HYDROCARBONS 7

Q1. The two equations below show reactions involving hydrocarbons.

$$C_{11}H_{24} \rightarrow C_2H_4 + C_4H8 + C_5H_{12}$$

$$C_4H_{10} \rightarrow 2C_2H_4 + H_2$$

(a) The reactions are examples of . . .

1 condensation.

2 polymerisation.

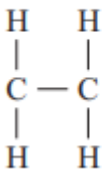
3 cracking.

4 hydrogenation.

(1 mark)

(b) The hydrocarbon C_2H_4 can be represented by

1



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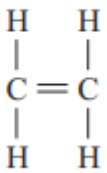

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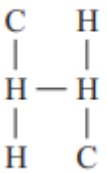

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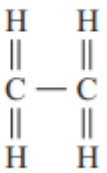


(1 mark)

(c) In the equations, the two hydrocarbons that are alkenes are . . .

1 C_2H_4 and C_4H_8

2 C_2H_4 and C_4H_{10}

3 C_2H_4 and C_5H_{12}

4 $C_{11}H_{24}$ and C_4H_{10}

(1 mark)

(d) Which of the hydrocarbons is used to make poly(ethene)?

1 C_2H_4

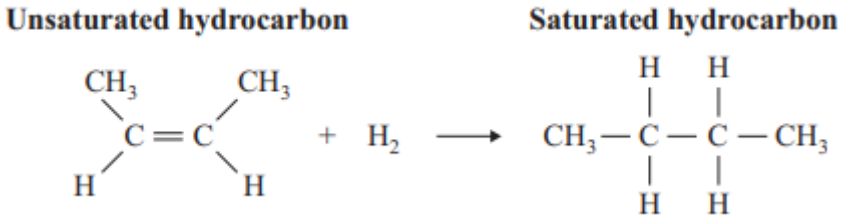
2 C_4H_8

3 C_4H_{10}

4 C_5H_{12}

(1 mark)

Q2. Unsaturated oils contain double carbon carbon bonds. If an unsaturated hydrocarbon is heated with hydrogen gas and a nickel catalyst, the following reaction takes place.



(a) What is this process called?

1 cracking

2 polymerisation

3 hydrogenation

4 combustion

(1 mark)

(b) An unsaturated oil is made into a saturated compound. The saturated compound . . .

1 contains fewer hydrogen atoms in its molecules.

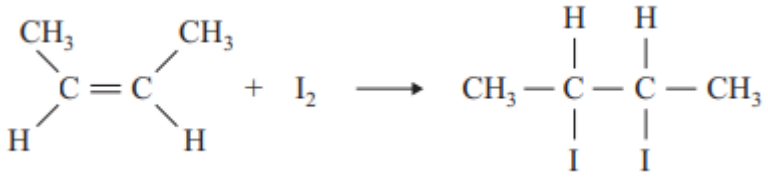
2 has a higher melting point.

3 feels softer but has the same melting point.

4 would be more useful as a fuel for vehicles.

(1 mark)

(c) Iodine (I_2) reacts with unsaturated hydrocarbons as shown in the equation.



The iodine number is the number of grams of iodine that will react with 100 g of the unsaturated hydrocarbon. The higher the iodine number, the more unsaturated the hydrocarbon is. 3 g of iodine are added to 1 g of a vegetable oil. When the reaction has finished, 1.2 g of iodine are left unreacted. What is the iodine number of the oil?

1 120

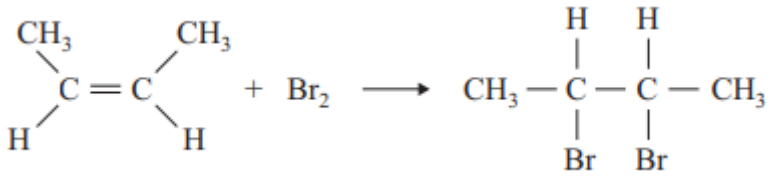
2 180

3 240

4 300

(1 mark)

(d) Bromine (Br_2) reacts with unsaturated hydrocarbons in the same way as iodine.



If bromine water is added drop-by-drop to a sample of vegetable oil, the bromine will be decolourised until all the double carbon carbon bonds have reacted.

A sample of an oil with an iodine number of 150 decolourises 25 drops of bromine water. The same amount of another vegetable oil decolourises 6 drops of the same bromine water.

What is the iodine number of the second oil?

1 30

2 36

3 40

4 45

(1 mark)

Q3. The table below shows some data on fats, K, L, M and N.

Fats	Type	Melting point in °C
K	Saturated	+63
L	Monounsaturated	+4
M	Polyunsaturated	–5
N	Polyunsaturated	–11

(a) Which of the fats has the lowest melting point?

