

MARK SCHEME

GCSE

CHEMISTRY

AQA - COMBINED SCIENCE

C7 - TEST 3

ORGANIC CHEMISTRY

Intermediate

Mark schemes

- 1.** B will have higher melting point
higher boiling point
be less volatile
be more viscous (allow less flammable)
any two for 1 mark each
- [2]
- 2.** hydrogen
carbon
in any order each for 1 mark
- [2]
- 3.** (a) (i) **X and Y**
both needed
- 1
- (ii) **Z**
- 1
- (iii) **X**
- 1
- (b) unsaturated / alkenes / those with double (C = C) bonds
- 1
- [4]
- 4.** (a) (i) exothermic
accept combustion
*allow burning **or** oxidation **or***
redox
- 1
- (ii) carbon monoxide / CO (is produced)
allow monoxide (is produced) ignore carbon oxide
- 1
- because there is incomplete / partial combustion (of the fuel)
accept because there is insufficient oxygen / air (to burn the fuel)
- 1

- (b) 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 refer to the information in the [Marking guidance](#).

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a statement that crude oil is heated **or** that substances are cooled. However there is little detail and any description may be confused or inaccurate.

Level 2 (3-4 marks)

There is some description of heating / evaporating crude oil **and either** fractions have different boiling points **or** there is an indication of a temperature difference in the column.

Level 3 (5-6 marks)

There is a reasonable explanation of how petrol is or fractions are separated from crude oil using evaporating **and** condensing.

If cracking is given as a preliminary or subsequent process to fractional distillation then ignore.

However, if cracking / catalyst is given as part of the process, maximum is **level 2**.

Examples of chemistry points made in the response could include:

- Some / most of the hydrocarbons (or petrol) evaporate / form vapours or gases
- When some of / a fraction of the hydrocarbons (or petrol) cool to their boiling point they condense
- Hydrocarbons (or petrol) that have (relatively) low boiling points and are collected near the top of the fractionating column or hydrocarbons with (relatively) high boiling points are collected near the bottom of the fractionating column
- The process is fractional distillation
- Heat the crude oil / mixture of hydrocarbons or crude oil / mixture is heated to about 350°C
- Some of the hydrocarbons remain as liquids
- Liquids flow to the bottom of the fractionating column
- Vapours / gases rise up the fractionating column
- Vapours / gases cool as they rise up the fractionating column
- The condensed fraction (or petrol) separates from the vapours / gases and flows out through a pipe
- Some of the hydrocarbons remain as vapours / gases
- Some vapours / gases rise out of the top of the fractionating column
- There is a temperature gradient in the fractionating column or the fractionating column is cool at the top and hot at the bottom

6

[9]

5.

(a) catalyst **or** speeds up the reaction (owtte)

*accept lowers activation energy **not** just helps reaction to take place
ignore increased surface area*

1

(b) C_8H_{18}

*allow $H_{18}C_8$
must be upper case
do **not** accept powers*

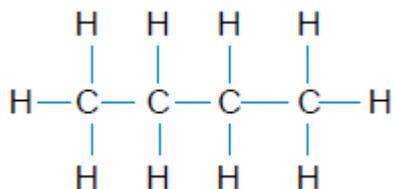
1

- (c) B
 because it is a gas **or** because it has small molecules **or** because they are small
*position **and** reason for mark*
allow it has a lower / very low boiling point than A
ignore references to solubility
accept does not condense
*do **not** accept light molecules **or** bubbles into B*
*do **not** accept it is small*
- 1
- (d) breakdown of a substance (owtte)
*do **not** accept decompose unqualified*
- 1
- by the action of heat (owtte)
- 1
- (e) **Quality of written communication**
if the written communication makes sense and it is in context then
award Q mark
 Q ✓ Q ✗
- 1
- large to small molecules **or** scientific word that implies smaller,
 e.g. alkene / ethane / petrol
any name or formula of alkane / alkene smaller than decane
- 1
- either advantages of smaller molecules **or** disadvantages of larger molecules
 e.g. hydrocarbons with large molecules are limited in their usefulness
or converse for smaller molecules
- 1
- large hydrocarbon molecules do not ignite easily / do not flow easily /
 are not very volatile
or converse for smaller molecules
- more large hydrocarbon molecules are produced than are needed
or converse for smaller molecules
- smaller molecules are useful as fuels
- alkenes / products can be used to make polymers
- (f) (fractional) distillation
accept fractionation
accept good description
 do **not** accept just diagram
- 1

