AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.2.2.2

State symbols

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**4**
Available paper years	**2019–2022**

Using this booklet

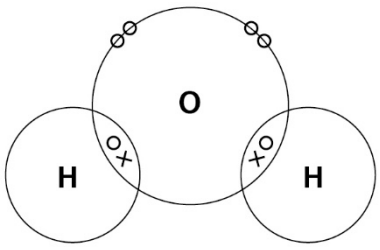
1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

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.

5.2.2.2 State symbols

Answer 01 · Mark scheme June 2019 | 8464/C/1F | Original Q5

05.1	(g)	allow g ignore formulae	1	AO1 5.2.2.2
05.2	40 (%)		1	AO2 5.1.1.1
05.3		an answer of 3.94 (g) scores **3** marks		AO2 5.3.1.3
	$\frac{3.76 + 3.98 + 4.09}{3}$ **or** $\frac{11.83}{3}$		1	
	= 3.943(333333333333333)		1	
	= 3.94 (g)	allow a correctly written answer to 3 significant figures from an incorrectly calculated mean	1	
05.4		allow combination of circles, dots, crosses or $e^{(-)}$		AO1 5.2.1.4
	one shared pair in each overlap	do **not** accept extra electron(s) on outer shell of hydrogen	1	
	4 non-bonding electrons in outer shell of oxygen	ignore any inner shell electrons	1	
		 diagram scores 2 marks		

5.2.2.2 State symbols

Answer 01 · Mark scheme

June 2019 | 8464/C/1F | Original Q5

05.5	covalent		1	AO1 5.2.2.1 5.2.2.4

05.6	higher (than) stronger (than between oxygen molecules)		1 1	AO2 5.2.2.4

Total			**10**

5.2.2.2 State symbols

Answer 01 · Mark scheme

June 2019 | 8464/C/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.2.2.2 State symbols

Answer 02 · Mark scheme June 2019 | 8464/C/1F | Original Q7

07.1	(aq)	allow aq ignore aqueous ignore formulae	1	AO1 5.2.2.2
07.2	HNO_3		1	AO1 5.1.1.1 5.4.2.2
07.3	red purple **or** blue	allow orange or yellow do **not** accept green allow shades of purple e.g. violet	1 1	AO1 5.4.2.4
07.4	D		1	AO3 5.4.2.4
07.5	 3 × 16 **or** 48 $\frac{48}{80}$ (×100) 60 (%)	an answer of 60 (%) scores **3** marks an answer of 20 (%) scores **2** marks for: $\frac{16}{80}$ (× 100) (1) = 20 (%) (1)	 1 1 1	AO2 5.3.1.2

5.2.2.2 State symbols

Answer 02 · Mark scheme

June 2019 | 8464/C/1F | Original Q7

Question	Answers	Mark	AO/ Spec. Ref
07.6	**Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 AO2
	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	5.5.1.1
	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 **Steps** • use a suitable container e.g. test tube • use insulation • add water • measure the initial water temperature (with a thermometer) • add stated mass e.g. 1g **or** 1 spatula • stir (to dissolve the solid) • measure the final (allow lowest or highest) temperature of the solution • calculate the temperature difference **or** determine graphically • repeat with different masses • repeat with the same volume of water to access level 3 there must be an indication of how the temperature change is determined using different masses dissolved in the same quantity of water		

Total			**14**

5.2.2.2 State symbols

Answer 03 · Mark scheme

November 2021 | 8464/C/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	green to red		1	AO1 5.4.2.4
07.2	decreases		1	AO1 5.4.2.4
07.3	(aq)	allow aq ignore aqueous ignore HNO_3	1	AO1 5.2.2.2
07.4	any **two** from: • (white) solid disappears • fizzing **or** bubbles (of gas) **or** effervescence • (then) stops fizzing • (white) solid left at the end / bottom	allow a gas is produced ignore colourless solution	2	AO3 5.4.2.2 5.4.2.3
07.5	$Zn(NO_3)_2$		1	AO2 5.1.1.1 5.4.2.2

5.2.2.2 State symbols

Question	Answers	Mark	AO / Spec. Ref.
07.6	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 5.4.2.2 5.4.2.3 RPA8
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method 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: • react hydrochloric acid • (with) copper oxide • in a suitable container • warm (hydrochloric) acid • add copper oxide • until is in excess **or** until solid remains • stir • filter excess copper oxide • pour solution / filtrate into evaporating basin • use of water bath **or** use of electric heater • to heat gently **or** partially evaporate • leave to cool / crystallise For level 3 the correct chemicals must have been selected.		
Total		**12**	

