AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.7.1 CARBON COMPOUNDS AS FUELS AND FEEDSTOCK (PACK 3)

SCORE	PERCENTAGE
/211	%

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Q1.

(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_2

1

B = sodium hydroxide / NaOH **or** sodium oxide / Na_2O

1

(iii) C = ethyl ethanoate (acetate) / $CH_3COOC_2H_5$ / $CH_3CO_2C_2H_5$

1

(iv) D = (concentrated) sulphuric acid / H_2SO_4

*do **not** accept dilute sulphuric acid*

1

E = sodium ethanoate (acetate) / CH_3COONa / CH_3CO_2Na

1

[9]

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Q2.

(a) hydrogen

*accept correct symbols but **not** H_2*

1

carbon

1

(b) (i) water

accept H_2O

1

(ii) limewater / calcium hydroxide

accept $Ca(OH)_2$

1

(iii) milky / cloudy / chalky / white

1

(c) (i) remains almost the same / increases then decreases slightly from 1000 to 1800

1

increases / rises after 1800

1

rapidly (owtte)

1

(ii) increased burning of hydrocarbon / (fossil) fuels, etc. **or** increased use of fuels

accept deforestation
accept (more) cars / lorries / planes etc.
accept power stations
*do **not** accept just 'factories'*

1

[9]

Q3.

(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 <u>they</u> are small

*position **and** reason for mark*
*allow it has a lower / <u>very</u> low boiling point than **A***
ignore references to solubility

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accept does not condense
*do **not** accept light molecules **or** bubbles into B*
*do **not** accept <u>it</u> 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]

Q4.

Quality of written communication:

*for correct sequencing or linking of **two** ideas or **two** points*
annotate Q ✓ or Q ✗

1

any **three** from:

ignore superfluous statements

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- **B** is least energy efficient in terms of cost (kJ per p), so **A** = **C** = **D** in terms of cost **or B** is the most expensive in terms of energy efficiency
owtte

  *accept **B** is poor value for money / **B** is most expensive*
  one is insufficient for mark

- **D** is 1st, since gives only water as product **or** gives no harmful products / gases **or** there are no pollutants
owtte

- **A** is 2nd best, since produces CO_2 owtte

- **C** is 3rd, since gives SO_2 owtte

  *if no other marks, then **D A C B** – based on energy per kJ per 100g only = **1** mark and Q mark if 2 ideas are linked*

3

[4]

Q5.

(a) hydrocarbon is a compound

__not__ mixture __not__ substance

1

containing carbon and hydrogen

accept of the elements carbon and hydrogen
accept of carbon and hydrogen
contains hydrogen and carbon only (2)

1

(b) (i) any order

carbon dioxide

accept CO_2
__exact__ formulae

2

water 1

accept H_2O
__not__ carbon in one box and dioxide in second box (0)
ignore any attempt to 'balance' the equation

(ii) it is poisonous

accept toxic
can kill you
accept any reasonable description
*of its effect on red blood cells **or** on*
haemoglobin in terms of reducing
oxygen transport
__not__ can explode, harmful,

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dangerous, flammable

1

[5]

Q6.

(a) (i) by heating

pressure is neutral

using a catalyst/pot/ceramic/porcelain/aluminium oxide

1

(ii) use bromine water/(alkaline) permanganate

accept bromine

1

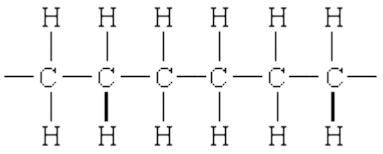
alkene makes bromine go colourless or lose its colour

accept alkane does not change the red/orange colour of bromine

***not** change colour/goes clear*

1

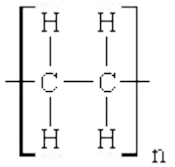
(b) (i)



either of these must show bonds at end

1

or



***not** H on ends*

*allow 3 instead of n **not** any other number*

(ii) poly(ethene) – brackets not essential

accept polythene

1

(iii) **large amount** of waste polymer/poly(ethene)/polythene/litter

*accept large amount of crude oil **or** finite resource used*

1

it is not biodegradable

accept it does not

decompose/decay/break down

it causes pollution/it creates toxic

fumes when burnt are neutral

***not** it is not recyclable*

2

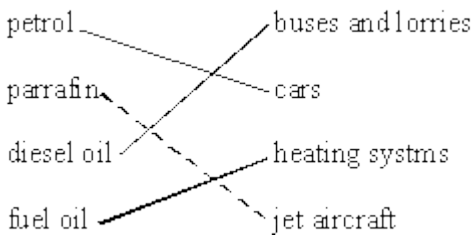
[8]

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Q7.