[9]

6. (i) carbon and hydrogen
only **or** compound of
for 1 mark each 2
- (ii) single bonds only
or no double bonds etc
or contains maximum number of hydrogen atoms
for 1 mark 1
- (iii) molecules of similar chain length
similar boiling points
limited range of boiling points etc
any 1 for 1 mark 1
- [4]**

7. (a) (i) high temperature
allow heating / hot / 250-900 °C 1
- catalyst or steam
allow named catalyst eg zeolite, Al₂O₃, silica, ceramic
allow in the absence of air / oxygen 1
- ignore any references to pressure*
- (ii) colourless
allow decolourised
ignore clear / discoloured 1
- (iii)



- (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]

8.

- (a) the more C atoms the higher the b.pt./temperature
Allow just higher. **Not** answer based on melting point

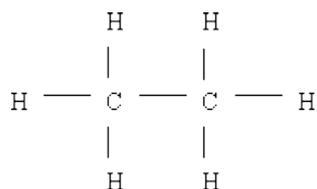
for 1 mark

1

- (b) (fractional) distillation/fractionation
for 1 mark

1

(c)



must include H atoms and lines **not** CH₃ – CH₃
for 1 mark

1

[3]

9.

- (a) hydrocarbons
for 1 mark

1

- (b) less carbon atoms / smaller molecule
for 1 mark

1

[2]

10.

- (a) the higher the boiling point, the greater the number of carbon atoms

1

- (b) volatility / viscosity / runnyness / flammability / smokiness / amount of oxygen needed for burning / melting point
do **not** credit how heavy it is / how it burns

1

- (c) hydrogen and carbon (both)
allow H and C (upper case)

1

[3]

11.

- (a) (i) any **three** from:
- (crude) oil is heated
 - (crude) oil evaporates
 - vapour condenses
- allow fractions condense
- at different temperatures.
- allow the fractions have different boiling points

3

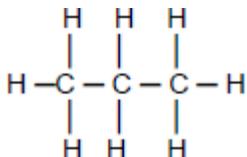
- (ii) (as number of carbon atoms increases)
(Boiling point) increases

1

(Viscosity) increases

1

- (b) (i)



1

- (ii) any **two** from:

- carbon dioxide
allow CO₂
- water
allow H₂O
allow water vapour
- carbon monoxide
allow CO
- carbon.
allow soot

2

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

- lack of availability of LPG
- cars need to be modified.
allow LPG cars are more expensive

1

[9]

12.

- (a) helps to distribute energy throughout beaker

allow heat / thermal energy

allow keeps all water at same temperature

1

all of oil (in tube) more likely to be at same temperature / oil likely to be at same temperature as thermometer

1

(b) (i) any **two** from:

- ball falls faster in **A** than in **B**
- **A** has a lower viscosity than **B**
allow descriptions of viscosity eg A is thinner
- increasing the temperature decreases the viscosity /
increases the speed of the ball
- increasing temperature has a greater effect on the viscosity of **A** than **B**
ignore lighter / heavier
ignore references to density ignore reference to size of molecules

2

(ii) **B** has a longer chain than **A** / **B** has more carbon atoms than **A**

*allow they have different numbers of carbon atoms / chain lengths /
size of molecules*

1

[5]

13. any **four** from:

- decane evaporates / vaporises
- broken pottery acts as catalyst
- (decane) is split / cracked
allow chains broken
allow large molecules into small molecules
- thermal decomposition
- into octane / alkane
- and an alkene / ethene / C_2H_4

4

[4]