

## 8: Organic 1 – Topic questions

## Paper 3

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

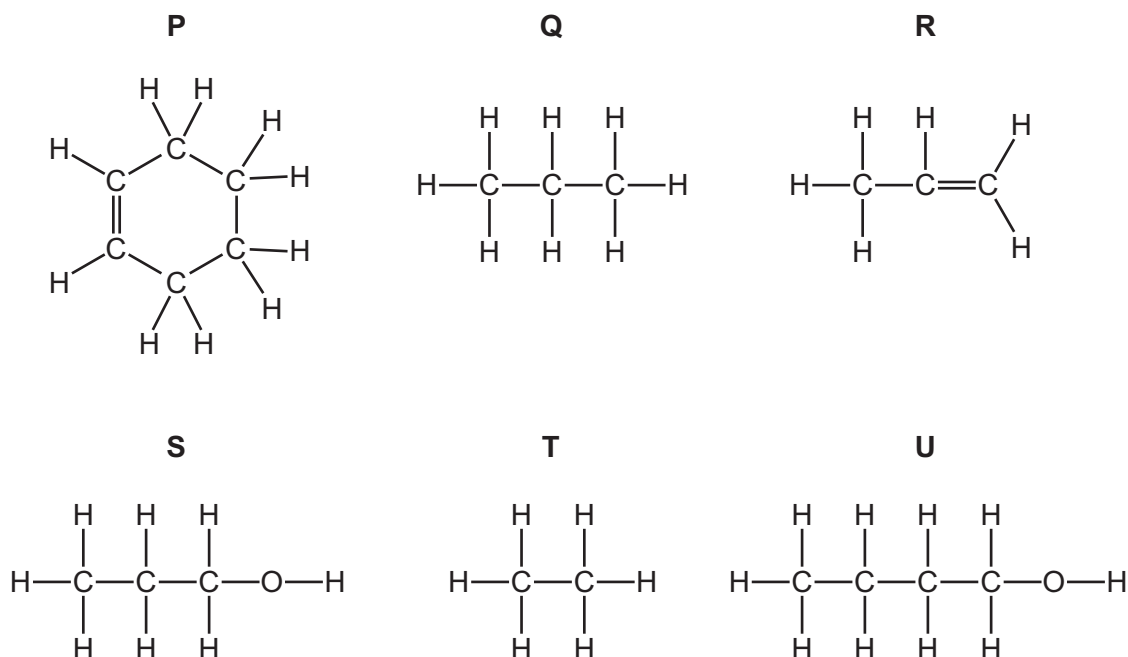
Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
4	2014	June	31
4	2014	June	32
4	2016	June	33

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

4 The structures of some organic compounds are shown.



(a) (i) Which **two** of these compounds are alcohols?

Explain your answer.

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

(ii) Which **two** of these compounds are saturated hydrocarbons?

..... [1]

(b) Methanol and ethanol are alcohols in the same homologous series.

Complete the following sentence about a homologous series using words from the list.

<b>alcohols</b>	<b>chemical</b>	<b>compounds</b>	<b>elements</b>
<b>functional</b>	<b>mixtures</b>	<b>physical</b>	

A homologous series is a family of similar ..... with similar  
..... properties due to the same ..... group. [3]

**(c)** Ethene is an alkene.

**(i)** Draw the structure of ethene showing all atoms and all bonds.

[1]

**(ii)** Describe how aqueous bromine is used to show that ethene is an unsaturated compound.

.....

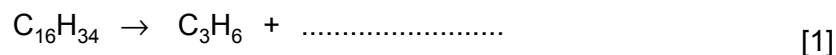
..... [2]

**(iii)** Ethene is manufactured by cracking.

State the conditions needed for cracking.

..... [1]

**(iv)** Complete the chemical equation for the cracking of hexadecane,  $C_{16}H_{34}$ , to form propene and one other hydrocarbon.



