National
Qualifications
2014

2014 Chemistry

National 5

Finalised Marking Instructions

General Marking Principles for National 5 Chemistry

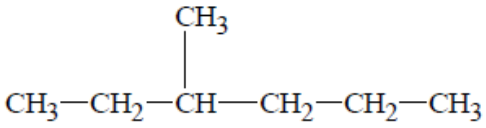
This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.

(b) 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.

(c) There are no half marks awarded.

(d) 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.

(e) 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.

(f) 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.

(g) 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) 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.

(j) 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.

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

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

(m) 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.

(n) 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.

(o) 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

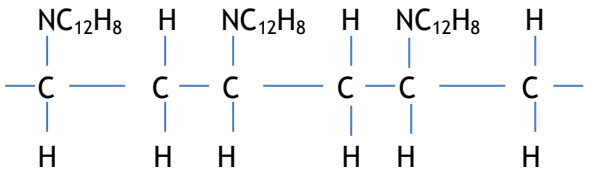
Question	Answer	Max Mark
1.	A	**1**
2.	D	**1**
3.	A	**1**
4.	C	**1**
5.	C	**1**
6.	A	**1**
7.	D	**1**
8.	A	**1**
9.	C	**1**
10.	B	**1**
11.	C	**1**
12.	B	**1**
13.	C	**1**
14.	C	**1**
15.	A	**1**
16.	D	**1**
17.	B	**1**
18.	B	**1**
19.	B	**1**
20.	D	**1**

Section 2

Question			Answer	Max Mark	Additional Guidance
1.	(a)		**Repulsion/repelled** by nucleus/positive nucleus /protons/positive protons/positive particles in nucleus or in atom or in gold/ like charges in nucleus, atom or gold	**1**	**Zero marks** for just mentioning positive particles/protons etc in nucleus without mentioning them repelling **Zero marks** for positive particles or like charges without mentioning it is those in nucleus or atom or gold Zero marks for positive charge of the gold atoms
	(b)	(i)	Protons – 79 Electrons – 79 Neutrons – 118 **All for 1 mark**	**1**	
		(ii)	Same atomic number / protons AND different mass number / mass / number of neutrons **Atoms of** the same element with different mass number / mass /number of neutrons Candidate must specify either same atomic number or number of protons/positive charges or atoms of the same element AND different mass number/mass/number of neutrons	**1**	If electrons mentioned this does **not** negate a correct answer Do **not** accept Particles, molecules or same atoms with … Same element with different mass number

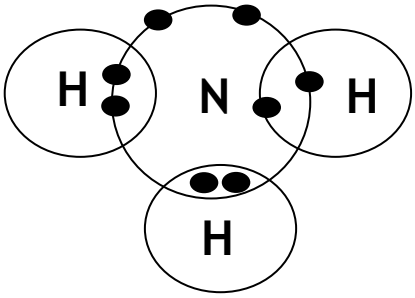
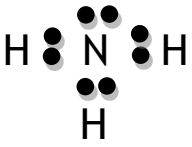
Question			Answer	Max Mark	Additional Guidance
2.	(a)		Covalent network Ionic lattice Metallic lattice (Discrete) covalent molecular	**2**	**All 4 correct - 2 marks** 2 or 3 correct - 1 mark 1 or 0 correct - 0 marks
	(b)		Delocalised /able or free to move or correct description	**1**	Mention of **ions** negates correct answer

Question			Answer	Max Mark	Additional Guidance
3.	(a)		Potassium is an essential element or humans / human body cannot store it / have no mechanism for storing it	**1**	
	(b)		0·022 or 0·02 (moles) **with no working** (2) 0·86 / 39 = (1) 0·022 or 0·02 (moles) (1)	**2**	Any incorrect answer with **no working** award zero marks Allow follow through if incorrect value extracted from text and correctly divided by 39. 39/0·86 = 45·34 1 mark 0·86/100 = 0·0086 1 mark 100/39 = 2·56 1 mark Any other response zero marks If incorrect unit used maximum of 1 mark awarded Accept mol(s) Do not accept ml, g
	(c)		Lilac/purple	**1**	
	(d)		$K^+ NO_3^-$ **both** charges must be shown	**1**	Also accept use of brackets which do **not** negate the correct ionic formula e.g. $(K^+) (NO_3^-)$ $(K)^+ (NO_3)^-$ $K^+ (NO_3^-)$ $(K^+) NO_3^-$ **Do not accept** $(K)^+ (NO)_3^-$ $K^+ No_3^-$ If ionic formula for potash $(K^+)_2 CO_3^{2-}$ is given this negates correct answer unless correct answer is identified by candidate as being saltpetre or potassium nitrate

