AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.6

Relative atomic mass

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**32**
Available paper years	**2008–2025**

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.

4.1.1.6 Relative atomic mass

Answer 01 · Mark scheme

Question 8

question	answers	extra information	mark
(a)	N_2O		1
(b)	13.8 to 14	gains full marks without working if answer incorrect 13 gains **1** mark **or** 14/101 × 100 gains **1** mark	2
total			3

4.1.1.6 Relative atomic mass

Answer 02 · Mark scheme

June 2008 | CHY2F | Original Q7 | Legacy

question	answers	extra information	mark
7(a)	157	correct answer with **or** without working (2 ×19 + 119) for **1** mark only allow (119 + 19 =) 138 for **1** mark only ignore units	2
7(b)	24.2	accept answers in the range 24 to 24.2038..... ignore incorrect rounding after correct answer 25 only without working gains **1** mark **or** 38/157 × 100 gains **1** mark **or** (19/157 × 100 =) 12 to 12.1 gains **1** mark allow error carried forward from part(a) 38/(a) × 100 gains **2** marks if calculated correctly (19/138 ×100 =) 13.8 gains **1** mark	2
7(c)	0.29	accept answers in the range 0.28 to 0.3 allow error carried forward from part (b) (b)/100 × 1.2 correctly calculated ignore units	1

Question 7 continued on the next page…

4.1.1.6 Relative atomic mass

COMPONENT NUMBER: CHY2F

COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

DATE: June 2008

Question 7 continued…

question	answers	extra information	mark
7(d)	an <u>electron</u>	allow electrons allow electron shared / lost for **1** mark apply list principle for additional particles	1
	is gained owtte	must be linked to electron accept can hold / take in if in correct context eg it can hold another electron (in its outer shell) = **2** marks it can take an electron (from another atom) = **2** marks ignore reference to fluoride ions incorrect number of electrons gained does **not** gain the second mark	1
Total			**7**

4.1.1.6 Relative atomic mass

Answer 02 · Mark scheme

June 2008 | CHY2F | Original Q7 | Legacy

COMPONENT NUMBER: CHY2F

COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

DATE: June 2008

4.1.1.6 Relative atomic mass

Answer 03 · Mark scheme

June 2009 | CHY2F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)	hydrogen / H^+ /$2H^+$ / H_3O^+	allow H / 2H do **not** accept H_2 apply list principle	1
8(b)(i)	143	correct answer with or without working = **2** marks ignore units if answer is not correct 40 + (2 × 35.5) + (2 × 16) gains **1** mark	2
8(b)(ii)	49.7% (49.6 to 50)	correct answer with or without working = **2** marks answer 49 gains **1** mark if answer is not correct: (71 ÷ 143) × 100 gains **1** mark allow error carried forward from part (b)(i) ie. (71 or their (2 × 35.5) ÷ answer to (b)(i)) × 100 gains **2** marks if calculated correctly and **1** mark if not calculated correctly. **Special case** 35.5 ÷ 143 × 100 = 24.8 to 25% **or** 35.5 ÷ answer to (b)(i) x 100 correctly calculated for **1** mark	2
8(b)(iii)	9.9 to 10g	allow ecf from (b)(i) or (b)(ii)	1

Question 8 continued on next page…

4.1.1.6 Relative atomic mass

Answer 03 · Mark scheme

June 2009 | CHY2F | Original Q8 | Legacy

CHY2F

Question 8

question	answers	extra information	mark
8(c)(i)	an alkali	apply list principle accept named alkali accept hydroxide accept soluble base ignore base	1
8(c)(ii)	a solid / insoluble substance (owtte)		1
8(c)(iii)	filter / filtration	allow decant / centrifuge accept filtration followed by evaporation **or** filtration and evaporation do **not** accept filtration or evaporation do **not** accept evaporation and filtration	1
Total			**9**

4.1.1.6 Relative atomic mass

Answer 04 · Mark scheme

January 2010 | CHY2F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	48		1
5(a)(ii)	3		1
5(b)	heat / energy given out / transfers to surroundings	 the mark for given out / transfers to cannot be awarded without heat / energy allow given off	1 1
5(c)	it has a low boiling point it is made of small molecules		1 1
Total			**6**

4.1.1.6 Relative atomic mass

Answer 04 · Mark scheme

January 2010 | CHY2F | Original Q5 | Legacy

CHY2F

4.1.1.6 Relative atomic mass

Answer 05 · Mark scheme

June 2010 | CHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	(nitrogen) + hydrogen → ammonia	accept H_2 and NH_3 ignore incorrect symbols ignore balancing	1
6(a)(ii)	any **one** from: • catalyst • to speed up the reaction • lower activation energy	 ignore causes reaction ignore heat / reference to particles 	1
6(a)(iii)	any **two** from: • cooled • ammonia condenses / turns into liquid • nitrogen and hydrogen do not condense / turn into liquid **or** nitrogen and hydrogen stay as gases	it = ammonia ignore references to boiling point if no marks awarded accept pass through / separated in condenser **or** unreacted nitrogen and hydrogen / gases recycled for **1** mark	2

Question 6 continues on the next page

4.1.1.6 Relative atomic mass

CHY2F

Question 6 continued

question	answers	extra information	mark
6(b)	80	correct answer with or without working gains **2** marks ignore units if answer incorrect, evidence of correct *working* gains **1** mark eg 14 + (4 x 1) + 14 + (3 x 16) (= 70) **or** 2N + 4H +30	2
6(c)	fertiliser is **C** evidence of correct working	 examples of minimum correct working: 39/101 **or** 14/101 **or** 38.61/100 **or** 13.86/100	1 1
Total			**8**

