AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.1.3

# Chromatography

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **28** |
| Available paper years | **2007–2025** |

## Using this booklet

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

**Name:** _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

### 4.8.1.3 Chromatography

**Answer 01 · Mark scheme** March 2007 | CHY1B | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **3** | **4** | **4** | **1** |

**Answer 02 · Mark scheme** June 2007 | CHY1B | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **2** | **3** | **4** | **4** |

**Answer 03 · Mark scheme** June 2007 | CHY1F | Original Q2 | Legacy

The full source mark scheme begins on page 44. Follow original question 2 in that document.

### 4.8.1.3 Chromatography

**Answer 04 · Mark scheme** January 2008 | CHY1F | Original Q2 | Legacy

**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | colours | | 1 |
| (a)(ii) | emulsifiers | | 1 |
| (a)(iii) | preservatives | allow antioxidants | 1 |
| (b) | drinks / colours B **and** C are safe<br><br>drinks / colours A **and** D are not safe | accept a pair of one safe colour **and** one not safe colour identified for **1** mark<br><br>accept A, B, C and D all contain one safe colour for **1** mark<br><br>ignore references to shading | 1<br><br>1 |
| total | | | 5 |

### 4.8.1.3 Chromatography

**Answer 04 · Mark scheme**

January 2008 | CHY1F | Original Q2 | Legacy

**CHY1F**

**Answer 05 · Mark scheme**

November 2008 | CHY1BP | Original Q6 | Legacy

| | | | | |
|---|---|---|---|---|
| Six | **4** | **3** | **1** | **2** |

**Answer 06 · Mark scheme**

June 2009 | CHY1BP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **3** | **1** | **1** | **2** |

4.8.1.3 Chromatography

Answer 07 · Mark scheme

June 2009 | CHY1F | Original Q3 | Legacy

## Question 3

| question | answers | extra information | mark |
|---|---|---|---|
| **3**(a)(i) | any **one** from:<br>• does not contain much saturated fat **or** low in saturated fat<br>• contains a lot of unsaturated fat **or** high in unsaturated fat | accept correct use of figures to compare the amount of fat to the total amount of fat | 1 |
| **3**(a)(ii) | bromine | | 1 |
| **3**(b)(i) | an emulsifier | | 1 |
| **3**(b)(ii) | texture | | 1 |
| **3**(c)(i) | any **two** from:<br>• **A** has four colours<br>• **B** has three colours<br>• **A / B** have two colours the same<br>• **B** has one different colour | if first two bullets not stated accept **A** has more colours (than **B**) **or B** has less colours (than **A**) for **1** mark only | 2 |
| **3**(c)(ii) | chromatography | | 1 |
| **Total** | | | **7** |

### 4.8.1.3 Chromatography

**Answer 07 · Mark scheme**

June 2009 | CHY1F | Original Q3 | Legacy

**CHY1F**

**Answer 08 · Mark scheme**

November 2009 | CHY1BP | Original Q7 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.8.1.3 Chromatography

Answer 09 · Mark scheme



## Question 2

| question | answers | extra information | mark |
|---|---|---|---|
| **2**(a)(i) | any **one** from:<br>• ice-cream (has additives)<br>• milk (has additives)<br>• strawberries (could contain additives)<br>• additives, such as a sweetener or colour may have been added | accept ingredients (may contain additives) | 1 |
| **2**(a)(ii) | any **one** from:<br>• cheaper<br>• keeps longer<br>• additives used for the strawberry flavour<br>• saves time | accept strawberries are expensive<br>accept strawberries do not keep<br>accept strawberries can cause an allergic reaction | 1 |
| **2**(b)(i) | 4 / four | | 1 |
| **2**(b)(ii) | dot / colour / E129 / allura red match | ignore chromatography (test) | 1 |
| **2**(b)(iii) | any **one** from:<br>• none of the colours / dots in the milkshake may be caused by E129 / allura red<br>• dot is not the same size<br>• only did one test | accept the matching dot may be caused by another / similar colour<br>accept this could be an anomalous result | 1 |
| **Total** | | | **5** |

### 4.8.1.3 Chromatography

**Answer 09 · Mark scheme**

January 2010 | CHY1F | Original Q2 | Legacy

**CHY1F**

4.8.1.3 Chromatography

Answer 10 · Mark scheme



**Question 4**

| question | answers | extra information | mark |
|---|---|---|---|
| **4**(a)(i) | 2 / two | | 1 |
| **4**(a)(ii) | E104<br><br>spots are at the same level / match | <br><br>independent mark | 1<br><br>1 |
| **4**(b)(i) | to improve / enhance the colour / change the colour | ignore sell more drinks<br><br>allow to improve appearance<br><br>do **not** accept preservative / emulsifier / improve taste / make it fizzy | 1 |
| **4**(b)(ii) | any **one** from:<br>• (artificial) flavourings<br>• carbon dioxide<br>• preservatives<br>• plastic (bottle / cap) | <br>accept sugar / saccharine / glucose / sweetener / caffeine<br><br><br><br>ignore other additives / tartrazine / quinoline yellow / sunset yellow | 1 |
| **4**(c)(i) | monomers<br><br>polymers | <br><br> | 1<br><br>1 |

**Question 4 Continues on the next page**

4.8.1.3 Chromatography



**CHY1F**

**Question 4 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **4**(c)(ii) | any **two** from:<br>• not enough space<br>• not biodegradable<br>• waste of resource / crude oil<br>• could be recycled<br>• can burn as a fuel to provide energy | ignore litter / global warming / animals / habitats<br>accept not enough landfills **or** landfills are full / filling up<br>allow crude oil is running out<br>ignore reuse | 2 |
| **Total** | | | **9** |

