

A-level Chemistry

Investigative and Practical Skills in AS Chemistry - CHM3T/Q14
Final Marking Guidelines

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Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

Guidance for teachers marking Chemistry ISAs

General principles

In general, you are looking for evidence that the student knows and understands the key idea required by the Marking Guidelines.

It is important to mark what the student has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

Conventions

The following conventions are used in the Marking Guidelines.

- An oblique stroke (/) separates alternatives within a marking point.
- Underlining of a word or phrase means that the term must be used.
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a student's answer.
- 'Accept' shows answers that have been allowed.
- 'Max' refers to the maximum mark that can be awarded for a particular question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key ideas.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'an increase in pressure favours the forward reaction' or 'a decrease in pressure favours the backward reaction'.

Occasionally, a student will give a chemically correct answer that is not present in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the student has written.

For each mark awarded, put a tick close to the key word or phrase. In all cases, a tick should equal one mark and the total number of ticks should match the mark given for that question. The teacher should write the total mark in the margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a **Λ** symbol, and to highlight irrelevancies or contradictions etc by underlining. It may also be helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points do not have to appear in the order in which they appear in the Marking Guidelines unless stated otherwise.

Chemical Error

Occasionally, an answer involves incorrect chemistry and the Marking Guidelines records CE = 0, which means a chemical error has occurred and no credit is given for that part.

Disqualifiers

A correct point should be disqualified when the student contradicts it in the same answer. Indicate by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, nor for surplus or neutral information.

The list rule

When a question asks for a specific number of points and the student gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents students from gaining full marks from a list of right and wrong answers.

'Neutral' points

ie ones which are not creditworthy but not actually incorrect, should not negate a correct answer. For example, in answer to 'Name **two** physical properties of metals' a student may give:

'Good conductor of electricity, solid, high density'.

In this case, one mark would be awarded for 'good conductor of electricity' and one for 'high density'. 'Solid' is a neutral point and should be ignored.

Two correct points on the same answer line should be credited.

Spelling

Reasonably close phonetic spellings should be credited.

Precision

In questions where students are **not** asked to give an answer to the appropriate precision, answers given with more precision than expected are not penalised. Answers given to a precision less than that indicated in the Marking Guidelines must be penalised. Where 'significant figures' are required leading zeros must be ignored before the numbers begin eg 3 significant figures would include 3.46, 12.6, 0.134 and 0.0345 but not 25.69, 0.16 or 0.05.

Rounding

Incorrect rounding of calculations must be penalised, but only once per paper.

Crossed out work

When considering crossed out work, **mark it** as if it were not crossed out **unless** it has been replaced by a later version; this later version then takes priority.

Stage 1 Assessment (Task)**Expected observations for Part 1 of the Task**

Appearance of the residue	White solid (allow 'white precipitate') (1) Allow 'none formed' if this matches the student's results
Appearance of the filtrate	Colourless solution (1)

Expected observations for Part 2 of the Task

Use a separate sample in each of the following tests.	Observations with solution Y Magnesium sulfate	Observations with solution Z Calcium chloride
Test 1 Sodium hydroxide Place about 10 drops of the sample in a test tube. Add about 15 drops of sodium hydroxide solution and shake the mixture.	White precipitate (1)	No visible change (1) Allow '(small amount of) white precipitate'
Test 2 Sulfuric acid Place about 10 drops of the sample in a test tube. Add about 10 drops of sulfuric acid and shake the mixture.	No visible change (1)	No visible change or White precipitate (on standing) (1)
Test 3 Sodium carbonate Place about 10 drops of the sample in a boiling tube. Add about 10 drops of sodium carbonate solution and shake the mixture. Add sulfuric acid to the mixture, with shaking, until no further change occurs. Do not fill more than one-third of the boiling tube.	White precipitate (1) Effervescence (1) Precipitate dissolves / colourless solution in excess (1)	White precipitate (1) Effervescence (1) Precipitate dissolves / colourless solution in excess (1)
Test 4 Silver nitrate Place about 10 drops of the sample in a test tube. Add about 10 drops of silver nitrate solution and shake the mixture.	No visible change (1)	White precipitate (1)
Test 5 Barium chloride Place about 10 drops of the sample in a test tube. Add about 10 drops of barium chloride solution and shake the mixture.	White precipitate (1)	No visible change (1)
Test 6 Solution B (Sodium phosphate) Place about 10 drops of the sample in a test tube. Add about 10 drops of solution B and shake the mixture. Add solution C (ammonium chloride solution) to the mixture, with shaking, until no further change occurs. Do not fill more than one-third of the test tube.	White precipitate (1) Precipitate dissolves / colourless solution (1) Allow 'some of the precipitate dissolves'	White precipitate (1) Precipitate insoluble / no visible change (1)

Stage 1 Assessment (Task)

Marking Guidelines	Mark	Additional Guidance
Results recorded clearly and in full in a table	(R) 1	If you can read it, it is clear. 'Full' means completes all of the boxes. Do not allow a list of results. Allow a table without gridlines.
Solution Y (magnesium sulfate) prepared correctly	(S) 1	Award this mark if the student: <ul style="list-style-type: none">• prepares a clear colourless solution• prepares sufficient quantity to complete all of the tests• works safely• leaves no mess.