4.1.1.6 Relative atomic mass

Answer 05 · Mark scheme

June 2010 | CHY2F | Original Q6 | Legacy

CHY2F

4.1.1.6 Relative atomic mass

Answer 06 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	65	correct answer with or without working = **2** marks if answer incorrect evidence of (81 – 16) for **1** mark ignore units	2
7(a)(ii)	zinc	accept error carried forward from (a)(i) allow correct symbol answer given should be element / metal closest to their answer do **not** allow compounds	1
7(b)(i)	• it loses electrons • three electrons	sharing / covalency = max **1** mark	1 1
7(b)(ii)	8 electrons shown in second shell.	accept dots / crosses / mixture of dots and crosses / e electrons do not need to be paired do **not** allow extra electrons in first shell	1
Total			**6**

4.1.1.6 Relative atomic mass

Answer 07 · Mark scheme

June 2011 | CHY2F | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	because they are gases	ignore vapours / evaporate / (g) allow it is a gas	1
7(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
7(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
7(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 7 continues on the next page

Question 7 continued

question	answers	extra information	mark
7(c)(i)	3.3	accept 3.33…….. or $3\frac{1}{3}$ or $3.3^{\cdot}$ or 3.3^{r}	1
7(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
7(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**

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

4.1.1.6 Relative atomic mass

Answer 08 · Mark scheme

January 2013 | CH2FP | Original Q6 | Legacy

question	answers	extra information	mark
6(a)(i)	an alloy		1
6(a)(ii)	harder		1
6(b)(i)	162.5	correct answer with or without working gains **2** marks if no answer or incorrect answer then evidence of correct working [56 + (3x35.5)] gains **1** mark	2
6(b)(ii) **(view with 6bi)**	34.46	accept rounding from 34 - 34.5 correct answer with or without working gains **2** marks accept ecf from 6 (b)(i) correctly calculated for **2** marks if no answer or incorrect answer then evidence of 56 / 162.5 **or** 56 / answer to 6(b)(i) gains **1** mark	2
Total			**6**

4.1.1.6 Relative atomic mass

Answer 08 · Mark scheme

January 2013 | CH2FP | Original Q6 | Legacy

January 2013

CH2FP

4.1.1.6 Relative atomic mass

Answer 09 · Mark scheme

June 2013 | CH2FP | Original Q1 | Legacy

Question 1

question	answers	extra information	Mark
1(a)	1 / one		1
1(b)(i)	protons		1
1(b)(ii)	neutrons		1
1(b)(iii)	7		1
1(c)(i)	losing		1
1(c)(ii)	a positive		1
1(c)(iii)	electrostatic		1
1(d)	high melting points strong bonds		1 1
1(e)(i)	58.5		1
1(e)(ii)	mole		1
1(f)	very small (particles) **or** 1-100nm in size **or** (particle with a) few hundred atoms	ignore tiny / small / smaller / microscopic etc.	1
Total			**12**

4.1.1.6 Relative atomic mass

Answer 10 · Mark scheme

June 2013 | CH2FP | Original Q7 | Legacy

Question 7

question	Answers	extra information	Mark
7(a)(i)	the more sodium hydrogencarbonate the greater the temperature change up to 8 spatula measures then the temperature change is constant	accept examples from the table accept any correct indication of when change occurs if no marks awarded allow **1** mark for: the more sodium hydrogencarbonate the lower the final temperature	1 1 1
7(a)(ii)	energy is taken in from the surroundings **or** endothermic		1
7(b)(i)	gas / carbon dioxide / steam / water is produced	accept carbon dioxide is a gas **or** steam / water is a gas allow gas / air expands when heated	1
7(b)(ii)	no, because (reaction) is exothermic **or** yes, to start the reaction	allow no, because (reactants) were formed by heating ignore references to cooling	1
7(c)(i)	84	correct answer with or without working gains **2** marks if no answer or incorrect answer then evidence of 23 +1 + 12 + (3 × 16) gains **1** mark	2
7(c)(ii)	14.29	accept rounding to 14.3 or 14 allow ecf from (c)(i)	1
Total			**9**

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

4.1.1.6 Relative atomic mass

Answer 11 · Mark scheme June 2014 | CH2FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)(i)	ions cannot move	*allow only conducts as a liquid*	1	1 / 2.7.1a	E
5(a)(ii)	chlorine		1	2 / 2.7.1b	G
5(a)(iii)	they are positively / oppositely charged **or** they are attracted		1	1 / 2.7.1c	E
5(a)(iv)	2		1	2 / 2.7.1e	G
5(b)(i)	any **one** from: • not all the magnesium was collected • *used less time* ***or*** *lower current* ***or*** *different battery / power pack* ***or*** *different balance* ***or*** *lower voltage* • error in reading balance • error in recording result	*allow some magnesium was lost*	1	3 / 2.7.1	E
5(b)(ii)	1.11	correct answer with or without working gains **2** marks. if answer incorrect, allow **1** mark for 0.99 **or** for 1.13+1.11+1.09	2	2 + 3 / 2.7.1	E
5(c)(i)	*25 – 25.3*	correct answer with or without working gains **2** marks. If answer incorrect, allow **1** mark for 24/95	2	2 / 2.3.3a	E
5(c)(ii)	71		1	2 / 2.3.1f	A
5(d)(i)	reversible reaction		1	1 / 2.3.3f	A
5(d)(ii)	decreases		1	1 / 2.5.1c	A
Total			**12**		

