H

National
Qualifications
2019

2019 Chemistry

Higher - Paper 1 – Multiple choice

Finalised Marking Instructions

SQA
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Marking instructions for each question

Question	Response	Mark
1.	C	1
2.	B	1
3.	A	1
4.	C	1
5.	B	1
6.	A	1
7.	D	1
8.	B	1
9.	D	1
10.	D	1
11.	C	1
12.	B	1
13.	D	1
14.	A	1
15.	C	1
16.	D	1
17.	B	1
18.	B	1
19.	B	1
20.	C	1
21.	A	1
22.	D	1
23.	C	1
24.	A	1
25.	D	1

[END OF MARKING INSTRUCTIONS]

National
Qualifications
2019

2019 Chemistry

Higher - Paper 2

Finalised Marking Instructions

General marking principles for Higher Chemistry

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a 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.

(c) Do not award half marks.

(d) Where a candidate makes an error at an early stage in a multi-stage calculation, award marks for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. Apply the same principle for questions that require several stages of non-mathematical reasoning. The exception to this rule is where the marking instructions for a numerical question assign separate 'concept marks' and an 'arithmetic mark'. In such situations, the marking instructions will give clear guidance on the assignment or partial marks.

(e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final response (including units) on its own.

(f) Candidates may fully access larger mark allocations whether their responses are in continuous prose, linked statements, or a series of developed bullet points.

(g) Do not deduct marks for inaccurate or unconventional spelling or vocabulary as long as the meaning of the word(s) is conveyed. **For example**, responses that include 'distilling' for 'distillation', or 'it gets hotter' for 'the temperature rises', are acceptable.

(h) In many questions, the unit in which the answer is to be expressed is given. In these questions, the candidate does not need to state a unit in their answer; but if they do, the unit must be correct. The full mark allocation cannot be awarded if an incorrect unit is shown. In these questions, incorrect units would only be penalised once in any paper.

(i) If a correct response is followed by a wrong response, award no marks. **For example** in response to the question, 'State the colour seen when blue Fehling's solution is warmed with an aldehyde', do not award marks for the response 'red green'. However, if a correct response is followed by additional information which does not conflict with that, ignore the additional information, whether correct or not. **For example** in response to a question concerned with melting point, 'State why the tube should not be made of copper', the response 'Copper has a low melting point and is coloured grey' **would** gain marks.

(j) Award full marks for the correct response to a calculation without working. Award partial marks, as shown in the detailed marking instructions, when working is given but the final response is incorrect. An exception is when candidates are asked to 'Find, by calculation' - do not award full marks for the correct response without working.

(k) Ignore the omission of one H atom from a full structural formula provided the bond is shown.

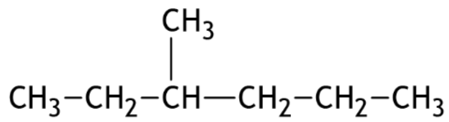
(l) Award marks for a symbol or correct formula in place of a name **unless stated otherwise in the detailed marking instructions.**

(m) When formulae of ionic compounds are given as responses, candidates only need 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, do not award marks.

(n) If an answer comes directly from the text of the question, do not award marks. **For example**, in response to the question, 'A student found that 0·05 mol of propane, C_3H_8 burned to give 82·4 kJ of energy. $C_3H_8(g) + 5O_2(g) = 3CO_2(g) + 4H_2O(\ell)$. Name the kind of enthalpy change that the student measured', do not award marks for 'burning' since the word 'burned' appears in the text.

(o) A guiding principle in marking is to give credit for correct elements of a response 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

- Award the full mark for '3, methyl-hexane', although the punctuation is not correct.

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.

CH_3COOH	1·65
$CH_2ClCOOH$	1·27
$CHCl_2COOH$	0·90
CCl_3COOH	0·51

Describe the relationship between the number of chlorine atoms in the molecule and the strengths of the acids.

- Award the full mark for a response such as 'the more Cl_2, the stronger the acid', although not completely correct.

(p) Unless the question is clearly about a non-chemistry issue, for example costs in an industrial chemical process, do not award marks for a non-chemical response.
For example, in response to the question, 'Why does the (catalytic) converter have a honeycomb structure?', do not award a mark for 'To make it work'. This response may be correct but it is not a chemical response.

