AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.1.2

# Mixtures

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **27** |
| Available paper years | **2018–2025** |

## 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.

### 5.1.1.2 Mixtures

Answer 01 · Mark scheme

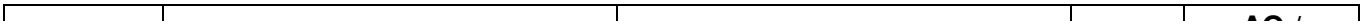
June 2018 | 8464/C/2F | Original Q2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.1** | red **and** blue | both needed for mark | 1 | AO3 5.8.1.3 |
| | unknown | | 1 | |
| **02.2** | red | ignore black | 1 | AO3 5.8.1.3 |
| | travels least far | dependent on correct colour<br>allow closest to the start line | 1 | AO2 5.8.1.3 |
| **02.3** | distance moved by green colour = 12 mm | allow 10 to 14 mm | 1 | AO2 5.8.1.3 |
| | distance moved by solvent = 36 mm | allow 35 to 36 mm | 1 | |
| | $\frac{12}{36}$ | allow correct substitution of student's measurements | 1 | |
| | $R_f$ value = 0.33 | allow correct answer from student's measurements for **2** marks | 1 | |
| **Total** | | | **8** | |

### 5.1.1.2 Mixtures

**Answer 01 · Mark scheme**

June 2018 | 8464/C/2F | Original Q2



5.1.1.2 Mixtures

Answer 02 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.1 | watch glass | | 1 | AO1<br>5.10.1.2 |
| 03.2 | identify 0.29 as anomaly | an answer of 0.14 (g) scores **3** marks | 1 | AO3<br>5.10.1.2 |
| | $\frac{0.12 + 0.14 + 0.15}{3}$<br>**or**<br>$\frac{0.41}{3}$ | allow $\frac{0.12 + 0.29 + 0.14 + 0.15}{4}$<br>**or**<br>$\frac{0.70}{4}$ | 1 | AO2<br>5.10.1.2 |
| | (=) 0.14 (g) | allow 0.18 (g) if first marking point not awarded | 1 | AO2<br>5.10.1.2 |
| 03.3 | evaporating<br>**or**<br>vaporisation | allow from liquid to vapour / gas<br>do **not** accept boiling | 1 | AO1<br>5.1.1.2<br>5.2.2.1 |
| 03.4 | pure<br>**or**<br>no salt | allow converse answers relating to seawater<br>allow not a mixture<br>allow desalinated<br><br>do **not** accept less salt<br>do **not** accept filtered | 1 | AO1<br>5.1.1.2<br>5.10.1.2 |
| 03.5 | uses (a lot of) energy | allow needs heating<br>allow needs electricity<br>allow needs fuel **or** any suitable fuel<br><br>ignore references to equipment<br>ignore references to time | 1 | AO1<br>5.10.1.2 |

5.1.1.2 Mixtures

Answer 02 · Mark scheme

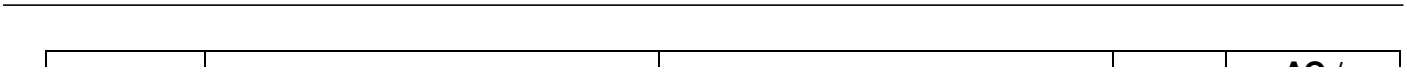
June 2018 | 8464/C/2F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.6 | filtering removes particles | allow solids **or** suitable named solids | 1 | AO1 5.10.1.2 |
| | sterilising kills bacteria / microbes | allow destroys viruses<br>allow kills viruses | 1 | |
| Total | | | 9 | |

### 5.1.1.2 Mixtures

**Answer 02 · Mark scheme**

June 2018 | 8464/C/2F | Original Q3



5.1.1.2 Mixtures

Answer 03 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.1** | condenses | | 1 | AO1<br>5.7.1.2 |
| **06.2** | the fractions have different boiling points | | 1 | AO1<br>5.7.1.2<br>5.7.1.3 |
| **06.3** | propane | do **not** accept propene | 1 | AO2<br>5.7.1.1 |
| **06.4** | $C_nH_{2n+2}$ | | 1 | AO1<br>5.7.1.1 |
| **06.5** | $CH_4 + \mathbf{2}\ O_2 \rightarrow CO_2 + \mathbf{2}\ H_2O$ | allow multiples | 1 | AO2<br>5.1.1.1<br>5.7.1.3 |
| **06.6** | bromine water | | 1 | AO1<br>5.7.1.4 |
| **06.7** | to assess the environmental impact (of the stages in the life of a product) | allow to see the effect / harm / damage on the Earth / environment / planet<br><br>ignore references to energy, pollution, carbon footprint, carbon dioxide, sustainability | 1 | AO1<br>5.10.2.1 |

5.1.1.2 Mixtures

Answer 03 · Mark scheme

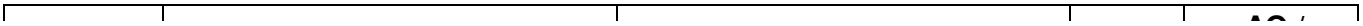


| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 06.8 | **Level 2:** Scientifically relevant features are identified; the ways in which they are similar / different is made clear and the magnitude of the similarity / difference noted. | 3–4 | AO3 |
| | **Level 1:** Relevant features are identified and differences noted. | 1–2 | AO2 |
| | **No relevant content** | 0 | |
| | **Indicative content**<br>• burning 10 000 bags produces 10 kg more of carbon dioxide than landfill<br>• putting 10 000 bags in landfill produces 0.02 kg more of solid residue than burning.<br>• putting 10 000 bags in landfill produces 50% more sulfur dioxide than burning<br>• burning 10 000 bags produces 25 kg of carbon dioxide, but landfill only produces15 kg<br>• putting 10 000 bags in landfill produces 0.07 kg of solid residue but burning only produces 0.05 kg<br>• landfill produces less carbon dioxide than burning<br>• landfill produces more solid residue than burning<br>• burning produces less sulfur dioxide than landfill | | 5.10.2.1<br>5.10.2.2<br>5.9.2.2 |
| **Total** | | | **11** |

### 5.1.1.2 Mixtures

**Answer 03 · Mark scheme**

June 2018 | 8464/C/2F | Original Q6



### 5.1.1.2 Mixtures

**Answer 04 · Mark scheme** June 2019 | 8464/C/1F | Original Q2

| | | | | |
|---|---|---|---|---|
| **02.1** | hydrochloric acid | | 1 | AO1<br>5.4.2.3 |
| **02.2** | (black) solid remains (after stirring) | allow copper oxide remains<br>allow no more copper oxide reacts | 1 | AO1<br>5.4.2.3 |
| **02.3** | first stage **B**<br>second stage **A**<br>third stage **C**<br>fourth stage **D** | all 4 correct for **2** marks<br>allow **1** mark if either first stage or fourth stage is correct | 2 | AO1<br>5.4.2.3 |
| **02.4** | (negative electrode) copper<br>(positive electrode) chlorine | allow Cu<br>allow $Cl_2$ / Cl<br>do **not** accept chloride or $Cl^-$<br>if no other mark awarded allow **1** mark if elements are reversed | 1<br>1 | AO2<br>5.4.3.2 |

5.1.1.2 Mixtures

Answer 04 · Mark scheme



| | | | | |
|---|---|---|---|---|
| **02.5** | a reading of an increase in mass<br><br>correct linked reading of the increase in time<br><br>correct evaluation of gradient | e.g. 4 (mg) in 10 (mins) scores 2 marks<br><br>e.g. ( $\frac{4}{10}$ =) 0.4 (mg per min)<br><br>allow correct calculation of gradient from incorrectly determined values for mass and/or time | 1<br><br>1<br><br>1 | AO2<br>5.4.3.4 |

| | | | | |
|---|---|---|---|---|
| **02.6** | cryolite<br><br>oxide | this order only | 1<br><br>1 | AO1<br>5.4.3.3 |

| | | | |
|---|---|---|---|
| **Total** | | | **11** |

### 5.1.1.2 Mixtures

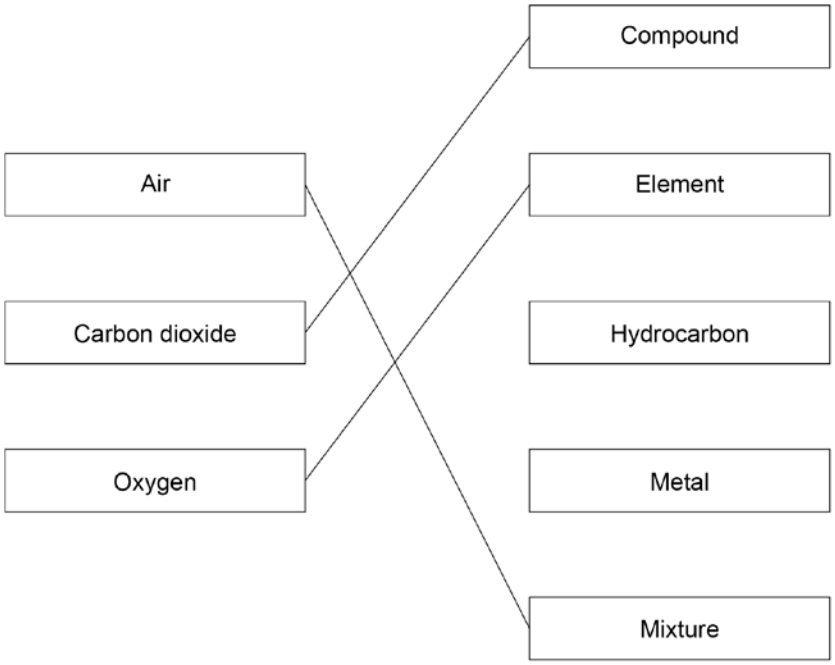
**Answer 04 · Mark scheme**

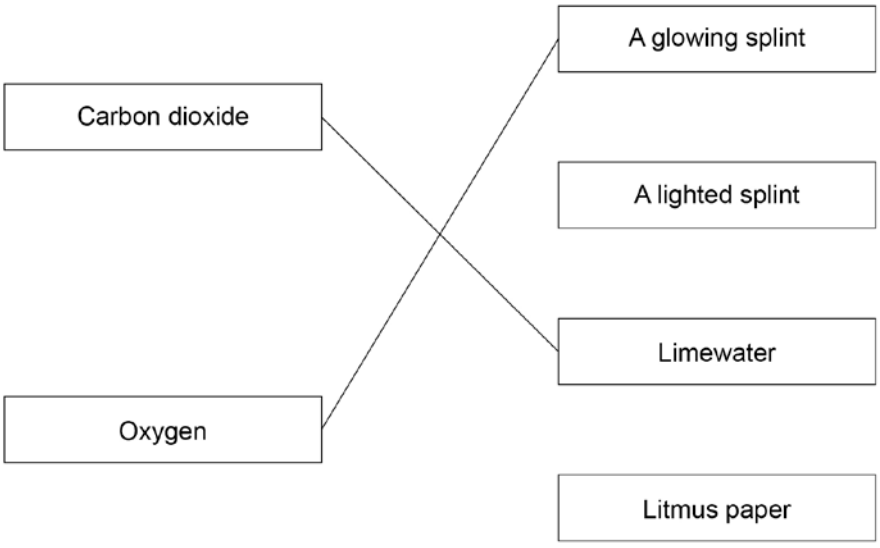
June 2019 | 8464/C/1F | Original Q2

| Question | Answers | Extra information | Mark | AO / Spec. |
|---|---|---|---|---|

### 5.1.1.2 Mixtures

**Answer 05 · Mark scheme** June 2019 | 8464/C/2F | Original Q1

| | | | |
|---|---|---|---|
| **01.1** | <br>If more than one line is drawn from any one substance and not crossed out, no mark is given for that substance.<br>The other marks can be awarded. | 1<br>1<br>1 | AO2.1<br>5.1.1.2<br>5.8.1.1<br>5.1.1.1 |

| | | | |
|---|---|---|---|
| **01.2** | <br>If more than one line is drawn from any one gas and not crossed out, no mark is awarded for that gas.<br>The other mark can be awarded. | 1<br>1 | AO1.1<br>5.8.2.2<br>5.8.2.3 |

| | | | | |
|---|---|---|---|---|
| **01.3** | dissolved in oceans<br><br>photosynthesis | | 1<br><br>1 | AO1<br>5.9.1.2<br>5.9.1.4 |

5.1.1.2 Mixtures

Answer 05 · Mark scheme



| | | | | |
|---|---|---|---|---|
| **01.4** | ⇌ | ignore any other words, formulae or symbols | 1 | AO1.1 5.6.2.1 |
| **01.5** | endothermic (reaction) | spelling must be correct<br>do **not** accept exothermic | 1 | AO1.1 5.6.2.2 |
| **01.6** | rate (of reaction) | allow speed or velocity<br>do **not** accept any other response | 1 | AO1 5.6.2.3 |
| **Total** | | | **10** | |