### 4.8.1.3 Chromatography

**Answer 10 · Mark scheme**

June 2010 | CHY1F | Original Q4 | Legacy

**CHY1F**

**Answer 11 · Mark scheme**

November 2010 | CHY1BP | Original Q5 | Legacy

| | | | |
|---|---|---|---|
| Five | **A** chromatography | **1** | |
| | **B** combustion | **4** | |
| | **C** hydrogenation | **3** | |
| | **D** unsaturation | **2** | |

| | A | B | C | D |
|---|---|---|---|---|

**Answer 12 · Mark scheme**

November 2010 | CHY1BP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **3** | **2** | **3** | **1** |

4.8.1.3 Chromatography

Answer 13 · Mark scheme



**Question 5**

| question | answers | extra information | mark |
|---|---|---|---|
| **5(a)(i)** | crushed / pressed<br><br>filtered | <br><br>allow sieve | 1<br><br>1 |
| **5(a)(ii)** | tap opened<br><br>**or**<br><br>allow water through<br><br>tap closed before oil runs through | <br><br><br><br><br>accept to leave oil (in the funnel)<br>accept collect oil in a different beaker | 1<br><br><br><br><br>1 |
| **5(b)(i)** | 3 / three | | 1 |
| **5(b)(ii)** | one colour is unsafe / two colours are safe | ignore no or do not know or yes<br>need to check the one colour that is different | 1 |
| **5(b)(iii)** | make (more) profit / money | accept sell (more) crisps **or** (more) people will want to buy their crisps | 1 |
| **Total** | | | **7** |

### 4.8.1.3 Chromatography

**Answer 13 · Mark scheme**

January 2011 | CHY1F | Original Q5 | Legacy

**CHY1F**

4.8.1.3 Chromatography

Answer 14 · Mark scheme

June 2011 | CHY1F | Original Q3 | Legacy

## Question 3

| question | answers | extra information | mark |
|---|---|---|---|
| 3(a) | to improve the appearance of the drink<br><br>because they are permitted colours | | 1<br><br>1 |
| 3(b)(i) | chromatography | | 1 |
| 3(b)(ii) | three / 3 | | 1 |
| 3(b)(iii) | because one colour / spot / E102 matched<br><br>because the other / two colours / spots / E104 and E110 did not match | if no other mark awarded allow because the drink did not contain E104 and E110 **or** because the drink contained E102 for **1** mark<br><br>accept only E102 matched for **2** marks | 1<br><br>1 |
| **Total** | | | **6** |

### 4.8.1.3 Chromatography

**Answer 14 · Mark scheme**

June 2011 | CHY1F | Original Q3 | Legacy

**CHY1F**

4.8.1.3 Chromatography

Answer 15 · Mark scheme

June 2012 | CH2FP | Original Q6 | Legacy

**Question 6**

| question | answers | extra information | mark |
|---|---|---|---|
| **6(a)(i)** | prevent evaporation of solvent | allow prevent loss of solvent<br><br>allow to support the (chromatography) paper | 1 |
| **6(a)(ii)** | ink dissolves in the solvent<br><br>**or**<br><br>carbon / graphite does not dissolve in the solvent | allow ink 'runs' / spreads **or** pencil does not 'run' / spread<br>allow ink would affect the result / mixes with colours<br><br>accept pencil for carbon / graphite | 1 |
| **6(b)(i)** | 4 | | 1 |
| **6(b)(ii)** | any **one** from:<br>• because not all colours match<br>• not all colours are safe<br>• some colours could be unsafe<br>• some colours travelled higher (than safe colours) | no mark for 'no / don't know'<br><br>ignore numbers | 1 |
| **6(c)(i)** | any **two** from:<br>• rapid / quick<br>• accurate<br>• sensitive **or** detects very small quantities | ignore reliable / precise<br><br>accept small sample | 2 |

**Question 6 continues on the next page…**

4.8.1.3 Chromatography



**CH2FP**

**Question 6 cont'd…**

| question | answers | extra information | mark |
|---|---|---|---|
| **6(c)(ii)** | separates | | 1 |
| **6(c)(iii)** | identifies solvents / compounds / substances | accept (relative) molecular mass<br>accept formula mass<br>accept $M_r$<br>accept relative mass<br>accept molecular ion peak | 1 |
| **Total** | | | **8** |

### 4.8.1.3 Chromatography

**Answer 15 · Mark scheme**

June 2012 | CH2FP | Original Q6 | Legacy

**CH2FP**

### 4.8.1.3 Chromatography

**Answer 16 · Mark scheme**



| question | answers | extra information | mark |
|---|---|---|---|
| **4(a)** | would melt | accept they have a low melting point<br>allow lose their shape<br>ignore would soften when hot<br>ignore boiling point | 1 |
| **4(b)** | to speed up the reaction | accept can use a lower temperature<br>accept less energy needed | 1 |
| **4(c)(i)** | mass spectrometer | allow mass spectroscopy | 1 |
| **4(c)(ii)** | any **one** from:<br>• accurate<br>• sensitive<br>• rapid / quicker<br>• small amount of sample | ignore reliable<br>ignore more precise | 1 |
| **4(d)** | any **two** from:<br>• pressure<br>• temperature<br>• catalyst **or** initiator<br>• solvent | allow concentration | 2 |
| **Total** | | | **6** |

### 4.8.1.3 Chromatography

**Answer 16 · Mark scheme**



January 2013

**CH2FP**

4.8.1.3 Chromatography

Answer 17 · Mark scheme

June 2013 | CH2FP | Original Q5 | Legacy

**Question 5**

| question | answers | extra information | Mark |
|---|---|---|---|
| **5(a)** | giant lattices | | 1 |
| **5(b)(i)** | heat / warm / increase the temperature | allow reduce pressure<br>do not accept melt | 1 |
| **5(b)(ii)** | (polymer) chains cannot slide<br>because they have cross-links | <br><br>if no other mark awarded allow polymers do not melt for **1** mark | 1<br>1 |
| **5(c)(i)** | separates (substances) | | 1 |
| **5(c)(ii)** | any **two** from:<br>• quick / rapid<br>• accurate<br>• can detect small quantities / sensitive | ignore reliable / precise / efficient<br>ignore references to cost | 2 |
| **Total** | | | **7** |