4.1.1.6 Relative atomic mass

Answer 11 · Mark scheme

June 2014 | CH2FP | Original Q5 | Legacy



4.1.1.6 Relative atomic mass

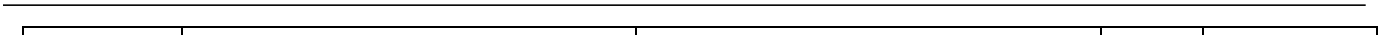
Answer 12 · Mark scheme June 2015 | CH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	1 very small	must be in this order accept negligible, 1/2000 allow zero	1 1	**AO1** 2.3.1b
1(b)	The mass number		1	**AO1** 2.3.1c
1(c)	C		1	**AO2** 2.3.1a
1(d)(i)	2		1	**AO2** 2.1.1a
1(d)(ii)	3		1	**AO2** 2.1.1a
1(e)(i)	28		1	**AO2** 2.3.1f
1(e)(ii)	42.9	accept ecf from (e)(i) accept 42 - 43	1	**AO2** 2.3.3a
1(f)(i)	0.9		1	**AO2** 2.3
1(f)(ii)	any **one** from: • accurate • sensitive • rapid • small sample		1	**AO1** 2.3.2a
Total			**10**	

4.1.1.6 Relative atomic mass

Answer 12 · Mark scheme

June 2015 | CH2FP | Original Q1 | Legacy



4.1.1.6 Relative atomic mass

Answer 13 · Mark scheme

June 2016 | CH2FP | Original Q6 | Legacy

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

Question 6 continues on the next page

Question 6 continued

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

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

Examples of chemistry points made in response:

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

Yield:

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

Profit:

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

Run off:

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

Examples of linking of ideas:

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

Examples of compromise:

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

Total			13

4.1.1.6 Relative atomic mass

Answer 14 · Mark scheme June 2017 | CH2FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	58.5		1	AO2 2.5.1b
4(b)	water		1	AO2 2.3.3a
4(c)(i)	prevents loss of thermal energy	allow prevents heat loss	1	AO1 2.6.1
4(c)(ii)	13/thirteen		1	AO3 2.5.1
4(c)(iii)	temperature changes/results are all similar	accept no anomalous results allow they are all similar do **not** accept temperature	1	AO2 2.5.1
4(c)(iv)	exothermic	allow giving out energy	1	AO3 2.5.1
4(d)(i)	ions move	allow they move ignore free ions do not accept movement of electrons	1	AO1 2.7.1a 2.2.2b
4(d)(ii)	(chloride ions are) negative	accept opposites attract do **not** accept chlorine is negative	1	AO1 2.7.1c
4(d)(iii)	Tick (✓) by: soap		1	AO1 2.7.1i
4(d)(iv)	1 bonding pair of electrons 6 unbonded electrons on Cl	accept dot, cross, e or – or any combination	1 1	AO2 2.1

4.1.1.6 Relative atomic mass

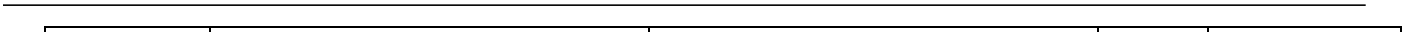
Answer 14 · Mark scheme

4(d)(v)	Tick (✓) by: $\frac{1}{36.5}$ x 100		1	**AO2** 2.3.3a
Total			**12**	

4.1.1.6 Relative atomic mass

Answer 14 · Mark scheme

June 2017 | CH2FP | Original Q4 | Legacy



Answer 15 · Mark scheme

June 2018 | 8462/1F | Original Q2

The full source mark scheme begins on page 61. Follow original question 2 in that document.

Answer 16 · Mark scheme

June 2018 | 8462/1F | Original Q3

The full source mark scheme begins on page 61. Follow original question 3 in that document.

Answer 17 · Mark scheme

June 2018 | 8462/1F | Original Q9

The full source mark scheme begins on page 61. Follow original question 9 in that document.

4.1.1.6 Relative atomic mass

Answer 18 · Mark scheme June 2019 | 8462/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	**A** nucleus **B** electron		1 1	AO1 4.1.1.4 4.1.1.7
01.2	electron		1	AO1 4.1.1.5
01.3	3 / three		1	AO2 4.1.2.1
01.4	(atomic number) 5 (mass number) 11		1 1	AO2 4.1.1.5
01.5	isotope		1	AO1 4.1.1.5
01.6	there are the same number of $^{79}_{35}Br$ atoms and $^{81}_{35}Br$ atoms		1	AO2 4.1.1.6
Total			**8**	

4.1.1.6 Relative atomic mass

Answer 19 · Mark scheme

June 2019 | 8462/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$\frac{184}{(232 + 6)} \times 100$	an answer of 77 (%) scores **2** marks an answer of 78.63247863 (%) correctly rounded to at least 2 significant figures scores **1** mark	1	AO2 4.3.3.2
	= 77 (%)	allow 77.31092437 (%) correctly rounded to at least 2 significant figures	1	
06.2	$\frac{38}{100} \times 40$	an answer of 15 (kg) scores **2** marks	1	AO2 4.4.1.3
	= 15 (kg)	allow 15.2 (kg)	1	
06.3	(2 x 27) + (3 x 16)	an answer of 102 scores **2** marks	1	AO2 4.3.1.2
	= 102	ignore units	1	
06.4	$\frac{28.4}{31.8} \times 100$	an answer of 89.3 (%) scores **3** marks	1	AO2 4.3.3.1
	= 89.3081761 (%)	allow 89.3081761(%) correctly rounded to at least 2 significant figures	1	
	= 89.3 (%)	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the masses in the question	1	