### 5.1.1.2 Mixtures

**Answer 05 · Mark scheme**

June 2019 | 8464/C/2F | Original Q1

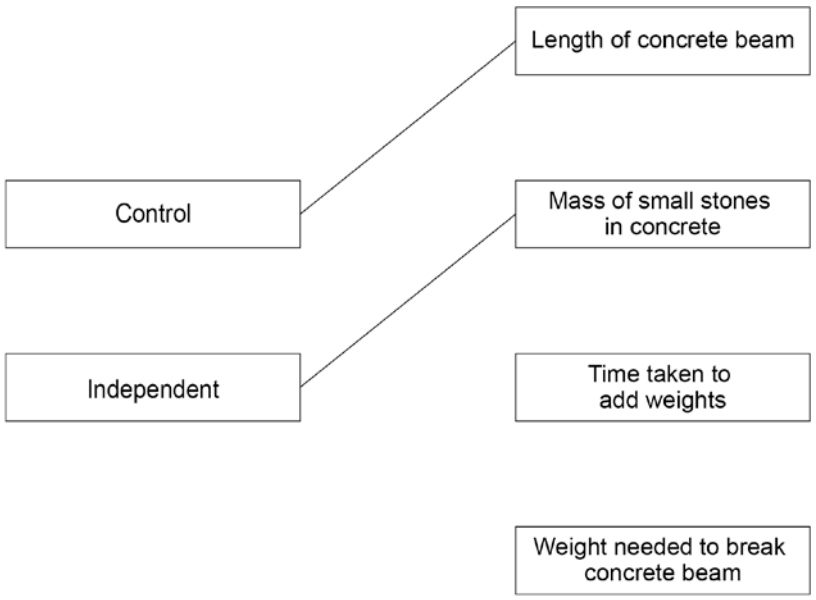
| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

### 5.1.1.2 Mixtures

**Answer 06 · Mark scheme** June 2019 | 8464/C/2F | Original Q2

| | | | | |
|---|---|---|---|---|
| **02.1** | formulation | | 1 | AO1<br>5.8.1.2 |

| | | | | |
|---|---|---|---|---|
| **02.2** | it has a giant structure<br><br>it has strong covalent bonds | | 1<br><br>1 | AO1<br>5.2.2.6<br>5.2.1.4 |

| | | | |
|---|---|---|---|
| **02.3** |  | 1<br><br>1 | AO3<br><br>AO2<br><br>5.8.1.2 |

| | | | | |
|---|---|---|---|---|
| **02.4** | all points correctly plotted<br><br>line of best fit | allow a tolerance of ± ½ a small square<br>allow 1 mark for 3 points correctly plotted<br><br>allow reasonable attempt at line of best fit using incorrectly plotted points | 2<br><br>1 | AO2.2<br>5.8.1.2 |

5.1.1.2 Mixtures

Answer 06 · Mark scheme

June 2019 | 8464/C/2F | Original Q2

| | | | | |
|---|---|---|---|---|
| **02.5** | 1500 (g)<br><br>highest point on graph | allow range from 1400 (g) to 1600 (g)<br>allow ecf from graph drawn in **Figure 2**<br><br>MP2 dependent on MP1<br>allow highest / largest / greatest / most weight needed to break concrete.<br>ignore numbers quoted from graph<br>ignore strongest | 1<br><br>1 | AO3<br>5.8.1.2 |

| | | | | |
|---|---|---|---|---|
| **02.6** | take more measurements | allow indication of a greater range of values<br>or<br>allow indication of measurements at smaller intervals<br><br>ignore repeat the investigation | 1 | AO3<br>5.8.1.2 |

| | | | |
|---|---|---|---|
| **Total** | | | **11** |

### 5.1.1.2 Mixtures

**Answer 06 · Mark scheme**

June 2019 | 8464/C/2F | Original Q2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

### 5.1.1.2 Mixtures

**Answer 07 · Mark scheme** November 2020 | 8464/C/1F | Original Q2

| | | | | |
|---|---|---|---|---|
| **02.1** | 21.1 (°C)<br><br>14.4 (°C) | <br><br>allow correct use of an incorrect start temperature | 1<br><br>1 | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA 10 |

| | | | | |
|---|---|---|---|---|
| **02.2** | any **two** from:<br><br>• surface area of metal<br>• 25 $cm^3$ / volume of copper sulfate solution<br>• concentration of copper sulfate solution<br>• mass / 1 g of metal | <br><br><br><br><br>ignore amount<br>ignore temperature<br>ignore stirring | 2 | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA 10 |

| | | | | |
|---|---|---|---|---|
| **02.3** | $\frac{9.2 + 9.5 + 9.2}{3}$ **or** $\frac{27.9}{3}$<br><br>= 9.3 (°C) | <br><br>if no other mark awarded allow **1** mark for 8.8 (°C) | 1<br><br>1 | AO3<br><br>AO2<br><br>5.4.1.2<br>5.5.1.1<br>RPA 10 |

5.1.1.2 Mixtures



| | | | | |
|---|---|---|---|---|
| **02.4** | (metal **A** / zinc) is less reactive (than magnesium)<br>**or**<br>(metal **A** / zinc) is lower in reactivity series<br>**or**<br>change in temperature is lower (with metal **A** / zinc) | allow converse | 1 | AO3<br>5.4.1.2<br>5.5.1.1<br>RPA 10 |
| **02.5** | stays the same | | 1 | AO3<br>5.4.1.2<br>5.5.1.1<br>RPA 10 |
| **02.6** | too dangerous<br>**or**<br>too reactive | allow potassium would react with water | 1 | AO2<br>5.1.2.5<br>5.4.1.2<br>5.5.1.1<br>(RPA 10) |
| **02.7** | $\frac{25}{100} \times 1.8$ **or** $\frac{1}{4} \times 1.8$<br>= 0.45 (g) | | 1<br>1 | AO2<br>5.3.2.5<br>RPA 10 |
| **Total** | | | **11** | |

### 5.1.1.2 Mixtures

**Answer 07 · Mark scheme**

November 2020 | 8464/C/1F | Original Q2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

### 5.1.1.2 Mixtures

**Answer 08 · Mark scheme** November 2020 | 8464/C/1F | Original Q6

| | | | | |
|---|---|---|---|---|
| **06.1** | 13<br><br>14 | this order only | 1<br><br>1 | AO2<br>5.1.1.4<br>5.1.1.5 |
| **06.2** | loss of oxygen | allow ($Al^{3+}$) gain of electrons<br><br>allow aluminium oxide loses oxygen | 1 | AO1<br>5.4.1.1<br>5.4.1.3 |
| **06.3** | <br><br>(at high temperature) oxygen reacts with carbon / electrode<br><br>(so the positive) electrode burns / wears away<br><br>to produce carbon dioxide | allow anode for (positive) electrode<br><br><br><br><br><br>$C + O_2 \rightarrow CO_2$ scores MP1 and MP3 | <br><br>1<br><br><br><br>1<br><br>1 | <br><br>AO1<br>5.4.3.1<br>5.4.3.2<br>5.4.3.3 |
| **06.4** | (delocalised) electron(s)<br><br>ion(s)<br><br>(delocalised) electron(s) | | 1<br><br>1<br><br>1 | AO1<br><br>AO2<br><br>AO1<br><br>5.2.2.3<br>5.2.2.8<br>5.2.3.2 |
| **Total** | | | **9** | |

### 5.1.1.2 Mixtures

**Answer 08 · Mark scheme**

November 2020 | 8464/C/1F | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

### 5.1.1.2 Mixtures

**Answer 09 · Mark scheme** November 2020 | 8464/C/2F | Original Q1

| | | | | |
|---|---|---|---|---|
| **01.1** | plankton<br><br>mud | must be in this order | 1<br><br>1 | AO1<br>5.7.1.1 |
| **01.2** | **B or** crude oil is heated<br><br>**A or** hydrocarbons evaporate<br><br>**C or** vapours condense | must be in this order<br>all correct for **1** mark | 1 | AO1<br>5.7.1.2 |
| **01.3** | fractional distillation | | 1 | AO1<br>5.1.1.2<br>5.7.1.2 |
| **01.4** | $C_3H_8$ | | 1 | AO2<br>5.7.1.1 |
| **01.5** | covalent bond | | 1 | AO2<br>5.2.1.4<br>5.2.2.4 |
| **01.6** | $C_nH_{2n+2}$ | | 1 | AO1<br>5.7.1.1 |
| **01.7** | 6.7 (billion) | allow 6 700 000 000 | 1 | AO2<br>5.10.2.2 |
| **Total** | | | **8** | |

### 5.1.1.2 Mixtures

**Answer 09 · Mark scheme**

November 2020 | 8464/C/2F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

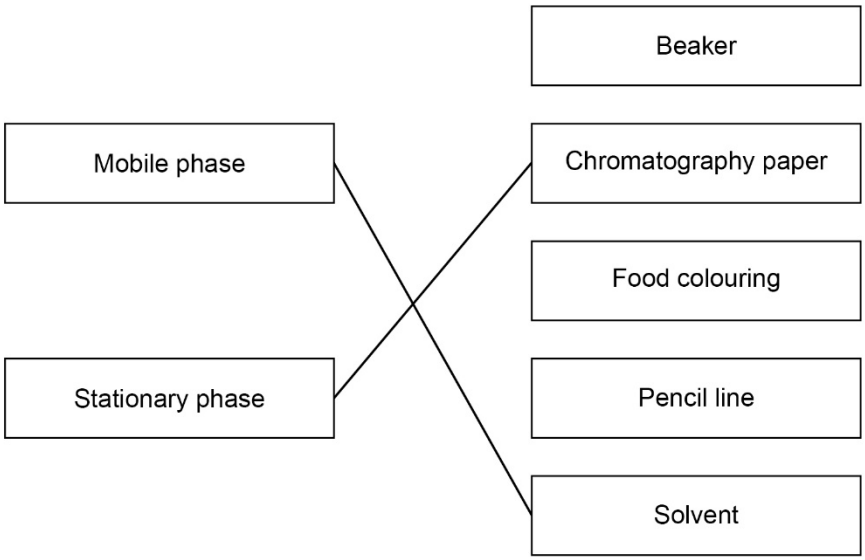
### 5.1.1.2 Mixtures

**Answer 10 · Mark scheme** November 2020 | 8464/C/2F | Original Q5

| | | | | |
|---|---|---|---|---|
| **05.1** | air | | 1 | AO1<br>5.8.1.1 |

| | | | | |
|---|---|---|---|---|
| **05.2** | formulation(s) | | 1 | AO1<br>5.8.1.2 |

**05.3**




1

1

additional line from a box on the left negates the mark for that box

AO2
5.8.1.3

| | | | | |
|---|---|---|---|---|
| **05.4** | **Y** contains 3 dyes | allow colour for dyes | 1 | AO3<br>5.8.1.3 |
| | **Y** contains 2 known dyes | allow **Y** contains **A** and **C** | 1 | |
| | **Y** contains an unknown dye | allow **Y** does not contain dye **B** | 1 | |
| | **alternative approach:** | | | |
| | **Y** contains 3 dyes (1) | | | |
| | **Y** contains 1 known dye (1) | allow **Y** contains dye **C** | | |
| | **Y** contains 2 unknown dyes (1) | allow **Y** does not contain dyes **A** and **B** | | |

5.1.1.2 Mixtures

Answer 10 · Mark scheme

November 2020 | 8464/C/2F | Original Q5

| | | | | |
|---|---|---|---|---|
| **05.5** | $(R_f =) \frac{60}{80}$<br><br>= 0.75 | <br><br>ignore units | 1<br><br>1 | AO2<br>5.8.1.3 |

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

### 5.1.1.2 Mixtures

**Answer 10 · Mark scheme**

November 2020 | 8464/C/2F | Original Q5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|

5.1.1.2 Mixtures

Answer 11 · Mark scheme

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

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

5.1.1.2 Mixtures

Answer 11 · Mark scheme

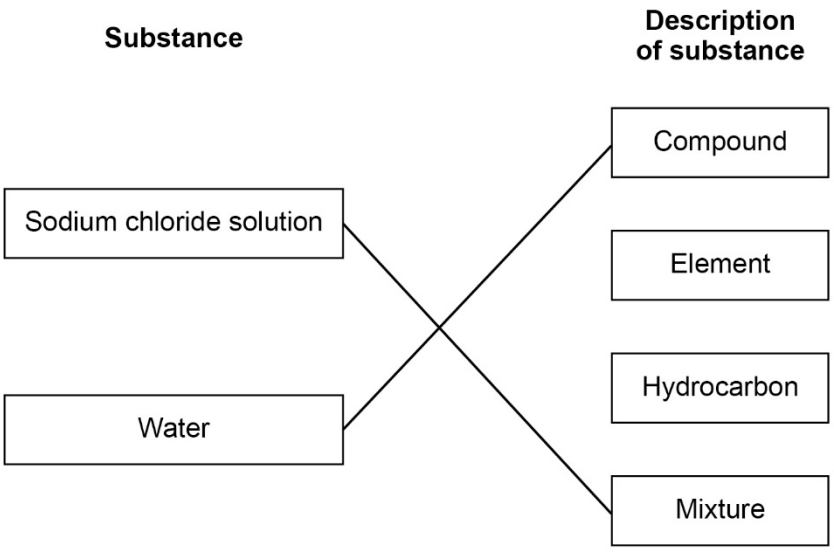
November 2021 | 8464/C/1F | Original Q7

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 07.6 | **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced. | 5–6 | AO1<br>5.4.2.2<br>5.4.2.3<br>RPA8 |
| | **Level 2:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. | 3–4 | |
| | **Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1–2 | |
| | **No relevant content** | 0 | |
| | **Indicative Content:**<br>• react hydrochloric acid<br>• (with) copper oxide<br>• in a suitable container<br>• warm (hydrochloric) acid<br>• add copper oxide<br>• until is in excess<br>**or**<br>until solid remains<br>• stir<br>• filter excess copper oxide<br>• pour solution / filtrate into evaporating basin<br>• use of water bath<br>**or**<br>use of electric heater<br>• to heat gently<br>**or**<br>partially evaporate<br>• leave to cool / crystallise<br>For level 3 the correct chemicals must have been selected. | | |
| **Total** | | **12** | |

