AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.1.2

# Relative formula mass

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **51** |
| 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.

### 4.3.1.2 Relative formula mass

**Answer 01 · Mark scheme**

June 2007 | CHY1A | Original Q9 | Legacy

| | | | | |
|---|---|---|---|---|
| Nine | **1** | **2** | **4** | **3** |

### 4.3.1.2 Relative formula mass

**Answer 02 · Mark scheme**



**Question 8**

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

### 4.3.1.2 Relative formula mass

**Answer 03 · Mark scheme**

June 2008 | CHY2F | Original Q7 | Legacy

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

**Question 7 continued on the next page…**

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

### 4.3.1.2 Relative formula mass

**Answer 03 · Mark scheme**

June 2008 | CHY2F | Original Q7 | Legacy

**COMPONENT NUMBER: CHY2F**

**COMPONENT NAME: Additional Science / Chemistry**

**STATUS: Final**

**DATE: June 2008**

4.3.1.2 Relative formula mass

Answer 04 · 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<br><br>do **not** accept $H_2$<br><br>apply list principle | 1 |
| **8**(b)(i) | 143 | correct answer with or without working = **2** marks<br><br>ignore units<br><br>if answer is not correct<br>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<br><br>answer 49 gains **1** mark<br><br>if answer is not correct:<br>(71 ÷ 143) × 100 gains **1** mark<br><br>allow error carried forward from part (b)(i)<br><br>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.<br><br>**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…**

### 4.3.1.2 Relative formula mass



**CHY2F**

**Question 8**

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

4.3.1.2 Relative formula mass

Answer 05 · 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<br><br>given out / transfers to surroundings | <br><br>the mark for given out / transfers to cannot be awarded without heat / energy<br><br>allow given off | 1<br><br>1 |
| 5(c) | it has a low boiling point<br><br>it is made of small molecules | | 1<br><br>1 |
| **Total** | | | **6** |

### 4.3.1.2 Relative formula mass

**Answer 05 · Mark scheme**

January 2010 | CHY2F | Original Q5 | Legacy

**CHY2F**

### 4.3.1.2 Relative formula mass

**Answer 06 · Mark scheme** June 2019 | CHY1F | Original Q6 | Legacy

## Question 6

| question | answers | extra information | mark |
|---|---|---|---|
| **6**(a)(i) | condensed | it = water vapour<br><br>accept temperature went below 100°C / boiling point of water<br>allow cooled to form liquid / water / rain<br>do **not** accept evaporated | 1 |
| | formed the oceans / seas | ignore rain<br>accept (water vapour) cooled and formed the ocean / sea for **2** marks | 1 |
| **6**(a)(ii) | any **two** from:<br>• used by (green) plants / *algae*<br>• changed into oxygen<br>• dissolved in oceans / seas<br>• (locked up) in carbonates / sedimentary rocks<br>• (locked up) in fossil fuels / named fossil fuel | ignore oxygen / nitrogen increased<br>ignore reference to volcanoes / respiration<br><br>accept photosynthesis / plants give out oxygen<br><br>accept (locked up) in shells / skeletons (of animals) | 2 |
| **6**(b)(i) | cannot get to / reach / drill to / see the core | accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface<br><br>accept it is (too) hot / radioactive<br>ignore lack of evidence unqualified | 1 |
| **6**(b)(ii) | any **three** from:<br>• heat / *energy* released<br>• from radioactive decay / processes<br>• (causing) convection currents<br>• in the mantle | accept radioactivity / nuclear reactions | 3 |
| **Total** | | | **8** |

4.3.1.2 Relative formula mass

Answer 07 · 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 $NH_3$<br>ignore incorrect symbols<br>ignore balancing | 1 |
| **6**(a)(ii) | any **one** from:<br>• catalyst<br>• to speed up the reaction<br>• lower activation energy | <br><br>ignore causes reaction<br>ignore heat / reference to particles<br> | 1 |
| **6**(a)(iii) | any **two** from:<br>• cooled<br>• ammonia condenses / turns into liquid<br>• nitrogen and hydrogen do not condense / turn into liquid<br>**or**<br>nitrogen and hydrogen stay as gases | it = ammonia<br><br>ignore references to boiling point<br><br><br><br>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**

4.3.1.2 Relative formula mass



**CHY2F**

**Question 6 continued**

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

### 4.3.1.2 Relative formula mass

**Answer 07 · Mark scheme** June 2010 | CHY2F | Original Q6 | Legacy

**CHY2F**

**Answer 08 · Mark scheme** November 2010 | CHY1BP | Original Q4 | Legacy

| | | | |
|---|---|---|---|
| Four | **A** | Venus | **1** |
| | **B** | Earth | **2** |
| | **C** | Mars | **4** |
| | **D** | Jupiter | **3** |
| | | | |

4.3.1.2 Relative formula mass

Answer 09 · Mark scheme

January 2011 | CHY2F | Original Q7 | Legacy

## Question 7

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

4.3.1.2 Relative formula mass

Answer 10 · 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)<br><br>allow it is a gas | 1 |
| 7(b)(i) | 80 / 79.5 | correct answer with or without working = **2** marks<br>ignore units<br><br>if no answer **or** incorrect answer then evidence of<br>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<br><br>if no answer **or** incorrect answer<br><br>then<br><br>evidence of $\frac{64}{80}$ **or** $\frac{63.5}{79.5}$ (x100)<br>gains **1** mark<br><br>accept (ecf)<br>$\frac{64 or 63.5}{answer(b)(i)}(\times 100)$ for **2** marks if correctly calculated<br><br>if incorrectly calculated<br>evidence of $\frac{64 or 63.5}{answer(b)(i)}(\times 100)$<br><br>gains **1** mark | 2 |
| 7(b)(iii) | 3.2 | correct answer with or without working = **1** mark<br><br>allow (ecf)<br>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<br>ignore accurate / repeat | 1 |
| 7(c)(iii) | any **two** from:<br>• different balances used **or** faulty balance<br>• reading / using the balance incorrectly **or** recording error<br>• spilling copper oxide / copper<br>• copper oxide impure<br>• not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used<br>• heated for different times<br>• heated at different temperatures<br>• some of the copper made is oxidised / forms copper oxide<br>• some of the copper oxide / copper blown out / escapes (from tube)<br>• some water still in the test tube | ignore systematic / human / apparatus / zero / measurement / random / weighing / reading errors unless qualified<br>ignore dirty apparatus<br>accept incorrect weighing of copper / copper oxide<br>allow some copper left in tube<br>allow impure copper (produced)<br>accept not all copper oxide (fully) reacted<br>accept Bunsen burner / flame at different temperatures<br>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

4.3.1.2 Relative formula mass

Answer 11 · Mark scheme

June 2012 | CH1FP | Original Q2 | Legacy

## Question 2

| question | answers | extra information | mark |
|---|---|---|---|
| 2(a) | A – core<br><br>B – mantle<br><br>C – crust | | 1<br><br>1<br><br>1 |
| 2(b) | any **two** from:<br><br>• carbon dioxide dissolves / absorbs in water / oceans<br><br>• plants / algae photosynthesise / absorb / use carbon dioxide<br><br>• marine organisms use (dissolved) carbon dioxide to form their shells / skeletons<br><br>**or**<br><br>limestone was formed from the shells / skeletons of marine organisms | <br><br>allow reacts with water<br><br>accept remains of plants / algae / marine organisms contain locked up carbon dioxide / carbon in the form of fossil fuels<br>do **not** accept plants use carbon dioxide for respiration<br><br>accept carbon dioxide became locked up in sedimentary rocks / carbonates / limestone<br><br>**or**<br><br>precipitation or formation of insoluble carbonates | 2 |
| **Total** | | | **5** |

### 4.3.1.2 Relative formula mass

**Answer 11 · Mark scheme** June 2012 | CH1FP | Original Q2 | Legacy

**CH1FP**

### 4.3.1.2 Relative formula mass

**Answer 12 · Mark scheme**



| 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<br>if no answer or incorrect answer then evidence of correct working [56 + (3x35.5)] gains **1** mark | 2 |
| **6(b)(ii)**<br>**(view with 6bi)** | 34.46 | accept rounding from 34 - 34.5<br>correct answer with or without working gains **2** marks<br>accept ecf from 6 (b)(i) correctly calculated for **2** marks<br>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** |

### 4.3.1.2 Relative formula mass

**Answer 12 · Mark scheme**

January 2013 | CH2FP | Original Q6 | Legacy

January 2013

**CH2FP**

4.3.1.2 Relative formula mass

Answer 13 · Mark scheme

June 2013 | CH1FP | Original Q7 | Legacy

**Question 7**

| question | answers | extra information | Mark |
|---|---|---|---|
| **7(a)** | any **two** from:<br>• copper / ores are running out / harder to find<br>• there are no / very small amounts of high-grade copper ores left<br>• copper metal is in demand<br>• copper is expensive<br>• now economical to extract copper from low-grade ores | it = copper<br>allow new methods of extraction e.g. bioleaching and phytomining<br>allow high-grade ores are running out for **2** marks | 2 |
| **7(b)(i)** | large amounts / 98% of rock to dispose of as waste<br>**or**<br>waste rock takes up a lot of space | accept contains toxic (metal) compounds / bioleacher | 1 |
| **7(b)(ii)** | (copper sulfide reacts with oxygen to) produce sulfur dioxide / $SO_2$<br>that causes acid rain | allow (sulfur reacts with oxygen to) produce sulfur dioxide / $SO_2$<br>allow description of effects of acid rain **or** sulfur dioxide<br>if no other mark awarded allow $CO_2$ produced which causes global warming **or** $CO_2$ produced by burning fuel or heating the furnace for **1** mark | 1<br>1 |
| **7(b)(iii)** | any **one** from:<br>• large amounts of fuels / energy used (for the furnace and electrolysis)<br>• (the extraction has) many steps / stages / processes<br>• large amounts of ore / material have to be mined | allow large amounts of electricity needed<br>ignore high temperature / electrolysis unqualified<br>allow (extraction) is a long process / takes a lot of time<br>allow ores contain a low percentage of copper | 1 |

