AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.2.2

Reactions of alkenes

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**61**
Available paper years	**2007–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.7.2.2 Reactions of alkenes

Answer 01 · Mark scheme January 2007 | CHY1F | Original Q5 | Legacy

Question 5

	answers	extra information	mark
(a)(i)	poly(ethene)	accept polythene	1
(ii)	cracking		1
(iii)	hydrogen		1
(b)(i)	bar labelled 9 bar drawn to correct height		1 1
(ii)	(boiling point) increases		1
(iii)	heat / evaporate (the crude oil) cool / condense (hydrocarbons at different temperatures)	accept separate by boiling point accept smaller molecules go to top / larger molecules stay at bottom accept fractional distillation for two marks **or** distillation / fractionation for **one** mark	1 1

Continued on next page

4.7.2.2 Reactions of alkenes

Answer 01 · Mark scheme

	answers	extra information	mark
(c)	**yes** any **two** from: • because plastic does not biodegrade **or** running out of space for landfills **or** land cannot be used for a long time • it provides heat energy • which can be used to generate electricity / heat homes or greenhouses • any other advantage of burning • any other disadvantage of landfill **or** **no** • burning plastic produces carbon dioxide / carbon emissions / toxic gases • causes global warming / climate change / increase greenhouse effect / global dimming / acid rain • any other disadvantage of burning • any other advantage of landfill	accept landfill does not produce carbon dioxide / carbon emissions	2
total			10

4.7.2.2 Reactions of alkenes

Answer 02 · Mark scheme

March 2007 | CHY1B | Original Q1 | Legacy

One	**A**	alkanes	**2**
	B	fuels	**1**
	C	monomers	**4**
	D	polymers	**3**

Answer 03 · Mark scheme

March 2007 | CHY1B | Original Q3 | Legacy

Three	**A**	ethanol	**2**
	B	ethene	**4**
	C	helium	**1**
	D	poly(propene)	**3**

Answer 04 · Mark scheme

June 2007 | CHY1B | Original Q6 | Legacy

Six	**A**	Corn	**1**
	B	Olive	**4**
	C	Rapeseed	**2**
	D	Sunflower	**3**

	A	**B**	**C**	**D**

Answer 05 · Mark scheme

November 2007 | CHY1B | Original Q5 | Legacy

Five	**A**	alkene with the smallest molecules	**2**
	B	alkene with the largest molecules	**3**
	C	alkane	**1**
	D	polymer	**4**

4.7.2.2 Reactions of alkenes

Answer 06 · Mark scheme

January 2008 | CHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
(a)(i)	monomers		1
(a)(ii)	crude oil		1
(b)	any **three** from: • metal may not corrode away / remains • plastic remains / does not break down (decay) / not affected by microorganisms • should recycle / conserve resources / mend the kettle / burn (plastic) as a fuel • landfill sites are limited / filling up • water pollution	accept non-biodegradable accept it is a waste of materials / resources ignore harms wildlife / habitats **or** problems caused by burning the kettle	3
total			5

4.7.2.2 Reactions of alkenes

Answer 06 · Mark scheme

January 2008 | CHY1F | Original Q4 | Legacy

CHY1F

4.7.2.2 Reactions of alkenes

Answer 07 · Mark scheme

Question 4

question	answers	extra information	mark
(a)(i)	ionic		1
(a)(ii)	elements		1
(b)(i)	chlorine (gas)	allow Cl_2 / Cl / Cl^2 allow chloride	1
(b)(ii)	hydrogen (gas)	allow H / H_2 / H^2	1
(b)(iii)	sodium hydroxide (solution)	allow NaOH allow sodium solution	1
total			5

4.7.2.2 Reactions of alkenes

Answer 07 · Mark scheme January 2008 | CHY2F | Original Q4 | Legacy

CHY2F

Answer 08 · Mark scheme March 2008 | CHY1BP | Original Q4 | Legacy

Four	**A**	alkanes	**2**
	B	alkenes	**1**
	C	catalysts	**4**
	D	polymers	**3**

Answer 09 · Mark scheme March 2008 | CHY1BP | Original Q6 | Legacy

Six	**A**	Molecule A	**1**
	B	Molecule B	**4**
	C	Molecule C	**2**
	D	Molecule D	**3**

	A	**B**	**C**	**D**

Answer 10 · Mark scheme June 2008 | CHY1BP | Original Q5 | Legacy

Five	**A**	C_8H_{18}	**4**
	B	C_2H_4	**2**
	C	C_3H_8	**1**
	D	C_3H_6	**3**

Answer 11 · Mark scheme June 2008 | CHY1BP | Original Q6 | Legacy

Six	**A**	catalysis	**2**
	B	polymerisation	**3**
	C	combustion	**4**
	D	thermal decomposition	**1**

	A	**B**	**C**	**D**

Answer 12 · Mark scheme June 2008 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**1**	**4**	**1**

4.7.2.2 Reactions of alkenes

Answer 13 · Mark scheme

June 2008 | CHY1F | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)	hydrogen	must be name	1
5(a)(ii)	a line of four or more ethene molecules joined to the original two with single bonds	at least two other ethene molecules joined to the original two in a chain gains **1** mark	2
5(b)(i)	any **two** from: • non-biodegradable • landfill sites are filling up / limited • waste of a resource / could be recycled / reused	accept remains a long time accept land / space used up ignore references to tablets / animals	2
5(b)(ii)	any **one** from: • (two) different polymers / plastics / materials • need to be separated • limited collection points / many need to be collected • tablets may still be present		1
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 13 · Mark scheme June 2008 | CHY1F | Original Q5 | Legacy

COMPONENT NUMBER: CHY1F

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: June 2008

Answer 14 · Mark scheme November 2008 | CHY1BP | Original Q3 | Legacy

Three	**A**	argon	**1**
	B	bromine	**3**
	C	ethanol	**2**
	D	nickel	**4**

Answer 15 · Mark scheme March 2009 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**3**	**4**	**2**

Answer 16 · Mark scheme June 2009 | CHY1BP | Original Q5 | Legacy

Five	**A**	Molecule **A**	**1**
	B	Molecule **B**	**4**
	C	Molecule **C**	**2**
	D	Molecule **D**	**3**

	A	**B**	**C**	**D**

4.7.2.2 Reactions of alkenes

Answer 17 · Mark scheme

June 2009 | CHY1F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	C_2H_4		1
5(a)(ii)	poly(ethene)		1
5(b)(i)	is not biodegradable		1
5(b)(ii)	not enough landfill sites / space	accept landfill sites are filling up **or** plastics remain for <u>years</u> **or** plastics not broken down ignore cost / waste of resources / not biodegradable / wildlife	1
5(b)(iii)	less (crude) oil / fuels / energy used	accept (crude) <u>oil</u> is a non-renewable resource	1
Total			**5**

4.7.2.2 Reactions of alkenes

Answer 17 · Mark scheme

June 2009 | CHY1F | Original Q5 | Legacy

CHY1F

4.7.2.2 Reactions of alkenes

Answer 18 · Mark scheme

January 2019 | CHY1F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • bond / join (together) • double bond opens	ignore polymerisation / heat	1
5(a)(ii)	any **one** from: • heat / energy • cost of fuels / the crude oil • construction of the factory / plant • wages / salaries	ignore many processes / distillation / cracking / polymerisation	1
5(a)(iii)	any **two** from: • non-biodegradable • landfill sites are filling up / limited • waste of a resource / could be recycled / reused	ignore gases released / burning / habitats accept remains a long time accept land / space used up accept crude oil is running out	2
5(b)	any **two** from: • renewable / sustainable • less fuel <u>burned</u> • biodegradable • <u>natural</u> resource • plants absorb carbon dioxide	ignore recycling ignore crude oil is running out accept less energy / heat needed	2
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 18 · Mark scheme January 2010 | CHY1F | Original Q5 | Legacy

