Topic Test: OxfordAQA International GCSE Chemistry 9202

Organic Chemistry

Name: _____

Class: _____

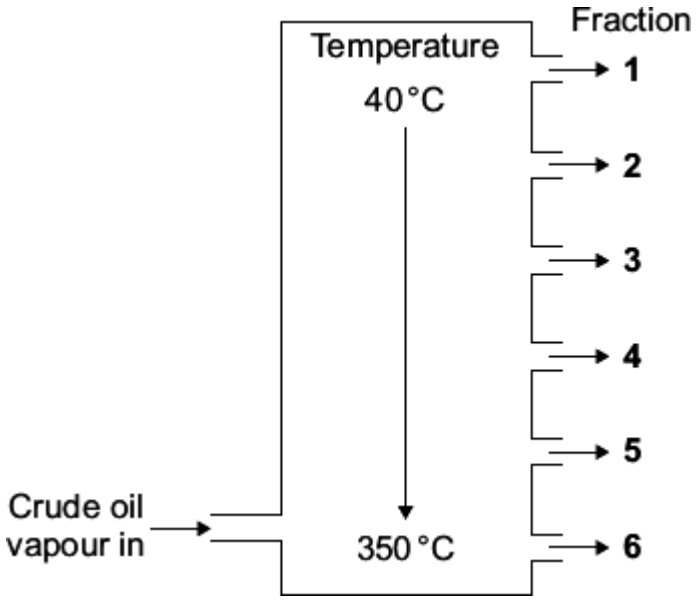
Date: _____

Time: **56 minutes**

Marks: **56 marks**

Comments:

1 Crude oil is a mixture of hydrocarbons.
Crude oil can be separated into fractions.



(a) (i) Complete the sentence.

The process used to separate the crude oil into fractions is called

fractional _____ .

(1)

(ii) Why do the fractions separate at different temperatures?

_____

_____

(1)

(b) Tick (✓) **two** properties of fraction **6**.

Property	Tick (✓)
contains hydrocarbons	
has a small number of carbon atoms in each molecule	
is easy to ignite	
has a high boiling point	

(2)

(c) Fraction **1** contains hydrocarbons called alkanes.
The general formula of an alkane is: C_nH_{2n+2}

What is the formula of the alkane that has 5 carbon atoms in each molecule?

Draw a ring around the correct answer.

C_5H_9 **C_5H_{10}** **C_5H_{11}** **C_5H_{12}**

(1)

(Total 5 marks)

2 This question is about compounds produced from crude oil.

The table below shows four of these compounds.

Compound	Melting point in °C	Boiling point in °C
methane (CH_4)	−183	−164
ethene (C_2H_4)	−169	−104
decane ($C_{10}H_{22}$)	−30	+174
icosane ($C_{20}H_{42}$)	+37	+343

(a) Tick (✓) **two** correct statements about the four compounds.

Statement	Tick (✓)
Methane has the lowest melting point and icosane has the highest boiling point.	
Ethene and methane are alkanes.	
Methane and decane are gases at room temperature (20°C).	
Decane and icosane are liquid at 100°C.	

(2)