**Question 7 continues on the next page**

4.3.1.2 Relative formula mass



**Question 7 continued**

| question | answers | extra information | Mark |
|---|---|---|---|
| 7(b)(iv) | (copper ions move towards) the negative electrode / *cathode*<br><br>because copper ions / $Cu^{2+}$ are positively charged **or** are oppositely charged **or** copper ions need to gain electrons | <br><br>allow because metal ions are positive **or** opposites attract | 1<br><br>1 |
| 7(b)(v) | (growing) plants | | 1 |
| **Total** | | | **9** |

### 4.3.1.2 Relative formula mass

**Answer 14 · 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<br>strong bonds | | 1<br>1 |
| **1(e)(i)** | 58.5 | | 1 |
| **1(e)(ii)** | mole | | 1 |
| **1(f)** | very small (particles) **or**<br>1-100nm in size **or**<br>(particle with a) few hundred atoms | ignore tiny / small / smaller / microscopic etc. | 1 |
| **Total** | | | **12** |

4.3.1.2 Relative formula mass

Answer 15 · 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<br><br>up to 8 spatula measures<br><br>then the temperature change is constant | accept examples from the table<br><br>accept any correct indication of when change occurs<br><br>if no marks awarded allow **1** mark for:<br>the more sodium hydrogencarbonate the lower the final temperature | 1<br><br>1<br><br>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<br><br>allow gas / air expands when heated | 1 |
| 7(b)(ii) | no, because (reaction) is exothermic<br><br>**or**<br><br>yes, to start the reaction | allow no, because (reactants) were formed by heating<br><br>ignore references to cooling | 1 |
| 7(c)(i) | 84 | correct answer with or without working gains **2** marks<br><br>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<br><br>allow ecf from (c)(i) | 1 |
| **Total** | | | **9** |

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

### 4.3.1.2 Relative formula mass

**Answer 16 · Mark scheme**

June 2014 | CH1FP | Original Q2 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **2(a)** | argon / Ar | | 1 | 1 / 1.1.2b | G |
| **2(b)(i)** | 0 | | 1 | 1 / 1.1.2b | A |
| **2(b)(ii)** | unreactive | | 1 | 1 / 1.1.2b | A |
| **2(c)(i)** | 94.96(%) | | 1 | 2 / 1.7.2c | E |
| **2(c)(ii)** | any **two** from:<br>• plants or photosynthesis<br>• absorbed in oceans / *seas*<br>• locked up in *(*sedimentary*)* rocks<br>• locked up in fossil fuels | allow oceans store **or** take in **or** dissolve carbon dioxide | 2 | 2 / 1.7.2f/g/h | E |
| **Total** | | | **6** | | |

### 4.3.1.2 Relative formula mass

**Answer 16 · Mark scheme**

June 2014 | CH1FP | Original Q2 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 17 · 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<br>**or**<br>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:<br>• not all the magnesium was collected<br>• *used less time* ***or*** *lower current* ***or*** *different battery / power pack* ***or*** *different balance* ***or*** *lower voltage*<br>• error in reading balance<br>• 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.<br>if answer incorrect, allow **1** mark for 0.99<br>**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.<br>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** | | |

### 4.3.1.2 Relative formula mass

**Answer 17 · Mark scheme**

June 2014 | CH2FP | Original Q5 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 18 · Mark scheme** June 2015 | CH1FP | Original Q2 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **2(a)(i)** | central block | | 1 | 1 / 1.3.3a |
| **2(a)(ii)** | conducts electricity | | 1 | 1 / 1.3.3a |
| **2(b)** | any **two** from:<br>• visual pollution<br>• noise pollution<br>• dust pollution<br>• habitat destruction | | 2 | 2 / 1.3.1b |
| **2(c)(i)** | to concentrate the ore/copper carbonate<br>**or**<br>to remove / separate the rock | | 1 | 2 / 1.3.1b |
| **2(c)(ii)** | 12 (tonnes) | If answer is incorrect allow one mark for (127 + 132) – 247 or<br>259 - 247 | 2 | 2 / 1.1.3c |
| **2(c)(iii)** | any **one** from:<br>• so no reactant is wasted/left unreacted<br>• so they know how much product they will make<br>• need to record/compensate for the carbon dioxide produced | allow so they can work out their carbon footprint | 1 | 3 / 1.1.3c |
| **Total** | | | **8** | |

### 4.3.1.2 Relative formula mass

**Answer 18 · Mark scheme**

June 2015 | CH1FP | Original Q2 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 19 · Mark scheme**

June 2015 | CH1FP | Original Q4 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **4(a)(i)** | the polymer is not biodegradable<br>the polymer is waterproof | | 1<br>1 | 2 / 1.5.2b/c |
| **4(a)(ii)** | any **one** from:<br>• made from a renewable/sustainable resource<br>• is biodegradable | ignore releases less carbon dioxide<br><br><br>allow decomposes | 1 | 3 / 1.5.2c/d |
| **4(b)(i)** | <br>crushing<br>filtering | in the correct order | <br>1<br>1 | 1 / 1.6.1a |
| **4(b)(ii)** | open the tap<br>to allow only water to flow out<br>**or**<br>close the tap to leave the oil in the funnel | <br><br><br>allow close tap then allow oil to flow out into a separate container | 1<br>1 | 2 / 1.6.1a |
| **4(c)(i)** | They provide a lot of energy | | 1 | 1 / 1.6.1b |
| **4(c)(ii)** | because the vegetable/plant absorbs / uses carbon dioxide<br>which is released when the biofuel burns | <br>second marking point is dependent on first marking point<br>allow a fossil fuel releases locked up carbon dioxide/carbon<br>if no other mark awarded allow carbon neutral for **one** mark | 1<br>1 | 1 / 1.5.2a |
| **Total** | | | **10** | |

### 4.3.1.2 Relative formula mass

**Answer 19 · Mark scheme**

June 2015 | CH1FP | Original Q4 | Legacy



### 4.3.1.2 Relative formula mass

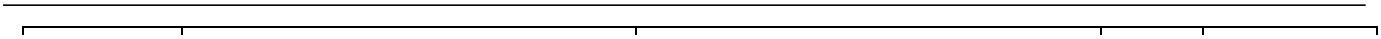
**Answer 20 · Mark scheme** June 2015 | CH2FP | Original Q1 | Legacy

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

### 4.3.1.2 Relative formula mass

**Answer 20 · Mark scheme**

June 2015 | CH2FP | Original Q1 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 21 · Mark scheme**

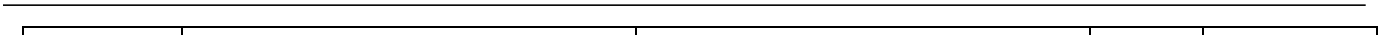
June 2015 | CH2FP | Original Q3 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **3(a)** | A compound | | 1 | **AO1**<br>2.1.1a |
| **3(b)** | lead nitrate<br>potassium iodide | in either order | 1<br>1 | **AO2**<br>2.6.1d |
| **3(c)** | filter paper is missing<br>so solid will go through funnel | | 1<br>1 | **AO3**<br>2.6.1b |
| **3(d)(i)** | percentage yield | | 1 | **AO2**<br>2.3.3e |
| **3(d)(ii)** | any **one** from:<br>• some product lost<br>• reaction may not go to completion<br>• unexpected reaction<br>• impure reactants | allow insufficient reactant | 1 | **AO1**<br>2.3.3d |
| **Total** | | | **7** | |

### 4.3.1.2 Relative formula mass

**Answer 21 · Mark scheme**

June 2015 | CH2FP | Original Q3 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 22 · Mark scheme** June 2016 | CH1FP | Original Q3 | Legacy

