AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.2.3

Test for carbon dioxide

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**13**
Available paper years	**2007–2023**

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.

4.8.2.3 Test for carbon dioxide

Answer 01 · Mark scheme

June 2007 | CHY1A | Original Q3 | Legacy

Three	**1**	**2**	**2**	**3**

4.8.2.3 Test for carbon dioxide

Answer 02 · Mark scheme June 2010 | CHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	(thermal) decomposition	allow it breaks down accept symbol equation or in words allow reaction with SO_2 (to form CO_2)	1
5(a)(ii)	calcium carbonate / calcium oxide / limestone / quicklime / it reacts with sulfur dioxide / forms calcium sulfate	accept it neutralises sulfur dioxide / neutralisation ignore references to sulfur do not accept 'calcium reacts with…'	1
5(b)	by incomplete / partial combustion (of the fuel) insufficient oxygen / *air* (to burn fuel)	 accept insufficient oxygen / *air* to burn fuel completely for **2** marks if no other marks awarded accept $C + CO_2 \rightarrow 2CO$ **or** $2C + O_2 \rightarrow 2CO$ **or** in words for **1** mark	1 1

Question 5 continues on the next page

4.8.2.3 Test for carbon dioxide

CHY1H

Question 5 continued

question	answers	extra information	mark
5(c)(i)	any **two** from: • (CO_2) from the atmosphere • (CO_2) taken in millions of years ago **or** early (atmosphere) • (CO_2) was used to form the shells / skeletons of marine organisms / fossil fuels	allow thousands / billions allow rocks formed millions of years ago accept sedimentary rocks allow used to form correct named fossil fuel ignore limestone	2
5(c)(ii)	any **one** from: • *(*increases / enhances*)* global warming • is additional carbon dioxide **or** not able to be absorbed by oceans / seas **or** used by (green) plants • acidification of sea water	allow greenhouse gas / effect do **not** accept ozone layer / acid rain / global dimming ignore consequences of global warming	1
Total			**7**

4.8.2.3 Test for carbon dioxide

Answer 02 · Mark scheme June 2010 | CHY1H | Original Q5 | Legacy

CHY1H

Answer 03 · Mark scheme November 2010 | CHY1AP | Original Q2 | Legacy

Two	**A**	Water			**4**
	B	Calcium oxide			**3**
	C	Calcium carbonate			**1**
	D	Carbon dioxide			**2**
	A		**B**	**C**	**D**

4.8.2.3 Test for carbon dioxide

Answer 04 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)	because they are gases	ignore vapours / evaporate / (g) allow it is a gas	1
2(b)(i)	80 / 79.5	correct answer with or without working = **2** marks ignore units if no answer **or** incorrect answer then evidence of 64 / 63.5 + 16 gains **1** mark	2
2(b)(ii)	80 / 79.87 / 79.9 / 79.375 / 79.38 / 79.4	correct answer with or without working = **2** marks if no answer **or** incorrect answer then evidence of $\frac{64}{80}$ **or** $\frac{63.5}{79.5}$ (x100) gains **1** mark accept (ecf) $\frac{64 or 63.5}{answer(b)(i)}(\times 100)$ for **2** marks if correctly calculated. if incorrectly calculated evidence of $\frac{64 or 63.5}{answer(b)(i)}(\times 100)$ gains **1** mark	2
2(b)(iii)	3.2	correct answer with or without working = **1** mark allow (ecf) 4 x ((b)(ii)/100) for **1** mark if correctly calculated	1

Question 2 continues on the next page

4.8.2.3 Test for carbon dioxide

Question 2 continued

question	answers	extra information	mark
2(c)(i)	3.3	accept 3.33…….. or $3\frac{1}{3}$ or 3.3• or 3.3^{r}	1
2(c)(ii)	measure to more decimal places **or** use a more sensitive balance / apparatus	allow use smaller scale (division) **or** use a smaller unit ignore accurate / repeat	1
2(c)(iii)	any **two** from: • different balances used **or** faulty balance • reading / using the balance incorrectly **or** recording error • spilling copper oxide / copper • copper oxide impure • not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used • heated for different times • heated at different temperatures • some of the copper made is oxidised / forms copper oxide • some of the copper oxide / copper blown out / escapes (from tube) • some water still in the test tube	ignore systematic / human / apparatus / zero / measurement / random / weighing / reading errors unless qualified ignore dirty apparatus accept incorrect weighing of copper / copper oxide allow some copper left in tube allow impure copper (produced) accept not all copper oxide (fully) reacted accept Bunsen burner / flame at different temperatures ignore some copper oxide / copper lost	2
Total			**10**

