AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.3.6

Instrumental methods

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**9**
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 | CHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)(i)		each correct test and one result = **1** mark	
		one other result for any test = **1 mark** this mark can only be awarded once	1
	Na_2CO_3: HCl → (odourless) gas (1) CO_2 / carbon dioxide (1)		1
	NaCl: $AgNO_3$ → white ppt (1) silver chloride (1)		1
	$NaNO_3$: Al + NaOH → pungent /sharp smell / choking gas (1) NH_3 / ammonia (1)		1
	Na_2SO_4: $BaCl_2$ → white ppt (1) barium sulfate (1)		1
(a)(ii)	all would give a yellow / yellow-orange (flame) / same coloured (flame) / same results **or** they all contain sodium owtte	allow orange (flame)	1
(b)	any **two** from: • fast / quick or comment about speed • small amounts • sensitive / accurate • ease of automation • sample not used up • reliable / efficient • can be left to run / continuous analysis	ignore cost ignore human error accept any valid answer accept operators do not need chemical skills ignore results can be saved	2
total			8

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Answer 02 · Mark scheme

January 2011 | CHY3H | Original Q2 | Legacy

Question 2

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

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Answer 02 · Mark scheme

January 2011 | CHY3H | Original Q2 | Legacy

CHY3H

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Answer 03 · Mark scheme

June 2011 | CHY3H | Original Q2 | Legacy

Question 2

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

4.8.3.6 Instrumental methods

Answer 03 · Mark scheme June 2011 | CHY3H | Original Q2 | Legacy

CHY3H

4.8.3.6 Instrumental methods

Answer 04 · Mark scheme

June 2012 | CH2HP | Original Q1 | Legacy

Question 1

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

Question 1 continues on the next page . . .

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CH2HP

Question 1 cont'd…..

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

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Answer 04 · Mark scheme

June 2012 | CH2HP | Original Q1 | Legacy

CH2HP

4.8.3.6 Instrumental methods

Answer 05 · Mark scheme

January 2013 | CH2HP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)	it is not used up	accept does not change accept reusable allow does not react	1
4(b)	they would melt **or** they have a low melting point	allow would lose their shape ignore soften	1
	because there are no cross links **or** there are weak intermolecular forces	accept there are weak bonds / forces between (polymer) chains	1
4(c)(i)		ignore reference to mass spectroscopy do **not** accept other incorrect process described	
	substances carried by gas	allow named gas	1
	(through) column / coil / tube **or** (through) solid (material) / powder		1
	at different speeds	accept different retention times	1
4(c)(ii)	(relative) molecular mass / M_r	allow (relative) formula mass **or** relative mass ignore relative atomic mass ignore identity of substance / molecule	1
Total			**7**

4.8.3.6 Instrumental methods

Answer 05 · Mark scheme

January 2013

CH2HP

4.8.3.6 Instrumental methods

Answer 06 · Mark scheme

June 2015 | CH2HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)		first 3 marks can be obtained from a suitably labelled diagram incorrect structure or bonding or particle = max 3		AO1 2.1.h,i 2.2.4a
	giant structure / lattice / layers / close packed		1	
	made up of atoms / positive ions		1	
	with delocalized / free electrons		1	
	so electrons can move / flow through the metal	accept so electrons can carry charge through the metal accept so electrons can form a current	1	
3(b)		accept converse for pure metal throughout both marks can be obtained from suitable diagrams		AO1 2,2,4c
	an alloy (is a metal which) has different types / sizes of atoms	allow made of different metals allow mixture of metals / atoms / elements ignore particles ignore properties do **not** accept compound	1	
	alloy has distorted layers	allow layers are unable to slide	1	
3(c)(i)	can return to its original shape	accept shape memory alloy accept smart alloy ignore other properties	1	AO1 2.2.4d

Question 3 continues on the next page

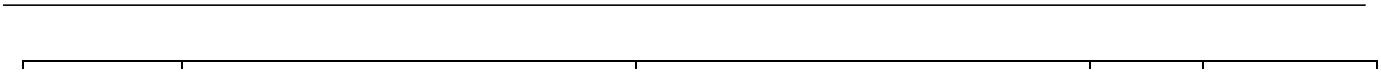
Question 3 continued

3(c)(ii)	(pure copper is too) soft	accept converse accept malleable or bends accept copper is running out ignore references to strength and weakness	1	**AO2** 2.2.4c 2.7.1d
3(c)(iii)	aluminium oxide	accept alumina accept Al_2O_3 ignore bauxite / aluminium ore	1	**AO1** 2.7.1h
3(c)(iv)	any **one** from: • different conditions • different catalyst • different pressure • different temperature	allow different concentration do **not** accept different monomers	1	**AO1** 2.2.5a
3(d)	any **two** from: • accurate • sensitive • rapid • small sample	both needed for 1 mark	1	**AO1** 2.3.2a
Total			**11**	

4.8.3.6 Instrumental methods

Answer 06 · Mark scheme

June 2015 | CH2HP | Original Q3 | Legacy



Answer 07 · Mark scheme

June 2017 | CH2HP | Original Q5 | Legacy

The full source mark scheme begins on page 19. Follow original question 5 in that document.