**Question 3**

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **3(a)** | because it is a good conductor of electricity. | | 1 | AO1 1.3.3b |
| **3(b)(i)** | 2.1 (%) | | 1 | AO2 1.3.1c |
| **3(b)(ii)** | correct bar for calcium at 3.6 %<br>correct bar for iron at 5.0 % | allow error of +/- 0.05%<br>allow error of +/- 0.05% | 1<br>1 | AO2 1.3.1c |
| **3(c)(i)** | decomposition | | 1 | AO1 1.1.3b; 1.2.1b/c |
| **3(c)(ii)** | carbon dioxide | | 1 | AO1 1.2.1c |
| **3(c)(iii)** | carbon = 1<br>oxygen = 3 | allow one<br>allow three | 1<br>1 | AO2 1.1.3 a |
| **3(c)(iv)** | 44 (g) | allow forty four | 1 | AO2 1.1.3 c |
| **3(d)(i)** | to make alloys for specific uses. | | 1 | AO1 1.3.2a/b/c |
| **3(d)(ii)** | any **three** from:<br>• to conserve resources of iron or iron ore<br>• to avoid the need for quarrying/mining<br>• to conserve energy resources or fossil fuels<br>• to limit the amount of carbon dioxide produced or to reduce global warming<br>• to reduce the amount of landfill | "it" = steel<br>ignore cost and reuse and time and waste<br>allow steel instead of iron or iron ore<br>allow limited resource or non-renewable | 3 | AO1 1.3.1j |
| **Total** | | | **13** | |

### 4.3.1.2 Relative formula mass

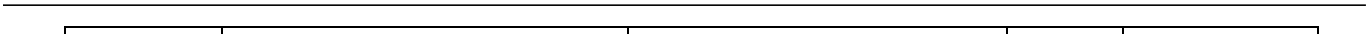
**Answer 23 · Mark scheme** June 2016 | CH2FP | Original Q1 | Legacy

| Question | Answers | Extra information | Mark | AO / SpecRef |
|---|---|---|---|---|
| 1(a)(i) | 7 / seven | | 1 | AO1 2.1.1e |
| 1(a)(ii) | 1<br>Electron | do **not** accept -1 | 1<br>1 | AO1 2.3.1b |
| 1(a)(iii) | isotopes | | 1 | AO1 2.3.1d |
| 1(b)(i) | (sodium + ) fluorine → sodium fluoride | | 1 | AO2 2.1.1d,e |
| 1(b)(ii) | compounds | | 1 | AO1 2.1.1a |
| 1(b)(iii) | mole | | 1 | AO1 2.3.1g |
| 1(b)(iv) | <br>sodium (atom) loses<br>fluorine (atom) gains<br>one electron<br>ions formed | **max 3** if reference to incorrect particle / bonding<br><br><br><br><br>allow sodium forms positive (ion) **or** fluorine forms negative (ion)<br>allow form ionic bond<br>allow to gain a full outer shell of electrons<br>allow forms noble gas structure | <br>1<br>1<br>1<br>1 | AO1 / AO2 2.1.1b,c,d,e,f |
| 1(b)(v) | Dissolve in water<br>High melting point | | 1<br>1 | AO1 2.2.2a,b |
| Total | | | 13 | |

### 4.3.1.2 Relative formula mass

**Answer 23 · Mark scheme**

June 2016 | CH2FP | Original Q1 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 24 · 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<br>if 17 or 34 not shown in working **max 2** marks<br>accept 82.4<br>accept 82.35 to full calculator display (82.35294...) correctly rounded to at least 2 sf<br>if no answer or incorrect answer, then<br>($M_r$ =) 17 gains **1** mark **or**<br>14/17 gains **2** marks<br>**OR**<br>($2M_r$ =) 34 gains **1** mark **or**<br>28/34 gains **2** marks<br>**OR**<br>14/their $M_r$ shown gains **1** mark **or**<br>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 $NH_4Cl$<br>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 |
|---|---|---|---|

### 4.3.1.2 Relative formula mass

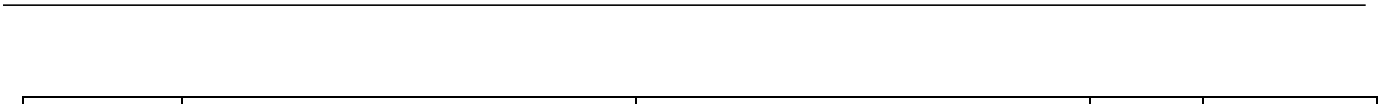
**Answer 25 · Mark scheme** June 2017 | CH1FP | Original Q5 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **5(a)(i)** | 2900 | allow with **or** without working<br>If answer is not correct allow one mark for 7000/2 **or** for 3500 (km) | 2 | **AO2**<br>1.7.1a |
| **5(a)(ii)** | plates<br>speeds<br>currents<br>processes | Must be in this order | 1<br>1<br>1<br>1 | **AO1**<br>1.7.1c |
| **5(b)(i)** | bar correct (47%) | allow ± ½ a square | 1 | **AO2**<br>1.7.1b |
| **5(b)(ii)** | 9 % | | 1 | **AO2**<br>1.7.1b |
| **5(b)(iii)** | limited / finite resource | allow running out **or** non-renewable<br>ignore cost **or** short supply **or** there is not a lot of it left | 1 | **AO3**<br>1.3.1j<br>1.3.3b |
| **5(b)(iv)** | electrolysis | | 1 | **AO1**<br>1.3.1h |
| **5(b)(v)** | copper ions are <u>attracted</u><br>because they are positive | allow opposite (charges) <u>attract</u><br>allow because they need to gain electrons (to form copper) | 1<br>1 | **AO1**<br>1.3.1g;h |
| **Total** | | | **12** | |

### 4.3.1.2 Relative formula mass

**Answer 25 · Mark scheme**

June 2017 | CH1FP | Original Q5 | Legacy



### 4.3.1.2 Relative formula mass

**Answer 26 · Mark scheme** June 2017 | CH2FP | Original Q4 | Legacy

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

### 4.3.1.2 Relative formula mass

**Answer 26 · Mark scheme**

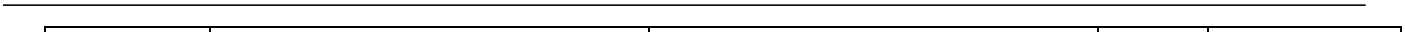


| | | | | |
|---|---|---|---|---|
| **4(d)(v)** | Tick (✓) by:<br>$\frac{1}{36.5}$ x 100 | | 1 | **AO2**<br>2.3.3a |
| **Total** | | | **12** | |

### 4.3.1.2 Relative formula mass

**Answer 26 · Mark scheme**

June 2017 | CH2FP | Original Q4 | Legacy



**Answer 27 · Mark scheme**

June 2018 | 8462/1F | Original Q2

The full source mark scheme begins on page 97. Follow original question 2 in that document.

**Answer 28 · Mark scheme**

June 2018 | 8462/1F | Original Q9

The full source mark scheme begins on page 97. Follow original question 9 in that document.

### 4.3.1.2 Relative formula mass

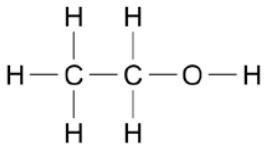
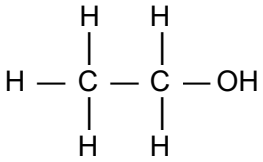
**Answer 29 · Mark scheme** June 2018 | 8462/2F | Original Q9

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **09.1** | formulation | | 1 | AO1<br>4.8.1.2 |
| **09.2** | $\frac{23.3}{265.5 + 23.3 + 3.0 + 1.5}$ (× 100)<br><br>= 7.9 (%) | an answer of 7.9 (%) scores **2** marks<br><br>allow $\frac{23.3}{293.3}$ (× 100)<br><br>allow 7.944084555 (%) rounded correctly | <br><br>1<br><br>1 | AO2<br>4.8.1.2 |
| **09.3** | to deter consumption / drinking (by people) | | 1 | AO3<br>4.7.2.3 |
| **09.4** | any **one** from:<br>• fuel<br>• solvent<br>• antiseptic | do **not** accept as an alcoholic drink<br><br>allow specific uses eg<br>• fuel additive<br>• cleaning products<br>• hand-sanitisers | <br>1 | AO2<br>4.7.2.3 |
| **09.5** | ferment(ation)<br><br>add yeast<br><br>anaerobic (conditions)<br>**or**<br>warm | ignore distillation<br><br><br>allow in the absence of oxygen<br><br>allow a temperature value in range 5 – 45 °C inclusive<br>allow room temperature<br><br>ignore hot / heat<br>ignore high temperature | 1<br><br>1<br><br>1 | AO1<br>4.7.2.3 |

### 4.3.1.2 Relative formula mass

**Answer 29 · Mark scheme**

June 2018 | 8462/2F | Original Q9

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **09.6** |  | allow  | 1 | AO1 4.7.2.3 |
| **09.7** | hydrogen | allow $H_2$ | 1 | AO1 4.7.2.3 |
| **09.8** | oxidising (agent) | allow permanganate / dichromate ions<br>allow [O]<br><br>ignore oxygen | 1 | AO1 4.7.2.3 |
| **Total** | | | **11** | |

### 4.3.1.2 Relative formula mass

**Answer 29 · Mark scheme**

June 2018 | 8462/2F | Original Q9

4.3.1.2 Relative formula mass

Answer 30 · 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<br><br>an answer of 78.63247863 (%) correctly rounded to at least 2 significant figures scores **1** mark | 1 | AO2<br>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<br>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<br>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<br>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 | |

