

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - TRIPLE SCIENCE

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C7 - TEST 5

ORGANIC CHEMISTRY

Advanced

## Mark schemes

- 1.** (a) hydrocarbon 1
- (b) thermal decomposition / cracking 1
- (c) (i) making polymers / poly(e)thene  
*accept plastic (bags)* 1
- (ii) fuel 1
- [4]**
- 2.** (a) add yeast 1
- and ferment **or** by fermentation  
*allow in a warm place or temperatures within the range 20-45°C or  
with an airlock / absence of air* 1
- (b) heat (the mixture) 1
- ethanol has a lower boiling point than water **or** more ethanol than water vaporises **or**  
ethanol evaporates first or when the temperature reaches 78°C  
*allow ethanol and water boil at different temperatures* 1
- condense (the vapour)  
*allow condense at different temperatures for the last two marking  
points*  
*if no other mark is awarded, allow repeat distillation or use fractional  
distillation apparatus for 1 mark* 1

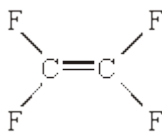
**[5]**

**3.**

- (a) poly(tetrafluoroethene) **or** polytetrafluoroethene  
accept *PTFE* or *Teflon*

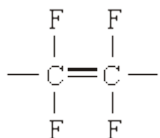
1

- (b) double bond

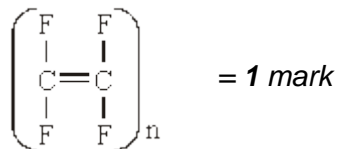


1

all other atoms and bonds correct including F for fluorine



ignore *n* in front



do **not** accept structures with more than 2 C atoms

1

(c) any **three** from:

- many monomers / (small) molecules / tetrafluoroethene molecules  
*allow many tetrafluoroethenes*  
*many particles alone is insufficient*  
*do **not** accept many polymers*
- (monomers, molecules etc.) join / bond / link / combine / attach  
*allow many particles join*  
*allow many atoms join*  
*do **not** accept collide / add ignore polymerise*  
*do **not** accept many polymers join*
- to form one molecule **or**  
to form a long-chain **or**  
to form a large molecule
- no other substances are produced /  
one substance formed (definition of addition)
- idea of double bond breaking / opening / opens / bond being  
used to join to another molecule **or** the double bond becomes a single bond

3

[6]

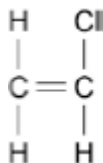
4.

(a) any **one** from:

- disposal or does not decompose (in landfill sites) or collection or sorting for recycling  
*ignore non-biodegradable alone*
- lack of space or more landfill sites
- other specified problems with waste (eg. litter **or** eyesore **or** harm to animals **or** destroys habitats)  
*ignore pollution unqualified.*

1

(b)



*if 2 marks not awarded, award 1 mark for **one** of the following:*

- *a double bond between the two carbons and no additional trailing bonds*
- *two C atoms bonded together with three single bonds to hydrogen atoms and one single bond to a chlorine atom. no additional Cl or H.*

2

(c) intermolecular forces **or** forces between the chains  
*allow intermolecular bonds* 1

(intermolecular forces are) weak  
*ignore references to no cross links between chains.*  
*allow 1 mark for weak forces between layers.* 1

which are easily overcome (by heat) **or** need little energy to overcome **or** chains /  
molecules can slide over one another (when heated)  
*if weak bonds **or** breaking covalent bonds mentioned only the third  
marking point is available.* 1

(d) Monomer **A** – carboxylic acid  
*do not allow carbolic* 1

Polymer **C** - ester (linkage) 1

**[8]**

**5.** (a)  $C_2H_4$  1

a correct other product **and** balanced eg  $C_4H_{10}$  1

(b) bubbling / fizzing / frothing / effervescence  
*ignore gas given off **or** solution goes cloudy* 1

- (c) any **five** from the following bullet points:  
*allow converse for ethanol from crude oil*

To gain full marks there should be both advantageous and disadvantageous issues and their importance

