AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.6.2.1

Reversible reactions

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**12**
Available paper years	**2010–2025**

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.

4.6.2.1 Reversible reactions

Answer 01 · Mark scheme

June 2010 | CHY2F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	white to blue	accept colourless to blue	1
1(b)	reversible		1
Total			**2**

4.6.2.1 Reversible reactions

Answer 01 · Mark scheme

June 2010 | CHY2F | Original Q1 | Legacy

CHY2F

4.6.2.1 Reversible reactions

Answer 02 · Mark scheme

June 2011 | CHY2F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	NH_3		1
1(a)(ii)	electrons		1
1(a)(iii)	covalent		1
1(b)(i)	air natural gas		1 1
1(b)(ii)	reversible		1
1(b)(iii)	iron		1
1(c)	nitric acid		1
1(d)(i)	any **one** from: • lost jobs / unemployment • meant that they had to move away from Humberstone **or** no one lives there • loss of income (owtte)	 allow closed down the town ignore it closed the mine unless it is further qualified by some effect of this on the local community	1

Question 1 continues on the next page

4.6.2.1 Reversible reactions

Question 1 continued

question	answers	extra information	mark
1(d)(ii)	any **two** from: • less transport (costs) • less pollution / greenhouse gases / global warming <u>from transport</u> • cheaper to make in country than to import • not dependent on Chile for nitrate supplies **or** reliable source • provides employment to workers in Britain • good for British economy • raw materials readily available • continuous process	ignore reference to environment / ecofriendly allow smaller carbon footprint ignore reference to quicker	2
Total			**11**

4.6.2.1 Reversible reactions

Answer 02 · Mark scheme

June 2011 | CHY2F | Original Q1 | Legacy

CHY2F

4.6.2.1 Reversible reactions

Answer 03 · Mark scheme

January 2013 | CH1FP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)(i)	Positive impact any **one** from: • provides employment **or** • improves local economy • improved transport - new roads are built, new rail links • after use the quarry could provide recreation facilities Negative impact any **one** from: • destruction of animal habitats • fewer plants and trees to absorb carbon dioxide • visual pollution **or** noise pollution **or** atmospheric / air pollution • more traffic • uses non-renewable resources	 allow dust pollution allow pollutants from burning diesel	1 1
4(a)(ii)	economical		1
4(b)	carbon / coke burns (in oxygen / air)	accept carbon / coke reacts with oxygen / air	1
4(c)(i)	iron oxide (reactant) carbon dioxide (product)	must be words	1 1
4(c)(ii)	reduction		1

4.6.2.1 Reversible reactions

Answer 03 · Mark scheme

CH1FP

question	answers	extra information	mark
4(d)(i)	oxygen reacts with carbon **or** oxygen and carbon produce carbon dioxide / carbon monoxide carbon dioxide / carbon monoxide is a gas **or** the carbon is removed as a gas		1 1
4(d)(ii)	much harder		1
4(e)	Advantage: less carbon dioxide is produced Disadvantage: there are different types of steel which must be sorted		 1 1
Total			**12**

4.6.2.1 Reversible reactions

Answer 03 · Mark scheme

January 2013 | CH1FP | Original Q4 | Legacy

CH1FP

4.6.2.1 Reversible reactions

Answer 04 · Mark scheme June 2014 | CH1FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)(i)	economical		1	1 / 1.3.1a	A
5(a)(ii)	phytomining		1	1 / 1.3.1g	A
5(a)(iii)	carbon dioxide		1	1 / 1.3.1d/f	A
5(b)(i)	copper / Cu iron sulfate / $FeSO_4$		1 1	2 / 1.3.1h	E
5(b)(ii)	copper/ ions have a positive charge	it = copper ions allow copper ions have a different charge accept copper / ions are free to move accept to gain electrons accept copper / ions are attracted to the negative electrode **or** opposite charges attract	1	1 / 1.3.1h	E
5(c)	any **two** from: • copper ores are limited / running out • copper can be recycled • copper can be reused • copper is expensive • landfill sites are filling up • copper compounds are toxic	ignore not biodegradable or does not decay allow copper is running out allow copper is toxic	2	3 / 1.3.1j	E
Total			**8**		

