AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.1.1

Conservation of mass and balanced chemical equations

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**17**
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.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 01 · Mark scheme

June 2007 | CHY1A | Original Q1 | Legacy

Question	Key		
One	**A**	atom	**3**
	B	compound	**2**
	C	element	**4**
	D	symbol	**1**

Answer 02 · Mark scheme

June 2007 | CHY1F | Original Q7 | Legacy

The full source mark scheme begins on page 28. Follow original question 7 in that document.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 03 · Mark scheme June 2010 | CHY1F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	building		1
1(b)	provides jobs		1
1(c)	any **two** from: • noise • dust / visual pollution • air / atmospheric • exhaust gases • (more) traffic	ignore references to water allow sound pollution accept global dimming ignore smoke accept acid rain / global warming / named gaseous pollutants accept more lorries	2
1(d)	O 3 / three	ignore any numbers	1 1
1(e)	calcium oxide	accept quicklime do **not** accept calcium dioxide	1
Total			**7**

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 03 · Mark scheme June 2010 | CHY1F | Original Q1 | Legacy

CHY1F

Answer 04 · Mark scheme June 2011 | CHY1AP | Original Q5 | Legacy

Five	**A** electrons		**2**
	B bonds		**3**
	C products		**1**
	D elements		**4**

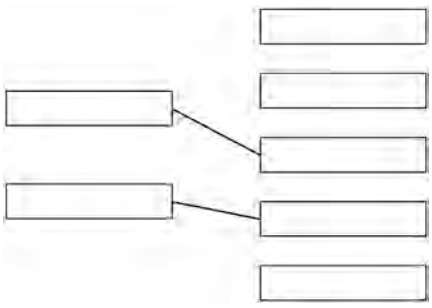
	A	B	C	D

Answer 05 · Mark scheme June 2018 | 8462/1F | Original Q10

The full source mark scheme begins on page 40. Follow original question 10 in that document.

4.3.1.1 Conservation of mass and balanced chemical equations

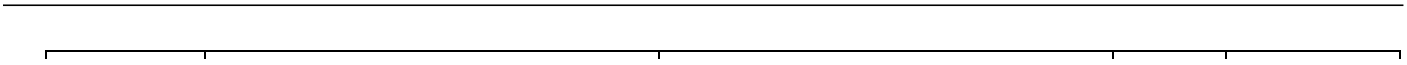
Answer 06 · Mark scheme June 2018 | 8462/2F | Original Q1

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**	

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 06 · Mark scheme

June 2018 | 8462/2F | Original Q1



4.3.1.1 Conservation of mass and balanced chemical equations

Answer 07 · Mark scheme

November 2020 | 8462/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	gas		1	AO2 4.1.2.6 4.2.2.1
01.2	-35 (°C)	allow any value between -35 °C and -100 °C	1	AO2 4.1.2.6 4.2.2.1
01.3	increase increase	 allow become stronger	1 1	AO1 AO2 4.1.2.6 4.2.2.4
01.4	chlorine gas is toxic		1	AO3 4.1.2.6
01.5	increased chlorine (atoms) are now part of the solid (iron chloride) **or** the mass of the chlorine (atoms) is now also measured		1 1	AO2 4.1.2.6 4.3.1.3
01.6	burns very vigorously	allow burns violently allow brighter (orange) glow allow (orange) flame allow explodes	1	AO3 4.1.2.1 4.1.2.6

4.3.1.1 Conservation of mass and balanced chemical equations

Question 1 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	$2\ Fe + 3\ Br_2 \longrightarrow 2\ FeBr_3$	allow multiples	1	AO2 4.1.1.1 4.1.2.6
01.8	56 + (3 × 80) = 296	 ignore units	1 1	AO2 4.3.1.2
Total			**11**	

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 08 · Mark scheme

November 2020 | 8462/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(total) mass before = 156.76 (g) **and** (total) mass after = 156.76 (g) **or** increase in mass of beaker **A** and contents = 29.96 (g) **and** decrease in mass of beaker **B** and contents = 29.96 (g) (so) the mass of products equals the mass of the reactants **or** (so) there is no change in mass during the reaction	allow 78.26 + 78.50 = 156.76 **and** 108.22 + 48.54 = 156.76 allow 108.22 – 78.26 = 29.96 **and** 48.54 – 78.50 = – 29.96 allow (so) no atoms were lost or made during the reaction	1 1	AO2 AO1 4.3.1.1
10.2	filter / filtration	allow a description of filtration	1	AO2 4.1.1.2
10.3	sodium nitrate (solution) **or** silver nitrate (solution) **or** sodium iodide (solution)	allow correct formulae allow sodium / nitrate / silver / iodide ions	1	AO2 4.1.1.2
10.4	to remove / evaporate the water	allow to dry (the solid)	1	AO3 4.1.1.2

Question 10 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	(total M_r = 170 + 150) = 320	allow (235 + 85) = 320	1	AO2 4.3.3.2
	(% atom economy =) $\frac{235}{320} \times 100$	allow correct use of incorrectly calculated total M_r	1	
	= 73.4375 (%)		1	
	= 73.4 (%)	allow an answer correctly calculated to 3 significant figures from an incorrect percentage calculation which uses the values in the question	1	
10.6	any **one** from: • for sustainable development • for economic reasons • to produce a high(er) percentage of useful product	allow to reduce waste	1	AO1 4.3.3.2
Total			**10**	