(a) all **three** lines correct **two** marks
one or two lines correct **one** mark

two *ticks only*



accept diesel oil joined to cars

1

(b) (i) because it has a different boiling point

accept because of its boiling point
or *it has a boiling point of 40 °C*

1

(ii) CO_2 **or** carbon dioxide

1

H_2O **or** water

accept steam

1

[5]

Q8.

(a) catalyst

1

(b) (i) made up of **only** carbon and hydrogen

1

(ii) C_8H_{18}

1

(c) (i) ethene

1

(ii) polymerisation

1

[5]

Q9.

(a) C_3H_8

1

(b) (i) increases / gets larger

1

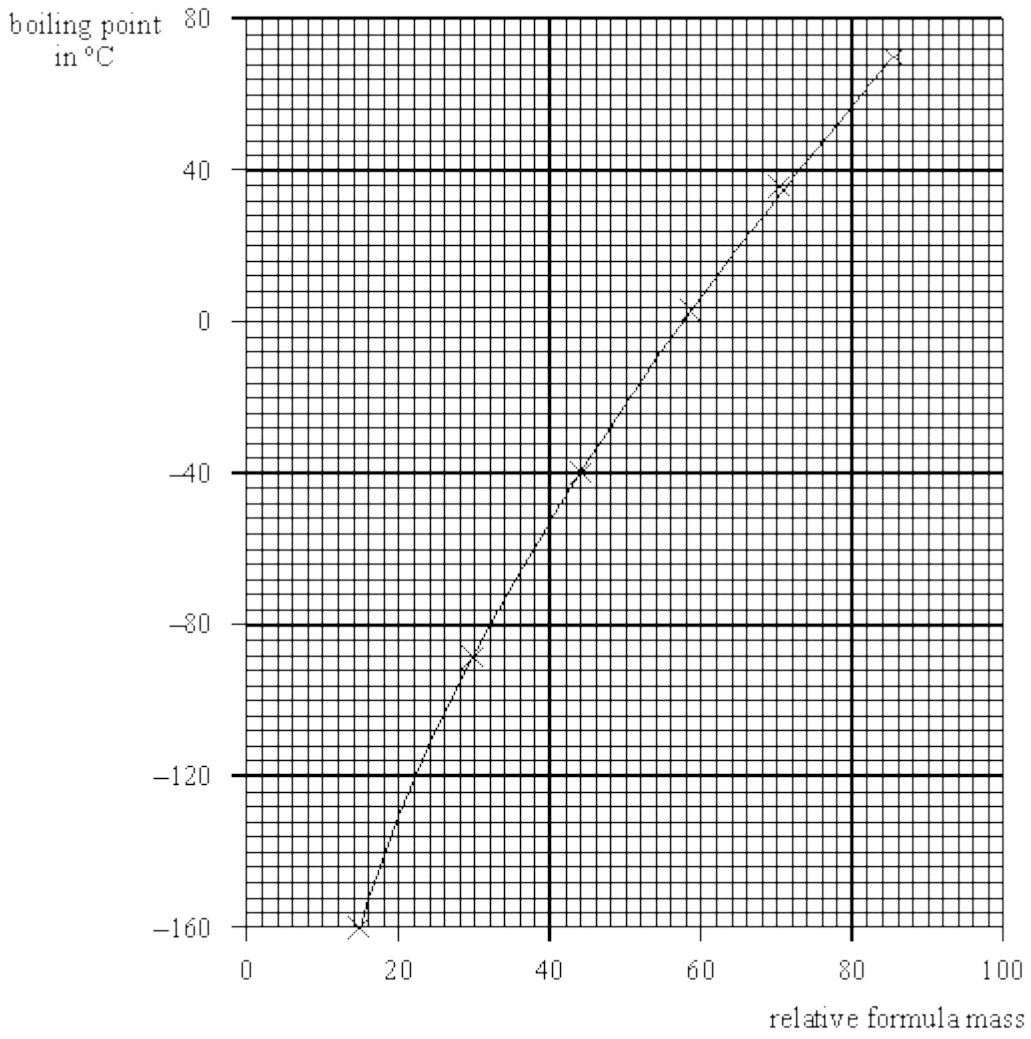
(ii) all 5 points plotted correctly

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deduct 1 mark for each incorrectly plotted point
*but **ignore** –90, 30*
allow error of one square in any direction

2

smooth line graph



1

(iii) boiling point estimate from their graph

allow ± 2 °C

1

(iv) shown clearly on graph

allow just one construction line drawn

1

(c) C_9H_{18}

1

[8]

Q10.