**Advantageous issues using sugar cane:**

*ignore costs – unless specified*  
*ignore safety*  
*ignore simple/low technology process*  
*ignore labour intensive as an advantage*  
**linked importance**

- sugar cane/plants absorb carbon dioxide / photosynthesise  
*so is carbon neutral **or** reduce global warming*
- sugar cane / plants are renewable / sustainable  
*and so save resources / oil **or** crude oil is non-renewable*
- low energy process  
*and so it saves fuel **or** / making ethanol from crude oil needs fuel for fractional distillation / cracking*

**Disadvantageous issues using sugar cane:**

*ignore fermentation releases carbon dioxide; destruction of habitats/land to build production plants; types of pollution; waste products*

- large areas of land are needed  
*which leads to destruction of habitats / forest*
- land could be used for food crops  
*may cause food shortages **or** increases the price of food **or** increasing world population*
- slow process  
*so limits supply / production of ethanol*
- ethanol is impure **or** contains 50% ethanol  
*so needs further separation or ethanol from crude oil is 100% pure*
- batch process  
*so uses more labour*
- the crop yield / supply of ethanol is unreliable  
*because growth is seasonal / weather dependent **or** possibility of crop failure*

**a justified conclusion**

**compensation mark**, if no other mark awarded allow one mark for

6.

- (a) (i) e.g. moles NaOH = moles of acid  
or formula:

$$0.2 \times \frac{45}{1000} = 0.009$$

$$15M_1 = 0.2 \times 45$$

1

rounding to 0.01 loses mark

$$= 0.009 \times \frac{1000}{15} = 0.6(M)$$

$$M_1 = 0.6(M)$$

ecf for arithmetical error

correct answer **2** marks

1

- (ii) 36

ecf – (a)(i) × 60

correct answer **2** marks

0.6 × 60 gets **1** mark

relative formula mass of ethanoic acid

= 60 for **1** mark

0.6 × incorrect molar mass gains second mark only

2

- (b) (i) A = hydrogen / H<sub>2</sub>

1

B = sodium hydroxide / NaOH **or**  
sodium oxide / Na<sub>2</sub>O

1

- (iii) C = ethyl ethanoate (acetate) /  
CH<sub>3</sub>COOC<sub>2</sub>H<sub>5</sub> / CH<sub>3</sub>CO<sub>2</sub>C<sub>2</sub>H<sub>5</sub>

1

- (iv) D = (concentrated) sulphuric acid /  $\text{H}_2\text{SO}_4$   
*do not accept dilute sulphuric acid* 1
- E = sodium ethanoate (acetate) /  $\text{CH}_3\text{COONa}$  /  $\text{CH}_3\text{CO}_2\text{Na}$  1

[9]

7.

- (a) (i) by (fractional) distillation  
*accept a description of the distillation process (heat and how separation works) eg heat **and** condense*  
*accept boil / vapourise etc for heat*
- or**
- fractionation 1
- (ii)  $\text{CO}_2$   
*note the order of these products must be correct* 1
- $\text{H}_2\text{O}$   
*wrong way round = 1 mark* 1
- (b) (i) (hexane) has been broken down (into smaller hydrocarbons / molecules)  
*accept (thermal) decomposition / cracked / split / broken up owtte* 1
- (ii)
- $$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{C} = \text{C} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$
- accept  $\text{CH}_2 = \text{CH}_2$*  1
- (iii) water / hydrogen oxide / steam  
*accept  $\text{H}_2\text{O}$*  1



- (c) candidates must include both sugar cane and crude oil in their evaluation **and** both an advantage and a disadvantage to gain full marks.  
if they do not then the maximum mark is three

any **four** from:

advantages of using sugar

- country has no wealth to buy (large quantities of) crude oil  
*not 'expensive' alone*
  - country has limited technological development
- or**
- underdeveloped / third world country
- able / suitable climate to grow sugar cane
  - enough land to grow sugar cane / land cannot be used to grow food / deforestation
  - sugar is a renewable source
- or**
- crude oil is a non-renewable resource / finite resource / limited resources
- CO<sub>2</sub> / carbon neutral

advantages of using alkanes:

- economic costs are low
- continuous process
- country has large oil resources
- country has oil refineries / cracking plants
- very pure product
- faster process

4

[10]

8.