5.1.1.2 Mixtures

Answer 12 · Mark scheme

November 2021 | 8464/C/2F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 01.1 | (the symbol) ⇌ | allow description of reversible sign | 1 | AO1 5.6.2.1 |
| 01.2 | white<br><br>blue | must be in this order | 1<br><br>1 | AO1 5.6.2.2 |
| 01.3 | to prevent reaction with water vapour (in the air) | allow to prevent reaction with moisture<br>allow to keep water out | 1 | AO3 5.6.2.2 |
| 01.4 | <br>do **not** accept more than one line from a box on the left | | 1<br><br>1 | AO2 5.1.1.2 |
| 01.5 | evaporation<br>**or**<br>crystallisation | | 1 | AO1 RPA 13 |
| 01.6 | (filtering) to remove solids<br><br>(sterilising) to kill bacteria | <br><br>allow to kill microbes | 1<br><br>1 | AO1 5.10.1.2 |

### 5.1.1.2 Mixtures

**Answer 12 · Mark scheme**

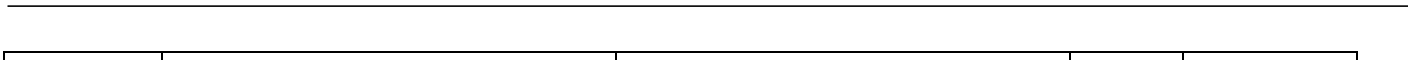


| | | | | |
|---|---|---|---|---|
| **01.7** | ground water | | 1 | AO1<br>5.10.1.3 |
| **01.8** | screening and removal of grit | | 1 | AO1<br>5.10.1.3 |
| **Total** | | | **11** | |

### 5.1.1.2 Mixtures

**Answer 12 · Mark scheme**

November 2021 | 8464/C/2F | Original Q1



Answer 13 · Mark scheme

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

## Question 3

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

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

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

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

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

5.1.1.2 Mixtures

Answer 13 · Mark scheme



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

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

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

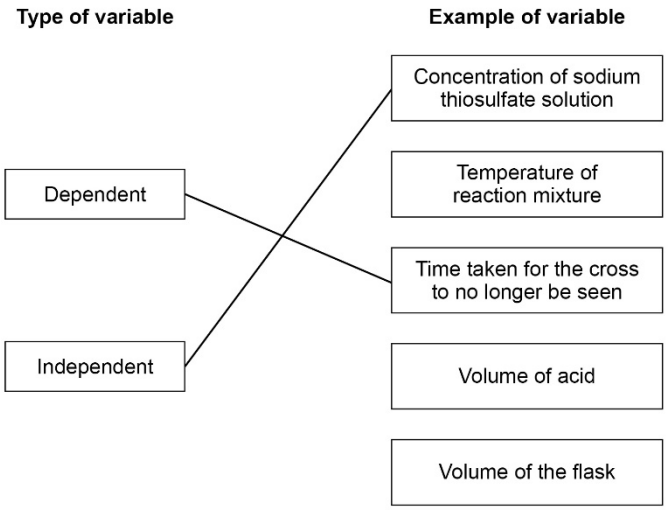
| **Total Question 3** | | **8** |
|---|---|---|

5.1.1.2 Mixtures

Answer 14 · Mark scheme

June 2022 | 8464/C/2F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | <br>do **not** accept more than one line from a box on the left | | 1<br><br><br><br>1 | AO2<br>5.6.1.1<br>RPA11 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | 19.5 (°C) | | 1 | AO2<br>5.6.1.2<br>RPA11 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | all points correctly plotted<br><br><br><br>line of best fit | allow a tolerance of ± ½ a small square<br>allow **1** mark for 3 / 4 / 5 points correctly plotted | 2<br><br><br><br>1 | AO2<br>5.6.1.1<br>RPA11 |

5.1.1.2 Mixtures

Answer 14 · Mark scheme

June 2022 | 8464/C/2F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.4** | 7 (s) | allow ecf from question **04.3**<br><br>allow a tolerance of ± ½ a small square | 1 | AO3<br>5.6.1.1<br>RPA11 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.5** | decreases | | 1 | AO2<br>5.6.1.1<br>RPA11 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.6** | (mean =) $\frac{0.725}{20}$<br><br>= 0.03625 | <br><br>ignore units | 1<br><br>1 | AO2<br>5.6.1.1<br>RPA11 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.7** | g/s | | 1 | AO1<br>5.6.1.1<br>RPA11 |

5.1.1.2 Mixtures

Answer 14 · Mark scheme

June 2022 | 8464/C/2F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.8 | (mean =) $\frac{60.5 + 63.2 + 65.7}{3}$<br><br>= 63.13333 (s) | allow for **1** mark<br>$\frac{60.5 + 63.2 + 65.7 + 82.3}{4} = 67.925$ | 1<br><br>1 | AO3<br><br>AO2 |
| | = 63.1 (s) | allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question | 1 | AO2<br><br>5.6.1.1 RPA11 |

| Total Question 4 | | 14 |
|---|---|---|

5.1.1.2 Mixtures

Answer 15 · Mark scheme

June 2022 | 8464/C/2F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | any **two** pairs from:<br><br>(start) line drawn in ink (1)<br><br>(so ink) will mix with solvent (1)<br><br>the solvent is above the (start) line (1)<br>(so) colours / ink will dissolve (1)<br><br>no lid on tank (1)<br>(so) solvent will evaporate (1) | <br><br>allow (start) line should be drawn in pencil<br>allow the ink will move up the paper<br><br>allow the solvent should be below the (start) line | 4 | AO3<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | any **two** from:<br><br>• (the brown ink) contains the blue, yellow and red (colours)<br><br>• (the brown ink) contains an unknown colour<br><br>• (the brown ink) does not contain green ink<br><br>• blue (colour) is the most soluble<br>**or**<br>red (colour) is the least soluble | <br><br><br><br><br><br>allow blue (colour) has the highest $R_f$ value<br><br>allow red (colour) has the lowest $R_f$ value<br><br>ignore green colour is insoluble | 2 | AO3<br>5.8.1.3<br>RPA12 |

5.1.1.2 Mixtures



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.3** | the green colour was insoluble in the solvent | | 1 | AO2<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.4** | $0.24 = \frac{1.8}{\text{distance moved by solvent}}$ | | 1 | AO2<br>5.8.1.3<br>RPA12 |
| | (distance moved by solvent =) $\frac{1.8}{0.24}$ | | 1 | |
| | = 7.5 (cm) | | 1 | |

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

5.1.1.2 Mixtures

Answer 16 · Mark scheme

June 2023 | 8464/C/1F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | energy / electricity | | 1 | AO1<br>5.4.3.1<br>5.4.3.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.2** | carbon dioxide | | 1 | AO1<br>5.4.3.1<br>5.4.3.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.3** | sodium reacts with air / oxygen<br>**or**<br>sodium is highly reactive | allow titanium (chloride) reacts with air / oxygen | 1 | AO3<br>5.1.2.5<br>5.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.4** | argon | | 1 | AO3<br>5.1.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.5** | $TiCl_4 + 4\,Na \longrightarrow Ti + \mathbf{4}\,NaCl$ | allow multiples | 1 | AO2<br>5.1.1.1<br>5.4.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.6** | 4.4 (g) | | 1 | AO2<br>5.3.1.1<br>5.3.1.3 |

5.1.1.2 Mixtures

Answer 16 · Mark scheme

June 2023 | 8464/C/1F | Original Q5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.7 | (the) mass decreased<br><br>(because) carbon dioxide escapes (into the atmosphere) | <br><br>allow (because) carbon dioxide is a gas<br><br>allow (because) a gas is produced | 1<br><br>1 | AO2<br>5.3.1.1<br>5.3.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.8 | the copper oxide is reduced<br><br>(reason)<br>(copper oxide) loses oxygen | | 1<br><br>1 | AO2<br>5.4.1.3 |

| Total Question 5 | 10 |
|---|---|

5.1.1.2 Mixtures

Answer 17 · Mark scheme

June 2023 | 8464/C/2F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | $CH_4 + \mathbf{2}\,O_2 \rightarrow CO_2 + \mathbf{2}\,H_2O$ | | 1 | AO2<br>5.7.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.2** | hydrocarbon molecules in petrol have fewer carbon atoms than those in diesel<br><br>petrol has a lower boiling point (range) than diesel | allow converse throughout<br><br>allow petrol is more flammable than diesel<br><br>allow petrol is less viscous than diesel | 1<br><br>1 | AO3<br>5.7.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.3** | oxygen | | 1 | AO1<br>5.8.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.4** | air | allow the atmosphere<br><br>allow from volcanoes | 1 | AO1<br>5.9.1.1<br>5.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.5** | global dimming | | 1 | AO2<br>5.9.3.1 |

Answer 17 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.6** | (carbon monoxide is) colourless<br>**or**<br>(carbon monoxide is) odourless | ignore clear | 1 | AO1<br>5.9.3.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.7** | (diesel) burns at a high temperature<br>**or**<br>(diesel) burns at a temperature greater than 100 °C | | 1 | AO2 |
| | (which is) above the boiling point of water | | 1 | AO3<br>5.2.2.1<br>5.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.8** | sulfur dioxide (is produced when diesel is burnt) | | 1 | AO1<br>5.9.3.1<br>5.9.3.2 |
| | (which causes) acid rain | | 1 | |
| | (which results in)<br>any **one** from:<br>• damage to buildings / statues / bridges<br>• damage to trees / plants<br>• damage to aquatic life<br>• acidification of lakes / rivers / soil<br>• respiratory problems | allow (which affects) asthma | 1 | |

| **Total Question 5** | **12** |
|---|---|

5.1.1.2 Mixtures

Answer 18 · Mark scheme

June 2023 | 8464/C/2F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.1** | stationary phase | | 1 | AO1<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.2** | any **one** from:<br>(the substances)<br>• move at different speeds<br>• have different solubilities<br>• have different attractions for the (chromatography) paper | | 1 | AO2<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.3** | 1 | | 1 | AO1<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.4** | ($R_f$ = )<br>$\frac{4.77}{5.30}$<br><br>= 0.9 | | 1<br><br>1 | AO2<br>5.8.1.3<br>RPA12 |

5.1.1.2 Mixtures

Answer 18 · Mark scheme

June 2023 | 8464/C/2F | Original Q6

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 06.5 | **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced. | 5–6 | AO1 5.8.1.3 |
| | **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>• **draw a pencil line**<br>• near the bottom edge of the (chromatography) paper<br><br>• **put a small dot of black ink on the pencil line**<br>• put a small volume of water / solvent in a beaker<br><br>• **place the (chromatography) paper in the solvent**<br>• the dots of ink should be above the level of the water / solvent<br>• support the paper in this position<br>• put a lid on the beaker<br><br>• **leave to run**<br>• mark position of solvent front<br>• remove from beaker and leave to dry<br><br>• **determine $R_f$ values**<br>• measure distance of all dots from start line<br>• measure distance of solvent front from start line<br>• calculate $R_f$ values for all dots<br>• compare with known $R_f$ values | | |

| | |
|---|---|
| **Total Question 6** | **11** |

5.1.1.2 Mixtures

Answer 19 · Mark scheme

June 2024 | 8464/C/1F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.1 | independent | | 1 | AO1<br>5.4.1.2<br>5.5.1.1<br>RPA10 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.2 | zinc sulfate | allow $ZnSO_4$ | 1 | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA10 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.3 | | ignore references to temperature / fizzing | | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA10 |
| | solution becomes colourless | allow solution changes colour | 1 | |
| | (brown / orange) solid produced | allow zinc changes colour | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.4 | (highest temperature =) 36 (°C) | | 1 | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA10 |
| | (temperature increase = 36 – 21 =) 15 (°C) | allow correct use of an incorrectly determined value for highest temperature<br><br>ignore minus sign | 1 | |

5.1.1.2 Mixtures

Answer 19 · Mark scheme

June 2024 | 8464/C/1F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.5 | (**B** =) $\frac{7.8 + 7.3 + 7.7}{3}$ **or** $\frac{22.8}{3}$<br>= 7.6 (°C)<br><br>**OR**<br><br>(**B** =) $\frac{7.8 + 7.7}{2}$ **or** $\frac{15.5}{2}$ (1)<br>= 7.75 (°C) (1) | allow 7.8 (°C) if working shown for calculation of the mean using 7.8 and 7.7 (°C) | 1<br><br>1 | AO2<br>5.4.1.2<br>5.5.1.1<br>RPA10 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.6 | (range =) 13.1 (°C to) 13.8 (°C) | allow (range =) 13.8 (°C to) 13.1 (°C) | 1 | AO2<br>5.3.1.4<br>5.4.1.2<br>5.5.1.1<br>RPA10 |