1 K

2 L

3 M

4 N

(1 mark)

(b) Which of the fats will not react with iodine?

1 K

2 L

3 M

4 N

(1 mark)

(c) Unsaturated fats and oils are healthier than saturated fats and oils. Which of the following statements is not true?

1 Scientists can find out if an oil is unsaturated.

2 Scientists can show that unsaturated oils are healthier.

3 Scientists can prevent people from eating unhealthy foods.

4 Scientists can change unsaturated oils to saturated oils.

(1 mark)

(d) It is thought that eating too much saturated fat can cause health problems. Some people say that saturated fats and oils are unhealthy. Who is likely to give the most reliable advice?

1 a Year 11 student at school

2 a farmer

3 a supermarket manager

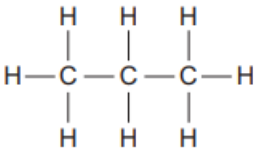
4 a research scientist

(1 mark)

Q4. This question is about the formulae of four compounds.

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

A



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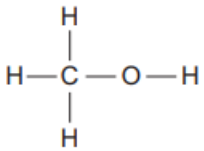

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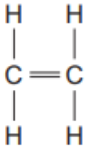
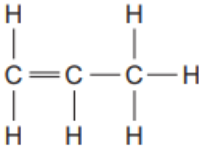


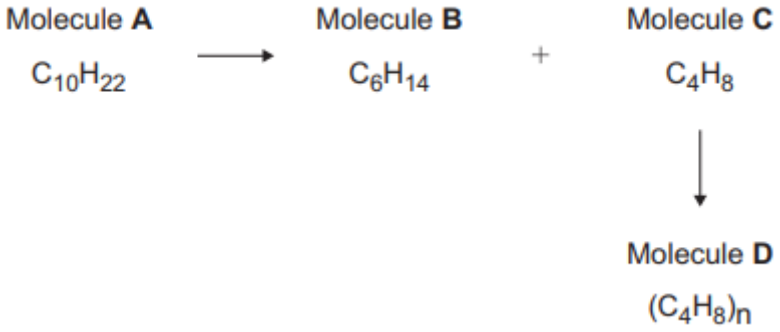
D



1	It is the alkene used to make ethanol.
2	It is a saturated hydrocarbon useful as a fuel.
3	It is not a hydrocarbon but burns to produce carbon dioxide and water vapour.
4	It belongs to the group with the general formula C_nH_{2n} where n = 3.

(4 marks)

Q5.



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

Molecule . . . 1 . . . has been cracked.

Molecule . . . 2 . . . is an alkene.

Molecule . . . 3 . . . is a polymer.

Molecule . . . 4 . . . is the alkane in the reactions with the smallest molecules.

(4 marks)

Q6. Hydrocarbon molecules can be broken down to produce smaller hydrocarbon molecules. An example is shown below.

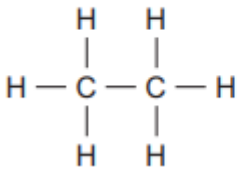
Match molecules, A, B, C and D, with the numbers 1– 4 in the table.

1	It is the hydrocarbon with the largest molecules.
2	It is the molecule that contains exactly 14 atoms.
3	It is the monomer from which poly(ethene) is made.
4	It is the second hydrocarbon in the alkene series.

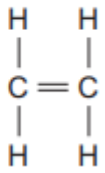
(4 marks)

Q7. The diagram shows one molecule of each of four compounds, J, K, L and M.

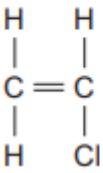
J



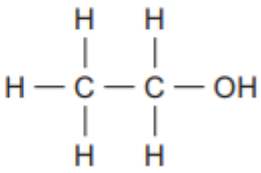
K



L



M



(a) Which of the compounds are hydrocarbons?

1 J and K

2 K and L

3 L and M

4 J, K and M

(1 mark)

(b) Which row in the table describes the bonding in these four compounds?

	Number of bonds to each carbon atom	Number of bonds to each hydrogen atom
1	1	1
2	1	4
3	4	1
4	4	4

(1 mark)

(c) Two of the compounds can form polymers because . . .

1 their molecules are saturated.

2 they are hydrocarbons.

3 their molecules have a double carbon carbon bond.

4 they are not biodegradable.

(1 mark)

(d) Compounds K and L will change bromine water from yellow-brown to colourless because . . .

1 their molecules are unsaturated.

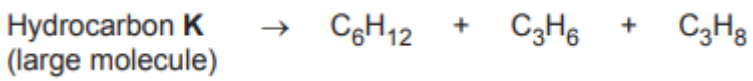
2 their molecules contain two carbon atoms.

