National
Qualifications
RESOURCE

2021 Chemistry

National 5

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.

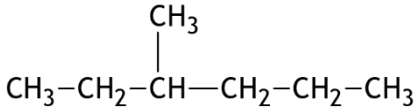
(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(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.

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

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.

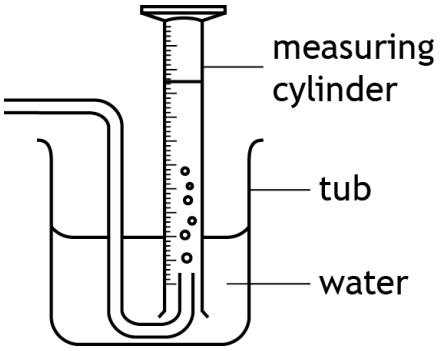
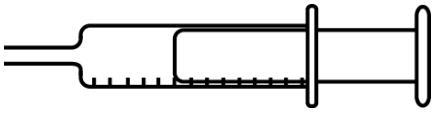
Marking instructions for each question

Section 1

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

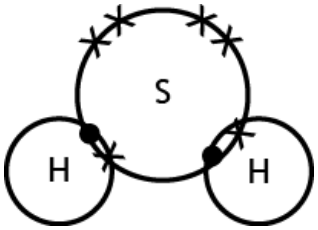
Section 2

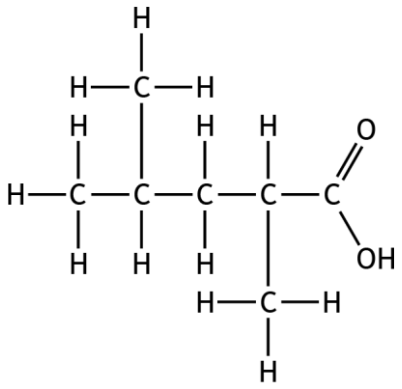
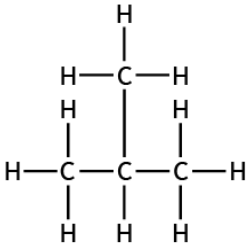
Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	Same atomic number/protons AND different mass number/mass/ number of neutrons **Atoms of** the same element with different mass number/mass/ number of neutrons Candidate must specify either same atomic number or number of protons/positive 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
		(ii)	120 **OR** $^{120}_{50}Sn$ **OR** ^{120}Sn **OR** Sn-120 **OR** tin-120.	**1**	Accept amu or g if stated.
	(b)		$^{124}_{50}Sn$	**1**	
	(c)		Covalent	**1**	Accept covalent molecular. Molecular on its own is not acceptable. Any mention of network or lattice or ionic or metallic negates a correct answer.

Question			Expected response	Max mark	Additional guidance
2.	(a)		Correctly drawn apparatus for either: Upturned measuring cylinder in water  **OR** Gas syringe  **Graduation marks must be shown.**	**1**	A graduated test tube would be acceptable. The apparatus set-up must work; delivery tube cannot enter measuring cylinder through side wall. Gas syringe must not be closed by bi-secting line. See additional exemplification guidance.
	(b)	(i)	Curve should be steeper and should plateau at same height.	**1**	
		(ii)	Reactants are being used up.	**1**	
	(c)	(i)	0·2174/0·217/0·22/0·2 **(2 marks)** Partial marking: **1 mark awarded for concept of change in volume/change in time.** 50/230 with an incorrect answer **OR** 50/145 = 0·345 or 0·34 **OR** 50/76 = 0·658 or 0·66	**2**	If working is shown then it must demonstrate the concept of change in volume over time. If wrong concept of change in time divided by change is volume is used, zero marks are awarded. eg 230/50

