Organic chemistry – 2021/20 GCSE Gateway Chemistry Combined Science A

1. Nov/2021/Paper_J250/10/No.7

The alkanes are members of a **homologous** series.

Which statement does **not** explain why alkanes are a homologous series?

A They are hydrocarbons.

B They have the same general formula.

C They react in similar ways.

D They show trends in physical properties.

Your answer ☐ **[1]**

2. Nov/2021/Paper_J250/10/No.8

The equation shows the reaction for the cracking of the alkane $C_{15}H_{32}$.

$$C_{15}H_{32} \rightarrow 2C_2H_4 + C_8H_{18} + \mathbf{X}$$

What is the formula of **X**?

A C_3H_6

B C_3H_8

C C_5H_{10}

D C_5H_{12}

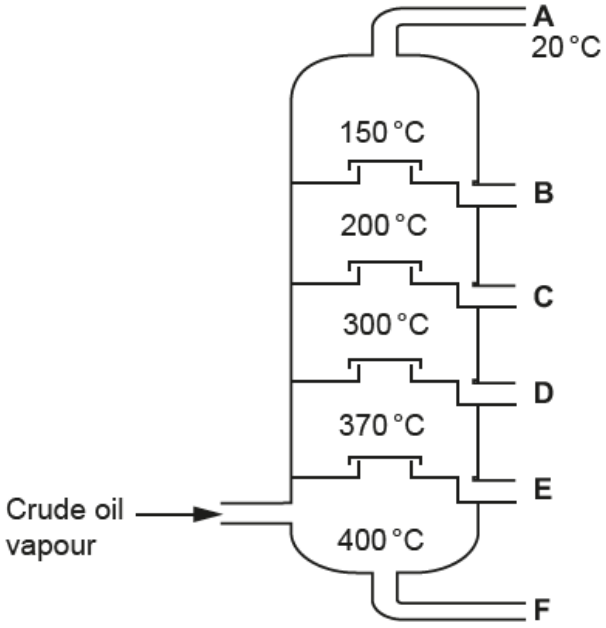
Your answer ☐ **[1]**

3. Nov/2021/Paper_J250/10/No.14

Crude oil is a mixture of alkanes which can be separated into different fractions.

The different fractions have a range of different boiling points.

The diagram shows the process of fractional distillation.



(a) Explain how fractional distillation separates the crude oil into fractions.

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..... **[3]**

(b) Icosane, $C_{20}H_{42}$, is an alkane found in one of the fractions.

It has a boiling point of 343 °C.

(i) Which fraction, **A**, **B**, **C**, **D**, **E** or **F**, contains icosane?

..... **[1]**

(ii) Icosane is converted into more useful products by cracking.

State the **two** conditions used for cracking.

1 .....

2 ..... **[1]**

(iii) Many different products can form when cracking icosane.

In one reaction, a molecule of icosane ($C_{20}H_{42}$) forms a molecule of hydrogen, H_2, and one other product.

Write the **balanced symbol** equation for this reaction.

..... **[1]**

(c)* Fraction **A** contains the alkanes methane, ethane, propane and butane.

Table 14.1 shows some information about these four alkanes.

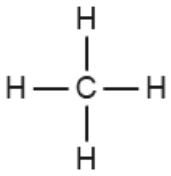
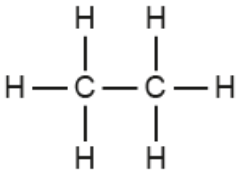
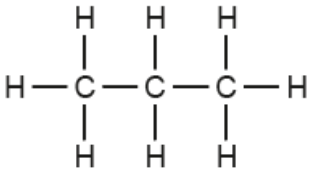
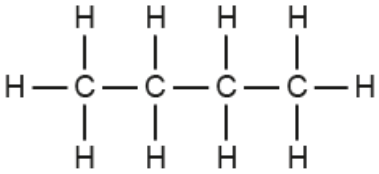
Alkane	Structure	Boiling point (°C)	Strength of the intermolecular forces
Methane		–162	
Ethane		–89	
Propane		–43	
Butane		–1	

Table 14.1

Describe and explain the similarities and differences in the boiling point of these four alkanes.

Use information in **Table 14.1** and your knowledge of structure and bonding in your answer.

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..... **[6]**

4. Nov/2020/Paper_J250/10/No.11

Look at the flowchart. It shows how crude oil is changed into useful substances.

Process 1. Fractional distillation	Crude oil is separated into fractions of similar hydrocarbons.
↓	
Process 2.	Some long chain hydrocarbons are turned into short chain hydrocarbons.
↓	
Process 3. Polymerisation	Some of the short chain hydrocarbons are used to make plastics.

(a) Complete the flowchart with the name of **Process 2**. **[1]**

(b) **Table 11.1** shows the supply and demand of two fractions of crude oil.

Fraction	Millions of barrels per day	
	Supply	Demand
Petrol	26	39
Fuel oil	19	11

Table 11.1

Explain the importance of **Process 2**.

Use information from **Table 11.1** in your answer.

.....

.....

.....

..... **[2]**

(c) The hydrocarbon fractions from **Process 1** contain different alkanes.

Table 11.2 shows the boiling point of different alkanes produced in **Process 1**.