4.1.1.6 Relative atomic mass

Answer 19 · Mark scheme

June 2019 | 8462/1F | Original Q6

06.5	aluminium is more reactive than carbon (so) carbon cannot displace aluminium **or** (so) carbon cannot reduce aluminium oxide	allow aluminium is above carbon in the reactivity series allow (so) carbon cannot replace aluminium allow (so) carbon cannot remove oxygen from aluminium oxide allow (so) carbon will not react with aluminium oxide	1 1	AO1 4.4.1.1 4.4.1.2 4.4.1.3 4.4.3.3
Total			**11**	

4.1.1.6 Relative atomic mass

Answer 20 · 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

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

Answer 21 · Mark scheme

November 2020 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	they form ions with different charges they have high melting points		1 1	AO1 4.1.3.1 4.1.3.2
09.2	the (grey) crystals are silver the copper ions (produced) are blue (because) copper displaces silver	 allow the copper nitrate / compound (produced) is blue 	1 1 1	AO3 4.4.1.2

Question 9 continued

Question	Answers	Mark	AO/ Spec. Ref
09.3	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 AO3 4.4.1.2 4.5.1.1 RPA 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 **Key steps** • add the metals to (dilute) hydrochloric acid • measure temperature change **or** compare rate of bubbling **or** compare colour of resulting solution for copper: • no reaction • shown by no temperature change **or** shown by no bubbles for magnesium and iron: • magnesium increases in temperature more than iron **or** magnesium bubbles faster than iron **or** magnesium forms a colourless solution and iron forms a coloured solution **Control variables** • same concentration / volume of hydrochloric acid • same mass / moles of metal • same particle size of metal • same temperature (of acid if comparing rate of bubbling)		

4.1.1.6 Relative atomic mass

Answer 21 · Mark scheme

November 2020 | 8462/1F | Original Q9

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	$\frac{(203 \times 30) + (205 \times 70)}{100}$ **or** $\frac{6090 + 14\,350}{100}$ = 204.4	 ignore units	1 1	AO2 4.1.1.6
Total			**11**	

4.1.1.6 Relative atomic mass

Answer 22 · Mark scheme

November 2021 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(atoms with the) same number of protons	allow atoms with the same atomic number allow atoms of the same element ignore the same number of electrons	1	AO1 4.1.1.4 4.1.1.5
	(but with) different numbers of neutrons	ignore (but with) different mass numbers do **not** accept (but with) different relative atomic mass	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$(A_r =) \frac{(69 \times 60) + (71 \times 40)}{100}$		1	AO2 4.1.1.6
	= 69.8		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(number of electrons) = 31		1	AO2 4.1.1.4
	(number of neutrons) = 38		1	4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	Ga^{3+}		1	AO3 4.2.1.2

4.1.1.6 Relative atomic mass

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(gallium) fitted in a gap (Mendeleev had left)		1	AO2 4.1.2.2
	(gallium's) properties were predicted correctly (by Mendeleev)	allow (gallium's) properties matched the rest of the group	1	

Total			**9**

4.1.1.6 Relative atomic mass

Answer 23 · Mark scheme

November 2021 | 8462/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(3 × M_r H_2O = 3 × (2 + 16) =) 54 (A_r **R** = 150 – 54 =) 96 **alternative approach**: (M_r **R**O_3 = 150 – 6 =) 144 (1) (A_r **R** = 144 – (3 × 16) =) 96 (1)	 ignore units ignore units	1 1	AO2 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	(**R** =) molybdenum / Mo	allow ecf from question **10.1**	1	AO3 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	(total M_r of reactants) = 163 (% atom economy =) $\frac{119}{163}$ (×100) = 73 (%)	 allow correct use of an incorrectly calculated value of total M_r allow 73.00613 (%) correctly rounded to at least 2 significant figures	1 1 1	AO2 4.3.1.2 4.3.3.2

Question 10 continued

Question	Answers	Mark	AO/ Spec. Ref
10.4	**Level 2:** Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3 4.4.1.3
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • carbon and iron are the cheapest reactants • hydrogen is the most expensive reactant • separating solid products is expensive • separating solid products is time consuming • in method 1, tungsten needs to be separated from tungsten carbide • in method 1, some tungsten is lost as tungsten carbide • in method 1, the carbon dioxide produced will escape • in method 2, the water vapour produced will escape • in method 2, no separation of solids is needed • in method 3, tungsten needs to be separated from iron oxide		

Total			10

4.1.1.6 Relative atomic mass

Answer 24 · Mark scheme

June 2022 | 8462/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Name: Neutron → Label: B Name: Proton → Label: D do **not** accept more than one line from a box on the left		1 1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	(number of electrons) 9 (number of neutrons) 10		1 1	AO2 4.1.1.5

4.1.1.6 Relative atomic mass

Answer 24 · Mark scheme

June 2022 | 8462/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3 Mark with question 01.4	(relative atomic mass =) $\frac{(39 \times 93.3) + (41 \times 6.7)}{100}$	allow (relative atomic mass =) $\frac{(3638.7) + (274.7)}{100}$	1	AO2 4.1.1.6
		allow (relative atomic mass =) 36.387 + 2.747		
	= 39.134		1	
	= 39.1	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses all the values in **Table 1**	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4 Mark with question 01.3	potassium / K	allow ecf from question **01.3**	1	AO3 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	neutrons		1	AO1 4.1.1.5

Total Question 1		**9**

4.1.1.6 Relative atomic mass

Answer 25 · Mark scheme

June 2022 | 8462/1F | Original Q6

Question 6

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

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

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

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

4.1.1.6 Relative atomic mass

Answer 25 · Mark scheme

June 2022 | 8462/1F | Original Q6

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

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

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

Total Question 6		**8**

4.1.1.6 Relative atomic mass

Answer 26 · Mark scheme

June 2022 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	hydroxide ions		1	AO1 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	27 (cm^3)		1	AO2 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	ions cannot move (freely in a solid)	allow ions are fixed in place (in a solid)	1	AO1 4.2.2.1 4.2.2.3 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4			1 1	AO2 4.4.3.2