### 4.3.1.2 Relative formula mass

**Answer 30 · Mark scheme**



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

4.3.1.2 Relative formula mass

Answer 31 · Mark scheme

June 2019 | 8462/2F | Original Q3

## Question 3

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

4.3.1.2 Relative formula mass

Answer 32 · Mark scheme

June 2019 | 8462/2F | Original Q9

## Question 9

| Question | Answers | Mark | AO/ Spec. Ref |
|---|---|---|---|
| 09.1 | **Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5–6 | AO1<br>4.8.2.3<br>4.8.3.1<br>4.8.3.3 |
| | **Level 2:** The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced. | 3–4 | |
| | **Level 1**: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1–2 | |
| | No relevant content | 0 | |
| | **Indicative content**<br><br>lithium:<br>• crush tablets or dissolve tablet (in water or acid)<br>• clean wire<br>• place on wire<br>• place in (roaring / blue / non-luminous) flame<br>• observe flame colour<br>• crimson flame<br><br>carbonate:<br>• add hydrochloric acid<br>• effervescence / fizzing<br>• bubble gas through limewater<br>• limewater becomes cloudy | | |
| 09.2 | formulation(s) | 1 | AO1<br>4.8.1.2 |

### 4.3.1.2 Relative formula mass

**Answer 32 · Mark scheme**

June 2019 | 8462/2F | Original Q9

| | | | | |
|---|---|---|---|---|
| **09.3** | | an answer of 58.3333333 (%) correctly rounded to at least 2 significant figures scores **3** marks | | AO2<br>4.8.1.2 |
| | 1.20 g = 1200 mg<br>**or**<br>700 mg = 0.700 g | | 1 | |
| | $\frac{700}{1200} \times 100$ **or** $\frac{0.700}{1.20} \times 100$ | allow correct use of incorrectly or not converted values from step 1 | 1 | |
| | = 58.3 (%) | allow 58.3333333 (%) correctly rounded to at least 2 significant figures | 1 | |
| **Total** | | | **10** | |

4.3.1.2 Relative formula mass

Answer 33 · Mark scheme

November 2020 | 8462/1F | Original Q1

## Question 1

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

4.3.1.2 Relative formula 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<br>4.1.1.1<br>4.1.2.6 |
| **01.8** | 56 + (3 × 80)<br><br>= 296 | <br><br>ignore units | 1<br><br>1 | AO2<br>4.3.1.2 |
| **Total** | | | **11** | |

4.3.1.2 Relative formula mass

Answer 34 · 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)<br>**and**<br>(total) mass after = 156.76 (g)<br><br>**or**<br><br>increase in mass of beaker **A** and contents = 29.96 (g)<br>**and**<br>decrease in mass of beaker **B** and contents = 29.96 (g)<br><br>(so) the mass of products equals the mass of the reactants<br>**or**<br>(so) there is no change in mass during the reaction | allow 78.26 + 78.50 = 156.76<br>**and**<br>108.22 + 48.54 = 156.76<br><br>allow 108.22 – 78.26 = 29.96<br>**and**<br>48.54 – 78.50 = – 29.96<br><br>allow (so) no atoms were lost or made during the reaction | 1<br><br>1 | AO2<br><br>AO1<br><br>4.3.1.1 |
| **10.2** | filter / filtration | allow a description of filtration | 1 | AO2<br>4.1.1.2 |
| **10.3** | sodium nitrate (solution)<br>**or**<br>silver nitrate (solution)<br>**or**<br>sodium iodide (solution) | allow correct formulae<br><br>allow sodium / nitrate / silver / iodide ions | 1 | AO2<br>4.1.1.2 |
| **10.4** | to remove / evaporate the water | allow to dry (the solid) | 1 | AO3<br>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:<br>• for sustainable development<br>• for economic reasons<br>• to produce a high(er) percentage of useful product | allow to reduce waste | 1 | AO1 4.3.3.2 |
| **Total** | | | **10** | |

4.3.1.2 Relative formula mass

Answer 35 · 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<br><br>($A_r$ **R** = 150 – 54 =) 96<br><br>**alternative approach**:<br>($M_r$ **R**$O_3$ = 150 – 6 =) 144 (1)<br><br>($A_r$ **R** = 144 – (3 × 16) =) 96 (1) | <br><br>ignore units<br><br><br><br>ignore units | 1<br><br>1 | AO2<br>4.3.1.1<br>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<br>4.1.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **10.3** | (total $M_r$ of reactants) = 163<br><br>(% atom economy =) $\frac{119}{163}$ (×100)<br><br>= 73 (%) | <br><br>allow correct use of an incorrectly calculated value of total $M_r$<br><br>allow 73.00613 (%) correctly rounded to at least 2 significant figures | 1<br><br>1<br><br>1 | AO2<br>4.3.1.2<br>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**<br>• carbon and iron are the cheapest reactants<br>• hydrogen is the most expensive reactant<br>• separating solid products is expensive<br>• separating solid products is time consuming<br>• in method 1, tungsten needs to be separated from tungsten carbide<br>• in method 1, some tungsten is lost as tungsten carbide<br>• in method 1, the carbon dioxide produced will escape<br>• in method 2, the water vapour produced will escape<br>• in method 2, no separation of solids is needed<br>• in method 3, tungsten needs to be separated from iron oxide | | |

| | | | |
|---|---|---|---|
| **Total** | | | **10** |

4.3.1.2 Relative formula mass

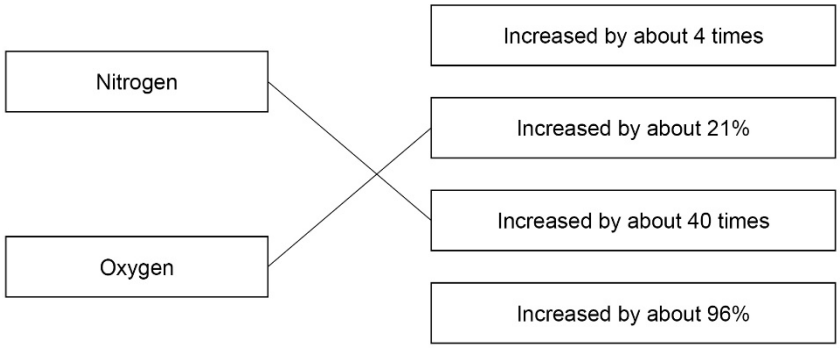
Answer 36 · Mark scheme

November 2021 | 8462/2F | Original Q1

## Question 1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.1 | 4.6 billion years ago | | 1 | AO1 4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.2 | 0.92 (%) | | 1 | AO2 4.9.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.3 |  do **not** accept more than one line from a box on the left | | 1<br>1 | AO1<br>AO2<br>4.9.1.1 4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.4 | carbon dioxide dissolving in sea water<br>formation of sedimentary rocks | | 1<br>1 | AO1 4.9.1.2 4.9.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.5 | carbon dioxide (+ water → )<br>(→ glucose +) oxygen | allow $CO_2$<br>allow $O_2$ | 1<br>1 | AO1 4.9.1.3 |

4.3.1.2 Relative formula mass



**Question 1 continued**

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.6** | evidence / proof | | 1 | AO1 4.9.1.2 |

| | | | |
|---|---|---|---|
| **Total** | | | **9** |

4.3.1.2 Relative formula mass

Answer 37 · 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 |

### 4.3.1.2 Relative formula mass

Answer 37 · Mark scheme

June 2022 | 8462/1F | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.5** | $C_2H_6$ | | 1 | AO2<br>4.2.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.6** | $H^+$ | | 1 | AO1<br>4.4.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.7** | ($M_r$ =)<br>(1 × 2) + 12 + (16 × 3)<br><br>= 62 | allow ($M_r$ =) 2 + 12 + 48 | 1<br><br>1 | AO2<br>4.3.1.2 |

| | | |
|---|---|---|
| **Total Question 6** | | **8** |

4.3.1.2 Relative formula mass

Answer 38 · Mark scheme

June 2022 | 8462/1F | Original Q8

## Question 8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.1** | hydroxide ions | | 1 | AO1<br>4.4.3.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.2** | 27 ($cm^3$) | | 1 | AO2<br>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<br>4.2.2.1<br>4.2.2.3<br>4.4.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.4** | | | | AO2<br>4.4.3.2 |

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

1

1

### 4.3.1.2 Relative formula mass

**Answer 38 · 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<br>4.4.1.2<br>4.4.1.3<br>4.4.3.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.6** | (I) | | 1 | AO1<br>4.2.2.2 |

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

| | | |
|---|---|---|
| **Total Question 8** | | **9** |

4.3.1.2 Relative formula mass

Answer 39 · Mark scheme

June 2022 | 8462/2F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.1 | 78.09 (%) | | 1 | AO2<br>4.9.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.2 | ammonia<br><br>methane | | 1<br><br>1 | AO1<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.3 | photosynthesis | | 1 | AO1<br>4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.4 | dissolving carbon dioxide in oceans<br><br>formation of sedimentary rocks | | 1<br><br>1 | AO1<br>4.9.1.2<br>4.9.1.4 |