Question			Answer	Max Mark	Additional Guidance
4.	(a)		 With or without brackets. The bond to $NC_{12}H_8$ does not need to be drawn to the nitrogen but must be drawn to the group.	**1**	Award mark if **one** end bond is missing Award mark if one end bond is shown with other end having a H in place of second end bond Allow dot or ~ to represent end bond Zero marks if **both** end bonds are missing / both ends have H / less than or more than three monomers shown / bond between two carbon missing
	(b)		Addition or additional	**1**	Do not award mark for "adding" Mention of condensation negates correct answer

Question			Answer	Max Mark	Additional Guidance
5.	(a)		alpha or α	**1**	$^4_2\mathrm{He}$ $^4_2\mathrm{He}^{2+}$ on their own not accepted but do not negate Any mention of beta or gamma negates correct answer
	(b)		¼ / 0·25 / 25% with no working (2) Two half-lives (1) ¼ or 0·25 or 25% (1)	**2**	If number of half lives is incorrect allow follow through to second step Incorrect answer with no working zero marks
	(c)		Sodium / Na $^{24}_{11}Na$ ^{24}Na $_{11}Na$	**1**	If mass/atomic number given they must be correct $^{24}_{11}X$ chromium zero marks $^{23}_{11}Na$ zero marks

Question			Answer	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) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The student has demonstrated a reasonable understanding of the chemistry involved. The 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 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**	

Question			Answer	Max Mark	Additional Guidance
7.	(a)	(i)	Haber	**1**	
		(ii)	Diagram showing three hydrogen atoms and one nitrogen atom with three pairs of bonding electrons and two non-bonding electrons in nitrogen eg   	**1**	Accept cross /dot /petal /circles The non-bonding electrons in nitrogen must be shown but do not need to be together / shown as a pair Electrons can be on the line or in the overlapping area. Either the nitrogen or all three hydrogen symbols must be shown If inner electrons on nitrogen are shown they must be correct ie 2 electrons
	(b)	(i)	Water / H_2O / Hydrogen oxide	**1**	
		(ii)	Arrow from nitrogen monoxide from absorber to nitrogen monoxide below reactor (anywhere below the reactor and above nitrogen dioxide)	**1**	Direction of arrow must be correct
	(c)	(i)	Neutralisation	**1**	

		(ii)	Evaporation or boil it / boil off the water or distillation or correct description	**1**	Filtration on its own is not acceptable It negates the correct answer if stated evaporation **OR** filtration/ evaporation and filtration/ filtration then leave to dry (unless stated filtrate left to dry) It does **not** negate if stated filtration followed by evaporation Filtration then evaporation/ filtration followed by evaporation accepted. Filtration and evaporation zero marks.

Question			Answer	Max Mark	Additional Guidance
8.	(a)		Perfumes, solvents, flavourings, fragrances, preservatives	**1**	If other answers are given the marker must be confident that esters are used for this purpose. Markers should check accuracy Also accept uses of polyesters But no marks awarded for esters are used to make polyesters
	(b)	(i)	Hydroxyl	**1**	Zero marks for hydroxide. If hydroxide is given along with hydroxyl – zero marks. Zero marks for OH or OH circled in molecule however these do not negate hydroxyl
	(b)	(ii)	Any correct **full or shortened** structural formula for an isomer	**1**	Incorrect name with a correctly drawn structural formula does not negate correct answer If shortened structure is used for a branch in a structure the bond must be to the carbon of the branch If isomer is another alcohol the carbon must be bonded to the oxygen of the hydroxyl group
	(b)	(iii)	$C_nH_{2n}O_2$ $C_nH_{2n+1}COOH$	**1**	Accept n or x Not acceptable $C_nH_{2n} + O_2$ C_nH_{2n} 2O The symbols can be in any order The subscripts must be a smaller font size than symbol cnH2nO2 - not acceptable