(q) Only award marks for a valid response to the question asked. Where candidates are asked to:

- **identify, name, give** or **state**, they must only name or present in brief form.
- **describe**, they must provide a statement or structure of characteristics and/or features.
- **explain**, they must relate cause and effect and/or make relationships between things clear.
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things.
- **complete**, they must finish a chemical equation or fill in a table with information.
- **determine** or **calculate**, they must determine a number from given facts, figures or information.
- **draw**, they must draw a diagram or structural formula, for example 'Draw a diagram to show the part of a poly(propene) molecule formed from two propene molecules.'
- **estimate**, they must determine an approximate value for something.
- **predict**, they must suggest what may happen based on available information.
- **evaluate**, they must make a judgement based on criteria.
- **suggest**, they must apply their knowledge and understanding of chemistry to a new situation. A number of responses are acceptable: award marks for any suggestions that are supported by knowledge and understanding of chemistry.
- **use their knowledge of chemistry or aspect of chemistry to comment on**, they must apply their skills, knowledge and understanding to respond appropriately to the problem/situation presented (for example by making a statement of principle(s) involved and/or a relationship or equation, and applying these to respond to the problem/situation). Candidates gain marks for the breadth and/or depth of their conceptual understanding.
- **write**, they must complete a chemical or word equation, for example 'Write the word equation for the complete combustion of ethanol.'

Marking instructions for each question

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>1.</td><td>(a)</td><td>(i)</td><td>$Na_2S_2O_3 + \mathbf{2}HCl \rightarrow S + SO_2 + \mathbf{2}NaCl + H_2O$</td><td>1</td><td>Correct multiples accepted.
Ignore state symbols if equation re-written.</td></tr>
<tr><td></td><td></td><td>(ii)
A</td><td><table><tr><th>Experiment</th><th>Volume of water (cm^3)</th></tr><tr><td>A</td><td>0</td></tr><tr><td>B</td><td>10</td></tr><tr><td>C</td><td>20</td></tr><tr><td>D</td><td>30</td></tr><tr><td>E</td><td>40</td></tr></table>
All entries correct 1 Mark.</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>B</td><td>35/35·1/35·09 (seconds or s)</td><td>1</td><td>No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).

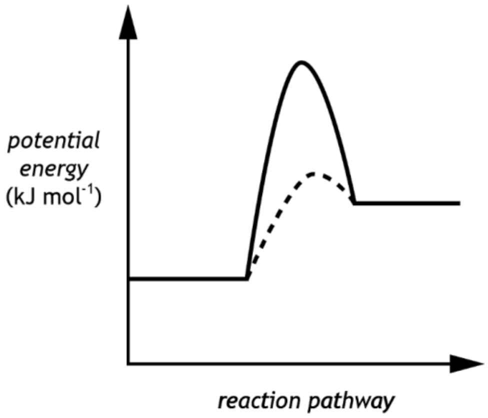
sec or secs not accepted.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>12 +/- 1 (°C)</td><td>1</td><td>Award 0 marks if 10°C given.

No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).

Degrees or ° not accepted</td></tr>
<tr><td></td><td>(b)</td><td></td><td>(Particles must have) sufficient or enough energy (to react).
OR
(Particles must have) energy equal to or greater than the activation energy or E_A.
OR
(Particles must have) minimum/ enough energy to form an activated complex. (1)

(Collision must occur with) suitable/correct/geometry/ orientation (1)</td><td>2</td><td>Do not accept ‘with correct speed’, ‘with high energy’ or “sufficient activation energy”.

“They”/”reactants” accepted for particles.</td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
1.	(c)	(i)	X shown at peak of curve	**1**	Must be centred and within the y-axis. Clear indication of the correct position of the activated complex is accepted.
		(ii)		**1**	The peak drawn shows a lower activation energy. Line drawn does not need to be a dotted/dashed line. The line drawn by the candidate must start and finish at the same potential energies as on the original diagram.

Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	Increasing/greater/stronger/larger nuclear charge (holds electrons more tightly) **OR** Increasing number of protons	**1**	Increased nuclear pull is not accepted on its own. Mention must be made of nuclear charge **or** number of protons. Increased attraction of the electron **for** the nucleus would be considered cancelling.
		(ii)	(More shells) so increased/more screening/shielding. **OR** Covalent radius increases/atom size increases/more shells so attraction of the nucleus/protons for the **outer electron** decreases.	**1**	'Shielding effect' by itself is not acceptable. If candidate says 'it' assume the candidate is talking about potassium.
	(b)	(i)	$N^+(g) \rightarrow N^{2+}(g) + e^-$	**1**	State symbols must be shown. Negative charge on the electron is not required.
		(ii)	The 6^{th} ionisation energy involves removing an electron from the shell which is inner/full (whole)/(more) stable/closer to the nucleus **OR** the 6^{th} electron is removed from the electron shell which is inner/full (whole)/(more) stable/closer to the nucleus. **(1)** The 6^{th} electron is less shielded **OR** the 6^{th} electron is more strongly attracted to/pulled towards the nucleus. **(1)**	**2**	Correct statements made about the 5th ionisation energy/electron can also be credited. Stating that the 6^{th} electron requires more energy than the 5^{th} electron is not sufficient on its own.
	(c)		Al forms Al^{3+}/loses electrons to form an ion **and** P forms P^{3-}/gains electrons to form an ion. **(1)** Aluminium ion has one less energy level than phosphide/phosphorus ion. **OR** Phosphide/phosphorus ion has one more energy level than aluminium ion. **(1)**	**2**	A diagram or electron arrangement of **both** ions would be sufficient to gain this first mark.

Question			Expected response	Max mark	Additional guidance
2.	(d)		(Radius ratio =) 0·96, (hence) caesium chloride (or correct formula).	**1**	Calculated value (of 0·96) or 135/140 must be written for radius ratio required for mark.

Question			Expected response	Max mark	Additional guidance
3.			This is an open ended question **1 mark:** The student has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. The student 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, at an appropriate level, of the chemistry involved. The student makes 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, at an appropriate level, of the chemistry involved. The student shows a good comprehension of the chemistry of the situation 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	Zero marks should be awarded if: The student has demonstrated no understanding of the chemistry involved. There is no evidence that the student has recognised the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the student merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	biological catalyst	**1**	Biochemical catalyst/protein that acts as a catalyst accepted
		(ii)	4·5/4·49/4·485 (%)	**1**	No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).
	(b)	(i)	Carbon dioxide/CO_2	**1**	
		(ii) A	0·25/0·3	**1**	Ignore any units.
		B	(Cider) B or (sample) 4	**1**	
	(c)		propan-1,2,3-triol **OR** propane-1,2,3-triol **OR** 1,2,3-propanetriol	**1**	
	(d)	(i)	(procyanidin B2) molecule is polar due to its **hydroxyl** groups **OR** (procyanidin B2) can form hydrogen bonds due to its **hydroxyl** groups **(1)** an explanation which links solubility of the molecule (procyanidin B2) to the polarity of water/hydrogen bonding of water **(1)**	**2**	(-)**OH** accepted as hydroxyl "Like dissolves like" on its own is not sufficient for 1 mark.
		(ii)	2-methylbutanoic acid	**1**	
		(iii)	Isoprene(s) **OR** 2-methylbuta-1,3-diene	**1**	Structure not accepted. Ignore any structure(s) drawn.
	(e)	(i)	carbonyl	**1**	
		(ii)	ethanoic acid/CH_3COOH	**1**	

