



**General Certificate of Education (A-level)
June 2013**

Chemistry

CHM6T/Q13

(Specification 2420)

Unit 6T: Practical and Investigative Skills

Investigative Skills Assignment

Final

Marking Guidelines

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

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Guidance for teachers marking Chemistry ISAs

Final Marking Guidelines must be used to mark students' work.

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.

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.

Task Assessment

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. Allow a table without gridlines.
<p>The accuracy of the observations</p> <p>15 scoring points</p> <p>14 -15 points scores 7 marks</p> <p>12 -13 points scores 6 marks</p> <p>10 -11 points scores 5 marks</p> <p>8 - 9 points scores 4 marks</p> <p>6 - 7 points scores 3 marks</p> <p>4 - 5 points scores 2 marks</p> <p>1 - 3 points scores 1 mark</p>	(A) 7	<p>Mark to the grid on page 6. If the teacher results differ from the published grid, consult your Assessment Adviser for guidance.</p> <p>If answers contradict, eg 'No visible change with effervescence' then scoring point is not awarded.</p> <p>Look for the basic colour; ignore additional shades if the answer is unambiguous.</p> <p>Accept 'no change', 'no visible reaction', 'stays the same' or 'nvc' instead of 'no visible change'.</p> <p>Do not accept 'clear' instead of 'colourless'. Penalise every time.</p> <p>Accept 'ppt', 'suspension', 'sediment' or 'solid' instead of 'precipitate'.</p> <p>Do not accept 'cloudy', 'misty', 'milky' or 'emulsion' instead of 'precipitate'. Penalise every time.</p> <p>In Test 2, with solutions P and Q, ignore references to 'effervescence'.</p> <p>In Tests 1(a), 1(b) and 2 with solution Q, allow 'rust (coloured) precipitate'.</p> <p>Penalise missing 'precipitate' every time.</p> <p>Penalise missing 'solution' once only.</p> <p>Penalise 'no reaction' or 'nothing happens' once only.</p>
Total	8	

Expected Observations for Task

Use a separate sample in each of the following tests.	Observations with Solution P Chromium(III) sulfate	Observations with Solution Q Iron(III) chloride	Observations with Solution R Copper(II) chloride
Test 1(a) Place about 10 drops of the sample in a test tube. Add sodium hydroxide solution, dropwise with gentle shaking, until in excess.	<u>Green / blue / grey precipitate</u> (1) Soluble in excess / dark green solution (1)	<u>brown / red-brown / orange precipitate</u> (1) Insoluble in excess (1)	<u>Blue precipitate</u> (1) Insoluble in excess (1)
Test 1(b) Half fill a 250 cm ³ beaker with the freshly boiled water provided. Stand the test tube containing the mixture from Test 1(a) in the beaker of hot water for about 10 minutes.	<u>Green / blue / grey precipitate</u> or no visible change (1)	<u>brown / red-brown / orange precipitate</u> or no visible change (1)	<u>Precipitate turns black / brown</u> (1) (ignore darkens in colour)
Test 2 Place about 10 drops of sodium carbonate solution in a test tube. Add about 10 drops of the sample and shake the mixture gently.	<u>Green / blue / grey precipitate</u> (1)	<u>brown / red-brown / orange precipitate</u> (1)	<u>Blue / green precipitate</u> (1)
Test 3 Place about 10 drops of the sample in a test tube. Add about 10 drops of silver nitrate solution and shake the mixture gently. Allow the test tube to stand for about 10 minutes.	No visible change (1)	<u>White precipitate</u> (1) (ignore colour of solution) (ignore all other observations that do not contradict)	<u>White precipitate</u> (1) (ignore colour of solution) (ignore all other observations that do not contradict)

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	States that results for solution P match those for chromium(III) sulfate (in Test 1(a) or Test 2)	1	Decision must correspond to student's results. Allow consequential answer from student's results. Allow 'same result in Test 1(a) or Test 2'. Ignore references to Test 3.
2	Appropriate barium salt - chloride, nitrate, ethanoate and Appropriate acid - hydrochloric, nitric White precipitate	1 1	Incorrect formula loses this mark but can access second mark. Do not allow 'barium ions' but can access second mark. Do not allow 'barium', 'barium oxide', 'barium hydroxide' or an insoluble barium salt and cannot access second mark. Do not allow 'acid' or 'acidified' if HCl or HNO ₃ not specified but can access the second mark. Do not allow this mark if test reagent is incorrect or missing.
3	Cu ²⁺	1	Allow consequential answer from student's results. Allow copper(II). Penalise missing or incorrect charge.
4	Blue to green/yellow (solution)	1	Full colour change required. Allow consequential answer from student's results. Do not award this mark if a precipitate is formed.