4.6.2.1 Reversible reactions

Answer 04 · Mark scheme

June 2014 | CH1FP | Original Q5 | Legacy



4.6.2.1 Reversible reactions

Answer 05 · Mark scheme June 2014 | CH3FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)	⇌ ammonia	 allow NH_3	1 1	2 / 3.5.1b	E
4(b)	increases quickly at first *then slows* *at any number in range from 160 – 220 (atmospheres)*	 *ignore* levels off allow *rate of increase slows for first two marking points* *allow any number in range 60 – 66 (%)*	1 1 1	2 / 3.5	E
4(c)	(nitrogen and hydrogen) recycled	*allow (nitrogen and hydrogen) reused*	1	1 / 3.5.1b	E
4(d)(i)	*jobs lost*	accept mines closed **or** local economy damaged	1	3 / 3.5	E
4(d)(ii)	any **one** from: • *nitrates* / fertilisers cost less • more crops / food can be grown • food costs less • *nitrates / fertilisers more widely available*		1	3 / 3.5	E
Total			**8**		

4.6.2.1 Reversible reactions

Answer 05 · Mark scheme

June 2014 | CH3FP | Original Q4 | Legacy



4.6.2.1 Reversible reactions

Answer 06 · Mark scheme

June 2016 | CH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
6(a)	endothermic		1	AO1 2.5.1d
6(b)	82 (%)	correct answer with working gains **3** marks if 17 or 34 not shown in working **max 2** marks accept 82.4 accept 82.35 to full calculator display (82.35294...) correctly rounded to at least 2 sf if no answer or incorrect answer, then (M_r =) 17 gains **1** mark **or** 14/17 gains **2** marks **OR** ($2M_r$ =) 34 gains **1** mark **or** 28/34 gains **2** marks **OR** 14/their M_r shown gains **1** mark **or** correct calculation of 14/their M_r gains **2** marks	3	AO2 2.3.3a, 2.3.1f
6(c)(i)	7 / seven		1	AO1 2.6.2d
6(c)(ii)	$H^+ + OH^- \rightarrow H_2O$		1	AO1 2.6.2e
6(c)(iii)	ammonium chloride	allow NH_4Cl ignore an incorrect formula	1	AO1 2.6.2b

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / SpecRef
6(d)			6	2AO2 / 4AO3 2.6.2c

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.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

Examples of chemistry points made in response:

A reasonable suggested amount of fertiliser would be in the region of 200 kg (per ha). Accept any suggestion from about 180 kg (per ha) to 500 kg (per ha).

Yield:

- Using fertiliser improves yield.
- Yield improved most up to about 200 kg (per ha) of fertiliser.
- Yield only increased slightly above about 200 kg (per ha).

Profit:

- About 200 kg of fertiliser gives the most profit.
- Above about 200 kg (per ha) of fertiliser profit declines.

Run off:

- Run off is at low levels until about 300 kg (per ha) of fertiliser.
- Above about 300 kg (per ha) of fertiliser, run off increases.

Examples of linking of ideas:

- Overall 200 kg gives high crop yield and most profit.
- In conclusion 200 kg gives high crop yield and low run off.
- 200 kg gives most profit and low run off.

Examples of compromise:

- Profits go down after about 200 kg (per ha) of fertiliser because cost of fertiliser is not covered by increased yield.
- 200 kg gives the highest profit although it is not the highest yield.
- 500 kg gives the best yield but has the most runoff.

Total			13

4.6.2.1 Reversible reactions

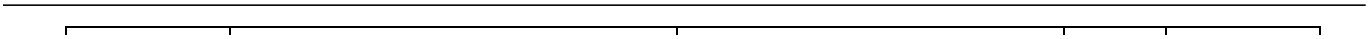
Answer 07 · Mark scheme June 2016 | CH3FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
4(a)(i)	nitrogen: air hydrogen: natural gas		1 1	AO1 3.5.1a
4(a)(ii)	as a catalyst so the reaction speeds up	 allow lowers activation energy or so a lower temperature can be used	1 1	AO1/AO2 3.5.1b
4(a)(iii)	cooled ammonia condenses / liquefies	 allow nitrogen **and** hydrogen remain in the gaseous state	1 1	AO1/AO2 3.5.1b
4(a)(iv)	recycled	allow reused or returned to the reactor	1	AO1 3.5.1b
4(b)	reversible arrows hydrogen **and** ammonia		1 1	AO1 3.5.1b
Total			**9**	

