H

National
Qualifications
2022

2022 Chemistry

Higher Paper 1 – Multiple choice

Finalised Marking Instructions

Marking instructions for each question

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

[END OF MARKING INSTRUCTIONS]

H

National
Qualifications
2022

2022 Chemistry

Higher Paper 2

Finalised Marking Instructions

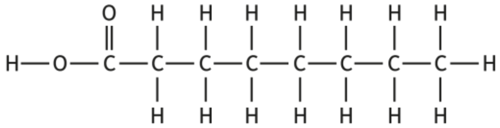
Marking instructions for each question

Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	(The atoms/nuclei) have the same attraction for the bonding electrons. **OR** (The atoms have) same electronegativity/electronegativity values given **OR** Bonding electrons shared equally (between the atoms).	**1**	Stating that it is a 'pure covalent bond' on its own is not sufficient. An unlabelled diagram on its own not sufficient
		(ii)	Increasing/greater/stronger/larger nuclear charge (holds electrons more tightly). **OR** Increasing number of/more 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.
	(b)	(i)	The energy required to remove one mole of electrons from one mole of gaseous atoms.	**1**	
		(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(s) decreases.	**1**	'Shielding effect' by itself is not acceptable.

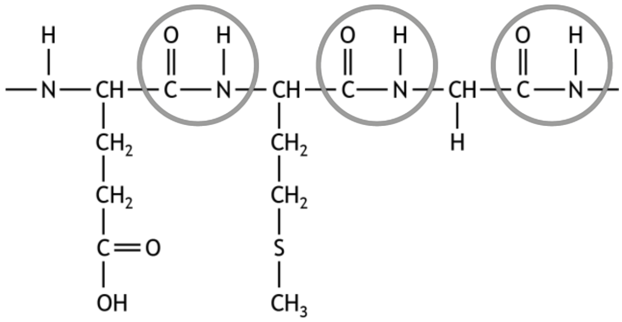
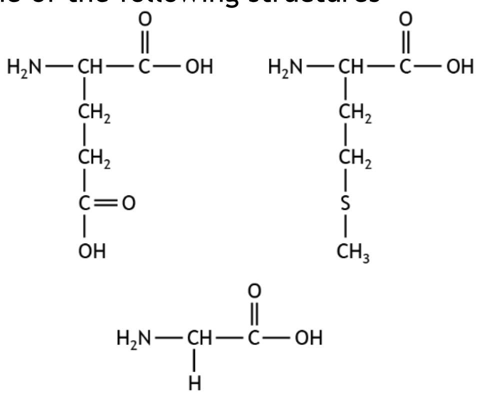
Question			Expected response	Max mark	Additional guidance
	(c)	(i)	Hydrogen bonds/bonding **(1 mark)** Hydrogen bonds occurs between molecules that have hydrogen: • bonded to N, O or F • bonded to a strongly electronegative element • bonded to an element with a large d difference in electronegativity compared to hydrogen • in a highly polar bond. **OR** Answers relating to the attraction between the opposite ends of the permanent dipole in molecules containing hydrogen atoms and the atoms of elements with high electronegativity/large difference in electronegativity **(1 mark)**	**2**	The first mark should not be cancelled by an incorrect explanation of how hydrogen bonding arises or an explanation of another type of bonding/interaction. All three of N, O and F must be listed.
		(ii)	Correctly identify that the London dispersion forces become stronger/increase (in moving from HCl to HI). **(1 mark)** The number of electrons in the molecules increases (from HCl to HI). **(1 mark)**	**2**	

