AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.3.6

# Instrumental methods

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **11** |
| Available paper years | **2008–2023** |

## 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.

### 4.8.3.6 Instrumental methods

**Answer 01 · Mark scheme** January 2008 | CHY3F | Original Q2 | Legacy

**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| (a)(i) | get wrong coloured flame/result owtte<br>**or**<br>to get the correct result | allow contaminated | 1 |
| (a)(ii) | high melting point<br>unreactive | | 1<br>1 |
| (a)(iii) | yellow-orange | | 1 |
| (b)(i) | bubbles / fizz / effervescence | ignore any named gas | 1 |
| (b)(ii) | milky | | 1 |
| (b)(c) | fast(er)<br>small(er) amount | | 1<br>1 |
| total | | | 8 |

### 4.8.3.6 Instrumental methods

**Answer 01 · Mark scheme**

January 2008 | CHY3F | Original Q2 | Legacy

**CHY3F**

4.8.3.6 Instrumental methods

Answer 02 · Mark scheme

June 2010 | CHY3F | Original Q4 | Legacy

## Question 4

| question | answers | extra information | mark |
|---|---|---|---|
| **4**(a)(i) | sodium hydroxide<br>green<br>solid | | 1<br>1<br>1 |
| **4**(a)(ii) | barium chloride<br>white<br>sulfate ions, $SO_4^{2-}$ | | 1<br>1<br>1 |
| **4**(b) | some indication of contact between (colourless) flame and the chemical | ignore colour of flame | 1 |
| **4**(c) | any **one** from:<br>• accurate<br>• precise<br>• sensitive<br>• reliable<br>• rapid<br>• only small amount needed | ignore reference to cost / safer | 1 |
| **Total** | | | **8** |

### 4.8.3.6 Instrumental methods

**Answer 02 · Mark scheme**

June 2010 | CHY3F | Original Q4 | Legacy

**CHY3F**

4.8.3.6 Instrumental methods

Answer 03 · Mark scheme

January 2011 | CHY3F | Original Q6 | Legacy

## Question 6

| question | answers | extra information | mark |
|---|---|---|---|
| 6(a) | filtered: removes insoluble / solid | Ignore named substances / minerals<br>do **not** accept ions | 1 |
| | chlorine: kills microorganisms / microbes / bacteria / disinfects (water) | allow kills germs / pathogens **or** sterilises<br>allow chlorine is a disinfectant<br>ignore cleans water or removes impurities / bacteria | 1 |
| 6(b)(i) | <u>advantages of portable</u>:<br>any **two** from :<br>• costs less<br>• little training needed<br>• water can be tested within 10 seconds / immediately / quicker<br>• can be used anywhere | accept converse throughout | 2 |
| | <u>disadvantage of portable</u><br>less precise / sensitive | allow only detect down to 0.1 mg<br>ignore less accurate | 1 |
| 6(b)(ii) | (PIWE) is unbiased<br>**or**<br>company may be biased | it / they = PIWE<br>allow honest / trusted / respected / reliable<br>ignore professional / scientific / skilled<br>allow company trying to sell products | 1 |
| **Total** | | | **6** |

### 4.8.3.6 Instrumental methods

**Answer 03 · Mark scheme**

January 2011 | CHY3F | Original Q6 | Legacy

**CHY3F**

4.8.3.6 Instrumental methods

Answer 04 · Mark scheme

June 2011 | CHY3F | Original Q6 | Legacy

**Question 6**

| question | answers | extra information | mark |
|---|---|---|---|
| 6(a)(i) | (copper) stops barnacles / seaweed (sticking) | it = copper<br><br>accept lead doesn't stop barnacles / seaweed (sticking)<br><br>ignore all other properties | 1 |
| 6(a)(ii) | (Muntz Metal) is less expensive / cheaper / cheapest | it = Muntz Metal<br><br>must be a comparison<br><br>accept copper is more expensive<br><br>ignore other properties | 1 |
| 6(b)(i) | atomic absorption spec(troscopy) / spectrometry **or** mass spec(trometry) / spectroscopy | accept spectroscopy / spectrometry alone<br><br>allow AAS / MS<br><br>do **not** allow NMR spectroscopy **or** IR spectrometry **or** chromatography | 1 |
| 6(b)(ii) | sensitive **or** detect (very) small amounts<br>**or** only small sample needed | it = instrumental method<br>allow (more) precise<br>ignore accurate<br><br>allow converse for chemical method<br>ignore metal contains small amount / low concentration of iron | 1 |
| 6(c) | any **two** from:<br>• unreactive / not very reactive<br>• strong / hard<br>• malleable / easy to shape | transition elements (= they)<br><br>allow does not corrode<br><br>ignore reference to rust<br><br>ignore tough / durable / hard wearing<br><br>ignore ductile / density / melting point | 2 |
| **Total** | | | **6** |