<p>The accuracy of the observations</p> <p>20 scoring points</p> <table border="0"> <tr> <td>18-20</td> <td>points scores</td> <td>6 marks</td> </tr> <tr> <td>15-17</td> <td>points scores</td> <td>5 marks</td> </tr> <tr> <td>12-14</td> <td>points scores</td> <td>4 marks</td> </tr> <tr> <td>9-11</td> <td>points scores</td> <td>3 marks</td> </tr> <tr> <td>5-8</td> <td>points scores</td> <td>2 marks</td> </tr> <tr> <td>1-4</td> <td>points scores</td> <td>1 mark</td> </tr> </table> <p>If the student has been supplied with a centre-prepared solution Y as a result of an error made by the student then 1 mark should be deducted from the accuracy mark out of 6. This should be clearly stated in the Teacher's Use Only box on the Candidate Results Sheet.</p> <p>Examples of student error would include:</p> <ul style="list-style-type: none"> • spillage or dropping of the solution • the solution contains some solid particles • the wrong reagents were used. 	18-20	points scores	6 marks	15-17	points scores	5 marks	12-14	points scores	4 marks	9-11	points scores	3 marks	5-8	points scores	2 marks	1-4	points scores	1 mark	<p>(A) 6</p>	<p>Mark to the grids on pages 5 and 6. If the teacher results differ from the published grids, consult your Assessment Adviser for guidance.</p> <p>If answers contradict eg 'no visible change with white precipitate' then the scoring point is not awarded.</p> <p>Accept 'ppt', 'suspension', 'sediment' or 'solid' instead of precipitate in part 2 of the task.</p> <p>Do not accept 'goes cloudy', 'cloudy solution', 'goes misty', 'misty solution', 'goes milky', 'milky solution' or 'emulsion' instead of 'precipitate'.</p> <p>Accept 'milky white precipitate'.</p> <p>If 'precipitate' or an acceptable alternative is missing in the answer, penalise each omission.</p> <p>If the colour of a precipitate is missing in the answer, penalise each omission.</p> <p>If 'solution' missing in the answer, penalise once.</p> <p>Accept 'liquid' instead of 'solution'.</p> <p>Do not accept 'clear solution' instead of 'colourless solution'.</p> <p>Do not accept 'goes clear' instead of 'precipitate dissolves' or 'colourless solution'.</p> <p>In Test 3, accept 'bubbles (of gas)', 'fizzes', 'colourless gas formed' or 'carbon dioxide evolved' instead of 'effervescence'.</p> <p>In Test 3, do not accept 'carbon dioxide formed / produced' instead of 'effervescence'.</p>
18-20	points scores	6 marks																		
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9-11	points scores	3 marks																		
5-8	points scores	2 marks																		
1-4	points scores	1 mark																		

		<p>In Test 3, the student must record three correct observations to be awarded all three scoring points.</p> <p>In Test 6, the student must record two correct observations to be awarded both scoring points.</p> <p>Accept 'no change', 'no visible reaction', 'stays the same', 'nvc' as well as 'no visible change'.</p> <p>Penalise 'no reaction' once.</p>
Total	8	

Stage 2 Assessment (Written Test)**Section A Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark.**

Question	Marking Guidelines	Mark	Additional Guidance
1(a)	Compound X <u>Solid</u> present at the end of the reaction / <u>solid</u> removed by filtration	1	Allow 'magnesium oxide / hydroxide'. Both parts needed to score mark. Allow 'solution A' and 'all of the solid disappeared' if this matches the student's results.
1(b)	Easily removed by filtration / excess liquid harder to remove	1	Ignore 'to ensure reaction goes to completion' without further qualification. Ignore 'to ensure all of solution A reacted'. Allow 'to ensure that all of the solid reacted' if this matches the student's results.
2	Y contains magnesium / Mg ²⁺ (ions) White precipitate in Test 1 / with sodium hydroxide	1 1	Allow consequential answer on task results. Answer must be consistent with task results. Lose mark if incorrect charge on magnesium ion. Allow consequential answer on task results. Answer must be consistent with task results. Allow 'white precipitate, colourless solution in ammonium chloride' in Test 6.