Question			Expected response	Max mark	Additional guidance
2.	(a)		$3KClO_4 + 8Al \rightarrow 3KCl + 4Al_2O_3$	**1**	Correct multiples accepted.
	(b)	(i)	1.4/1.35/1.351 (litres) Partial marking Moles of $KClO_3$ = 0.03752 moles **(1 mark)** A 2:3 ratio applied to an incorrectly calculated number of moles and multiplied by 24 **(1 mark)** **OR** by proportion 245.2 g $\rightarrow$ 72 litres **(1 mark)** Follow through from incorrect multiples of 122.6 or 24 **(1 mark)**	**2**	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).
		(ii)	None/no effect	**1**	
		(iii)	2596/2595.6 (kJ)	**1**	Accept -2596/2595.6 Accept kJ per mole ($kJmol^{-1}$) KJ/Kj is acceptable in place of kJ No units required. No mark can be awarded for the correct answer if wrong unit is given. (Wrong units would only be penalised once in any paper).
		(iv)	Increases the number of particles with energy equal to or greater than the activation energy **OR** Increases the number of particles with (sufficient) energy to form an activated complex/to react **(1 mark)** More successful collisions **(1 mark)**	**2**	'Activation' complex accepted.
	(c)		Sodium	**1**	

Question			Expected response	Max mark	Additional guidance
3.			**This is an open-ended question.** **1 mark:** The candidate has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. They have made some statement(s) that are relevant to the situation, showing that they have understood at least a little of the chemistry within the problem. **2 marks:** The candidate has demonstrated, at an appropriate level, a reasonable understanding of the chemistry involved. They make some statement(s) that are relevant to the situation, showing that they have understood the problem. **3 marks:** The maximum available mark would be awarded to a candidate who has demonstrated, at an appropriate level, a good understanding, of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and provide 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. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks.	3	**Award 0 marks** where the candidate has not demonstrated, at an appropriate level, an understanding of the chemistry involved. There is no evidence that they have recognised the area of chemistry involved, or they have not given any statement of a relevant chemistry principle. Award zero marks also if the candidate merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	Ester (link)	1	
		(ii)		1	Accept correct shortened structural formula.
		(iii)	Any correctly named alcohol with 7 carbons.	1	Position of OH must be given in name.
	(b)	(i)	35 – 45 inclusive	1	
		(ii)	Glyceryl trilinoleate	1	
	(c)	(i)	By reacting with glycerol.	1	Adding/combining/joining to glycerol not accepted.
		(ii)	Correctly identifying that the emulsifier has two parts with different polarities or two parts that are hydrophobic/hydrophilic. **(1 mark)** Hydrophobic part/hydrocarbon chain/fatty acid chain/non-polar part dissolves in non-polar liquids whilst the hydrophilic part/hydroxyl groups/polar part dissolve in polar liquids. **(1 mark)**	2	Reference to heads and tails as parts of molecule is accepted.

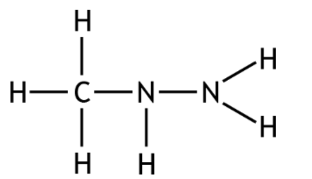
<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>5.</td><td>(a)</td><td></td><td>3-methylbutan-1-ol</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>$C_3H_7OH \rightarrow C_3H_6O + 2H^+ + 2e^-$</td><td>1</td><td>Ignore state symbols.
Charge on electron not required.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>To provide hydrogen ions</td><td>1</td><td>Ignore state symbols.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Orange to green</td><td>1</td><td>Accept blue or blue/green</td></tr>
<tr><td></td><td></td><td>(iv)</td><td>Tollens’ (reagent)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(v)</td><td>It is a tertiary alcohol.</td><td>1</td><td>Correct description of tertiary alcohol accepted.</td></tr>
<tr><td></td><td></td><td>(vi)</td><td><table><tr><th></th><th>Oxygen to hydrogen ratio</th></tr><tr><td>Butan-1-ol</td><td>1:10</td></tr><tr><td>Butanal</td><td>1:8</td></tr></table></td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	Biological catalyst	**1**	Biochemical catalyst/protein that acts as a catalyst are accepted.
		(ii) (A)		**1**	Any one correctly circled peptide link from those shown. Accept the C-N circled. Either the bond alone or including the C and N.
		(ii) (B)	any one of the following structures 	**1**	Ignore incorrect connectivity in the side chains only.
		(ii) (C)	An amino acid that cannot be made in the body/must be obtained through diet.	**1**	
		(ii) (D)	Condensation	**1**	Condensation polymerisation accepted.
		(iii)	Enzyme becomes denatured/ enzyme changes shape **(1 mark)** Intermolecular/hydrogen bonds are broken **(1 mark)**	**2**	
		(iv)	Diagram showing closed reaction vessel with reactants in contact with each other **(1 mark)** A means of measuring and collecting gas from the closed vessel **(1 mark)** Correct labelling of hydrogen peroxide, sweet potato and oxygen. Oxygen must be labelled inside the gas collection apparatus. **(1 mark)**	**3**	Addition of catalase/water labels are regarded as non-cancelling. Graduations must be shown on gas collection apparatus. First mark not awarded if delivery tube passes through the side of a measuring cylinder.

