

Name: _____

Organic Chemistry part 1 AQA Triple Chemistry

Class: _____

Date: _____

Time: **71 minutes**

Marks: **67 marks**

Comments:

1.

Alkanes and alkenes are hydrocarbons.

Hydrocarbon molecules are made up of hydrogen and carbon atoms only.

An alkene has the formula C_3H_6

(a) Which alkene has the formula C_3H_6 ?

Tick (✓) **one** box.

Butene

Ethene

Propene

(1)

(b) How many atoms are there in a molecule of C_3H_6 ?

Tick (✓) **one** box.

2

3

6

9

(1)

(c) Which is a use of C_3H_6 ?

Tick (✓) **one** box.

Making a polymer

Making ammonia

Making glass

(1)

(d) The percentage (%) by mass of each element in a molecule of C_3H_6 is:

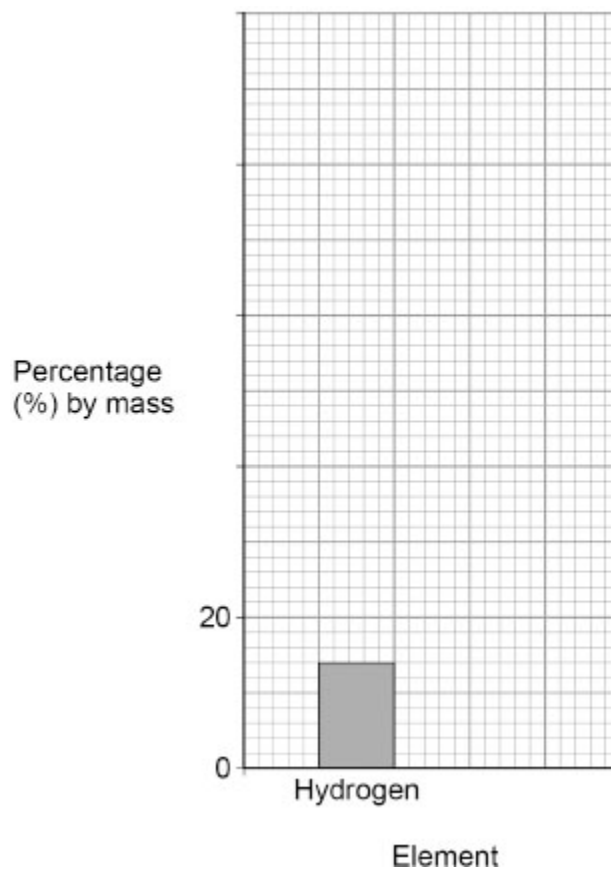
- hydrogen 14%
- carbon 86%.

The figure below shows the percentage by mass of hydrogen in a molecule of C_3H_6

Complete the figure below.

You should:

- complete the y -axis scale
- plot the percentage by mass of carbon as a bar
- label the bar plotted for carbon.



(3)

Alkanes can be cracked to produce alkenes and smaller alkane molecules.

(e) Describe a test for alkenes.

Give the result of the test.

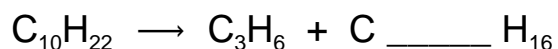
Test _____

Result _____

(2)

(f) $C_{10}H_{22}$ can be cracked to produce C_3H_6 and an alkane.

Complete the equation for the reaction.



(1)

(g) Complete the sentence.

Choose the answer from the box.

ceramics	fertilisers	fuels
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Smaller alkanes from cracking are useful as _____.

(1)

High temperatures between 450°C and 750°C are used in cracking reactions.

(h) Which statement describes the molecules at 750°C compared with the molecules at 450°C?

Tick (✓) **one** box.

The molecules collide more frequently at 750°C.

The molecules have less energy at 750°C.

The molecules move more slowly at 750°C.

