HYDROCARBONS 5

Q1. The alkanes are a series of hydrocarbons.

(a) What is the general formula for the alkane series?

1 C_nH_n

2 C_nH_{2n}

3 C_nH_{2n+2}

4 $C_{2n}H_{2n-2}$

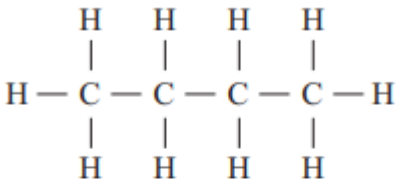
(1 mark)

The table shows information about four alkanes.

Alkane	Number of carbon atoms in each molecule
Methane	1
Butane	4
Octane	8
Dodecane	12

(b) The structural formula for butane is . . .

1



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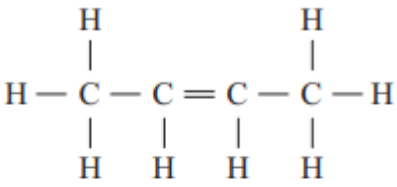

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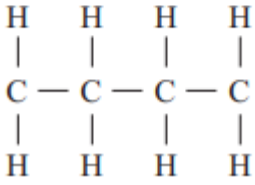

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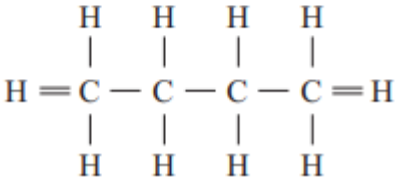


(1 mark)

(c) When compared with octane, dodecane . . .

1 has a lower boiling point.

2 is easier to ignite.

3 evaporates less easily.

4 is less viscous.

(1 mark)

(d) When pure methane burns in plenty of oxygen, the only products are . . .

1 carbon dioxide and hydrogen.

2 carbon, carbon dioxide and water.

3 carbon dioxide, sulfur dioxide and water.

4 carbon dioxide and water.

(1 mark)

Q2. Fuel oil is a mixture of compounds, mainly hydrocarbons. Fuel oil is obtained from crude oil by fractional distillation.

(a) Which of the following hydrocarbons is an alkane?

1 CH_6

2 C_3H_6

3 C_2H_6

4 C_2H_4

(1 mark)

(b) Which of the following describes how fuel oil is obtained from crude oil during fractional distillation?

1 boiling followed by evaporation

2 evaporation followed by boiling

3 evaporation followed by condensation

4 condensation followed by evaporation

(1 mark)

(c) Which of the following is a correct list of gases that might be produced by burning fuel oil?

1 carbon dioxide, water vapour, sulfur dioxide, carbon monoxide

2 hydrogen, carbon dioxide, sulfur dioxide, carbon monoxide

3 sulfur dioxide, carbon dioxide, water vapour, hydrogen

4 carbon, water vapour, sulfur dioxide, carbon monoxide

(1 mark)

(d) Which row in the table correctly describes the type of combustion and a substance produced when fuel oil is burned?

	Type of combustion	Substance produced
1	Incomplete	Hydrogen
2	Complete	Carbon particles
3	Incomplete	Carbon particles
4	Complete	Carbon monoxide

(1 mark)

Q3. This question is about four alkanes, A, B, C and D.

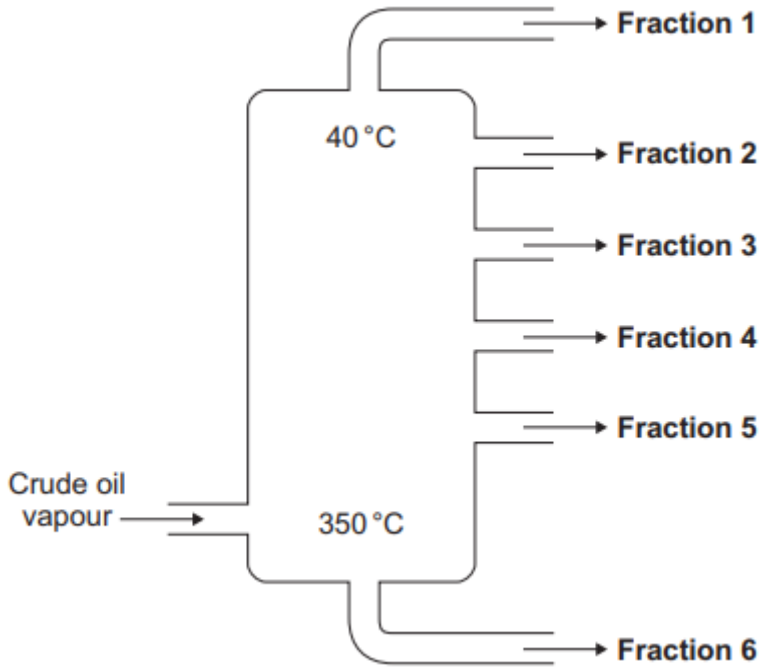
	Name of alkane	Number of carbon atoms in each molecule	Boiling point in °C
A	Ethane	2	−89
B	Pentane	5	+36
C	Hexane	6	+69
D	Dodecane	12	+216