Question			Expected response	Max mark	Additional guidance
6.	(b)	(i)	To prevent unwanted oxidation/to oxidise in place of the compounds they have been added to protect/to stop (oxidation of edible oils) food acquiring a rancid flavour.	**1**	To 'prevent oxidation' on its own is not sufficient. To stop food going rancid is accepted.
		(ii)	Vitamin C molecule is polar due to its hydroxyl groups. **OR** Vitamin C can form hydrogen bonds due to its hydroxyl groups. **(1 mark)** An explanation which links solubility of vitamin C to the polarity of water/hydrogen bonding of water. **(1 mark)**	**2**	Accept (-OH) for hydroxyl. 'like dissolves like' not sufficient on its own for 1 mark
	(c)		975 (2) g (1) Partial marking 195 (mg) (of solanine) **(1 mark)** **OR** 15 (g) **(1 mark)** **OR** Correct scaling of a calculated mass of solanine to a mass of potato **(1 mark)**	**3**	Allow alternative units of mass as long as these match the numerical answer eg 0.975 kg Units mark can only be awarded with wrong numerical answer as long as evidence of scaling is shown.

Question			Expected response	Max mark	Additional guidance
7.	(a)		0.2/0.20/0.203 g Partial marking Using cmΔT with c = 4·18, m = a factor of 10 of 0.1 and ΔT = 27 (**1 mark**) Applying the concept that the combustion of 1 mole (16 g) of methane burns to produce 891 kJ (**1 mark**)	**3**	No units required. Only 2 marks can be awarded for the correct answer if wrong unit is given. (Wrong units would only be penalised once in any paper).
	(b)		-816 (kJ mol^{-1}) Partial marking 1 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, 804, 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**	+816 would qualify for 1 mark Bond breaking (4 × 412) + (2 × 498) = 2644 Bond forming [(2 × 804) + (4 × 463)] = -3460) 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.

Question			Expected response	Max mark	Additional guidance
7.	(c)		17.647/17.65/17.6/18 (%) --------------------------------------- Partial mark for correct use of atom economy relationship without correct use of stoichiometry (working must be shown). Partial marking Correct working with no correct answer given. $\frac{(3 \times 2)}{(16 + 18)} \times 100$ $\frac{6}{(16 + 18)} \times 100$ **OR** Incorrect use of stoichiometry. $\frac{2}{(16 + 18)} \times 100 = 5.88$ Answer and working must be shown. --------------------------------------- 0.176 **(1 mark)**	2	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).
	(d)		<table><tr><th>Condition</th><th>High/Low</th></tr><tr><td>Temperature</td><td>**high**</td></tr><tr><td>Pressure</td><td>**low**</td></tr></table>	1	