4.8.3.6 Instrumental methods

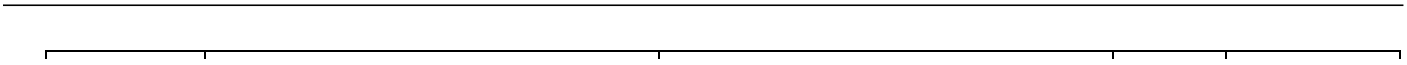
Answer 08 · Mark scheme June 2018 | 8462/2H | Original Q1

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

4.8.3.6 Instrumental methods

Answer 08 · Mark scheme

June 2018 | 8462/2H | Original Q1



4.8.3.6 Instrumental methods

Answer 09 · Mark scheme

June 2023 | 8462/2H | Original Q3

Question 3

Question	Answers	Mark	AO / Spec. Ref
03.1	**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 (potassium ions) • **place sample on (clean metal) wire** • **introduce into (blue / non-luminous) flame** • using (Bunsen) burner • **observe lilac flame colour** • which shows presence of potassium (ions) (bromide ions) • **dissolve sample** • in (distilled) water • in test tube • add (dilute) nitric acid • **add silver nitrate (solution)** • using (dropping) pipette • **observe cream precipitate (formed after addition of silver nitrate solution)** • which shows presence of bromide (ions)		

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

4.8.3.6 Instrumental methods

Answer 09 · Mark scheme

June 2023 | 8462/2H | Original Q3

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

Total Question 3	8

4.8.3.6 Instrumental methods



GCSE

Additional Science / Chemistry

CH2HP
Final Mark scheme

4408 / 4402
June 2017

Version/Stage: v1.0

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

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

Further copies of this mark scheme are available from aqa.org.uk

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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 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	Pluto, Mars, Moon	1
2	Pluto, 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

Full marks can be given for a correct numerical answer, 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 or by each stage of a longer calculation.

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 '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 Accept/allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain a marking point. Any further correct amplification could gain the marking point.
Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4 Quality of Written Communication and levels marking

In Question 2 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information.
- Simple understanding.
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail.
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information.
- Clear understanding.
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given.
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised.
- Detailed understanding, supported by relevant evidence and examples.
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	a smooth curve through or close to all points except (30,12)		1	AO2 2.4
1(a)(ii)	correct reading from the curve in 1(a)(i) (cm^3)	allow a tolerance of +/- 0.5 cm^3	1	AO2 2.4
1(a)(iii)	45-50 (seconds)		1	AO3 2.4
1(a)(iv)	line becomes less steep because gas is produced more slowly	ignore line levels out or plateaus allow examples with figures, eg 12 cm^3 gas from 0 to 20s but 1.5 cm^3 gas in last 20s ignore reaction has stopped or no more gas produced	1 1	AO3 2.4
1(a)(v)	0.6 (cm^3 per second)	allow 0.55 to 0.65	1	AO2 2.4
1(b)(i)	 temperature volume (of hydrogen peroxide)	concentration of hydrogen peroxide = max **1** ignore amount (of hydrogen peroxide)	 1 1	AO3 2.4
1(b)(ii)	 rate increases because more particles (in the same volume) so frequency of collisions increases	incorrect reference to energy = max **2** accept particles closer together allow greater chance of collisions ignore more collisions	 1 1 1	AO1 2.4.1e

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1(c)	(increasing the amount of catalyst) increases rate same final volume of gas	accept steeper graph or graph levels off earlier	1 1	**AO2** 2.4.1g
Total			**13**	

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>2</td><td></td><td></td><td>6</td><td rowspan="6">AO1
2.1.1h
2.2.4b,c
2.2.5a,b</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4"><table>
<tr><th>0 marks</th><th>Level 1
(1–2 marks)</th><th>Level 2
(3–4 marks)</th><th>Level 3
(5–6 marks)</th></tr>
<tr><td>no relevant information given</td><td>a statement about the structure or a property of a metal
or
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer
and
at least one statement linking structure and property</td></tr>
</table></td></tr>
<tr><td colspan="4">Statements shown as HT only are credited on both FT and HT.
However, HT only means that these statements are not expected in a FT answer.</td></tr>
<tr><td colspan="4">Examples of chemistry points made in response

Metal:

Properties
shiny
hardness
(tensile) strength
melting point/boiling point
density
malleable/flexible
ductile
conduct electricity or thermal energy</td></tr>
</table>

