National Qualifications 2025

2025 Chemistry

National 5

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

General marking principles for National 5 Chemistry

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 detailed marking instructions, which identify the key features required in candidate responses.

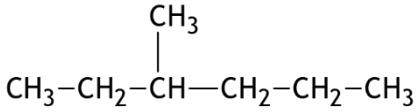
(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) 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.

(c) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

A guiding principle in marking is to give credit for correct chemistry rather than to look for reasons not to award 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 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 in the table.

Structural formula	***pH***
CH_3COOH	1.65
$CH_2ClCOOH$	1.27
$CHCl_2COOH$	0.90
CCl_3COOH	0.51

State how the strength of the acids is related to the number of chlorine atoms in the molecule.

Although not completely correct, an answer such as 'the more Cl_2, the stronger the acid' should gain the mark.

(d) There are no half marks awarded.

(e) Candidates must respond to the 'command' word as appropriate and may be required to write extended answers in order to communicate fully their knowledge and understanding.

(f) Marks should be awarded for answers that have 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.

However, the example below would not be given any credit, as an incorrect chemical term, which the candidate should know, has been given.

Example: If the correct answer is 'ethene', and the candidate's answer is 'ethane', this should not be accepted.

(g) A correct answer followed by a wrong answer should be treated as a cancelling error and no marks should be awarded.

Example: State what colour is seen when blue Fehling's solution is warmed with an aldehyde.

The answer 'red, green' gains no marks.

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

Example: State why the tube cannot be made of copper.

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

(h) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units if required) on its own.

The partial marks shown in the marking scheme are for use when working is given but the final answer is incorrect. An exception is when candidates are asked to 'Find, by calculation', when full marks cannot be awarded for the correct answer without working.

(i) In most questions units are not required. However, if the candidate writes units then they must be correct. An incorrect unit would not be acceptable and one mark would not be awarded.

This marking instruction must only be applied a maximum of once per paper.

(j) Where the marking instructions specifically allocate a mark for units in a calculation, this mark should not be awarded if the units are incorrect or missing. Missing or incorrect units at intermediate stages in a calculation should be ignored.

(k) As a general rule, where a wrong numerical answer (already penalised) is carried forward to another step, credit will be given provided the result is used correctly. 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 of partial marks.

(l) Ignore the omission of one H atom from a full structural formula provided the bond is shown or one carbon to hydrogen bond missing provided the hydrogen is shown.

(m) A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the marking instructions**.

(n) 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.

(o) If an answer comes directly from the text of the question, no marks should be awarded.

Example: A student found that 0·05 mol of propane, C_3H_8 burned to give 82.4 kJ of energy.

Name the type of enthalpy change which the student measured.

No marks should be awarded for 'burning' since the word ‘burned’ appears in the text.

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

Example: Suggest why the (catalytic) converter has 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 awarded.

Marking instructions for each question

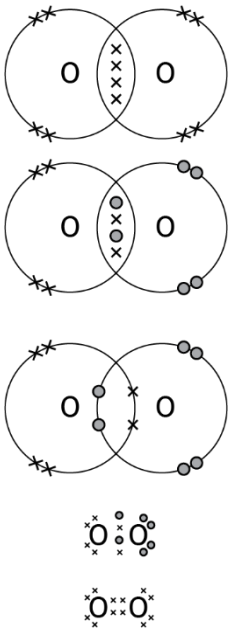
Section 1

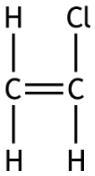
Question	**Answer**	**Mark**
1.	A	**1**
2.	C	**1**
3.	D	**1**
4.	B	**1**
5.	B	**1**
6.	A	**1**
7.	D	**1**
8.	B	**1**
9.	A	**1**
10.	C	**1**
11.	D	**1**
12.	D	**1**
13.	C	**1**
14.	A	**1**
15.	B	**1**
16.	C	**1**
17.	B	**1**
18.	A	**1**
19.	D	**1**
20.	D	**1**
21.	A	**1**
22.	C	**1**
23.	C	**1**
24.	D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