Question			Expected response	Max mark	Additional guidance
7.	(e)	(i)	-4632 (kJ) [(-216) + (+100) + (-1576) + (-3432) + (+492)] = -4632 (kJ) Partial marking Either would be acceptable for 1 mark. Evidence of understanding of reversal of first enthalpy value (ie –54 or -216 must be seen) and the second enthalpy value (ie +20 or +100 must be seen). The other three enthalpy values (regardless of value) must not be reversed, or this partial mark cannot be awarded. **OR** Evidence of understanding of multiplying the first enthalpy value by 4 (+/- 216) **and** the second enthalpy value by 5 (+/1 100) **and** the third enthalpy value by 4 (+/- 1576) **and** the fourth enthalpy value by 12 (+/- 3432) **and** the fifth enthalpy value by 12 (+/- 492). Ignore the enthalpy signs associated with these numbers.	2	
		(ii)		1	

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>8.</td><td>(a)</td><td>(i)</td><td>One mark for effect on rate (both responses needed), one mark for effect on equilibrium position.

<table><tr><th>Feature of reaction</th><th>Effect of catalyst</th></tr><tr><td>Rate of forward reaction</td><td>Increase</td></tr><tr><td>Rate of reverse reaction</td><td>Increase</td></tr><tr><td>Position of equilibrium</td><td>No effect</td></tr></table></td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Graph should show decrease in yield as temperature increases.</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Correctly calculates number of moles of:
Sorbic acid = 0.0625
Potassium hydroxide = 0.125

OR

Working out that 14 g of sorbic acid would be needed to react with potassium hydroxide (1 mark)

Statement demonstrating understanding of limiting reactant:

E.g. that there are fewer moles of sorbic acid therefore it is the limiting reactant

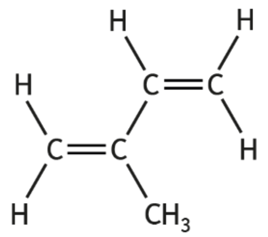
OR

there are more moles of potassium hydroxide therefore it is in excess

OR

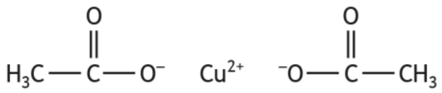
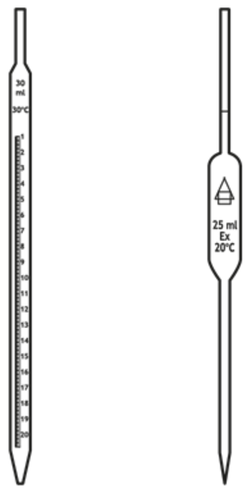
that 0.125 moles of potassium hydroxide would require 0.125 moles of sorbic acid (1 mark)</td><td>2</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
8.	(c)		2.52×10^{-5} (moles) Partial marking 1/261.8 (0.00382) in 100 cm^3 0.0126 in 330 cm^3 **(1 mark)** Follow through from incorrectly calculated number of moles multiplied by 0.002 **(1 mark)** **OR** $0.002 \times 3.3 = 0.0066$ **(1 mark)** Follow through from incorrectly calculated mass divided by 261.8 **(1 mark)**	**2**	

Question			Expected response	Max mark	Additional guidance
8.	(d)	(i) (A)	Volatile/non-water soluble/aroma	**1**	
		(B) (I)	Terpene	**1**	
		(B) (II)		**1**	
		(B) (III)	3	**1**	
		(ii) (A)	Water/H_20	**1**	
		(ii) (B)	hydroxyl AND carbonyl	**1**	Formulae -OH/-C=O not accepted. Ether or benzene ring accepted.