Molten compound	**Product at negative electrode**	**Product at positive electrode**
Potassium iodide	Potassium	**Iodine**
Zinc bromide	**Zinc**	Bromine

4.1.1.6 Relative atomic mass

Answer 26 · Mark scheme

June 2022 | 8462/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	carbon is less reactive than sodium		1	AO1 4.4.1.2 4.4.1.3 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(I)		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	(percentage atom economy =) $\frac{48}{80} \times 100$ = 60 (%)		1 1	AO2 4.3.3.2

Total Question 8		**9**

4.1.1.6 Relative atomic mass

Answer 27 · 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

4.1.1.6 Relative atomic mass

Answer 27 · Mark scheme

June 2023 | 8462/1F | Original Q8

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

4.1.1.6 Relative atomic mass

Answer 28 · Mark scheme

June 2023 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	a ball of positive charge with (negative) electrons embedded	do **not** accept references to protons, nuclei, neutrons	1 1	AO1 4.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(earliest) electrons protons (latest) neutrons		1	AO1 4.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(number of outer shell electrons) 7 (reason) (tennessine is in) Group 7	 allow the number of outer electrons is the same as the group number allow tennessine is a halogen MP2 is dependent on MP1 being awarded	1 1	AO2 4.1.2.1 4.1.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(time needed for) peer review	allow the idea that other scientists had to check the results	1	AO3 4.1.2.2

4.1.1.6 Relative atomic mass

Answer 28 · Mark scheme

June 2023 | 8462/1F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(A_r =) $\frac{(6 \times 7.6) + (7 \times 92.4)}{100}$	allow $\frac{45.6 + 646.8}{100}$ allow (6 × 0.076) + (7 × 0.924) allow 0.456 + 6.468	1	AO2 4.1.1.6
	= 6.924		1	
	= 6.9	allow an answer correctly rounded to 1 decimal place from an incorrect calculation which uses all the data in the table	1	

Total Question 9	9

4.1.1.6 Relative atomic mass

Answer 29 · Mark scheme

June 2024 | 8462/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	displacement		1	AO1 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(percentage =) $\frac{63.5}{159.5} \times 100$		1	AO2 4.3.1.2
	= 39.81191 (%)		1	
	= 39.8 %	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both the values in the question	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	volume of copper sulfate solution		1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	0.8(0) g		1	AO3 4.5.1.1 RPA4

4.1.1.6 Relative atomic mass

Answer 29 · Mark scheme June 2024 | 8462/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(maximum temperature change) = 47 – 22 (ºC) = 25 (ºC)	 allow correct use of incorrectly determined value(s) from the graph	1 1	AO2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(conversion 25 cm^3 =) 0.025 dm^3 (concentration =) $\frac{6.75}{0.025}$ (g/dm^3) = 270 (g/dm^3)	 allow correct use of an incorrectly determined or unconverted volume	1 1 1	AO2 4.3.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	line of best fit using the first five points line of best fit using the last four points	max **1** mark if the lines do not intersect	1 1	AO2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	energy is **taken in from** the surroundings so the reaction is **endothermic**		1	AO3 4.5.1.1 RPA4

Total Question 3	**14**

4.1.1.6 Relative atomic mass

Answer 30 · 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	<table><tr><th>Molten compound</th><th>Product at negative electrode</th><th>Product at positive electrode</th></tr><tr><td>Lead chloride</td><td>Lead</td><td>Chlorine</td></tr><tr><td>Potassium iodide</td><td>Potassium</td><td>Iodine</td></tr><tr><td>Zinc bromide</td><td>Zinc</td><td>Bromine</td></tr></table>	1 1 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) = 102		1 1	AO2 4.3.1.2

4.1.1.6 Relative atomic mass

Answer 30 · 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

4.1.1.6 Relative atomic mass

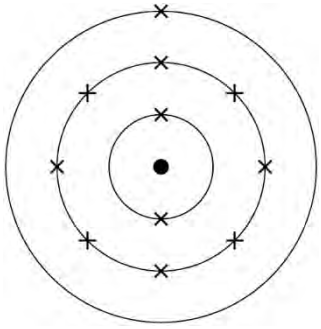
Answer 31 · Mark scheme

June 2025 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	towards the right **and** the top	allow a description of the position in the periodic table allow in Groups (3) 4 to 0	1	AO1 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	a melting point below 100 °C		1	AO3 4.1.2.3 4.2.2.7 4.2.2.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3		allow any combination of ×, ●, o, $e^{(-)}$ for electrons	1	AO1 4.1.1.7

4.1.1.6 Relative atomic mass

Answer 31 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **one** from: • so elements / tellurium / iodine were in groups with similar properties • iodine has similar properties to Group 7 elements • iodine has different properties to Group 6 elements	ignore reference to atomic structure allow named elements for Group 6 / 7 elements allow converse arguments in terms of tellurium	1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	argon has a full outer shell (of electrons)	allow energy level for shell allow argon has eight outer shell electrons ignore argon has no outer shell electrons	1	AO1 4.1.2.4
	(so argon) has a stable arrangement of electrons **or** (so argon) has a stable electronic structure	allow (so argon) does not gain / lose / share electrons	1	

4.1.1.6 Relative atomic mass

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	atoms with the same number of protons (but with) different numbers of neutrons	allow atoms of the same element allow atoms with the same atomic number ignore atoms with the same number of electrons	1 1	AO1 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	~115		1	AO2 4.1.1.6

Total Question 8	**9**

4.1.1.6 Relative atomic mass

Answer 32 · 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	

4.1.1.6 Relative atomic mass

Answer 32 · 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

4.1.1.6 Relative atomic mass

Answer 32 · Mark scheme

June 2025 | 8462/1F | Original Q10

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

4.1.1.6 Relative atomic mass

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.1.1.6 Relative atomic mass

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

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 <u>not</u> 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.