Match alkanes, A, B, C and D, with the numbers 1– 4 in the table below.

1	It has the lowest boiling point.
2	It has the largest molecules.
3	It has 12 hydrogen atoms in each molecule.
4	It has a total of 20 atoms in each molecule.

(4 marks)

Q4. Crude oil can be separated into fractions by fractional distillation.



(a) The fractions can be separated in this way because the hydrocarbons in the crude oil

1 have different chemical properties.

2 are compounds containing only two elements.

3 are gases, liquids and solids.

4 have different boiling points.

(1 mark)

(b) Each fraction will contain . . .

1 a single alkane.

2 alkanes with the same chemical formula.

3 a mixture of alkanes.

4 alkanes with the same number of carbon atoms in each molecule.

(1 mark)

(c) When compared with Fraction 5, Fraction 3 . . .

1 will be more difficult to ignite.

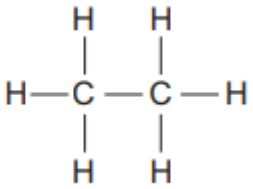
2 will be more volatile.

3 will be more viscous.

4 will have boiling points in a higher range.

(1 mark)

(d) The diagram shows a molecule of an alkane.



In which fraction will most of this alkane be found?

1 Fraction 1

2 Fraction 2

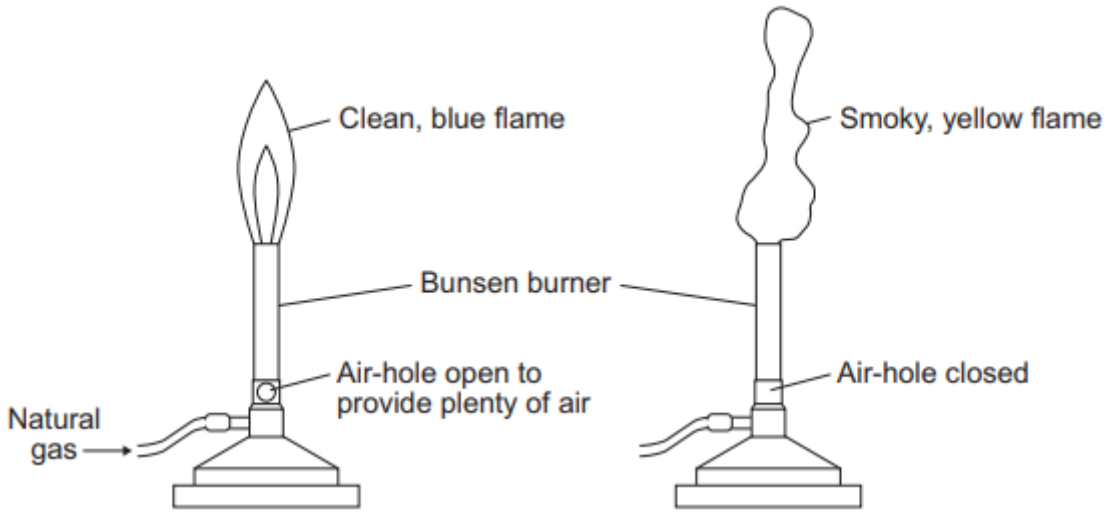
3 Fraction 4

4 Fraction 6

(1 mark)

Q5. The diagram shows two different flames that can be produced when natural gas burns.

Natural gas is mainly methane, an alkane.



Match substances, A, B, C and D, with the numbers 1– 4 in the sentences.

A carbon dioxide

B carbon monoxide

C oxygen

D sulfur dioxide

With the air-hole open, the two main products of combustion are water and . . . 1 . . . .