(a) fractional distillation

1

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boiling point or use

1

(b) (i) mixture: compounds **or** elements **or** substances together but not chemically combined

ignore references to separation

1

compound: (different) elements **or** different atoms together and chemically combined

ignore references to separation

1

(ii) element: contains only one type of atom

accept made of atoms which contain the same number of protons

1

compound: contains different types of atom chemically combined

'chemically combined' not needed here if already stated in (b)(i)

1

[6]

Q11.

(a) (i) heat

accept increase temperature ignore pressure

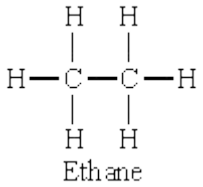
1

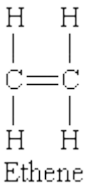
with a catalyst

1

(ii)

1





accept displayed formulae only

1

(iii) O_2

1

$CO_2 + H_2O$

ignore state symbols

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1

correct balancing
$2 + 7 \rightarrow 4 + 6$

accept $1 + 3\frac{1}{2} \rightarrow 2 + 3$ *only if reactants and products correct*

1

(b) double bond breaks

1

many (ethene) molecules

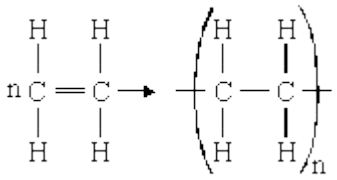
accept many monomers

1

bond together

accept join ***or*** *combine for bond*

accept



for first ***2*** *marks ignore unsaturated becomes saturated*

1

[10]

Q12.

(a) N_2

1

20–21%

accept an answer in this range

1

Ar

1

(b) (i) compound of carbon and hydrogen only

do ***not*** *accept 'mixture'*

1

(ii) Oxygen **or** O_2

1

(iii) exothermic

accept combustion ***or*** *oxidation*

1

(iv) **increases** greenhouse effect

1

global warming **or** example

1

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[8]

Q13.

(a) organic

1

sediment

1

(b) (i) gases

1

(ii) bitumen

1

(c) (i) cracking

accept thermal decomposition

*do **not** accept endothermic*

1

(ii) many **or** short **or** small (ethene) molecules

accept monomer

*accept double bonds open up **or** break*

1

join to make larger molecules

accept polymer

accept polymerisation

*accept short chain to long chain (**or** molecules)*

*do **not** accept unsaturated to saturated*

1

(d) poor ventilation

accept limited air supply

accept insufficient oxygen

1

causes incomplete combustion

accept produces CO

1

(fumes contain) carbon monoxide which dangerous

*toxic is **not** awarded a mark*

*do **not** accept harmful or poisonous*

1

[10]

Q14.

air or oxygen;
oxygen;
heat;
carbon dioxide;
water;
chemical

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for 1 mark each

[6]

Q15.

(a) A compound made from carbon and hydrogen (not mixture etc.)

1

(b) C_5H_{12}

1

(c) (i) Break down

by heat

(ii) Speeds up reaction

(iii) C_8H_{16}

each for 1 mark

4

[6]

Q16.

(a) oxygen/O_2

for 1 mark

1

(b) water/H_2O

for 1 mark

1

(c) carbon dioxide/CO_2
(if symbols are used they must be correct)

for 1 mark

1

(d) gives out

for 1 mark

1

heat or energy (2 independent marks)

for 1 mark

1

[5]

Q17.

(a) fume cupboard
plastic gloves (only one tick)

for 1 mark

1

(b) (i) plotting points (allow ± 0.5 units either vertically or horizontally)
(all correct = 2) (3 correct =1)
curve (not joined with straight lines. Must be very close
to all points. One line only) (1 mark)

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gains 3 marks

3

(ii) as read from graph (±0.5 units) –
points must be joined

for 1 mark

1

(iii) decreases, gets less, quicker

for 1 mark

1

(c) (i) flows, moves, passes through (not rubbing/moving of engine parts)

for 1 mark

less etc

for 1 mark

2

(ii) parts rub against each other
increases wear of engine parts
damages the oil
engine seizes
overheating of engine
(not burns or blows up)
(not just 'damage')

any 1 for 1 mark

1

[9]

Q18.

(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]

Q19.

(a) C_2H_4

1

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H H H
H C C C H
H H H

Accept even if in wrong columns

1

(b) (i) polythene or poly(ethene)

1

(ii) addition

1

[4]

Q20.