4.8.2.3 Test for carbon dioxide

Answer 04 · Mark scheme

June 2011 | CHY2H | Original Q2 | Legacy

CHY2H

4.8.2.3 Test for carbon dioxide

Answer 05 · Mark scheme

January 2012 | CH1HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	limewater **or** calcium hydroxide solution		1
	(reacts with carbon dioxide and) turns cloudy / milky	linked to first point if no other mark awarded 'puts out lighted splint' gains **1** mark	1
6(b)(i)	any **two** from: • same volume / amount of the acids • concentration of the acids • temperature • same surface area / size / mass / amount of calcium carbonate • same measuring equipment		2

Question 6 continues on the next page…….

4.8.2.3 Test for carbon dioxide

CH1HP

Question 6 cont'd…

question	answers	extra information	mark
6(b)(ii)	any **three** from: • (after about 4 minutes) the sulfuric acid stops reacting **or** nitric acid continues to react • (initially) the reaction with sulfuric acid is faster • (the reaction stops) because calcium sulfate is a solid • (the reaction continues) because calcium nitrate is soluble / in solution / aqueous • because the calcium sulfate prevents the sulfuric acid reacting with the calcium carbonate • (the rate is faster) because sulfuric acid contains two hydrogens	accept more CO_2 with nitric acid at any time after 4 minutes allow sulfuric acid produces a solid allow nitric acid produces an (aqueous) solution	3
Total			**7**

4.8.2.3 Test for carbon dioxide

Answer 05 · Mark scheme

January 2012 | CH1HP | Original Q6 | Legacy

CH1HP

4.8.2.3 Test for carbon dioxide

Answer 06 · Mark scheme

January 2013 | CH1HP | Original Q2 | Legacy

question	answers	extra information	mark
2(a)	time from when the heating is started until the limewater turns cloudy / milky		1 1
2(b)(i)	the temperature was not high enough the bubbles of gas were air	accept the copper carbonate had not started to decompose / react accept it takes time to heat up the copper carbonate accept no carbon dioxide produced	1 1
2(b)(ii)	the copper carbonate was decomposing / reacting so carbon dioxide was produced	accept the temperature was high enough to cause decomposition / a reaction allow correct word / symbol equation	1 1
2(b)(iii)	copper oxide was produced because the copper carbonate had completely decomposed / reacted	allow correct word / symbol equation ignore all of the carbon dioxide had been given off	1 1
Total			**8**

4.8.2.3 Test for carbon dioxide

Answer 06 · Mark scheme

January 2013 | CH1HP | Original Q2 | Legacy

CH1HP

4.8.2.3 Test for carbon dioxide

Answer 07 · Mark scheme June 2013 | CH2HP | Original Q6 | Legacy

Question 6

question	Answers	extra information	Mark
6(a)	has simple / small molecules the intermolecular forces / intermolecular bonds (are weak) only need a small amount of energy to be overcome	accept molecular covalent do **not** accept weak covalent bonds **or** reference to incorrect bonding accept only need a small amount of energy to separate the molecules if no other mark awarded, allow it has a low boiling point for **1** mark	1 1 1
6(b)(i)	to separate		1
6(b)(ii)	(relative) molecular mass	allow M_r / (R)MM / relative mass / mass of molecule / (R)FM	1
6(c)(i)	any pH value from 0 to 6.9		1
6(c)(ii)	hydrogen	allow H^+ ignore H / H_2 / H^-	1
6(d)	any **three** from: • same number of protons • ^2H has one neutron • ^1H has no neutrons • same number of electrons	 accept same atomic number numbers if given must be correct accept different mass number **or** different number of neutrons for **1** mark ignore relative atomic mass numbers if given must be correct	3
Total			**10**