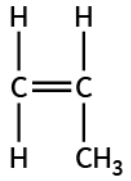
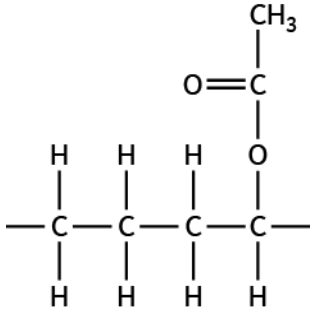
Question			Expected response	Max mark	Additional guidance
2.	(c)	(ii)	As the temperature (of acid) increases the time taken decreases. **OR** As the temperature (of the acid) decreases the time taken increases. **OR** The time taken increases as the temperature decreases. **OR** The time taken decreases as the temperature increases.	**1**	Must have correct cause and effect. eg As the time decreases, the temperature increases. -Zero marks would be awarded. As temperature increases, rate increases. -Zero marks would be awarded.
		(iii)	Greater number/concentration/ moles of hydrogen ions/H^+ **OR** more H^+ ions. **OR** H_2SO_4 is diprotic.	**1**	Award zero marks for 'more hydrogen'/more hydrogen atoms/ more 'H'/more acid/more moles of acid. Award zero marks for mention of stronger/weaker acid but this does not negate a correct answer.

Question			Expected response	Max mark	Additional guidance
3.	(a)		Catalysts are substances that speed up chemical reactions (but can be recovered chemically unchanged at the end of the reaction).	**1**	
	(b)	(i)	Phosphorus/P **OR** Potassium/K	**1**	
	(b)	(ii)	Soluble	**1**	
	(c)	(i)	46·67/46·7/47 (%) **(3 marks)** Partial marking: GFM = 60 **(1 mark)** $\frac{28}{\text{candidate's GFM}} \times 100$ **(1 mark)** This step on its own is worth 2 marks if the candidate's GFM is 60. Calculation of **final answer** using the relationship % by mass = $\frac{m}{GFM} \times 100$ **(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. Maximum 2 marks **(working must be shown)** Incorrectly calculated GFM-allow follow through using the mass of nitrogen from working **OR** Using total mass of N as 14- 14/60 × 100 = 23·3% 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.** **An incorrect GFM of urea must be supported by working.** See additional exemplification guidance.
		(ii)	Thermometer/temperature probe	**1**	

Question			Expected response	Max mark	Additional guidance
4.	(a)		Triethylene glycol	**1**	
	(b)		Diagram showing sulfur with two hydrogen atoms: each of the two overlap areas must have two electrons in or on overlap area. Either the sulfur or both hydrogen symbols must be shown.  	**1**	The diagram does not need to show the angular shape. Accept cross or dot or e or e- to represent electrons or a mixture of these. Accept petal diagram. The non-bonding electrons in sulfur must be shown but do not need to be together/shown as two pairs. Bonding electrons MUST be on the line or in the overlapping area. If inner electrons on sulfur are shown they must be correct ie 2,8. See additional exemplification guidance.
	(c)		131	**1**	
	(d)		hydroxyl	**1**	OH is not acceptable, but does not negate the correct answer. Hydroxide is not acceptable.

Question			Expected response	Max mark	Additional guidance
4.	(e)	(i)	A correct shortened or full structural formula for 2,4-dimethylpentanoic acid. eg $CH_3CH(CH_3)CH_2CH(CH_3)COOH$ $HOOCCH(CH_3)CH_2CH(CH_3)CH_3$  Or mirror images.	**1**	Accept CH_3 for branch in a full structural formula. See additional exemplification guidance.
		(ii)	A correct shortened or full structural formula for 2-methylpropane. 	**1**	2-methylpropane (0 marks) $CH_3CH(CH_3)CH_3$ would be acceptable. See additional exemplification guidance for Question 4(e)(i)
	(f)		Unsaturated	**1**	Carbon to carbon double bond or alkene 0 marks.