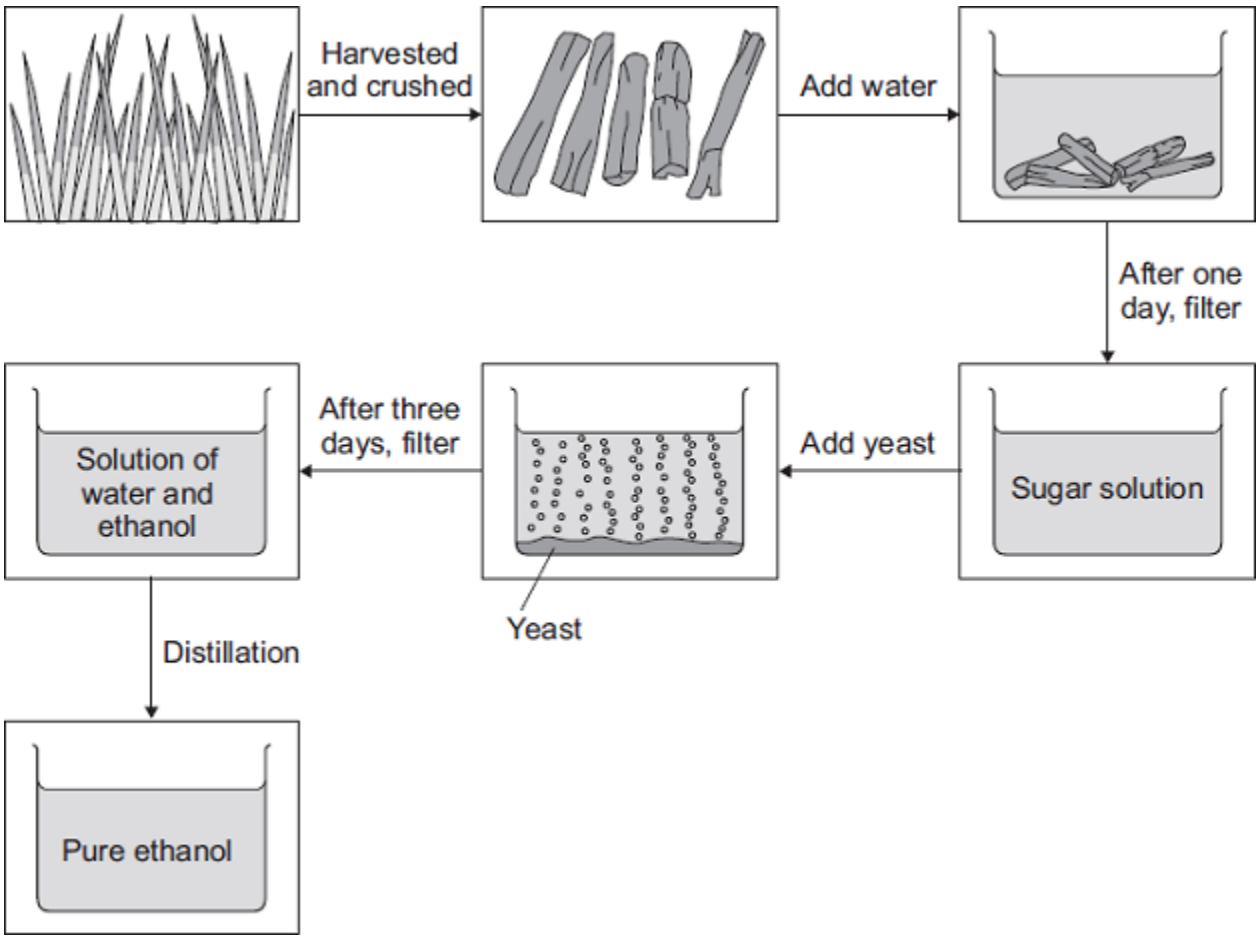
(b) Petrol contains a mixture of compounds, including octane (C_8H_{18}).

Complete the word equation for the complete combustion of octane.

octane + oxygen → _____ + _____

(2)

(c) Most petrol used in cars contains about 5% ethanol (C_2H_5OH).
Ethanol can be produced from sugar cane.



(i) Draw a ring around the correct answer to complete the sentence.

The reaction to produce ethanol from sugar solution is

combustion.
displacement.
fermentation.

(1)

(ii) Some people say that increasing the production of ethanol from sugar cane will be **good** for the environment.

Suggest **two** reasons why.

1. _____

_____

_____

2. _____

_____

_____

(2)

(iii) Other people say that increasing the production of ethanol from sugar cane will be **bad** for the environment.

Suggest **two** reasons why.

1. _____

_____

_____

2. _____

_____

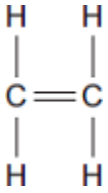
_____

(2)

(Total 9 marks)

3 Crude oil is used to make useful substances such as alkenes and plastics.

(a) The alkene shown is ethene.



(i) Tick (✓) the correct formula for ethene.

Formula	Tick (✓)
CH_4	
C_2H_4	
C_2H_6	

(1)

(ii) Tick (✓) the name of the plastic formed when many ethene molecules join together.

Name of plastic	Tick (✓)
Poly(ethene)	
Poly(ethenol)	
Poly(propene)	

(1)

(b) Read the article about plastics and then answer the questions.