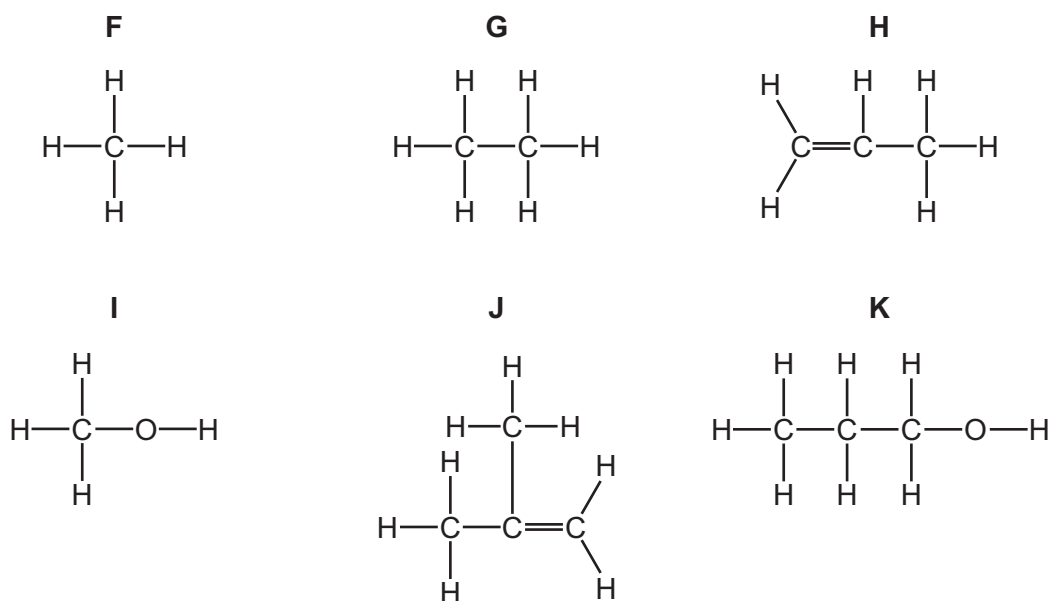
[Total: 11]

4 Alkanes, alkenes and alcohols are three different homologous series of organic compounds.

(a) What is meant by the term *homologous series*?

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

(b) The structures of some alkanes, alkenes and alcohols are shown below.



(i) Which **two** of these compounds, **F**, **G**, **H**, **I**, **J** and **K**, are saturated hydrocarbons?

Explain your answer.

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

(ii) Which **one** of these compounds is the main constituent of natural gas?

..... [1]

(iii) Which **two** of these compounds are alkenes?

..... and ..... [2]

(iv) Why are two compounds, **I** and **K**, not hydrocarbons?

..... [1]

(c) The table gives some information about four alcohols.

alcohol	molecular formula	density in g/cm <sup>3</sup>	boiling point /°C
methanol	CH <sub>4</sub> O	0.793	
	C <sub>2</sub> H <sub>6</sub> O	0.789	79
propanol	C <sub>3</sub> H <sub>8</sub> O	0.804	98
butanol	C <sub>4</sub> H <sub>10</sub> O	0.810	117

(i) Give the name of the alcohol with the formula C<sub>2</sub>H<sub>6</sub>O.

..... [1]

(ii) A student predicts that the density of the alcohols increases as the number of carbon atoms increases.

Does the data in the table support this prediction?

Explain your answer.

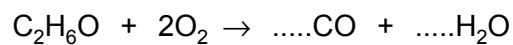
.....  
.....  
..... [1]

(iii) Suggest a value for the boiling point of methanol.

..... [1]

- (d) The alcohol with the formula  $C_2H_6O$  burns in a limited supply of air to form carbon monoxide and water.

(i) Complete the chemical equation for this reaction.



[2]

(ii) State an adverse effect of carbon monoxide on health.

..... [1]

[Total: 15]

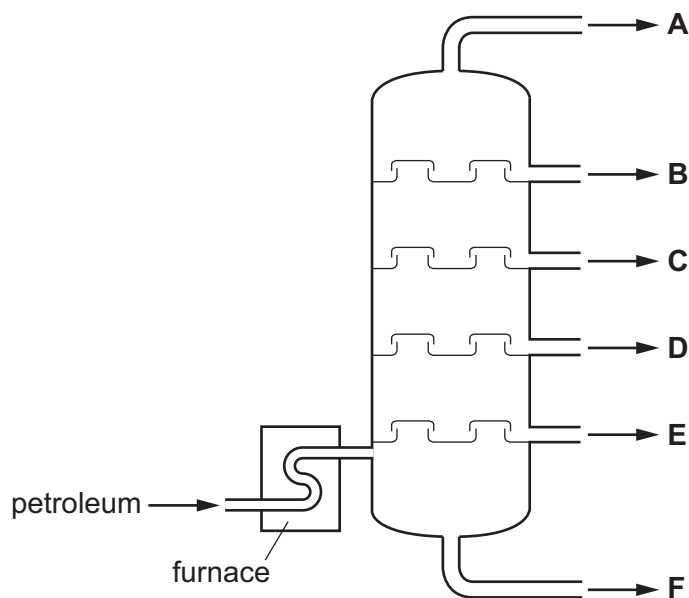
4 Petroleum is a mixture of hydrocarbons.