CHY1F

Answer 19 · Mark scheme March 2010 | CHY1BP | Original Q4 | Legacy

Four	**A**	Kevlar	**3**
	B	Acrylic	**1**
	C	66 Nylon	**2**
	D	Polyester	**4**

Answer 20 · Mark scheme March 2010 | CHY1BP | Original Q8 | Legacy

Eight	**3**	**2**	**1**	**1**

Answer 21 · Mark scheme June 2010 | CHY1BP | Original Q4 | Legacy

Four	**A**	Hydrocarbon **A**	**4**
	B	Hydrocarbon **B**	**2**
	C	Hydrocarbon **C**	**1**
	D	Hydrocarbon **D**	**3**

Answer 22 · Mark scheme June 2010 | CHY1BP | Original Q8 | Legacy

Eight	**2**	**3**	**1**	**2**

Answer 23 · Mark scheme November 2010 | CHY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	Crack	**2**
	B	Evaporate	**1**
	C	Polymerise	**4**
	D	Burn	**3**

Answer 24 · Mark scheme November 2010 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**4**	**3**

4.7.2.2 Reactions of alkenes

Answer 25 · Mark scheme

January 2011 | CHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	carbon hydrogen	accept in either order ignore number eg 2 carbons 4 hydrogens	1 1
4(a)(ii)	(a carbon carbon) double (bond)		1
4(b)	poly(ethene)		1
4(c)	any **two** from: • made from crude oil • non–renewable resources • litter • not biodegradable • use energy to make • when burned or biodegraded carbon dioxide is released • encourage customers to reuse bags / use their own bags	ignore pollution / cost / global warming / harms environment / recycling accept resources are running out accept go to landfill accept reduces carbon emissions / footprint	2
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 25 · Mark scheme January 2011 | CHY1F | Original Q4 | Legacy

CHY1F

Answer 26 · Mark scheme March 2011 | CHY1BP | Original Q5 | Legacy

Five	**A** Formula **A**	**2**		
	B Formula **B**	**3**		
	C Formula **C**	**1**		
	D Formula **D**	**4**		
	A	**B**	**C**	**D**

Answer 27 · Mark scheme March 2011 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**3**	**2**

Answer 28 · Mark scheme June 2011 | CHY1BP | Original Q4 | Legacy

Four	**A** alkenes	**2**
	B polymers	**3**
	C monomers	**4**
	D alkanes	**1**

4.7.2.2 Reactions of alkenes

Answer 29 · Mark scheme

June 2011 | CHY1F | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	heat / high temperature / hot / vaporise	if (fractional) distillation / hydrogenation mentioned as the method = max 1 allow thermal decomposition ignore evaporation do **not** accept 'burns' do **not** accept temperature < 100	1
	catalyst **or** silica / alumina / porous pot **or** steam	ignore other named catalyst allow heat (the vapour) to a very high temperature / >800°C for **2** marks	1
7(a)(ii)	C_2H_3Cl	ignore attempts to balance equation	1
7(a)(iii)	single bonds between C – H, C – Cl **and** C – C	do **not** accept symbols outside the bracket	1
7(b)(i)	so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples	allow because different sizes would give different results accept because size is a control variable ignore references to reliability / precision etc	1
7(b)(ii)	to improve the reliability (of the investigation)	accept to calculate a mean accept to check for anomalous results **or** to check the range of results ignore accuracy / precision etc	1

Question 7 continues on the next page

Question 7 continued

question	answers	extra information	mark
7(b)(iii)	23	correct answer with or without working = **2** marks if answer is incorrect allow $\frac{22+23+24}{3}$ **or** 21 for **1** mark	2
7(b)(iv)	(PVC) sample had been stretched / used / tested in first three tests	accept higher temperature allow worn **or** become weaker ignore (human) error ignore more flexible / softer ignore intermolecular forces	1
7(c)	does not bend (easily / much) **or** it is not flexible **or** it is rigid	ignore non-biodegradable / low maintenance ignore sturdy / stronger / harder	1
Total			**10**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.7.2.2 Reactions of alkenes

Answer 30 · Mark scheme

June 2011 | CHY3F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	orange		1
4(a)(ii)	colourless		1
4(a)(iii)	a carbon carbon double bond		1
4(b)(i)	C		1
4(b)(ii)	B		1
4(b)(iii)	only produces water **or** does not produce carbon dioxide	do **not** accept CO^2	1
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 30 · Mark scheme June 2011 | CHY3F | Original Q4 | Legacy

CHY3F

Answer 31 · Mark scheme November 2011 | CHY1BP | Original Q7 | Legacy

Seven	**4**	**3**	**1**	**1**

4.7.2.2 Reactions of alkenes

Answer 32 · Mark scheme

June 2012 | CH1FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	6 oxygen		1 1
6(b)(i)	heating the hydrocarbon to a high temperature the presence of a catalyst		1 1
6(b)(ii)	all bonds correct four C—H bonds **and** one C=C bond		1
6(b)(iii)	water	accept hydrogen oxide/steam allow H_2O	1
6(c)(i)	carbon dioxide	allow CO_2	1
6(c)(ii)	by filtering/decanting/centrifuging (to remove yeast) (fractional) distillation (to separate ethanol from water)	ignore sieving accept a description of (fractional) distillation	1 1
Total			**9**

4.7.2.2 Reactions of alkenes

Answer 32 · Mark scheme

June 2012 | CH1FP | Original Q6 | Legacy

CH1FP

4.7.2.2 Reactions of alkenes

Answer 33 · Mark scheme

June 2012 | CH1FP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	(1) 5 3 (6) 4 2	all numbers in the correct order gains both marks any two numbers in the correct position gains **1** mark	2
8(a)(ii)	water	ignore formula if correct name given accept hydrogen oxide allow H_2O	1
	carbon dioxide	allow CO_2 accept carbon monoxide / CO **or** carbon / C	1

Question 8 continues on the next page . . .

CH1FP

Question 8 cont'd

question	answers	extra information	mark
8(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 on page 2**, and apply a 'best-fit' approach to the marking.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a **basic** description of at least one advantage **or** one disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a **clear** description of both an advantage **and** a disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a **detailed** description of both advantages **and** disadvantages caused by using plastic shopping bags made from poly(ethene).

examples of the chemistry/social points made in the response:
ignore cost unqualified

Advantages:

- Simple properties eg strong / low density / water resistant
- Bags can be reused (for shopping) **or** another specified use eg bin liners
- Money charged for bags can go to good causes **or** encourage reuse
- Poly(ethene) bags can be recycled eg made into milk bottle crates
- Poly(ethene) bags can be burned to provide heat for buildings/generation of electricity
- New bags are now made that can biodegrade

Disadvantages:

- (Older) bags can take many years to biodegrade
- There is a shortage of landfill space
- Bags are made from (crude) oil which is a non-renewable resource/running out
- Large amounts of energy/fuel are used for the production of poly(ethene)
- Production of poly(ethene) releases carbon dioxide/causes global warming
- Specified issue caused by litter eg visual pollution or effect on wildlife
- Burning bags release carbon dioxide / causes global warming

Total			10

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.7.2.2 Reactions of alkenes

Answer 34 · Mark scheme

June 2012 | CH2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	79 79		1 1
2(b)	hundred		1
2(c)(i)	electron(s)		1
2(c)(ii)	three		1
2(d)	changes rate of reaction **or** speeds up / slows down reaction	accept lowers activation energy accept reduces costs	1
2(e)(i)	melt		1
2(e)(ii)	crosslinking **or** (covalent) bonds between polymers / chains	allow answers on diagram allow bonds between layers do **not** allow intermolecular	1
Total			**8**

