similar	
1				
1. Crud	le oil is separated by fractional	l,		
2. It is :	separated into with	numbers of car	oon atoms.	
	aration works due to different			
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	process involves and			
4. The _l	process involves and _ tions are processed to produce		products.	
4. The _I 5. Fract	process involves and _ tions are processed to produce industry makes solven	e and		
4. The page 15. Fract 6. The g	tions are processed to produce industry makes solven	e and		
4. The part 4. The part 3	tions are processed to produce	e and ts, lubricants and po		
4. The part 5. Fract 6. The Part 3	tions are processed to produce industry makes solven B: Multiple Choice the correct answer for each questi	e and ts, lubricants and po ion.	ymers.	
4. The part 5. Fract 6. The part 3 Circle the 1. How	tions are processed to produce industry makes solven B: Multiple Choice the correct answer for each questing w does fractional distillation se	e and ts, lubricants and po ion.	ymers. 3. Which is NOT a petrochemical product?	
4. The properties of the prope	tions are processed to produce industry makes solven B: Multiple Choice the correct answer for each question we does fractional distillation seconds.	e and ts, lubricants and po ion.	3. Which is NOT a petrochemical product?A. Solvents	
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4. The plant 3. Fract 6. The part 3. Circle the hydron A. By the B. By the C. By the D. By the state of the part 3. The part 3	industry makes solven industry makes solven B: Multiple Choice the correct answer for each question w does fractional distillation sectors their chemical reactivity their boiling points their density their colour	e and ts, lubricants and po ion. parate	3. Which is NOT a petrochemical product? A. Solvents B. Polymers C. Lubricants D. Electricity 4. Why do fractions condense at different heigh	nts?
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GCSE Combined Science: Fractional Distillation & Petrochemicals

AQA Specification 5.7.1.2 - Continued

Part 4: Process & Applications
1. Describe what happens during the evaporation stage:
2. Explain why smaller hydrocarbon molecules rise higher in the column:
3. Name two fuels produced from crude oil fractions:
4. What is meant by 'feedstock' in the petrochemical industry?
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Part 5: Challenge Question (6 marks)
Fractional distillation is a crucial process in the petroleum industry with wide-ranging applications.
Explain how fractional distillation separates crude oil into different fractions. (2 marks)
Describe two important products of the petrochemical industry and their uses. (2 marks)
Explain why modern society depends heavily on products derived from crude oil. (2 marks)
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Fractional Distillation Column

Fractionating Column - Temperature decreases upwards

- ↑ Refinery gases (1-4 carbon atoms) 25°C
- ↑ Gasoline/Petrol (5-12 carbon atoms) 40-100°C
- ↑ Kerosene (12-15 carbon atoms) 150-200°C
- ↑ Diesel oil (15-25 carbon atoms) 250-300°C 1 Fuel oil (20-70 carbon atoms) - 300-350°C
 - 1 Bitumentosty/sciencegcseconsk/ >350°C

GCSE Combined Science: Fractional Distillation - ANSWER SHEET

AQA Specification 5.7.1.2

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Part 1: Key Terminology

- 1. Fractional Distillation → C. Separating crude oil using boiling points
- 2. Fraction → E. Group of hydrocarbons with similar boiling points
- 3. Petrochemical → D. Chemical derived from petroleum
- 4. Distillation \rightarrow B. Process of vaporising then condensing a liquid
- 5. Feedstock → F. Raw material for industrial processes
- 6. Petrochemical Industry → A. Industry producing chemicals from petroleum

Part 2: Gap Fill

- 1. Crude oil is separated by fractional distillation.
- 2. It is separated into **fractions** with **similar** numbers of carbon atoms.
- 3. Separation works due to different **boiling** points.
- 4. The process involves evaporation and condensation.
- 5. Fractions are processed to produce **fuels** and **petrochemical** products.
- 6. The **petrochemical** industry makes solvents, lubricants and polymers.

Part 3: Multiple Choice

1. B. By their boiling points

Different hydrocarbons have different boiling points

2. B. They rise to the top

Smaller molecules have lower boiling points

3. D. Electricity

Electricity is not a chemical product

4. A. Different boiling points

Each fraction condenses at its specific boiling point

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GCSE Combined Science: Fractional Distillation - ANSWER SHEET

AQA Specification 5.7.1.2 - Continued

Part 4: Process & Applications

- 1. Crude oil is heated until it vaporises (evaporates) into a gas. (1 mark)
- 2. Smaller hydrocarbon molecules have lower boiling points, so they remain as vapour longer and rise higher before condensing. (1 mark)
- 3. Any two from: petrol, diesel, kerosene, heavy fuel oil, liquefied petroleum gases. (1 mark)
- 4. Raw material used as input for industrial processes to make other chemicals. (1 mark)

Part 5: Challenge Question (6 marks)

• Crude oil is heated until it evaporates. The vapour rises up a fractionating column where temperature decreases with height. Different hydrocarbons condense at different levels based on their boiling points - larger molecules (higher boiling points) condense lower down, smaller molecules (lower boiling points) condense higher up. (2 marks)

1 mark for evaporation, 1 mark for condensation at different levels

• Any two from: Polymers (plastics, synthetic materials), Solvents (cleaning products, paints), Lubricants (engine oils, greases), Detergents (cleaning products). (2 marks)

1 mark for each correct product with use

• Modern society depends on crude oil for transportation fuels (petrol, diesel), heating, electricity generation, and countless petrochemical products including plastics, medicines, cosmetics, synthetic fabrics, and agricultural chemicals that are essential to contemporary lifestyles. (2 marks)

1 mark for fuels, 1 mark for other petrochemical products

Total marks: 20 - Part 1 (6) + Part 2 (6) + Part 3 (4) + Part 4 (4) + Part 5 (6) = **26 marks total**

Additional Marking Guidance

- Accept equivalent wording for all answers
- For products, accept any valid petrochemical products with uses
- Key concepts: boiling point separation, evaporation/condensation, petrochemical uses
- Award partial marks for correct understanding even if terminology is imperfect

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