(1)

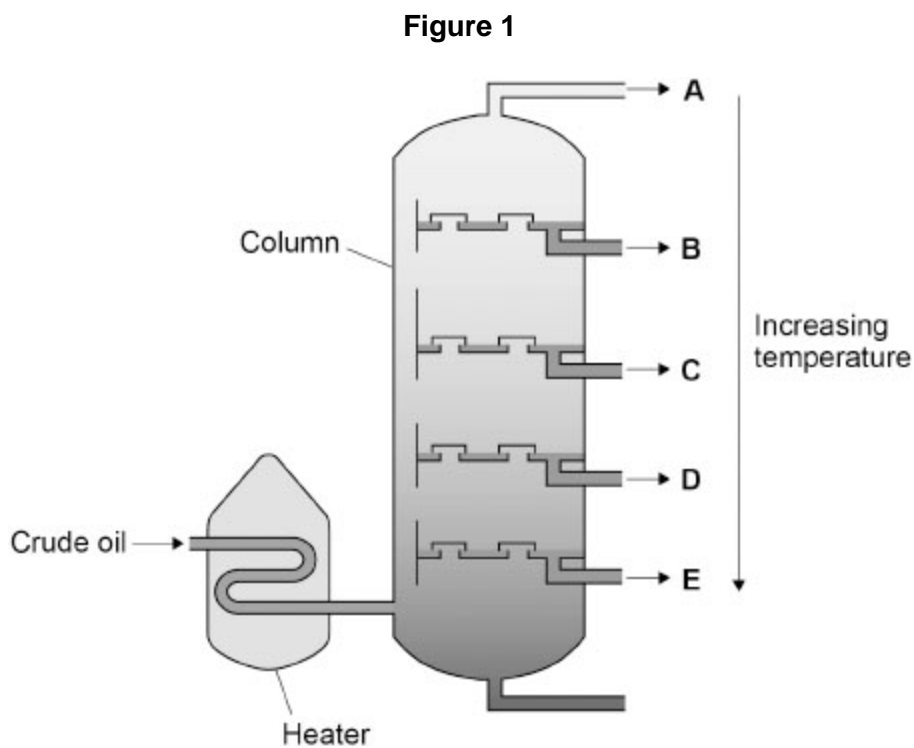
(i) How does the rate of reaction at 750°C compare with the rate of reaction at 450°C?

(1)
(Total 12 marks)

2.

This question is about hydrocarbon fuels.

Figure 1 represents the process used to separate hydrocarbon fuels from crude oil.



(a) Name the process represented by **Figure 1**.

(1)

(b) Changes of state take place during the process in **Figure 1**.

Name the change of state taking place in:

- the heater
- the column.

Heater _____

Column _____

(2)

Different fuels are obtained from crude oil at the points on **Figure 1** labelled **A** to **E**.

The table below shows the boiling point ranges of different fuels obtained from the process in **Figure 1**.

Fuel	Boiling point range in °C
Diesel oil	260 – 320
Heavy fuel oil	320 – 400
Kerosene	180 – 260
Petrol	40 – 110
Petroleum gases	Below 30

(c) Which fuel is obtained at **B** in the column?

Use **Figure 1** and the table above.

(1)

(d) Fuels with higher boiling point ranges contain larger molecules.

What is the order of increasing flammability of the fuels?

Use the table above.

Tick (✓) **one** box.

Heavy fuel oil → diesel oil → kerosene

Heavy fuel oil → kerosene → diesel oil

Kerosene → diesel oil → heavy fuel oil

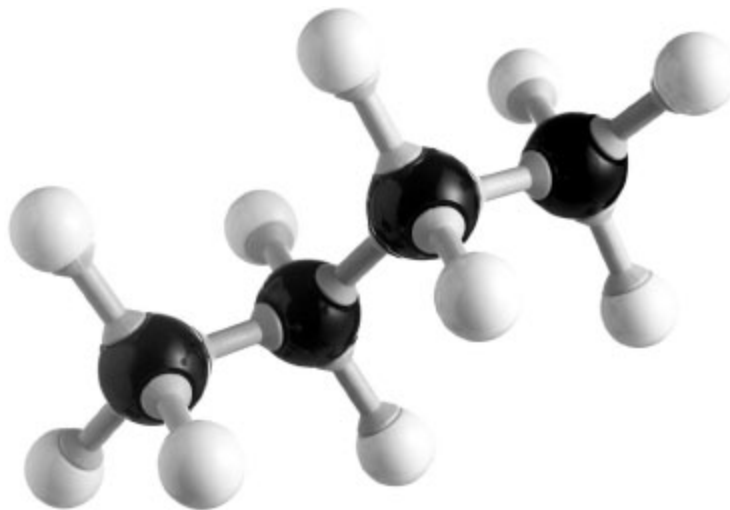
Kerosene → heavy fuel oil → diesel oil

(1)

Liquified petroleum gases are a mixture of several different hydrocarbons.