5.1.1.2 Mixtures

Answer 19 · Mark scheme

June 2024 | 8464/C/1F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.7 | | MP2 is dependent on MP1 being awarded | | AO3<br>5.4.1.2<br>5.5.1.1<br>RPA10 |
| | (result) 12.9 (°C) | allow (result / experiment) 2 | 1 | |
| | any **one** from:<br>• (the result is) much lower than the other two results | | 1 | |
| | • (used) less than 3 g zinc | allow (used) incorrect mass of zinc | | |
| | • (used) more than 50 $cm^3$ of copper sulfate (solution) | allow (used) incorrect volume of copper sulfate (solution) | | |
| | • the mixture was not stirred | | | |

| Total Question 3 | 11 |
|---|---|

5.1.1.2 Mixtures

Answer 20 · Mark scheme

June 2024 | 8464/C/1F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.1** | (paper) chromatography | | 1 | AO1<br>5.1.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.2** | filtration / filtering | | 1 | AO1<br>5.1.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.3** | (because) **C** is insoluble<br>**or**<br>(because) **C** does not dissolve (in water)<br><br>(whereas) **D** is soluble<br>**or**<br>(whereas) **D** dissolves (in water) | | 1<br><br>1 | AO3<br>5.1.1.2 |

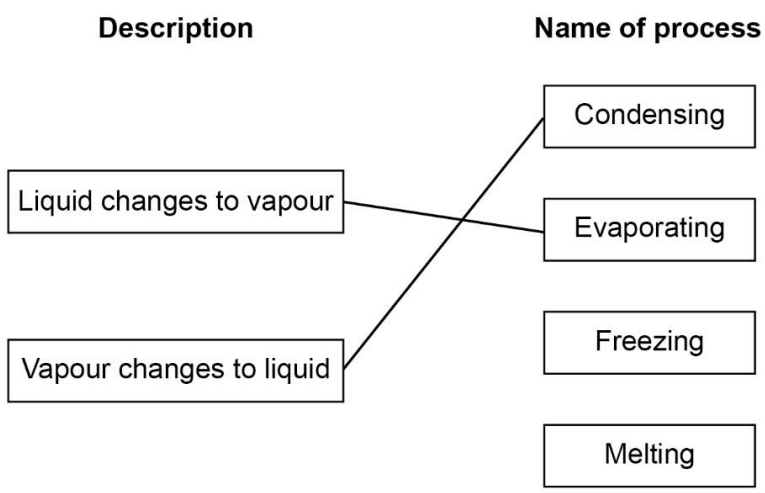
| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.4** | (fractional) distillation | allow (simple) distillation | 1 | AO1<br>5.1.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.5** | **G** | | 1 | AO3<br>5.1.1.2 |

5.1.1.2 Mixtures

Answer 20 · Mark scheme

June 2024 | 8464/C/1F | Original Q4

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 04.6 | <br>do **not** accept more than **one** line from a box on the left | 1<br><br>1 | AO2<br>5.1.1.2<br>5.2.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.7 | the temperature of water at **K** is higher than at **J** | | 1 | AO3<br>5.1.1.2 |

| Total Question 4 | 9 |
|---|---|

5.1.1.2 Mixtures

Answer 21 · Mark scheme

June 2024 | 8464/C/1F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | any **two** from:<br>• mass of copper produced increased (from 1900 to 2010)<br>• before 1930 the mass of copper produced increased slightly<br>• after 1930 the mass of copper produced increased rapidly<br>• the highest mass of copper was produced in 2010<br>• the lowest mass of copper was produced in 1900<br>• the increase in the mass of copper produced was not linear | <br><br>allow a value in the range 1925 to 1930<br><br>allow a value in the range 1925 to 1930<br><br>allow the highest mass of copper produced was 15.8 ($\times 10^9$ kilograms)<br><br>allow the lowest mass of copper produced was 0.2 ($\times 10^9$ kilograms) | 2 | AO3<br>5.2.2.7 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | (alloy of copper and zinc is harder because) the atoms are different sizes<br><br>(so the) layers are distorted<br><br>(so the) layers cannot easily slide | <br><br><br><br>allow (so the) atoms cannot slide over each other | 1<br><br>1<br><br>1 | AO2<br>5.2.2.7 |

5.1.1.2 Mixtures

Answer 21 · Mark scheme

June 2024 | 8464/C/1F | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.3 | (% copper = 100 – 13.5 =) 86.5 (%) | | 1 | AO2 5.2.2.7 |
| | (mass of copper =) $\frac{86.5}{100}$ × 5.25 | allow correct use of an incorrectly determined percentage of copper | 1 | |
| | = 4.54125 (g) | | 1 | |
| | = 4.54 (g) | allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question | 1 | |
| | **OR** | | | |
| | (mass of zinc =) $\frac{13.5}{100}$ × 5.25 (1) | | | |
| | = 0.70875 (g) (1) | | | |
| | (mass of copper = 5.25 – 0.70875) = 4.54125 (g) (1) | allow correct use of an incorrectly determined mass of zinc | | |
| | = 4.54 (g) (1) | allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question | | |

| Total Question 6 | 9 |
|---|---|

5.1.1.2 Mixtures

Answer 22 · Mark scheme

June 2024 | 8464/C/2F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | formulation | | 1 | AO1<br>5.8.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.2** | pencil<br><br>(reason)<br>(so) the start line does not dissolve in the solvent | | 1<br><br>1 | AO3<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.3** | (distance moved by red colour)<br>3.2 (cm)<br>**or**<br>32 (mm)<br><br>(distance moved by solvent)<br>8.0 (cm)<br>**or**<br>80 (mm)<br><br>($R_f$ =) $\frac{3.2}{8.0}$ **or** $\frac{32}{80}$<br><br>= 0.4 | allow a value in the range 3.1 to 3.3 (cm)<br><br>allow a value in the range 31 to 33 (mm)<br><br><br><br><br>allow correct use of incorrectly determined distance(s) | 1<br><br><br><br><br>1<br><br><br>1<br><br><br>1 | AO2<br>5.8.1.3<br>RPA12 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.4** | prussian<br><br>(prussian) has the closest $R_f$ value (to the colour in the printer ink) | allow 0.88 | 1<br><br>1 | AO3<br>5.8.1.3<br>RPA12 |

| **Total Question 3** | **9** |
|---|---|

5.1.1.2 Mixtures

Answer 23 · Mark scheme

June 2024 | 8464/C/2F | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.1** | (molecules) made up of carbon and hydrogen (atoms only) | | 1 | AO1<br>5.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.2** | $C_{10}H_{22}$ | | 1 | AO2<br>5.7.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.3** | (crude oil) is heated | | 1 | AO1<br>5.7.1.2 |
| | (so some of the hydrocarbons) vaporise | | 1 | |
| | the column has a temperature gradient | allow the column gets cooler going up | 1 | |
| | (so) the hydrocarbons / fractions condense at different heights / temperatures in the column<br>**or**<br>(and) the hydrocarbons / fractions condense at their boiling points | | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.4** | $C_{14}H_{30} \rightarrow C_8H_{18} + \mathbf{2}\,C_3H_6$ | | 1 | AO2<br>5.1.1.1<br>5.7.1.4 |

5.1.1.2 Mixtures



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.5 | add bromine (water)<br><br>(bromine water) changes (from orange) to colourless | <br><br>allow (bromine water) decolourises<br><br>ignore clear<br><br>MP2 is dependent on MP1 being awarded | 1<br><br>1 | AO1<br>5.7.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.6 | polymer | allow plastic<br><br>allow hydrocarbon | 1 | AO1<br>5.2.1.4<br>5.7.1.4 |

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

5.1.1.2 Mixtures

Answer 24 · Mark scheme

June 2025 | 8464/C/1F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | compounds | | 1 | AO1 5.4.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | iron is less reactive than carbon | | 1 | AO1 5.4.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | to reduce the amount of energy used | | 1 | AO1 5.4.3.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.4 | the electrodes react with oxygen gas | | 1 | AO1 5.4.3.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.5 | the alloy is harder than the pure metal | | 1 | AO1 5.2.2.7 |

5.1.1.2 Mixtures

Answer 24 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.6 | (melting point of alloy) decreases | | 1 | AO2 5.2.2.7 |
| | until 70% (silver) | allow a value in the range 69% to 71% | 1 | |
| | **or** | | | |
| | until 530 °C | allow a value in the range 520 °C to 540 °C | | |
| | then (melting point) increases | | 1 | |
| | | if no other mark awarded, allow **1** mark for (melting point) increases from 660 °C to 960 °C **or** (melting point) increases by 300 °C | | |

| Total Question 4 | 8 |
|---|---|

5.1.1.2 Mixtures

Answer 25 · Mark scheme

June 2025 | 8464/C/1F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.1 | any **two** from:<br>• measure the volume of the alkali<br>• repeat **and** calculate a mean<br>• stir / swirl the mixture<br>• use universal indicator solution | ignore references to safety<br>allow use a measuring cylinder (to measure the alkali)<br>allow use a burette (to measure the alkali)<br>allow use a pH probe | 2 | AO3<br>5.4.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.2 | 7 | | 1 | AO1<br>5.4.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.3 | neutralisation | | 1 | AO1<br>5.4.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.4 | $H^+$ | | 1 | AO1<br>5.4.2.4 |

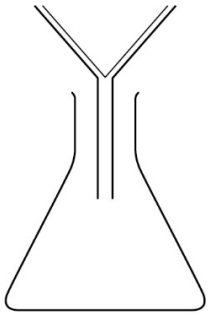
| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.5 | nitric (acid) | allow $HNO_3$ | 1 | AO2<br>5.4.2.2 |

5.1.1.2 Mixtures

Answer 25 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.6** | (**A**) overall energy change | | 1 | AO1 5.5.1.2 |
| | (**B**) progress of reaction | | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.7** | filter funnel with filter paper inside | | 1 | AO1 5.4.2.3 RPA8 |
| | a container to collect the filtrate | | 1 | |
| | | an answer of  scores **2** marks | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.8** | zinc | allow Zn | 1 | AO2 5.4.2.1 |

| **Total Question 5** | **11** |
|---|---|

5.1.1.2 Mixtures

Answer 26 · Mark scheme

June 2025 | 8464/C/1F | Original Q7

## Question 7

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 07.1 | (a reaction) which transfers energy to the surroundings | allow heat for energy<br><br>allow (a reaction) which releases energy (to the surroundings) | 1 | AO1 5.5.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 07.2 | (mass of oxygen = 2 × 16 =) 32 | | 1 | AO2 5.3.1.2 |
| | (percentage =) $\frac{32}{74}$ × 100 | allow correct use of an incorrectly determined mass of oxygen | 1 | |
| | = 43.2 (%) | allow 43.2432 (%) correctly rounded to at least 2 significant figures | 1 | |

5.1.1.2 Mixtures

Answer 26 · Mark scheme

June 2025 | 8464/C/1F | Original Q7

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 07.3 | **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5–6 | AO1<br>5.5.1.1<br>RPA10 |
| | **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>• measure volume of water<br>  ○ using a measuring cylinder<br>  ○ pour into a suitable container eg insulated cup<br>• measure initial temperature of water<br>  ○ using a thermometer<br>• add known mass of calcium oxide<br>  ○ measured with a balance<br>  ○ stir<br>• measure the highest temperature reached by the mixture<br>**or**<br>measure temperature reached after set time period<br>  ○ determine the temperature change<br>• repeat with different masses of calcium oxide<br>**or**<br>add successive masses to the same mixture<br>• use the same volume of water<br>  ○ use the same initial temperature of water<br><br>for **Level 3** all key steps should be described and the control variable the same volume of water must be given | | |

| | |
|---|---|
| **Total Question 7** | **10** |

5.1.1.2 Mixtures

Answer 27 · Mark scheme

June 2025 | 8464/C/2F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | formulation | | 1 | AO1<br>5.8.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.2** | 14 | | 1 | AO2<br>5.1.1.1<br>5.8.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.3** | carbon monoxide is a toxic gas | | 1 | AO1<br>5.9.3.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.4** | $2\,CH_4O + 3\,O_2 \rightarrow 2CO_2 + 4\,H_2O$ | allow multiples | 1 | AO2<br>5.1.1.1<br>5.3.1.1<br>5.7.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.5** | (test)<br>add a burning splint<br><br>(result)<br>(hydrogen burns with) a pop sound | do **not** accept glowing splint<br><br>MP2 is dependent on MP1 being awarded | 1<br><br>1 | AO1<br>5.8.2.1 |

Answer 27 · Mark scheme

June 2025 | 8464/C/2F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.6 | any **two** from:<br>• melting ice caps<br>• rising sea levels<br>• more flooding<br>• extremes of weather<br>• increase in droughts<br>• increase in wildfires<br>• loss of habitats<br>• reduction in biodiversity<br>• change in migration patterns | allow increase in frequency of storms<br>allow desertification<br>ignore global warming<br>do **not** accept acid rain<br>do **not** accept global dimming<br>do **not** accept deforestation<br>do **not** accept natural disasters<br>do **not** accept references to ozone | 2 | AO1<br>5.9.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.7 | colour change (from blue to pink) | | 1 | AO2<br>5.6.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.8 | endothermic | allow (thermal) decomposition | 1 | AO2<br>5.6.2.2 |

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

5.1.1.2 Mixtures

Answer 11 · Examiner comments

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

**Question 7 (standard demand)**

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

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

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

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

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

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

5.1.1.2 Mixtures



**Concluding Remarks**

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

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

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

5.1.1.2 Mixtures

Answer 11 · Examiner comments



**Mark Ranges and Award of Grades**

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

5.1.1.2 Mixtures

Answer 12 · Examiner comments — November 2021 | 8464/C/2F | Original Q1

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

The reversible symbol was well known, but many students did not recognise that the starting point for the reaction was the anhydrous form of copper sulfate, so were unable to identify the colours of the salts. They did not appreciate the link between the reversible reaction and the storage of the anhydrous salt. Most students referred incorrectly to the toxicity of the salt.