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 09 · Mark scheme

November 2020 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	acid rain		1	AO1 4.9.3.2
02.2	oxygen carbon	must be in this order	1 1	AO1 4.9.3.1
02.3	dimming		1	AO1 4.9.3.1 4.9.3.2
02.4	$2\ CH_4 + 3\ O_2 \rightarrow$ **2** $CO + 4\ H_2O$	allow multiples	1	AO2 4.3.1.1 4.9.3.1
02.5	air oxygen oxides of nitrogen	must be in this order	1 1 1	AO1 4.9.3.1
Total			**8**	

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 10 · Mark scheme

November 2021 | 8462/1F | Original Q5

Question 5

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	neutralisation		1	AO1 4.4.2.2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$H_2SO_4 + 2\,KOH \rightarrow K_2SO_4 + 2\,H_2O$	allow multiples	1	AO2 4.1.1.1 4.4.2.2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	14		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	pipette		1	AO3 4.4.2.5 RPA2

4.3.1.1 Conservation of mass and balanced chemical equations

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	add potassium hydroxide (solution) to the (conical) flask add (a few drops of) indicator add the (sulfuric) acid (from the burette) until the colour (of the indicator) changes read the volume from the burette		1 1 1 1 1	AO1 4.4.2.5 RPA2

Total			**10**

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 11 · 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

4.3.1.1 Conservation of mass and balanced chemical equations

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**

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 12 · Mark scheme

June 2022 | 8462/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$Na_2S_2O_3 + 2\,HCl \rightarrow$ **2** $NaCl + H_2O + SO_2 + S$	allow multiples	1	AO2 4.1.1.1 4.3.1.1 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(s)		1	AO1 4.2.2.2 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	a cross on a piece of paper		1	AO1 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	the rate of reaction decreased		1	AO3 4.6.1.1 4.6.1.2 RPA5

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 12 · Mark scheme

June 2022 | 8462/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	one of the reactants was used up		1	AO3 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	initially the line of best fit would be steeper		1	AO2 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	fewer reactant particles have the activation energy the reactant particles move more slowly		1 1	AO2 4.6.1.2 4.6.1.3

Total Question 6		8

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 13 · Mark scheme

June 2023 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Fe_2O_3 + 3 C → **2** Fe + **3** CO	allow multiples allow **1** mark for 2 Fe **or** allow **1** mark for 3 CO	2	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(iron oxide) loses oxygen	ignore references to gain of electrons	1	AO2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	(M_r =) (2 × 56) + (3 × 16) = 160	allow 112 + 48	1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(percentage atom economy =) $\frac{63.5}{2 + 79.5} \times 100$ = 77.9 (%)	 allow 77.914110 (%) correctly rounded to at least 2 significant figures	1 1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **one** from: • colour change (in solution) • colour change (in metal) • change of temperature	 allow bubbles	1	AO3 4.1.1.1 4.4.1.2

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 13 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(most reactive) **D** **B** **A** (least reactive) **C** (reason) more reactive (metals) displace less reactive (metals)	 allow **D** has most (displacement) reactions **and C** does not react allow the more reactive metals have more (displacement) reactions	1 1	AO3 4.4.1.2

Total Question 8	10

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 14 · Mark scheme

June 2024 | 8462/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	ions can move through the molten substance to the electrodes		1	AO1 4.4.3.1

Question	Answers	Mark	AO / Spec. Ref.
06.2	**Molten compound** / **Product at negative electrode** / **Product at positive electrode** Lead chloride / **Lead** / Chlorine — 1 Potassium iodide / Potassium / **Iodine** — 1 **Zinc bromide** / Zinc / Bromine — 1		AO2 4.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$2Al_2O_3 \rightarrow 4Al + 3O_2$	allow **1** mark for 4 Al allow **1** mark for 3 O_2	2	AO2 4.1.1.1 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(M_r =) (27 × 2) + (16 × 3) — 1 = 102 — 1			AO2 4.3.1.2

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 14 · Mark scheme

June 2024 | 8462/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	(by electrolysis) any **one** from: • potassium / K • lithium / Li	allow aluminium / Al allow sodium / Na allow calcium / Ca allow magnesium / Mg	1	AO3 4.4.1.2 4.4.1.3 4.4.3.3
	(by carbon reduction) any **one** from: • zinc / Zn • tin / Sn	allow iron / Fe allow copper / Cu	1	

Total Question 6	10

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 15 · Mark scheme

June 2025 | 8462/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	zinc bromide		1	AO2 4.1.1.1

Question	Answers	Mark	AO / Spec. Ref.
01.2	<table><tr><th>Symbol of element</th><th>Name of element</th><th>Number of atoms of the element in a molecule of C_2H_6O</th></tr><tr><td>C</td><td>**Carbon**</td><td>2</td></tr><tr><td>H</td><td>Hydrogen</td><td>**6**</td></tr><tr><td>**O**</td><td>Oxygen</td><td>1</td></tr></table>	1 1 1	AO1 AO2 AO1 4.1.1.1