Figure 2 shows a model of one of these hydrocarbons.

Figure 2



(e) Write the molecular formula of the hydrocarbon represented by the model in **Figure 2**.

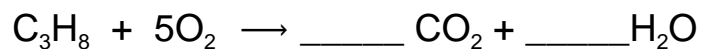
(1)

(f) Name the hydrocarbon represented by the model in **Figure 2**.

(1)

(g) Petroleum gases also contain a hydrocarbon with the formula C₃H₈

Balance the equation for the complete combustion of C₃H₈



(2)

(Total 9 marks)

3.

This question is about unsaturated hydrocarbons.

(a) The table below shows the boiling points of some unsaturated hydrocarbons.

Formula of unsaturated hydrocarbon	Boiling point in °C
C_2H_4	- 104
C_3H_6	- 47
C_4H_8	X
C_5H_{10}	30
C_6H_{12}	63

Estimate the boiling point **X** in the table above.

_____ °C

(1)

(b) C_2H_4 reacts with water vapour (steam).

Name the compound produced when C_2H_4 reacts with water vapour.

(1)

C_4H_8 reacts with chlorine (Cl_2).

(c) Describe the test for chlorine.

Give the result of the test.

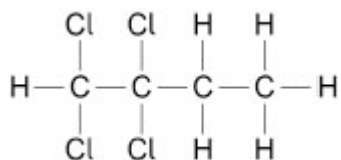
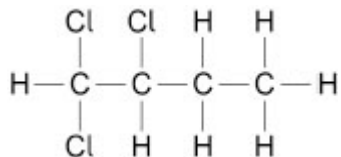
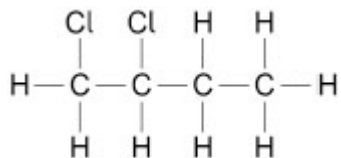
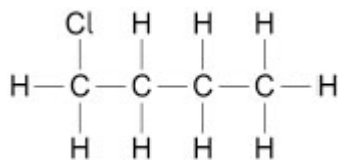
Test _____

Result _____

(2)

- (d) Which is the displayed formula of the organic compound produced when C_4H_8 reacts with chlorine?

Tick (✓) **one** box.



(1)

- (e) Name the unsaturated hydrocarbon with the formula C_3H_6

(1)

- (f) Why does C_3H_6 tend to burn in air with a smoky flame?

(1)

(g) C_3H_6 is a gas at room temperature and pressure.

Calculate the volume of 2.1 g of C_3H_6 at room temperature and pressure.

Give your answer in cm^3 .

The volume of one mole of any gas at room temperature and pressure is 24 dm^3 .

Relative atomic masses (A_r): H = 1 C = 12

Volume = _____ cm^3

(5)

(Total 12 marks)

4.

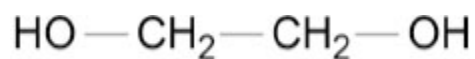
This question is about polymers.

A condensation polymer is produced from two different compounds, **A** and **B**.

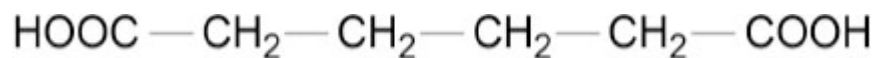
Figure 1 represents a molecule of **A** and a molecule of **B**.

Figure 1

A



B



(a) Name compound **A** and compound **B**.

A _____

B _____

(2)

(b) Compound **A** and compound **B** react to produce a condensation polymer.

Name the type of condensation polymer produced from compound **A** and compound **B**.

