A-level

Chemistry

Investigative and Practical Skills in A2 Chemistry - CHM6T/Q14
Final Marking Guidelines

Specification 2420
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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)

Results recorded clearly and in full	(R) 1	If you can read it, it is clear. 'Full' means there must be observations for all the Tests including the separate parts.

The accuracy of the student's observations 25 scoring points For 23-25 correct observations 20-22 17-19 13-16 9-12 5-8 1-4	(A) 7 7 6 5 4 3 2 1	Mark to the grid on page 7. If the teacher results differ from the published grid, consult your Assessment Adviser for guidance. If answers contradict, eg 'No visible change with effervescence' then scoring point is **not** awarded. Look for the basic colour; ignore additional shades if the answer is unambiguous. Accept 'no change', 'no visible reaction', 'stays the same', 'nvc' as well as 'no visible change'. Do not accept 'clear solution' instead of 'colourless solution'. Do not accept 'goes cloudy', 'cloudy solution', 'goes misty', 'misty solution', 'goes milky', 'milky solution' or 'emulsion' instead of 'precipitate'. Accept 'ppt', 'suspension', 'sediment' or 'solid' instead of precipitate. If 'precipitate' or an acceptable alternative is missing in the answer when required, penalise each omission. If the colour of a precipitate is missing in the answer, penalise each omission. In Test 2, penalise missing 'purple' once only.

		If 'solution' missing in the answer, penalise once. Accept 'liquid' instead of 'solution'. Do not accept 'goes clear' instead of 'precipitate dissolves' or 'colourless solution'. Accept 'bubbles (of gas)', 'fizzes', 'colourless gas formed' or 'carbon dioxide evolved' instead of 'effervescence'. Do not accept 'carbon dioxide formed / produced' instead of 'effervescence'.

Total	**8**

Test	Part	Observation
1 Ammonium or sodium vanadate(V) + HCl	1	Yellow solid or orange solid (1) Yellow solution or orange solution or orange-brown solution (1)
	2	Gas evolved (1) (solution turns) green (1)
	3	Colour changes to blue (1) then to green (1) then to blue / purple (1)
2 Potassium manganate(VII) + hydrogen peroxide	1	Effervescence (1) Purple solution (1) gives a brown (ppt.) (1)
	2	Purple solution to colourless solution (1) Effervescence (1)
3 Iron(II) sulfate + sodium hydroxide	1	Pale green solution (1) gives a (grey-)green ppt. (1)
	2	Brown ppt. / ppt. darkens (1)
4 Copper(II) sulfate + potassium iodide solution		Blue solution (1) gives a white / cream / brown ppt. (1) and a yellow / orange / brown solution (1)
5 Iron(III) chloride + potassium iodide solution		Yellow / orange solution (1) gives a dark brown / red-brown solution (1)
6 Chromium(III) potassium sulfate + alkaline hydrogen peroxide	1	Green solution (1) gives a green / grey-green / blue-green ppt. (1) Green solution (1)
	2	Yellow solution (1) Effervescence (1)

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)	$VO_3^- + 4H^+ + e^- \rightarrow VO^{2+} + 2H_2O$ $Zn \rightarrow Zn^{2+} + 2e^-$	1 1	Allow multiples, including fractions but ignore state symbols.
1(b)	$2VO_3^- + Zn + 8H^+ \rightarrow 2VO^{2+} + Zn^{2+} + 4H_2O$	1	Allow multiples, including fractions but ignore state symbols. Allow $8HCl \rightarrow 8Cl^-$
2	To prevent air / oxygen entering the tube / to keep the hydrogen gas in the test tube Pressure would build up in the tube if it was closed / sealed (with a rubber bung)	1 1	 Allow 'explosive'.
3	<u>Manganese(II)</u> ions or Mn^{2+} or $Mn(H_2O)_6^{2+}$	1	
4	A <u>solution</u> would form	1	Allow 'precipitate redissolves'. Ignore any references to colours.
5	The (white) precipitate is CuI(s) The (brown) solution is due to $I_3^-(aq)$	1 1	Copper(II) ions are reduced. Iodide ions are oxidised. Any colours quoted must match task observations.

6(a)	Platinum electrode Solution in beaker is a mixture of named soluble iron(II) compound <u>and</u> named soluble iron(III) compound Concentrations of Fe(II) <u>and</u> Fe(III) ions are both 1 mol dm^{-3}	1 1 1	 Allow correct formulae for the iron compounds. Ignore any references to temperature. If eg $Fe_2(SO_4)_3$ used then concentration must be 0.5
6(b)	Purpose: Allow movement <u>of ions</u> between electrodes Requirement: Must not react with the electrolyte / ions in solution	1 1	Allow to maintain an electric circuit. Do not allow reference to movement of electrons in salt bridge. Do not allow 'must not react' without further qualification.
7(a)	CrO_4^{2-}	1	Accept this answer only.
7(b)	(Yellow solution to) Orange (solution)	1	Lose this mark if a precipitate is suggested.
8(a)	Test 2 –1 to 0 Test 6 –1 to –2	1 1	Allow +1 alone (as the <u>change</u> in oxidation number). Allow –1 alone (as the <u>change</u> in oxidation number).
8(b)	1.5 (moles)	1	Allow a consequential answer to Q7(a).
Total		**19**	

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
9(a)	$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	1 1	If equations reversed, allow **M1** only. Ignore state symbols.
9(b)	Moles of copper(II) reacted = (100/1000) × 0.5 = 0.05 Moles of zinc reacted = 0.05 Mass of zinc lost = 0.05 × 65.4 = 3.27 g	1 1 1	 Correct final answer without working scores **M3** only.
9(c)	Allow cell to discharge until $[Cu^{2+}]$ is 0.5 Confirmed by colorimetric measurement or other suitable method Weigh the Zn electrode before and after the experiment	1 1 1	Alternative: Allow cell to discharge completely. Solution colourless or use of chemical test to determine absence of copper(II) Weigh Zn electrodes before and after and halve the mass change.
10(a)	Solar cells do not supply electrical energy all the time Rechargeable cells can store electrical energy for use when the solar cells are not working	1 1	
10(b)	Prevent pollution of the environment by toxic or dangerous substances / recycling of valuable components	1	Do not allow 'will not use up landfill sites'.
Total		**11**	