4.7.2.2 Reactions of alkenes

Answer 34 · Mark scheme

June 2012 | CH2FP | Original Q2 | Legacy

CH2FP

4.7.2.2 Reactions of alkenes

Answer 35 · Mark scheme

question	answers	extra information	mark
5(a)	Methane has the lowest melting point and icosane has the highest boiling point Decane and icosane are liquid at 100°C		1 1
5(b)	 water / H_2O carbon dioxide / CO_2	either order allow hydrogen oxide	 1 1
5(c)(i)	fermentation		1
5(c)(ii)	any **two** from: • sugar cane/plants absorb carbon dioxide • growing sugar cane/plants reduces global warming • renewable resource/sustainable	 ignore oxygen released allow ethanol from plants is carbon neutral accept conserves fossil fuels / petrol	2
5(c)(iii)	any **two** from: • destruction of habitats/forests (to grow sugar cane/crops) • fermentation releases carbon dioxide • production plants cause visual pollution • pollution from the transportation of sugar cane / Ethanol • growing sugar cane / plants uses a lot of land		2
Total			**9**

4.7.2.2 Reactions of alkenes

Answer 35 · Mark scheme

January 2013 | CH1FP | Original Q5 | Legacy

CH1FP

4.7.2.2 Reactions of alkenes

Answer 36 · Mark scheme

January 2013 | CH2FP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)	would melt	accept they have a low melting point allow lose their shape ignore would soften when hot ignore boiling point	1
4(b)	to speed up the reaction	accept can use a lower temperature accept less energy needed	1
4(c)(i)	mass spectrometer	allow mass spectroscopy	1
4(c)(ii)	any **one** from: • accurate • sensitive • rapid / quicker • small amount of sample	ignore reliable ignore more precise	1
4(d)	any **two** from: • pressure • temperature • catalyst **or** initiator • solvent	allow concentration	2
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 36 · Mark scheme

January 2013

CH2FP

4.7.2.2 Reactions of alkenes

Answer 37 · Mark scheme

June 2013 | CH1FP | Original Q2 | Legacy

Question 2

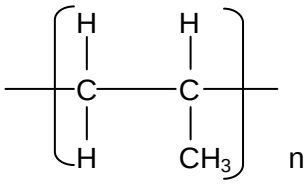
question	Answers	extra information	Mark
2(a)	oxygen	must be name do **not** accept oxide or dioxide	1
2(b)(i)	2 x C–C and 5 x C–H	all single (line) bonds	1
2(b)(ii)	C_3H_8	must be formula do **not** accept lower case h	1
2(b)(iii)	water		1
2(c)	ethane and butane boil at temperatures less than 20°C ethene and hexene each have a carbon-carbon double bond		1 1
2(c)	ethane and butane boil at temperatures less than 20°C ethene and hexene each have a carbon-carbon double bond		1 1
Total			**6**

4.7.2.2 Reactions of alkenes

Answer 38 · Mark scheme

June 2013 | CH1FP | Original Q5 | Legacy

Question 5

question	answers	extra information	Mark
5(a)(i)	ethene	allow C_2H_4	1
5(a)(ii)		accept line drawn from word 'Monomer' or from the monomer box to the correct 'Polymer' allow the correct 'Polymer' indicated by a tick, circled etc.	1
5(b)(i)	nickel	accept Ni	1
5(b)(ii)	75(%)		1
5(b)(iii)	(stainless steel) is hard /strong / durable (stainless steel) resistant to corrosion **or** unreactive	it = stainless steel accept (pure) iron is soft accept (pure) iron rusts / corrodes / reacts do **not** allow corrosive	1 1
5(c)	**Advantage**: Conserves resources of crude oil and ores **Disadvantage**: High cost of separating materials	do **not** allow more than one tick in the advantage column do **not** allow more than one tick in the disadvantage column	1 1
Total			**8**

4.7.2.2 Reactions of alkenes

Answer 39 · Mark scheme

June 2014 | CH1FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)	hydrocarbons **or** hydrocarbon		1	1 / 1.4.1c	G
4(b)(i)	distillation		1	1 / 1.4.2b	G
4(b)(ii)	evaporation		1	2 / 1.4.2b	G
4(b)(iii)	condensation		1	2 / 1.4.2b	G
4(c)(i)	bond		1	1 / 1.4.2a	G
4(c)(ii)	$(C_6H)_{14}$		1	2 / 1.4.2a	G
4(c)(iii)	cracking		1	1 / 1.5.1a	G
4(d)(i)	poly(butene)	allow with or without brackets	1	1 / 1.5.2a	E
4(d)(ii)	Advantage=energy is released Disadvantage=carbon dioxide is produced	do **not** accept more than one tick in the advantage column do **not** accept more than one tick in the disadvantage column	1 1	3 / 1.5	G
Total			**10**		

4.7.2.2 Reactions of alkenes

Answer 39 · Mark scheme

June 2014 | CH1FP | Original Q4 | Legacy



4.7.2.2 Reactions of alkenes

Answer 40 · Mark scheme

June 2014 | CH1FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7(a)(i)	reaction with water / steam	allow add water / steam *(to produce ethanol)* *allow H_2O or hydrogen oxide for water* *ignore mix*	1	1 / 1.5.3a	E
7(a)(ii)	filter / decant (to remove the yeast)	*allow answers in either order* *accept description of decanting* *ignore sieve*	1	2 / 1.5.3b	E
	(fractional) distillation / distil	*accept evaporation then condensation*	1		

Answer 40 · Mark scheme

June 2014 | CH1FP | Original Q7 | Legacy

7(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 on page 5, and apply a 'best-fit' approach to the marking.	1+2+3 / 1.4.3e	E

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is a stated advantage **or** disadvantage of using biodiesel ***or*** petroleum diesel.	There is a stated advantage **or** disadvantage of using biodiesel **or** petroleum diesel with a linked consequence.	There is at least one stated advantage **and** at least one stated disadvantage of using biodiesel **or** petroleum diesel with a linked consequence for each.

Examples of points made in the response could include:

Advantages *of biodiesel*:

- Produces less carbon dioxide
- Produces no sulfur dioxide
- Produces less particulates
- Sustainable / renewable
- Growing crops absorb carbon dioxide
- Carbon neutral
- Produces less acid rain
- Conserves the limited amount of petroleum diesel

Disadvantages *of biodiesel*:

- Produces more nitrogen oxides
- Deforestation for land
- Destruction of habitats for land
- Uses land that could be used for food crops
- Creates food shortages
- Crops are not reliable

Total			**9**

4.7.2.2 Reactions of alkenes

Answer 41 · Mark scheme June 2015 | CH1FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	mixture (of different substances)		1	1 / 1.4.1a
3(a)(ii)	boiling (points)		1	1 / 1.4.2c
3(a)(iii)	distillation		1	1 / 1.4.1b
3(b)(i)	combustion		1	1 / 1.4.3b
3(b)(ii)	(reactant) oxygen (products) carbon dioxide **and** water	allow correct formulae products in any order allow carbon or carbon monoxide allow water vapour or steam or hydrogen oxide	 1 1	2 / 1.4.3b
3(b)(iii)	(burning sulfur) produces sulfur dioxide / SO_2 causes acid rain	allow it/sulfur reacts with oxygen ignore sulfur oxide	1 1	1+2 / 1.4.3c/d
3(c)(i)	propane is a fuel		1	2 / 1.5.1e
3(c)(ii)	double bond drawn between carbon atoms	do not allow any other bonds or symbols	1	1 / 1.5.1c
3(c)(iii)	orange to colourless		1	1 / 1.5.1d
3(c)(iv)	poly(pentene)	allow polymer(s)	1	1 / 1.5.1d
Total			**12**	