Question			Expected response	Max mark	Additional guidance
5.			This is an open ended question. **1 mark:** The candidate has demonstrated a limited understanding of the chemistry involved. The candidate has made a/some statement(s) that is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The candidate has demonstrated a reasonable understanding of the chemistry involved. The candidate has made a/some statement(s) that is/are relevant to the situation, showing that the problem is understood. **3 marks:** The candidate has demonstrated a good understanding of the chemistry involved. The candidate 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**	**0 marks**: The candidate has demonstrated no understanding of the chemistry involved. There is no evidence that the candidate has recognized the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the candidate merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)		**1**	Accept full or shortened structural formula. See additional exemplification guidance.
		(ii)	For appropriate format: bars (not points) **(1 mark)** The 'percentage' axis of the graph has a suitable scale. For the graph paper provided within the question paper, the selection of a suitable scale will result in a graph (plotted bars) that occupies greater than 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 bars are plotted accurately (within a half box tolerance). **This mark can only be accessed if a linear scale for the y-axis has been provided. (1 mark)**	**4**	If a scatter/line graph is drawn a maximum of 3 marks can be awarded. Bars should be separate, however mark would still be awarded if bars are drawn together. The last bar must finish beyond the mid-point of the graph paper. 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. See additional exemplification guidance.
	(b)	(i)	They are unsaturated/contain a carbon to carbon double bond	**1**	If double bond is mentioned carbon to carbon must be included.
		(ii)		**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/bond between two carbon missing.

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Sodium methanoate	**1**	
		(ii)	Any value less than 7	**1**	
	(b)	(i)	Titration	**1**	
		(ii)	Within 0·2 cm^3 (of each other) **OR** The same	**1**	
	(c)	(i)	Red	**1**	
		(ii)	$Ba^{2+}SO_4^{2-}$	**1**	Brackets, if included, must be in the correct place.

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	Limewater	**1**	
		(ii)	Same general formula **AND** Same/similar chemical properties	**1**	Award zero marks for - molecular formula - structural formula - chemical formula. Award zero marks for - physical properties in place of chemical properties however, it does not negate if given in addition to chemical properties.
		(iii)	$C_4H_{10} + 6{\cdot}5\ O_2 \rightarrow 4\ CO_2 + 5H_2O$	**1**	Accept correct multiples
	(b)		Final temperature 70 with no working **(4)** --- **Partial marking** ΔT= correctly calculated **53** =76·32/(0·4 x 3·6) **(3)** --- Using the correct concept of ΔT=E/mc With both c = 3·6 and Eh = 76·32 correctly substituted **(1)** 0·4 with or without concept **(1)** **Calculation of** ΔT **(1)** provided concept mark has been awarded. Calculation of final temperature T using incorrect ΔT **(1)** provided working is shown. ---	**4**	No units required but a maximum of three marks can be awarded if wrong unit is given. (Wrong units are only penalised once in any paper) 76320 and 3600 can be used to together in the calculation. See additional exemplification guidance.

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Ore/bauxite filtration aluminium hydroxide aluminium oxide **All 4 for both marks** **3 or 2 correct for 1 mark**	**2**	 Zero marks awarded for 1 correct entry.
		(ii)	Arrow from bottom sodium hydroxide to top sodium hydroxide **OR** Arrow from lower aluminium hydroxide to upper aluminium hydroxide	**1**	See additional exemplification guidance.
	(b)	(i)	Decomposition/breaking apart of an ionic compound (into its elements) using electricity	**1**	
		(ii)	Allows the product(s) to be identified. **OR** To make sure that only one product is produced at each electrode. **OR** To separate the aluminium from the oxygen.	**1**	Award zero marks for • allows ions to separate • so each electrode stays the same charge • so the electricity/current goes in the one direction
		(iii)	Ions are free to move.	**1**	Award zero marks for electrons/ molecules/charged particles in place of ions.
		(iv)	$\mathbf{4}Al^{3+} + \mathbf{6}O^{2-} \rightarrow \mathbf{4}Al + \mathbf{3}O_2$ (or correct multiples) **All must be correct for 1 mark**	**1**	Zero marks awarded for any electrons shown in equation. Ignore state symbols if given.