(1)

(c) Name the small molecule lost when molecules of compound **A** and of compound **B** react.

(1)

Glycine is an amino acid.

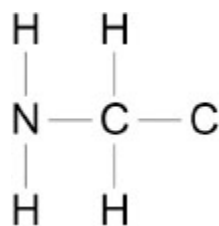
Glycine can produce condensation polymers.

(d) Name the type of condensation polymer produced when glycine polymerises.

(1)

(e) Complete **Figure 2** to show the displayed structural formula of glycine.

Figure 2



(1)

(f) Which polymer is produced when different amino acids are combined in the same chain?

Tick (✓) **one** box.

Cellulose

DNA

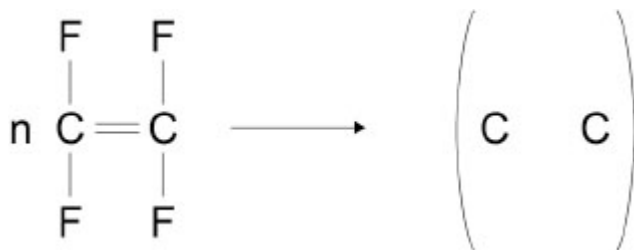
Protein

Starch

(1)

The polymer poly(tetrafluoroethene) is produced from the monomer tetrafluoroethene (C₂F₄).

(g) Complete the equation for the production of poly(tetrafluoroethene) from tetrafluoroethene.



(3)

(h) Poly(tetrafluoroethene) is a thermosoftening polymer.

Some other polymers are thermosetting polymers.

Describe the structure of a thermosetting polymer.

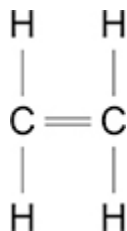
(2)

(Total 12 marks)

5.

This question is about addition reactions.

The figure below shows the displayed structural formula of ethene.



(a) Complete the sentence.

When bromine water is added to ethene, the bromine water changes from orange to

_____.

(1)

Chlorine reacts with ethene.

(b) What is used to identify chlorine?

Tick (✓) **one** box.

A lighted splint

Damp litmus paper

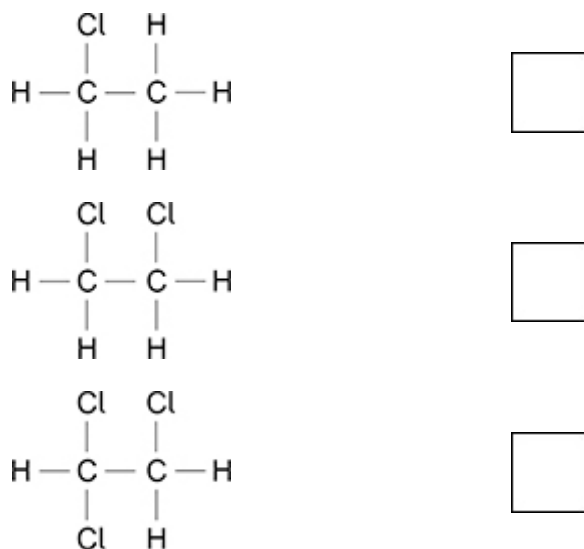
Limewater

(1)

- (c) Which of the following shows the displayed structural formula of the compound produced when chlorine reacts with ethene?

Use the figure above.

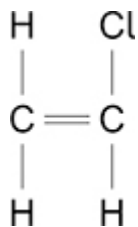
Tick (✓) **one** box.



(1)

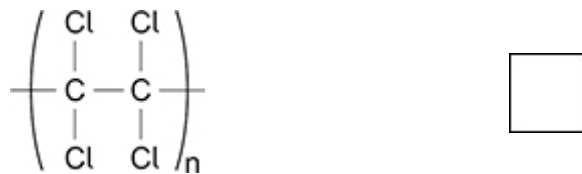
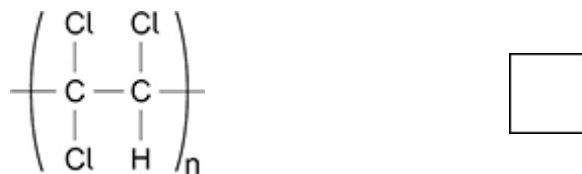
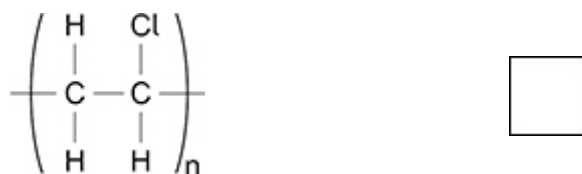
- (d) Chloroethene can be used to produce a polymer called poly(chloroethene).