The topic of water treatment was not well understood. Credit was given for the idea of filtering removing large insoluble solid material from the water and sterilising removing bacteria and pathogens, but not germs.

Answer 13 · Examiner comments — June 2022 | 8464/C/2F | Original Q3

**Question 3**

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

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

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

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

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

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

Answer 13 · Examiner comments — June 2022 | 8464/C/2F | Original Q3

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

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

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

5.1.1.2 Mixtures

Answer 14 · Examiner comments

June 2022 | 8464/C/2F | Original Q4

## Question 4

The skills tested in this question led to some good responses from students, particularly when reading scales, graph plotting and in guided calculations.

**04.1** Identifying variables from a practical procedure is still one of the skills that students find challenging. Only 1 in 5 scored both marks, with a further quarter of these students correctly identifying one of the variables.

**04.2** Nearly 95% of students were able to read the thermometer to give the temperature.

**04.3** A quarter of students gained all the marks for plotting the graph, including a curved line of best fit. Fewer than 1 in 5 gained no marks. The common error was the line of best fit, with many drawing a straight line. Students need to realise that lines of best fit can be curved or straight and they need to make that judgement.

**04.4** A quarter of students were able to successfully extrapolate the graph to find the value requested. Students should be encouraged to extrapolate the lines and read from that line, as opposed to estimating where the line crosses the point.

**04.5** Two thirds of students correctly completed the sentence.

**04.6** Guided calculations with no manipulation of the equation are well understood by students, and this one was no exception, with nearly 4 in 5 achieving both marks for the calculation. Transposition errors (both written and putting into calculators) accounted for a number of the incorrect responses.

**04.7** The units were correctly identified by nearly 80% of students.

**04.8** Around 1 in 4 students achieved all three marks for this calculation. The two most frequently seen errors were including the anomalous result and not rounding to 3 significant figures. This is another example where students need to read the whole question, perhaps highlighting the requirements, before embarking on the solution.

5.1.1.2 Mixtures

Answer 15 · Examiner comments — June 2022 | 8464/C/2F | Original Q6

**Question 6**

This Required Practical Activity is a familiar context on examination papers and most students were able to make some progress.

**06.1** Often students gave solutions as opposed to the problems the errors would lead to. The start line being drawn in ink was the most common correct response, however, the problems encountered were often vague such as the experiment would not work. A quarter of students gained at least 1 mark, with a further quarter gaining 2. Far fewer were able to progress much beyond this.

Answer 15 · Examiner comments — June 2022 | 8464/C/2F | Original Q6

**06.2** Conclusions were often poorly expressed or incomplete. The conclusion needed to be in terms of what was in brown ink. Common incorrect responses referred to the amount of a colour being linked to where it is found on a chromatogram.

**06.3** Just over three quarters of students were able to identify that the green colour was insoluble in the solvent.

**06.4** The calculation of the $R_f$ value relied on the skill of rearranging the given equation. Just over 35% of students gained all 3 marks. Where an incorrect response was obtained, no further credit was given when there was no working. Students should be encouraged to show their working in calculations so that appropriate credit can be awarded if a final answer is not given or is incorrect.

5.1.1.2 Mixtures

Answer 16 · Examiner comments

June 2023 | 8464/C/1F | Original Q5

**Question 5 (low/standard demand)**

05.1 More than a third of students knew that the extraction of aluminium is expensive because the process uses large amounts of energy. Heat was a very common response that was insufficient to gain credit.

05.2 More than 50% of students knew that carbon dioxide is produced when oxygen reacts with the positive carbon electrodes when aluminium is extracted by electrolysis from a molten mixture of aluminium oxide and cryolite.

05.3 Only a very small number of students were able to suggest that when titanium was extracted from a mixture of titanium chloride and sodium an inert atmosphere was essential to prevent the sodium reacting with air.

05.4 A third of students knew that argon is used for the inert atmosphere when titanium is extracted from a mixture of titanium chloride and sodium.

05.5 Just over half of the students correctly balanced the equation for the reaction of sodium with titanium chloride. Students should be aware that they should not change the formula of the compounds in the equation.

05.6 Students should know that the law of conservation of mass states that the mass of reactants equals to the mass of products. In this experiment the mass of carbon dioxide produced equals the difference between the sum of the mass of copper oxide and carbon (reactants) minus the mass of copper produced (other product). Only 20% of students calculated this correctly.

05.7 Students were asked to explain why the mass of a mixture of copper oxide and carbon in a crucible changed when the mixture was heated. Few students recognised that the mass would decrease because the carbon dioxide produced is a gas that escapes into the atmosphere. The term evaporation was incorrectly used by a large number of students. Only a small number of students gained two marks.

05.8 This question asked what happens to copper oxide in the reaction between copper oxide and carbon. Students should be careful with their use of technical terms as many incorrectly stated that ‘copper’ loses oxygen. Approximately 30% of students knew that copper oxide was reduced but very few students were then able to give a reason why.

5.1.1.2 Mixtures

Answer 17 · Examiner comments

June 2023 | 8464/C/2F | Original Q5

**Question 5**

05.1 Around a third of students successfully balanced the equation. Having to balance two numbers in the equation led to many students trying to add other atoms, usually C and/or H to the equation.

05.2 One in five students gained both marks for comparing petrol and diesel. A further third gained one mark. On this occasion, students needed to interpret what the table headings meant, so many were not able to gain credit as they referred to the range of numbers of carbons, rather than the number of carbons and similarly, though more infrequent, for the boiling points.

05.3 Three in five students identified oxygen as the common element in the compounds released from a car engine.

05.4 Only 15% of students were able to identify that nitrogen came from the air. Much more common suggestions were from the engine or the diesel fuel.

05.5 This question tested a little known part of the specification, with fewer than one in twenty identifying global dimming as a consequence of particulates in the atmosphere. By far the most common incorrect response was for global warming.

05.6 Just below half of students could answer that carbon monoxide is either colourless or odourless. Many students gave both, despite being asked for one.

05.7 Fewer than one in ten gained any marks on this question, which was applying ideas from across the specification. Just a statement that water evaporates was insufficient for credit, as there needed to be a realisation that water is produced as a vapour, rather than turning into a vapour during the process.

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Answer 17 · Examiner comments

June 2023 | 8464/C/2F | Original Q5

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05.8 Around one in ten students gained at least one mark on this question, usually for recognising that sulfur is responsible for acid rain. The consequences of acid rain were not well known, and even fewer knew that sulfur enters the atmosphere as sulfur dioxide. Global warming was the most common incorrect response.

5.1.1.2 Mixtures

Answer 18 · Examiner comments

June 2023 | 8464/C/2F | Original Q6

## Question 6

06.1 Over half of students knew that the stationary phase was the other phase in chromatography.

06.2 Only approximately one in fifty students knew that separation of inks in chromatography was due to either a difference in solubility or different attractions for the paper. Many students thought that the separation was dependent on melting point, concentration, density, or formula mass.

06.3 Lots of random numbers were seen for this question, but just over a quarter were able to deduce that there would be one spot.

06.4 Just under a quarter of students were able to correctly calculate the Rf from the values given. There were many examples of students multiplying the numbers, subtracting them, or dividing them upside down.

06.5 Students were asked to plan an experiment using paper chromatography to separate the colours in black ink and to subsequently identify the colours from their Rf values.

To access level 3, which was done by fewer than one in ten students, the plan needed to lead to a valid outcome. This required students to identify the key steps in the indicative content. Some students were able to explain how to determine the Rf values but very few recognised that the values needed to be compared to known Rf values and how this should be done.

To access level 2, which was done by nearly one third of students, the method did not necessarily lead to a valid outcome. Common mistakes included the idea that the pencil line should be submerged in the solvent and that the experiment should be left for too long for example, until the ink reached the top of the paper.

Common weaker responses usually gained credit for identifying that the pencil line needed to be drawn in pencil.

It should be noted that just over a quarter of students did not attempt this question at all.

5.1.1.2 Mixtures

Answer 18 · Examiner comments



**Mark Ranges and Award of Grades**

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

Answer 19 · Examiner comments

June 2024 | 8464/C/1F | Original Q3

# Question 3 (low & standard demand)

**03.1** In an investigation the independent variable is the one that is changed, the dependent variable is the one that is measured, and all other variables must be controlled. If a student investigates the temperature change when different masses of zinc are added to copper sulfate solution the independent variable is the mass of zinc and the dependent variable is the temperature change. Just under half of the students answered this correctly. Control (variable) was a slightly more common incorrect response than dependent (variable).

**03.2** A word equation was provided to help students identify that the salt zinc sulfate is produced when zinc reacts with copper sulfate solution. A quarter of students gave the correct answer.

**03.3** Students found this question challenging. When a question asks for observations students should be encouraged to think 'before', 'during' and 'after'. In the reaction between zinc and copper sulfate solution, zinc is replaced by brown/orange copper solid and the blue colour of the copper sulfate solution fades as colourless zinc sulfate is produced. The colours are not required in the specification, hence the allow statements where there is just reference to the solution/zinc changing colour. 'Colour change' is too vague to gain credit as it does not refer to either the zinc solid or the copper sulfate solution.

The equation for the reaction was provided to help and, although it does not contain any gaseous products, many students gave 'bubbles' or 'fizzing' as an observation.

0 3 . 3 The temperature of the solution increases when zinc reacts with copper sulfate solution.

Give **two** other observations that can be made when zinc reacts with copper sulfate solution.

**[2 marks]**

1 Fizzing

2 colour change

This student did not gain any credit as 'colour change' on its own is insufficient (it could be referring to either zinc or the solution).

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### 5.1.1.2 Mixtures

**Answer 19 · Examiner comments** June 2024 | 8464/C/1F | Original Q3

**03.4** The temperature shown on the diagram of the thermometer scale showed 36 °C. Most students read this correctly and then subtracted the starting temperature to give a temperature increase of 15 °C. A number of students did not use the temperature scale correctly and did not score marking point 1 but could access marking point 2 for a correct subtraction from their highest temperature.

**03.5** The calculation of the mean temperature increase was correctly carried out by nearly three-quarters of students. Most students achieved either 2 or 0 marks.

**Table 4**

| Mass of zinc in grams | Temperature increase in °C | | | |
|---|---|---|---|---|
| | Experiment 1 | Experiment 2 | Experiment 3 | Mean |
| 1.0 | 7.8 | 7.3 | 7.7 | **B** |
| 2.0 | 13.1 | 13.8 | 13.3 | 13.4 |
| 3.0 | 20.4 | 12.9 | 20.2 | 20.3 |

0 3 . 5 Calculate value **B** in **Table 4**.

**[2 marks]**

7.8 + 7.3 + 7.7 = 17.666666667

B = 17.6 °C

This student did not gain any credit. They divided only the last number (7.7) by 3, then added, rather than dividing the sum of all three numbers (ie 22.8) by 3.

**03.6** The range of results is the 'minimum value to the maximum value'. In the data set the lowest value is 13.1 °C and the highest value is 13.8 °C. 60% of students gained this mark.

