N5

National
Qualifications
2023

2023 Chemistry

National 5

Finalised Marking Instructions

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Marking instructions for each question

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

Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)		7	**1**	
	(b)		35/Chlorine-35/ ^{35}Cl / $^{35}_{17}Cl$	**1**	Accept Cl^{35} or Cl^{35}_{17}
	(c)		Fluorine/F_2 **OR** Bromine/Br_2 **OR** Any other group 7 element.		Do not accept F/Br/I.
	(d)		<table><tr><td></td><td>**Electrons**</td><td>**Neutrons**</td></tr><tr><td>$^{24}_{12}Mg^{2+}$</td><td>10</td><td></td></tr><tr><td>$^{37}_{17}Cl^{-}$</td><td></td><td>20</td></tr></table>	**2**	

Question			Expected response	Max mark	Additional guidance
2.	(a)		Hydrocarbon	**1**	
	(b)	(i)	Hydrogen/H_2	**1**	Do not accept H
		(ii)	Bromine/Br_2 decolourised (by ethene.) **OR** Bromine/Br_2 goes colourless (in ethene.)	**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/orange-brown/red-brown or brown.
	(c)	(i)	$H—C \equiv C—H$	**1**	
		(ii) (A)	Carbon dioxide and water. Both required for **1 mark**	**1**	Accept correct formulae.
		(ii) (B)	(A reaction that) produces/ releases energy/heat.	**1**	

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>3.</td><td>(a)</td><td></td><td>Group 1/Column 1
OR
Group 2/Column 2</td><td>1</td><td>Accept correct group names in place of number.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>$KMnO_4$</td><td>1</td><td>If charges are included, both need to be present and correct.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Aluminium/Al
OR
Zinc/Zn
OR
Beryllium/Be</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Gas produced</th><th>Test and result</th></tr><tr><td>hydrogen</td><td>burns with a pop</td></tr></table>
Both required for 2 marks.

Incorrect gas with correct test for that gas. (1 mark)

Correct gas but incorrect test/result. (1 mark)</td><td>2</td><td>Award one mark if no gas is identified but a correct test and result is given for hydrogen gas.</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>Voltage higher than 0.5 but lower than 2.7 (volts/V).</td><td>1</td><td>No unit is required but an incorrect unit negates. This marking principle is only applied once per paper.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(Electrically conducting) solutions/ melts containing ions/ionic solution.</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Volume/type/concentration of electrolyte/solution.

Depth of immersion of metals/ electrodes.

Size/mass of metals/electrodes.

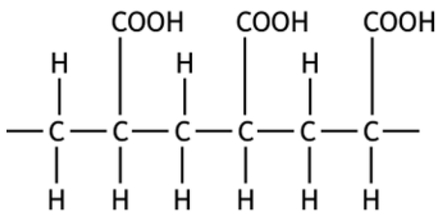
Separation of metals/electrodes.

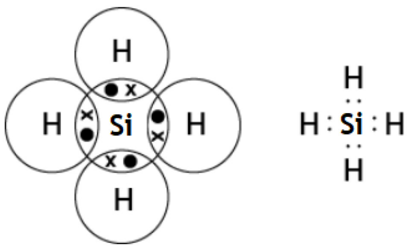
Temperature.

Use of copper each time.</td><td>1</td><td>Zero marks awarded for amount of electrolyte/time/metal.</td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
4.	(a)		(The) air/atmosphere.	**1**	
	(b)		It doesn't get used up/can be recovered, chemically unchanged, at the end of the reaction/can be reused **OR** Allows the reaction to be carried out at a lower temperature.	**1**	
	(c)		534/534.1/534.09 (moles) --- Partial Marking: n = $\frac{4700}{44}$ = 106.82/106.8/107 (moles) **(1 mark)** **OR** (m = 4700 × 5 =) 23 500 **(g)** **(1 mark)** **OR** Candidates' calculated number of moles multiplied by 5 **(1 mark)** **OR** $\frac{4700}{44}$ × 5 with incorrect answer **(1 mark)**	**2**	Unit is not required but if included must be correct. This marking instruction must only be applied a maximum of once per paper. Where the candidate has only carried out one of the two steps and their final answer includes a unit, one mark can be awarded for; **106.8 moles** or **23500 g** Working must be shown for calculated number of moles