Question			Answer	Max Mark	Additional Guidance
	(c)		ethanol (1) propanoic acid (1) Spelling of both must be correct	**2**	If they specify which is **X** and which is **Y** they must be correct eg **X** is ethanol **Y**= propanoic acid **X** = propanoic acid **Y**= ethanol is awarded zero marks If the name of **two acids** or **two alcohols** are given zero marks awarded unless specified as **X** and **Y** eg **X** is ethanol award 1 **Y** is propanol Ethanol and propanol award 0

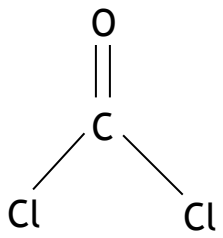
Question			Answer	Max Mark	Additional Guidance
9.	(a)		They have similar chemical properties **and** They have the same general formula. **Both required for 1 mark**	**1**	Correct answers can be ticked, circled or highlighted in some other way. If **more than two boxes** ticked zero marks awarded.
	(b)		Butane, or it, has stronger / more / bigger forces of attraction (1) **between molecules or mention of intermolecular attractions** (1) If neither of these two points are given a maximum of one mark can be awarded for Butane is bigger / has more carbon or hydrogens / 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 2 marks can be awarded if candidate explains why propane has a lower boiling point but they must state propane in answer. 1 mark - propane is smaller / has less carbon or hydrogens / smaller carbon chain. Propane must be stated to gain the mark

	(c)		2090 with no working = (3) $E_H = cm\Delta T = 4{\cdot}18 \times 25 \times 20 = 2090$ (3) using concept cmΔT with $c = 4{\cdot}18$ (1) using correct data ie 25 and 20 (1) final answer 2090 (1) If awarding partial marks, the mark for the final answer can only be awarded if the concept mark has been awarded.	**3**	Ignore negative sign if present. Unit not required however if wrong unit given do **not** award mark for final answer.eg kJ^{-1} or kg. Accept kj, kJ, Kj or KJ. If 25 is divided by 1000 = 0·025 maximum 2 marks Answer in joules is accepted but the units must be given. ie 2 090 000 J is acceptable. 2 090 000 on its own is not acceptable.

Question			Answer	Max Mark	Additional Guidance
	(d)		Produces SO_2 / acidic gases / oxides of sulfur Produces acid rain	**1**	Zero marks - for produces pollution / toxic or poisonous gases / not environmentally friendly/ flammable on their own but do **not** negate correct answer

Question			Answer	Max Mark	Additional Guidance
10.	(a)	(i)	The higher/lower the number of carbon atoms the higher/lower the flash point The flash point increases/decreases as the number of carbon atoms increases/decreases	**1**	Cause and effect must be stated correctly Zero marks for: The higher/lower the flash point the higher/lower the number of carbons The number of carbons increases/decreases as the flash point increases/decreases Accept as alternatives increases - goes up/gets higher decreases - goes down/gets lower/less Answer must specifically relate to the number of carbon atoms or length of carbon chain, not to the size of the hydrocarbon molecule. eg accept as the length of the carbon chain increases…. Do not accept as the hydrocarbon gets bigger….
	(a)	(ii)	47 – 51 inclusive (units not required)	**1**	