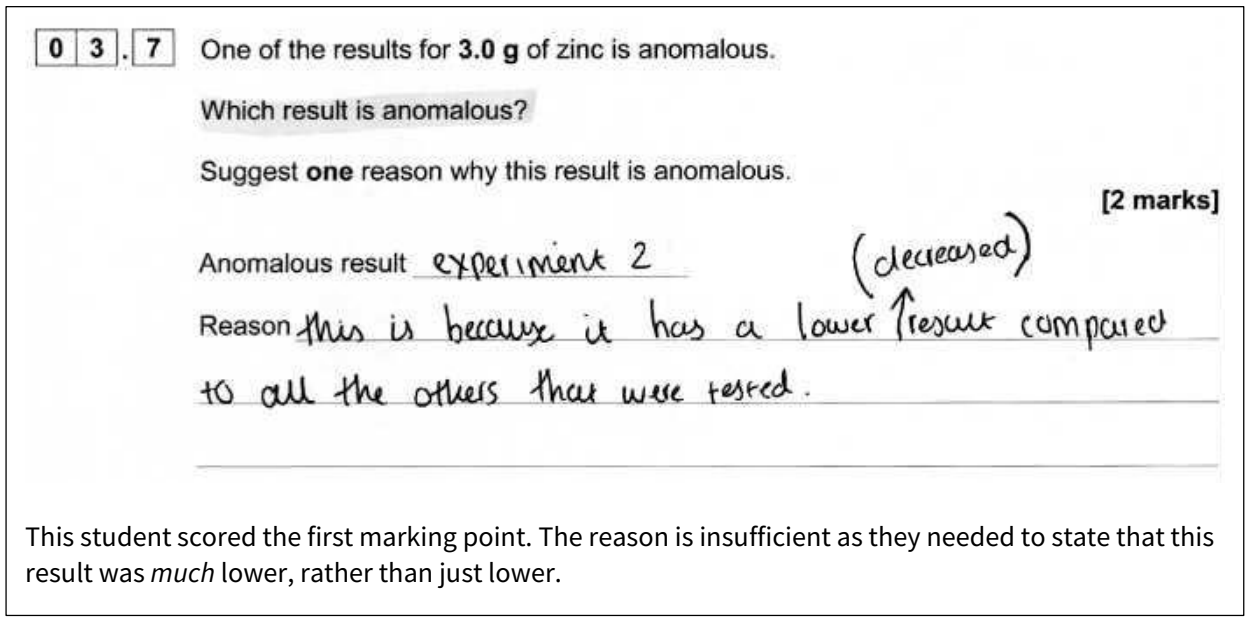
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### 5.1.1.2 Mixtures

**Answer 19 · Examiner comments** June 2024 | 8464/C/1F | Original Q3

**03.7** More than half of students correctly identified the anomalous result as 12.9 °C. Reasons why this result is anomalous were not well expressed, however: this result is *much* lower than the other two results (20.4 °C and 20.2 °C).

Alternative answers giving a reason why the result is anomalous such as 'used less than 3 g zinc', 'used more than 50 $cm^3$ of copper sulfate (solution)' or 'the mixture was not stirred' were much less common.



0 3 . 7 One of the results for **3.0 g** of zinc is anomalous.

Which result is anomalous?

Suggest **one** reason why this result is anomalous.

**[2 marks]**

Anomalous result experiment 2 (decreased)

Reason this is because it has a lower result compared to all the others that were tested.

This student scored the first marking point. The reason is insufficient as they needed to state that this result was *much* lower, rather than just lower.

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Answer 20 · Examiner comments

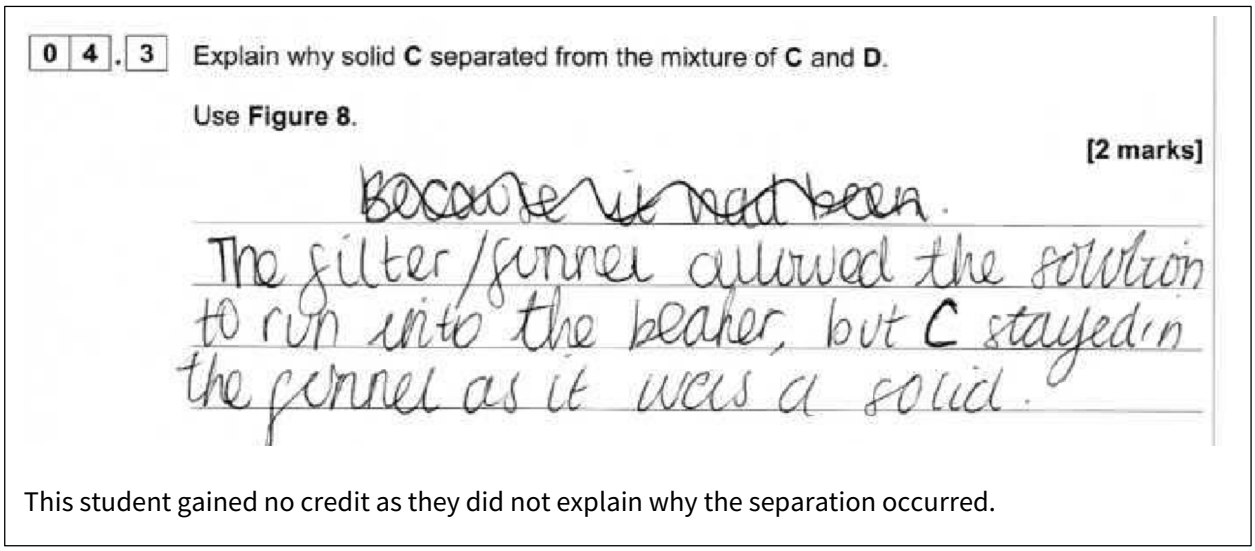
June 2024 | 8464/C/1F | Original Q4

# Question 4 (low demand)

**04.1** Many students were able to identify this method as chromatography, though 16% of students did not attempt this question. Students should ensure they are familiar with the rubric of the question paper; after each question the number of marks is shown in square brackets before the area where responses are recorded. Common incorrect responses tended to describe the process with terms such as colour separation, separating ink or the dye experiment.

**04.2** Around two-thirds of students were able to identify this method as filtration. 12% of students did not attempt this question. Those who only named the apparatus (eg a funnel) did not answer the question and gained no credit.

**04.3** Students found it difficult to explain why solid C separated from the mixture of C and D. 11% of students did not attempt this question. Many incorrectly focussed their answers on how filtration works and described that large particles get trapped by the paper. They needed to answer in terms of solubility of the substances.



0 4 . 3 Explain why solid **C** separated from the mixture of **C** and **D**.

Use **Figure 8**.

**[2 marks]**

Because it had been.
The filter/funnel allowed the solution to run into the beaker, but C stayed in the funnel as it was a solid.

This student gained no credit as they did not explain why the separation occurred.

**04.4** Fractional distillation is the method used to separate a mixture of liquids; distillation was accepted. Around a third of students were able to identify this method although many referred to processes occurring in the method such as evaporation or condensation. 15% of students did not attempt this question.

**04.5** More than two-thirds of students were able to deduce that liquid G collected first as it has the lowest boiling point. Approximately a quarter of students selected 100 °C as their answer, a value they recognise as the boiling point of water.

**04.6** Condensing and evaporating were well known and most students gained 2 marks.

**04.7** Just over half of students were able to deduce that the temperature of the water leaving the condenser is higher than the temperature of the water entering the condenser. 30% of students thought that the temperature of the water leaving the condenser is lower.

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Answer 21 · Examiner comments

June 2024 | 8464/C/1F | Original Q6

# Question 6 (standard demand)

**06.1** Few students gained 2 marks on the although more than half gained 1 mark. The graph showed that the mass of copper produced each year slowly increased from 1900 to 1930 and then rapidly increased until 2010. Students were asked to give two conclusions, so statements that merely quoted numerical values and years from the graph or made predictions of the future were insufficient.

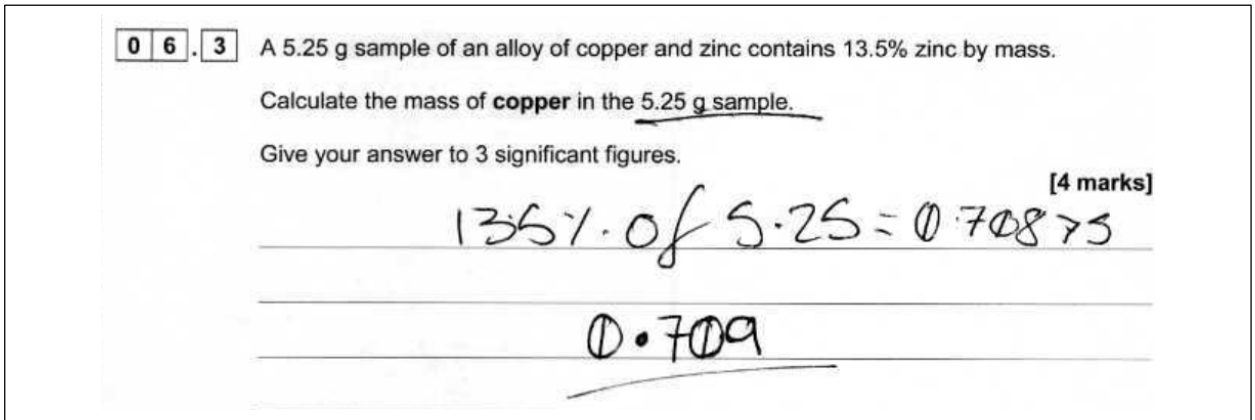
Non-creditworthy responses referred to use or demand of copper or involved incorrect readings, for example 'rapid increase from 1950' (rather than from 1925 to 1930) was common.

**06.2** Students should know that metals are soft so are mixed with other metals to make alloys, which are harder. A diagram representing the structures of pure copper and of an alloy of copper and zinc was given that showed larger zinc atoms disrupting the layers of atoms in the alloy, thus the layers of atoms cannot easily slide. Some students did not read the question carefully and talked about copper rather than the alloy.

15% of students gained 1 mark or more and few students achieved all 3 marks. Those who gained a mark usually referred to the difference in the sizes of the atoms. Many answers attributed hardness of the alloy to some form of bonding between copper and zinc.

**06.3** In this calculation students were told that the alloy contains 13.5% zinc by mass and were asked to calculate the mass of copper in the alloy. As always there are a number of approaches students took and those who showed their working often gained credit even after making errors. In the calculation working with an accompanying percentage sign, such as 13.5% or 86.5% are considered to be equivalent to 13.5 ÷ 100 and 86.5 ÷ 100 respectively eg 13.5% of 5.25 gains marking point 1 in the second method.

More than half of students scored at least 1 mark and nearly a fifth gained all 4. 16% of students did not attempt this question. Those who gained 1 mark achieved this by either determining the percentage of copper as 86.5% (mark scheme method one) or for a calculation that used the values in the question (5.25 and 13.5) if the expression was evaluated correctly and the answer was rounded to 3 significant figures eg 13.5 ÷ 5.25 = 2.57 (marking point 4 in either method one or method two).

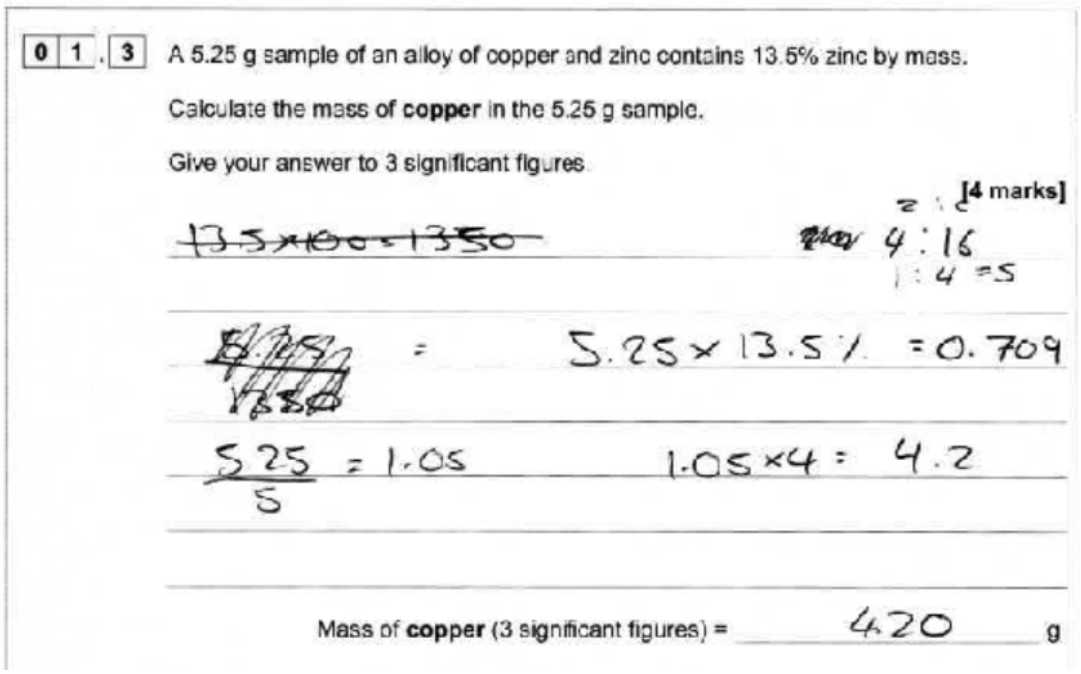



This response (from a Foundation tier paper) used mark scheme method 2. The student correctly determined the mass of zinc to 3 significant figures but did not subtract this from the mass of the sample. They achieved marking points 1, 2 and 4 so scored 3 of the 4 marks.

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### 5.1.1.2 Mixtures

**Answer 21 · Examiner comments** June 2024 | 8464/C/1F | Original Q6



0 1 . 3 A 5.25 g sample of an alloy of copper and zinc contains 13.5% zinc by mass.

Calculate the mass of **copper** in the 5.25 g sample.

Give your answer to 3 significant figures

**[4 marks]**

135×100=1350

4 : 16

1 : 4 = 5

5.25 = 5.25 × 13.5% = 0.709

525 / 5 = 1.05 1.05×4 = 4.2

Mass of **copper** (3 significant figures) = 420 g

This response (from a Higher tier paper) has several different methods in the answer box. Initially the student might gain marking points 1, 2 and 4 from method 2 (as the previous example did). However, the student then gives a totally different method which gives the answer on the answer line and this is the one that takes precedence so the method attached to this is the one that is marked. Although 4.20 is correctly rounded to 3 significant figures it does not come from a calculation using all values in the question (ie 13.5% has not been used) so gains no credit.

