



# **GCSE Chemistry**

## **Cracking**

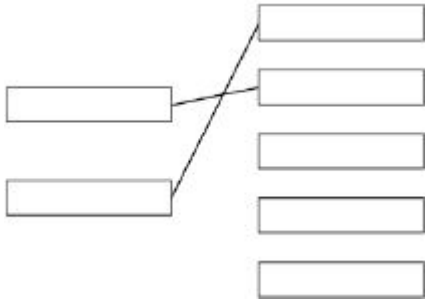
### **Mark Scheme**

**Time available: 63 minutes**

**Marks available: 63 marks**

**[www.accesstuition.com](http://www.accesstuition.com)**

## Mark schemes

- 1.** (a)  $C_{12}H_{26}$  1
- (b) alkane 1
- (c) air  
*allow atmosphere* 1
- (d)   
*particulates – global dimming* 1  
*sulfur dioxide – acid rain* 1
- (e) carbon dioxide 1  
carbon monoxide 1
- (f) develop fuel efficient engines  
use electric cars 1
- [9]**
- 2.** (a)  $C_6H_{14}$  1
- (b) **A** 1
- (c) **B** 1
- (d) **C** 1
- (e) Propanol 1
- [5]**

3.

- (a) (i) high temperature  
*allow heating / hot / 250-900 °C* 1
- catalyst or steam  
*allow named catalyst eg zeolite, Al<sub>2</sub>O<sub>3</sub>, silica, ceramic*  
*allow in the absence of air / oxygen* 1
- ignore any references to pressure*
- (ii) colourless  
*allow decolourised*  
*ignore clear / discoloured* 1
- (iii)
- $$\begin{array}{cccc} & \text{H} & \text{H} & \text{H} & \text{H} \\ & | & | & | & | \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & | & | & | & | \\ & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$
- 1
- (b) (i) 20.3(0) (kJ)  
*if answer incorrect allow 1 mark for 24.36/1.2* 2
- (ii) use a lid  
*allow insulate beaker or use draught shield* 1
- reduce energy / heat loss  
*ignore references to thermometer or repeats or distance of flame or loss of water vapour*  
*allow stir (1) to distribute energy / heat (1)*  
*allow use a metal can (1) as it's a better conductor (1)* 1
- (iii) carbon/soot  
*ignore tar, smoke* 1
- (produced by) incomplete combustion  
*allow from a limited supply of oxygen/air* 1
- (iv) hexane gives out the greatest energy (per 1.0 g)  
*ignore more energy* 1
- hexane produces the least smoke / carbon / soot  
*allow has the cleanest flame*  
*ignore less smoke / carbon / soot* 1

- (c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

**Level 3 (5 – 6 marks):**

Descriptions of advantages **and** disadvantages that are linked to their own knowledge.

**Level 2 (3 – 4 marks):**

Descriptions of an advantage **and** a disadvantage with some use of their knowledge to add value.

**Level 1 (1 – 2 marks):**

Statements made from the information that indicate whether at least one statement is an advantage **or** a disadvantage **or** a linked advantage or disadvantage

**0 marks:**

No relevant content

**Examples of the added value statements and links made in the response could include:**

**Note that link words are in bold; links can be either way round.**

**Accept reverse arguments and ignore cost throughout.**

**Advantages of using hydrogen:**

- Combustion only produces water **so** causes no pollution
- Combustion does not produce carbon dioxide **so** this does not contribute to global warming or climate change
- Combustion does not produce sulfur dioxide **so** this does not contribute to acid rain
- Incomplete combustion of petrol produces carbon monoxide **that is** toxic
- Incomplete combustion of petrol produces particulates **that** contribute to global dimming
- Petrol comes from a non-renewable resource **but** there are renewable/other methods of producing hydrogen
- Hydrogen releases more energy **so** less fuel needed or more efficient

**Disadvantages of using hydrogen:**

- Hydrogen is a gas **so** is difficult to store or transfer to vehicles
- Hydrogen gas is very flammable **so** leaks cause a greater risk of explosion
- Most hydrogen is produced from fossil fuels **which** are running out
- Cannot be used in existing car engines **so** modification / development or replacement is needed
- Lack of filling stations **so** difficult to refuel your vehicle

6

[18]

**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<sub>8</sub>H<sub>18</sub> smaller molecule  
*It = C<sub>8</sub>H<sub>18</sub>* 1
- therefore there are weaker intermolecular forces  
*allow intermolecular bonds*  
*do **not** accept breaking covalent bonds / bonds*
- or**
- weaker intermolecular forces in C<sub>8</sub>H<sub>18</sub> (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)
- $$\left( \begin{array}{cc} \text{H} & \text{H} \\ | & | \\ \text{---C} & \text{---C---} \\ | & | \\ \text{H} & \text{H} \end{array} \right)_n$$
- 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) (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) oxygen could react / *burn* with the hydrocarbons  
*allow oxygen 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]**

6. (a) vaporise / evaporate  
*allow boil for vaporise* 1
- different condensing points / temperatures  
*accept condense at different levels*  
*ignore different size molecules or different densities*  
*mention of cracking = max 1*  
*allow boils at different temperatures and condenses for 2 marks*  
*if no other marks awarded allow*  
*fractional distillation for 1 mark* 1
- (b) (i) 3 (C<sub>2</sub>H<sub>4</sub>)  
*accept +C<sub>4</sub>H<sub>8</sub>* 1

(ii) (decane / naphtha / hydrocarbon) vaporise / evaporate

*allow crude oil*

*allow boil for vaporise*

1

(passed over) a catalyst / alumina / porous pot

*ignore other names of catalysts*

1

(c) any **two** from:

*'they' must be clarified*

- alkanes / butane (molecules) do not have a (carbon carbon) double bond / are saturated / have (carbon carbon) single bonds

- alkenes / ethene (molecules) have (carbon carbon) double bonds

**or**

are unsaturated

- alkenes / ethene molecules are able to bond to other molecules

2

(d) single bonds between carbon atoms

$- C - C -$

1

the  $-CH_3$  group appears on each pair of carbons on the 'chain'

*NB any double bonds = 0 marks*

1

[9]