4.7.2.2 Reactions of alkenes

Answer 41 · Mark scheme

June 2015 | CH1FP | Original Q3 | Legacy



4.7.2.2 Reactions of alkenes

Answer 42 · Mark scheme June 2015 | CH1FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	the polymer is not biodegradable the polymer is waterproof		1 1	2 / 1.5.2b/c
4(a)(ii)	any **one** from: • made from a renewable/sustainable resource • is biodegradable	ignore releases less carbon dioxide allow decomposes	1	3 / 1.5.2c/d
4(b)(i)	crushing filtering	in the correct order	1 1	1 / 1.6.1a
4(b)(ii)	open the tap to allow only water to flow out **or** close the tap to leave the oil in the funnel	 allow close tap then allow oil to flow out into a separate container	1 1	2 / 1.6.1a
4(c)(i)	They provide a lot of energy		1	1 / 1.6.1b
4(c)(ii)	because the vegetable/plant absorbs / uses carbon dioxide which is released when the biofuel burns	 second marking point is dependent on first marking point allow a fossil fuel releases locked up carbon dioxide/carbon if no other mark awarded allow carbon neutral for **one** mark	1 1	1 / 1.5.2a
Total			**10**	

4.7.2.2 Reactions of alkenes

Answer 42 · Mark scheme

June 2015 | CH1FP | Original Q4 | Legacy



4.7.2.2 Reactions of alkenes

Answer 43 · Mark scheme

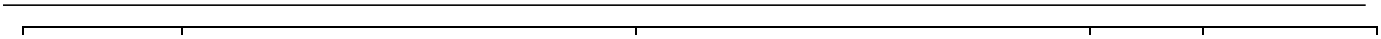
June 2015 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	sharing/covalent/metallic = max 2 sodium loses (electron) chlorine gains (electron) 1 **or** an (electron)		 1 1 1	**AO1/AO2** 2.1.1b,c,d, e,f
2(b)(i)	Have no overall electric charge		1	**AO1** 2.2.1a,c
2(b)(ii)	Should iodine be added to salt? reason: any **one** from: • cannot be done by experiment • based on opinion / view • ethical **or** economic issue	 accept difficult to get / not enough evidence allow must be done by survey	1 1	**AO3** 2.2.1
2(c)(i)	nitric (acid)		1	**AO1** 2.6.2b
2(c)(ii)	an alkali		1	**AO1** 2.6.2a
2(c)(iii)	indicator	accept any named acid base indicator	1	**AO1** 2.6.1b
2(d)(i)	Crystallisation		1	**AO1** 2.6.1c
2(d)(ii)	fertiliser	allow to help crops grow	1	**AO1** 2.6.2c
2(d)(iii)	any **one** from: • pressure • temperature • catalyst	 allow concentration ignore heat	1	**AO1** 2.2.5a
Total			**12**	

4.7.2.2 Reactions of alkenes

Answer 43 · Mark scheme

June 2015 | CH2FP | Original Q2 | Legacy



4.7.2.2 Reactions of alkenes

Answer 44 · Mark scheme

June 2016 | CH1FP | Original Q4 | Legacy

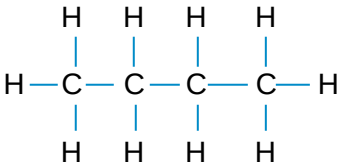
Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	fermentation		1	AO1 1.5.3b
4(a)(ii)	hydration		1	AO1 1.5.3a
4(a)(iii)	resources of crude oil are non-renewable producing ethanol from plants uses less energy		1 1	AO3 1.4.3e; 1.5.3b
4(b)(i)	turns cloudy / milky / white because carbon dioxide is produced	ignore bubbles allow CO_2 produced	1 1	AO1 1.2.1e
4(b)(ii)	filter paper		1	AO3 1.5.3b; 4.3
4(c)(i)	vegetable oils cook foods at higher temperatures than boiling water		1	AO1 1.6.1c
4(c)(ii)	(flask **A**) vegetable oil and water <u>do not mix</u> or are immiscible **or** vegetable oil <u>does not dissolve</u> in water (flask **B**) vegetable oil, water and an emulsifier form an emulsion **or** a suspension or a stable mixture	 allow correct description using hydrophilic and/or hydrophobic	1 1	AO2+AO3 1.6.2a
Total			**10**	

4.7.2.2 Reactions of alkenes

Answer 45 · Mark scheme June 2016 | CH1FP | Original Q5 | Legacy

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	high temperature catalyst or steam	allow heating / hot / 250-900 °C allow named catalyst eg zeolite, Al_2O_3, silica, ceramic allow in the absence of air / oxygen ignore any references to pressure	1 1	AO1 1.5.1a
5(a)(ii)	colourless	allow decolourised ignore clear / discoloured	1	AO1 1.5.1d
5(a)(iii)			1	AO2 1.4.2a
5(b)(i)	20.3(0) (kJ)	if answer incorrect allow **1** mark for 24.36/1.2	2	AO2 1.4.3b
5(b)(ii)	use a lid reduce energy / heat loss	allow insulate beaker or use draught shield 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 1	AO3 4.3.2b/c/d
5(b)(iii)	carbon/soot (produced by) incomplete combustion	ignore tar, smoke allow from a limited supply of oxygen/air	1 1	AO1+AO2 1.4.3a/b
5(b)(iv)	hexane gives out the greatest energy (per 1.0 g) hexane produces the least smoke / carbon / soot	ignore more energy allow has the cleanest flame ignore less smoke / carbon / soot	1 1	AO3 1.4.2c; 1.4.3a/b

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(c)			6	AO1+AO2+ AO3 1.1.3b; 1.4.1b/c; 1.4.3a/b/c/d ;1.7.2h/i

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 on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	Statements made from the information that indicate whether at least one statement is an advantage **or** a disadvantage **or** a linked advantage or disadvantage	Descriptions of an advantage **and** a disadvantage with some use of their knowledge to add value.	Descriptions of advantages **and** disadvantages that are linked to their own knowledge.

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

Total			18

4.7.2.2 Reactions of alkenes

Answer 46 · Mark scheme

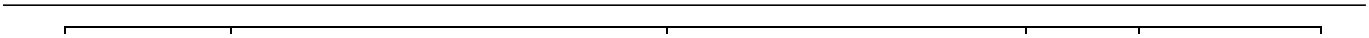
June 2016 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
2(a)(i)	hard	ignore strong	1	AO2 2.2.3b
2(a)(ii)	hundred		1	AO1 2.2.6a
2(b)(i)	Covalent		1	AO1 2.2.3a
2(b)(ii)	3		1	AO1 2.2.3.c
2(b)(iii)	Soft and slippery		1	AO1 2.2.3a,c
2(c)(i)	cross-links	allow bonds ignore links do **not** accept intermolecular	1	AO1 2.2.5b
2(c)(ii)	melt		1	AO1 2.2.5b
2(c)(iii)	any **two** from: • temperature • pressure • catalyst	allow heat(ing)	2	AO1 / AO3 2.2.5a
2(d)(i)	CH_4		1	AO1 2.1.1g
2(d)(ii)	Small molecules		1	AO1 2.2.1a
Total			**11**	

4.7.2.2 Reactions of alkenes

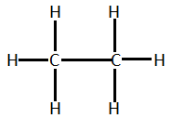
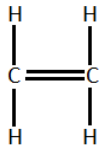
Answer 46 · Mark scheme