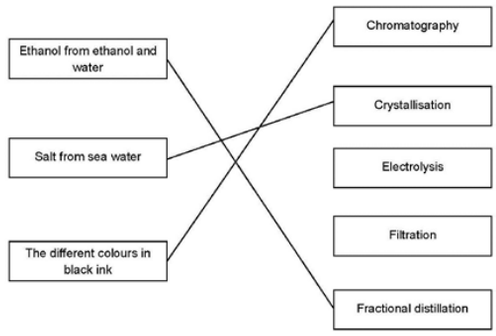
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

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.

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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

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

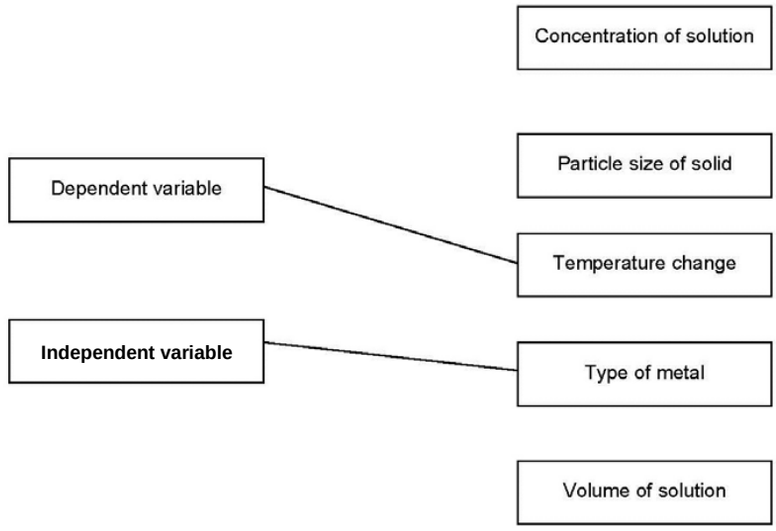
4.1.1.6 Relative atomic mass

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	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	a correctly calculated value from their answer to question **05.7** scores **2** marks allow (mass =) answer from question **05.7** × 20	1	AO2 4.3.1.3
	correctly calculated value (g)		1	
Total			**10**	

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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

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

4.1.1.6 Relative atomic mass

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

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**	

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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**

4.1.1.6 Relative atomic mass

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

4.1.1.6 Relative atomic mass

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**	

4.1.1.6 Relative atomic mass

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 15 · Examiner comments

June 2018 | 8462/1F | Original Q2

Question 2 (low and standard demand)

02.1 42% of students did not realise that the number of outer shell electrons would be the same as the Group number.

02.2 19% of students were able to deduce that hydrogen bromide exists as small molecules. The majority of answers were fairly evenly split between giant covalent and ionic lattice.

02.3 59% of students were able to select F_2 as the correct formula for fluorine, with most of the others opting for F.

02.4 26% of students scored two or more marks, usually for giving the correct trend in reactivity and stating that iodine had no reactions or no changes.

Very few students could articulate their reasoning in terms of displacement. Several tried to answer in terms of reactivity of the potassium halides rather than the halogens, or were misusing the term ‘halide’ instead of ‘halogen’, making it difficult to gain any credit. Others thought that darkness of colour was an indication of reactivity, whilst some referred to melting or boiling points, which were not relevant.

Some students tried to answer in terms of ease of gaining an electron, rather than by using the information in the table as intended. Those who did so were given credit, with the most common mark being for a description of the iodine atom being larger than the chlorine atom.

02.5 74% of students were able to calculate the M_r of TiO_2 correctly. Of those who didn’t gain credit, often they didn’t recognise that there are two oxygen atoms, giving an answer of 64

02.6 This question discriminated well with 32% of students achieving both marks. Many students could convert 1.2 kg to 1200 g. However, many used the mass of reactant, 500 g, as either the numerator or denominator in the percentage yield expression. Others inverted the % yield expression or tried to subtract values.

Answer 16 · Examiner comments

June 2018 | 8462/1F | Original Q3

Question 3 (low and standard demand)

03.1 This question was answered very well, with 60% of students achieving four or five marks. 11% of students achieved all five marks, the key difference being that they knew Chadwick proved the existence of the neutron, which is a new area of the specification.

03.2 78% of students were able to substitute in the values and calculate the relative atomic mass correctly. However, some calculator errors were seen which often led to an answer of 45.1 instead of 63.6. A few students, having looked at the periodic table, 'corrected' their answer to 63.5, thereby forfeiting a mark.

03.3 This question was answered well, with 76% of students able to identify the element as copper. Those who had calculated their relative atomic mass incorrectly were able to gain credit, for example, by giving the answer scandium after a value of 45.1.

Some looked at the mass numbers of the isotopes and were able to identify copper in that way. However, those who looked at the isotope of mass number 65 and gave the answer zinc did not gain credit.

03.4 Students found this calculation difficult, with 39% achieving both marks. Many multiplied by 10 000 or divided by 1×10^{-4}. A few introduced the relative atomic mass of copper.

Partial credit was given for a correct answer not expressed in standard form. 12% of students did not attempt the question.

Answer 17 · Examiner comments

June 2018 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 Because the question asked for the formula rather than the empirical formula, an answer of Fe_9S_{18} was accepted. Even so, 21% of students were able to answer this correctly.

