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General Certificate of Education (A-level)
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Chemistry CHM6T/P13

(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.
The accuracy of the observations 16 scoring points 15 -16 points scores 7 marks 14 points scores 6 marks 12 -13 points scores 5 marks 10 -11 points scores 4 marks 8 - 9 points scores 3 marks 4 - 7 points scores 2 marks 1 - 3 points scores 1 mark	(**A**) 7	Mark to the grid on page 6. 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' or 'nvc' instead of 'no visible change'. Accept 'bubbles of gas', 'fizzes', 'colourless gas formed' or 'CO_2 evolved' instead of 'effervescence'. Do not allow 'CO_2 formed/produced'. Do not accept 'clear' instead of 'colourless'. Penalise every time. Accept 'ppt', 'suspension', 'sediment' or 'solid' instead of 'precipitate'. Do not accept 'cloudy', 'misty', 'milky' or 'emulsion' instead of 'precipitate'. Penalise every time. In **Test 2**, Solution C, allow 'brown solution'. Penalise missing 'precipitate' every time. Penalise missing 'solution' once only. Penalise 'no reaction' or 'nothing happens' once only.
Total	**8**	

Expected Observations for Task

Use a separate sample in each of the following tests.	**Observations with Solution A Methanoic acid**	**Observations with Solution B Glucose**	**Observations with Solution C Propanone**	**Observations with Solution D Propanoic acid**
Test 1 Fehling's solution Place about 10 drops of the sample in a test tube. Add about 10 drops of Fehling's solution and shake the mixture. Half fill a 250 cm^3 beaker with the freshly boiled water provided. Stand the test tube in the beaker of hot water for about 10 minutes.	Effervescence (1)	Red / orange precipitate (1)	No visible change (1)	Effervescence (1)
Test 2 Potassium manganate(VII) Place about 10 drops of the sample in a test tube. Add about 10 drops of potassium manganate(VII) solution and shake the mixture. Half fill a second 250 cm^3 beaker with the freshly boiled water provided. Stand the test tube in the beaker of hot water for about 10 minutes.	Yellow / colourless solution (1)	Colourless solution (1)	Brown precipitate (1)	No visible change **or** purple / red solution (1)
Test 3 Sodium hydrogencarbonate Place about 10 drops of the sample in a test tube. Use a spatula to add a small amount of the solid sodium hydrogencarbonate.	Effervescence (1) (ignore white solid / ppt or solid dissolves)	No visible change (1) (ignore white solid / ppt or solid dissolves)	No visible change (1) (ignore white solid / ppt or solid dissolves)	Effervescence (1) (ignore white solid / ppt or solid dissolves)
Test 4 Iodine / sodium hydroxide Place about 10 drops of the sample in a test tube. Add 20 drops of iodine solution and shake the mixture. Add sodium hydroxide solution dropwise until the yellow colour of the iodine is no longer visible.	No visible change **or** colourless solution (1) (ignore reference to a yellow solution)	No visible change **or** colourless solution (1) (ignore reference to a yellow solution)	Yellow precipitate (1) (ignore reference to a yellow solution)	No visible change **or** colourless solution (1) (ignore reference to a yellow solution)

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	**B** Aldehyde	1	Mark consequentially on Task results. Answers must correspond to Task results. Allow (R)-CHO Do not allow (R)-COH
	D Carboxylic acid	1	Allow (R)-COOH or (R)-CO_2H Do not allow 'acid'.
2	No because the results do not confirm the presence of one functional group	1	Allow 'other functional group(s) could give the same results'. Allow consequential answer from the Task.
3	Yes because the results suggest a (carboxylic) <u>acid</u> and another functional group which can be oxidised (eg alcohol)	1	Allow consequential answer from the Task. Do not allow aldehyde as the other functional group unless there was a positive result in Test 1, Solution A.
4	(OH at) 2500-3000 (cm^{-1})	1	Accept a wavenumber within this range.