The displayed structural formula of chloroethene is



Which represents the structure of poly(chloroethene)?

Tick (✓) **one** box.



(1)

Ethene can be used to produce another polymer called poly(ethene).

The table below shows information about poly(chloroethene) and poly(ethene).

	Poly(chloroethene)	Poly(ethene)
Density in g/cm ³	1.5	0.9
Temperature at which polymer completely melts in °C	260	120

(e) Determine the simplest whole number ratio of the density of poly(chloroethene) : density of poly(ethene).

Simplest whole number ratio = _____ : _____

(3)

(f) Poly(ethene) **and** poly(chloroethene) can both be used to make pipes.

Suggest why neither polymer is suitable for pipes carrying steam at a temperature of 300 °C.

Use the table above.

(1)

(g) Poly(ethene) and paper can both be used to make shopping bags.

Poly(ethene) is produced from crude oil. Paper is produced from trees.

Suggest **one** reason why paper is more sustainable than poly(ethene) for making shopping bags.

(1)

(Total 9 marks)

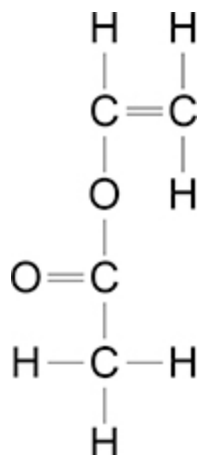
6.

This question is about monomers and polymers.

Compound **A** has an alkene functional group and an ester functional group.

Figure 1 represents a molecule of compound **A**.

Figure 1



(a) Draw a circle around the alkene functional group on **Figure 1**.

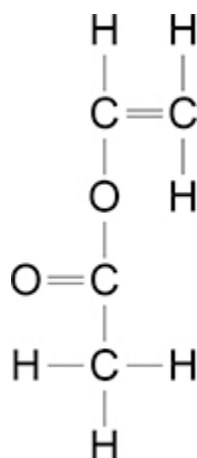
(1)

(b) Describe what will be seen when compound **A** is shaken with bromine water.

(2)

(c) **Figure 2** is a repeat of **Figure 1**.

Figure 2



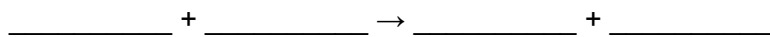
Draw a circle around the ester functional group on **Figure 2**.

(1)

(d) Compound **A** has the formula $\text{C}_4\text{H}_6\text{O}_2$

Compound **A** is flammable.

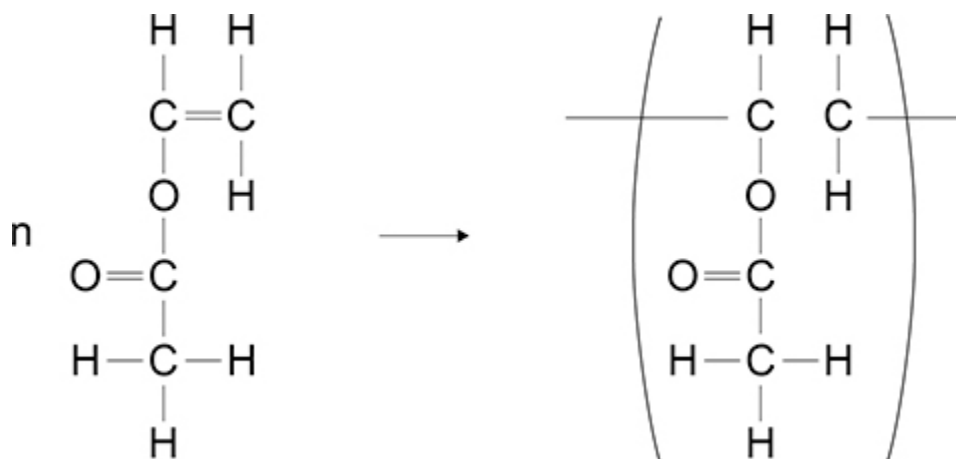
Write a balanced equation for the complete combustion of compound **A**.