5(a)	$\text{Na}_2\text{CrO}_4 + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbCrO}_4 + 2\text{NaNO}_3$	1	Allow multiples, including fractions. Allow $\text{Pb}^{2+} + \text{CrO}_4^{2-} \rightarrow \text{PbCrO}_4$ Ignore state symbols.
5(b)	Is not washed away / dissolved by <u>rain</u>	1	Ignore reference to insolubility. Allow 'prevents toxic compounds getting into water supplies'.
5(c)	Will not react with <u>oxygen in the air</u>	1	
5(d)	Compound is toxic / poisonous	1	Ignore 'harmful' or 'dangerous'. Do not allow 'corrosive'.
Total		9	

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
6(a)	Percentage of oxygen is 42.5% (M1) Co $13.0/58.9 = 0.221$, N $18.6/14 = 1.329$, K $25.9/39.1 = 0.662$, O $42.5/16 = 2.656$ (M2) $\text{CoN}_6\text{K}_3\text{O}_{12}$ (M3)	1 1 1	Allow if shown clearly in the calculation. Allow alternative method if chemically correct. If A_r has been divided by the percentage, chemical error, lose M2 and M3 . Allow in any order. Correct answer without working scores this mark only.
6(b)	$\text{Co}(\text{NO}_2)_6^{3-}$	1	Allow a correct diagram bonding through N or O Do not allow $\text{CoN}_6\text{O}_{12}^{3-}$ Must have correct overall charge. Allow consequential answer from Q6(a) if the charge on the anion is correct.
7(a)	$\text{FeSO}_4 + \text{Na}_2\text{C}_2\text{O}_4 \rightarrow \text{FeC}_2\text{O}_4 + \text{Na}_2\text{SO}_4$	1	Allow multiples, including fractions. Allow $\text{Fe}^{2+} + \text{C}_2\text{O}_4^{2-} \rightarrow \text{FeC}_2\text{O}_4$ Allow correct equation which includes water of crystallisation.
7(b)	$M_r \text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 277.9$ Moles = $6.95/277.9 = 2.5(0) \times 10^{-2}$	1 1	Allow if shown clearly in the calculation. Allow 278 Do not penalise precision but must be to a minimum of two significant figures. Allow correct calculation using incorrect M_r . Correct answer without working scores this mark only.

7(c)	$3(.00) \times 10^{-2}$	1	
7(d)	Theoretical mass = $2.50 \times 10^{-2} \times 179.8 = 4.50\text{g}$ as long as 2.50×10^{-2} is the smaller of Q7(b) and Q7(c) (M1) Yield = $3.31 \times 100 / 4.50 = 73.6\%$ (M2)	1	Allow consequential answer from Q7(b) and Q7(c). Allow theoretical mass = (smaller of Q7(b) and Q7(c)) $\times 179.8$ If larger of Q7(b) and Q7(c) used, lose M1 but can score M2 . Allow answers based on moles of reactant and product.
		1	Award this mark only if answer given to 3 significant figures. Correct answer without working scores this mark only, provided answer given to 3 significant figures.
7(e)	Some left in solution / some lost during filtration	1	Do not allow 'incomplete reaction'. Do not allow 'reaction is reversible'.
7(f)	MnO_4^- will oxidise the iron(II) ion and the ethanedioate ion	1	
	MnO_4^- does not oxidise the Cu^{2+} ion / larger volume needed for iron(II) ethanedioate	1	
8(a)	<u>Water in the gaseous state</u> from the precipitate <u>absorbed by drying agent</u> OR <u>Water vapour</u> from the precipitate <u>absorbed by drying agent</u>	1	Allow 'water vapour <u>reacts with drying agent</u> '. Do not allow 'absorb water' without qualification.
8(b)	(Blue to) pink / pink colour observed	1	

9(a)	Stoppered flask or similar with side arm	1	Allow gas outlet through stopper.
	Calibrated container for collection eg gas syringe	1	Allow collection over water, but must use calibrated vessel for collection. Lose 1 mark if apparatus is not gas tight.
9(b)	Plot a graph of 'volume (of gas)' against 'time'	1	
	Determine the <u>slope (gradient) at the beginning</u>	1	
9(c)	Repeat with same volume or concentration of hydrogen peroxide <u>and</u> at the same temperature	1	Ignore references to results. Do not allow 'keep everything the same' or words to that effect. Must mention volume or concentration and temperature.
	Add cobalt(II) chloride to one experiment	1	
Total		21	