Question			Expected response	Max mark	Additional guidance
5.	(a)	(i)	-694 (kJ mol^{-1}) Bond breaking (4 x 412) + (2 x 498) = 2644 Bond forming [(2 x 743) + (4 x 463)] = -3338 A single mark is available if either of the following operations is correctly executed **Either** The four relevant values for bond enthalpies of the C-H, O=O, C=O, and O-H (or multiples thereof) are retrieved from the data booklet (412, 498, 743, 463 – ignore signs). **OR** If only three correct values are retrieved, the candidate recognises that bond breaking is endothermic and bond forming is exothermic and have correctly manipulated the bond enthalpies and multiples that they have used with working shown.	**2**	+694 would qualify for 1 mark No units required. Only 1 mark can be awarded for the correct answer if wrong unit is given. (wrong units would only be penalised once in any paper) kJ is acceptable in place of kJ mol^{-1} (KJ or Kj or KJ mol^{-1} or Kj mol^{-1} accepted). If less than three bond enthalpies are retrieved then no mark can be awarded.
		(ii)	Mean bond enthalpy must refer to an average energy and to a number of compounds and bond enthalpy must relate to one compound/diatomic molecule.	**1**	

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>5.</td><td>(a)</td><td>(iii)</td><td>0·367/0·37/0·4 (g) (2)

Partial marking

n = V/V_m = 0·2/24 = 0·008333….(1)

an incorrectly calculated number of moles based on gas volume x 44 (1)

or by proportion

24 l → 44 g (1)

Follow through from incorrect multiples of 24 l or 44 g (1)</td><td>2</td><td>No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).

Working must be shown for incorrectly calculated number of moles based on gas volume.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(Record the) mass/weight of the burner before and after (heating the water)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>-3496 (kJ mol^{-1}) (3 marks)

If final answer is wrong a maximum of 2 marks for the following concepts may be awarded

1 mark for a demonstration of the correct use of the relationship $E_h = cm\Delta T$ as shown by
(4·18 x (an order of magnitude of 4) x 23)
(ignore units for this mark).

1 mark for evidence of the knowledge that enthalpy of combustion relates to 1 mole, evidenced by the scaling up of a calculated value of energy released.</td><td>3</td><td>An answer of +3496 would gain 2 marks.

No units required. A maximum of 2 marks can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).

kJ is acceptable in place of kJ mol^{-1} (KJ or Kj or KJ mol^{-1} or Kj mol^{-1} accepted).</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>1 mark for any of the following
Loss of heat/energy to the surroundings
Incomplete combustion (of heptane/alkane)
Loss (of heptane/alkane) by evaporation
No lid on container
No stirring
Absorption of heat glass/beaker or copper can</td><td>1</td><td>‘Not using a bomb calorimeter’ on its own would not be awarded a mark.
“Loss of heat” on its own is not sufficient but would not be cancelling.</td></tr>
</table>

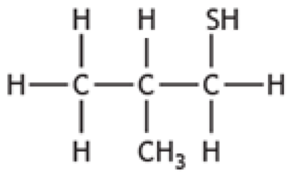
Question			Expected response	Max mark	Additional guidance
6.	(a)	(i) A	Same number of electrons (34) **(1)** **OR** same strength of London dispersion forces/LDFs **(1)**	**1**	
		(i) B	Propan-1-ol has stronger intermolecular/Van der Waal's forces than ethanethiol or vice versa. **OR** The intermolecular forces in propan-1-ol take more energy to break than those in ethanethiol or vice versa. **(1)** **1 mark** for identifying that the intermolecular forces in propan-1-ol are hydrogen bonds AND those in ethanethiol are permanent dipole – permanent dipole interactions/ attractions. **(1)**	**2**	If candidate says 'it/its' assume the candidate is talking about propan-1-ol. Any mention of breaking covalent/ ionic/metallic bonds is cancelling. Accept London Dispersion Forces/ LDFs in place of permanent dipole-permanent dipole interactions.
		(ii)	methanethiol	**1**	Accept methanthiol

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td></td><td></td><td>(iii)</td><td>11·853/11·85/11·9/12 mg – units required (2)

Correctly calculated mass of ethanethiol without units (1)

Appropriate units (1)
<table>
<tr><th>Mass (1)</th><th>Units (1)</th></tr>
<tr><td>12</td><td>mg</td></tr>
<tr><td>0·012</td><td>g</td></tr>
<tr><td>$1{\cdot}2 \times 10^{-5}$</td><td>kg</td></tr>
</table></td><td>2</td><td>If an incorrect mass is calculated but the units used are appropriate to the calculation then 1 mark would be awarded.