Question			Expected response	Max mark	Additional guidance
10.	(a)		Wolframite	**1**	
	(b)		W_2O_3	**1**	
	(c)		Any temperature greater than or equal to 2870 ºC and lower than 6000 ºC	**1**	
	(d)		15·785/15·79/15·8/16 **(2 marks)** …… **Partial Marks** Density of titanium = 4·51 **(1 mark)**	**2**	Density of tungsten × 3·5 19·3 × 3.5 = 67·55 **(1 mark)**

Question			Expected response	Max mark	Additional guidance
11.	(a)		proton/ $^{1}_{1}p$ / $^{1}_{1}H$ /H/hydrogen	**1**	Zero marks for H_2
	(b)	(i)	5500-6000 years	**1**	Unit is not required however if the wrong unit is given do **not** award mark. This marking instruction must only be applied a maximum of once per paper.
		(ii)	4 x candidate's answer to (b) (i) **(2 marks)** --- Partial marking: 1 mark can be awarded for **either**: • 4 half-lives **OR** • number of years correctly calculated for an incorrect number of half-lives (provided the working supports the number of half-lives).	**2**	Allow follow through from (b) (i). See additional exemplification guidance. Unit is not required; however, a maximum of 1 mark can be awarded for the correct value with incorrect unit. This marking instruction must only be applied a maximum of once per paper.
		(iii)	There would be no C-14 left in the bone/levels of C-14 too small to measure/Half-life is too short	**1**	'It' refers to C-14
12.	(a)		Hydrocarbons are compounds containing only hydrogen and carbon (atoms).	**1**	Must contain **only**.
	(b)	(i)	Hydrogenation	**1**	
		(ii)	Any acceptable alkene isomer.	**1**	See additional exemplification guidance.

Question			Expected response	Max mark	Additional guidance
12.	(c)		115(g) **(3 marks)** --- Partial marks Both GFMs ie 23 and 70 **(1 mark)** **OR** Moles of cyclopentane ie (175÷70) = 2·5 mol **(1 mark)** --- 1 concept mark for either: $175 \times \frac{2 \times \text{candidate's GFM of sodium}}{\text{candidate's GFM of cyclopentane}}$ **(1 mark)** **OR** Moles of cyclopentane × (2 × candidate's GFM of sodium) **(1 mark)** **OR** Moles of cyclopentane × (1 × 23) **(1 mark)** --- Where the candidate has been awarded any concept mark, a further mark can be awarded for correct follow through to a final answer **(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. **Award zero marks if the candidate's working does not use cyclopentane.** A maximum of two marks can be awarded where the candidate has carried out the calculation using **cyclopentane** and 1,5-dibromopentane provided working is shown. An incorrect GFM, with no working shown, cannot be used to gain the concept mark and therefore arithmetical follow through cannot be accessed. See additional exemplification guidance.
	(d)		4	**1**	Unit is not required; however, a maximum of 1 mark can be awarded for the correct value with incorrect unit. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
13.			This is an open ended question. **1 mark:** The candidate has demonstrated a limited understanding of the chemistry involved. The candidate has made a/some statement(s) that is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The candidate has demonstrated a reasonable understanding of the chemistry involved. The candidate has made a/some statement(s) that is/are relevant to the situation, showing that the problem is understood. **3 marks:** The candidate has demonstrated a good understanding of the chemistry involved. The candidate 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**	**0 marks**: The candidate has demonstrated no understanding of the chemistry involved. There is no evidence that the candidate has recognized the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the candidate merely restates the chemistry given in the question.

[END OF MARKING INSTRUCTIONS]

Exemplification of Marking Instructions

Marking – units in calculations

Where units are given in a question, there is no requirement for the candidate to include units in their answer.

If a candidate gives a wrong unit, this mark is not awarded **only once per paper**.

Centres are required to keep note of if and where this mark has not been awarded.

Scored out answers

(a) Silica has a melting point of 1713 °C.

State the term used to describe the structure of silica. 1

~~covalent network~~

Although answer is scored out, a correct answer can be seen. There is nothing else written and so this mark can be awarded.

Formula writing

Symbols can be in any order. Numbers must be smaller than symbol or subscript. Symbols must be correct. Zero marks awarded for; e.g.