THE PROBLEM WITH PLASTIC WASTE

Millions of tonnes of plastics are made from crude oil every year.

Most of the litter found on beaches is plastic waste.

80 % of plastics produced end up in landfill sites.

(i) Draw a ring around the correct answer in the box to complete the sentence.

Plastic waste needs to be removed from beaches because it

decomposes.
is reactive.
is not biodegradable.

(1)

(ii) Suggest a problem caused by 80 % of plastics going to landfill sites.

_____

_____

(1)

(iii) Suggest **one** way of reducing the amount of plastics going to landfill sites.

_____

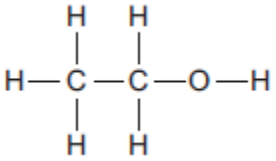
_____

(1)

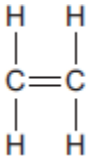
(Total 5 marks)

4 The figure below shows the displayed structures of five organic compounds, **A, B, C, D** and **E**.

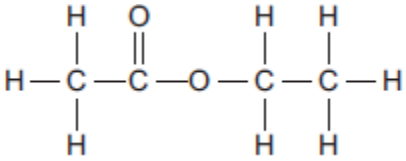
A



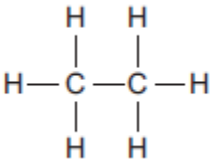
B



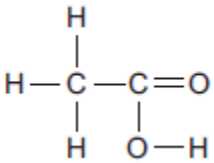
C



D



E



(a) Choose which organic compound, **A, B, C, D** or **E**, matches the descriptions.

You may choose each compound once, more than once or not at all.

Write the letter of the compound that:

(i) is a saturated hydrocarbon ☐ **(1)**

(ii) comes from a homologous series with the general formula C_nH_{2n} ☐ **(1)**

(iii) has the empirical formula C_2H_6O ☐ **(1)**

(iv) reacts with calcium carbonate to produce carbon dioxide ☐ **(1)**

(v) reacts with compound **A** to produce compound **C**. ☐ **(1)**

(b) Compound **B** (C_2H_4) and C_8H_{18} are produced by cracking $C_{14}H_{30}$

$$C_{14}H_{30} \longrightarrow 3C_2H_4 + C_8H_{18}$$

(i) Give **two** conditions for cracking.

_____

_____

(2)

(ii) Explain why C_8H_{18} has a lower boiling point than $C_{14}H_{30}$

_____

_____

_____

_____

(2)

(c) Compound **B** is a colourless gas.

Give a chemical test and its result to show that compound **B** is unsaturated.

Test _____

_____

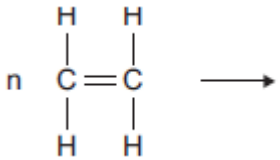
Result _____

_____

(2)

(d) Compound **B** is ethene.

Complete the equation to show the formation of poly(ethene) from ethene.



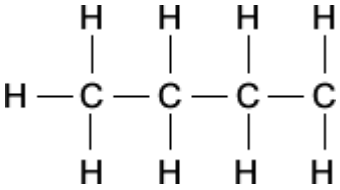
(3)

(Total 14 marks)