(a) What is the meaning of the term *hydrocarbon*?

..... [1]

(b) Petroleum can be separated into different fractions by fractional distillation.

The diagram shows a fractionating column. The fractions are shown by letters.



Describe how fractional distillation is used to separate the petroleum into fractions.

In your answer refer to

- changes of state,
- differences in boiling points.

.....  
.....  
.....  
.....  
.....  
.....  
.....

[5]

(c) The properties of the fractions are shown in the table.

fraction	number of carbon atoms	percentage by mass of the fraction	boiling range / °C
<b>A</b>	1 – 4	3	less than 40
<b>B</b>	4 – 10	14	40 – 160
<b>C</b>	10 – 16	13	160 – 250
<b>D</b>	16 – 20	9	250 – 300
<b>E</b>	20 – 25	9	300 – 350
<b>F</b>	more than 25		more than 350
		total = 100	

(i) Describe how the number of carbon atoms affects the boiling range.

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

(ii) Determine the percentage by mass of fraction **F** in this sample of petroleum.

..... [1]

(iii) Which **one** of the fractions is mainly gaseous at 25 °C?

..... [1]

(iv) Fraction **F** is the residue. It contains bitumen.

Give **one** use of bitumen.

..... [1]

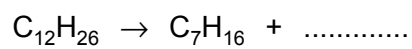
(d) Fraction **C** can be cracked to form alkenes.

(i) Describe **one** condition required for cracking.

..... [1]

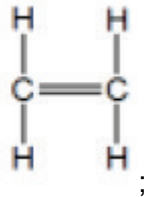


- (ii) Complete the chemical equation for the cracking of dodecane,  $C_{12}H_{26}$ , to form heptane,  $C_7H_{16}$ , and one other hydrocarbon.



[1]

[Total: 12]

Question	Answer	Marks
4 (a) (i)	S and U; both have OH (group);	2 1 1
4 (a) (ii)	Q and T;	1
4 (b)	compounds; chemical; functional;	3 1 1 1
4 (c) (i)		1
4 (c) (ii)	aqueous bromine is added to (test tube of) ethene / aqueous bromine is orange; aqueous bromine turns colourless / solution turns colourless;	2 1 1
4 (c) (iii)	High temperature / heat;	1
4 (c) (iv)	C <sub>13</sub> H <sub>28</sub> ;	1
		Total: 11

*Continues on next page ...*

Question	Answer	Marks
4 (a)	any 2 from: <ul style="list-style-type: none"> <li>family / group of similar chemicals;</li> <li>with same functional group;</li> <li>trend in physical properties;</li> <li>same general formula;</li> <li>same / similar chemical reaction;</li> <li>successive members differ by <math>\text{CH}_2</math>;</li> </ul>	2
4 (b) (i)	F and G; contain only carbon and hydrogen; have only single bonds / no double bonds;	3 1 1 1
4 (b) (ii)	F / methane / $\text{CH}_4$ ;	1
4 (b) (iii)	H; J;	2 1 1
4 (b) (iv)	contain oxygen;	1
4 (c) (i)	ethanol;	1
4 (c) (ii)	yes and because there is a general increase in the numbers / the numbers go up steadily; <b>OR</b> no and because the numbers go down then up again;	1
4 (c) (iii)	65 °C	1
4 (d) (i)	2 (CO); 3 ( $\text{H}_2\text{O}$ );	2 1 1
4 (d) (ii)	poisonous / toxic	1
Total: 15		

*Continues on next page ...*

Question	Answer	Marks
4 (a)	compound containing carbon and hydrogen only;	1
4 (b)	Any 5 of: <ul style="list-style-type: none"> <li>petroleum vaporised (in furnace);</li> <li>column is hot at the bottom and cool at the top;</li> <li>smaller / lighter molecules move higher up the column ora;</li> <li>fractions with lower boiling points move further up column ora;</li> <li>smaller / lighter molecules have lower boiling points ora;</li> <li>fractions condense when the temperature in the column falls below the (average) boiling point of the fraction;</li> </ul>	5
4 (c) (i)	the higher the values of the boiling range, the greater the number of (carbon) atoms / boiling range is higher, the greater the number of (carbon) atoms / the more atoms, the more energy it takes to boil;	1
4 (c) (ii)	52%	1
4 (c) (iii)	A;	1
4 (c) (iv)	road surfaces / roofing / cattle sprays / synthetic crude oil / battery sealant / treating fences / waterproofing;	1
4 (d) (i)	high temperature / heat;	1
4 (d) (ii)	C <sub>5</sub> H <sub>10</sub> ;	1
		Total: 12