### 4.3.1.2 Relative formula mass

**Answer 39 · Mark scheme** June 2022 | 8462/2F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.5** | 1500 (millions of years ago) | | 1 | AO2<br>4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.6** | 2500 (millions of years ago) | allow a value in the range 2500 to 2700 (millions of years ago) | 1 | AO3<br>4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.7** | plankton | | 1 | AO1<br>4.7.1.1<br>4.9.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.8** | (there is) limited evidence | allow the timescale was millions / billions of years | 1 | AO2<br>4.9.1.2 |

| | | |
|---|---|---|
| **Total Question 3** | | **10** |

4.3.1.2 Relative formula mass

Answer 40 · Mark scheme

June 2023 | 8462/1F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | (total atoms =) 30<br><br>(percentage =) $\frac{6}{30}$ × 100<br><br>= 20 (%) | <br><br>allow correct use of an incorrectly determined total number of atoms | 1<br><br>1<br><br>1 | AO2<br>4.2.2.7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | sizes<br><br>slide (over each other) | allow diameters<br>do **not** accept shapes<br><br>allow move over each other | 1<br><br>1 | AO1<br><br>AO3<br><br>4.2.2.7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | (as the percentage by mass of tin increases the) melting point (of solder) decreases<br><br>to 183 °C<br><br>then increases | <br><br>allow a value in the range 182–184 °C<br>allow to 62% (tin) | 1<br><br>1<br><br>1 | AO2<br>4.2.2.7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.4 | 232 °C | | 1 | AO3<br>4.2.2.7 |

### 4.3.1.2 Relative formula mass

**Answer 40 · Mark scheme** June 2023 | 8462/1F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.5** | the atoms gain energy and their arrangement becomes less ordered | | 1 | AO1 4.2.2.1 |

| | |
|---|---|
| **Total Question 4** | **10** |

4.3.1.2 Relative formula mass

Answer 41 · 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<br><br>allow **1** mark for 2 Fe<br>**or**<br>allow **1** mark for 3 CO | 2 | AO2<br>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<br>4.4.1.1 |

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

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

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

### 4.3.1.2 Relative formula mass

**Answer 41 · Mark scheme** June 2023 | 8462/1F | Original Q8

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

| Total Question 8 | 10 |
|---|---|

4.3.1.2 Relative formula mass

Answer 42 · Mark scheme

June 2023 | 8462/2F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.1 | carbon dioxide<br><br>methane | | 1<br><br>1 | AO1<br>4.9.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.2 | (greenhouse gases) maintain temperatures on Earth (high enough to support life) | | 1 | AO1<br>4.9.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.3 | (greenhouse gases absorb long wavelength) radiation | (greenhouse gases absorb long wavelength) infra-red (radiation) | 1 | AO1<br>4.9.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.4 | higher sea levels<br><br>melting polar ice | | 1<br><br>1 | AO1<br>4.9.2.3 |

### 4.3.1.2 Relative formula mass

**Answer 42 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.5** | (mass =) $\frac{0.25}{100} \times 350$ | | 1 | AO2<br>4.9.1.1<br>4.9.2.1 |
| | = 0.875 (kg) | | 1 | |
| | = 875 (g) | allow a correct conversion of an incorrectly determined mass | 1 | |
| | **alternative approach:**<br>350 kg = 350 000 g (1)<br>(mass =) $\frac{0.25}{100} \times 350\,000$ (1)<br>= 875 (g) (1) | allow correct use of incorrect / no conversion of mass | | |

| | |
|---|---|
| **Total Question 5** | **9** |

4.3.1.2 Relative formula mass

Answer 43 · Mark scheme

June 2023 | 8462/2F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | coal is a solid<br><br>(so solid) coal cannot flow through pipelines | ignore references to cost<br><br>allow (so) coal has to be made into a slurry to flow through pipelines | 1<br><br>1 | AO3 4.2.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | (fuel) coal<br><br>(reason) (coal contains the) highest percentage of sulfur | MP2 is dependent upon MP1 being awarded | 1<br><br>1 | AO3 4.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.3 | any **one** from:<br>• acid rain<br><br>• respiratory problems (in humans) | allow specified effects of acid rain<br>allow specified respiratory problems | 1 | AO1 4.9.3.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.4 | (fuel) (natural) gas<br><br>(reason) (natural gas produces) fewer / fewest solid particles | MP2 is dependent upon MP1 being awarded | 1<br><br>1 | AO3 4.9.3.1 |

### 4.3.1.2 Relative formula mass

Answer 43 · Mark scheme

June 2023 | 8462/2F | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.5 | any **one** from:<br>• global dimming<br>• health problems for humans | | 1 | AO1<br>4.9.3.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.6 | combustion | | 1 | AO1<br>4.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.7 | any **three** from:<br>• more oil is used than gas<br>• use of oil has decreased overall<br>• use of oil increased in some years<br>• there was a large drop in use of oil between 2019 and 2020<br>• use of natural gas decreased overall<br>• use of natural gas increased in some years<br>• use of natural gas remained fairly constant from 2014 to 2020 | | 3 | AO2<br>4.9.2.4<br>4.9.3.1 |

| Total Question 6 | 12 |
|---|---|

4.3.1.2 Relative formula mass

Answer 44 · 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 |

### 4.3.1.2 Relative formula mass



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

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

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

| | |
|---|---|
| **Total Question 3** | **14** |

4.3.1.2 Relative formula mass

Answer 45 · 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<br>1<br>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<br>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** | ($M_r$ =)<br>(27 × 2) + (16 × 3)<br><br>= 102 | | 1<br><br>1 | AO2 4.3.1.2 |

4.3.1.2 Relative formula mass

Answer 45 · Mark scheme

June 2024 | 8462/1F | Original Q6

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

| Total Question 6 | 10 |
|---|---|

4.3.1.2 Relative formula mass

Answer 46 · Mark scheme

June 2024 | 8462/2F | Original Q1

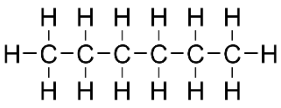
## Question 1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.1 | carbon<br><br>hydrogen | ignore C<br><br>ignore H | 1<br><br>1 | AO1<br>4.1.1.1<br>4.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.2 | 20 | | 1 | AO2<br>4.1.1.1<br>4.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.3 | $C_nH_{2n+2}$ | | 1 | AO2<br>4.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.4 | alkanes | | 1 | AO2<br>4.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.5 |  | | 1 | AO2<br>4.7.1.1 |

### 4.3.1.2 Relative formula mass

Answer 46 · Mark scheme

June 2024 | 8462/2F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.6** | fuel | allow fossil fuel | 1 | AO1<br>4.7.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.7** | soot<br><br>carbon monoxide | | 1<br><br>1 | AO1<br>4.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.8** | $C_6H_{12}$ | | 1 | AO2<br>4.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.9** | bar drawn to 84%<br><br>bars labelled C / carbon<br>**and**<br>H / hydrogen | allow a tolerance of ± ½ a small square | 1<br><br>1 | AO2<br>4.7.1.1 |

| **Total Question 1** | **12** |
|---|---|

4.3.1.2 Relative formula mass

Answer 47 · Mark scheme

June 2024 | 8462/2F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | percentage of nitrogen increases<br><br>until 2.3 billion years<br><br>then remains constant | <br><br>allow a value in the range 2.1 to 2.4 billion years<br>allow until 80% | 1<br><br>1<br><br>1 | AO2<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | the percentage of carbon dioxide decreased | | 1 | AO1<br>4.9.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | light | | 1 | AO1<br>4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.4 | algae<br><br>plants | | 1<br><br>1 | AO1<br>4.9.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.5 | cellulose<br><br>starch | | 1<br><br>1 | AO1<br>4.7.3.4 |

### 4.3.1.2 Relative formula mass

**Answer 47 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.6** | $1.4 \times 10^{11}$ | | 1 | AO2<br>4.3.1.2<br>4.7.3.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.7** | 70 000 000 000 | | 1 | AO2<br>4.7.3.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.8** | helix | | 1 | AO1<br>4.7.3.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.9** | 4 | | 1 | AO1<br>4.7.3.4 |

| **Total Question 4** | **13** |
|---|---|

### 4.3.1.2 Relative formula mass

Answer 48 · Mark scheme

June 2024 | 8462/2F | Original Q8

## Question 8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.1** | (test)<br>flame test<br><br>(result)<br>yellow (flame)<br><br>**OR**<br><br>(test)<br>flame emission spectroscopy (1)<br><br>(result)<br>lines match sodium spectrum (1) | <br><br><br><br><br><br><br>allow FES | 1<br><br><br>1 | AO1<br>4.8.3.1<br>RPA7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.2** | (test)<br>(add acidified) silver nitrate (solution)<br><br>(result)<br>white precipitate | <br><br><br>MP2 is dependent upon the award of MP1 | 1<br><br>1 | AO1<br>4.8.3.4<br>RPA7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.3** | to ensure that all the water has evaporated | | 1 | AO3<br>4.10.1.2<br>RPA8 |

### 4.3.1.2 Relative formula mass

**Answer 48 · Mark scheme**

June 2024 | 8462/2F | Original Q8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.4** | mass of evaporating dish and dry contents – mass of empty evaporating dish | | 1 | AO1<br>4.10.1.2<br>RPA8 |