### 4.8.1.3 Chromatography

**Answer 18 · Mark scheme** June 2014 | CH2FP | Original Q6 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **6(a)(i)** | (phosphoric) acid | *allow phosphoric* | 1 | 2 / 2.6.2d | G |
| **6(a)(ii)** | $H^+$ / hydrogen (ion) | *if ion symbol given, charge must be correct* | 1 | 2 / 2.6.2d | E |
| **6(b)(i)** | pencil<br>so it will not run / smudge / *dissolve*<br>**or**<br>because ink would run / smudge / *dissolve* | <br>*ignore pencil will not interfere with / affect the results*<br><br>*ignore ink will interfere with / affect the results* | 1<br>1 | 2 / 2.3.2b | E |
| **6(b)(ii)** | any **three** from:<br>• *3* colours in Cola<br>• *2* colours in Fruit drink<br>• one of the colours is the same<br>• two of the colours in Cola are different<br>• one of the colours in Fruit drink is different<br>• *one of the colours in Cola is the most soluble* | *reference to spots / dots = max **2***<br>*allow colouring for colour*<br>*allow more colours in cola **or** fewer colours in fruit drink*<br>*allow some of the colours in the drinks are different*<br>*accept one of the colours in Cola has the highest $R_f$ value* | 3 | 3 / 2.3.2b | E |
| **6(c)** | different substances travel at different speeds **or** have different retention times | *accept different attraction to solid*<br>*ignore properties of compounds* | 1 | 1 / 2.3.2c | E |

### 4.8.1.3 Chromatography

**Answer 18 · Mark scheme**

June 2014 | CH2FP | Original Q6 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **6(d)(i)** | Is there caffeine in a certain brand of drink? | | 1 | 3 / 2.3.2 | A |
| **6(d)(ii)** | any **two** from:<br>• cannot be done by experiment<br>• based on opinion / *lifestyle choice*<br>• ethical, *social* or economic issue | *accept caffeine has different effects on different people* | 2 | 3 / 2.3.2 | E |
| **Total** | | | **11** | | |

### 4.8.1.3 Chromatography

**Answer 18 · Mark scheme** June 2014 | CH2FP | Original Q6 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **7** Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking. | | | | 1 + 2 / 2.1.1f/g 2.2.1a 2.2.2a | E |

| 0 marks | Level 1 (1–2 marks) | Level 2 (3–4 marks) | Level 3 (5–6 marks) |
|---|---|---|---|
| No relevant content | *There is a statement about the bonding and/or structure **or** melting / boiling point of chlorine **or** sodium chloride.* | *There are statements about the bonding and/or structure of chlorine **or** sodium chloride.* | *There are statements about the bonding and/or structure of chlorine **and** sodium chloride.*<br>*There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.* |

**Examples of chemistry points made in response:**

**Chlorine:**

covalent bonds between atoms

forming (simple) molecules

*no / weak attraction / bonds between molecules*

low boiling point

**Sodium chloride:**

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

*large amounts of energy needed to break bonds*

*high melting point*

| Total | | | 6 |
|---|---|---|---|

### 4.8.1.3 Chromatography

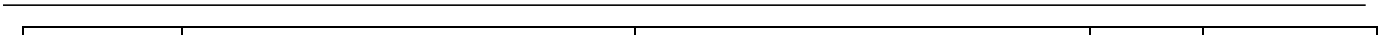
**Answer 19 · Mark scheme** June 2017 | CH2FP | Original Q1 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **1 (a)(i)** | the ink would run / smudge / smear | accept converse | 1 | **AO1** 2.3.2b |
| **1 (a)(ii)** | below | | 1 | **AO1** 2.3.2b |
| **1 (a)(iii)** | any **two** from:<br>• contains red<br>• does not contain blue<br>• contains two other colours<br>• contains three colours in total | do **not** accept contains red and blue | 2 | **AO3** 2.3.2b |
| **1(b)(i)** | separated | | 1 | **AO1** 2.3.2c |
| **1(b)(ii)** | 6/six | | 1 | **AO2** 2.3.2c |
| **1(b)(iii)** | any **one** from:<br>• accurate<br>• sensitive<br>• rapid / fast<br>• small sample. | do **not** accept more precise<br>do **not** accept more reliable | 1 | **AO1** 2.3.2a |
| **Total** | | | **7** | |

### 4.8.1.3 Chromatography

**Answer 19 · Mark scheme**

June 2017 | CH2FP | Original Q1 | Legacy



**Answer 20 · Mark scheme**

June 2018 | 8462/1F | Original Q1

The full source mark scheme begins on page 56. Follow original question 1 in that document.

