



2014 Chemistry

Higher (Revised)

Finalised Marking Instructions

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Part One: General Marking Principles for: Chemistry Higher (Revised)

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question.

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader/Principal Assessor.
- (b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

GENERAL MARKING ADVICE: Chemistry Higher (Revised)

The marking schemes are written to assist in determining the “minimal acceptable answer” rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates’ evidence, and apply to marking both end of unit assessments and course assessments.

General information for markers

The general comments given below should be considered during all marking.

- 1 Marks should **not** be deducted for incorrect spelling or loose language as long as the meaning of the word(s) is conveyed.

Example: Answers like ‘distilling’ (for ‘distillation’) and ‘it gets hotter’ (for ‘the temperature rises’) should be accepted.

- 2 A right answer followed by a wrong answer should be treated as a cancelling error and no marks should be given.

Example: What is the colour of universal indicator in acid solution?

The answer ‘red, blue’ gains no marks.

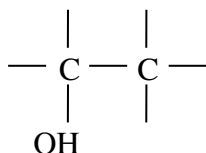
- 3 If a right answer is followed by additional information which does not conflict, the additional information should be ignored, whether correct or not.

Example: Why can the tube not be made of copper?

If the correct answer is related to a low melting point, ‘It has a low melting point and is coloured grey’ would **not** be treated as having a cancelling error.

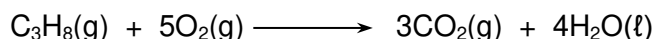
- 4 Full marks are usually awarded for the correct answer to a calculation on its own; the part marks shown in the marking scheme are for use when working is given. An exception is when candidates are asked to ‘Find, by calculation,’.
- 5 A half mark should be deducted in a calculation for each arithmetic slip.
- 6 A half mark should be deducted for incorrect or missing units **only when stated in the marking scheme**. No marks should be deducted for incorrect or missing units at intermediate stages in a calculation.

- 7 Where a wrong numerical answer (already penalised) is carried forward to another step, no further penalty is incurred provided the result is used correctly.
- 8 Ignore the omission of one H atom from a full structural formula provided the bond is shown.
- 9 With structures involving an – OH or an – NH₂ group, a half mark should be deducted if the 'O' or 'N' are not bonded to a carbon, ie OH–CH₂ and NH₂–CH₂.
- 10 When drawing structural formulae, a half mark should be deducted if the bond points to the 'wrong' atom, eg



- 11 A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the marking scheme**.
- 12 When formulae of ionic compounds are given as answers it will only be necessary to show ion charges if these have been specifically asked for. However, if ion charges are shown, they must be correct. If incorrect charges are shown, no marks should be awarded.
- 13 If an answer comes directly from the text of the question, no marks should be given.

Example: A student found that 0.05 mol of propane, C₃H₈ burned to give 82.4 kJ of energy.

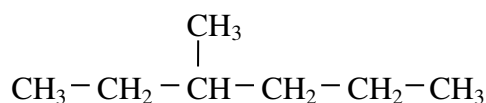


Name the kind of enthalpy change which the student measured.

No marks should be given for 'burning' since the word 'burned' appears in the text.

- 14 A guiding principle in marking is to give credit for (partially) correct chemistry rather than to look for reasons not to give marks.

Example 1: The structure of a hydrocarbon found in petrol is shown below.



Name the hydrocarbon.

Although the punctuation is not correct, '3, methyl-hexane' should gain the full mark.

Example 2: A student measured the pH of four carboxylic acids to find out how their strength is related to the number of chlorine atoms in the molecule. The results are shown.

Structural formula	pH
CH ₃ COOH	1.65
CH ₂ ClCOOH	1.27
CHCl ₂ COOH	0.90
CCl ₃ COOH	0.51

How is the strength of the acids related to the number of chlorine atoms in the molecule?

Although not completely correct, an answer such as 'the more Cl₂, the stronger the acid' should gain the full mark.

- 15 Unless the question is clearly about a non-chemistry issue, eg costs in industrial chemistry, a non-chemical answer gains no marks.

Example: Why does the (catalytic) converter have a honeycomb structure?

A response such as 'to make it work' may be correct but it is not a chemical answer and the mark should not be given.

- 16 When it is very difficult to make a decision about a partially correct answer, a half mark can be awarded.
- 17 When marks have been totalled, a half mark should be rounded up.