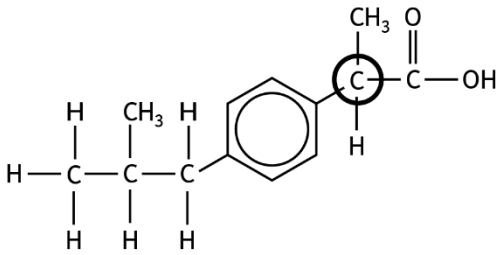
Section 2

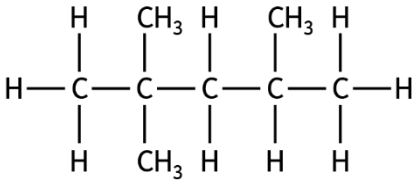
Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	Burns with a pop.	**1**	Any mention of glowing splint would negate.
		(ii)	No stopper on conical flask. **OR** Bisecting line on end of delivery tube indicates a blockage. **OR** Graduation marks should be on measuring cylinder. **OR** Measuring cylinder should be labelled.	**1**	Any one correct response for 1 mark. If more than one is given, then all must be correct. Annotation on the diagram is acceptable if correct.
		(iii)	Evaporation	**1**	Accept a correct description e.g. heat it. Do not accept burning in place of heat. Filtration should be awarded zero marks but does not negate a correct answer.
	(b)	(i)	1.72 - 1.76 ($cm^3\ s^{-1}$) **(2 marks)** Partial marking 1 mark awarded for concept of change in volume/change in time. $\frac{86}{50}$ $\frac{87}{50}$ $\frac{88}{50}$ **(1 mark)**	**2**	The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper. Accept cm^3/s or unit in words. Do not accept cm^3/s^{-1} or sec. **The mark for a final answer can only be awarded if the concept of change in volume/change in time is correct ie incorrect values from the graph used (volumes chosen must correspond to chosen times).** An answer out with the range of 1.72 - 1.76 must be supported by working.

Question			Expected response	Max mark	Additional guidance
1.	(b)	(ii)	Line must start at zero and be less steep than the line given in the question. If the line levels off then it must do so **on or after** 80 s with a final volume of 96 cm^3.	**1**	Apply a ½ box tolerance to where the line starts and where the line levels off.
		(iii)	48 (cm^3)	**1**	The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
2.	(a)		Must show all outer electrons 	**1**	Accept cross or dot or e or e- to represent electrons or a mixture of these. Accept petal diagram. Bonding electrons MUST be on the line or in the overlapping area. Element symbols do not need to be shown if the circles for the outer shell are shown. If inner electrons are shown they must be correct.
	(b)		Any element name or correct symbol of: Sulfur/Selenium/Tellurium/ Polonium/Livermorium.	**1**	
	(c)		As the temperature increases the solubility decreases. **OR** As the temperature decreases the solubility increases.	**1**	Zero marks awarded for an incorrect cause and effect. eg As the solubility increases the temperature decreases. **OR** As the solubility decreases the temperature increases.
	(d)	(i)	Angular	**1**	
		(ii)	Positive, electrons	**1**	

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)		**1**	
		(ii)	Diatomic	**1**	Any mention of compound/element/atoms would negate a correct answer.
	(b)	(i)	Bars not points **(1 mark)** All bars correct (within a ½ box tolerance) **(1 mark)**	**2**	
		(ii)	The PVC would melt. **OR** The melting point of PVC is too low/less than 100 °C/less than the boiling point of water.	**1**	Zero marks awarded for 'it has a low/lower melting point' on its own, but this does not negate a correct answer.

Question			Expected response	Max mark	Additional guidance
4.	(a)		Carboxyl	**1**	Zero marks awarded for -COOH **OR** Carboxylic.
	(b)	(i)	Hydrogenation	**1**	
		(ii)	A substance that speeds up a chemical reaction (but can be recovered chemically unchanged at the end of the reaction).	**1**	Use of element / compound in place of substance is not accepted.
	(c)			**1**	
	(d)		Ibuprofen	**1**	

Question			Expected response	Max mark	Additional guidance
5.	(a)		Substance that burns/combusts to release energy/heat.	**1**	
	(b)	(i)		**1**	Accept mixture of shortened and full structural formula. Zero marks awarded for C_8H_{18}
		(ii)	Isobutene will decolourise bromine solution. **OR** Isobutane will not decolourise bromine solution.	**1**	Accept bromine/bromine water/ bromine solution but do not accept bromide or Br. Zero marks awarded for 'goes clear' however if given in addition to a correct answer it does not negate. If starting colour is given it must be correct eg orange/yellow/red/orange-brown/red-brown or brown. Award zero marks if the candidate implies it is the hydrocarbon that is being decolourised.
	(c)	(i)	(increasing the number of branches) Lowers (the flash point).	**1**	Zero marks awarded for an incorrect cause and effect. eg As the flash points lowers the number of branches increases. Zero marks awarded for decreasing the number of branches increases the flash point.
		(ii)	29 – 31 (^oC)	**1**	The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
5.	(d)	(i)	They contain/provide/supply oxygen. **OR** They ensure **complete combustion**.	**1**	Candidates response must indicate that the oxygenates contain oxygen.
		(ii)	Ethanol/it has bigger/stronger/ more forces (of attraction). **(1 mark)** Between molecules or mention of intermolecular attractions. **(1 mark)** --- If neither of these two points are given, a maximum of 1 mark can be awarded for – ethanol/it is bigger/has more (carbon or hydrogen) atoms/longer carbon chain.	**2**	The term bond is only acceptable if it is specifically identified as between the molecules or used with the term intermolecular. Mention of breaking bonds/bonds within molecule or chain/breaking carbon to carbon or carbon to hydrogen bonds or more bonds cannot gain the second mark but does not negate the first mark. Candidates can be awarded the full/partial marks if they correctly explain why methanol has a lower boiling point, but methanol **must** be stated in their answer. More bonds in the compound is not sufficient to imply a larger molecule but does not negate.