5 Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

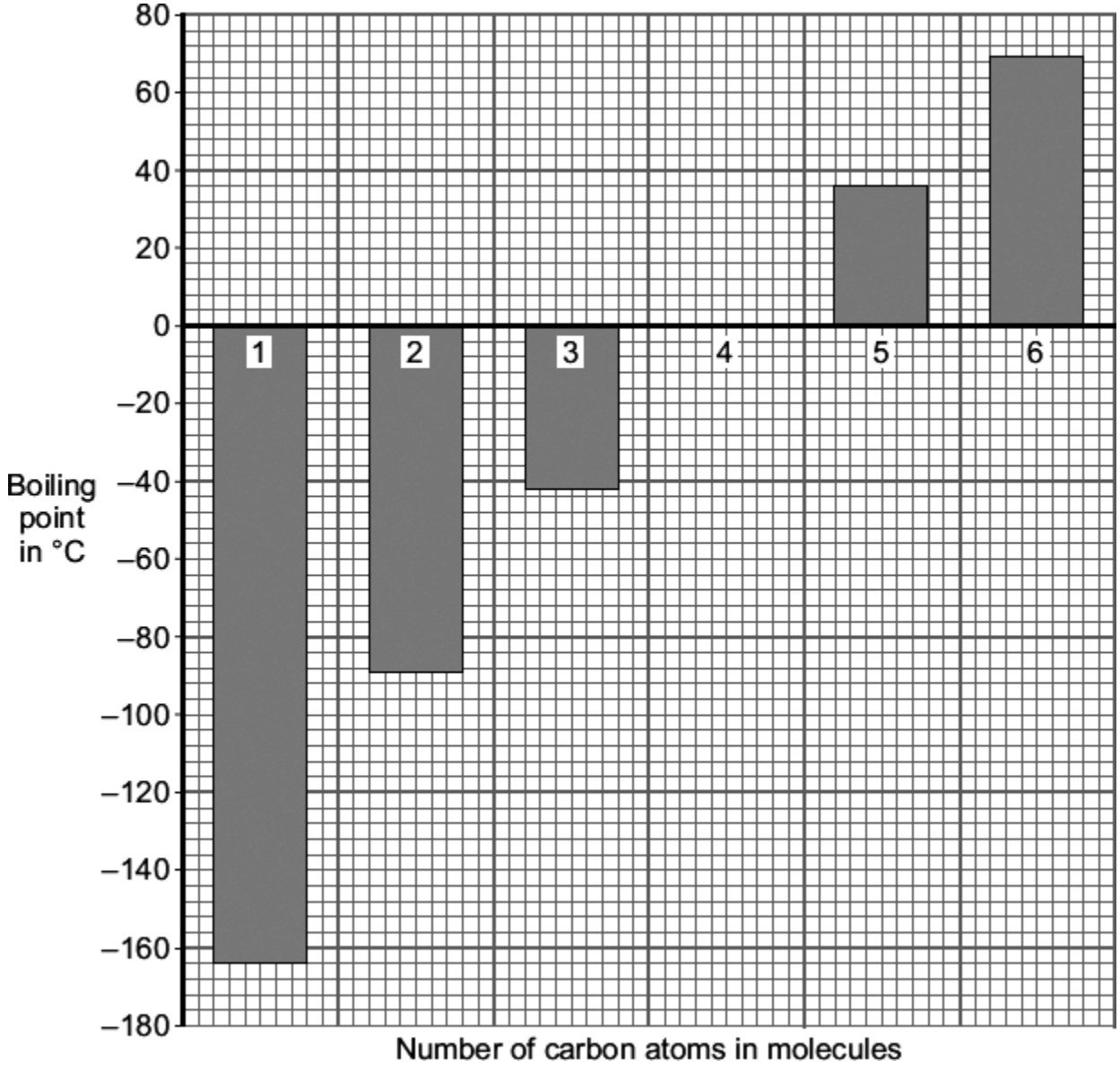
(a) The general formula of an alkane is C_nH_{2n+2}

Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1)

(b) The boiling points of alkanes are linked to the number of carbon atoms in their molecules.



(i) Describe the link between the number of carbon atoms in an alkane molecule and its boiling point.

_____

_____

(1)

(ii) Suggest **two** reasons why all of the alkanes in the bar chart are better fuels than the alkane with the formula $C_{30}H_{62}$

1. _____

_____

2. _____

_____

(2)

(c) During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %.
Over the last 100 years the percentage of carbon dioxide in the atmosphere has increased to about 0.04 %.
Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport.
Fossil fuels contain carbon that has been locked up for millions of years.

(i) Burning fossil fuels, such as petrol, releases this locked up carbon. Balance the chemical equation for the combustion of one of the alkanes in petrol.

$$2\ C_8H_{18} + 25\ O_2 \longrightarrow \_\_\_\_\ CO_2 + \_\_\_\_\ H_2O$$

(1)

(ii) Where did the carbon that is locked up in fossil fuels come from?

_____

_____

(1)

(iii) The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %.
Explain why.

_____

_____

_____

_____

_____

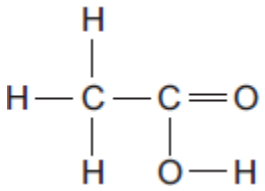
_____

(2)

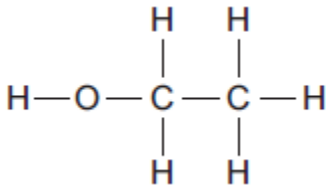
(Total 8 marks)

6 The diagrams represent two compounds, **A** and **B**.

Compound A



Compound B



(a) (i) Compound **B** is an alcohol.