Question			Expected response	Max mark	Additional guidance
5.			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
6.	(a)	(i)	Carboxyl	**1**	Award zero marks for carboxylic (acid) or COOH.
		(ii)	(Addition) polymerisation	**1**	
		(iii)		**1**	Mark can still be awarded if one end bond is missing or if one H atom is shown on an end bond. Allow dot or ~ to represent end bond. Connectivity to the carboxyl group must be to the carbon. Zero marks awarded if • both end bonds are missing • both ends have a hydrogen atom • less than or more than three monomers shown • a bond between two carbons is missing.
	(b)	(i)	(Material) A **AND** CsCl	**1**	
		(ii)	Bar above $SrCl_2$ greater than 18 and less than 32.	**1**	Ignore any shading of the bar.
	(c)	(i)	Measuring cylinder/Burette/Pipette.	**1**	
		(ii)	For appropriate format: points (not bars). **(1 mark)** The axis/axes of the graph has/have suitable scale(s). For the graph paper provided within the question paper, the selection of suitable scales will result in a graph that occupies at least half of the width and half of the height of the graph paper. **(1 mark)** The axes of the graph have suitable labels and units. **(1 mark)** All data points plotted accurately with a line of best fit (smooth curve/ straight line) drawn. **(1 mark)**	**4**	Where the candidate has drawn a bar graph the format mark is not awarded, but the remaining three marks can still be accessed. Spelling mistakes or the use of abbreviations should not be penalised if the meaning of an axis label may be clearly understood. Where the candidate has drawn a bar graph, the mark for accurate plotting can be awarded if the heights of bars are plotted accurately but in this case no line of best fit should be used. If the scale is non-linear then the mark for accurate plotting can only be accessed if the error occurs out with the data-set.

Question			Expected response	Max mark	Additional guidance
7.	(a)		Trisilane	**1**	Marker should only refer to answers in the table if no answer has been provided in the space beneath the question.
	(b)		12 /Si_5H_{12}/ H_{12}	**1**	Marker should only refer to answers in the table if no answer has been provided in the space beneath the question
	(c)		180 – 195 (°C)	**1**	Unit is not required but if included must be correct. This marking instruction must only be applied a maximum of once per paper. Marker should only refer to answers in the table if no answer has been provided in the space beneath the question.
	(d)		Diagram showing carbon with four hydrogen atoms: each of the four overlap areas must have two electrons in or on overlap area (cross, dot, petal diagram) eg 	**1**	Accept cross or dot or e or e^- to represent electrons or a mixture of these. Bonding electrons **MUST** be on the line or in the overlapping area. The diagram does not need to show tetrahedral shape. The symbols must be shown for either the silicon atom **or** all four hydrogen atoms. If inner electrons are shown then these must be correct.

Question			Expected response	Max mark	Additional guidance
	(e)		Pentasilane/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 pentasilane/it is bigger/ has more (silicon or hydrogen) atoms/longer silicon 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 silicon to silicon or silicon to hydrogen bonds or more bonds cannot gain the second mark but does not negate the first mark. If the candidate uses carbon in place of silicon this would negate the awarding of one of the marks. Candidates can be awarded the full/partial marks if they correctly explain why tetrasilane has a lower melting point but tetrasilane **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
	(f)		3.1 (g) **(3 marks)** Partial marks can be awarded for a maximum of two of the following three steps. **<u>Method A</u>** 1 mark for correctly calculating the number of moles of silicon dioxide. ie n = m/GFM = 6/60 = 0.1 mol **(1)** 1 mark for calculating the moles of disilane by correctly applying the molar ratio ie 0.5 × candidate's calculated moles of silicon dioxide. **(1)** 0.05 (mol) on its own. **(2)** 1 mark for calculating the mass of disilane ie m = n × GFM using candidates calculated moles of silicon dioxide and candidate's calculated GFM of disilane. **<u>Method B</u>** Both GFMs 60 and 62 **(1)** 120 ↔ 62 This step on its own is worth 2 marks. **(2)** Correct application of mole ratio to candidate's GFM of disilane ie $\frac{\text{candidate's GFM of disilane}}{\text{2 x candidate's GFM of silicon dioxide}} \times 6$ Where the candidate has been awarded the mark for correct proportionality, shown by GFM of disilane over GFM of silicon dioxide with or without the mole ratio applied, a further mark can be awarded for correct follow through to a final answer.	**3**	Unit is not required, however a maximum of 2 marks can be awarded for the correct value with incorrect unit. This marking instruction must only be applied a maximum of once per paper. A maximum of two marks can be awarded where the candidate has carried out the calculation **using silicon dioxide** and one wrong chemical provided working is shown. ie if a candidate calculates the mass of $MgCl_2$ or H_2O instead of disilane, a maximum of 2 marks can be awarded for 33.25 (g) for using $MgCl_2$ or 8.4 (g) for using Mg or 3.6 (g) for using H_2O provided the GFM of each of these chemicals is correct. Award zero marks if candidate's working does not use silicon dioxide. Award 2 marks for $\frac{62}{60} \times 6 = 6.2$ Award 1 mark for $\frac{\text{candidate's GFM of disilane}}{\text{candidate's GFM of silicon dioxide}} \times 6$ Working **must** be shown to support an incorrect GFM to allow the concept mark to be awarded.