### 4.8.1.3 Chromatography

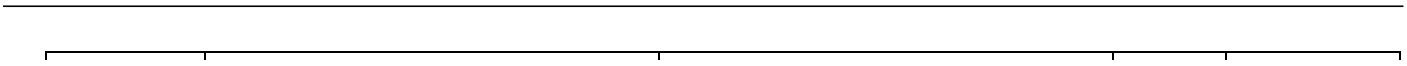
**Answer 21 · Mark scheme** June 2018 | 8462/2F | Original Q5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | crush the flower<br><br>use more flowers | | 1<br><br>1 | AO3<br>4.8.1.3 |
| **05.2** | the start line is drawn in ink<br><br>uses water as the solvent | | 1<br><br>1 | AO3<br>4.8.1.3 |
| **05.3** | flower A contains a single pure colour<br><br>the colour in flower C is a mixture | | 1<br><br>1 | AO3<br>4.8.1.3 |
| **05.4** | <br><br>$\frac{7.2}{9.0}$<br><br>= 0.8 | an answer of 0.8 scores **2** marks<br>ignore units | <br><br>1<br><br>1 | AO2<br>4.8.1.3 |
| **Total** | | | **8** | |

### 4.8.1.3 Chromatography

**Answer 21 · Mark scheme**

June 2018 | 8462/2F | Original Q5



4.8.1.3 Chromatography

Answer 22 · Mark scheme

June 2019 | 8462/1F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | B | | 1 | AO2<br>4.1.1.1<br>4.1.1.2 |
| **03.2** | D | | 1 | AO2<br>4.1.1.1<br>4.1.1.2 |
| **03.3** | E | | 1 | AO2<br>4.1.1.1<br>4.1.1.2 |
| **03.4** | chromatography – blue food colour from a mixture of food colours<br>chromatography – copper from an alloy of copper and zinc<br>crystallisation – copper sulfate from copper sulfate solution<br>crystallisation – ethanol from a mixture of ethanol and water<br>additional line from a box negates the mark for that box | | 1<br><br>1 | AO2<br>4.1.1.2 |
| **03.5** | (filter) funnel containing filter paper<br>suitable vessel for collecting filtrate<br>sand **and** water labelled in correct place | | 1<br>1<br>1 | AO1<br>AO1<br>AO2<br>4.1.1.2 |
| **03.6** | 100 °C | | 1 | AO2<br>4.1.1.2 |

4.8.1.3 Chromatography



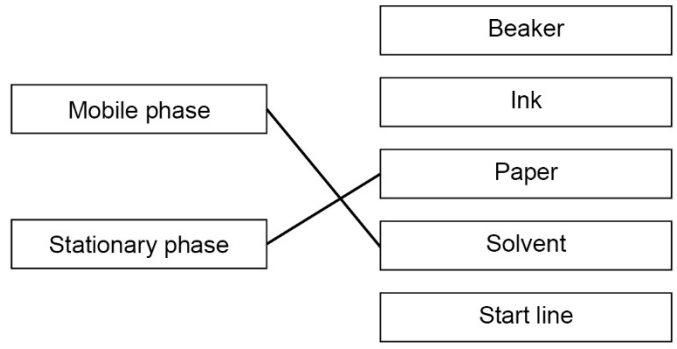
| | | | | |
|---|---|---|---|---|
| 03.7 | any **four** from:<br>• solution is heated<br>• water evaporates<br>• the vapour cools in the condenser<br>• the vapour condenses **or** the vapour turns to a liquid<br>• (pure) water collects in the beaker | allow water boils / vaporises | 4 | AO1 4.1.1.2 |
| **Total** | | | **13** | |

4.8.1.3 Chromatography

Answer 23 · Mark scheme

November 2020 | 8462/2F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.1** | 2.7 / 9.0<br><br>= 0.3 | <br><br>ignore units | 1<br><br>1 | AO2<br>4.8.1.3<br>RPA6 |
| **04.2** | **C** and **D** | | 1 | AO1<br>4.8.1.3<br>RPA6 |
| **04.3** | <br>additional line from a box on the left negates the mark for that box | | <br><br>1<br><br>1 | AO1<br>4.8.1.3<br>RPA6 |
| **04.4** | 17 : 3 | | 1 | AO2<br>4.8.1.2 |
| **04.5** | formulation | | 1 | AO2<br>4.8.1.2 |
| **04.6** | the $R_f$ value would stay the same | | 1 | AO3<br>4.8.1.2 |
| **Total** | | | **8** | |

4.8.1.3 Chromatography

Answer 24 · Mark scheme

November 2021 | 8462/2F | Original Q10

## Question 10

| Question | Answers | Mark | AO/ Spec. Ref |
|---|---|---|---|
| 10.1 | **Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5–6 | AO1 4.8.1.3 RPA6 |
| | **Level 2:** The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced. | 3–4 | |
| | **Level 1**: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1–2 | |
| | **No relevant content** | 0 | |
| | **Indicative content**<br>**Method**<br>• draw (pencil) start line on (chromatography) paper<br>• place spot of food colouring on start line<br>• use of suitable solvent<br>• place solvent in beaker / container<br>• place (chromatography) paper in beaker / container<br>• so (chromatography) paper is in solvent<br>• but solvent is below start line<br>• use a lid<br>• wait for solvent to travel up the (chromatography) paper (until near top)<br>• mark solvent front<br>• dry the (chromatography) paper<br>**Measurements**<br>• measure distance between start line and centre of spot<br>• measure distance between start line and solvent front<br>• use of measurements to determine $R_f$ value | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 10.2 | different solvent used | | 1 | AO3 4.8.1.3 RPA6 |

4.8.1.3 Chromatography



**Question 10 continued**

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **10.3** | paper | | 1 | AO1<br>4.8.1.3<br>RPA6 |

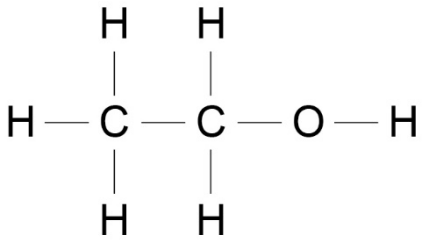
| | | | |
|---|---|---|---|
| **Total** | | | **8** |

4.8.1.3 Chromatography

Answer 25 · Mark scheme

June 2022 | 8462/2F | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 |  | | 1 | AO1 4.7.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | in hand gel to kill microbes | | 1 | AO1 4.7.2.3 |