June 2016 | CH2FP | Original Q2 | Legacy



4.7.2.2 Reactions of alkenes

Answer 47 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	electronic structure drawn	allow any representation of an electron allow 2,4	1	**AO2** 1.1.1h
6(a)(ii)	six / 6 protons (protons) are positively charged	 do **not** allow electrons in nucleus otherwise ignore electrons do **not** allow nucleus is neutral allow (protons are) + / +1 / 1+ ignore statements about mass if no other mark awarded allow one mark for nucleus	1 1 1	**AO1** **AO2** 1.1.1c;d;e
6(b)	(a hydrocarbon is) made up of hydrogen and carbon (atoms) only	do **not** allow mixture	1	**AO1** 1.4.1a;c
6(c)(i)	 	ethane correctly drawn with another hydrogen on each carbon and another three single bonds ethene correctly drawn with a double bond between the carbon atoms	1 1	**AO1** 1.4.2a 1.5.1c
6(c)(ii)	as the number of carbon atoms increases the boiling point increases	allow converse ignore alkene	1	**AO3** 1.4.2c

4.7.2.2 Reactions of alkenes

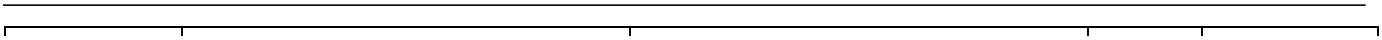
Answer 47 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(c)(iii)	the boiling points of alkanes are higher than the boiling points of alkenes	allow the boiling points of alkenes are lower than the boiling points of alkanes	1	**AO2** 1.4.2b;c
	that has the same number of carbon atoms	consequential on first marking point	1	
	or state a correct example	e.g. hexane has a higher boiling point than hexene **or** hexane boils at 69°C hexene boils at 64°C		
		if no other mark awarded allow both alkanes and alkenes have the same pattern of the more carbon atoms the higher the boiling point for one mark		
6(d)	(alkane molecules are) cracked	allow break down / up **or** decompose **or** split up	1	**AO1 AO2 AO3** 1.5.1a;b;d
	to produce small(er) molecules / alkanes / hydrocarbons	allow short chain for small	1	
	and alkenes **or** a named alkene	allow molecules that have a double bond **or** are unsaturated	1	
		if no other mark awarded allow evaporate **or** boil for one mark		
		ignore turns to gas		
Total			**13**	

4.7.2.2 Reactions of alkenes

Answer 47 · Mark scheme

June 2017 | CH1FP | Original Q6 | Legacy



4.7.2.2 Reactions of alkenes

Answer 48 · Mark scheme

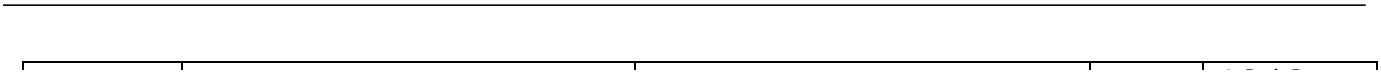
June 2017 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	**AO2** 2.6.1a
2(a)(ii)	to speed up the reaction		1	**AO2** 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	**AO1** 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	**AO1** 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	**AO1** 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	**AO1** 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	**AO3** 2.3.3d
2(d)(i)	white	accept grey	1	**AO1** 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	**AO1** 2.5.1d
2(e)(i)	polymers		1	**AO1** 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	**AO2** 2.6; 3.7.12
2(e)(iii)	no relationship		1	**AO2** 2.6; 3.7.12
Total			**12**	

4.7.2.2 Reactions of alkenes

Answer 48 · Mark scheme

June 2017 | CH2FP | Original Q2 | Legacy



4.7.2.2 Reactions of alkenes

Answer 49 · Mark scheme

June 2019 | 8462/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nitrogen **and** methane	in either order, both required for mark allow phonetic spellings allow N_2 for nitrogen allow CH_4 for methane	1	AO2 4.9.1.1
04.2	nitrogen bar to 78% oxygen bar to 21%	ignore width of bars ignore additional bars	1 1	AO2 4.9.2.2
04.3	Titan's atmosphere contains too little carbon dioxide.		1	AO3 4.9.1.3
04.4	long wavelength radiation is reflected back to the surface of Titan.		1	AO1 4.9.2.1
04.5	methane propene forms a blue solution forms a colourless solution forms a green solution forms a white precipitate no effect	an extra line from a gas to an effect on bromine water negates that mark	1 1	AO1 4.7.1.4

4.7.2.2 Reactions of alkenes

Answer 49 · Mark scheme

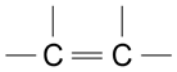
June 2019 | 8462/2F | Original Q4

04.6	$\frac{7 \times 21}{3}$ = 49 (g)	an answer of 49 (g) scores **2** marks.	1 1	AO2 4.7.2.2
Total			**9**	

Answer 50 · Mark scheme

June 2019 | 8462/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	covalent		1	AO1 4.2.1.4
05.2			1	AO1 4.7.2.1 4.7.2.2
05.3	composite		1	AO2 4.10.3.3
05.4	limestone sand	either order	1 1	AO1 4.10.3.3
05.5	any **two** from: (makes the board) • strong • hard • tough • waterproof • durable • aesthetic reasons • rigid • less friction • protection	ignore corrosion / erosion / rotting / rusting allow long lasting allow streamlined / smooth allow prevents damage	2	AO3 4.10.3.3
05.6	(advantages of addition polymers) low(er) cost low(er) density (disadvantages of addition polymers) weak(er) hard(er) to dispose of	 allow cheap(er) allow light(er) allow (more) likely to break ignore references to recycling or use as a fuel	 1 1 1 1	AO3 4.10.1.1 4.10.2.1

4.7.2.2 Reactions of alkenes

Answer 50 · Mark scheme

05.7	150 = $\frac{5.25}{\text{volume}}$ (volume =) $\frac{5.25}{150}$ (volume =) 0.035 (m^3)	an answer of 0.035 (m^3) scores **3** marks. allow **2** marks for an answer of 0.105 (m^3) (addition polymer)	1 1 1	AO2 4.10.1.1
Total			**14**	

4.7.2.2 Reactions of alkenes

Answer 51 · Mark scheme

November 2020 | 8462/2F | Original Q6

Question 6

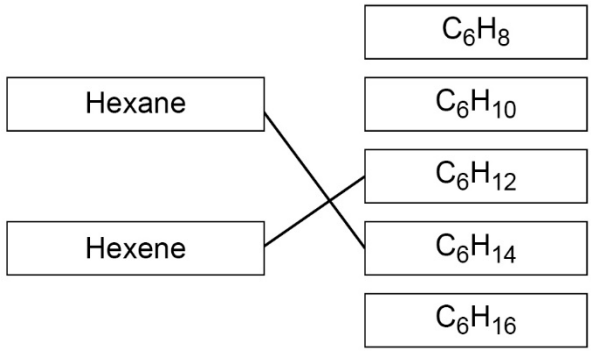
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	disposal at the end of useful life		1	AO3 4.10.2.1
06.2	heating in a furnace shaping wet clay		1 1	AO1 4.10.3.3
06.3	polymers propene	allow (a) monomer	1 1	AO1 AO2 4.7.3.1
06.4	cracking fractional distillation		1 1	AO2 4.7.1.2 4.7.1.4
06.5	covalent		1	AO1 4.2.2.5 4.7.3.1
06.6	thermosetting		1	AO3 4.10.3.3
06.7	polymer **A** has crosslinks (between polymer molecules) **or** polymer **B** has no crosslinks (between polymer molecules)		1	AO3 4.10.3.3
Total			**10**	

4.7.2.2 Reactions of alkenes

Answer 52 · Mark scheme

November 2020 | 8462/2F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	 additional line from a box on the left negates the mark for that box		1 1	AO2 4.7.1.1 4.7.2.1
10.2	(remains) orange (becomes) colourless	must be in this order allow no (colour) change ignore initial colour ignore clear	 1 1	AO2 4.7.1.4