Question			Expected response	Max mark	Additional guidance
8.	(a)		Fluorapatite	**1**	
	(b)		$C_6H_{12}O$	**1**	Accept $C_5H_{12}CO$ Symbols can be in any order
	(c)	(i)	Nitrogen/N/N_2	**1**	Any mention of potassium negates a correct answer.
		(ii)	It is (very) soluble.	**1**	
	(d)		31.63/31.6/32 (%) **(3 marks)** -- Partial marking: GFM = 98 **(1 mark)** $\frac{\text{candidate's mass of phosphorus}}{\text{candidate's GFM}} \times 100$ **(1 mark)** This step on its own is worth 2 marks if the candidate’s GFM is 98. Calculation of final answer using the relationship % by mass = m/GFM × 100 **(1 mark)**	**3**	Unit is not required, however a maximum of 2 marks can be awarded for the correct value with incorrect unit. This marking instruction must only be applied a maximum of once per paper. Maximum 2 marks if candidate correctly calculates percentage of hydrogen (3/3.1/3.06 %) or oxygen (65/65.3/65.31 %) rather than phosphorus but **working must be shown.** Working **must** be shown to support an incorrect GFM to allow the concept mark to be awarded. The value used for m in the concept must be used in the working for the candidate’s calculated GFM. The mark for the final answer can only be awarded if the correct relationship between total mass of element present divided by GFM × 100 is shown with working.
	(e)		Filtration	**1**	
	(f)		½ or 0.5 or half	**1**	

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	0.627/0.63/0.6 (kJ) **(3 marks)** --- Partial Marking using the correct concept of $cm\Delta T$ with c = 4·18 **(1 mark)** To be awarded this concept mark, candidates do not specifically need to write $cm\Delta T$. The concept mark is awarded for using this relationship with three values, one of which must be 4.18 For values 0.01 **and** 15 **(1 mark)** A further mark can be awarded for arithmetical follow through to the candidate's answer only if the mark for the concept has been awarded. **(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. 627 J can be awarded 3 marks if used with 4180 and the correct unit is given.
		(ii)	Heat loss to the surroundings. **OR** Glass is a poor conductor of heat. **OR** Incomplete combustion.	**1**	Answer must describe the reason why the value is lower, simply providing an improvement is not sufficient but does not negate.
	(b)		150 (kilocalories) Partial Marks 627 (30 × 20.9) **(1 mark)** **OR** 5 (20.9/4.18) **(1 mark)** **OR** (20.9 × 30)/4.18 with incorrect answer **(1 mark)**	**2**	No units required but a maximum of one mark can be awarded if an incorrect unit is given. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	Electrolysis	**1**	
		(ii)	Reduction	**1**	
	(b)	(i)	${}^{0}_{-1}e$ **OR** ${}^{0}_{-1}\beta$	**1**	
		(ii)	(Alpha particles) they • cannot penetrate/pass through (the paper/metal) • are stopped (by the paper/metal) • are absorbed (by the paper/ metal) • can only pass through air	**1**	Award zero marks for • they do not travel far • they cannot reach the detector • air absorbs alpha particles. However, they do not negate a correct answer.
		(iii) (A)	Time for half of the nuclei to decay. **OR** Time taken for the (radio)activity to half	**1**	Time taken for mass to half is not accepted.

Question			Expected response	Max mark	Additional guidance
		(iii) (B)	$\frac{15}{16}$ /93.75/93.8/94 (%) **(3 marks)** ---------------------------------- **Partial marking** 4 half-lives. **(1 mark)** **OR** Correct percentage or fraction left for a correct number of half-lives. **(2 marks)** **OR** Correct percentage or fraction left for an incorrect number of half-lives. Working must be shown. **(1 mark)** **OR** Correct percentage or fraction decayed with incorrect number of half-lives. Working must be shown. **(2 marks)**	**3**	Unit is not required, however a maximum of 2 marks can be awarded for the correct value with incorrect unit. If a candidate does not demonstrate the application of half-lives they cannot access the final mark for calculating the percentage/fraction remaining.

Question			Expected response	Max mark	Additional guidance
11.	(a)		Covalent molecular.	**1**	
	(b)	(i)	$WF_6 + \mathbf{3}H_2O \rightarrow WO_3 + \mathbf{6}HF$	**1**	Accept correct multiples.
		(ii)	More hydrogen ions/H^+ than hydroxide ions/OH^-	**1**	
	(c)		$W^{6+} + 2e^- \rightarrow W^{4+}$	**1**	

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]

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.

$$\begin{array}{c} \qquad\qquad\quad CH_3 \\ \qquad\qquad\quad | \\ CH_3-CH_2-CH-CH_2-CH_2-CH_3 \end{array}$$

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.

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

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.