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

4.8.2.3 Test for carbon dioxide

Answer 08 · Mark scheme

June 2016 | CH1HP | Original Q3 | Legacy

Question 3

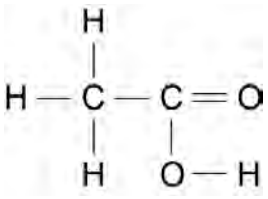
Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	(thermal) decomposition	allow decomposes or endothermic	1	AO1 1.2.1b/c
3(a)(ii)	copper oxide		1	AO2 1.2.1b/c
3(b)(i)	the (potassium) carbonate did not decompose/change/react (when heated) the mass did not change or the limewater did not go cloudy because no carbon dioxide produced	allow temperature not high enough do **not** allow potassium did not decompose ignore references to reactivity	1 1 1	AO1+AO2 +AO3 1.2.1c/e; 4.5.4a
3(b)(ii)	the less reactive the metal the more (easily) its carbonate will decompose/react or vice versa	needs to be a relative comparison allow max **1** mark where the distinction between a metal and its carbonate is not clear allow **1** mark for carbonates of reactive metals do not decompose or vice versa	2	AO3 1.2.1 c; 1.3
3(c)(i)	make it economical (to extract the metal/iron)	allow make it worth extracting allow so they can make money/profit	1	AO1 1.3.1a
3(c)(ii)	Fe balanced correctly (2,3,4,3)	 not ecf allow correct balanced equation but with $2Fe_2$ on right for one mark	1 1	AO2 1.1.3b; 1.3.2c

4.8.2.3 Test for carbon dioxide

3(c)(iii)	**iron** from the blast furnace is brittle **steel** produced is strong / flexible	"it" = iron allow steel has more/specific uses allow steel is rust-resistant	1 1	AO1 1.3.2a/b/c
3(c)(iv)	(recycling) is used to conserve iron (ore) **or** energy **or** resources **or** minimise pollution **or** reduce the need to quarry (not reuse) because of damage, paint removal, rusting/corrosion, metal fatigue/weaker (not landfill) because sites have limited space **or** loss of habitats	allow reverse arguments. allow to reduce the use of landfill	1 1 1	AO1+AO2 1.3.1j
Total			**15**	

4.8.2.3 Test for carbon dioxide

Answer 09 · Mark scheme June 2016 | CH3HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
1(a)(i)	fizz / effervescence / bubbles	allow calcium carbonate decreases in size or dissolves	1	AO2/AO3 3.4.1d, 3.6.2b
	because carbon dioxide produced / released	allow because gas produced / released	1	
	limewater turns cloudy / milky / white		1	
	because (a precipitate of or solid) calcium carbonate forms	allow because of carbon dioxide if not already credited	1	
1(a)(ii)		allow –OH do not allow lower case 'h'	1	AO1 3.6.2a
1(a)(iii)	acid	must be in this order ignore any name of an acid	1	AO1 3.6.2b
	ester(s)		1	
1(b)	white (precipitate) no change no change no change	all four correct 2 marks any two correct 1 mark	2	AO2 3.4.1e,f
1(c)(i)	lilac red	must be in this order allow purple	1 1	AO1 3.4.1a
1(c)(ii)	colours are masked / changed by each flame colour		1	AO3 3.4.1a
Total			12	

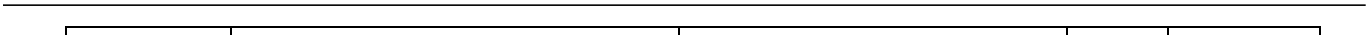
4.8.2.3 Test for carbon dioxide

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / SpecRef</th></tr>
<tr><td>2</td><td></td><td></td><td>6</td><td rowspan="6">2AO1 / 3AO2 / 1AO3
3.4.1g</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4"><table>
<tr><th>0 marks</th><th>Level 1 (1–2 marks)</th><th>Level 2 (3–4 marks)</th><th>Level 3 (5–6 marks)</th></tr>
<tr><td>No relevant content.</td><td>There is a simple description of using some of the apparatus.</td><td>There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.</td><td>There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.</td></tr>
</table></td></tr>
<tr><td colspan="4">examples of chemistry points made in the response could include:
• acid in burette or flask
• alkali/sodium hydroxide or acid in burette or flask
• volume of acid or alkali measured using the pipette
• indicator in flask
• white tile under the flask
• slow addition
• swirling/mixing
• colour change of indicator
• burette volume measured</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Total</td><td></td><td></td><td>6</td><td></td></tr>
</table>