Part Two: Marking Instructions for each Question

Section A

Question	Acceptable Answer(s)
1	B
2	C
3	A
4	B
5	A
6	A
7	D
8	A
9	B
10	C
11	D
12	B
13	C
14	D
15	D

Question	Acceptable Answer(s)
16	B
17	D
18	B
19	B
20	A
21	C
22	A
23	A
24	C
25	C
26	C
27	B
28	D
29	D
30	C

Section B

Question			Acceptable Answer/s	Max Mark	Unacceptable
1	a		Completed table in order: Metallic (metal) Network (lattice) Covalent Molecular (discrete) 2/3 pieces of info (1 mark) 4 pieces of info (2 marks)	2	
1	b		Increasing nuclear charge / increasing number of protons / stronger pull from the nucleus (pulls electrons closer)	1	Increasing atomic number Increasing no. of electrons therefore bigger pull
1	c	i	(Fractional) distillation	1	
1	c	ii	5.8×10^7 tonnes OR 57 692 307 tonnes 57.7 OR 57.7 or 58 million tonnes (ignore wrong or missing units)	1	
1	c	iii	Magnesium oxide would form/ magnesium would react with oxygen in the air OR Magnesium would react with the nitrogen in the air.	1	General reactivity statements such as magnesium reacts with other substances in the air or the liquid air would react

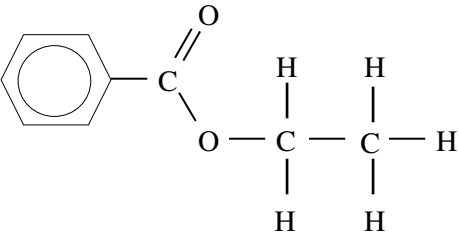
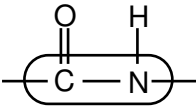
Question			Acceptable Answer/s	Max Mark	Unacceptable
1	c	iv	This is an open ended question. 1 mark: The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. 2 marks: The student has demonstrated a reasonable understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that the problem is understood. 3 marks: The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an “excellent” answer or a “complete” one.	3	
2	a	i	The enzyme changes shape when heated (so cannot catalyse the reaction).	1	Past optimum temperature
2	a	ii	Oxygen to hydrogen ratio has decreased OR Hydrogen to oxygen ratio has increased OR Hydrogen has been gained.(accept gain of hydrogen ions)	1	Gain of electrons on its own Reverse of oxidation

Question			Acceptable Answer/s	Max Mark	Unacceptable
2	a	iii	87% Partial marks can be awarded using a scheme of two “concept” marks and one “arithmetic” mark. 1 mark is given for candidate displaying understanding of the 1:2 stoichiometry in the reaction. 1 mark is given for candidate showing understanding of the concept of an actual yield divided by a theoretical yield either using masses or moles of reactant and product. (445/511 would be worth 2 marks) 1 mark is awarded for correct arithmetic throughout the calculation. This mark can only be awarded if both concept marks have been awarded.	3	Percentage yield $= \frac{0.445 \times 100}{1}$ = 44.5%
2	b		29 717 (or roundings) (no units required and ignore sign if included) Accept 29.7 kJ g⁻¹ if units given	1	
2	c		3.87 (%) For 1 mark candidate must have either 1035–1005 or 30 or 0.129	2	

Question			Acceptable Answer/s	Max Mark	Unacceptable
3	a		-551 (kJ mol⁻¹) For 1 mark candidate must have Either bond breaking = (432 +155) or 587 OR Bond making = or (2 x -569) or -1138 OR (+)551	2	
3	b		For 1 mark Stronger intermolecular forces between H-F molecules than between F-F molecules (No need to name forces) OR for 1 mark – More energy is required to break intermolecular forces in HF than in F₂ For 1 mark Strong intermolecular forces (H bonds) caused by: (large) difference in electronegativity OR indication of polar bonds OR indication of permanent dipole For 1 mark Weak intermolecular forces (LDF) caused by: temporary dipoles OR uneven distribution of electrons OR electron cloud wobble	3	

Question			Acceptable Answer/s	Max Mark	Unacceptable
4	a		Diagram completed to show viable method of drying gas using calcium oxide.	1	
4	b	i	37.7 g (no units required— ignore incorrect units) Partial marks can be awarded using a scheme of two “concept” marks and one “arithmetic” mark. 1 mark for demonstration of use of the relationship $E_h = cm\Delta T$ to calculate the E_h this mark is for the concept, do not penalise for incorrect units or incorrect arithmetic. The value of 43.89 (kJ) would automatically gain this mark. 1 mark for demonstration of knowledge that the enthalpy value provided relates to 1 mole of calcium oxide reacting with water. This mark could be awarded if the candidate is seen to be working out the number of moles of calcium oxide required (0.67) or if the candidate's working shows a proportion calculation involving use of the gfm for calcium oxide (56). 1 mark is awarded for correct arithmetic throughout the calculation. This mark can only be awarded if both concept marks have been awarded.	3	
4	b	ii	– 147 kJ mol⁻¹ partial marks 1 mark is awarded for 2 out of the four following numbers + 635 + 286 – 986 – 82	2	+ 147 with no working shown