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Answer 22 · Examiner comments



# Question 3 (low & standard demand)

**03.1** Fewer than half of students gained the mark for formulation, formula being the most common distractor chosen.

**03.2** About 70% of students gained the first mark for stating that the line should be drawn with a pencil, but the second mark was less often attained due to weak use of language. Instead of stating the pencil would not dissolve, there were many comments about mixing, smudging, moving and running, and other vague explanations that were not acceptable. Some students suggested that the line should be drawn in pencil so it could be rubbed out if necessary.

Some said the line should be drawn in black pen, so it would be clear. Many students had not read the question properly and said the line should be drawn with a ruler, so it would be straight.

**03.3** This question was generally well answered, with about two-thirds of students gaining 2 or more marks. Most students were able to correctly measure the distance moved by the red colour; fewer were able to measure the distance moved by the solvent. There was a large variation in the distances given for this value, which suggests students did not know what the solvent front was rather than not having the skills to measure the distance correctly.

Over half of students were then able to correctly substitute their numbers into the $R_f$ expression and attain marking point 3. Some students substituted the numbers into the expression upside down.

About a third of students were correctly able to evaluate the $R_f$ expression and state the correct value for their calculation. The most common reason for not gaining the fourth mark was incorrect rounding.

**03.4** Most students correctly identified Prussian in this AO3 question and over half went on to give the correct explanation. Some students incorrectly explained that the answer was Prussian because it had the highest value. Other incorrect answers included Cobalt, because it was the lowest value or Ultramarine because it was the same number but the digits had been written the wrong way round.

5.1.1.2 Mixtures

Answer 23 · Examiner comments



# Question 6 (standard demand)

**06.1** Few students knew the definition of a hydrocarbon. A ‘mixture’ and an ‘atom’ were seen frequently.

**06.2** This AO2 determination of a formula of a hydrocarbon was not done very well, with fewer than a fifth of students gaining the mark. Many responses had ‘n’ in the formula, and it was expected that the tops of the numbers were clearly below the tops of the letters, following chemical convention in writing formulas.

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### 5.1.1.2 Mixtures

**Answer 23 · Examiner comments** June 2024 | 8464/C/2F | Original Q6

**06.3** This question has typically been targeted at high demand in previous years. However, this year it was set at standard demand, with the diagram containing more detail and the mark scheme for loosened a little to separate the first two marking points. Most students were able to make a start on the explanation of fractional distillation.

Four marks were available for this question. Most students who gained 1 mark did so for correctly identifying that the crude oil is heated. Some students indicated that the crude oil was heated once it was in the fractional distillation column itself, which was not creditworthy. Fewer students were able to explain that some of the hydrocarbons were vaporised/evaporated/boiled or turned into a gas for marking point 2. Very few students explained that there was a temperature gradient in the column even though this could have been explained as a comparative statement, for example, the column is cooler at the top or by using sensible temperature values. Few students were able to explain that the hydrocarbons/fractions condensed or were able to give a clear description of condensation.

The most common responses that gained no marks referred to the different sizes and boiling points of the hydrocarbons/fractions.

**06.4** Many students were able to correctly balance the equation. The most common incorrect response was to rewrite the formula $C_3H_6$ on the answer line.

**06.5** The test for alkenes was not well known by students. The most common incorrect responses referred to using universal indicator, limewater or a lit splint.

When students correctly identified bromine (water) as the correct test most also then gained the second marking point for the correct colour change. The most common incorrect response identified bromine (water) as being red.

**06.6** Given the prompts in the stem of this question it was expected that it would be well answered; however, this was not the case. The most common creditworthy answer was for identifying the poly(propene) as being a hydrocarbon with a few students identifying it as being a polymer or plastic. The most common incorrect response referred to it being an alkene.

Answer 24 · Examiner comments



# Question 4 (Low demand)

**04.1** Half the students were able to select the word from the box to complete the sentence that most metals are found in the Earth as compounds. Elements was the common incorrect distractor. Credit was awarded if the student identified the correct answer in the box.

**04.2** Half the students knew that iron is extracted from iron oxide by reduction with carbon because iron is less reactive than carbon. A third of students selected the incorrect converse response that iron is more reactive than carbon.

**04.3** Less than half of students knew that cryolite is added to aluminium oxide to reduce the amount of energy used in the extraction of aluminium from aluminium oxide by electrolysis. The most popular incorrect distractor was to reduce the rate of reaction.

**04.4** In the extraction of aluminium from aluminium oxide by electrolysis the positive electrodes need to be replaced. Fewer than 20% of students knew that this is because the electrodes react with oxygen gas. The other three options were all more popular. The electrodes react with aluminium was the most common incorrect response.

**04.5** Just under half of students recalled that an alloy is harder than a pure metal. The converse statement an alloy is less hard than a pure metal was the most popular incorrect distractor.

**04.6** When describing trends in graphs examiners are looking for students to state how the change in the *x*-axis (an increase in the independent variable) affects the value plotted on the *y*-axis (the dependent variable). In figure 9 as the percentage of silver in the mixture (*x*-axis) increased the melting point (*y*-axis) decreased. However, there was a marked change in the trend at 70% silver (where the curve was a minimum) after which the melting point increased. Students may have realised how the 3 marks were allocated. Examiners were not looking for a description of the rate of changes e.g. a sharp increase after 70% silver. Some students were careless with their terminology referring to the percentage of aluminium not silver and the boiling point of the alloy. A third of students gained all 3 marks. Many were awarded 1 mark usually for the initial decrease in melting point.

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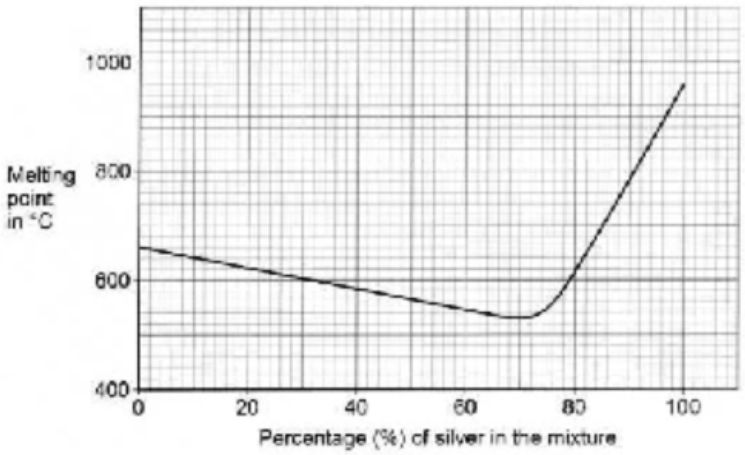
### 5.1.1.2 Mixtures

**Answer 24 · Examiner comments** June 2025 | 8464/C/1F | Original Q4

**0 4 . 6** Aluminium can form an alloy with silver.

**Figure 9** shows how the melting point of the alloy changes with the percentage (%) of silver in the mixture.

**Figure 9**




Describe how the melting point of the alloy changes as the percentage of silver in the mixture increases.

Use data from **Figure 9**.

**[3 marks]**

the melting point decreases as the percentage of silver increases, however once the mixture is over 70% the melting point significantly increases.

All 3 marking points were awarded. The student has described an initial decrease (in melting point), followed by an increase and has also indicated the point at which the change occurs.

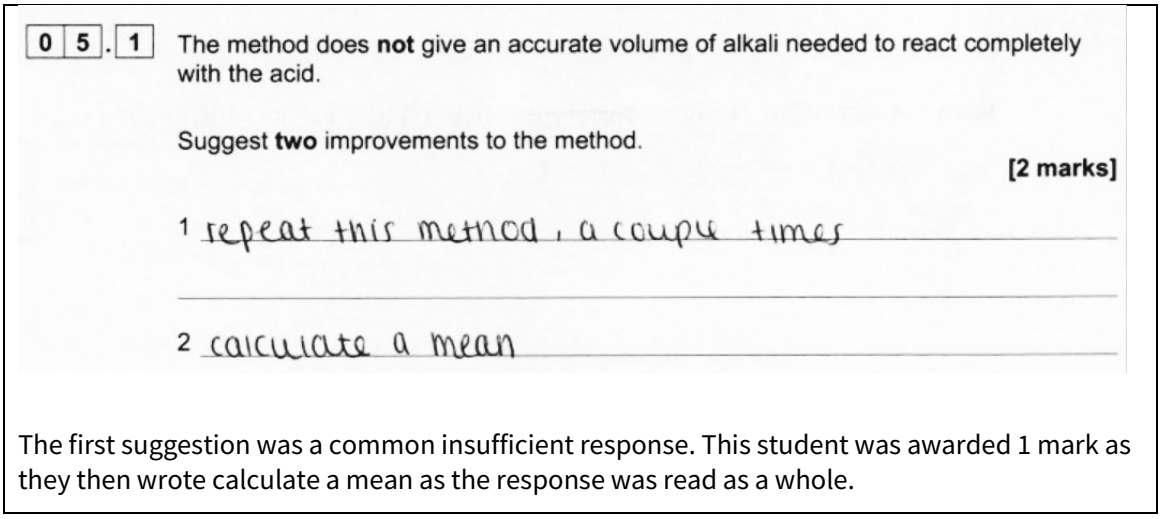
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Answer 25 · Examiner comments

June 2025 | 8464/C/1F | Original Q5

# Question 5 (Low and Standard demand)

**05.1** Improvements to methods are assessed as AO3 and are often not well attempted. Answers needed to improve the accuracy of measuring the volume of alkali, so creditworthy responses included measuring the volume of the alkali (e.g. with a measuring cylinder), ensuring that the reagents reacted by stirring the mixture or repeating and calculating a mean. This was not a high scoring question. There were many insufficient responses of 'repeat' without the necessary 'mean' included. Many responses used the inadequate terms 'amount' or 'how much' alkali, and others suggested altering the size or weight of the universal indicator paper rather than using a solution. Other uncreditworthy responses included attempting to control the 'time' or using 'more acid'. Others mentioned the need to use a measuring cylinder but referred to the acid and therefore gained no credit.



0 5 . 1 The method does **not** give an accurate volume of alkali needed to react completely with the acid.

Suggest **two** improvements to the method.

**[2 marks]**

1 repeat this method a couple times

2 calculate a mean

The first suggestion was a common insufficient response. This student was awarded 1 mark as they then wrote calculate a mean as the response was read as a whole.

**05.2** Nearly two thirds of students knew that universal indicator paper turns green when pH = 7. The most popular incorrect distractor was pH = 5.

**05.3** Nearly two thirds of students knew that neutralisation is the name of the reaction between an acid and an alkali. Combustion was the most common incorrect response.

**05.4** Half of students knew that acids contain $H^+$ ions. The most popular incorrect distractor was $Na^+$ ions.

**05.5** Nitric acid was the unknown acid that reacted with sodium hydroxide to produce sodium nitrate. This was not well known. Common responses that were not awarded the mark were nitrogen, nitrate (possibly because they had appeared earlier in the paper), hydrochloric acid, sulfuric acid and sodium.

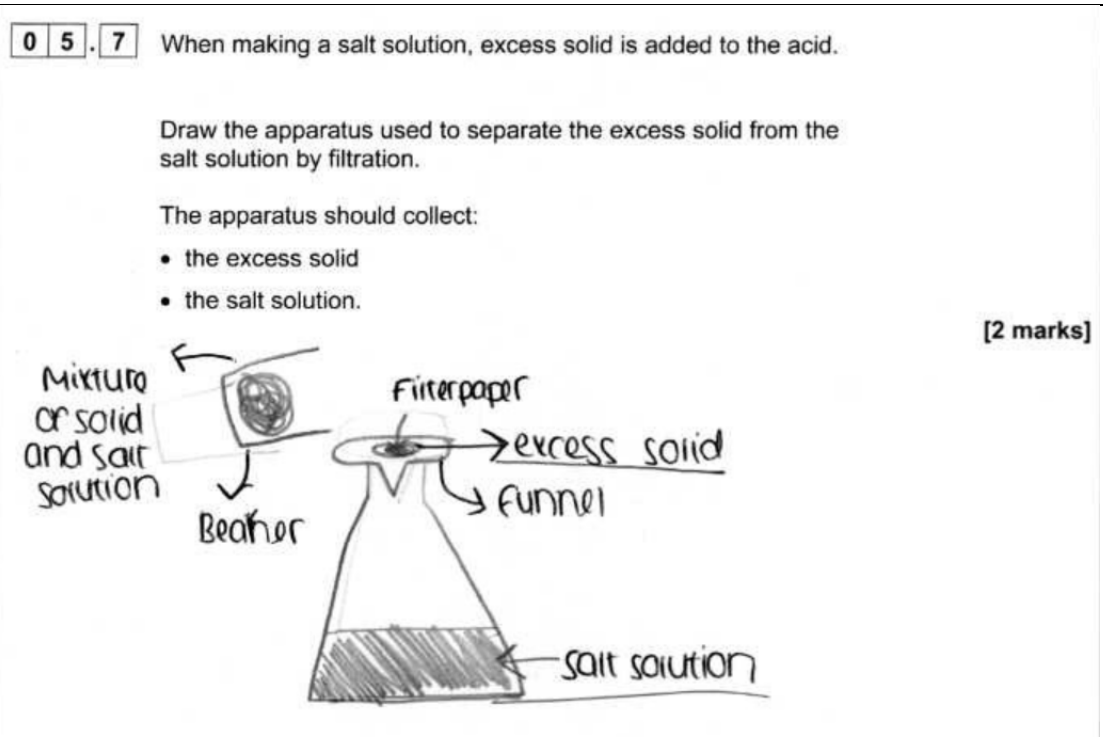
**05.6** A third of students were able to select the labels from the box to complete the reaction profile. Reactants and products were common incorrect distractors. Credit was awarded if the student identified the correct answer in the box.