Question	Answers	Mark	AO / Spec. Ref.
01.3	potassium + sulfur → potassium sulfide allow 2 K + S → K_2S	1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	**2** Al + **3** F_2 → 2 AlF_3	allow multiples allow **1** mark for 2 Al **or** allow **1** mark for 3 F_2	2	AO2 4.1.1.1

Total Question 1	7

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Mark scheme

June 2025 | 8462/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(substance reduced) SnO_2	allow tin oxide	1	AO2 4.4.1.1 4.4.1.3
	(reason) (SnO_2) loses oxygen	allow (tin oxide) loses oxygen MP2 is dependent upon MP1 being awarded	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	carbon is more reactive than tin	allow tin is less reactive than carbon	1	AO3 4.4.1.2 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	(total M_r = 128 + 12 =) 140	allow (total M_r = 112 + 12 + 16 =) 140	1	AO2 4.3.3.2
	(% atom economy =) $\frac{112}{140} \times 100$	allow correct use of an incorrectly determined total M_r	1	
	= 80 (%)		1	

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4		allow the converse for potassium allow the transition metal for tungsten allow the Group 1 metal for potassium ignore references to atomic structure		
	any **two** from: tungsten • has a higher melting / boiling point • is denser • is harder • is stronger • is less reactive • has ions with different charges • forms coloured compounds • can be a catalyst	 allow is less malleable / ductile allow specific reactions showing difference in reactivity	2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	(sum of relative formula masses on left hand side =) 232 + (3 × 2) = 238 (is equal to sum of relative formula masses on right hand side =) 184 + (3 × 18) = 238	allow (sum of relative formula masses on left hand side =) 232 + 6 = 238 allow (is equal to sum of relative formula masses on right hand side =) 184 + 54 = 238 if no other mark awarded, allow **1** mark for 232 + 6 = 184 + 54 **or** allow **1** mark for both sides = 238	1 1	AO2 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	for sustainable development **or** for economic reasons	allow to minimise use of limited resources allow to minimise use of energy allow to minimise waste ignore references to yield	1	AO1 4.3.3.2

Total Question 10	**11**

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 17 · Mark scheme

June 2025 | 8462/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	fractional distillation		1	AO1 4.1.1.2 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(heater) evaporation (column) condensation	allow liquid to gas allow boiling allow gas to liquid	1 1	AO1 4.2.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	petrol		1	AO3 4.7.1.2

Question	Answers	Mark	AO / Spec. Ref.
09.4	heavy fuel oil ⟶ diesel oil ⟶ kerosene	1	AO3 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	C_4H_{10}		1	AO2 4.2.1.4 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	butane		1	AO1 4.7.1.1

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 17 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	$C_3H_8 + 5\ O_2 \rightarrow$ **3** CO_2 + **4** H_2O	allow **1** mark for **3** CO_2 allow **1** mark for **4** H_2O	2	AO2 4.1.1.1 4.3.1.1 4.7.1.3

Total Question 9	**9**

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1F Unit Chemistry 1

Mark Scheme

2007 examination - June series

4.3.1.1 Conservation of mass and balanced chemical equations

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 1

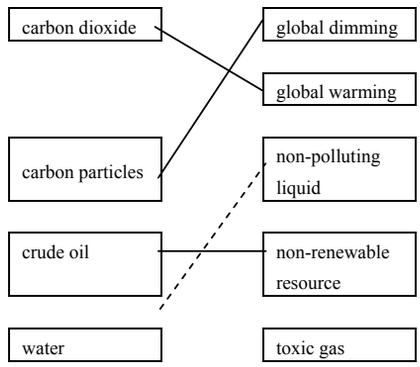
	answers	extra information	mark
(a)	low density unreactive		1 1
(b)	a polymer		1
(c)	any **one** from: • not broken down by (microorganisms) • does not decay (naturally)	ignore cannot recycle / degrade / disintegrate	1
total			4

CHY1F Question 2

	answers	extra information	mark
(a)(i)	additive		1
(b)	any **three** from: • colour 1 is made up of only one colour / dye • colour 2 is made up of only one colour / dye • colour 3 is made up of two colours / dyes **or** more colours (than colours 1 and 2) • colours 1, 2 and 3 are all different • colour 1 is less dark than colour 2	accept colour 3 is a mixture of colours 1 and 2 for **3** marks accept E-number or additive instead of colour ignore comments about height / level	3
total			4

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 3

	answers	extra information	mark
(a)	hydrogen	ignore formulae	1
(b)	any **two** from: • different sized molecules / more or less (carbon) atoms (in molecules) • fuels have <u>different</u> boiling points • fuels condense at <u>different</u> temperatures	ignore different densities	2
(c)		all three correct = **3** marks two correct = **2** marks one correct = **1** mark	3
total			6