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

for 1 mark

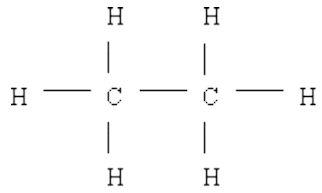
1

(b) (fractional) distillation/fractionation

for 1 mark

1

(c)



must include H atoms and lines **not** $CH_3 – CH_3$

for 1 mark

1

[3]

Q21.

(a) $C_{16} H_{34}$

for 1 mark

1

(b) electron

gains 1 mark

but shared electrons

gains 2 marks

2

[3]

Q22.

(a) (fractional) distillation/fractionation

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for 1 mark

1

(b) (i) cracking/decomposition

for 1 mark

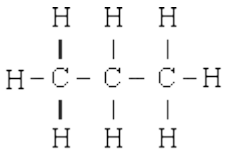
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(ii) polymerisation/addition reaction

for 1 mark

1

(c)



(Must have H atoms)

for 1 mark

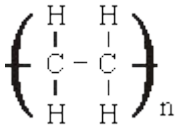
1

(d) contains <u>only/all</u> single bonds
no double bonds
contains maximum number of H atoms
carbon atoms bonded to 4 other atoms (not 4 H atoms)
will not undergo addition reactions

any 1 for 1 mark

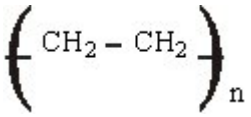
1

(e)



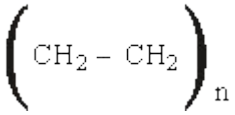
(n must be on (right))

= 2 marks

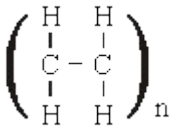


(n on left = 1 mark)

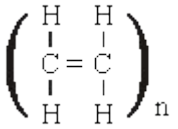
= 2 marks



= 1 mark



= 1 mark

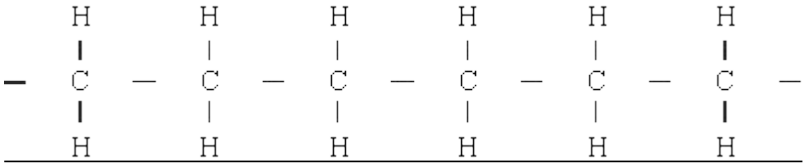


(Double bond loses both marks)

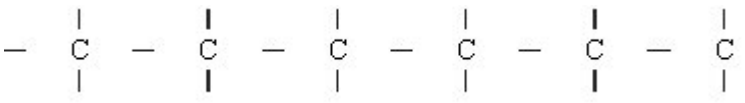
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= 0 marks

OR

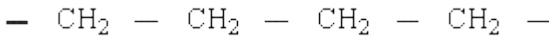


= 2 marks

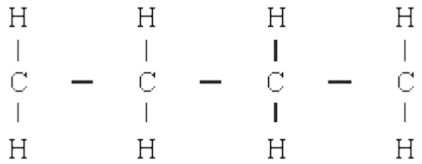


(for both a minimum of 4 carbon atoms)

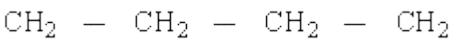
= 1 mark



= 2 marks



= 1 mark



= 1 mark

2

[7]

Q23.

(a) hydrocarbons

for 1 mark

1

(b) less carbon atoms / smaller molecule

for 1 mark

1

[2]

Q24.

(a) hydrogen and carbon

for 1 mark

1

(b) (i) the oil is evaporated / boiled / liquid converted to gas / vaporised

oil is condensed/changed back to liquid/cooled below boiling point (not just cooled)

liquids of different boiling points condense at different levels /
fractions with lower boiling points form near the top /
boiling point linked to chain length or Mr

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each for 1 mark

3

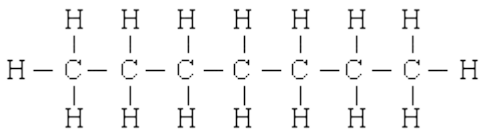
(ii) Assume they mean naphtha unless they say otherwise.
smaller molecules
/contains less atoms
/lower boiling point
/more volatile
/less bonds to break
/lower activation energy

If the answer is given the opposite way around then diesel must be specified.

any one for 1 mark

1

(iii)



correct number of atoms = 1
correct number of bonds (attached to correct atoms) = 1
Accept diagrams which show electrons correctly.
$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$ = 1

for 2 marks

2

[7]

Q25.