5.2.2.2 State symbols

Answer 04 · Mark scheme

June 2022 | 8464/C/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	hydrogen chloride	allow hydrochloric acid	1	AO1 5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(g)		1	AO1 5.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	⇌	allow reversible sign / arrow	1	AO1 5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	exothermic		1	AO1 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	rate		1	AO1 5.6.2.3

5.2.2.2 State symbols

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	C		1	AO1 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **one** from: • increases rate of reaction • reduces energy required • lower temperature can be used		1	AO1 5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	formulation		1	AO1 5.8.1.2

Total Question 3		**8**

5.2.2.2 State symbols

Answer 03 · Examiner comments

November 2021 | 8464/C/1F | Original Q7

Question 7 (standard demand)

07.1 Approximately one quarter of students were able to give the colour change, 'green to red', as the observed change when nitric acid is added to a mixture of universal indicator and water.

07.2 Many students appeared to confuse the increase in acidity when nitric acid is added to water with an increase in pH, which proved to be a strong distractor.

07.3 Very few students were able to give (aq) as the state for a substance dissolved in water.

07.4 The required practical activity of making a soluble salt starts by reacting either an insoluble metal oxide or metal carbonate with an acid. The word equation was provided to help students with this question although many students found difficulty in making links between this and the resulting observations. Since carbon dioxide is produced, initial observations would be fizzing and white solid disappearing. Excess zinc carbonate would result in all the nitric acid reacting; fizzing would stop and excess solid would collect at the bottom. Just under one fifth of students gained a mark.

07.5 Zn_2NO_3 proved a more commonly seen response than $Zn(NO_3)_2$, the correct answer. Just under one quarter of students answered this correctly.

07.6 Students had difficulty in describing the essential steps of the method of making a soluble salt from an insoluble metal oxide and an acid. Most failed to select the correct chemicals, copper oxide and hydrochloric acid, without these the method would not lead to a valid outcome. Just under one third of students gave a level one answer and very few got into level two.

5.2.2.2 State symbols

Concluding Remarks

The demand of this paper was similar to those previously set for this specification. Students should note that two-mark questions require two answer points and so on.

15% of marks are based upon the required practical activities; students should question 'what and why' is happening in each step of these procedures. Answers should be chemically accurate, e.g. crystals are produced from salt solutions when the solution is heated (partially evaporated to produce a more concentrated solution) and then left to crystallise, rather than implying that 'all the water was evaporated'.

In chemistry 20% are marks are for questions assessing mathematical skills. In these questions, students should show their working for each step. If an error is made, such as an incorrect evaluation of values in the question, credit can be awarded for each correct step shown. Students should be encouraged to think about their answers; in **01.5** a small number gave percentages in excess of 100. In **01.7** students did not always disregard the anomalous result but were able to get a mark for the correct division of all four values. A few were unable to give the answer to two significant figures. In **02.6** students needed to use all the data provided and to use the ratio of volumes to evaluate the mass. In **04.4** a minority of students multiplied, rather than adding, the relative atomic masses. In **06.5** not all students used all the data provided to evaluate the relative atomic mass, a weighted mean of the mass numbers.

5.2.2.2 State symbols

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

5.2.2.2 State symbols

Answer 04 · Examiner comments — June 2022 | 8464/C/2F | Original Q3

Question 3

The equilibrium identified in this question is detailed in the specification, however, many students found the questions challenging.

03.1 Around half of the students were able to identify hydrogen chloride or hydrochloric acid as the other product.

03.2 Students were told that ammonia is a gas in the stem of the question. However only half of the students gained the mark on this item.

03.3 Nearly two thirds of students were able to either draw the equilibrium symbol or describe the symbol with sufficient clarity.

03.4 Three quarters of students identified the reverse reaction as exothermic.

03.5 Approximately 60% of students were able to identify rate in this item. Nearly all the incorrect responses were concentration.

Answer 04 · Examiner comments — June 2022 | 8464/C/2F | Original Q3

03.6 Less than a third of students identified C correctly. The most common incorrect responses were B and D with similar numbers identifying each.

03.7 Approximately one third of students gained a mark here. The most common correct response was for increasing the rate. Responses such as catalysts were not used up or catalysts could be reused did not answer the question.

03.8 In this open question only 1 in 20 students were able to identify a formulation. Bleach was the most seen incorrect response.