Question			Expected response	Max mark	Additional guidance
9.			**This is an open-ended question.** **1 mark:** The candidate has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. They have made some statement(s) that are relevant to the situation, showing that they have understood at least a little of the chemistry within the problem. **2 marks:** The candidate has demonstrated, at an appropriate level, a reasonable understanding of the chemistry involved. They make some statement(s) that are relevant to the situation, showing that they have understood the problem. **3 marks:** The maximum available mark would be awarded to a candidate who has demonstrated, at an appropriate level, a good understanding, of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and provide 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. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks.	3	**Award 0 marks** where the candidate has not demonstrated, at an appropriate level, an understanding of the chemistry involved. There is no evidence that they have recognised the area of chemistry involved, or they have not given any statement of a relevant chemistry principle. Award zero marks also if the candidate merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	Less fluorine(s) (atoms) give a higher ODP. **OR** More fluorine(s) (atoms) gives a lower ODP. **OR** Less chlorine(s) (atoms) give a lower ODP. **OR** More chlorine(s) (atoms) gives a higher ODP.	**1**	Symbols F/Cl accepted in place of names. Use of fluorine/ chlorine 'molecules' would be considered cancelling.
		(ii)	1 and 5	**1**	$C_2F_4Br_2$ (1) and $C_2F_4Cl_2$ (5)
		(iii)	Carbon dioxide and ammonia do not contain halogen (atoms)/do not damage the ozone layer.	**1**	Accept names of halogens or group 7 elements Use of 'molecules' would be considered as cancelling.
	(b)	(i)	Species (atoms/molecules/particles) with unpaired electrons.	**1**	Use of 'element(s)' would be considered as cancelling.
		(ii) A	initiation	**1**	
		(ii) B	Any correct propagation step accepted, e.g. $F\bullet + CH_3F \rightarrow \bullet CH_2F + HF$ **OR** $F_2 + \bullet CH_2F \rightarrow CH_2F_2 + F\bullet$ **OR** $F_2 + \bullet CH_3 \rightarrow CH_3F + F\bullet$ **OR** $\bullet CH_2F + HF \rightarrow CH_2F_2 + H\bullet$	**1**	
	(c)		0.208/0.21/0.2 (moles)	**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
11.	(a)	(i)	water and carbon dioxide	**1**	Formulae accepted.
		(ii)	$(CH_3COO^-)_2Cu^{2+}$ 	**1**	Brackets are required.
	(b)		Dissolve oxalic acid (in small volume of water) **(1 mark)** transfer quantitatively/with rinsings/washings **(1 mark)** fill/make up to the mark/line in a volumetric/standard flask. **(1 mark)**	**3**	If a solvent other than water is mentioned a maximum of 2 marks can be awarded.
	(c)	(i)	Diagram of graduated or bulb pipette. NOT dropping (Pasteur) pipette  graduated pipette volumetric pipette	**1**	Volumetric mark must be shown. End of pipette must narrow to a point.
		(ii)	pink to colourless	**1**	'Clear' is not accepted for colourless.
		(iii)	concordant	**1**	

Question			Expected response	Max mark	Additional guidance
11.	(d)		0.27/0.3 (mol l^{-1}) average titre = 26.75cm^3 n (oxalic acid) = 0.02675 × 0.126 = 3.3705 × 10^{-3} moles n (sodium hydroxide) = 2 × 3.3705 × 10^{-3} =6.741 × 10^{-3} moles concentration = 6.741 × 10^{-3} ÷ 0.025 = 0.27 (0.26964)moll^{-1} **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 oxalic acid solution e.g. 0·02675 × 0·126 = 3.3705 × 10^{-3} moles **OR** calculation of concentration of sodium hydroxide e.g. 6.741 × 10^{-3} ÷ 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 oxalic acid and sodium hydroxide. This could be shown by one of the following steps: Calculation of moles sodium hydroxide from moles oxalic acid eg 2 × 3.3705 × 10^{-3} =6.741 × 10^{-3} moles **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. Only 2 marks can be awarded for the correct answer if wrong unit is given. (Wrong units would only be penalised once in any paper).

[END OF 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.

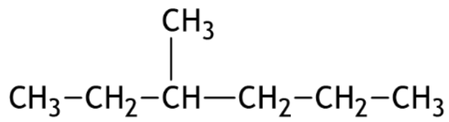
(l) Award marks for a symbol or correct formula in place of a name **unless stated otherwise in the detailed marking instructions.**

(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. $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(\ell)$. 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.'