Name compound **B**.

_____

(1)

(ii) Use the correct answer from the box to complete the sentence.

burned	**decomposed**	**oxidised**

To form compound **A**,

compound **B** is _____

(1)

(iii) Compounds **A** and **B** are both colourless liquids.

A test tube contains a colourless liquid, which could be either compound **A** or compound **B**.

Describe a simple **chemical** test to show which compound, **A** or **B**, is in the test tube.

_____

_____

_____

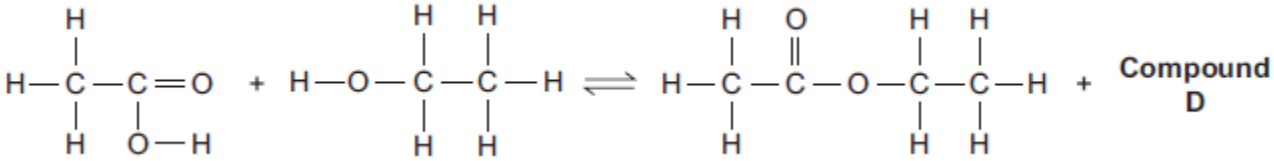
_____

_____

(2)

(b) Compounds **A** and **B** react to produce compound **C** and compound **D**.

Compound A **Compound B** **Compound C**



(i) What is the formula of compound **D**?

_____

(1)

(ii) Compound **C** is an ester.

Name compound **C**.

_____

(1)

(iii) State **one** use of esters.

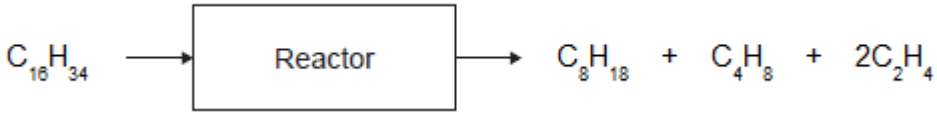
_____

(1)

(Total 7 marks)

7 Poly(butene) is a polymer made from crude oil in two stages.

(a) The first stage in making poly(butene) is to break down large hydrocarbon molecules from crude oil into smaller hydrocarbon molecules, as shown in the figure below.



(i) The products contain two types of hydrocarbon with different general formulae.

Name the two types of hydrocarbon.

_____

(1)

(ii) Describe the conditions in the reactor.

_____

_____

_____

_____

(2)

(iii) Suggest why air must **not** enter the reactor.

_____

_____

(1)

(iv) Suggest a method that can be used to separate butene (C_4H_8) from the other hydrocarbons.

_____

(1)

(b) The second stage is to use butene (C_4H_8) to produce poly(butene).

(i) Draw the displayed structure of a butene (C_4H_8) molecule.

(1)

(ii) Describe how molecules of butene (C_4H_8) form poly(butene).

_____

_____

_____

_____

(2)

(Total 8 marks)

1

(a) (i) distillation

1

(ii) condense (at different temperatures)

accept they / fractions / hydrocarbons have different boiling points

ignore melting point / size of molecule

1

(b) contains hydrocarbons

1

has a high boiling point

1

(c) C_5H_{12}

1

[5]

2

(a) Methane has the lowest melting point and icosane has the highest boiling point

1

Decane and icosane are liquid at 100°C

1

(b) water / H_2O

either order

1

carbon dioxide / CO_2

allow hydrogen oxide

1

(c) (i) fermentation

1

(ii) any **two** from:

- sugar cane / plants absorb carbon dioxide
  ignore oxygen released
- growing sugar cane / plants reduces global warming
  allow ethanol from plants is carbon neutral
- renewable resource / sustainable
  accept conserves fossil fuels / petrol

2

(iii) any **two** from:

- destruction of habitats / forests (to grow sugar cane/crops)
- fermentation releases carbon dioxide
- production plants cause visual pollution
- pollution from the transportation of sugar cane / Ethanol
- growing sugar cane / plants uses a lot of land

2

[9]