4.6.2.1 Reversible reactions

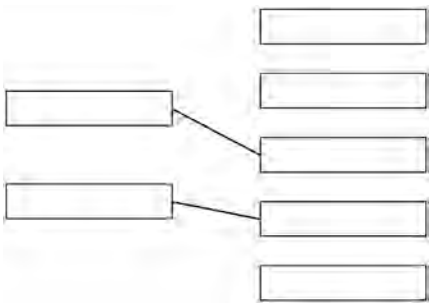
Answer 07 · Mark scheme

June 2016 | CH3FP | Original Q4 | Legacy



4.6.2.1 Reversible reactions

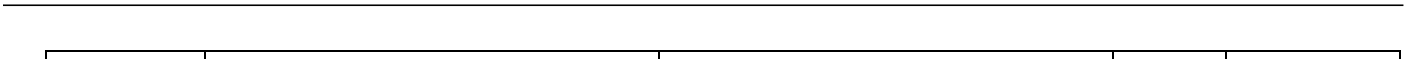
Answer 08 · Mark scheme June 2018 | 8462/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	reactant		1	AO1 4.6.2.1
01.2	reversible		1	AO1 4.6.2.1
01.3	blue	allow shades of blue, eg pale blue	1	AO1 4.6.2.2
01.4	1.6 (g)		1	AO2 4.6.2.2
01.5	$\frac{0.9}{2.5} \times 100$ = 36 (%)	an answer of 36 (%) scores **2** marks	1 1	AO2 4.6.2.2
01.6		copper sulfate – $CuSO_4$ water – H_2O	1 1	AO2 4.1.1.1 AO1 4.1.1.1
Total			**8**	

4.6.2.1 Reversible reactions

Answer 08 · Mark scheme

June 2018 | 8462/2F | Original Q1



4.6.2.1 Reversible reactions

Answer 09 · Mark scheme

June 2019 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(equation contains a) ⇌ (symbol)	allow description of arrow / symbol	1	AO1 4.6.2.1
03.2	exothermic		1	AO1 4.6.2.2
03.3	to reduce costs to use less energy		1 1	AO3 4.6.1.4
03.4	(the world production of ammonia) increased (the increase was) not steady / linear	 do **not** accept decreases ignore levels off	1 1	AO2 4.10.4.1
03.5	the demand for food changed the world population changed		1 1	AO2 AO3 4.10.4.2
03.6	**C** and **D**		1	AO3 4.10.4.2
03.7	**D**		1	AO3 4.10.4.2
Total			**10**	

Answer 10 · Mark scheme

November 2021 | 8462/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(equation contains the symbol) ⇌	allow description of arrow / symbol	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the mass of each substance does not change the rates of the forward reaction and reverse reaction are equal		1 1	AO3 AO1 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	the mixture will have become a paler purple		1	AO3 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	increases decreases increases	must be in this order	1 1 1	AO1 4.6.1.2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	change the temperature **or** add a catalyst	ignore references to pressure	1	AO1 4.6.1.2 4.6.1.3

Total			8

4.6.2.1 Reversible reactions

Answer 11 · Mark scheme

June 2023 | 8462/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	water (vapour) is colourless (calcium hydroxide and calcium oxide are) both white (powders / solids) **or** there is no change in the appearance of the powder / solids	allow water vapour cannot be seen	1 1	AO3 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the stopper would be pushed out	allow test tube may break	1	AO3 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	the mass of the empty test tube		1	AO2 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	5 minutes		1	AO2 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(mass =) 2.00 – 1.51 = 0.49 (g)		1 1	AO2 4.3.1.1 4.6.2.1

4.6.2.1 Reversible reactions

Answer 11 · Mark scheme

June 2023 | 8462/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	5.90 kJ		1	AO2 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	endothermic		1	AO2 4.6.2.2