C35 H72

c_{35} H_{72}

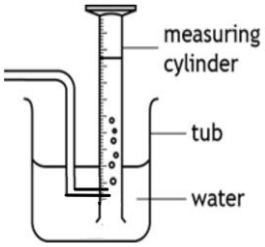
C35 h72

c35 h72

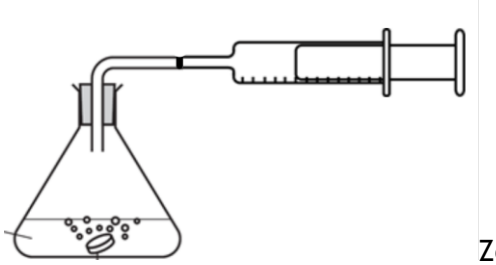
Open ended questions

In terms of best practice, allocation of marks to open-ended questions can be done in a collegiate manner where benchmarks can be set using the live candidate evidence. This will allow practitioners to have a better understanding of what a 1, 2 or 3 mark answer may look like. It is advisable to refer to SQA Understanding Standards materials for further exemplification.

Exemplification for Question 2(a)



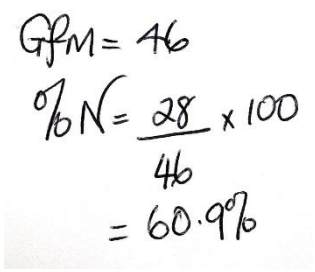
Zero marks would be awarded as this experimental set up would not work.



Zero marks would be awarded as delivery tube is bi-sected.

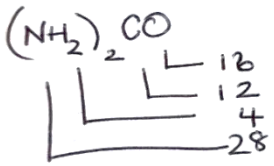
Exemplification of Question 3 (c) (i)

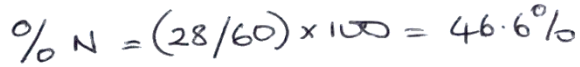
Example 1



2 marks
0 mark for incorrect GFM
1 mark for $\frac{28}{\text{candidate's GFM}}$ x 100
1 mark for the final answer as they have used the relationship
% by mass = $\frac{m}{GFM} \times 100$

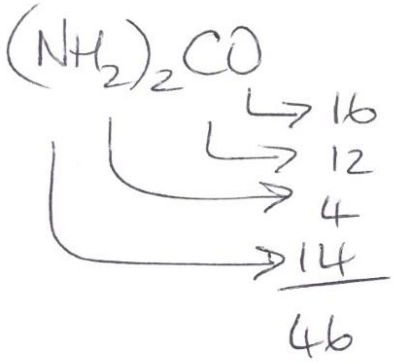
Example 2





2 marks
1 mark for correct GFM
1 mark for $\frac{28}{\text{candidate's GFM}} \times 100$
0 mark for answer due to incorrect rounding

Example 3



$\frac{14}{46} \times 100 = 30.4\%$

2 marks

0 marks for incorrect GFM

1 mark for $\frac{14}{46}$ x 100 as incorrect mass of N from GFM working has been used correctly

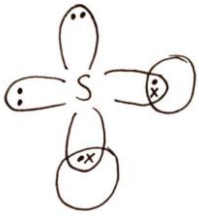
1 mark for final answer as concept correctly used.

Exemplification of Question 4(b)

1 mark. Symbol is missing for sulfur, but as hydrogen atoms have symbols the mark can be awarded.

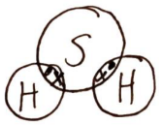
0 marks. Bonding electrons are out-with the overlap region and therefore the mark would not be awarded.

1 mark. Both pairs of bonding electrons are within the overlap region and the mark would therefore be awarded.



1 mark. Petal diagram is an acceptable format, and as symbol for one of the elements, sulfur, has been given.

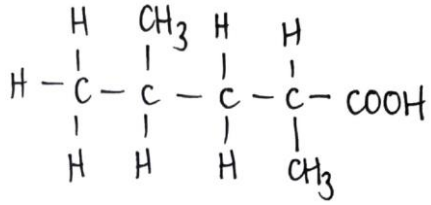
1 mark. Non-bonding electrons are unpaired; this is acceptable.