(3)

- (e) Many molecules of compound **A** join together to form polymer **B**.

Complete the displayed formula equation which represents this reaction.



(2)

- (f) What type of polymer is polymer **B**?

Tick (✓) **one** box.

Addition polymer

Condensation polymer

DNA

Protein

(1)

Polymer **B** is a polymer which melts when heated.

- (g) What word is used to describe polymers which melt when heated?

(1)

(h) Explain why some polymers do **not** melt when heated.

(2)

(Total 13 marks)

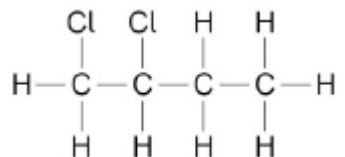
Mark schemes

1. (a) propene 1
- (b) 9 1
- (c) making a polymer 1
- (d) (y-axis 0, 20), 40, 60, 80, (100)
ignore intermediate values 1
- carbon bar drawn to 86%
allow a tolerance of $\pm \frac{1}{2}$ a small square 1
- carbon bar labelled 1
- (e) (test)
add bromine (water) 1
- (result)
(bromine water) turns (from orange to) colourless
allow (bromine water) decolorises
ignore clear
MP2 is dependent upon MP1 being awarded 1
- (f) $C_{10}H_{22} \rightarrow C_3H_6 + C_7H_{16}$ 1
- (g) fuels 1
- (h) the molecules collide more frequently at 750°C 1
- (i) (at 750°C the rate of reaction is) higher
allow (at 450°C the rate of reaction is) lower 1
- [12]
2. (a) fractional distillation 1

- (b) (heater)
evaporation
allow liquid to gas
allow boiling 1
- (column)
condensation
allow gas to liquid 1
- (c) petrol 1
- (d) heavy fuel oil → diesel oil → kerosene 1
- (e) C₄H₁₀ 1
- (f) butane 1
- (g) C₃H₈ + 5 O₂ → 3 CO₂ + 4 H₂O
allow 1 mark for 3 CO₂
allow 1 mark for 4 H₂O 2
- 3.** (a) - 6 (°C)
allow a value in the range
(+)4 to -16 (°C) 1
- (b) ethanol
allow C₂H₅OH 1
- (c) (test)
damp litmus paper 1
- (result)
litmus paper is bleached
or
litmus paper turns white
ignore litmus paper turns red 1

[9]

(d)



1

(e) propene

1

(f) (because of) incomplete combustion
ignore insufficient oxygen

1

(g) (conversion $24 \text{ dm}^3 =$)
 $24\,000 \text{ cm}^3$

allow conversion of volume anywhere in method

1

$(M_r = (3 \times 12) + (6 \times 1) =) 42$

1

(moles = $\frac{2.1}{42} =$) 0.05

allow correct use of an incorrectly determined M_r

1

(volume =) $24\,000 \times 0.05$

allow correct use of an incorrectly determined number of moles

allow correct use of an incorrect / no conversion of volume

1

= $1200 \text{ (cm}^3\text{)}$

1

alternative approach

(conversion $24 \text{ dm}^3 =$)

$24\,000 \text{ cm}^3$ (1)

allow conversion of volume anywhere in method

($M_r = (3 \times 12) + (6 \times 1) =$)

42 (1)

(ratio of mass = $\frac{42}{2.1} =$) 20 (1)

allow correct use of an incorrectly determined M_r

(volume =) $\frac{24\,000}{20}$ (1)

allow correct use of an incorrect / no conversion of volume

= $1200 \text{ (cm}^3\text{)}$ (1)

[12]

4.