Question 10 (continued)

Question	Answers	Mark	AO / Spec. Ref.
10.3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 AO2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	4.7.1.1 4.7.1.3 4.7.1.4 4.7.2.1 4.7.2.2 4.9.3.1
	Indicative content **Structure and bonding** • both are hydrocarbons • both contain two carbon atoms (per molecule) • ethane contains six hydrogen atoms (per molecule) • (but) ethene contains four hydrogen atoms (per molecule) • both have covalent bonds • ethane contains a single C—C bond • (but) ethene contains a double bond • both contain C—H bonds • both small molecules **Reactions** • both react with oxygen in complete combustion reactions • to produce water and carbon dioxide • both react with oxygen in incomplete combustion reactions • to produce water, carbon monoxide and carbon • incomplete combustion is more likely with ethene • ethene decolourises bromine water • (but) ethane does not decolourise bromine water • ethene is more reactive (than ethane) • ethene can react with hydrogen (to produce ethane) • ethene can react with water (to produce ethanol) • ethene can react with halogens (to produce halogenoalkanes) • ethene can undergo addition reactions • ethene can polymerise (to produce poly(ethene)) ignore physical properties ignore references to flammability		

Total			10

Answer 53 · Mark scheme

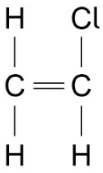
November 2021 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	limestone sodium carbonate		1 1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(advantage) stronger (reason) less easily damaged		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(advantage) lower density (reason) lighter (to install)		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4			1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(add damp) litmus paper (litmus paper) is bleached **or** (litmus paper) turns white	ignore (litmus paper) turns red	1 1	AO1 4.8.2.4

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(polymers) last a long time (wood) renewable	ignore references to cost allow break down slowly allow trees can be replanted allow aesthetic reasons	 1 1	 AO3 AO1 4.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	(percentage of aluminium =) $\frac{5.94}{6.00} \times 100$ = 99 (%)		1 1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	(alloy is) harder (than pure aluminium)	allow (alloy is) stronger (than pure aluminium) ignore references to cost	1	AO2 4.2.2.7 4.10.3.2

Total			14

4.7.2.2 Reactions of alkenes

Answer 54 · Mark scheme

November 2021 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	fuel		1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	propene		1	AO2 4.7.2.1 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(percentage yield =) $\frac{380}{400} \times 100$ = 95 (%)		1 1	AO2 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	some ethanol changes back into ethene and steam some ethanol escapes from the apparatus		1 1	AO2 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	C_2H_5OH + **3** O_2 → 3 H_2O + 2 CO_2	allow multiples	1	AO2 4.1.1.1 4.3.1.1 4.7.2.3

Question 7 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	(advantages) (fermentation) low energy usage (fermentation) uses renewable raw materials (disadvantages) (fermentation) produces impure ethanol (fermentation) slow rate of reaction		 1 1 1 1	AO3 4.7.2.2 4.7.2.3 4.10.1.1

Total			**11**

4.7.2.2 Reactions of alkenes

Answer 55 · Mark scheme

June 2022 | 8462/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	D		1	AO1 4.2.1.4 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	4 / four		1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	very hard		1	AO1 4.2.2.6 4.2.3.1

4.7.2.2 Reactions of alkenes

Answer 55 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	C_2H_6		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	H^+		1	AO1 4.4.2.4

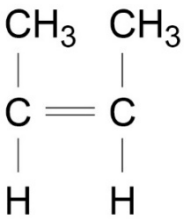
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	(M_r =) (1 × 2) + 12 + (16 × 3) = 62	allow (M_r =) 2 + 12 + 48	1 1	AO2 4.3.1.2

Total Question 6		**8**

Answer 56 · Mark scheme

June 2022 | 8462/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	C=C bond		1	AO2 4.7.3.1
	2x C-H bonds **and** 2x C-CH_3 bonds	do **not** accept extra bonds	1	
		an answer of  scores **2** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	any **one** from: • (otherwise) the copper (produced) would be impure	allow (otherwise) the copper (produced) would be contaminated	1	AO3 4.10.2.2
	• (otherwise) the copper (produced) would be a mixture • (otherwise) the insulation would burn / melt (during recycling) • copper and poly(butene) are recycled by different methods	allow (otherwise) poly(butene) could produce toxic fumes		

4.7.2.2 Reactions of alkenes

Answer 56 · Mark scheme

June 2022 | 8462/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	(wire heated until) copper melts (re)cast / reformed (into pipes)	 allow (re)shaped / extruded / (re)moulded	1 1	AO1 4.10.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	 any **two** from: (recycling scrap copper) • uses less energy • conserves copper (ore) • (produces) less waste • specified environmental impact	allow converse statements for extracting copper from ores ignore references to cost allow less landfill required	 2	AO1 4.10.1.1 4.10.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	 sodium hydroxide (solution) blue precipitate	MP2 dependent on MP1 allow NaOH for sodium hydroxide allow blue solid	 1 1	AO1 4.8.3.2 RPA7

4.7.2.2 Reactions of alkenes

Answer 56 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(add acidified) barium chloride (solution)	MP2 dependent on MP1 allow $BaCl_2$ for barium chloride allow (add acidified) barium nitrate (solution) do **not** accept add sulfuric acid	1	AO1 4.8.3.5 RPA7
	white precipitate	allow white solid	1	

Total Question 8		**11**

Answer 57 · Mark scheme

June 2023 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(the poly(propene) beaker will begin to) melt	allow poly(propene) has a low melting point	1	AO3 4.7.3.1
	(the poly(propene) beaker will) burn / ignite	allow poly(propene) is flammable	1	

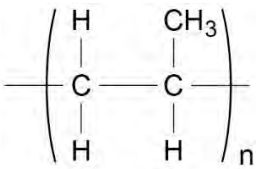
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(poly(propene) beakers are) less easily broken	allow (poly(propene) beakers are) less likely to shatter allow (poly(propene) beakers are) tougher allow (poly(propene) beakers have a) higher resistance to impact	1	AO3 4.7.3.1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	boron trioxide		1	AO1 4.10.3.3

Question	Answers	Mark	AO / Spec. Ref.
02.4	<table><tr><th>Symbol for element</th><th>Name of element</th><th>Number of atoms of element in one molecule of propene</th></tr><tr><td>C</td><td>carbon</td><td>3</td></tr><tr><td>H</td><td>hydrogen</td><td>6</td></tr></table> if no other mark awarded allow **1** mark for a correct column	1 1	AO1 AO2 4.1.1.1 4.7.2.1

4.7.2.2 Reactions of alkenes

Answer 57 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5			1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(**Stage 1** is) fractional distillation		1	AO1
	(**Stage 2** is) cracking		1	AO2
	(**Stage 3** is) polymerisation		1	AO2
				4.7.1.2 4.7.1.4 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	alkene		1	AO2 4.7.2.1
	monomer		1	4.7.3.1

Total Question 2	**12**

4.7.2.2 Reactions of alkenes

Answer 58 · Mark scheme

June 2023 | 8462/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(mass =) $\frac{39.8}{29.6}$ (× 1) = 1.34 (g)	 allow 1.34459459 (g) correctly rounded to at least 2 significant figures	1 1	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	all six points plotted correctly	allow a tolerance of ± ½ a small square allow **1** mark for four or five points plotted correctly	2	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	40.6 (kJ)	allow a value in the range 40.4 – 40.8 (kJ) allow a value consistent with the plotted points	1	AO2 4.7.2.3

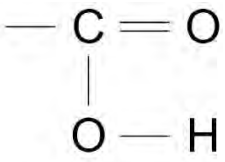
Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	calcium hydroxide		1	AO1 4.8.2.3