Question			Acceptable Answer/s	Max Mark	Unacceptable
5	a	i	$\text{C}_6\text{H}_8\text{O}_6 \longrightarrow \text{C}_6\text{H}_6\text{O}_6 + 2\text{H}^+ + 2\text{e}^-$	1	
5	a	ii	Pipette rinsed with fruit juice and burette with iodine solution Both for 1 mark Conical flask rinsed with water 1 mark	2	
5	a	iii	Improve reliability (accept improved accuracy) / allow an average value to be calculated.	1	
5	a	iv	0.28 g Accept answers in range 0.26 g – 0.28 g if there is evidence of rounding at intermediate stages. Partial marks can be awarded using a scheme of two “concept” marks and one “arithmetic” mark. 1 mark for knowledge of the relationship between moles, concentration and volume. This could be shown by any one of the following steps: calculation of moles of iodine/vit C using volume x concentration either by a stand-alone method or using a volumetric equation. calculation of moles of vit C in 1 litre $0.0000317 \times 50 = 0.00159$ OR Correct pairings in in volumetric equation 1 mark for knowledge of the relationship between moles, mass and GFM of vit C ie $0.00159 \times 176 = 0.279$ 1 mark is awarded for correct arithmetic throughout the calculation. This mark can only be awarded if both concept marks have been awarded.	3	
5	b		80% 48 (mg) vit C 1 mark $48/60 \times 100 = 80\%$ 1 mark (follow through)	2	

Question			Acceptable Answer/s	Max Mark	Unacceptable
6	a	i	Water bath/heating mantle	1	
6	a	ii	Condensation	1	Condensing
6	a	iii	 A correct structural formula for ethylbenzoate	1	
6	b		82.3 (82%) 1 mark: Concept atom economy ie desired product mass over reactant masses 1 mark: Correct arithmetic	2	
7	a		Peptide link correctly identified including just 	1	
7	b		Hydroxyl	1	Hydroxide
7	c	i	Glycerol OR propane-1,2,3-triol OR glycerine OR propan-1,2,3-triol	1	
7	c	ii	(£) 18	1	

Question			Acceptable Answer/s	Max Mark	Unacceptable
7	c	iii	From a hydrogen connected to an oxygen or nitrogen to another oxygen (includes the carbonyl oxygen) or nitrogen. Hydrogen bond correctly drawn.	1	
7	d		This is an open ended question. 1 mark: The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. 2 marks: The student has demonstrated a reasonable understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that the problem is understood. 3 marks: The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	3	
8	a	i	Atoms/molecules with unpaired electrons.	1	
8	a	ii	UV radiation/ high energy radiation (breaks bonds in molecules/excites electrons.)	1	
8	a	iii	Propagation	1	
8	b		O=C=C=C=O or other structural formula which obeys valency rules	1	

Question			Acceptable Answer/s	Max Mark	Unacceptable
9	a		14 (°C) accept answers in the range 13.5 to 14.5	1	
9	b		Collision must occur with sufficient or required or activation energy 1 mark Collision must occur with suitable geometry 1 mark	2	With correct speed With high energy
10	a		Secondary (or tertiary) alcohols have lower boiling points than primary or words to that effect such as the hydroxyl being on an end carbon gives a higher boiling point 1 mark more branched the (isomeric) alcohol the lower the boiling point or words such a methyl group lowers the boiling point 1 mark (both structural feature and effect must be correct)	2	
10	b		Predicted boiling point less than 149 greater than 121.	1	
11	a		$\text{IO}_4^- + 2\text{H}^+ + 2\text{e}^- \longrightarrow \text{IO}_3^- + \text{H}_2\text{O}$	1	
11	b	i	Mention of transferring of rinsings. 1 mark Mention of making solution up to the mark of the standard/ volumetric flask 1 mark	2	
11	b	ii	Accurately determine permanganate concentration (mg/l) for 0.30 absorbance (using a line of best fit graph candidate has drawn) (28) 1 mark Conversion of this value into mass of manganese 12.94 or 12.9 (mg) 1 mark Correct units shown 1 mark If use 0.30 gives 13.85 mg 2 marks	3	

Question			Acceptable Answer/s	Max Mark	Unacceptable
12	a		0.973 litres OR 973 cm³ 1 mark for GFM 1 mark correct stoichiometry 1 mark is awarded for follow-through arithmetic	3	
12	b		2CO + 3CO₂ + 4H₂O + 2N₂ Ignore state symbols that are either wrong or missing.	1	

[END OF MARKING INSTRUCTIONS]