(i) C_8H_{18}

for one mark

1

(ii) mixture

for one mark

1

(iii) fractions molecules
atoms
evaporated condensed

in this order for 1 mark each

5

[7]

Q26.

(a) (i) bonds / pair of electrons / shared electrons

for one mark

1

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(ii) saturated since it has single bonds / no double bonds / no multiple bonds / maximum number of atoms attached

for one mark

1

(iii) sensible answer (e.g. it is harmful)
or better solvent could be used on expanded polystyrene or foam

for one mark

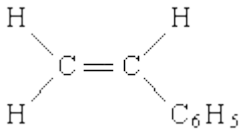
1

(b) (i) simply writing monomers form / react to form polymers gains no mark
monomers join / bond / combine / link to form polymers = 1 mark
the mark is for the idea of joining
to gain the second mark the idea of the relative size of monomer and polymer is required
small molecules join to form a polymer (2 marks)
many monomers join to form a polymer (2 marks)
monomers join to form a large molecule / long chain (2 marks)
many molecules join together (2 marks)

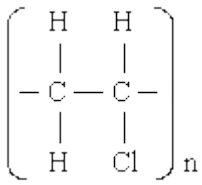
for 1 mark each

2

(ii) polyethene / poly(ethene) / polythene



don't worry too much about the exact positioning of the C_6H_5 at the end of the bond



placement of linking bonds inside / outside brackets is not important
must have n

for 1 mark each

[8]

Q27.

(a) low

1

hydrogen

1

(b) any **three** from

- flame

  accept it is a blue / yellow colour

- reacts with oxygen

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accept burns in oxygen / bonds broken

- carbon dioxide carbon monoxide forms
  accept CO_2 arco / bonds forming in CO_2/CO and H_2O
  bonds forming 1 mark max
  *accept an oxide of hydrogen **or** H_2O*

- water (vapour) forms
  *accept heat **or** light released / temperature increase / exothermic*

- energy released

3

[5]

Q28.

(a) any **three** from

carbon (atom) spine / chain
accept idea of 'backbone' of carbon (atoms)

surrounded by hydrogen (atoms)
accept idea of only bonded to hydrogen (atoms)

3

single (covalent) bonds between carbon atoms
accept no double bonds

saturated (hydrocarbons)

(general formula) C_nH_{2n+2}

(b) many small molecules/ monomers
*accept many unsaturated molecules **or** alkenes*

1

join together to form a large / long molecule / polymer

1

[5]

Q29.

(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]

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Q30.

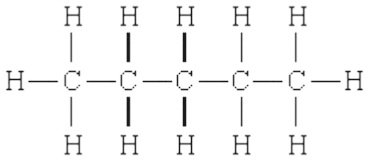
(a) **B** because it contains more of the light fraction)

1

Quantitative answer e.g. **B** has 30%,
A has 20% / 10% more / 1.5 times more

1

(b) (i)



1

(ii) heat

1

catalyst

if neither mark gained allow cracking for 1 mark

1

[5]

Q31.

(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]

Q32.

(a) LHS lithium + water

accept Li and H_2O
accept hydrogen oxide for water

1

RHS hydrogen + lithium hydroxide

accept H_2 and LiOH
ignore attempts at balancing
ignore charges

1

(b) ***Quality of written communication***

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One mark for the correct use of any **three** of the terms atom, covalent, bond(ing), saturated, hydrocarbon or alkane

1

any **three** from*:*

one / the carbon (atom)

reject molecules once

four hydrogen (atoms)

shape / properties neutral

CH_4

hydrocarbon

saturated / single bond

covalent bond / shared electrons

alkane

reject ionic bond

3

[6]

Q33.

(a) carbon

1

hydrogen

any order

1

(b) fractional

1

distillation

accept description

- *heat **or** evaporate / boil (1mark)*
- *separated when they condense **or** by boiling points (1 mark)*

1

(c) alkenes

*accept names **or** unsaturated hydrocarbons*

1

[5]

Q34.

(a) any **two** 1 mark each

burning / combustion

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fossil fuels **or** (locked up) carbon
accept fuel / named fuel

oxygen used

2

(b) any **three** from

produces (calcium) carbonate

which is insoluble

produces (calcium) hydrogencarbonate

which is soluble

photosynthesis

releases oxygen

3

[5]

Q35.

(a) all plots correct
*3 **or** 2 plots correct gains 1 mark*

2

all sectors correctly labelled

1

(b) (i) (fractional) distillation

1

(ii) gases

1

(iii) bitumen

1

[6]

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