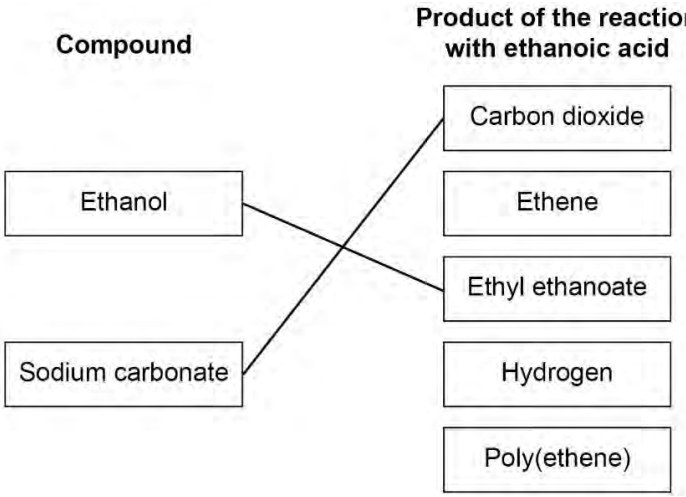
Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(limewater turns) milky / cloudy	allow white precipitate (formed) allow calcium carbonate is produced	1	AO1 4.8.2.3

4.7.2.2 Reactions of alkenes

Answer 58 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	an oxidising agent		1	AO1 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7			1	AO1 4.7.2.4

Question	Answers	Mark	AO / Spec. Ref.
09.8	 do **not** accept more than **one** line from a box on the left	1 1	AO1 4.7.2.4

Total Question 9	11

4.7.2.2 Reactions of alkenes

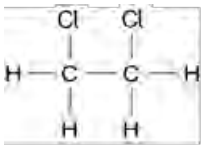
Answer 59 · Mark scheme

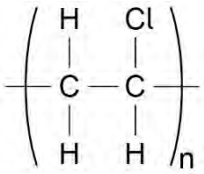
June 2024 | 8462/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	colourless	ignore clear	1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	damp litmus paper		1	AO1 4.8.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3			1	AO1 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4			1	AO2 4.7.3.1

4.7.2.2 Reactions of alkenes

Answer 59 · Mark scheme

June 2024 | 8462/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	1.5 × 10 0.9 × 10		1	AO2 4.7.3.1
	(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 =) $\frac{1.5}{0.9}$ $\frac{0.9}{0.9}$ (1)			
	1.666 : 1 (1)			
	= 5 **:** 3 (1)	allow correct determination of the simplest whole number ratio from an attempt at a density ratio		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	the pipes will melt **or** the polymers will melt	allow the melting point of both polymers is below 300°C	1	AO3 4.7.3.1 4.10.3.3

4.7.2.2 Reactions of alkenes

Answer 59 · Mark scheme

June 2024 | 8462/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	oil is non-renewable **or** paper is obtained from a renewable source	allow oil is finite	1	AO2 4.10.1.1

Total Question 6	**9**

4.7.2.2 Reactions of alkenes

Answer 60 · Mark scheme

June 2025 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	CaS		1	AO2 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	calcium (atom) loses electrons		1	AO2 4.2.1.1 4.2.1.2
	sulfur (atom) gains electrons		1	
	reference to transfer of two electrons		1	
	calcium forms positive ions **and** sulfur forms negative ions	allow Ca^{2+} (ions) **and** S^{2-} (ions) are formed allow calcium ions **and** sulfide ions are formed	1	

Answer 60 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
09.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.2.1.1 4.2.1.4 4.2.2.6 4.2.3.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • giant structure • layers • of hexagonal rings • each (carbon) atom forms three bonds • has no covalent bonds between layers • with delocalised electrons • one delocalised electron from each carbon atom • the bonds are covalent • with shared (pairs of) electrons • the (covalent) bonds are strong		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the molecules do not have an (overall electric) charge	allow there are no ions allow there are no delocalised electrons	1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	poly(ethene) has stronger intermolecular forces to overcome than methane		1	AO1 4.2.2.4 4.2.2.5

Total Question 9	11

Answer 61 · Mark scheme

June 2025 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	propene		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	9		1	AO2 4.1.1.1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	making a polymer		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(*y*-axis 0, 20), 40, 60, 80, (100)	ignore intermediate values	1	AO2 4.7.2.1
	carbon bar drawn to 86%	allow a tolerance of ± ½ a small square	1	
	carbon bar labelled		1	

Answer 61 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(test) add bromine (water) (result) (bromine water) turns (from orange to) colourless	 allow (bromine water) decolorises ignore clear MP2 is dependent upon MP1 being awarded	1 1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	$C_{10}H_{22} \longrightarrow C_3H_6 + C_7H_{16}$		1	AO2 4.1.1.1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	fuels		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	the molecules collide more frequently at 750 °C		1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	(at 750 °C the rate of reaction is) higher	allow (at 450 °C the rate of reaction is) lower	1	AO2 4.6.1.2

Total Question 2	**12**

Answer 55 · Examiner comments

June 2022 | 8462/1F | Original Q6

Question 6 (Low and standard demand)

06.1 Nearly two thirds of students could select the correct diagram to show graphite. The structures of the two fullerenes were popular distractors.

06.2 Fewer than half of students could identify **D** as representing poly(ethene). All three other diagrams were popular, with **B** attracting a quarter of the responses.

06.3 Although a diagram was provided, only just over a half of students gave 4 as their answer.

06.4 The great majority of students could identify that diamond is very hard.

06.5 Just over half of the students could count the atoms in the figure and then write the formula correctly. Many failed to gain credit because the numbers were not subscripts but the same size as the letters, or even larger.

06.6 Just over a third of students could demonstrate their knowledge and understanding of acids to choose the hydrogen ion, with the majority of students opting for the hydroxide ion.

06.7 Over a half of students got the correct answer. The most common error was to assume there were three atoms of carbon as well as oxygen, giving an answer of 86. Other common errors were to add 1, 12 and 16 together, or to multiply relative atomic masses together.

Answer 56 · Examiner comments

June 2022 | 8462/2F | Original Q8

Question 8 (Standard demand)

08.1 This was well answered by a small minority of students with around 10% of students scoring both marks. The most common errors were to omit the double bond, to add additional bonds or atoms to the carbon atoms. Brackets and/or the inclusion of the letter n were ignored.

08.2 The better responses correctly referred to the insulation being burned or melted or the lack of purity or 'contamination' of the copper produced. Uncreditworthy responses often made comments such as 'so you only get copper'. Around 40% of the students scored this mark.

08.3 This was reasonably well answered as responses such as the copper melting and being reformed/moulded into new pipes were seen. Responses referring to 'heating the wire' were insufficient to gain credit. Around 40% of the students scored both marks.

08.4 The most common correct responses referred to the conservation of copper and the use of less energy in this process. Relatively few answers identified specified environmental impacts.

Weaker responses referred to 'pollution' alone which was too vague to gain credit. Some referred to cost without making a link to the amount of energy needed. Less than 10% of students were able to identify two advantages of recycling, though just over 40% could identify one.

08.5 The test for copper(II) ions was not well known.

A variety of tests were chosen, with the most common incorrect response being the use of flame tests. The addition of acids, especially hydrochloric acid, was also often suggested.

Acceptable results included shades of blue precipitate, e.g. pale/light blue, but answers giving two colours such as green/blue were not credited. Around 1% of students scored both the marks.

08.6 The use of barium chloride or barium nitrate as the reagent for the test was generally followed by the correct result.

The test was often incorrect, with the result, therefore, not able to be awarded a mark. The most common incorrect reponses were the use of a flame test or an incorrect reagent(s). Again, around 1% of students scored both the marks.