(a) (A)
ethanediol

1

(B)
hexanedioic acid

1

(b) polyester

1

(c) water

allow H_2O

1

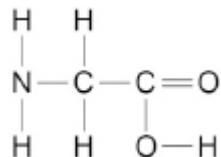
(d) polypeptide

allow polyamide

ignore protein

1

(e)



1

(f) protein

1

(g) 4 × C—F **and** 1 × C—C bonds

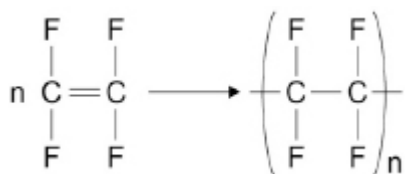
1

2 × single bonds extending through brackets

1

n after polymer repeating unit

an answer of



scores **3** marks

1

(h) long chain molecules

allow long chains of monomers

1

with covalent bonds between the chains

allow with cross links between the chains

ignore intermolecular forces

1

[12]

5.

(a) colourless

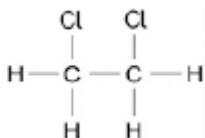
ignore clear

1

(b) damp litmus paper

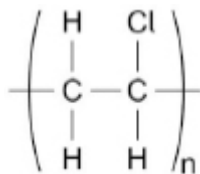
1

(c)



1

(d)



1

(e) 1.5×10 0.9×10

1

(ratio =) 15 : 9

1

= 5 : 3

allow correct determination of the simplest whole number ratio from an attempt at a density ratio

1

alternative approach

(ratio =)

$$\frac{1.5}{0.9} \quad \frac{0.9}{0.9} \text{ (1)}$$

1.666 : 1 (1)

= 5 : 3 (1)

allow correct determination of the simplest whole number ratio from an attempt at a density ratio

(f) the pipes will melt

or

the polymers will melt

allow the melting point of both polymers is below 300°C

1

(g) oil is non-renewable

or

paper is obtained from a renewable source

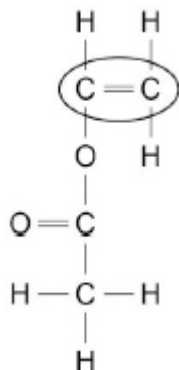
allow oil is finite

1

[9]

6.

(a)



1

(b) orange (bromine water)

allow yellow / brown

1

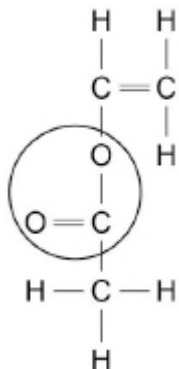
turns colourless

allow is decolourised

ignore clear

1

(c)



1

(d) $2 \text{C}_4\text{H}_6\text{O}_2 + 9 \text{O}_2 \rightarrow 8 \text{CO}_2 + 6 \text{H}_2\text{O}$

allow multiples

allow 1 mark for

$\text{C}_4\text{H}_6\text{O}_2 + \text{O}_2 \rightarrow$ *with incorrect / no multipliers*

allow 1 mark for

$\rightarrow \text{CO}_2 + \text{H}_2\text{O}$

with incorrect / no multipliers

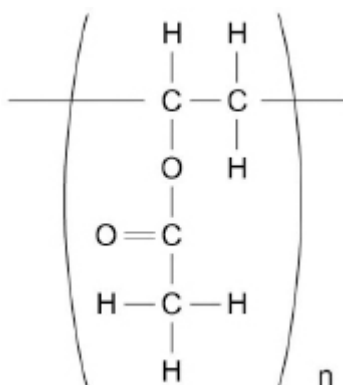
ignore state symbols

3

- (e) single C-C bond in polymer repeating unit
do **not** accept extra atoms added to trailing bonds

1

n after polymer repeating unit
an answer of



scores 2 marks

1

- (f) addition polymer

1

- (g) thermosoftening

allow thermoplastic

1

- (h) cross-links between (polymer) chains

allow covalent bonds between (polymer) chains

1

(so) too much energy needed to overcome the cross-links

allow (so) too much energy needed to overcome the covalent bonds
between (polymer) chains

1

[13]