4.8.1.3 Chromatography

Answer 25 · Mark scheme

June 2022 | 8462/2F | Original Q4

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 04.3 | **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced. | 3–4 | AO1 4.8.1.3 RPA6 |
| | **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>• **draw** pencil **start line**<br>• **place spot of ink on start line**<br>• name suitable solvent<br>• place solvent in beaker<br>• **place paper in solvent so solvent is below start line**<br>• use a lid<br>• **allow solvent / dyes to travel up paper** (until near top)<br>• dry<br>• count spots | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.4 | yeast | | 1 | AO1 4.7.2.3 |

4.8.1.3 Chromatography

Answer 25 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.5 | (mass =) $\frac{4.4 \times 5}{100}$ | | 1 | AO2 4.7.1.3 4.7.2.3 |
| | = 0.22 (kg) | | 1 | |
| | (conversion 0.22 kg =) 220 (g) | allow a correct conversion of an incorrectly calculated mass | 1 | |
| | **alternative approach:** (conversion 4.4 kg =) 4400 g (1) | | | |
| | (mass =) $\frac{4400 \times 5}{100}$ (1) | allow correct use of an incorrectly converted mass | | |
| | = 220 (g) (1) | | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.6 | | allow converse argument for E5 | | AO3 4.9.1.3 4.9.2.2 4.9.2.4 |
| | E10 contains more ethanol (produced from sugar than E5) | | 1 | |
| | (so) more sugar is used | allow (so) more plants are grown | 1 | |
| | (so more) carbon dioxide is absorbed by plants (when growing) | allow (so more) carbon dioxide is used in photosynthesis (by plants) | 1 | |

4.8.1.3 Chromatography

Answer 25 · Mark scheme

June 2022 | 8462/2F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.7** | (E10 has) less energy (in a fixed mass) | allow cannot travel as far (on a full tank of E10) | 1 | AO3<br>4.7.1.3<br>4.7.2.3 |

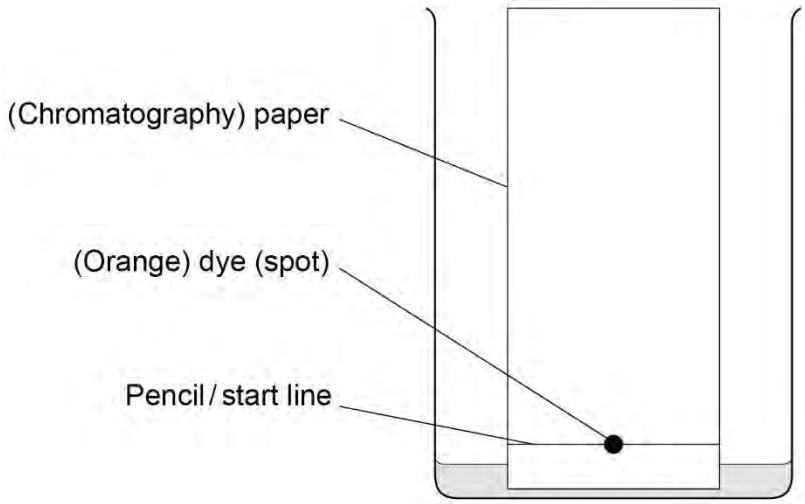
| | | |
|---|---|---|
| **Total Question 4** | | **14** |

4.8.1.3 Chromatography

Answer 26 · Mark scheme

June 2023 | 8462/2F | Original Q3

## Question 3

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 03.1 |  | 1<br>1<br>1 | AO1<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.2 | left the investigation for too long | | 1 | AO3<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.3 | (there is) more than one spot<br>**or**<br>(there are) three spots | | 1 | AO3<br>4.8.1.1<br>4.8.1.3<br>RPA6 |

4.8.1.3 Chromatography

Answer 26 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.4 | (distance moved by red spot) = 1.8 (cm)<br><br>(distance moved by solvent) = 7.2 (cm)<br><br>($R_f$ =) $\frac{1.8}{7.2}$<br><br>= 0.25 | allow a value in the range 1.6 to 2.0 (cm)<br><br>allow a value in the range 7.1 to 7.3 (cm)<br><br>allow correct use of incorrectly determined distance(s) | 1<br><br>1<br><br>1<br><br>1 | AO2<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.5 | dark yellow spot | | 1 | AO3<br>4.8.1.3<br>RPA6 |

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

4.8.1.3 Chromatography

Answer 27 · Mark scheme

June 2024 | 8462/2F | Original Q3

## Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | (drew start line in) ink<br><br>ink runs / smudges / dissolves<br><br>**OR**<br><br>a pencil should be used (to draw the start line) (1)<br><br>so that the ink does not run / smudge / dissolve (1) | | 1<br><br>1 | AO3<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.2** | 2 | | 1 | AO3<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.3** | (dye)<br>**A**<br><br>(reason)<br>(dye) **A** travelled the same distance as a spot from (substance) **Y**<br>**or**<br>(dye) **A** has the same $R_f$ value as a spot from (substance) **Y** | <br><br><br>allow (dyes) **B, C,** and **D** did not travel the same distance as either spot from (substance) **Y**<br><br>allow (dyes) **B, C,** and **D** do not have the same $R_f$ value as either spot from (substance) **Y**<br><br>MP2 is dependent upon the award of MP1 | <br>1<br><br><br>1 | AO2<br>4.8.1.3<br>RPA6 |

4.8.1.3 Chromatography

Answer 27 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.4** | (dye) **D** is insoluble (in water) | allow there is no attraction between (dye) **D** and water | 1 | AO3<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.5** | $(R_f =) \frac{2.4}{6.0}$<br><br>= 0.4 | <br><br>ignore units | 1<br><br>1 | AO2<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.6** | solvent | | 1 | AO2<br>4.8.1.3<br>RPA6 |