3

(a) (i) C_2H_4

1

(ii) poly(ethene)

1

(b) (i) is not biodegradable

1

(ii) not enough landfill sites / space

*accept landfill sites are filling up **or** plastics remain for years **or** plastics not broken down*

ignore cost / waste of resources / not biodegradable / wildlife

1

(iii) recycle / burn

accept reduce the amount of packaging used

ignore reused

1

[5]

4

(a) (i) D

1

(ii) B

1

(iii) A

1

(iv) E

1

(v) E

1

(b) (i) high temperature

ignore hot / heat

allow temperature quoted (range 300-900 °C)

1

catalyst **or** steam

1

(ii) C_8H_{18} smaller molecule

It = C_8H_{18}

1

therefore there are weaker intermolecular forces

allow intermolecular bonds

*do **not** accept breaking covalent bonds / bonds*

or

weaker intermolecular forces in C_8H_{18} (1)

allow intermolecular bonds

so less energy to break (1)

1

(c) add bromine water

1

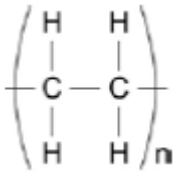
turns (from orange / yellow / red / brown) to colourless **or** decolourises

do not accept discoloured

*ignore clear incorrect test = **0** marks*

1

(d)



single C – C bond

1

four carbon-hydrogen bonds in place and two trailing bonds

1

structure in brackets and n at bottom right

1

[14]

5 (a) complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)

1

(b) (i) the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa

allow as the (carbon) chain gets longer the boiling point increases

ignore melting points

*do **not** accept reference to greater number of molecules*

1

(ii) *they = hydrocarbons from the graph*
it = $C_{30}H_{62}$

any **two** from:

- low boiling point / volatile
  accept they are gases or liquids
- low viscosity
- high flammability
  accept easier to burn / ignite
- small molecules
  accept short chains
  ignore number of carbon atoms
- burn completely
  ignore speed of burning

2

(c) (i) 16 (CO_2) + 18 (H_2O)

1

(ii) (carbon dioxide in the Earth's early) atmosphere
accept from volcanoes (millions of years ago)
or *from <u>dead</u> plants / animals*
allow dead sea creatures
ignore shells

1

(iii) <u>increase</u> in burning / use of fossil fuels

1

locked up carbon (carbon dioxide) is released
allow carbon / carbon dioxide from millions of years ago is released
accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)

1

[8]

6 (a) (i) ethanol

1

(ii) oxidised

1

(iii) **Test**

add any named carbonate or hydrogen carbonate
the first mark is for the test; the second is for the result
if the test is incorrect award 0 marks.

1

Result

A will effervesce (carbon dioxide) **or B** will not effervesce.

if the result is incorrect, award the first mark only

1

or

candidates do not have to name a gas but penalise an incorrect gas.

Test

add a named (magnesium, aluminium, zinc, iron or tin) metal

give credit to any test that will work.

Result

A will effervesce (hydrogen), **B** will not

*allow a test that would identify **B**.*

or

Test

add an acid-base indicator

Result

credit any acid colour for that indicator eg for universal indicator allow red, yellow or orange

give credit for the neutral colour for **B**

or

Test

add an alcohol (+ acid catalyst)

Result

sweet or fruity smell of esters.

(b) (i) H_2O

1

(ii) ethyl ethanoate

1

(iii) any **one** from:

- flavourings
- perfumes
- solvents
- plasticisers

allow any correct use of esters

1

[7]

7 (a) (i) alkanes **and** alkenes

any order

*allow saturated **and** unsaturated (hydrocarbons)*

1

(ii) high temperature

allow temperatures from 300 – 900 °C

allow vapours

*ignore heat / hot **or** pressure*

1

catalyst **or** steam

allow zeolite / aluminium oxide

ignore names of other catalysts

1

(iii) <u>oxygen</u> could react / *burn* with the hydrocarbons

allow <u>oxygen</u> could cause an explosion

1

(iv) *(fractional)* distillation

1

(b) (i) displayed structure of butene drawn

1

(ii) many monomers **or** many butene molecules

1

*form chains **or** very large molecules*

*if no other mark awarded allow double bond breaks / opens up **or** double bond forms a single bond for **1** mark*

1

[8]