Number of carbon atoms in a molecule of the alkane	Boiling point (°C)
1	−162
2	−89
3	.....
4	−1
5	36

Table 11.2

(i) Complete **Table 11.2** with an estimate of the missing boiling point for an alkane molecule with **3 carbon atoms**. **[1]**

(ii) Write the formula for an alkane with **7 carbon atoms**.

..... **[1]**

5. Nov/2020/Paper_J250/10/No.17

The alkanes in crude oil can be separated by fractional distillation.

This is because they have different boiling points.

The table shows the boiling points of hexane and octane.

Alkane	Boiling point (°C)
Hexane	69
Octane	126

(a) Hexane molecules are smaller than octane molecules.

Explain the difference in the boiling points of hexane and octane.

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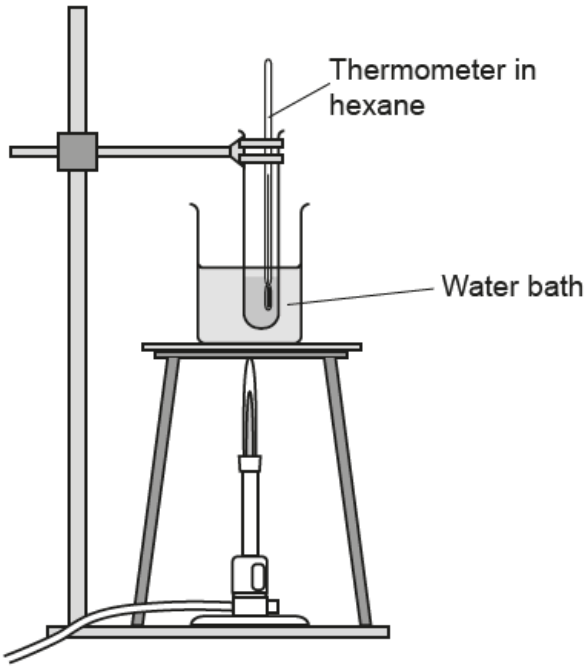
..... **[2]**

(b) A teacher checks the boiling point of hexane.

The diagram shows his experiment.



The teacher slowly heats up the water until hexane boils.

He records the temperature at the boiling point of hexane.

A student thinks that this method can be used to determine the boiling point of hexane but **not** the boiling point of octane.

Explain why the student is correct.

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..... **[2]**

6. Nov/2021/Paper_J250/04/No.7

Octane, C_8H_{18}, is a compound in petrol.

Which statement about octane is correct?

A It is a hydrocarbon with a relative molecular mass of 66.

B It is a hydrocarbon with the empirical formula C_4H_9.

C It is extracted from crude oil by filtration.

D It is in the bitumen fraction of crude oil.

Your answer ☐ [1]

7. Nov/2021/Paper_J250/04/No.13

Crude oil is a mixture of different chemicals called fractions.

(a) What is the name of the process used to separate crude oil into fractions?

..... [1]

(b) **Table 13.1** shows the stages in the separation of crude oil into fractions.

The stages are **not** in the correct order.

	Stages in the separation of crude oil into fractions
W	The vapours are piped into the bottom of the fractionating column.
X	The vapours cool and the fractions condense at different temperatures.
Y	Crude oil is heated and vaporised.
Z	The vapours rise up the column.

Table 13.1

Write **W**, **X**, **Y** and **Z** in the boxes to show the correct order of the stages.

☐ ☐ ☐ ☐

[1]

(c) **Table 13.2** shows information about the different gases in the LPG (liquefied petroleum gas) fraction separated from crude oil.

Gas in the LPG fraction	Formula	Boiling point (°C)
Methane	CH_4	−162
Ethane	C_2H_6	−89
Propane	C_3H_8	−42
Butane	C_4H_{10}	

Table 13.2

(i) Write the name of the homologous series of the gases in the LPG fraction.

..... **[1]**

(ii) What is the correct general formula for this homologous series?

Put a (ring) around the correct answer.

C_nH_n C_nH_{2n} C_nH_{2n+2} $C_{2n}H_{2n}$ $C_{2n}H_{2n+2}$

[1]

(iii) Use the data in **Table 13.2** to estimate the boiling point of butane.

Estimated boiling point = ... °C **[1]**

(d) The equation shows the reaction for methane burning in a limited amount of oxygen.

$2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(g)$

(i) Write down the name of the hazardous gas formed in this reaction.

..... **[1]**

(ii) State why the gas identified in **(d)(i)** is hazardous to humans.

..... **[1]**

8. Nov/2020/Paper_J250/04/No.2

Crude oil is a **finite** resource.

What does this mean?

A Crude oil is a mixture of hydrocarbons.

B Crude oil is expensive to produce.

C Crude oil is renewable.

D Crude oil will run out.

Your answer ☐ **[1]**

9. Nov/2020/Paper_J250/04/No.17

Look at the flowchart. It shows how crude oil is changed into useful substances.

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↓	
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Fraction	Millions of barrels per day	
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Table 17.1

Explain the importance of **Process 2**.

Use information from **Table 17.1** in your answer.

.....

.....

.....

..... **[2]**

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Table 17.2

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..... **[1]**