4.7.2.2 Reactions of alkenes

Answer 57 · Examiner comments

June 2023 | 8462/2F | Original Q2

Question 2 (Low demand)

02.1 More than two thirds of students were able to use the information provided in the table to provide two correct reasons as to why poly(propene) beakers should not be used to heat liquids. More students suggested that poly(propene) would burn rather than melt. Common incorrect responses did not refer to the effect of heat on poly(propene) instead referring to the effect of the liquid being heated on the polymer.

02.2 More than half of students used the information in the table to suggest a reason why using poly(propene) beakers could save money. The most common incorrect responses did not include a comparison to the glass beakers so that the unqualified 'because they are tough' added no value to the data in the table. Some students used the wrong column and said the poly(propene) does shatter (on impact) even though this then made no sense in the context of saving money.

02.3 More than half of students successfully identified boron trioxide as a raw material for making borosilicate glass.

02.4 More that 90% of students obtained at least one mark on this question (usually for completing the 'name' column correctly) with just over 50% achieving both marks. The most common incorrect response was to incorrectly identify the number of carbon atoms. A minority of students failed to identify the number of atoms but instead calculated the mass of each element.

02.5 This question was very well answered with over 80% of students correctly identifying the repeating unit of poly(propene). The distractors attracted roughly equal support.

02.6 Students struggled to recognise and correctly identify the stages needed to produce poly(propene) from the descriptions provided in the question. Quite often, correct processes were identified but sequenced incorrectly. Less than one-third of students obtained all three marks and less than half achieved 2 marks.

02.7 Just over one third of students achieved 2 marks to identify both of the words that described a hexene molecule during a polymerisation reaction. About half of students achieved 1 mark by identifying hexene as an alkene or by identifying it as a monomer.

4.7.2.2 Reactions of alkenes

Answer 58 · Examiner comments June 2023 | 8462/2F | Original Q9

Question 9 (Standard demand)

09.1 The calculation discriminated well. More than 25% of students successfully completed the calculation, usually showing full details of their working. Students need to be sufficiently familiar with their calculator to understand when it is appropriate to include a recurring dot over one or more digits, and also when it is not. Weaker responses included rounding errors.

09.2 Around half of students obtained both marks for correctly plotting all the points. Over 20% of students incorrectly plotted at least two of the points, with the most frequently seen error being to incorrectly identify the number of carbon atoms present, for example, plotting ethanol as having one carbon atom. If a line of best fit was drawn, this was ignored, as this was not required and is inappropriate in the context of a discrete variable on the x-axis.

09.3 Over 40% of students gained this mark. Any line of best fit drawn was ignored. The answer, within the tolerances stated in the mark scheme, was estimated from the plotted points alone and was as stated in the mark scheme unless misplotted points (usually for hexanol and/or heptanol) suggested otherwise.

09.4 Over 30% of students gained this mark, but the other three distractors were all popular.

09.5 Over 40% of students gained this mark. A small number asserted that the limewater became colourless or clear.

09.6 Less than one third of students gained this mark. 'Water' was not a popular distractor, but 'a halogen' and 'an alkali metal' were both frequently selected.

09.7 The carboxylic acid functional group was not well known.
Less than 2% of students were able to successfully complete the displayed structural formula for this functional group. Many students completed a square of points around the 4 atoms provided.

09.8 Over 20% of students gained both marks and a further 40% gained 1 mark. A number of students drew multiple lines from the boxes on the left.

Answer 59 · Examiner comments June 2024 | 8462/2F | Original Q6

Question 6 (low and standard demand)

06.1 The test for unsaturation is not well known by students. The question includes that bromine water is orange but only one in five students were able to correctly identify the colour change

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Answer 59 · Examiner comments June 2024 | 8462/2F | Original Q6

when bromine water is added to ethene. The most common incorrect responses were brown, black, and clear.

06.2 Just over 60% of students correctly identified the test for chlorine.

06.3 Around half of the students were able to correctly identify the displayed structural formula of the compound produced when chlorine reacts with ethene.

06.4 Around two thirds of students were able to correctly identify the structure of poly(chloroethene).

06.5 Over half the students successfully processed the density values and correctly evaluated them for two marks. Only two out of five of these students then went on to determine the simplest whole number ratio and achieve all three marks. Incorrect responses included the use of temperature values rather than density or simply rounding the density values to the nearest whole number.

06.6 Three out of five students were able to correctly identify why neither polymer was suitable to carry steam at 300 °C. Incorrect responses included those that just quoted values from the table or stated low melting temperatures without including any consequence of the high temperature to either the pipe or the polymer. An incorrect unit for temperature was frequently seen in responses.

06.7 ‘Sustainable’ is a poorly understood term with only one third of students correctly answering this question. Incorrect responses included reference to different stages in a life cycle assessment including comparisons in terms of the environmental consequences of different disposal methods for each material. Some students struggled to express that paper was made from a renewable resource, suggesting that paper is renewable or that paper can be regrown.

Answer 60 · Examiner comments

June 2025 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 Students found this very difficult, with only one in ten scoring the mark. Of those who knew they needed to count the ions of each element, few could then appreciate that the ratio was 1:1 so the formula was therefore CaS. Many just wrote the number of Ca atoms and of S atoms from the diagram.

09.2 Two fifths of students were able to score at least one mark, and one in eight scored all four. Many described electrons transferring from calcium to sulfur, and of those, most realised that 2 electrons would be transferred. Students were less able to gain the final marking point for a correct description of the ions formed. Some students contradicted an answer in terms of electron transfer by also referring to sharing electrons.

09.3 Students were unable to recall many details about the structure and bonding of graphite, even with the diagram as a prompt. Many did describe layers of carbon atoms, but few mentioned the giant structure or covalent bonding. Many focussed on the use of graphite in pencils, which was not relevant in the context of the question. Most responses did not mention the number of bonds per atom, or the delocalised electrons, or the lack of bonds between layers. The hexagonal rings, if mentioned at all, were not described well, with whole layers or even individual atoms being described as hexagonal. Fewer than a quarter of students scored a single mark and very few scored all four.

09.4 Only one in six students scored the mark, despite the clear statement in the specification that the molecules do not have an overall electrical charge. Those who did gain credit usually mentioned there being no delocalised electrons. 'Free' is not the same as delocalised in this context and did not gain credit. Popular incorrect responses were that the molecules are too small or that the molecules cannot move.

09.5 Only a third of students gave the correct reason, with stronger or more covalent bonds to break both being almost as popular.

4.7.2.2 Reactions of alkenes

Answer 61 · Examiner comments June 2025 | 8462/2F | Original Q2

Question 2

02.1 Half of the students correctly identified the alkene as propene. Both butene and ethene were commonly seen.

02.2 Over 80% of students were able to give the number of atoms in the molecule as 9.

02.3 Over two thirds of students correctly identified the use of alkenes.

02.4 Nearly 80% of students scored all three marks for plotting the bar chart. Of the remaining students, most scored two marks, the most common error was to plot the bar at 92, rather than 86.

02.5 The test for alkenes is not well known. Slightly more than 1 in 10 students scored either mark on this question. A full range of tests was seen, with nearly 30% of students did not attempt this item.

Answer 61 · Examiner comments June 2025 | 8462/2F | Original Q2

02.6 Nearly two thirds of students correctly completed the formula in the equation. Many students recognised that the number should be 7, but did not follow the conventions of writing formulas, so did not gain the mark because the 7 was too large. When writing formulas, it is expected that the tops of numbers are discernibly below the tops of upper-case letters.

02.7 Over half of students correctly identified the use of alkanes as fuels. Both distractors were frequently seen.

02.8 Nearly 90 % of students correctly answered this item.

02.9 Three quarters of students correctly compared the rates, with many explaining why the rate changes using the ideas from the previous item.