A-level

Chemistry

Investigative and Practical Skills in A2 Chemistry – CHM6T/P14
Final Marking Guidelines

Specification 2420
June 2014

Version: 1.1 Final Marking Guidelines

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.
- <u>Underlining</u> of a word or phrase means that the term <u>must</u> 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)

Marking Guidelines	Mark	Additional Guidance
Student reads the burette correctly	(B) 1	If the student does not read the burette correctly, tell the student the correct reading.
Results recorded clearly and in full in a sensible table	(R) 1	If you can read it, it is clear. 'Full' means the table must have 'Initial reading', 'Final reading' and 'Titre values' for at least two sets of results. Labels such as 'Initial reading', 'Final reading' etc are not essential. The table does not have to have gridlines. Allow a clear answer outside of a table box. Lose this mark if the initial reading is recorded as 50.0 cm^3. Lose this mark if there is an arithmetic error in calculating a titre. Do not penalise missing units but lose this mark if units are incorrect. Do not penalise a student who does more than five titrations. Errors in recording the final titre are not penalised here but may be penalised in the Written Test.

All titre volumes to 0.05 cm^3	(P) 1	For example, accept 20.30 and 20.35 but do not accept 20.3, 20.31, 20.32 etc.
		Allow zero entries as 0 or 0.0
		If a set of readings are labelled 'rough' or 'trial' etc, ignore their precision unless the titre is used in calculating the average.

Concordant if two titres are within 0.10 cm^3 of each other	(C) 1	Award the mark for concordancy if the table contains at least **two** concordant titres, even if the student has not recognised these as concordant titres.
		Do not award this mark if two concordant results are only achieved by incorrect arithmetic.
		Can score concordancy mark if titre volumes are only recorded to 1 decimal place but will lose Precision mark.

The accuracy of the student's average titre, measured against a teacher value for the titration		If a student has two concordant titres then both concordancy and accuracy marks can be awarded.
This mark can be awarded independent of precision		If a student does not have two concordant titres but does have two titres within 0.20 cm^3 of each other, then the concordancy mark cannot be awarded but accuracy marks can.
Average titre is within 1% of teacher value Average titre is within 1.5% of teacher value Average titre is within 2% of teacher value Average titre is within 2.5% of teacher value	(A) 4 3 2 1	Titres which differ from each other by more than 0.20 cm^3 cannot receive concordancy or accuracy marks.
There is no penalty in the task for an incorrectly calculated average titre		Check that the student has calculated the average titre correctly. If not, calculate the correct average and base the student's accuracy mark on the correct average. The student does not have to use all of the concordant titres in obtaining an average. There will be a penalty for an incorrect calculation of the average titre in Q1 of the Written Test.

Enter your mark for burette (B), recording (R), precision (P), concordancy (C) and accuracy (A) in the table at the bottom of each Candidate Results Sheet If the student has been supplied with a centre-prepared equilibrium mixture **as a result of an error made by the student** then 1 mark should be deducted from the total for the task. This should be clearly stated on the Candidate Results Sheet. Examples of student error would include: • spillage or dropping of the sample before placing in the volumetric flask • making up the volume in the volumetric flask significantly above the mark • realisation that the sample in the volumetric flask had been insufficiently mixed ie a heterogeneous mixture.		If a student has one set of concordant results, and has correctly identified these results, base the accuracy mark on the student's average titre. A student may have one set of concordant results, but uses a non-concordant titre in calculating the average. Average all of the student's concordant titres, and use this average to determine the mark for accuracy. There will be a penalty for including a non-concordant titre in calculating the average in Q1 of the Written Test. A student may have two sets of concordant results which do not overlap. The teacher should choose the set of concordant titres that gives the higher accuracy mark, even if the student chooses the other set. Allow a correct calculation of an average titre for either set of concordant results. If the initial burette reading is given as 50.00, and the final titre is given as, say, 22.30, the titre could be 22.30 or 27.70. Use the value which gives the student the higher accuracy mark. If most students score low marks for accuracy, contact your Assessment Adviser.