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Structure • metals contain atoms /((positive) ions HT only) • (the atoms/(positive) ions/particles are) closely packed / in a regular pattern / in a giant structure/in layers / in a lattice • strong bonds/(electrostatic attractions HT only) • (metal has delocalised electrons HT only) **Polymer:** **Properties** • flexible • melting/boiling point • density • can be shaped/moulded • poor conductor of electricity or thermal energy **Structure** • polymer consists of chains • polymer chains may be tangled • polymer has no cross links. • (polymer has weak intermolecular forces HT only) **Level 3:** **Examples of linked statements:** • metal can be bent and shaped because the layers can slide • some metals are soft because layers can slide • some metals are hard because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure/ in a lattice • metal has high melting/boiling point because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure / in a lattice • metal is strong because of strong bonds • some metals are dense because the atoms are closely packed • (metal can conduct thermal energy and electricity because metal has delocalised electrons HT only) • thermosoftening polymer melts when heated because it has no cross-links (or has weak intermolecular forces HT only) • thermosoftening polymer is flexible because the chains can move over each other	

Total			**6**

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Question	Answers	Extra Information	Mark	AO / Spec. Ref
3(a)(i)	2 bonding pairs 4 unbonded electrons on each atom	accept dots, crosses, e, - or any combination ignore any electrons on any inner shells if no other mark awarded allow **1** mark for 1 bonding pair and 6 unbonded electrons on each atom	1 1	**AO2** 2.1.1g
3(a)(ii)	covalent	allow convalent and covelant ignore single or double ignore shared, shared bond or sharing	1	**AO1** 2.1.1g
3(a)(iii)	weak intermolecular forces require little energy to overcome	reference to weak covalent or weak ionic bonds = **0** accept weak intermolecular bonds MP2 dependent on MP1 if no other mark awarded allow 1 mark for simple/small molecules	1 1	**AO1** **AO2** 2.2.1a,b

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3(b)(i)	**2** Mg + O_2 → **2** MgO	accept multiples	1	**AO2** 2.2.2
3(b)(ii)		reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **2**		**AO1** **AO2** 2.1.1a,b,c,f
	magnesium loses (electrons) **and** oxygen gains (electrons)		1	
	two (electrons transferred)		1	
	noble gas structure **or** 8 electrons in outer shells **or** (electrostatic) attraction between ions **or** forms ionic bonds	accept full outer shell (of electrons)	1	
3(b)(iii)	particles 1-100 nm in size	accept contain a few hundred atoms/ions accept have a high surface area to volume ratio ignore reference to (very) small particles do **not** accept smaller than an atom/ion	1	**AO1** 2.2.6a

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3(c)	has a high melting point	allow will not melt allow a lot of energy needed to melt ignore boiling point reference to incorrect particles or incorrect bonding or incorrect structure = max **1** from MP2 and MP3	1	**AO1** **AO2** 2.2.3a
	because all atoms linked to other atoms	allow giant structure/lattice ignore many bonds	1	
	by covalent bonds	allow strong bonds allow a lot of energy needed to break bonds accept giant covalent structure for MP2 and MP3	1	
Total			**13**	

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Question	Answers	Extra Information	Mark	AO / Spec. Ref
4(a)	add copper oxide and (sulfuric) acid		1	**AO1** **AO2** 2.6.1b,c
	excess (copper oxide)		1	
	filter (to remove excess)	ignore impurities	1	
	heat /boil / evaporate / leave (to crystallise)	do **not** accept to dryness	1	
4(b)	(M_r CuO =) 79.5		1	**AO2** 2.3.3c
	24.95/249.5 **or** 0.1 **OR** 79.5/249.5 **or** 0.3186…	allow ecf for M_r CuO from step 1 allow correct rounding to min 2SF	1	
	(24.95/249.5 x 79.5=) 7.95	allow ecf for M_r CuO from step 1 allow ecf from step 2 of incorrect calculation/ rounding of correct ratio allow correct rounding to min 2SF correct answer with or without working gains 3 marks	1	
4(c)(i)	as wealth decreases, ethene production decreases (with the exception of country C or D)	accept converse	1	**AO2** **AO3** 2.6
	sulfuric acid production is not linked to wealth		1	

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4(c)(ii)	use of products of ethene has increased	allow use of polymers / plastics / ethanol / poly(ethene) has increased ignore use of ethene as a (bio)fuel ignore cost	1	**AO3** 2.2.5
Total			**10**	