5	Test silver nitrate (solution) **(M1)**	1	Allow an alternative soluble silver salt eg fluoride, sulfate. Do not allow 'silver ions' but can access second mark. Incorrect formula loses this mark but can access second mark. Do not allow 'silver' or an insoluble silver salt and **cannot** access second mark. Ignore references to acidification of the silver nitrate. If an acid is specified it should be nitric acid, but allow sulfuric acid in this case as there are no metal ions present. If hydrochloric acid is used, CE = 0/2. Do not allow 'add water'.
	Observation white precipitate **(M2)**	1	Ignore 'cloudy'. Do not allow 'white fumes' or 'effervescence'. Do not allow this mark if test reagent is incorrect or missing. Allow named indicator paper or named indicator solution for **M1**. Allow correct colour change for **M2**.
6	Dichromate(VI) will also oxidise / give a positive test with alcohols	1	Allow 'dichromate'. Allow 'dichromate(VI) will oxidise other organic molecules / functional groups'.

7(a)	Yes, because it is oxidised to ethanal / CH_3CHO **OR** it is oxidised to a compound that contains CH_3CO group	1	Ignore 'primary alcohols are oxidised to aldehydes'. Need 'yes' and an explanation to be awarded the mark.
7(b)	M_r CHI_3 = 393.7 **(M1)**	1	Allow if clearly shown in a calculation. Allow 394
	Moles CHI_3 = 10 / 393.7 = 2.54 x 10^{-2} **(M2)**	1	Allow a consequential answer on an incorrect M_r. 2.54 x 10^{-2} scores **M1** and **M2**.
	Moles I_2 = 7.62 x 10^{-2} **(M3)**	1	Allow 3 x **M2**.
	Mass I_2 = 7.62 x 10^{-2} x 253.8 = 19.34 g **(M4)**	1	Allow **M3** x 253.8 or **M3** x 254
	Scaling 19.34 / 0.832 = 23.2 g **(M5)**	1	Allow **M4** / 0.832 Lose this mark if the answer is not given to 3 significant figures. Answer without working scores **M5** only. Allow any chemically correct alternative method. Calculations which combine several steps in one expression can score the marks for all of these individual steps.
7(c)	Remove soluble impurities	1	Allow 'remove excess sodium hydroxide / iodine'. Allow 'remove excess sodium methanoate / sodium iodide'. Allow 'remove excess reagents'.
7(d)	Will not dissolve solid / solid is insoluble in water	1	Allow 'will not react with solid'.
Total		**16**	

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
8(a)	To prevent vigorous / uneven boiling / bubbling	1	Allow 'so the liquid does not jump / spit'. Reference to an effect on reaction loses this mark. Ignore references to bumping.
8(b)	Allows vapour to escape	1	Allow 'prevents an explosion / apparatus will fly apart / stopper will come out / prevents build up of pressure'. Ignore references to a hole for the thermometer.
8(c)	Boiling point above that of sample Does not ignite easily	1 1	Allow 'boiling point above 150 ^{o}C / stable to heat(ing)'. Allow 'not flammable'.
8(d)	Boiling point varies with pressure	1	Allow fair comparison with a data book value.
8(e)	Many compounds have the same boiling point	1	Do not allow 'an inaccurate boiling point'. Ignore 'boiling point was not obtained at standard pressure'.
9	Compare spectrum of aldehyde with known spectrum of pentanal Exact match	1 1	Must be a specific reference to a comparison. Allow 'fingerprint regions match exactly'.
10(a)	Over time / after storage meter does not give accurate readings	1	Do not allow 'to get an accurate reading' or 'reading drifts' on its own. Allow 'temperature variations affect readings'.

10(b)	Any **five** from: • Measure pH (of the acid) • Add alkali in known small portions • Stir mixture • Measure pH (after each addition) • Repeat until alkali in excess • Add in smaller increments near endpoint	5 max	Ignore references to the use of the pipette, the filling of the burette and the calibration of the pH meter. Allow 1 – 2 cm^3. Allow 27 – 50 cm^3. Allow 0.1 – 0.5 cm^3. To score full marks, the sequence must follow a logical order.

Total	**14**