If the candidate’s working is unclear then the mark for units cannot be awarded.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>SH group is on a carbon connected to 3 other carbons/SH group is opposite the branch in a chain.

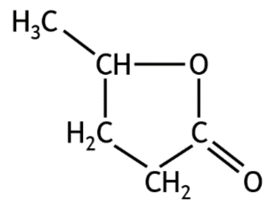
The SH group is attached to a carbon which has no hydrogens attached.</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii) A</td><td></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii) B</td><td>41·2 (g) (2)

OR

correct calculation of

Theoretical mass = 49·07 (g) (1)

Allow follow on from incorrect calculation of theoretical mass for 1 mark</td><td>2</td><td>Award 0 marks if candidate gives 25·6 grams (84% of reactant mass)</td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	propagation	1	
		(ii)	UV/ultraviolet	1	
		(iii)	Anti-oxidant/free radical scavenger/reducing agent/electron donor	1	
	(b)	(i)	Water/H_2O	1	
		(ii)		1	
		(iii)	3-hydroxybutanoic acid	1	

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	6	***1***	
		(ii)	London dispersion forces	**1**	Accept LDF
	(b)	(i)	dissolve the gelatin (in a small volume of water) **(1)** transfer quantitatively/with rinsings/washings **(1)** fill to the mark/line (of the volumetric flask) **(1)**	**3**	
		(ii)	11·0/11	**1**	
	(c)	(i)	Bromelain/enzyme changes shape or denatured. Bromelain/enzyme hydrogen bonds broken.	**1**	
		(ii)	38/37·9/37·88 (g)	**1**	No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	(+) 220 (+/- 2) (kJ mol^{-1})	1	No units required. No mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper). kJ is acceptable in place of kJ mol^{-1} (KJ or Kj or KJ mol^{-1} or Kj mol^{-1} accepted).
		(ii)	(Increasing temperature) favours the endothermic/reverse reaction **OR** The (forward) reaction is exothermic. **OR** The reverse reaction is endothermic.	1	
	(b)		Diagram shows a workable method for removal of HCl(g) allowing transfer of chlorine gas. Water/H_2O must be labelled. **(1)** Diagram shows a workable method of collecting a gas (eg a gas syringe). **(1)**	2	Treat each mark separately. Mark not awarded if delivery tube passes through the wall of measuring cylinder/test tube A closed system would not be a suitable method for collecting a gas.

Question			Expected response	Max mark	Additional guidance
	(c)		-391 (kJ mol^{-1}) **(2 marks)** Partial marks Treat as two concepts. Either would be acceptable for **1 mark**. Evidence of understanding of reversal of first enthalpy value. ie +75 must be seen. The other two enthalpy values (regardless of value) **must** be negative, or this partial mark cannot be awarded. **OR** Evidence of understanding of multiplying the third enthalpy value by 4(± 92). **OR** ± 368 Multiplication of any other enthalpy value by any factor is taken as cancelling of this partial mark.	**2**	**Only one concept mark can be awarded if the final answer is incorrect.** If answer given is +391, maximum of 1 mark can be awarded. No units required. Only 1 mark can be awarded for the correct answer if wrong unit is given. (wrong units would only be penalised once in any paper) kJ is acceptable in place of kJ mol^{-1} (KJ or Kj or KJ mol^{-1} or Kj mol^{-1} accepted).

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>10.</td><td>(a)</td><td></td><td>Chloride ions/magnesium ions/metal ions/salts may be present in tap water or not present/less in deionised/distilled water.</td><td>1</td><td>“ions” on its own is not sufficient
Accept chlorine but not chlorine ion(s).
If ions are shown, charges must be correct.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><th>Measurement</th><th>Apparatus</th></tr><tr><td>20·0 cm^3 (accurately)</td><td>Pipette</td></tr><tr><td>35 cm^3 (approximately)</td><td>Measuring cylinder</td></tr></table>
1 mark for each correct entry</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>E → C → B → D → A
First step … Last step

All correct for 1 mark</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>0·463/0·46/0·5 (g)

Partial marking (1 mark)

1 mark for knowledge of relationship between moles of silver chloride and magnesium chloride. This could be shown by a calculated number of moles of silver chloride correctly divided by 2