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 4

	answers	extra information	mark
(a)(i)	any **one** from: • iron ore is a limited resource / non-renewable • iron is in high demand • provide jobs • economic advantage		1
(ii)	any **two** from: • would damage (wildlife) habitats / countryside / greenfield sites • extra traffic • visual (pollution) / eyesore • noise (pollution) / sound (pollution) • dust (pollution) • river (pollution) • carbon dioxide (from traffic) / adds to greenhouse effect / global warming • damage roads / buildings by <u>vibrations</u> / <u>shockwaves</u>		2
(b)(i)	carbon monoxide / carbon	accept formulae CO / C	1
(ii)	atoms are all the same (size) / type	accept (particles) are all the same (size) / type for one mark	1 1

Continued on next page

4.3.1.1 Conservation of mass and balanced chemical equations

Question 4 continued

	answers	extra information	mark
(iii)	any **two** from: • impurities / carbon / different (sized) atoms **or** elements **or** metals • changes the structure / disrupts the pattern or layers • prevents layers sliding over each other • it is an alloy		2
total			8

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 5

	answers	extra information	mark
(a)	core	ignore outer or inner	1
	mantle		1
(b)(i)	carbon dioxide	accept formula CO_2	1
	oxygen	accept formulae O_2 / O	1
(ii)	4%		1
(iii)	carbon dioxide has <u>decreased</u> / from 95% to 0%		1
	oxygen has <u>increased</u> / from 0% to 21%		1
	any **one** from: (carbon dioxide decrease) • carbon dioxide used during photosynthesis / by plants • carbon dioxide dissolves in oceans • carbon dioxide is locked up in rocks / carbonates / fossil fuels (oxygen increase) • oxygen released during photosynthesis / by plants		1
total			8

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 6

	answers	extra information	mark
(a)	any **two** from: • nitrogen • carbon dioxide • water (vapour) / steam	 accept formulae N / N_2 accept formula CO_2 ignore CO accept formula H_2O	2
(b)	any **three** from: <u>limestone</u> • abundant / local • natural material **or** no 'processing' needed • relatively easy to cut • appearance better <u>concrete</u> • <u>raw materials</u> are abundant • can be reinforced (by steel rods) / strong(er) / supported (by steel rods) • concrete mixture can be poured / moulded / constructed on site • less reactive with acid rain / weathering / erosion	no mark for 'limestone' or 'concrete' on first line – mark advantages only ignore ideas of speed of production or easier to use accept 'can build higher' ignore density / extraction / quarrying / pollution / cost	3
total			5

4.3.1.1 Conservation of mass and balanced chemical equations

CHY1F Question 7

	answers	extra information	mark
(a)(i)	$Cu_2S + 2O_2 \rightarrow 2CuO + SO_2$	accept fractions and multiples	1
(ii)	any **two** from: • sulfur dioxide • causes acid rain • consequence of acid rain eg kills fish / plants	 accept sulphur dioxide / sulphur oxide / SO_2 ignore other comments eg global warming / ozone / global dimming / greenhouse effect	2
(b)	any **two** from: • heat (copper oxide with carbon) • oxygen is removed by carbon **or** carbon monoxide / carbon dioxide is produced **or** carbon displaces copper • because carbon is more reactive than copper	 accept copper (oxide) loses oxygen **or** carbon gains oxygen accept carbon oxide accept a correct word or balanced symbol equation allow a correct comparison of reactivity	2
(c)(i)	electrolysis	accept electroplating	1
(ii)	(electrical) wiring / appliances / coins / pipes / cladding for buildings / jewellery / making alloys **or** named alloys		1

Continued on next page

4.3.1.1 Conservation of mass and balanced chemical equations

Question 7 continued

	answers	extra information	mark
(d)	any **three** explanations from: <u>for recycling</u> • less acid rain (pollution) • copper reserves last longer / conserved **or** do not run out • energy for extraction (saved) **or** less energy required • less mining / quarrying • less waste (copper) / electrical appliances dumped **or** less landfill <u>against recycling</u> • collection problems • transport problems • difficult to separate copper from appliances • energy used to melt the collected copper	ignore electrolysis / pollution ignore ideas about less machinery / plant ignore idea of cost	3
total			10

4.3.1.1 Conservation of mass and balanced chemical equations

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.3.1.1 Conservation of mass and balanced chemical equations

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

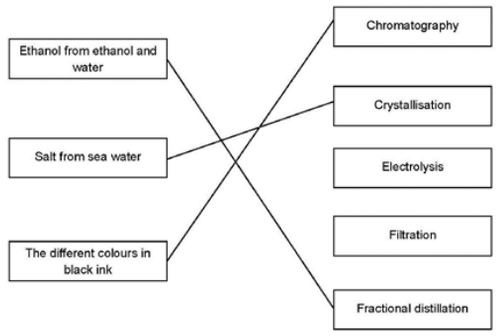
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1 1 1	AO1 4.1.1.2
01.2	include a (filter) funnel	allow funnel drawn on the diagram ignore clamp stand	1	AO3 4.1.1.2
01.3	evaporate condense	must be this order	1 1	AO1 4.1.1.2
01.4	$\frac{2}{20} \times 100$ = 10 (%)	an answer of 10 (%) scores **2** marks an answer of 11.1(%) **or** 90 (%) scores **1** mark	1 1	AO2 4.2.2.7
01.5	an alloy		1	AO1 4.2.2.7
01.6	the layers in the mixture are distorted		1	AO1 4.2.2.7