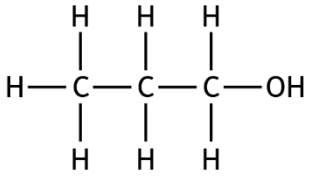
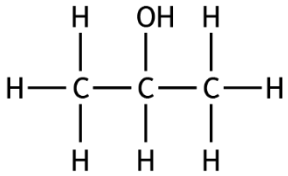
Question			Expected response	Max mark	Additional guidance
6.			This is an open ended question. **1 mark**: The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) that is/are relevant to the situation, showing that at least a little of the chemistry within the context is understood. **2 marks**: The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) that is/are relevant to the situation, showing that the context is understood. **3 marks**: The maximum available mark would be awarded to a student who has demonstrated a good understanding 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 context. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	**3**	

Question			Expected response	Max mark	Additional guidance
7.	(a)		The nucleus	**1**	
	(b)	(i)	Sodium, hydrogen and oxygen. **OR** Na, H and O	**1**	Phosphorus is not required but would not negate a correct answer. Phosphate would negate a correct answer. Accept H_2/O_2.
		(ii)	Stays the same	**1**	
	(c)	(i)	Xenon/Xenon-131/Xe/Xe-131 **OR** ^{131}Xe / $^{131}_{54}Xe$ / $_{54}Xe$	**1**	
		(ii)	8 (days) **(2 marks)** Partial Marking 4 half lives **(1 mark)** If incorrect number of half lives is calculated then 1 mark can be awarded for 32 divided by the candidates number of half lives provided the arithmetic is correct.	**2**	The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper.
	(d)	(i)	Scale - going up in increments of 5 starting at zero.	**1**	A minimum of two numbers must be shown on the scale. The zero does not need to be shown.
		(ii)	Time **and** Years (both required).	**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></td><td>Mass</td><td>1</td><td>Zero marks awarded for ‘mass of a molecule’ but this does not negate a correct answer.</td></tr>
<tr><td></td><td>(b)</td><td></td><td>$^{12}_{6}C$</td><td>1</td><td>Do not penalise if the atomic number and mass number is written on the right hand side of the symbol.</td></tr>
<tr><td></td><td>(c)</td><td></td><td>18 (g)</td><td>1</td><td>The unit is not required but, if given, must be correct.

This marking instruction must only be applied a maximum of once per paper.</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Electrons (they) have no/negligible mass.</td><td>1</td><td></td></tr>
<tr><td></td><td>(e)</td><td></td><td><table><tr><th>Molecular formula</th><th>Total number of atoms in molecule</th><th>Number of atoms in one mole</th></tr><tr><td>CH_4</td><td>5</td><td>5L</td></tr></table></td><td>1</td><td>Accept $3.01x10^{24}$ in place of 5L

The L in the table must be uppercase.</td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Isomers	**1**	
		(ii)	 **AND** propan-1-ol **(2 marks)** **OR**  **AND** propan-2-ol **(2 marks)** --- Partial Marking 1 mark can be awarded for either a correct name or correct structure.	**2**	Accept mixture of shortened and full structural formula. Accept - 1-propanol in place of propan-1-ol - 2-propanol in place of propan-2-ol Ignore - the omission of one H atom, from a carbon, in full structural formula provided the bond is shown. **OR** - one carbon to hydrogen bond missing provided the hydrogen is shown. Connectivity to the hydroxyl group must be to the oxygen.
	(b)		$C_3H_7OH + 4.5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$	**1**	Accept correct multiples. If equation is rewritten, all formulae must be correct and correct format. Ignore state symbols if given.
	(c)	(i)	To prevent heat loss (to the surroundings).	**1**	
		(ii) (A)	21 (^oC)	**1**	The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
9.	(c)	(ii) (B)	8.78/8.778/8.8/9 (kJ) **(3 marks)** --- Partial Marking Use of correct concept of Eh = cmΔT with c = 4.18 **(1 mark)** To be awarded this concept mark, candidates do not specifically need to write cmΔT. The concept mark is awarded for multiplying three values, one of which must be 4.18 0.1 and answer from (c)(ii)(A). **(1 mark)** A further mark can be awarded for the candidate's calculated answer only if the mark for the concept has been awarded. **(1 mark)**	**3**	Allow follow through from (c)(ii)(A). No units required but a maximum of two marks can be awarded if an incorrect unit is given. This marking instruction must only be applied a maximum of once per paper. 8778 J can be awarded 3 marks if used with 4180 and the correct unit is given.