4.3.1.2 Relative formula mass

Answer 48 · Mark scheme

June 2024 | 8462/2F | Original Q8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 08.5 | (mean concentration of NaCl =) $\frac{35.2 + 34.6 + 36.4 + 33.8}{4}$ **or** $\frac{140}{4}$ | allow **1** mark for $\frac{35.2 + 34.6 + 33.8}{3} = 34.5$ | 1 | AO2 4.10.1.2 RPA8 |
| | = 35.0 ($g/dm^3$) | | 1 | |
| | (mean concentration of $Na^+$ =) $35.0 \times \frac{39.3}{100}$ | allow correct use of an incorrectly determined mean concentration of sodium chloride | 1 | |
| | = 13.8 ($g/dm^3$) | allow 13.755 correctly rounded to at least 3 significant figures | 1 | |
| | **alternative approach 1:** | | | |
| | (total concentration of NaCl = 35.2 + 34.6 + 36.4 + 33.8 = 140 total concentration of Na+ =) $140 \times \frac{39.3}{100}$ (1) | allow **1** mark for (35.2 + 34.6 + 33.8 = 103.6) $103.6 \times \frac{39.3}{100} = 40.71$ | | |
| | = 55.02 ($g/dm^3$) (1) | | | |
| | (mean concentration of $Na^+$ =) $\frac{55.02}{4}$ (1) | allow correct use of an incorrectly determined total concentration of $Na^+$ | | |
| | =13.8 ($g/dm^3$) (1) | allow 13.755 correctly rounded to at least 3 significant figures | | |

| | | | | |
|---|---|---|---|---|
| | **alternative approach 2:**<br><br>(concentrations of $Na^+$ =)<br>$35.2 \times \frac{39.3}{100}$<br><br>$34.6 \times \frac{39.3}{100}$<br><br>$36.4 \times \frac{39.3}{100}$<br><br>$33.8 \times \frac{39.3}{100}$ (1)<br><br>= 13.83 13.60 14.31 13.28 (1)<br><br>(mean concentration of $Na^+$ =)<br>$\frac{13.83 + 13.60 + 14.31 + 13.28}{4}$<br>(1)<br><br>=13.8 ($g/dm^3$) (1) | allow **1** mark if a concentration of 36.4 is treated as an anomaly and not used<br><br>allow correct use of incorrectly determined concentration(s) of $Na^+$<br><br>allow 13.755 correctly rounded to at least 3 significant figures | | |

| | |
|---|---|
| **Total Question 8** | **10** |

4.3.1.2 Relative formula mass

Answer 49 · Mark scheme

June 2025 | 8462/1F | Original Q10

## Question 10

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 10.1 | (substance reduced)<br>$SnO_2$ | allow tin oxide | 1 | AO2<br>4.4.1.1<br>4.4.1.3 |
| | (reason)<br>($SnO_2$) loses oxygen | allow (tin oxide) loses oxygen<br><br>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<br>4.4.1.2<br>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<br>4.3.3.2 |
| | (% atom economy =) $\frac{112}{140} \times 100$ | allow correct use of an incorrectly determined total $M_r$ | 1 | |
| | = 80 (%) | | 1 | |

### 4.3.1.2 Relative formula mass

**Answer 49 · Mark scheme**



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

### 4.3.1.2 Relative formula mass

**Answer 49 · Mark scheme**



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

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

| | |
|---|---|
| **Total Question 10** | **11** |

4.3.1.2 Relative formula mass

Answer 50 · Mark scheme

June 2025 | 8462/2F | Original Q2

## Question 2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.1** | propene | | 1 | AO1<br>4.7.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.2** | 9 | | 1 | AO2<br>4.1.1.1<br>4.7.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.3** | making a polymer | | 1 | AO1<br>4.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.4** | (*y*-axis 0, 20), 40, 60, 80, (100) | ignore intermediate values | 1 | AO2<br>4.7.2.1 |
| | carbon bar drawn to 86% | allow a tolerance of ± ½ a small square | 1 | |
| | carbon bar labelled | | 1 | |

### 4.3.1.2 Relative formula mass



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.5** | (test)<br>add bromine (water)<br><br>(result)<br>(bromine water) turns (from orange to) colourless | <br><br><br>allow (bromine water) decolorises<br><br>ignore clear<br><br>MP2 is dependent upon MP1 being awarded | 1<br><br>1 | AO1<br>4.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.6** | $C_{10}H_{22} \longrightarrow C_3H_6 + C_7H_{16}$ | | 1 | AO2<br>4.1.1.1<br>4.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.7** | fuels | | 1 | AO1<br>4.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.8** | the molecules collide more frequently at 750 °C | | 1 | AO2<br>4.6.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.9** | (at 750 °C the rate of reaction is) higher | allow (at 450 °C the rate of reaction is) lower | 1 | AO2<br>4.6.1.2 |

| **Total Question 2** | **12** |
|---|---|

4.3.1.2 Relative formula mass

Answer 51 · Mark scheme

June 2025 | 8462/2F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | line of best fit | | 1 | AO2<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | 40 (%) | | 1 | AO2<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.3 | carbon dioxide was dissolved in oceans | | 1 | AO3<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.4 | nitrogen was released during volcanic activity | | 1 | AO3<br>4.9.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.5 | 2.5 billion years ago | | 1 | AO3<br>4.9.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.6 | ammonia<br><br>methane | | 1<br><br>1 | AO1<br>4.9.1.2 |

### 4.3.1.2 Relative formula mass

**Answer 51 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.7** | photosynthesis | | 1 | AO1<br>4.9.1.3 |

| | |
|---|---|
| **Total Question 6** | **8** |

**4.3.1.2 Relative formula mass**



AQA

# GCSE
# CHEMISTRY

## 8462/1F - PAPER 1 FOUNDATION TIER

## Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

### 4.3.1.2 Relative formula 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 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.

### 4.3.1.2 Relative formula mass





**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.

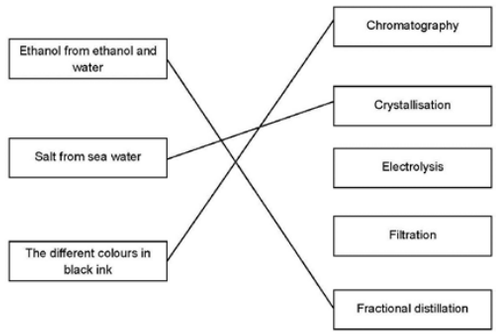
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula 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** | |

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula 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<br>4.4.3.4 |
| **04.2** | hydrogen line only | | 1 | AO3<br>4.4.3.4 |
| **04.3** | both lines | | 1 | AO3<br>4.4.3.4 |
| **04.4** | graphite has delocalised electrons | | 1 | AO1<br>4.2.3.2 |
| **04.5** | **cathode** zinc (1) **anode** chlorine (1)<br><br>hydrogen (1) bromine (1) | do **not** accept chloride<br><br>allow **1** mark if chlorine and zinc the wrong way around<br><br>do **not** accept bromide<br><br>allow **1** mark if bromine and hydrogen the wrong way around | 1+1<br><br>1+1 | AO2<br>4.4.3.2<br>4.4.3.4 |
| **Total** | | | **8** | |

### 4.3.1.2 Relative formula mass



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

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | gas | | 1 | AO1<br>4.2.2.2 |
| **05.2** | the gas escapes | allow carbon dioxide escapes<br><br>do **not** accept references to evaporation | 1 | AO1<br>4.3.1.3 |
| **05.3** | 5.12 (g) | | 1 | AO2<br>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<br>4.3.1.3 |
| **05.5** | reheat<br><br>(and reweigh) until constant mass | <br><br>an answer of heat to constant mass scores **2** marks<br><br>if no other mark scored allow for **1** mark<br>heat for longer<br>**or**<br>(heat at a) higher temperature<br><br>**alternative approach**:<br><br>(1) continue heating and pass gas through limewater<br><br>(1) until the (lime)water stops bubbling<br>**or**<br>until the limewater no longer turns cloudy | 1<br><br>1 | AO3<br>4.3.1.3 |

### 4.3.1.2 Relative formula mass



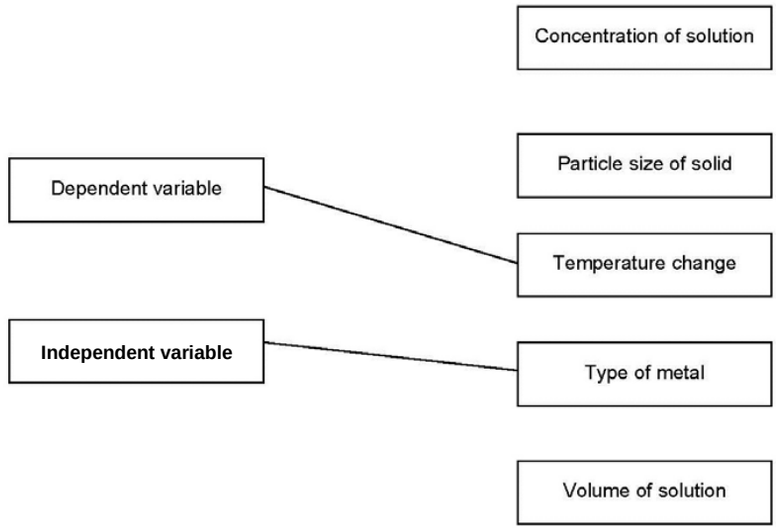
MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

| 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** | | 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** | |