3 their molecules contain only carbon atoms and hydrogen atoms.

4 their molecules can be cracked.

(1 mark)

Q8. Large hydrocarbon molecules can be broken down to produce smaller molecules. An example is shown below.



(a) What are the conditions needed for this reaction to take place most successfully?

1 heat hydrocarbon K vapour over a hot catalyst

2 heat hydrocarbon K vapour with hydrogen

3 heat hydrocarbon K with a dilute acid

4 heat hydrocarbon K at 40 °C

(1 mark)

(b) The formula for hydrocarbon K is . . .

1 C_9H_{18}

2 $C_{12}H_{24}$

3 $C_{12}H_{26}$

4 $C_{26}H_{12}$

(1 mark)

(c) Which row in the table shows the products that react with bromine water and the colour change seen when they react?

	Product(s)	Colour change
1	C_6H_{12} and C_3H_6	from yellow-brown to colourless
2	C_3H_6 and C_3H_8	from yellow-brown to colourless
3	C_6H_{12} and C_3H_6	from colourless to yellow-brown
4	C_3H_8 only	from yellow-brown to colourless

(1 mark)

(d) Two of the products can form polymers because . . .

1 they are obtained from crude oil by fractional distillation.

2 they are saturated compounds.

3 their molecules have a double carbon carbon bond.

4 they vaporise at temperatures below 20 °C

(1 mark)

Q9. This question is about four chemical reactions.

Match products, A, B, C and D, with the numbers 1– 4 in the equations.

A C_2H_5OH

B $2CO_2 + 2H_2O$

C C_3H_8

D $C_2H_4 + H_2$

$C_2H_4 + 3O_2 \rightarrow$ . . . 1 . . .

$C_2H_6 \rightarrow$ . . . 2 . . .

$C_2H_4 + H_2O \rightarrow$ . . . 3 . . .

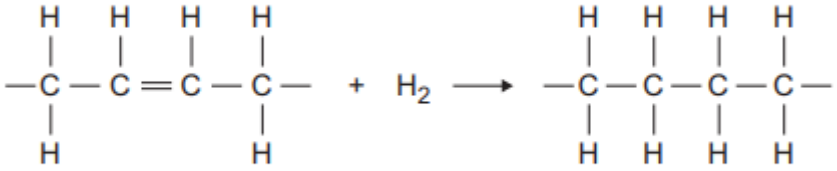
$C_3H_6 + H_2 \rightarrow$ . . . 4 . . .

(4 marks)

Q10. Most vegetable oils contain unsaturated molecules.

They can be converted into saturated compounds, as shown in Equation 1.

Equation 1



Part of an unsaturated molecule in sunflower oil

(a) Which one of the following shows the correct conditions for this reaction?

1 react with hydrogen using a nickel catalyst at 60 °C

2 vaporise and pass the vapours over a hot iron catalyst

3 react with oxygen using a nickel catalyst below 37 °C

4 vaporise and pass the vapours over a nickel catalyst below 37 °C

(1 mark)

(b) Compared with the unsaturated compound in sunflower oil, the saturated compound produced in Equation 1 . . .

1 has a softer consistency.

2 has a higher melting point.

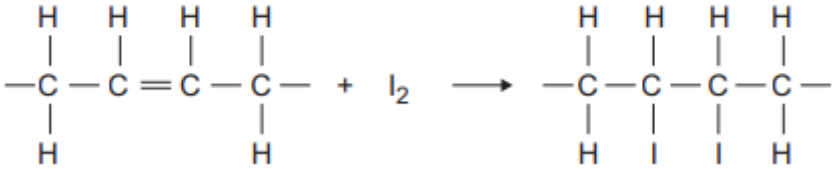
3 has more carbon atoms in each molecule.

4 has fewer hydrogen atoms in each molecule.

(1 mark)

Iodine reacts with the double carbon carbon bond in unsaturated hydrocarbons, as shown in Equation 2.

Equation 2



The iodine number is the number of grams of iodine that will react with 100 grams of the unsaturated hydrocarbon.

(c) Which of the following is a true statement?

1 the higher the iodine number, the smaller the oil molecules

2 the higher the iodine number, the larger the oil molecules

3 the higher the iodine number, the fewer double bonds in each oil molecule

4 the higher the iodine number, the more double bonds in each oil molecule

(1 mark)

(d) 2.5 grams of iodine was added to 1.0 grams of a vegetable oil. When the reaction finished, 1.0 grams of iodine was left unreacted. What is the iodine number of this vegetable oil?

1 100

2 150

3 200

4 250

(1 mark)