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	Solvent	**1**	
		(ii) (A)	Ethenol	**1**	
		(ii) (B)	It does not have a carbon-to-carbon double bond/it only contains single carbon-to-carbon bonds. **OR** It is saturated/it is not unsaturated.	**1**	
	(b)	(i)	Titration	**1**	
		(ii)	To indicate the end point/to show when the reaction is neutral/ complete.	**1**	

Question			Expected response	Max mark	Additional guidance
10.	(b)	(iii)	0·152 / 0.15 / 0.2 (mol l^{-1}) **(3 marks)** --- **Method A** 1 mark for the correct number of moles of sodium carbonate. ie n = CV = 0.1 × 0.019 = 0.0019 mol **(1 mark)** 1 mark for calculating the moles of hydrochloric acid by correctly applying the mole ratio. ie 2 × candidate's calculated number of moles of Na_2CO_3 **(1 mark)** 0·0038 mol of HCl on its own. **(2 marks)** 1 mark for calculating the concentration of the hydrochloric acid. ie C = n/V using candidate's calculated number of moles of HCl and 0·025 **(1 mark)** --- **Method B** $\frac{0.1 \times 19}{1} = \frac{C_2 \times 25}{2}$ **(1 mark)** **(1 mark)** $C_2 \times 12.5 = 1.9$ or $C_2 \times 25 = 3.8$ (this step on its own gets **2 marks**) **OR** $\frac{0.1 \times 0.019}{1} = \frac{C_2 \times 0.025}{2}$ **(1 mark)** **(1 mark)** $C_2 \times 0.0125 = 0.0019$ **OR** $C_2 \times 0.025 = 0.0038$ (this step on its own gets **2 marks**)	**3**	No units required but a maximum of two marks can be awarded if an incorrect unit is given. This marking instruction must only be applied a maximum of once per paper. Accept mol l^{-1} or mol/l but not mol/l^{-1} or mol^{-1} or mol l **For method A** Candidates should not be penalised if 19 **and** 25 (volumes of sodium carbonate and hydrochloric acid) are both expressed in cm^3. If candidate only calculates number of moles of sodium carbonate the volume must be in litres to be awarded 1 mark. If candidate correctly multiplies their calculated number of moles of sodium carbonate by 2 the mark for the mole ratio can be awarded. If concentration of incorrect chemical is calculated then max = 1 mark. **For method B using relationship shown in the data book.** 1 mark is awarded for the correct pairings of volume (in the same unit) and concentration. 1 mark is awarded for the correct mole ratio **being applied**. 1 mark is awarded for the correct arithmetic. This mark can only be awarded if either of the first two marks have been awarded.

Question			Expected response	Max mark	Additional guidance
11.	(a)		Lithium nitrate	**1**	
	(b)		3·75/3.8 (g) **(3 marks)** --- Partial Marks can be awarded for a maximum of two of the following three steps: 1 mark for correctly calculating the number of moles of lithium oxide. ie n = CV = 0·25 × 0·5 = 0·125 mol **(1 mark)** 1 mark for correctly calculating the GFM of lithium oxide. ie GFM = 30 **(1 mark)** 1 mark for calculating the mass of lithium oxide. ie m = n × GFM using candidates calculated moles of lithium oxide and candidates calculated GFM **(1 mark)**	**3**	No units required but a maximum of two marks can be awarded if an incorrect unit is given. This marking instruction must only be applied a maximum of once per paper. An incorrect number of moles or GFM of lithium oxide must be supported by working.
	(c)		Copper carbonate **OR** $CuCO_3$	**1**	
	(d)	(i)	exothermic	**1**	
	(d)	(ii) (A)	−100 (kJ)	**1**	Negative value must be shown. The unit is not required but, if given, must be correct. This marking instruction must only be applied a maximum of once per paper.
		(ii) (B)	Decrease (**1 mark**) No Effect (**1 mark**)	**2**	

Question			Expected response	Max mark	Additional guidance
12.			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) that is/are relevant to the situation, showing that at least a little of the chemistry within the context is understood. **2 marks**: The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) that is/are relevant to the situation, showing that the context is understood. **3 marks**: The maximum available mark would be awarded to a student who has demonstrated a good understanding 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 context. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	**3**	

[END OF MARKING INSTRUCTIONS]