### 4.3.1.2 Relative formula mass



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

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

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

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

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula 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<br>4.1.1.1<br>4.1.2.5<br>4.4.1.1 |
| **07.2** | oxidation | | 1 | AO1<br>4.4.1.1 |
| **07.3** | 13 | | 1 | AO1<br>4.4.2.4 |
| **07.4** | sodium hydroxide | | 1 | AO2<br>4.1.1.1 |
| **07.5** | $OH^-$ | | 1 | AO1<br>4.4.2.4 |
| **07.6** | (volume =) $\frac{250}{1000}$ or ¼<br>or 0.25 ($dm^3$)<br>**or**<br>(mass per $cm^3$ =) $\frac{40}{1000}$ (g)<br>or 0.04 (g)<br><br>($\frac{250}{1000}$ × 40 =) 10 (g) | an answer of 10 (g) scores **2** marks | 1<br><br>1 | AO2<br>4.3.2.5 |

### 4.3.1.2 Relative formula 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<br><br>allow **1** mark for 3 points correct<br><br>ignore any attempt at a line of best fit | 2 | AO2<br>4.1.2.5 |
| **07.8** | 39 (°C) | allow any value from 34 to 46 (°C) | 1 | AO2<br>4.1.2.5 |
| **Total** | | | **10** | |

### 4.3.1.2 Relative formula mass



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

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

### 4.3.1.2 Relative formula 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**<br><br>• use magnesium oxide and sulfuric acid<br>• add sulfuric acid to a beaker<br>• warm sulfuric acid<br>• add magnesium oxide<br>• stir<br>• continue adding until magnesium oxide is in excess<br><br>• filter<br>• using a filter paper and funnel<br>• to remove excess magnesium oxide<br><br>• heat solution in an evaporating basin<br>• to crystallisation point<br>• leave to crystallise<br>• pat dry with filter paper<br><br>credit may be given for diagrams | | |
| **Total** | | | **8** |

### 4.3.1.2 Relative formula 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<br>4.2.1.3 |
| **09.2** | 26<br>30<br>26 | must be this order | 1<br>1<br>1 | AO2<br>4.1.1.4<br>4.1.1.5 |
| **09.3** | any **two** from:<br>• iron has a high(er) melting / boiling point<br>• iron is dense(r)<br>• iron is hard(er)<br>• iron is strong(er)<br>• iron is less reactive<br>• iron has ions with different charges<br>• iron forms coloured compounds<br>• iron can be a catalyst | allow the converse statements for sodium<br>allow transition metal for iron<br>allow Group 1 metal for sodium<br>ignore references to atomic structure<br>ignore iron rusts<br>allow iron is less malleable / ductile<br>allow specific reactions showing difference in reactivity<br>allow iron is magnetic | 2 | AO1<br>4.1.2.5<br>4.1.3.1<br>4.1.3.2 |

### 4.3.1.2 Relative formula 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)<br>**or**<br>(so) carbon will remove oxygen (from nickel oxide) | allow (so) nickel ions gain electrons<br><br>allow (so) carbon transfers electrons to nickel (ions) | 1 | |
| **09.5** | | an answer of 67.8 (%) scores **3** marks<br><br>an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks<br><br>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)<br>$= \frac{59}{87} \times 100$ | allow (percentage atom economy)<br>$= \frac{59}{\text{incorrectly calculated } M_r} \times 100$ | 1 | |
| | = 67.8 (%) | allow an answer from an incorrect calculation to 3 sig figs | 1 | |
| **Total** | | | **11** | |

### 4.3.1.2 Relative formula 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<br>4.5.2.1 |
| **10.2** | a reactant is used up | allow the reaction stops<br><br>allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant | 1 | AO1<br>4.5.2.1 |
| **10.3** | the reaction is not reversible | | 1 | AO1<br>4.5.2.1 |
| **10.4** | $2H_2 + O_2 \rightarrow 2H_2O$ | allow fractions / multiples<br><br>allow **1** mark for $O_2$ | 2 | AO1<br>AO2<br>4.1.1.1<br>4.5.2.2 |

### 4.3.1.2 Relative formula mass



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

<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<br><br>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<br>or<br>a fuel cell does not need to be recharged<br>• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy<br>• lithium-ion batteries can catch fire<br>• produces only water<br>or<br>no pollutants produced<br>• lithium-ion batteries may release toxic chemicals on disposal<br>• 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<br>• cost of lithium-ion car much less<br>• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable<br>• charging points are more widely available than hydrogen filling stations<br>• hydrogen takes up a lot of space<br>or<br>is difficult to store<br>• hydrogen can be highly flammable / explosive<br>• no emissions produced<br>• (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<br>4.5.2.1<br>4.5.2.2</td></tr>
<tr><td>Total</td><td></td><td></td><td>11</td></tr>
</table>

4.3.1.2 Relative formula mass

Answer 27 · 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 28 · Examiner comments



# 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.

4.3.1.2 Relative formula mass

Answer 29 · Examiner comments

June 2018 | 8462/2F | Original Q9

# Question 9 (standard demand)

**09.1** 2% of students recognised a formulation from this part of the specification.

**09.2** This was a more difficult calculation as there were lots of numbers given in the question. It appeared to presented little difficulty for some students, however.

**09.3** Reading the stem would have avoided answers such as ‘to make it more attractive to drink’. 14% of students realised that it was to warn people not to drink it.

**09.4** Uses of ethanol, and therefore methylated spirits, as a solvent, steriliser and fuel were well known with 42% of students achieving the mark.

**09.5** Very few students knew about the production of ethanol from sugar solution by fermentation. Some knew the name of the process but could give no correct detail. 8% of students achieved two or three marks.

**09.6** 3% of students could complete the displayed formula for ethanol. Ethane was the most common answer, but more students did not attempt this question.

**09.7** 12% of students knew that hydrogen would be the gas produced.

**09.8** Even fewer knew that an oxidising agent was required.

4.3.1.2 Relative formula mass

Answer 30 · 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.

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Answer 37 · 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.

4.3.1.2 Relative formula mass

**Answer 38 · 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.

**Answer 39 · Examiner comments** June 2022 | 8462/2F | Original Q3

**Question 3 (Low and standard demand)**

**03.1** Just over half of the students correctly worked out the percentage of nitrogen.

**03.2** Nearly 60% of the students gained two marks, with methane being well known but ammonia less so.

**03.3** Photosynthesis was correctly identified by nearly 90% of the students.

**03.4** Nearly 50% of the students gained two marks, with carbon dioxide dissolving in oceans better known than formation of sedimentary rocks.

**03.5** Nearly four fifths of the students could correctly read the value from the graph.

**03.6** Even though the numerical scale was increasing in the backwards direction, more than 90% of the students scored this mark.

**03.7** Plankton was identified by nearly 60% of the students.

**03.8** The answer required the idea of limited evidence or that it was billions (or millions) of years ago. Lack of proof or data or that it was a long time ago were insufficient. Just over 20% of the students answered this question correctly.

4.3.1.2 Relative formula mass

Answer 40 · Examiner comments

June 2023 | 8462/1F | Original Q4

**Question 4 (low and standard demand)**

**04.1** This question discriminated well. Nearly a third succeeded in calculating the percentage of lead atoms as 20%, though it was less common to show the working as a simple mathematical expression. A response of 25% was fairly common, as a result of assuming the total number of atoms was 24 instead of adding all the atoms together. This answer scored two marks.

**04.2** Few students scored both marks, although two fifths scored one mark. Many did know that it was the layers' ability to slide over each other that was reduced, but fewer knew that this was due to the different sizes of the two types of atom.

**4.3** This question discriminated well, with the majority of students scoring at least one mark and about two fifths scoring all three. Students generally followed the sequence when describing the effect of the mass of tin on melting point and took note of the instruction to 'Use data from Figure 5.' Often, however, the data was contradictory, with many students quoting 60% tin rather than 62%, which meant that even though they quoted 183°C, they could not be awarded the mark for identifying the turning point.

**04.4** Most students did not realise that pure tin means 100% tin, so did not read the correct value of temperature from the graph. Many gave 323 °C as a result of two errors: looking at 0% tin (ie pure lead) and misreading the scale on the y-axis.

**04.5** This was well answered, with well over half choosing the correct option.

4.3.1.2 Relative formula mass

Answer 41 · 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’.

4.3.1.2 Relative formula mass

Answer 42 · Examiner comments — June 2023 | 8462/2F | Original Q5

**Question 5 (Low and standard demand)**

**05.1** This question was well answered with over two thirds of students successfully identifying both greenhouse gases.

**05.2** Fewer than 15% of students could identify why greenhouse gases are essential for supporting life on earth. The most frequently seen incorrect responses identified carbon dioxide as the greenhouse gas and answers were given in terms of the importance of photosynthesis for life on earth or described global warming or the effects of global warming. There were a large number of incorrect responses linked to the ozone layer.

**05.3** A fifth of students correctly completed the sentence using radiation. The most commonly seen incorrect responses included rays, energy or named incorrect types of electromagnetic radiation.

**05.4** This question was well answered with over 80% of students achieving 2 marks. The distractors attracted roughly equal support.

**05.5** This was a more challenging calculation which needed a unit conversion and the use of a percentage. Less than 50% of students gained a mark on this question and less than 20% gained full marks. The most commonly seen incorrect response was where students incorrectly identified the percentage in the question as being 25% and just divided the mass of water vapour in the atmosphere by 4. Few students attempted the unit conversion and of those that did a large number were unable to do so correctly.