Many students ignored the necessity for correct capital and lower case letters, with a lower case 'f' being seen quite frequently. Others did not count the atoms correctly, or used a large figure '2' in an inappropriate position.

09.2 This question worked very well. 84% of students managed to achieve at least one mark, with 51% achieving two or more. The most frequent error was in the number of neutrons.

09.3 Whilst 56% of students achieved at least one mark, 34% of these students achieved both.

- Many students repeated information in the stem of the question. And some appeared to ignore it as they declared sodium to be a non-metal.
- Many gave differences in the structure of the atoms instead of differences in properties of the substances.
- Some effectively gave the same difference twice, for example writing that sodium is soft on one line and iron is hard on the other.

09.4 26% of students achieved at least one mark on this question, although some very good answers were seen. As with some other questions, students were sometimes prone to imprecise use of language.

Many students thought that carbon is more reactive than oxygen rather than nickel, or said that carbon is reacting with oxygen (it is not, it is reacting with nickel oxide to remove the oxygen). Those who tried to answer in terms of electron transfer often struggled to gain all the marks.

09.5 Students struggled with this calculation; with 9% of students providing a fully correct answer. This question relies on knowledge of the expression for atom economy. Those who quoted the expression often did not know what was meant by 'reactants'.

It was also common to include the M_r of all the products instead of just the nickel, leading to an answer of 100%, which is clearly incorrect as there is more than one product.

There seemed to be trouble with the interpretation of some calculator displays. Many students lost the final mark because they gave an answer of $67.\dot{8}$. This answer is neither correct (it is not 67.8888888…) nor to three significant figures (it is to an infinite number of significant figures). Some even recognised this latter point and rounded, incorrectly, to 67.9.

4.1.1.6 Relative atomic mass

Answer 18 · Examiner comments June 2019 | 8462/1F | Original Q1

Question 1 (low demand)

01.1 Approximately 80% of students identified both the nucleus and the electron in the diagram of an atom.

01.2 Approximately 60% of students identified the electron as having the lowest mass.

01.3 Approximately three-quarters of students correctly applied their knowledge and understanding of the link between electronic structure and group number.

01.4 Almost 60% of students scored both marks. Here, they applied their knowledge and understanding of the links between atomic structure and both atomic number and mass number.

01.5 Approximately 70% of students knew the term 'isotope' for the type of atom described.

01.6 Students found this multiple choice question about the link between isotope ratios and relative atomic mass difficult.

The first incorrect option was chosen more often than the correct one. This suggests that, in many cases, students did not understand how the relative atomic mass is determined from the average mass of all isotope atoms and were perhaps drawn towards the word 'fewer' alongside the smaller number '79'.

Answer 19 · Examiner comments June 2019 | 8462/1F | Original Q6

Question 6 (low and standard demand)

06.1 Approximately 60% of students calculated the percentage atom economy correctly.

A final answer of 77.3 with a dot over the 3 signifying a recurring 3 was a common error.

06.2 Approximately two-thirds of students performed the percentage calculation correctly.

06.3 Approximately 70% of students calculated the relative formula mass correctly.

06.4 The requirement to give the answer to 3 significant figures made this calculation more challenging. However, approximately a half of students scored all 3 marks.

A final answer of 89.3 with a dot over the 3 signifying a recurring 3 was a common error.

06.5 Students found this question difficult. Almost three-quarters of students scored 0 marks.

For those students who scored 1 mark, it was almost always for the relative reactivity of aluminium and carbon.

4.1.1.6 Relative atomic mass

Answer 24 · Examiner comments June 2022 | 8462/1F | Original Q1

Question 1 (Low and standard demand)

01.1 The great majority of students scored both marks.

01.2 The majority of students scored at least one mark, with just under half scoring both marks.

01.3 Most students could substitute the values into the equation and obtain a correct value for the relative atomic mass. However, only about half could then give their answer to three significant figures. Some students did not appear to understand how to input their expression into a calculator and incorrectly calculated the value as

$$(39 \times 93.3) + \left(\frac{41 \times 6.7}{100}\right)$$

which gave a value of 3641.

01.4 Students who had correctly calculated the relative atomic mass were less successful at identifying the element, with some giving the response argon, and others mistakenly using the atomic number, giving a response of yttrium.

01.5 Fewer than 40% of students gave the correct answer.

Answer 25 · Examiner comments June 2022 | 8462/1F | Original Q6

Question 6 (Low and standard demand)

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

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

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

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

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

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

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

4.1.1.6 Relative atomic mass

Answer 26 · Examiner comments

June 2022 | 8462/1F | Original Q8

Question 8 (Low demand)

08.1 Fewer than 40% of students recognised the hydroxide ion as the source of oxygen; the most popular distractor was hydrogen ions.

08.2 Most students could read the volume of gas in the inverted measuring cylinder. Some tried to read the scale upwards and gave a response of 33 cm^3.

08.3 Only about 20% of students were awarded the mark. Students needed to explain why ionic solids do not conduct, rather than why solutions or molten compounds do conduct. Even when directed to answer in terms of ions, some students still thought that electrons were somehow involved.

08.4 This was well answered, with the great majority of students naming both correct products.

08.5 Over a half of students gave the correct reason in terms of the relative reactivity of carbon and sodium. The electrical conductivity of carbon was a popular distractor.

08.6 About a half of students gave (aq) as the state symbol for a molten substance.
Only about 30% gave the correct answer (l).