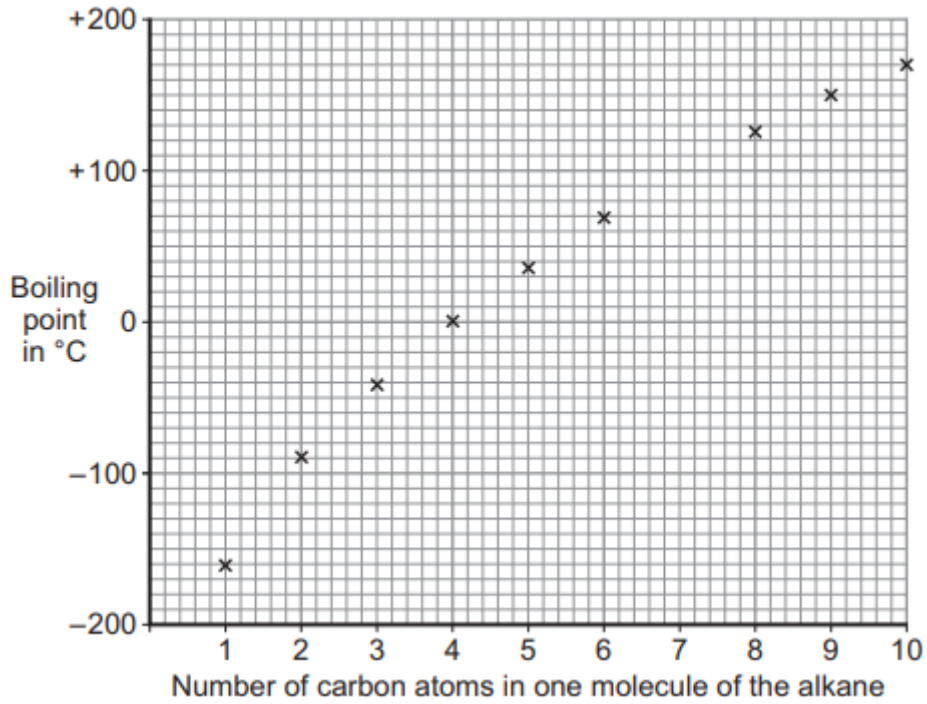
Water is formed when the hydrogen in methane reacts with . . . 2 . . . .

With the air-hole closed, a different carbon compound that is produced during combustion is . . . 3 . . . .

When natural gas burns, a gas that causes acid rain may be produced. This gas is . . . 4 . . . .

(4 marks)

Q6. The boiling points of nine alkanes are plotted on the graph.



(a) The evidence from the graph indicates that . . .

1 the more carbon atoms in the molecule, the lower the boiling point.

2 the boiling point increases as the number of carbon atoms in the molecule increases.

3 the boiling point is directly proportional to the number of carbon atoms in the molecule.

4 the fewer the number of carbon atoms in the molecule, the higher the boiling point.

(1 mark)

(b) The alkane with seven carbon atoms in each molecule will have a boiling point of . . .

1 75 °C.

2 100 °C.

3 125 °C.

4 150 °C.

(1 mark)

(c) The alkanes that are gases at –50 °C are . . .

1 CH_4 and C_2H_6

2 C_2H_6 and C_3H_8

3 in the range C_3H_8 to $C_{10}H_{22}$

4 C_9H_{20} and $C_{10}H_{22}$

(1 mark)

(d) Compared with the alkane with 10 carbon atoms, the alkane with 2 carbon atoms . . .

1 is more viscous.

2 ignites more easily.

3 burns less easily.

4 burns releasing more carbon particles.

(1 mark)

Q7. The alkanes are a series of compounds.

(a) Which of the following changes in the alkane series?

1 the general formula

2 the number of bonds on each carbon atom

3 the ratio of carbon atoms to hydrogen atoms

4 the number of elements present

(1 mark)

(b) Which of these statements is correct for the alkanes?

1 They all have the general formula C_nH_{2n+1}

2 They are saturated compounds.

3 Most are gases at room temperature (20 ^{o}C).

4 Every carbon atom is bonded to four hydrogen atoms.

(1 mark)

(c) Which of the following represents the equation for the complete combustion of methane?

1 $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

2 $CH_4 + O_2 \rightarrow CO_2 + 2H_2$

3 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

4 $CH_4 + O_2 \rightarrow CO_2 + H_2O$

(1 mark)

Total marks (27)