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

4.8.3.6 Instrumental methods

Answer 05 · 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…**

4.8.3.6 Instrumental methods



**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** |

### 4.8.3.6 Instrumental methods

**Answer 05 · Mark scheme**

June 2012 | CH2FP | Original Q6 | Legacy

**CH2FP**

### 4.8.3.6 Instrumental methods

**Answer 06 · 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** |

### 4.8.3.6 Instrumental methods

**Answer 06 · Mark scheme**



January 2013

**CH2FP**

4.8.3.6 Instrumental methods

Answer 07 · 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 |

### 4.8.3.6 Instrumental methods

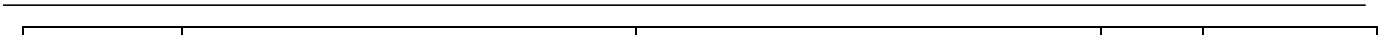
**Answer 08 · Mark scheme** June 2015 | CH2FP | Original Q1 | Legacy

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

### 4.8.3.6 Instrumental methods

**Answer 08 · Mark scheme**

June 2015 | CH2FP | Original Q1 | Legacy



### 4.8.3.6 Instrumental methods

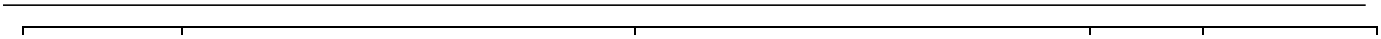
**Answer 09 · Mark scheme** June 2017 | CH2FP | Original Q1 | Legacy

| 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** | |

### 4.8.3.6 Instrumental methods

**Answer 09 · Mark scheme**

June 2017 | CH2FP | Original Q1 | Legacy



### 4.8.3.6 Instrumental methods

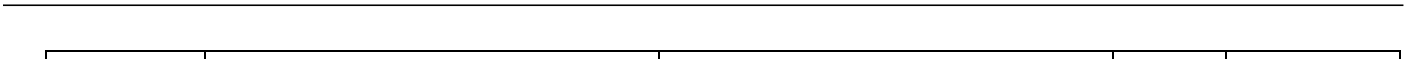
**Answer 10 · Mark scheme** June 2018 | 8462/2F | Original Q8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **08.1** | yellow | allow orange<br>allow orange-yellow | 1 | AO1<br>4.8.3.1 |
| **08.2** | copper (ion) | allow $Cu^{2+}$<br>allow copper (II)<br><br>allow barium (ion)<br>allow $Ba^{2+}$ | 1 | AO1<br>4.8.3.1 |
| **08.3** | (flame) colours are masked | allow (flame) colours mix / blend<br>allow only see one colour<br>allow cannot see two colours at once<br><br>ignore hard to distinguish | 1 | AO1<br>4.8.3.1 |
| **08.4** | $Li^+$<br><br>$Na^+$ | | 1<br><br>1 | AO2<br>4.8.3.7 |
| **08.5** | bromide (ion) | allow $Br^-$<br><br>ignore bromine | 1 | AO1<br>4.8.3.4 |
| **08.6** | add barium chloride (solution)<br><br>add hydrochloric acid<br><br><br>white precipitate produced | allow barium nitrate (solution)<br><br>allow nitric acid<br>allow acidified<br>do **not** accept sulfuric acid<br><br>dependent on use of a barium compound | 1<br><br>1<br><br><br>1 | AO1<br>4.8.3.5 |
| **Total** | | | **9** | |