08.7 Correct answers to this calculation were given by the great majority of students.

4.1.1.6 Relative atomic mass

Answer 27 · 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 28 · Examiner comments

June 2023 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 The description of the plum pudding model in the specification (a ball of positive charge with negative electrons embedded in it) is not well known. Very few students scored both marks and fewer than a quarter scored one. Many students believed that the positive

Answer 28 · Examiner comments June 2023 | 8462/1F | Original Q9

charge represented a proton, or that the atom as a whole is positively charged. Some referred to a ‘sea’ or ‘cloud’ of positive charge, but these terms do not convey the shape.

09.2 Fewer than a third of students knew the correct order of discovery of the particles.

09.3 About a third of students scored both marks. Most missed the relevance of the instruction to use the period table. Many tried to work out the electron configuration, instead of simply locating element 117 in Group 7 and deducing that there must be 7 outer shell electrons.

09.4 This question was very poorly answered and did not discriminate well. Students seemed unfamiliar with the concept of the need for peer review. Most answered in terms of the rarity of the element, but this was also true for the original scientists and does not explain the time lag before acceptance.

09.5 Whilst one in ten students scored all three marks, overall, few remembered how to do this standard calculation. The four numbers in the table were manipulated in various random ways. Some students did not even use all the data. Most did not realise that the answer must lie somewhere between 6 and 7, the two mass numbers. One in five students made no attempt to answer.

4.1.1.6 Relative atomic mass

Answer 29 · Examiner comments — June 2024 | 8462/1F | Original Q3

Question 3 (low and standard demand)

03.1 Two thirds of students recognised this as a displacement reaction. Combustion proved surprisingly popular.

03.2 Nearly a half of students scored 2 or 3 marks on this calculation. A common error was to give the answer to three decimal places instead of three significant figures. A few students thought that 39.81 should be rounded up to 39.9, and some left a recurring dot on the $\dot{8}$ of 39.$\dot{8}$ (so an infinite number of significant figures). Many students operated on the data provided seemingly at random, with addition, subtraction and multiplication seen as well as the division the wrong way round. It was common to leave the ' × 100' out of the expression, so that marking point 1 could not be awarded if the answer was incorrect.

03.3 Two thirds of students identified the volume of copper sulfate solution as the control variable.

03.4 Two thirds of students gave the correct answer. Some students gave the minimum or maximum temperature as their answer, rather than reading the mass at the turning point of the graph.

03.5 Most students realised that they needed to subtract the minimum temperature from the maximum, and three fifths of students scored at least one mark. Some, however, misread those values from the graph, with 45.4 – 20.4 being frequently seen. Although this gave the correct answer, it was as the result of incorrect working so did not score both marks. A minority of students were unable to start the calculation, and various multiplications of random values were seen.

03.6 Over a half of students gave a fully correct answer. Many students could not convert their volume to dm^3 even given the conversion factor, with many trying to do a calculation involving the mass of copper sulfate. However, partial credit was then awarded for those who substituted their value of volume into the given equation and calculated the results correctly. Many students do not seem to understand the terms volume and concentration, and that they mean different things.

03.7 Just over a half of students were able to draw two sharp straight lines, with a ruler, which passed through all the points. Some did not use a ruler, and a few drew an extra line joining the first and last points, meaning that full marks could not be awarded.

03.8 Students struggled with this standard demand question, with only a quarter gaining a mark. More than a half of students selected the second distractor, in which both parts of the statement are the opposite of the correct version. When temperature decreases, heat energy is being taken in from the surroundings and converted to chemical energy, so the reaction is endothermic. It is this reduction in heat energy that causes the temperature decrease. A misconception for many students is thinking that when heat energy is taken in from the surroundings it remains as heat energy in the system, causing the confusion with the direction of temperature change.

Answer 30 · 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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4.1.1.6 Relative atomic mass

Answer 30 · 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 31 · Examiner comments

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Question 8 (standard demand)

08.1 Only one student in six could give a correct description of where the non-metals are found, despite there being a clear statement in the specification. Many referred to the right of the table, but few referred to the top. Those who referred to specific groups were often correct but some omitted Group 0. Some referred to a 'staircase' but did not specify what it means; it should be noted that the periodic table provided does not show a staircase.

08.2 About half correctly chose the low melting point, with the three distractors all being popular. Several ticked more than one box, which automatically scores zero when the instruction is to tick **one** box.

08.3 Three fifths of students drew the structure correctly. A few tried to put in 23 electrons and a few 12. One in seven students did not attempt to answer; this is a common occurrence when a question is not accompanied by answer lines. Students do need to read all the words, so they are aware there is a task to do.

08.4 This was answered less successfully. Many stated that Mendeleev left spaces for other elements to be discovered which, while true, does not answer the question. Others answered in terms of atomic number, which was not known in Mendeleev's time. Even those who tried to answer in terms of placing elements in the 'correct' group rarely mentioned properties.

08.5 Whilst about two fifths knew that argon has a full outer shell, not many were able to go on to say that this is a stable electronic structure, or that electrons are not transferred or shared. Many simply repeated information in the question with different words, such as 'argon is a noble gas' or 'argon is stable'.

08.6 Whilst about a quarter of students knew that a different number of neutrons was involved, few stated that isotopes are <u>atoms</u> with the same number of protons or <u>atoms</u> of the same element. Some referred to 'elements' implying more than one element, which contradicts the idea of atoms of the same element. Some students implied incorrectly that an isotope is a single atom in which the number of neutrons is different to the number of protons and electrons.

08.7 Fewer than half of students could correctly estimate that the A_r must be closest to 115 as there was such a high proportion of the 115 isotopes. The most popular answer was ~114, taking a simple mean rather than a weighted mean of the mass numbers.

4.1.1.6 Relative atomic mass

Answer 32 · 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.

4.1.1.6 Relative atomic mass

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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.

4.1.1.6 Relative atomic mass

Mark Ranges and Award of Grades

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