4.8.2.3 Test for carbon dioxide

Answer 09 · Mark scheme

June 2016 | CH3HP | Original Q1 | Legacy



4.8.2.3 Test for carbon dioxide

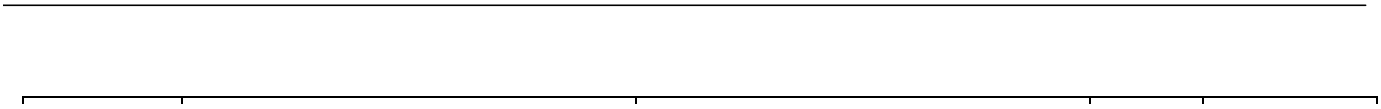
Answer 10 · Mark scheme June 2017 | CH1HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	same number of protons **or** 12 protons in each	ignore electrons ignore it is the same element do **not** allow same number of neutrons	1	AO2 1.1.1f,g
1(a)(ii)	(the mass number is) the sum of the protons and neutrons (so the atoms contain) different numbers of neutrons	ignore electrons in shells do **not** allow electrons in nucleus allow 12, 13 and 14 neutrons for two marks if no other mark awarded allow one mark for isotopes	1 1	AO1 AO2 1.1.1g
1(b)(i)	3 / three		1	AO2 1.1.3a,b
1(b)(ii)	7 / seven		1	AO2 1.1.3a,b
1(c)	319 g($CuSO_4$) and 36 g(H_2O)		1	AO3 1.1.3b,c
1(d)	any **two** changes from: • limewater turns cloudy • solution turns blue • mass decreases • copper carbonate **or** (green) solid disappears • bubbles / fizzing / effervescence explanation: because carbon dioxide is produced **or** copper sulfate is produced **or** calcium carbonate is produced	allow milky / white allow weight decreases explanation must be linked to their observation	2 1	AO1 AO2 AO3 1.2.1e,f
Total			**9**	

4.8.2.3 Test for carbon dioxide

Answer 10 · Mark scheme

June 2017 | CH1HP | Original Q1 | Legacy



4.8.2.3 Test for carbon dioxide

Answer 11 · Mark scheme

June 2019 | 8462/2H | Original Q2

Question 2

Question	Answers	Mark	AO/ Spec. Ref
02.1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.8.2.3 4.8.3.1 4.8.3.3
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content lithium: • crush tablets or dissolve tablet (in water or acid) • clean wire • place on wire • place in (roaring / blue / non-luminous) flame • observe flame colour • crimson flame carbonate: • add hydrochloric acid • effervescence / fizzing • bubble gas through limewater • limewater becomes cloudy		
02.2	formulation(s)	1	AO1 4.8.1.2

4.8.2.3 Test for carbon dioxide

Answer 11 · Mark scheme

02.3	1.20 g = 1200 mg **or** 700 mg = 0.700 g	an answer of 58.3333333 (%) correctly rounded to at least 2 significant figures scores **3** marks	1	AO2 4.8.1.2
	$\frac{700}{1200} \times 100$ **or** $\frac{0.700}{1.20} \times 100$	allow correct use of incorrectly or not converted values from step 1	1	
	= 58.3 (%)	allow 58.3333333 (%) correctly rounded to at least 2 significant figures	1	
Total			**10**	

4.8.2.3 Test for carbon dioxide

Answer 12 · Mark scheme

November 2020 | 8462/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**test:** (use a) glowing splint **result:** relights	do **not** accept burning splint dependent on correct test in MP1 ignore with a pop	1 1	AO1 4.8.2.2 4.9.1.3
09.2	starch cellulose	 allow glycogen	1 1	AO1 4.7.3.4
09.3	2		1	AO1 4.7.3.3
09.4	water	allow H_2O	1	AO1 4.7.3.3
09.5	ammonia nitrogen	 if no other mark awarded, allow **1** mark for NO / NO_2 / N_2O / NO_x or equivalent named compounds	1 1	AO3 4.7.3.3 4.9.1.2