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	8000 nm^3		1	AO2 4.2.4.1
Total			**11**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7		1	AO1 4.1.2.6
02.2	small molecule		1	AO2 4.1.2.6 4.2.2.4
02.3	F_2		1	AO1 4.1.1.1 4.1.2.6
02.4	the reactivity decreases (going down Group 7) (because) chlorine displaces bromine and iodine (and) bromine displaces iodine **or** iodine does not react	allow the reactivity decreases from chlorine to iodine allow (because) chlorine has two reactions allow (because) neither bromine nor iodine can displace chlorine allow (and) bromine has one reaction **or** iodine has no reactions allow (and) iodine cannot displace bromine	1 1 1	AO1 4.1.2.6 AO3 4.1.2.6 AO3 4.1.2.6
02.5	80		1	AO2 4.3.1.2

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(1.2 kg =) 1200 (g) **or** (900 g =) 0.9 (kg)	an answer of 75 (%) scores **2** marks	1	AO2 4.3.3.1
	$(\frac{900}{1200} \times 100) = 75(\%)$ **or** $(\frac{0.9}{1.2} \times 100) = 75(\%)$	allow an answer correctly calculated from: $(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$ **or** $(\frac{\text{incorrect attempt at conversion of 900}}{1.2} \times 100)$	1	
Total			**9**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus neutron neutron electron proton	must be in this order	1 1 1 1 1	AO1 4.1.1.3 4.1.1.4 4.1.1.5
03.2	$(A_r)\ \frac{(63 \times 70) + (65 \times 30)}{100}$ = 63.6	an answer of 63.6 scores **2** marks	1 1	AO2 4.1.1.6
03.3	copper / Cu	allow ecf from answer to question **03.2**	1	AO2 4.1.1.1
03.4	$\frac{1.2 \times 10^{-10}}{10\,000}$ **or** $1.2 \times 10^{-10} \times 1 \times 10^{-4}$ $= 1.2 \times 10^{-14}$ (m)	an answer of 1.2×10^{-14} (m) scores **2** marks a correct answer not in standard form scores **1** mark	1 1	AO2 4.1.1.5
Total			**10**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	3.6 (cm^3)		1	AO2 4.4.3.4
04.2	hydrogen line only		1	AO3 4.4.3.4
04.3	both lines		1	AO3 4.4.3.4
04.4	graphite has delocalised electrons		1	AO1 4.2.3.2
04.5	**cathode** zinc (1) **anode** chlorine (1) hydrogen (1) bromine (1)	do **not** accept chloride allow **1** mark if chlorine and zinc the wrong way around do **not** accept bromide allow **1** mark if bromine and hydrogen the wrong way around	1+1 1+1	AO2 4.4.3.2 4.4.3.4
Total			**8**	

4.3.1.1 Conservation of mass and balanced chemical equations

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gas		1	AO1 4.2.2.2
05.2	the gas escapes	allow carbon dioxide escapes do **not** accept references to evaporation	1	AO1 4.3.1.3
05.3	5.12 (g)		1	AO2 4.3.1.3
05.4	4.00 (g) trial 1	allow 2.89 written in either space, or ringed in the table, unless contradicted by mass of copper carbonate or trial number	1	AO3 4.3.1.3
05.5	reheat (and reweigh) until constant mass	 an answer of heat to constant mass scores **2** marks if no other mark scored allow for **1** mark heat for longer **or** (heat at a) higher temperature **alternative approach**: (1) continue heating and pass gas through limewater (1) until the (lime)water stops bubbling **or** until the limewater no longer turns cloudy	1 1	AO3 4.3.1.3