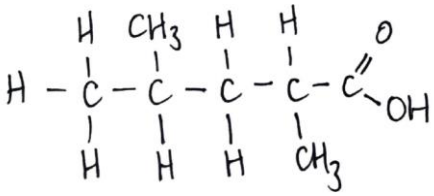
0 marks. Non-bonding electrons on sulfur have not been shown. No mark can be awarded.

0 marks. Sulfur has an extra electron so mark cannot be awarded

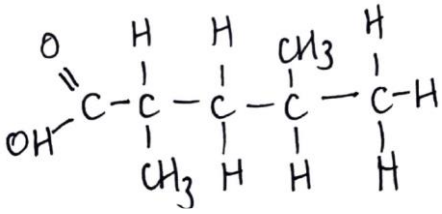
Exemplification for Question 4 (e) (i)



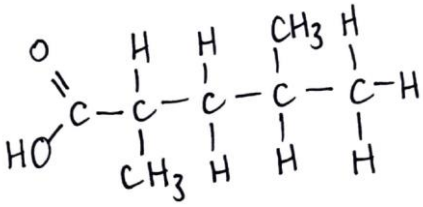
1 mark. A mixture of full and shortened structural formula is acceptable.



0 marks. The bond connectivity of the methyl group on carbon number 4 is incorrect and the mark would therefore not be awarded.

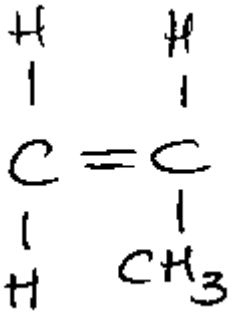


0 marks. The bond connectivity of the hydroxyl of the carboxyl group is incorrect.

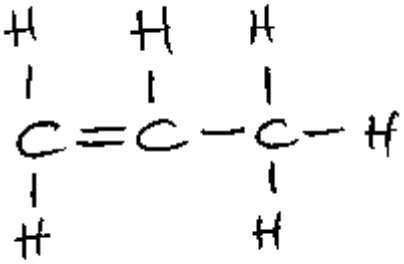


0 marks. The bond connectivity of the methyl group on carbon number 2 is questionable. It is closer to the hydrogen than the carbon.

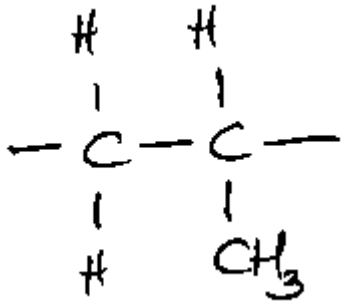
Exemplification of Question 6 (a) (i)



0 marks. Bond to CH_3 group not going to C of CH_3.



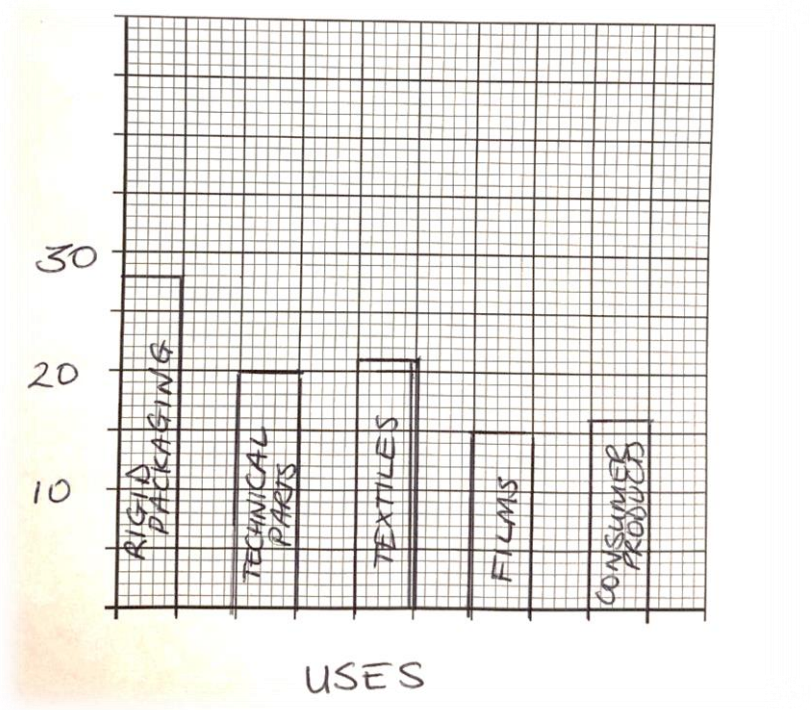
1 mark. Correctly drawn structure of propene although not in usual monomer format.