- (a) (i) heat / evaporate the crude oil / change to gas or vapour  
*do not accept heat with catalyst*

1

cool / condense (hydrocarbons)

*allow small molecules at top and / or large molecules at bottom*

1

at different temperatures / boiling points

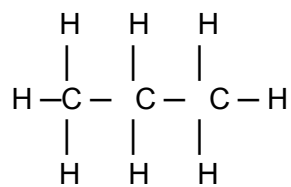
*if the answer describes cracking ' no marks*

1

- (ii)  $C_4H_{10}$

1

(b)



1

- (c) (i)  $C_5$  to  $C_8$  fraction are fuels **or** easier to burn or petrol (fraction)  
*accept  $C_{21}$  to  $C_{24}$  fraction not useful as fuels*  
*do not accept produce more energy*

1

- (ii)  $C_2H_4$

*do not accept  $C_4H_8$*

1

- (iii) any **three** from:

- use different / lighter crude oils
- develop markets for low demand fractions
- develop new techniques / equipment to use low demand fractions as fuels
- cracking
- convert low demand fractions to high demand fractions or bigger molecules to smaller molecules
- develop alternative / bio fuels  
*do not accept price*

3

[10]

<b>9.</b>	<p>(a) (i) CH<sub>4</sub>  <i>allow H<sub>4</sub>C</i>  <i>do <b>not</b> allow lower-case h</i>  <i>do <b>not</b> allow superscript</i></p>	1
	<p>(ii) single</p>	1
	<p>(iii) alkanes</p>	1
(b)	<p>(i) carbon / C  <i>any order</i></p> <p>hydrogen / H  <i>allow phonetic spelling</i></p> <p>sulfur / sulphur / S</p>	1
	<p>(ii) air / atmosphere</p>	1
	<p>(iii) acid rain</p> <p>damages trees / plants <b>or</b> kills aquatic organisms <b>or</b> damages buildings / statues <b>or</b> causes respiratory problems  <i>allow harmful to living things</i></p>	1
(c)	<p>carbon / C  <i>accept soot / particulates / charcoal</i></p>	1
(d)	<p>any <b>four</b> from:</p> <ul style="list-style-type: none"> <li>• (supports hypothesis) because when the fuel contained more carbon the temperature of the water went up more / faster (in 2 minutes)</li> <li>• (does not support hypothesis as) temperature change per gram decreases as the number of carbons increases</li> <li>• (does not support hypothesis) because the more carbon in the fuel the more smoke <b>or</b> the dirtier / sootier it is</li> <li>• only tested hydrocarbons / alkanes / fuels with between 5 and 12 carbon atoms</li> <li>• valid, justified, conclusion</li> </ul> <p><i>accept converse statements</i></p>	4

(e) (i) 0.15

*correct answer with or without working gains 2 marks*  
*if answer incorrect,  $M_r$  carbon dioxide = 44 gains 1 mark*  
*allow 0.236 / 0.24 / 0.2357142 (ecf from  $M_r$  of 28) for 1 mark*

2

(ii) 0.4(0)

1

(iii)  $C_3H_8$

*correct formula with or without working scores 2 marks*

$$0.15 / 0.05 = 3$$

*allow ecf from (e)(i)*

**and**

$$0.4 / 0.05 = 8 (1)$$

*allow ecf from (e)(ii)*

*allow 1 mark for correct empirical formula from their values*

If use 'fall-back-values:

$$0.50 / 0.05 = 10$$

**and**

$$0.20 / 0.05 = 4$$

*1 mark*

$C_4H_{10}$

*1 mark*

*if just find ratio of C to H using fall-back values, get  $C_2H_5$  allow 1 mark*

2

[19]