Answer 43 · Examiner comments — June 2023 | 8462/2F | Original Q6

**Question 6 (Low and standard demand)**

**06.1** Students struggled to express themselves when answering this question with just over 40% of students achieving 1 mark by usually stating that coal was a solid. Less than 30% of students achieved both marks. Most incorrect responses failed to recognise that coal would not flow or pass through the pipeline but suggested it would be in some way difficult to get coal through the pipe. Many other incorrect responses used information from the table and suggested possible dangers to the pipeline, the environment, or operatives due to coals' high sulfur content.

**06.2** Over 70% of students gained 1 mark by correctly identifying the fuel as coal. Less than 30% of these students went on to use the information in the table to provide a correct reason that compared coal to the other fuels.

**06.3** Fewer than 25% of the students could correctly identify a problem caused by sulfur dioxide emissions.

Frequently seen incorrect responses included that sulfur dioxide:

- is a greenhouse gas
- causes global warming
- is a toxic gas
- causes unspecified pollution.

**06.4** Over 85% of students gained 1 mark by correctly identifying the fuel as natural gas. However, less than 25% of these students went on to use the information in the table to provide a reason that compared natural gas to the other fuels.

### 4.3.1.2 Relative formula mass

**Answer 43 · Examiner comments** June 2023 | 8462/2F | Original Q6

**06.5** Students found this question challenging with fewer than 15% of the students correctly identifying a problem caused by particulates. Over 20% of students did not attempt this question. A common incorrect response was to link particulates to global warming or the effects of global warming.

**06.6** Over 60% of the students were able to successfully complete the sentence. A common incorrect response was to include burning.

**06.7** Almost 30% of students obtained all 3 marks and a further 35% 2 marks. Weaker responses tended to just describe the changes in the lines on the figure without linking the changes in fuel use to the passage of time. Some students struggled to express how natural gas use remained fairly constant from 2014 to 2020.

4.3.1.2 Relative formula mass

Answer 44 · 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 45 · 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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### 4.3.1.2 Relative formula mass

**Answer 45 · 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 46 · Examiner comments** June 2024 | 8462/2F | Original Q1

**Question 1 (low and standard demand)**

01.1 The vast majority of students scored both marks and correctly identified the elements present in a hydrocarbon.

01.2 Over 80% of students correctly identified the number of atoms in the formula provided. The most common distractor was to identify the number of elements present.

01.3 About 70% of students correctly identified the general formula of the alkanes.

01.4 Just over half the students correctly identified the compound as being an alkane.

01.5 Less than 40% of students correctly completed the displayed structural formula of the alkane. The most common incorrect response was to omit the bonds between the carbon atoms. A small percentage of students went on to include additional bonds attached to the ends of the molecule or to include one or more double bonds between carbon atoms. Over a third of students did not attempt this question.

01.6 This question was not well answered with fewer than one third of students correctly identifying petrol as being a fuel. Over 60% of students incorrectly identified alternative general names to describe the reaction of petrol when burned including combustion (complete and incomplete), burning and exothermic.

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### 4.3.1.2 Relative formula mass

**Answer 46 · Examiner comments** June 2024 | 8462/2F | Original Q1

01.7 This question was a good discriminator with roughly one third of students correctly identifying both of the atmospheric pollutants. Just over one third of students correctly identified one pollutant most commonly the gaseous pollutant carbon monoxide. The most commonly seen incorrect responses included to identify coal as the solid pollutant and sulfur dioxide as the gaseous pollutant.

01.8 Just over 60% of students correctly completed the equation. Many failed to gain credit because the numbers were not subscripts but the same size as the letters. The most commonly seen incorrect formula was $C_3H_7$.

01.9 More than 80% of students were able to complete and label the bar chart correctly with a further 10% obtaining one mark. Students should use a ruler when drawing bars to ensure their line stays within the tolerance stated in the mark scheme.

**Answer 47 · Examiner comments** June 2024 | 8462/2F | Original Q4

**Question 4 (low and standard demand)**

04.1 One in four students obtained all three marks in this question with two out of five obtaining two marks. The most frequently seen reason for not obtaining full marks was to incorrectly determine the date in billions of years at which the percentage of nitrogen in the atmosphere became constant. Students need to be exposed to as many examples as possible of explaining trends as some struggled to express the percentage of nitrogen becoming constant, describing the line as becoming, steady, calm, stable, stopping or going at a constant speed or using vague statements about 'it.'

04.2 Almost 80% of students correctly identified that the percentage of carbon dioxide decreased.

04.3 Well over 80% of students correctly identified light as being the energy source for photosynthesis.

04.4 Nearly 80% of students identified the two organisms that produce oxygen. A further 15% correctly identified one organism, usually plants.

04.5 Less than 30% of students could correctly identify the two natural polymers produced from glucose. It is important that students read the question carefully as there was a significant number of students who ticked only one box rather than the two requested.

04.6 Well over 75% of students correctly expressed the relative formula mass of DNA in standard form.

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### 4.3.1.2 Relative formula mass

**Answer 47 · Examiner comments** June 2024 | 8462/2F | Original Q4

04.7 Only one in two students were able to correctly calculate the relative formula mass of each polymer chain in DNA. The most popular incorrect distractor was 140 000 000 000 where the student had failed to realise that the DNA molecule was comprised of two chains.

04.8 Just under 75% of students correctly described the shape of a DNA molecule as a double helix. The most common incorrect response was double bond.

04.9 Less than 35% of students were able to correctly identify the number of different nucleotides present in a molecule of DNA.

**Answer 48 · Examiner comments** June 2024 | 8462/2F | Original Q8

**Question 8 (standard demand)**

08.1 The test for sodium ions and the correct result were not well known with only 10% of students achieving both marks and a further 10% achieving one mark. Some students attempted to describe a flame test but failed to include the flame or how to introduce the sample into the flame in some way. Incorrect flame colours were often seen, particularly orange or crimson. Other incorrect tests that were commonly seen was the use of limewater or universal indicator.

08.2 The specific test for chloride ions is poorly understood with fewer than 1.5% of students achieving any marks. Many students misread the question and correctly described the test for chlorine gas. The mark for the result of the test was dependent upon a mark being awarded for a correct test.

08.3 The majority of students (more than 96%) were not awarded this mark. The use of words such as solution or liquid were common incorrect responses. The removal of **all** of the water was also not included by many students.

08.4 Less than 50% of students correctly identified how the mass of solid sodium chloride was calculated.

08.5 More than one in two students correctly calculated the mean concentration of sodium chloride and gained two marks. Fewer than one in five students correctly calculated the percentage. The remaining students either failed to progress in the calculation or attempted to calculate a percentage, frequently missing multiplying by one hundred, or getting the expression upside down. Many students incorrectly identified one of the concentrations as being anomalous despite this not being asked for in the q uestion. The only possible anomaly would be 36.4g/dm$^3$ and omitting only this value allowed students access to one of the two marks for the calculation of the mean concentration.

4.3.1.2 Relative formula mass

Answer 49 · 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.

### 4.3.1.2 Relative formula mass

**Answer 49 · 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.

4.3.1.2 Relative formula mass

Answer 49 · 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.

4.3.1.2 Relative formula mass

**Answer 50 · Examiner comments** June 2025 | 8462/2F | Original Q2

## Question 2

02.1 Half of the students correctly identified the alkene as propene. Both butene and ethene were commonly seen.

02.2 Over 80% of students were able to give the number of atoms in the molecule as 9.

02.3 Over two thirds of students correctly identified the use of alkenes.

02.4 Nearly 80% of students scored all three marks for plotting the bar chart. Of the remaining students, most scored two marks, the most common error was to plot the bar at 92, rather than 86.

02.5 The test for alkenes is not well known. Slightly more than 1 in 10 students scored either mark on this question. A full range of tests was seen, with nearly 30% of students did not attempt this item.

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**Answer 50 · Examiner comments** June 2025 | 8462/2F | Original Q2

02.6 Nearly two thirds of students correctly completed the formula in the equation. Many students recognised that the number should be 7, but did not follow the conventions of writing formulas, so did not gain the mark because the 7 was too large. When writing formulas, it is expected that the tops of numbers are discernibly below the tops of upper-case letters.

02.7 Over half of students correctly identified the use of alkanes as fuels. Both distractors were frequently seen.

02.8 Nearly 90 % of students correctly answered this item.

02.9 Three quarters of students correctly compared the rates, with many explaining why the rate changes using the ideas from the previous item.

4.3.1.2 Relative formula mass

Answer 51 · Examiner comments

June 2025 | 8462/2F | Original Q6

## Question 6

06.1 Nearly 80% of students completed the line of best fit.

06.2 Two thirds of students correctly read 40% from the graph. The most common incorrect response was 24%, which corresponds to 3.25 billion years ago.

06.3 3 in 5 students correctly identified that carbon dioxide dissolving in water caused the concentration to drop initially.

06.4 Over half of students knew that the percentage of nitrogen increasing in the atmosphere was caused by volcanic action.

06.5 Knowledge of the changes of the atmosphere over time was known by fewer than half of the students.

06.6 Fewer than 20% of students identified both gases in the Earth's early atmosphere. Hydrogen and helium were the two distractors that were seen most.

06.7 Over half of students correctly identified the process as photosynthesis. Respiration and combustion were the two most common incorrect answers.