4.8.2.3 Test for carbon dioxide

Question 9 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	two polymer chains	allow two polymer strands	1	AO1 4.7.3.4
	four (different) monomers / nucleotides	allow four (different) bases allow cytosine, guanine, adenine and thymine allow C G A T	1	
	(double) helix	allow spiral	1	
		if no other mark awarded, allow **1** mark for DNA		

Total			**11**	

4.8.2.3 Test for carbon dioxide

Answer 13 · Mark scheme

June 2023 | 8462/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(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.
02.2	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.
02.3	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

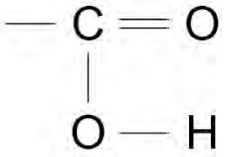
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	calcium hydroxide		1	AO1 4.8.2.3

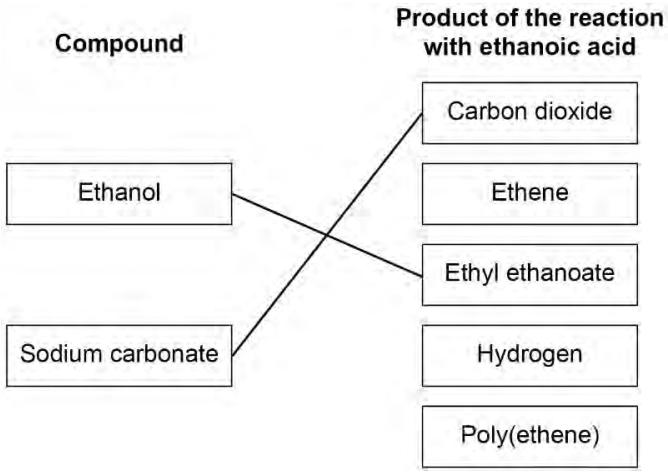
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(limewater turns) milky / cloudy	allow white precipitate (formed) allow calcium carbonate is produced	1	AO1 4.8.2.3

4.8.2.3 Test for carbon dioxide

Answer 13 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7			1	AO1 4.7.2.4

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

Total Question 2	11

4.8.2.3 Test for carbon dioxide

Answer 12 · Examiner comments November 2020 | 8462/2H | Original Q9

Question 9 (standard / high and high demand)

09.1 This part was not very well attempted. Those students who gave the correct test almost always gave the correct result too. However, many tests for carbon dioxide were seen, because students had focused on the first bullet point rather than the whole question. Splints that have been **put out** do not relight. Nor do **lighted** splints as they are already burning.

Answer 12 · Examiner comments November 2020 | 8462/2H | Original Q9

09.2 These polymers were not well known. Other naturally occurring polymers were frequently seen, such as DNA and proteins. Many students stated that water, oxygen and carbon dioxide are polymers.

09.3 The majority of students knew that there are two functional groups in amino acids.

09.4 The majority of students knew that water was the other product of the polymerisation.

09.5 The vast majority of students scored the mark for nitrogen. Very few scored the mark for ammonia.

09.6 Most students identified a double helix, fewer mentioned four monomers, nucleotides or bases and very few referred to two polymer chains.

4.8.2.3 Test for carbon dioxide

Answer 13 · Examiner comments

June 2023 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 This simple calculation was answered correctly by more than three-quarters of the students. Occasionally errors were seen using 38.9 kJ/g rather than 39.8 kJ/g. In these cases, it was impossible to tell whether this was a transcription error or use of the value for hexanol. Either way, we cannot award credit for transcription errors.

02.2 Nearly 9 in 10 students were able to plot the data within tolerance on all points. However, nearly all drew a line of best fit, which for a discrete variable in this context was not appropriate. These lines of best fit were ignored.

02.3 Around two-thirds of students gained this mark. 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.

02.4 Fewer than half of students knew that lime water is aqueous calcium hydroxide.

02.5 Around 90% of students could describe the result of this test adequately to gain credit.

02.6 More than half of the students gave a correct response. ‘An alkali metal’ was a strong distractor.

02.7 This was not well known, with only around 30% scoring the mark. Many students completed a square of bonds around the four atoms provided.

02.8 More than half of the students gained both marks. There was no discernible pattern amongst those who scored one mark.