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

Answer 28 · Mark scheme

June 2025 | 8462/2F | Original Q5

## Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | labelled paper in solvent | allow paper touching solvent | 1 | AO1 4.8.1.3 RPA6 |
| | labelled start line above solvent level | do **not** accept start line touching solvent | 1 | |
| | labelled ink spot on start line | | 1 | |
| | | if no other mark awarded allow **1** mark for a complete unlabelled diagram | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.2** | (so the start line) does not smudge / run / dissolve<br>**or**<br>pencil is insoluble | allow (because an ink line) would smudge / run / dissolve | 1 | AO1 4.8.1.3 RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.3** | $0.80 = \frac{5.2}{\text{distance moved by solvent}}$ | | 1 | AO2 4.8.1.3 RPA6 |
| | distance moved by solvent $= \frac{5.2}{0.80}$ | | 1 | |
| | = 6.5 (cm) | | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.4** | from the start line to the centre of the spot | | 1 | AO1 4.8.1.3 RPA6 |

4.8.1.3 Chromatography

Answer 28 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.5 | use a different solvent<br><br>use a different type of chromatography paper | | 1<br><br>1 | AO1<br>4.8.1.3<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.6 | 1 | | 1 | AO2<br>4.8.1.1<br>4.8.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 05.7 | more accurate | | 1 | AO2<br>4.8.3.6 |

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

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Science B 4462 / Chemistry 4421

## CHY1F Unit Chemistry 1

# Mark Scheme

*2007 examination - June series*

### 4.8.1.3 Chromatography



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

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

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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*Dr Michael Cresswell*, Director General.

### 4.8.1.3 Chromatography





## MARK SCHEME

## Information to Examiners

### 1. General

The mark scheme for each question shows:

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

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

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

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

### 2. Emboldening

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

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

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

### 3. Marking points

#### 3.1 Marking of lists

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

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

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

### 4.8.1.3 Chromatography





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

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

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

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

**3.2 Use of chemical symbols / formulae**

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

**3.3 Marking procedure for calculations**

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

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

**3.4 Interpretation of 'it'**

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

**3.5 Errors carried forward**

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

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

**3.6 Phonetic spelling**

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

**3.7 Brackets**

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

**3.8 Unexpected Correct Answers not in the Mark Scheme**

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

### 4.8.1.3 Chromatography





**CHY1F Question 1**

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

**CHY1F Question 2**

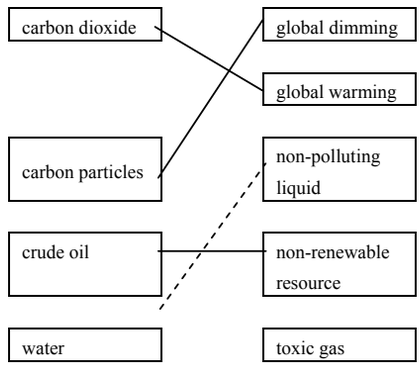
| | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | additive | | 1 |
| (b) | any **three** from:<br>• colour 1 is made up of only one colour / dye<br>• colour 2 is made up of only one colour / dye<br>• colour 3 is made up of two colours / dyes<br>**or**<br>more colours (than colours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

### 4.8.1.3 Chromatography





**CHY1F Question 3**

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

### 4.8.1.3 Chromatography





**CHY1F Question 4**

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

**Continued on next page**

### 4.8.1.3 Chromatography





**Question 4 continued**

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

### 4.8.1.3 Chromatography





**CHY1F Question 5**

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

### 4.8.1.3 Chromatography





**CHY1F Question 6**

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

### 4.8.1.3 Chromatography





**CHY1F Question 7**

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

**Continued on next page**

### 4.8.1.3 Chromatography





**Question 7 continued**

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

4.8.1.3 Chromatography



AQA

# GCSE
# CHEMISTRY

## 8462/1F - PAPER 1 FOUNDATION TIER

## Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

### 4.8.1.3 Chromatography



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

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

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

# Information to Examiners

## 1. General

The mark scheme for each question shows:

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

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

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

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

## 2. Emboldening and underlining

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

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

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

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

## 3. Marking points

### 3.1 Marking of lists

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

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

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

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

**[1 mark]**

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

Example 2: Name two planets in the solar system.

**[2 marks]**

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

### 3.2 Use of chemical symbols / formulae

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

### 3.3 Marking procedure for calculations

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

### 3.4 Interpretation of 'it'

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

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

### 3.5 Errors carried forward

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

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

### 3.6 Phonetic spelling

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

### 3.7 Brackets

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

### 3.8 Allow

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

### 3.9 Ignore

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

### 3.10 Do not accept

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

## 4. Level of response marking instructions

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

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

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

**Step 1: Determine a level**

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

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

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

**Step 2: Determine a mark**

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

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

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

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

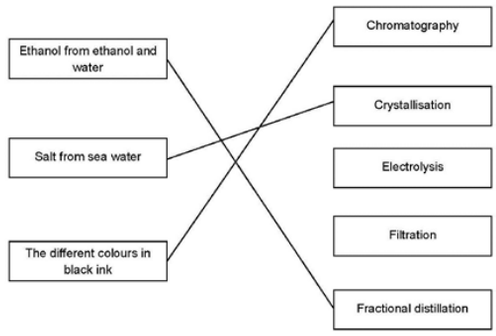
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