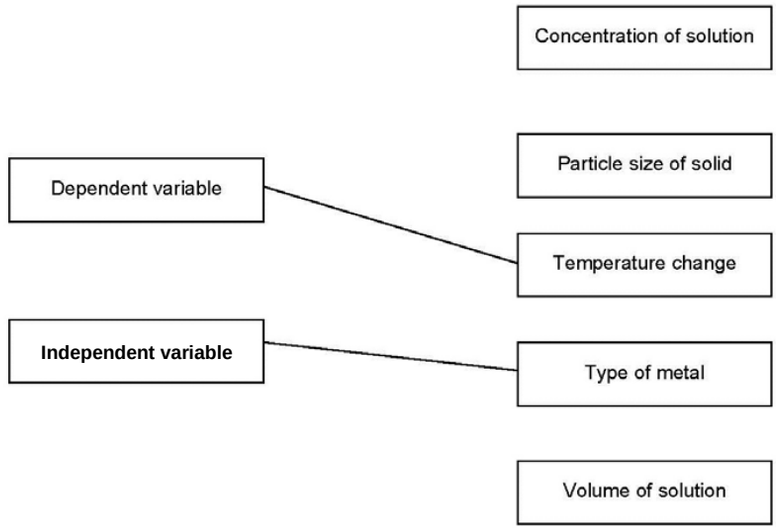
4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	straight line of best fit	must touch at least 5 of the 6 plots	1	AO2 4.3.1.3
05.7	correct value read from line of best fit in Figure 8	allow tolerance of ± ½ small square	1	AO2 4.3.1.3
05.8		a correctly calculated value from their answer to question **05.7** scores **2** marks		AO2 4.3.1.3
	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	allow (mass =) answer from question **05.7** × 20	1	
	correctly calculated value (g)		1	
Total			**10**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	 allow **one** mark if answers are reversed		1 1	AO1 4.5.1.1
06.2	polystyrene is a better insulator		1	AO3 4.5.1.1
06.3	both bars labelled both bars correctly plotted	 allow tolerance of ± ½ small square ignore width and spacing of bars if no other mark scored, allow **1** mark for any one bar correctly plotted and labelled	1 1	AO2 4.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	temperature increases **or** temperature does not decrease	ignore because it is exothermic allow (because) energy / 'heat' is transferred to the surroundings energy / 'heat' is not taken in from the surroundings allow the energy of the products is less than the energy of the reactants	1	AO3 4.5.1.1
06.5	(most reactive) magnesium (zinc) nickel	this order only	1	AO3 4.5.1.1 4.4.1.2
06.6	suitable method described the observations / measurements required to place in order an indication of how results would be used to place the unknown metal in the reactivity series **approaches that could be used:** **approach 1:** add the unknown metal to copper sulfate solution (1) measure temperature change (1) place the metals in order of temperature change (1)		1 1 1	AO3 4.4.1.2 4.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6 cont.	**approach 2:** add the metal to salt solutions of the other metals **or** heat the metal with oxides of the other metals (1) measure temperature change (only if salt solutions used) **or** observe whether a chemical change occurs (1) compare temperature change or whether there is a reaction to place in correct order (1) **approach 3:** add all of the metals to an acid (1) measure temperature change or means of comparing rate of reaction (1) place the metals in order of temperature change or rate of reaction (1) **approach 4:** set up electrochemical cells with the unknown metal as one electrode and each of the other metals as the other electrode (1) measure the voltage of the cell (1) place the metals in order of voltage (1)			
06.7	D		1	AO1 4.5.1.2
06.8	C		1	AO1 4.5.1.2
Total			**12**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	sodium oxide	allow Na_2O	1	AO2 4.1.1.1 4.1.2.5 4.4.1.1
07.2	oxidation		1	AO1 4.4.1.1
07.3	13		1	AO1 4.4.2.4
07.4	sodium hydroxide		1	AO2 4.1.1.1
07.5	OH^-		1	AO1 4.4.2.4
07.6	(volume =) $\frac{250}{1000}$ or ¼ or 0.25 (dm^3) **or** (mass per cm^3 =) $\frac{40}{1000}$ (g) or 0.04 (g) ($\frac{250}{1000}$ × 40 =) 10 (g)	an answer of 10 (g) scores **2** marks	1 1	AO2 4.3.2.5

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	all points correct	allow a tolerance of ± ½ a small square allow **1** mark for 3 points correct ignore any attempt at a line of best fit	2	AO2 4.1.2.5
07.8	39 (°C)	allow any value from 34 to 46 (°C)	1	AO2 4.1.2.5
Total			**10**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • metal • (metal) hydroxide • (metal) carbonate • alkali	allow named example allow correct formula ignore base allow ammonium hydroxide allow ammonium carbonate allow soluble base allow ammonia	1	AO1 4.4.2.1 4.4.2.2 4.4.2.3
08.2	$Ca(NO_3)_2$	allow $Ca^{2+}(NO_3^-)_2$	1	AO2 4.4.2.2

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.4.2.3
	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 • use magnesium oxide and sulfuric acid • add sulfuric acid to a beaker • warm sulfuric acid • add magnesium oxide • stir • continue adding until magnesium oxide is in excess • filter • using a filter paper and funnel • to remove excess magnesium oxide • heat solution in an evaporating basin • to crystallisation point • leave to crystallise • pat dry with filter paper credit may be given for diagrams		
Total			**8**

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	FeS_2	do **not** accept equations	1	AO2 4.2.1.3
09.2	26 30 26	must be this order	1 1 1	AO2 4.1.1.4 4.1.1.5
09.3	any **two** from: • iron has a high(er) melting / boiling point • iron is dense(r) • iron is hard(er) • iron is strong(er) • iron is less reactive • iron has ions with different charges • iron forms coloured compounds • iron can be a catalyst	allow the converse statements for sodium allow transition metal for iron allow Group 1 metal for sodium ignore references to atomic structure ignore iron rusts allow iron is less malleable / ductile allow specific reactions showing difference in reactivity allow iron is magnetic	2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	carbon is more reactive (than nickel)	allow converse	1	AO1 4.4.1.2 4.4.1.3
	(so) carbon will displace / replace nickel (from nickel oxide) **or** (so) carbon will remove oxygen (from nickel oxide)	allow (so) nickel ions gain electrons allow (so) carbon transfers electrons to nickel (ions)	1	
09.5		an answer of 67.8 (%) scores **3** marks an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps		AO2 4.3.3.2
	(total M_r of reactants =) 87		1	
	(percentage atom economy) $= \frac{59}{87} \times 100$	allow (percentage atom economy) $= \frac{59}{\text{incorrectly calculated } M_r} \times 100$	1	
	= 67.8 (%)	allow an answer from an incorrect calculation to 3 sig figs	1	
Total			**11**	