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### 5.1.1.2 Mixtures

**Answer 25 · Examiner comments** June 2025 | 8464/C/1F | Original Q5

**05.7** Students had to draw apparatus used to separate excess solid from salt solution by filtration. Filter paper inside a filter funnel gained the first mark. Many diagrams had either the funnel or paper missing but those students who clarified their diagrammatic response with labels (for the paper and funnel) were awarded credit even if it was not clear that both pieces of equipment were drawn. The second mark was for any container to collect the filtrate although this could only be accessed if there was some evidence of filtration apparatus even if incorrect. Those students who included additional equipment which would affect the filtrate, for example, a Bunsen burner to heat the collection vessel with were not awarded the second mark. More than a quarter of students did not attempt this question.




Both marking points were awarded. It is not clear that there is filter paper inside a filter funnel but this student has clarified their diagram with two labels. A conical flask after filtration is creditworthy.

**05.8** Half the students knew that the zinc reacts with hydrochloric acid to produce zinc chloride and hydrogen gas. Phonetic spellings were credited. Chlorine was the main incorrect response, zinc oxide/hydroxide often appeared, and there were a few other metals e.g. iron, infrequently.

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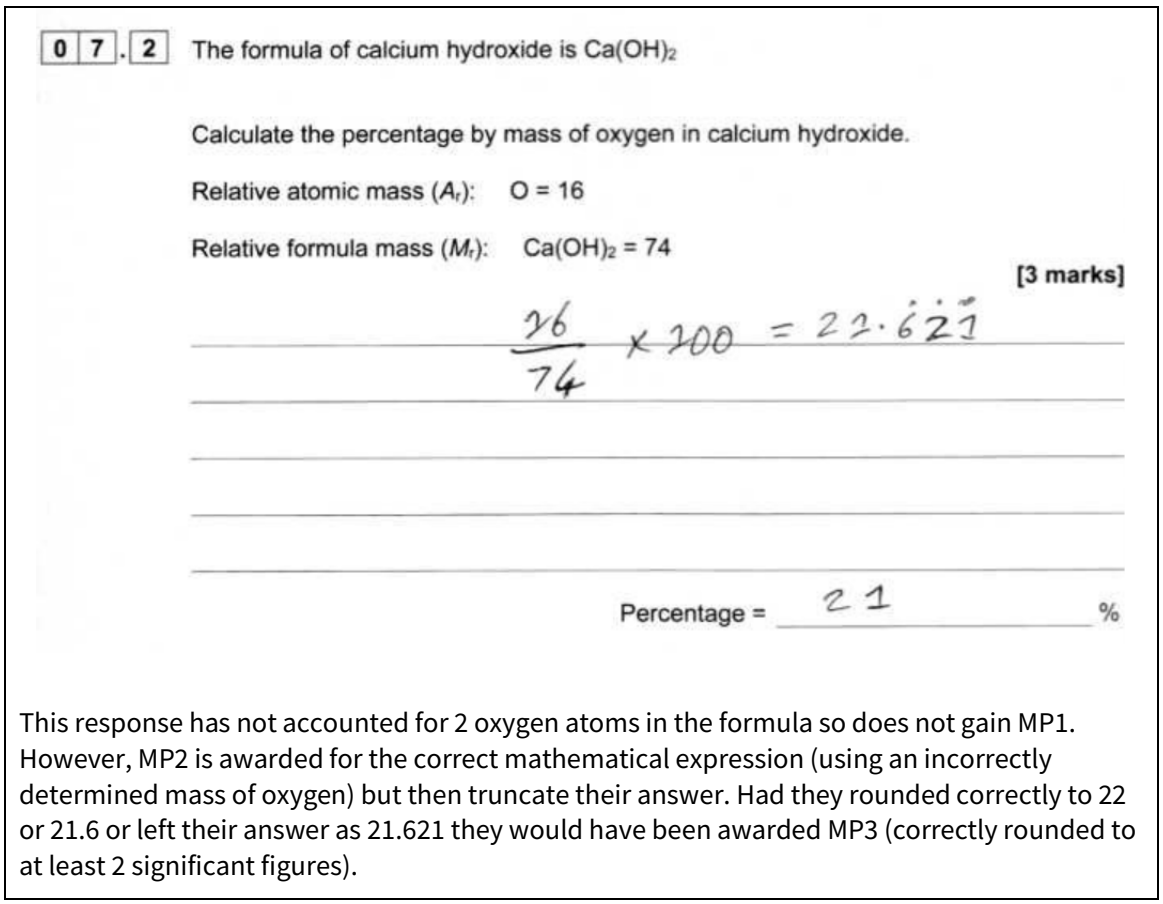
Answer 26 · Examiner comments

June 2025 | 8464/C/1F | Original Q7

# Question 7 (Standard demand)

**07.1** The definition for an 'exothermic' reaction was not well known. Students rarely stated that energy or heat was released or transferred to 'the surroundings'. Answers were mostly general explanations, describing how energy or heat were 'given off' or 'released'. Common non-creditworthy responses referred to energy or heat being *produced*, the idea of heat or energy being 'lost' or references to an increase in temperature. Some answers stated that 'oxygen' or 'a gas' was given off by the reaction.

**07.2** This question was poorly answered, and 20% of students did not attempt this question. The majority of students didn't understand the use of brackets in a formula as they ignored the subscript 2. Evidence of 32 in their answers was not commonly seen. Students were unclear about how to calculate a percentage. Lots of different variations on the use of 16 and 74 were often seen such as 74+16, 74-16 or 74÷16. Many students attempted to calculate the $M_r$ when it was already given.



0 7 . 2 The formula of calcium hydroxide is $Ca(OH)_2$

Calculate the percentage by mass of oxygen in calcium hydroxide.

Relative atomic mass ($A_r$): O = 16

Relative formula mass ($M_r$): $Ca(OH)_2$ = 74

[3 marks]

$\frac{16}{74} \times 100 = 22.621$

Percentage = 21 %

This response has not accounted for 2 oxygen atoms in the formula so does not gain MP1. However, MP2 is awarded for the correct mathematical expression (using an incorrectly determined mass of oxygen) but then truncate their answer. Had they rounded correctly to 22 or 21.6 or left their answer as 21.621 they would have been awarded MP3 (correctly rounded to at least 2 significant figures).

**07.3** This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the three levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Students were asked to plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction when calcium oxide is added to water. The indicative content includes 5 key steps and the control variable, along with some additional information.

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### 5.1.1.2 Mixtures

**Answer 26 · Examiner comments** June 2025 | 8464/C/1F | Original Q7

At Level 1, students needed to identify some relevant steps. To enter Level 2, three key steps, or two with the control variable, were required. To achieve marks in Level 3, all 5 key steps and the control variable were needed. Only a very small minority of students were able to obtain 6 marks.

**0 7 . 3** When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

**[6 marks]**

Step 1 - Measure out the calcium oxide, place into a conical flask

Step 2 - Measure out 100ml of water, and place into the same conical flask

Step 3 - record the before temperature, using a thermometer

Step 4 - Place stopper and let reaction occur.

Extra space Step 5 - Record after temperature, and measure + calculate the change in temperature.

In this response, the student has stated a valid volume of water but omitted 'mass' of calcium oxide. In step 3 they record the 'before' temperature, but this is after both reactants have been added to the conical flask so is not credited with taking the initial temperature. They have not stated when the subsequent temperature is measured nor described how the temperature change is determined. Had the student 'repeated the experiment with different masses of calcium oxide' they would have been credited with the control variable as this would imply fixing the volume stated. The students uses a thermometer which is a valid point in the mark scheme.

Only one key step is stated with some additional information (correct use of a thermometer) so this is a Level 1 response and is awarded 1 mark.

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### 5.1.1.2 Mixtures

**Answer 26 · Examiner comments** June 2025 | 8464/C/1F | Original Q7

Most students added calcium oxide to water but many omitted either volume (of water) or mass (of solid) although 'amount' was creditworthy for both here. Students usually described taking the 'initial' temperature (but often after they had added solid to water). Many were less clear on when and how the subsequent temperature or temperatures were to be taken. Too frequently it was stated that the 'temperature change' was to be measured which is not creditworthy, as this requires a calculation. The need for a control variable, whilst rarely stated as such, was often found in a Level 2 response due to the students realising that the volume of water needed to be fixed along with the experiment being repeated in some way. An indication of how the temperature change was to be determined was rarely seen.

**0 7 . 3** When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

**[6 marks]**

- Place water in a polystegrene cup with a thermometer and lid
- ~~Add in~~ measure out different masses of calcium oxide
- add smallest mass to cup, place lid on top and measure maximum temperature and temperature change
- repeat with increasing masses of calcium oxide
- repeat previous steps to make sure investigation is accurate
- ~~Measure~~ find the mean temperature of each reaction of increasing calcium oxide mass and water.

Extra space

In this response, the student has omitted volume of water but stated mass of calcium oxide. The initial temperature is not recorded but the maximum temperature is. They repeat for accuracy and then repeat with different masses of calcium oxide. They have not stated how the temperature change is determined nor that they need to use the same volume of water when repeating. The student uses a suitable container (an insulated cup) and a thermometer which are valid ideas from the mark scheme.

There are three key steps with some additional information (thermometer and insulated cup) so this is a Level 2 response and is awarded 3 marks.

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### 5.1.1.2 Mixtures

**Answer 26 · Examiner comments** June 2025 | 8464/C/1F | Original Q7

**0 2 . 3** When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

**[6 marks]**

1. Measure 25cm$^3$ of water using a measuring cylinder and pour into a polystyrene cup.
2. Place the cup into a beaker and measure initial temperature using a thermometer
3. Measure 4g of calcium oxide using a balance
4. Add the calcium oxide and put on a lid
5. Once the temperature has come to a stable point take final temperature reading using a thermometer
6. calculate temperature change by doing final temp - initial temp
7. Repeat steps 1-6 with different masses of calcium oxide e.g 6g, 8g. and compare results.

(for more accurate results use cotton wool in the beaker as an insulater and use a digital thermometer)

In this response (from a Higher tier paper), the student has stated a valid volume of water and mass of calcium oxide. The initial temperature (before the solid is added) and final temperature are recorded. They repeat with different masses of calcium oxide and are using the same volume of water so are credited with having a control variable. They have shown how the temperature change is determined. The student uses a measuring cylinder, suitable container (an insulated cup), balance and a thermometer which are additional valid points in the mark scheme.

There are all five key steps, a control variable, how the temperature change is determined with lots of additional information, so this is a Level 3 response and is awarded 6 marks.

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5.1.1.2 Mixtures



# Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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### 5.1.1.2 Mixtures

**Answer 27 · Examiner comments** June 2025 | 8464/C/2F | Original Q3

## Question 3 (Low and Standard demand)

**03.1** Well over half of all students recognised screenwash as a formulation.

**03.2** Nearly three quarters of students were able to work out the number of atoms in one molecule of glycerol correctly as 14.

**03.3** Most students could state that carbon monoxide is a toxic gas. The most common incorrect response was that carbon monoxide is a greenhouse gas.

**03.4** Many students were able to correctly balance the equation. A significant number however incorrectly added an H or CH in front of the $CO_2$
There was clear evidence of many pupils working out the numbers of individual atoms to correctly balance the equation.

**03.5** Many students remembered that hydrogen burns with a pop or squeaky pop however far fewer identified that a burning/lit splint was needed in order for that to happen, therefore neither mark could be awarded.

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**Answer 27 · Examiner comments** June 2025 | 8464/C/2F | Original Q3

The most common incorrect response referred to using a glowing splint, confusing the test for oxygen and hydrogen.
When students correctly identified a burning/lit splint as the correct test, most also then went on to state the correct result and gained both marks.

**03.6** Many students were able to correctly give one effect of global climate change, but fewer were able to correctly give two. The most common creditworthy responses were for identifying 'melting ice caps' and 'rising sea levels'.
Many responses referring to floods, storms and wildfires but could not gain credit as they were not comparative. The question was looking for the idea that there would be '*more* floods' for example, as floods happen without climate change.
Very few students answered in terms of a reduction in biodiversity or changes to migration patterns.

**03.7** Many students correctly recognised that the anhydrous cobalt chloride would change colour or described the correct colour change. Incorrect responses often referred to the water or solution changing colour, or included additional observations, such as 'fizzing' or 'bubbles'.

**03.8** Many students correctly identified the type of reaction as being endothermic.