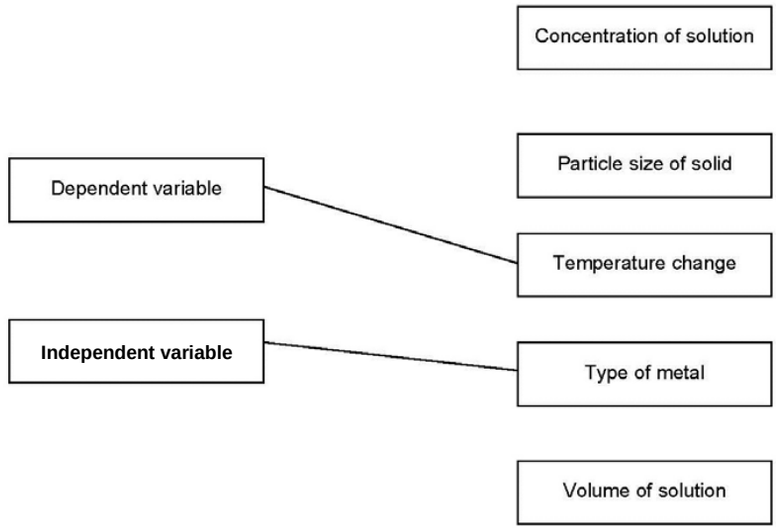
MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 01.3 | **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5–6 | AO1 4.4.2.3 |
| | **Level 2:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. | 3–4 | |
| | **Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1–2 | |
| | **No relevant content** | 0 | |
| | **Indicative content**<br><br>• use magnesium oxide and sulfuric acid<br>• add sulfuric acid to a beaker<br>• warm sulfuric acid<br>• add magnesium oxide<br>• stir<br>• continue adding until magnesium oxide is in excess<br><br>• filter<br>• using a filter paper and funnel<br>• to remove excess magnesium oxide<br><br>• heat solution in an evaporating basin<br>• to crystallisation point<br>• leave to crystallise<br>• pat dry with filter paper<br><br>credit may be given for diagrams | | |
| **Total** | | | **8** |

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

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

### 4.8.1.3 Chromatography



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

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td rowspan="5">AO3<br><br>AO3<br><br>AO2<br><br><br>4.4.3.4<br>4.5.2.1<br>4.5.2.2</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td></tr>
<tr><td>No relevant content</td><td>0</td></tr>
<tr><td colspan="2">Indicative content<br><br>reasons why fuel cells could be judged as better<br><br><table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• time for refuelling a fuel cell is faster than recharging<br>or<br>a fuel cell does not need to be recharged<br>• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy<br>• lithium-ion batteries can catch fire<br>• produces only water<br>or<br>no pollutants produced<br>• lithium-ion batteries may release toxic chemicals on disposal<br>• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr></table><br>reasons why the lithium-ion battery could be judged as better<br><br><table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• lithium-ion uses energy more efficiently<br>• cost of lithium-ion car much less<br>• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable<br>• charging points are more widely available than hydrogen filling stations<br>• hydrogen takes up a lot of space<br>or<br>is difficult to store<br>• hydrogen can be highly flammable / explosive<br>• no emissions produced<br>• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr></table></td><td></td></tr>
<tr><td>Total</td><td colspan="2"></td><td>11</td></tr>
</table>

4.8.1.3 Chromatography

Answer 20 · Examiner comments

June 2018 | 8462/1F | Original Q1

## Question 1 (low demand)

**01.1** 74% of students achieved two or more marks, with 34% of students achieving all three. The vast majority of students knew that black ink would be separated by chromatography, but filtration was a popular incorrect answer for obtaining salt from seawater.

**01.2** This question was not well answered. Many students did not know what to call a funnel, referring to it as a plastic cone. Other errors were to use more pieces of paper, or to suggest substituting a beaker for the conical flask. Answers which gave diagrams gained credit.

**01.3** 69% of students gained both marks, with about one in eight scoring neither.

**01.4** 51% of students scored both marks on this, the first calculation on the paper. Partial credit was given to those who calculated 2 ÷ 18 as a percentage rather than 2 ÷ 20, or who correctly calculated the percentage of metal A instead of metal B.

**01.5** 68% of students knew that a mixture of metals is an alloy. The most popular incorrect answer was ‘a compound’.

Answer 20 · Examiner comments

June 2018 | 8462/1F | Original Q1

**01.6** 48% of students realised that the correct answer is that the layers in the mixture are distorted. 25% of students thought that the correct answer is that ‘the mixture has a giant structure’. Whilst true, this statement does not give the correct explanation for the extra hardness of the mixture.

**01.7** 74% of students could calculate the volume of the cube correctly. The most popular distractor was 400 $nm^3$, with 400 $nm^2$ being the surface area of one face.

4.8.1.3 Chromatography

**Answer 21 · Examiner comments** June 2018 | 8462/2F | Original Q5

## Question 5 (low demand)

**05.1** 39% of the answers correctly identified both methods of making the solution more concentrated. A significant number ignored the instruction to tick two boxes, by ticking one.

**05.2** A large majority knew that the start line should not be in ink. But far fewer picked up the clue in the stem, that the colours were insoluble in water.

**05.3** This was well answered, with 70% of students achieving both marks.

**05.4** Full marks were achieved by 93% of students. The only common errors were caused by either inverting the values in the given formula or multiplying instead of dividing.

**Answer 22 · Examiner comments** June 2019 | 8462/1F | Original Q3

### Question 3 (low and standard demand)

**03.1** This question tested recognition of a diagram representing only one compound.

Almost half of the students identified the correct option.

The diagram representing only one element was a strong distractor.

**03.2** This question tested recognition of a diagram representing a mixture of elements.

Approximately 55% of students identified the correct option.

**03.3** This question tested recognition of a diagram representing a mixture of an element and a compound.

Approximately 60% of students identified the correct option.

**03.4** This question tested students' ability to apply their knowledge and understanding of chromatography and crystallisation.

Approximately two-thirds of students scored both marks.