Question			Answer	Max Mark	Additional Guidance
	(b)		99 with no working (3) 32/128 = 0·25 (1) 0·25 gives 2·25 (9 x 0·25) (1) (this step on its own 2 marks) 2·25 x 44 = 99 (1) (this step on its own 3 marks) --- 128 g and 44 g both shown (1) 128 g gives 396 g (9 x 44) (1) (this step on its own 2 marks) 32 g gives 99 g [(396/128) x 32] (1) (this step on its own 3 marks) --- 128 g and 44 g both shown (1) 128 g gives 396 g (9 x 44) (1) (this step on its own 2 marks) 128/32 = 4 396/4 = 99 (1) (this step on its own 3 marks) Any other valid method accepted.	**3**	32/96 (mass of nonane incorrect) = 0·33 zero marks 0·33 x 9 = 2·97 1 mark correct follow through 2·97 x 44 = 130·68 1 mark correct follow This would be awarded 2 out of 3 marks --- Any other answer without working = zero marks Unit not required however if wrong unit given do **not** award mark for final answer. If candidate uses incorrect mass for 9 moles CO_2 and has clearly shown working for this step maximum 2 marks can be awarded. If candidate uses incorrect mass for 9 moles of CO_2 and has shown no working for this step maximum of 1 mark can be awarded. This also applies to GFM of nonane.

Question			Answer	Max Mark	Additional Guidance
11.	(a)		$2Cl^- \longrightarrow Cl_2 + 2e^-$ or $2Cl^- - 2e^- \longrightarrow Cl_2$	**1**	Ignore state symbols if given / state symbols not required Do not need negative sign on electron Negative sign must be shown on chloride ion
	(b)	(i)	sodium hydroxide or sodium oxide	**1**	Accept correct formula If charges shown they must be correct
		(ii)	Water is the **only** product Hydrogen is infinite/renewable Doesn't produce greenhouse gases / CO_2 / CO The products/gases produced do not contribute to the greenhouse effect/global warming Fossil fuels not being used up as fuel	**1**	Zero marks - environmental friendly / safer / less pollution / less soot Does not produce / toxic gases / harmful gases / SO_2 / acid rain Mention of contribution to global warming/greenhouse effect without referring to the combustion products/gases produced would not be awarded a mark These are not acceptable on their own but do **not** negate
	(c)			**1**	

Question			Answer	Max Mark	Additional Guidance
12.	(a)		Reduction	**1**	Redox - zero marks
	(b)		70 with no working (3) GFM = 160g (1) 112 / 160 x 100 (1) = 70 (1)	**3**	If atomic numbers are used with working shown (68·4 %) maximum 2 marks 68·4 on its own – 0 marks Allow follow through If candidate correctly calculates percentage of oxygen (30%) rather than iron maximum 2 marks but working must be shown 30% on its own zero marks Unit not required however if wrong unit given do **not** award mark for final answer.
	(c)		Electrolysis Or correct description eg passing electricity through it	**1**	Electricity on its own is awarded zero marks heating with carbon negates correct answer heating negates the correct answer unless it is clear that this is used to melt the ore

Question			Answer	Max Mark	Additional Guidance
13.	(a)		16	**1**	Unit not required however if wrong unit given do **not** award mark for final answer.
	(b)		0·08 with no working 3 marks 0·1 x 0·016 = 0·0016 (1) 0·0016/2 = 0·0008 (1) 0·0008/0·01 = 0·08 (1) 0·08 on its own 3 marks or $\frac{0·1 \times 16}{2} = \frac{C_2 \times 10}{1}$ (1) $0·8 = C_2 \times 10$ (1) $C_2 = 0·08$ (1) or any alternative correct method	**3**	Allow follow through from part (a) For the first method shown candidates should not be penalised if 16 (or volume from part a) and 10 (volume of sodium carbonate solution) are both expressed in cm^3. If candidate **only** calculates number of moles of acid the volume must be in litres to be awarded 1 mark. If candidate correctly divides their number of moles of acid by 2 the mark for the mole ratio can be awarded. Unit not required however if wrong unit given do **not** award mark for final answer. Accept mol l^{-1} or mol/l but not mol/l^{-1} or mol^{-1} or mol l If concentration of incorrect chemical is calculated then max= 1 mark

Question			Answer	Max Mark	Additional Guidance
14.			This is an open ended question **1 mark:** The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The student has demonstrated a reasonable understanding of the chemistry involved. The 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 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**	

[END OF MARKING INSTRUCTIONS]