OR

Incorrect mole ratio used but the relationship between moles and mass used correctly twice

OR

by proportion

95·3 $\leftrightarrow$ 286·8 (2 x 143·4)

OR

Mole ratio not applied correctly but proportion used correctly</td><td>2</td><td>No units required. Only 1 mark can be awarded for correct answer if wrong unit is given (where no unit required, wrong units would only be penalised once in any paper).</td></tr>
<tr><td></td><td></td><td>(c)</td><td>96/96·0 (%)</td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
11.			This is an open ended question **1 mark:** The student has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. The student 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, at an appropriate level, of the chemistry involved. The student makes 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, at an appropriate level, of the chemistry involved. The student shows a good comprehension of the chemistry of the situation 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**	Zero marks should be awarded if: The student has demonstrated no understanding of the chemistry involved. There is no evidence that the student has recognised the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the student merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
12	(a)	(i)	Ionic and positively charged Both needed	**1**	Accept positive/+ve/+
		(ii) A	alkaline hydrolysis/saponification	**1**	Do not accept "hydrolysis" on its own. Hydrolysis with named strong alkali would be acceptable.
		(ii) B	(Compound C) has an ionic/hydrophilic part **and** a non polar/hydrophobic part (or alternative wording/diagram showing knowledge of these parts of the molecule) **(1)** Correctly identifies the part of the molecule/head/COO^- dissolves in water/ is hydrophilic and the part of the molecule/tail/hydrocarbon chain dissolves in oil/hydrophobic. **(1)** Agitation separates oil from the surface/cause small oil droplets to form **OR** The (negatively-charged) ball-like structures repel each other (and the oil or grease is kept suspended in the water) **OR** Soaps/compound C allow(s) emulsions to form or break(s) oil into micelles. **(1)** Accept correct diagrams with annotations that show above.	**3**	
		(iii)	Reacting them (edible oils) with glycerol/ propan-1,2,3-triol/propane-1,2,3-triol/ 1,2,3-propanetriol/$C_3H_8O_3$	**1**	

Question			Expected response	Max mark	Additional guidance
12.	(b)	(i)	Both nuclei have the same attraction for the bonding electrons. **OR** Both atoms have same electronegativity/ or electronegativity values given **OR** Bonding electrons shared evenly.	**1**	Diagram on its own not sufficient
		(ii)	**1 mark** for any of the following • To ensure all chlorine is used up/to prevent chlorine being released • NaOH is the cheaper/less expensive reactant • To ensure that the bleach cleaner contains sodium hydroxide • Excess NaOH would neutralise any acid added to cleaner • Excess NaOH helps break up oil/grease	**1**	
	(c)		(Adding acid) adds/increases H^+ (ions) **(1)** Rate of forward reaction is increased/ speeds up (by addition of acid) **(1)**	**2**	
	(d)	(i)	$OCl^-_{(aq)} + 2H^+_{(aq)} + 2e^- \rightarrow Cl^-_{(aq)} + H_2O_{(l)}$	**1**	State symbols not required but **any** given must be correct. Charge on electron not required.

Question			Expected response	Max mark	Additional guidance
12	(d)	(ii)	$1{\cdot}76 \times 10^{-2}$ (mol l^{-1}) (3 marks) 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 one of the following steps: Calculation of moles thiosulfate solution eg 0·098 × 0·009 = 0·000882 **OR** calculation of concentration of iodine solution eg 0·000441/0·025 **OR** Insertion of correct pairings of values for concentration and volume in a valid titration formula **1 mark** for knowledge of relationship between moles of thiosulfate and hypochlorite. This could be shown by one of the following steps: Calculation of moles hypochlorite from moles thiosulfate eg 0·000882/2 = 0·000441 **OR** Insertion of correct stoichiometric values in a valid titration formula **1 mark** is awarded for correct arithmetic through the calculation. This mark can only be awarded if both concept marks have been awarded.	**3**	No units required but only two marks can be awarded for correct answer if wrong unit is given. (wrong units would only be penalised once in the paper).

[END OF MARKING INSTRUCTIONS]