**03.5** The diagram showing how a mixture of sand and water can be separated by filtration was often drawn and labelled clearly enough to score all 3 marks. The most common omissions were a filter funnel or filter paper.

**03.6** Approximately two-thirds of students correctly predicted the temperature of 100 °C.

4.8.1.3 Chromatography

**Answer 22 · Examiner comments** June 2019 | 8462/1F | Original Q3

**03.7** This question which required a description of distillation was generally answered well. Almost 60% of students scored at least 3 marks.

The marks for the solution being heated and for the water being collected in the beaker were the most often scored.

Marks for the vapour cooling in the condenser and for the vapour condensing were the least often scored. Here, the term vapour / gas / steam needed to be used rather than, for example, evaporated water.

**Answer 25 · Examiner comments** June 2022 | 8462/2F | Original Q4

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

**04.1** Around 40% of students were able to complete the displayed structural formula. Others added double bonds or even extra atoms.

**04.2** Over 70% of the students gained a mark for their knowledge of hand gels as a use of ethanol. A sizeable minority chose testing for hydrogen.

**04.3** This was an extended response question on chromatography and was quite well answered, with most students gaining at least two marks. However access to level 2 was often restricted by missing out one or more of the key steps, without which the investigation would not work. Around a quarter of the students gained all four marks, and around one-third gained two.

**04.4** Students found this question challenging, with fewer than 15% of students recognising that yeast must be added.

**04.5** This was a more challenging calculation which also needed a unit conversion. About 25% students gained full marks, with just under half gaining at least 1 mark.

**04.6** Many students answered in terms of petrol, which cannot possibly remove carbon dioxide from the atmosphere. Many answered in terms of E10 containing more ethanol, without going on to give a further explanation. The ideas of more sugar or plants being needed to carry out more photosynthesis to remove more carbon dioxide were needed. Only around 10% of the students gained all three marks.

**04.7** Around 30% of the students realised that E10 produced less energy than E5.

4.8.1.3 Chromatography

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

**03.1** Less than 50% of students achieved all 3 marks on this question. Frequent incorrect responses were for MP1 incorrectly identifying chromatography paper as being litmus paper, wrongly identifying the spot as black ink in MP2, negating the information in the

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question and for MP3 incorrectly identifying the start line as the solvent front. A number of students said that the spot was 'pen' rather than 'ink'.

**03.2** Less than one third of students were able to identify the correct reason for the mistake identified in the question. The most common incorrect response was to suggest that the student had used the incorrect solvent, which was more popular than the correct answer.

**03.3** More than half of students achieved this mark. Common incorrect responses suggested that the dye had changed colour, or that the orange spot was not seen as either the dye was insoluble or that the dye had gone off the top of the paper.

**03.4** About one third of students achieved all four marks for this question. A commonly seen incorrect response was to wrongly measure the distance travelled by the dye and/or to a lesser extent the solvent. Most students correctly substituted and evaluated the equation. A minority of students went on to incorrectly round their answer and so did not achieve MP4.

**03.5** More than two thirds of the students correctly identified the dye with the largest Rf value. Around one-fifth thought that the red spot had largest $R_f$ value.

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

03.1 Over 55% of students obtained two marks by correctly identifying the mistake and providing a correct reason. Almost 30% of students obtained one mark usually by correctly identifying the mistake as using ink but providing an insufficient reason for the mistake such as mix, ruin, or affect the result. In this question there was evidence of students not understanding the meaning of the terms solute and solvent and using them incorrectly.

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### 4.8.1.3 Chromatography

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03.2 Nearly 80% of students correctly identified the number of different dyes in substance **Y**. The most common incorrect response was five, where students had mistakenly counted the spots on the chromatogram.

03.3 Over 70% of students correctly identified dye **A** as being present in substance **Y** but only 17% of students provided a correct reason. The most frequently seen incorrect reason was to state that both travelled the same distance failing to take account of the second dye in **Y**. Other vague insufficient reasons that were frequently seen included that the dyes were in line or in the same place.

03.4 Less than 15% of students identified that dye **D** must be insoluble. The most frequently seen incorrect responses included that the dye did not react with the water, was permanent, waterproof, or suggested that the dye was not soluble enough. Other incorrect responses included the idea that substance **D** was pure or contained no other dyes and so could not separate.

03.5 Nearly 90% of students were able to correctly substitute into the equation provided and calculate the $R_f$ from the values given. The most common incorrect response was the values being substituted incorrectly.

03.6 Just over 50% of students correctly identified water as being a solvent. The most common incorrect distractor was solute.

4.8.1.3 Chromatography

**Answer 28 · Examiner comments** June 2025 | 8462/2F | Original Q5

## Question 5

05.1 A third of students gained all three marks, completing a clear diagram of the chromatography required practical. The details of what was required were included in the instructions, however many students did not seem to read the instructions, as labels were frequently missed. Another point worth noting was that nearly 20% of students made no attempt to answer this item. This suggests that some students are not reading all the given information. The information given in exam papers is designed to support students in answering the questions.

05.2 Over half of students knew why a pencil, rather than a pen, was used to draw the start line. Many others struggled to express themselves with the clarity that was expected.

05.3 Nearly 60% of students scored all three marks on this familiar calculation. The students who scored nothing were unable to rearrange the equation. Some students gained 1 mark for substituting values into the given equation, but then not rearranging correctly.

05.4 Only one third of students knew that measurements need to be made to the centre of the spot. Both the distractors were commonly seen.

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**Answer 28 · Examiner comments** June 2025 | 8462/2F | Original Q5

05.5 Three quarters of students scored at least 1 mark for this question. The most common distractor was leaving for a different length of time.

05.6 Two thirds of students correctly gave 1 as the number of spots produced during the chromatography of a pure substance.

05.7 Over 4 in 5 students gave the correct response of more accurate.