4.3.1.1 Conservation of mass and balanced chemical equations

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	copper, zinc, sodium chloride solution		1	AO2 4.5.2.1
10.2	a reactant is used up	allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant	1	AO1 4.5.2.1
10.3	the reaction is not reversible		1	AO1 4.5.2.1
10.4	$2H_2 + O_2 \rightarrow 2H_2O$	allow fractions / multiples allow **1** mark for O_2	2	AO1 AO2 4.1.1.1 4.5.2.2

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td>AO3</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td><td>AO3</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td><td>AO2</td></tr>
<tr><td>No relevant content</td><td>0</td><td></td></tr>
<tr><td>Indicative content

reasons why fuel cells could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• time for refuelling a fuel cell is faster than recharging
or
a fuel cell does not need to be recharged
• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy
• lithium-ion batteries can catch fire
• produces only water
or
no pollutants produced
• lithium-ion batteries may release toxic chemicals on disposal
• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr>
</table>
reasons why the lithium-ion battery could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• lithium-ion uses energy more efficiently
• cost of lithium-ion car much less
• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable
• charging points are more widely available than hydrogen filling stations
• hydrogen takes up a lot of space
or
is difficult to store
• hydrogen can be highly flammable / explosive
• no emissions produced
• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr>
</table></td><td></td><td>4.4.3.4
4.5.2.1
4.5.2.2</td></tr>
<tr><td>Total</td><td></td><td></td><td>11</td></tr>
</table>

Answer 05 · Examiner comments

June 2018 | 8462/1F | Original Q10

Question 10 (standard demand)

10.1 54% of students recognised that there had to be two different metals, and that water alone would not be suitable as the electrolyte. The next most popular answer was 'zinc, zinc, water' which missed both of the essentials. A significant number of students ticked more than one box.

10.2 This is a new area of the specification and students found it difficult. 24% of students answered correctly. Many mixed up the answers to questions **10.2** and **10.3**, and many thought that charge, energy, or electrons run out.

10.3 11% of students achieved this mark. This question required students to demonstrate their knowledge of statements from the specification.

10.4 25% of students achieved both marks. Many realised that the missing reactant was oxygen, but were unable to write its formula correctly so lost both marks. A few achieved a single mark for writing the correct formula for oxygen without correctly balancing the equation.

10.5 This 'extended response' question discriminated well, with 51% of students scoring four or more marks. Many students limited themselves to level 2 as they just used the table, without bringing in any of their own knowledge, or failed to give a judgement on which method is better.

Many students wasted space quoting data from the table. A statement such as 'you can go further with a hydrogen fuel cell before stopping to refuel' is shorter, and gains more credit, than 'you can go 415 miles between refuelling with a hydrogen fuel cell car but 240 miles between recharges of a lithium-ion battery car'.

A lot of repetition was seen; once you have said that one thing is **more** expensive, you do not need to say that the other is cheaper. There were many vague statements about something being 'better for the environment' without saying how or why.

There was also some misinterpretation of the data on distance travelled per unit of energy. Some students thought this referred to energy per mile or something similar, so though incorrectly that the fuel cell was better.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 06 · 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.

Answer 12 · Examiner comments June 2022 | 8462/2F | Original Q6

Question 6 (Low and standard demand)

06.1 The equation was correctly balanced by about three-quarters of the students.

06.2 Over 80% of the students knew that (s) represents a solid reactant.

06.3 The use of a cross on paper to monitor the turbidity of the sulfur produced was known by over 70% of the students, although use of a gas syringe was a common incorrect response.

06.4 Over 80% of the students gained the mark, by associating a drop in gradient on the graph with a fall in the rate of reaction.

06.5 Many deduced that one of the reactants was used up, with over 60% of the students gaining a mark. A sizeable number asserted that no light was reaching the sensor, even though the graph did not reach $y = 0$.

06.6 Over 60% of the students gained a mark, but most of the remainder thought that the line would be less steep at the start.

06.7 Over 50% of the students gained two marks. However, there was a wide range of incorrect response combinations, the most common of which used the two responses which were linked to a higher temperature rather than a lower one.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 13 · Examiner comments June 2023 | 8462/1F | Original Q8

Question 8 (low and standard demand)

08.1 The great majority of students scored at least one mark, with three-fifths scoring both. Most could give the correct coefficient for Fe, but that for CO proved to be more challenging, with values of 5 or 6 being seen quite frequently. This question discriminated well.

08.2 Just over a quarter of students were able to articulate that iron oxide loses oxygen. Many expressed their answer as if decomposition of iron oxide were occurring.

08.3 There were many correct answers, with three fifths of students scoring both marks. However, many students do not realise that all they have to do is add the relative atomic masses of two Fe and three O atoms. 56 x 112 was frequently seen. Some students used three Fe atoms and two O instead of the other way round, misunderstanding the subscripts in the formula. Those who made an arithmetic error but had shown their working were able to score one mark. The question discriminated well.