3	<p>Y is sulfate / SO_4^{2-}</p> <p>White precipitate in Test 5 / with barium chloride</p> <p>Z is chloride / Cl^-</p> <p>White precipitate in Test 4 / with silver nitrate</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Allow consequential answer on task results. Answer must be consistent with task results. Lose mark if incorrect charge on sulfate ion.</p> <p>Allow consequential answer on task results. Answer must be consistent with task results.</p> <p>Allow consequential answer on task results. Answer must be consistent with task results. Do not accept 'chlorine' or 'Cl' Accept 'bromide' or 'Br^-' Do not accept 'bromine' or 'Br' Lose mark if incorrect charge on an ion. Penalise an incorrect charge on an ion once only in this question.</p> <p>Allow consequential answer on task results.</p>
4(a)	$\text{SrCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{SrSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$	1	<p>Allow multiples, including fractions. Allow ionic equations. Lose this mark if any of the state symbols are missing or incorrect.</p>

4(b)	Add nitric acid to the mixture (until in excess) Filter (to isolate strontium sulfate)	1 1	Do not allow any suggestion that the solution is an emetic.
5	<u>Insoluble barium sulfate</u> is formed	1	Allow ' <u>removes barium ions as a precipitate</u> '.
6	Add silver nitrate, <u>then dilute ammonia</u> (solution) M1 Cream precipitate M2 No visible change or precipitate dissolves slightly in dilute ammonia M3	1 1 1	Do not allow answers which imply silver nitrate and ammonia are added at the same time. Allow 'add silver nitrate, then concentrated ammonia (solution)'. Can score M1 in the answer for M3 Allow 'off white precipitate'. Allow 'soluble / colourless solution / precipitate dissolves in concentrated ammonia'. Allow 3 marks for: Add dilute ammonia (solution), then silver nitrate M1 No visible change M2 Cream / off white precipitate with silver nitrate M3
Total		15	

Section B Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark.

Question	Marking Guidelines	Mark	Additional Guidance
7(a)	1.08×10^{-2}	1	Do not penalise precision but must be to at least 2 significant figures. Do not accept 1×10^{-2}
7(b)	$5.4(0) \times 10^{-3}$	1	Allow Q7(a) / 2 Do not penalise precision but must be to at least 2 significant figures.
7(c)	266.6	1	Lose this mark if answer not given to 1 decimal place.
7(d)	mass = $5.4(0) \times 10^{-3} \times 266.6 = 1.44 \text{ g}$ M1 percentage = $1.44 \times 100/2.25 = 64.0$ M2	1 1	Allow Q7(b) \times Q7(c). Allow consequential answer from M1 Lose this mark if answer not given to 3 significant figures. Correct answer with no working scores M2 only.

7(e)(i)	Would give an <u>incorrect / too large mass</u> (of silver chloride)	1	Do not allow 'to get an accurate result' without qualification.
7(e)(ii)	<u>To remove soluble impurities / excess silver nitrate (solution) / strontium nitrate (solution)</u>	1	Do not allow 'to remove impurities'. Do not allow 'to remove excess strontium chloride solution'.
8(a)	$\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$	1	Allow $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{OH}^{-})_2(\text{s})$ Allow multiples, including fractions. Lose mark if state symbols are missing or incorrect. Lose mark if incorrect charge on an ion.
8(b)	Does not produce CO_2 / gas which distends stomach / does not produce wind / does not increase pressure in stomach	1	Allow 'prevents flatulence' and 'prevents burping'. Do not allow 'gas' without qualification.
9	$(\text{CH}_3\text{COO})_2\text{Ca} \rightarrow \text{CH}_3\text{COCH}_3 + \text{CaCO}_3$	1	Allow multiples. Allow propanone as $\text{C}_3\text{H}_6\text{O}$ Allow $(\text{CH}_3\text{COO}^{-})_2\text{Ca}^{2+} \rightarrow \text{CH}_3\text{COCH}_3 + \text{Ca}^{2+}\text{CO}_3^{2-}$

10	Ca (salt) - no visible change with sodium chromate(VI) M1	1	Allow 'yellow solution formed' or 'no ppt. forms'. Allow M1 and M2 in any order.
	Sr and Ba (salts) give (yellow) <u>precipitate</u> with sodium chromate(VI) M2	1	Lose this mark if precipitate has an incorrect colour.
	Sr precipitate (chromate(VI)) dissolves in ethanoic acid / Ba precipitate (chromate(VI)) does not dissolve in ethanoic acid M3	1	If ethanoic acid is added first, allow access to M1 and M3 .
11	C 42.09/12, H 2.92/1, N 8.18/14, O 37.42/16 and S 9.39/32.1	1	Accept any other correct method of working. If relative atomic mass has been divided by the percentage composition is used then CE = 0/2
	$C_{12}H_{10}N_2O_8S$	1	Correct answer with no working scores 1 mark only.
Total		15	