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	Average titre value using at least two concordant results	1	Do not penalise precision of average titre. Do not award to student given Teacher Results. Allow a correct calculation of an average titre for either set of two sets of concordant results but not if all sets (or a majority) are averaged. Award this mark for a correct answer on the Written Test even if it is different from the average titre on the Candidate Results Sheet. Lose this mark if there are no concordant results.
2	Mol of NaOH = Q1 × 0.200/1000 (= mol of acid in titration) **M1**	1	Do not penalise precision but must be to a minimum of 2 significant figures.
	Mol of acid in flask = answer to M1 × 10 **M2**	1	Correct answer without working scores this mark only.
3(a)	Catalyst	1	To speed up rate of reaction / rate of attainment of equilibrium.
3(b)	Q2 – 0.00400	1	Do not penalise precision but must be to a minimum of 2 significant figures.
3(c)	0.105 – Q3(b)	1	Do not penalise precision but must be to a minimum of 2 significant figures.
4	The mixture is turning less alkaline / more acidic	1	Do not allow any absorption of acidic gases / CO_2
	as the ester is hydrolysed / (position of) equilibrium moves to the left	1	

5	Propan-1-ol = 0.080 – Q3(c)	1	0.043 (if using supplied data)
	Propyl ethanoate = Q3(c)	1	0.037 (if using supplied data)
	Water = 0.111 + Q3(c)	1	0.148 (if using supplied data)
			Do not penalise precision but must be to a minimum of 2 significant figures.
6	$K_c = \dfrac{[CH_3COOCH_2CH_2CH_3][H_2O]}{[CH_3COOH][CH_3CH_2CH_2OH]}$	1	Incorrect expression, CE = 0/2
			Allow words in place of formulae.
			Ignore errors in the transcription of chemical formulae.
			Must have square brackets.
	Correct substitution of own figures leading to correct answer	1	If 0.037 used for Q3(c) then value should be 1.87
			Lose this mark if answer not to 3 significant figures.
7	Make up more than one mixture and test one mixture after 1 week and another mixture after a longer time	1	Do not allow any suggestion that pH can be used to determine when equilibrium is attained.
	Titre values / values of K_c should be the same if equilibrium has been established	1	
8	Acid in the flask would be more dilute / the pipetted volume would have less acid in it	1	Allow 'smaller titre obtained'.
	It would appear that more acid had turned into ester	1	Allow this mark even if **M1** is incorrect.
			Allow 'more ester would appear to have formed'.
Total		**17**	

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)	Correct orientation of graph (pH on y-axis)	1	
	Scale – plotted points cover at least half the grid and y-axis should start at pH 4	1	
	All points plotted correctly	1	+/– one small square.
	<u>Curve</u> of best fit drawn correctly	1	Allow some leniency here with a complex graph – it is important that the section between pH 8.5 and 9.7 is close to linear.
			Lose this mark if the line is pulled towards the anomaly at 3.0 cm^3.
			Lose this mark if first point at pH 5.1 is treated as an anomaly.
			Do not accept doubled lines but allow some slight discontinuity where the curve changes direction.
9(b)	11.6-11.9 (cm^3) only	1	Do not mark consequentially to student's graph.
9(c)	pK_a = value of pH related to Q9(b) **M1**	1	Mark consequentially on student's graph – ideally 9.0-9.1
			Do not penalise precision of answer.
	$K_a = 10^{-pKa}$ **M2**	1	Ideally 1.0×10^{-9} to 7.9×10^{-10}
			Ignore precision of answer but lose **M2** for 1 significant figure here.

9(d)	pH 8.7 Ineffective stirring / swirling of the mixture	1	Both points needed for this mark. Do not allow pH 5.1 Do not allow 'overshooting (at 3 cm^3 addition)'.

9(e)	Take more pH readings around the end-point / add smaller volumes of NaOH near the end-point	1	Do not allow 'use a more accurate / reliable pH meter / probe'. Do not allow the use of a thermostatted mixture.

10	Identification of acid by suitable method eg named indicator, named carbonate, specified reactive metal	1	Ignore any reference to the smell of the ester. Do not allow the use of any instrumental method eg i.r. or n.m.r.; must be a <u>chemical</u> test.
	with expected results	1	
	Identification of alcohol by suitable method eg oxidation by acidified potassium dichromate(VI)	1	
	with expected results	1	

Total		**13**	