08.4 This question also discriminated well. Most students could substitute the values correctly into the given expression. However, some did not know how to evaluate that expression and some incorrectly rounded a value of 77.9% to 77% instead of 78%.

08.5 About two thirds of students gave an acceptable observation**.** The majority of students gave bubbling as an observation. This was accepted as bubbles do form as a side reaction to the main displacement reaction. The expected observations of a colour change in either the metal or the solution, or a temperature change, were more rarely seen.

08.6 About three-quarters of students placed the metals in the correct order, but fewer could give a coherent reason. It was common to see the metals listed in reverse order. Students sometimes did not understand the difference between a metal and a metal sulfate, giving incorrect statements such as ‘C had most ticks’.

Answer 14 · Examiner comments June 2024 | 8462/1F | Original Q6

Question 6 (low and standard demand)

06.1 Fewer than a half of students identified the reason why molten substances can be electrolysed. The incorrect distractor that electrons can move through the substance was almost as popular.

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4.3.1.1 Conservation of mass and balanced chemical equations

Answer 14 · Examiner comments June 2024 | 8462/1F | Original Q6

06.2 Nearly three quarters of students could name all three substances correctly. The most common errors were iodide instead of iodine and zinc bromine instead of zinc bromide.

06.3 Nearly a half of students gave a completely balanced equation. The oxygen was correctly balanced more often than the aluminium.

06.4 Nearly three fifths of students set out their work clearly and obtained the correct answer. The most common incorrect answers were 27 + 16 = 43 and 27 × 16 = 432.

06.5 Fewer than two thirds of students scored one or two marks, with fewer than one third scoring both marks. It was expected that students would chose appropriate metals from the list provided, but other correct answers were accepted. Gold was not given credit, since students should know that gold is found in the Earth as the metal itself, so does not need chemical extraction. Carbon was often given as a response.

Answer 15 · Examiner comments June 2025 | 8462/1F | Original Q1

Question 1 (low demand)

01.1 Nearly all students chose the correct name.

01.2 Most students filled in the table correctly, with the vast majority scoring at least two marks and about five sixths scoring all three marks. The most common error was 1 for the number of hydrogen atoms in the molecule. Occasionally chlorine was given as the name for the symbol C.

Answer 15 · Examiner comments June 2025 | 8462/1F | Original Q1

01.3 More than three quarters of students gave a correct word equation. The most common errors were 'potassium sulfuride' and potassium sulphate for the name of the product. A few tried unsuccessfully to write a symbol equation despite the instruction to write a word equation.

01.4 About five sixths of students could balance the Al atoms but there were more errors with the F atoms, with under a half of students scoring both marks. 1 F_2 and 2 F_2 were commonly seen.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Examiner comments

June 2025 | 8462/1F | Original Q10

Question 10 (standard demand)

10.1 Students found this question difficult and fewer than one in ten could give the correct substance. Many gave tin (the result of the reduction) as the answer instead of tin oxide, and many did not appreciate that reduction is loss of oxygen.

10.2 One in six students could give an acceptable answer in terms of reactivity. Students were expected to compare the reactivities of carbon and tin, so both needed to be named. There was some ambiguous use of the word 'it'.

10.3 Whilst a third of students scored one mark, only about one in ten scored all three. Many could not recall the expression for percentage atom economy and therefore did not attempt to find the total M_r of the reactants. A significant minority added the two relative atomic masses provided to give 124 and then divided by 128.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Examiner comments

June 2025 | 8462/1F | Original Q10

10.4 Nearly a half of students scored at least one mark. Many answers were not comparative so could not gain credit. Some gave two halves of the same comparison as two different differences in properties, e.g. tungsten is hard for one answer and potassium is soft for the other. Answers in terms of atomic structure, rather than properties of the element, did not gain credit.

10.5 Nearly a half of students scored both marks by producing working to show that the total M_r on each side was 238.

10.6 One in five students scored the mark. Common correct responses included minimising waste or making more profit. Common incorrect answers included references to yield, rate or safety.

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 16 · Examiner comments

June 2025 | 8462/1F | Original Q10

Mark Ranges and Award of Grades

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

4.3.1.1 Conservation of mass and balanced chemical equations

Answer 17 · Examiner comments — June 2025 | 8462/2F | Original Q9

Question 9

09.1 Fractional distillation was given by about 40% of the students. Few of the rest gave distillation alone, the most common incorrect responses were cracking and fracking.

09.2 Just over a quarter of students correctly identified both changes of state. It was clear that many students did not understand what a change of state and only gave a state at each point.

09.3 Two thirds of students correctly identified petrol from the table.

09.4 A third of students made the correct link between boiling point and flammability, gaining a mark for this item.

Answer 17 · Examiner comments — June 2025 | 8462/2F | Original Q9

09.5 Half of students wrote out the correct molecular formula, using the expected format. Some students wrote general formulas, and some had the carbon and hydrogen atoms the wrong way round.

09.6 A quarter of students named butane correctly. Propane was the most common incorrect answer.

09.7 2 in 5 students balanced the equation correctly. A further 25% balanced one of the two components.