### 4.8.3.6 Instrumental methods

**Answer 10 · Mark scheme**

June 2018 | 8462/2F | Original Q8



4.8.3.6 Instrumental methods

Answer 11 · Mark scheme

June 2023 | 8462/2F | Original Q10

## Question 10

| Question | Answers | Mark | AO/ Spec. Ref |
|---|---|---|---|
| 10.1 | **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced. | 5–6 | AO1 4.8.3.1 4.8.3.4 RPA7 |
| | **Level 2:** The method 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 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>(potassium ions)<br>• **place sample on (clean metal) wire**<br><br>• **introduce into (blue / non-luminous) flame**<br>• using (Bunsen) burner<br><br>• **observe lilac flame colour**<br>• which shows presence of potassium (ions)<br><br>(bromide ions)<br>• **dissolve sample**<br>• in (distilled) water<br>• in test tube<br>• add (dilute) nitric acid<br><br>• **add silver nitrate (solution)**<br>• using (dropping) pipette<br><br>• **observe cream precipitate (formed after addition of silver nitrate solution)**<br>• which shows presence of bromide (ions) | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 10.2 | flame emission spectroscopy | | 1 | AO1 4.8.3.7 |

### 4.8.3.6 Instrumental methods

**Answer 11 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **10.3** | any **one** from:<br>• (more) accurate<br>• (more) sensitive<br>• fast(er)<br>• determine the concentration of ions present | allow requires a small(er) sample | 1 | AO1<br>4.8.3.6 |

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

4.8.3.6 Instrumental methods

Answer 10 · Examiner comments

June 2018 | 8462/2F | Original Q8

## Question 8 (standard demand)

**08.1** 38% of students gave yellow or orange. There was a lot of variety in the wrong answers with all the colours of the spectrum represented.

**08.2** Copper was the most common answer given although a few gave barium

**08.3** A lot of students lost this mark as it was unclear if they were talking about the mixture of flame colours or the mixture of metal ions. 29% of students answered correctly.

**08.4** 57% of students correctly identified both of the ions in the flame emission spectrum.

**08.5** 3% of students identified the correct answer as bromide. A few put bromine but most seemed to guess.

**08.6** The test for sulfate ions was not well known: 10% achieved the mark while 42% of students left it blank.

4.8.3.6 Instrumental methods

Answer 11 · Examiner comments

June 2023 | 8462/2F | Original Q10

**Question 10 (Standard demand)**

**10.1** This extended response question used the command word ‘plan’.

**A simplistic approach to the level descriptors might be:**

Level 3 – will produce the expected outcomes.
Level 2 – might produce the expected outcomes with additions or modifications.
Level 1 – will not produce the expected outcomes.

4.8.3.6 Instrumental methods

Answer 11 · Examiner comments



**However,** the marking of extended response questions must always be holistic, so a best-fit approach must always be followed.

Key steps were shown in the indicative content in **bold**.

Most students found this question very difficult with only around 6% of students managing at least a mark in Level 2 and only 25% of students gaining at least 1 mark.

The flame test for the potassium ions was seen more often than the test for the bromide ion, with some students identifying the flame colour but not being able to describe how to carry out the test. Many responses failed to include putting the sample of medicine on the wire or making it clear that the Bunsen was lit. A number of students placed the wire under the Bunsen or did not make it clear that the Bunsen was lit. Some students thought that they needed to sterilise an inoculating loop before using in a flame test.

Many students mixed up the tests by carrying out flame tests on all the reagents.

The test for bromide ions was poorly understood with less than 1% of students recognising that silver nitrate should be added to the medicine and being able to state the correct test result.

Around one-fifth of students scored a Level 1 mark by using the medicine or correct test result in their response and including some relevant points in the correct context from the question.

**10.2** The instrumental method was known by very few students with only 1% of students being able to correctly identify flame emission spectroscopy. Most students who attempted the question mentioned laboratory or industrial processes such as fractional distillation or electrolysis. More than a third of the students did not attempt this question.

**10.3** Over 30% of students correctly identified an advantage for using an instrumental method over a chemical test. The most popular correct responses were rapidity and accuracy. One quarter of the students did not answer this question.

4.8.3.6 Instrumental methods



**Mark Ranges and Award of Grades**

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