Total Question 4	9

4.6.2.1 Reversible reactions

Answer 12 · Mark scheme

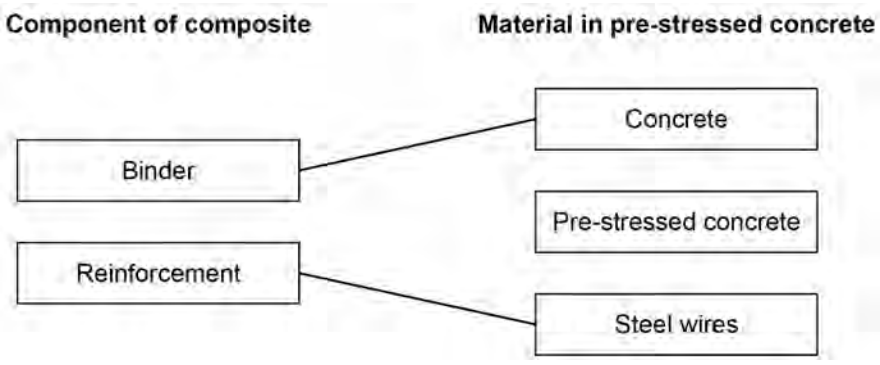
June 2025 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(the sign) ⇌	allow a description of the reversible sign	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	endothermic	allow (thermal) decomposition	1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(energy released =) $\frac{4}{20} \times 23$ = 4.6 (kJ)		1 1	AO2 4.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
03.4	 do **not** accept more than one line from a box on the left	1 1	AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	iron	allow Fe	1	AO1 4.10.3.2

4.6.2.1 Reversible reactions

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	clay		1	AO1 4.10.3.3

Total Question 3	**8**

4.6.2.1 Reversible reactions

Answer 08 · Examiner comments

June 2018 | 8462/2F | Original Q1

Question 1 (low demand)

01.1 58% of answers were correct, although 'product' was given by 25% of students.

01.2 95% of students could correct identify the reversible reaction symbol.

01.3 69% of the responses were correct.

01.4 Again, this question was answered well with 72% of students realising that this was a subtraction and carried it out correctly.

01.5 55% of students could answer this percentage calculation correctly. Where errors occurred it was usually caused by the student involving the mass of anhydrous copper sulfate (1.6 g) calculated in the previous part of the question.

01.6 99% of students got the formula for water, with 71% able to identify sulfuric acid's formula.

4.6.2.1 Reversible reactions

Answer 11 · Examiner comments

June 2023 | 8462/2F | Original Q4

Question 4 (Low and standard demand)

04.1 Students found this question challenging, with fewer than 50% of students being able to interpret the information provided in the table and achieve marks. Incorrect responses often failed to identify that the colourless gas was water vapour or confused reactants and products. Less than 20% of students achieved 2 marks for this question.

04.2 Students found this question challenging with less than 20% of students achieving this mark. From the responses it appears that many students are unfamiliar with the term 'stopper'.

The most common incorrect responses were those that suggested that the solid would still be able to escape the tube or that the reaction in some way required oxygen. Others correctly suggested that the pressure in the tube would increase but failed to include a possible consequence of this.

04.3 Less than half of students were able to identify the other measurement needed to calculate the mass of the contents in the test tube. 'The mass of the contents of the test tube at the start' was a very common incorrect response.

04.4 More than two thirds of students correctly identified the minimum heating time for the calcium hydroxide. '6 minutes' was often seen.

04.5 Less than 50% of the students gained two marks. The most common incorrect response was to total all the individual mass readings.

04.6 Around 40% of students correctly identified that in this reversible reaction the energy taken in from the surrounding would equal that released in the reverse reaction.

04.7 Over two thirds of students correctly identified the forward reaction as endothermic. Very few selected 'combustion'.

4.6.2.1 Reversible reactions

Answer 12 · Examiner comments June 2025 | 8462/2F | Original Q3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students

Question 3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students were able to identify iron. Aluminium and copper were the most frequently seen incorrect answers.

Answer 12 · Examiner comments June 2025 | 8462/2F | Original Q3

03.6 Three quarters of students correctly identified clay. Poly(ethene) was the most common incorrect response.