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Question	Answers	Extra Information	Mark	AO / Spec. Ref
5(a)(i)	draw line on paper put (dots of) inks on line place (bottom of) paper in solvent / water any **one** from: line drawn in pencil allow dots of ink to dry line above solvent lid		1 1 1 1	**AO1** 2.3.2b
5(a)(ii)	any **two** from: • A has 3 colours **and** B has 4 colours • 2 colours are the same • **A** has 1 colour not in **B and B** has 2 colours not in **A**	accept 3 colours are different if no other mark awarded allow **one** more colour in ink **B** than in ink **A** (or converse)	2	**AO3** 2.3.2b
5(b)(i)	substances carried by gas through column / tube / coil (packed with solid) (different substances move through the column) at different speeds	 accept (different) substances come out at different times or have different retention times	1 1 1	**AO1** 2.3.2c
5(b)(ii)	(relative) molecular mass	allow (relative) formula mass allow RFM, RMM, M_r	1	**AO1** 2.3.2c
Total			**10**	

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Question	Answers	Extra Information	Mark	AO / Spec. Ref
6(a)(i)	tick (✓) by: the initial temperature reading was too low		1	**AO3** 2.5
6(a)(ii)	the reaction is exothermic	allow energy is given out	1	**AO3** 2.5.1b
6(b)(i)	(positive/hydrogen) ions gain electrons hydrogen is below sodium in the reactivity series so hydrogen / H_2 is produced	accept (positive/hydrogen) ions are reduced accept reference to high reactivity of sodium If no other mark awarded allow hydrogen (and sodium) ions **or** positive ions are attracted to negative electrode for **1** mark	1 1 1	**AO1** **AO2** 2.7.1c,f,i
6(b)(ii)	**2** (Cl^-) → **Cl_2 + 2e^-**	must be completely correct allow multiples	1	**AO1** 2.7.1g
6(b)(iii)	solution is alkaline because sodium hydroxide / NaOH is produced **or** sodium hydroxide / NaOH is left over	accept hydroxide (ions) / OH^- is produced **or** hydroxide (ions) / OH^- is left over	1 1	**AO1** **AO2** 2.7.1i; 2.6.2d
Total			**8**	

4.8.3.6 Instrumental methods

Answer 08 · Examiner comments

June 2018 | 8462/2H | Original Q1

Question 1 (standard demand)

01.1 80% of students gave yellow or orange. There was a lot of variety in the wrong answers with all the colours of the spectrum represented.

01.2 This was well answered. Copper was the most common answer given although a few gave barium and gained credit.

01.3 60% of students achieved this mark. Popular incorrect responses implied that the flame colours were similar or the same.

01.4 87% of students could correctly identify both of the ions in the flame emission spectrum.

01.5 33% of students identified the correct answer as bromide. A few put bromine but many seemed to guess.

01.6 The test for sulfate ions was not well known with many students gaining only the acidification mark. 27% of students achieved full marks.

4.8.3.6 Instrumental methods

Answer 09 · Examiner comments June 2023 | 8462/2H | Original Q3

Question 3 (standard demand)

4.8.3.6 Instrumental methods

Answer 09 · Examiner comments

03.1 This extended response question used the command word 'plan', which was well understood by most students.

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.

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**.

In general, most students were familiar with the analytical tests required for this method and wrote coherent plans that would lead to valid outcomes. The flame test for potassium ions was better known.

Many students added value to their responses by describing the use of acid to treat the nichrome wire before use. However, a few omitted to introduce the wire into the flame of the Bunsen burner (as opposed to just holding the wire over the Bunsen burner without stating that the burner was alight) or by using the orange or 'safety' flame for the test.

The halide test was slightly less well known.

Many students assumed that the medicine sample was in solution, and if this was apparent in their response (for example referring to drops of the medicine), this was credited.

Most students added both dilute nitric acid and silver nitrate solution to their sample, although acidification was not strictly necessary as a key step. Some students incorrectly referred to bromine ions, or a slightly incorrect result such as a cream solution. Unfortunately, a very small number of students failed to score any marks at all as despite correctly describing some tests and results, they failed to mention testing the medicine sample and so their methods would not lead to a valid outcome. The minority of students who clearly did not know the tests involved also usually failed to score any marks, as use of reagents and techniques had to be placed in the correct context in order to be creditworthy.

Around 45% of students gave a Level 3 response, whilst more than 20% provided a Level 2 response

03.2 In this question, knowledge of the name of an instrumental method, flame emission spectroscopy, was being tested. The full name was required for the mark. A substantial proportion of students did not know the name of this method. The abbreviation F.E.S. was not creditworthy. Around one third of students gained this mark.

03.3 This question was generally answered well, with 'more accurate' being the most common correct advantage of flame emission spectroscopy given. However, a minority of students answered the question in terms of disadvantages of other methods such as flame tests and this was not creditworthy. Some students suggested incorrectly that this instrumental method was more precise. A few students referred to the identification of multiple ions in a sample, but this was not considered to be a sufficiently creditworthy advantage. More than half of students gained credit here.