0 marks. A repeating unit is not acceptable. The monomer must be shown with the C=C.

Exemplification of Question 6 (a) (ii)

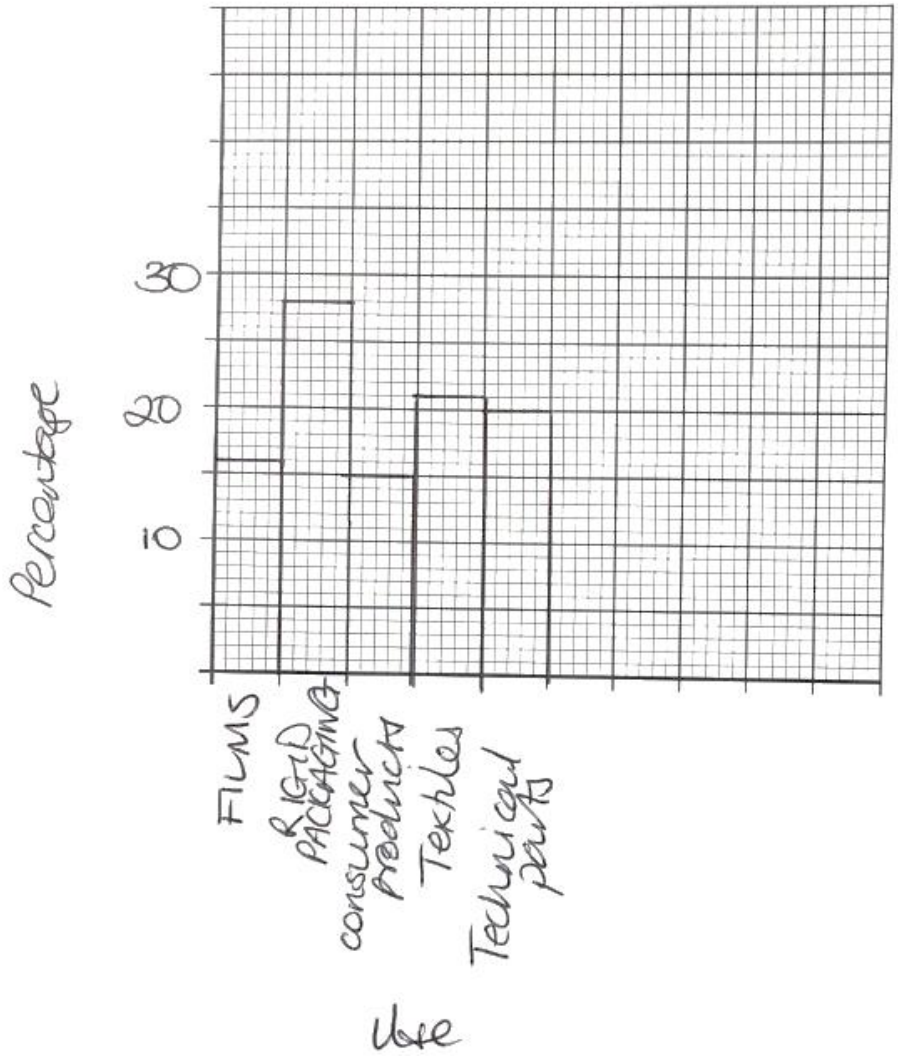
Graph 1



2 marks

1 mark for correct type – bars plotted.
1 mark for scales
0 mark for labels (missing y-axis label)
0 mark for plotting (films and consumer packaging wrongly plotted)

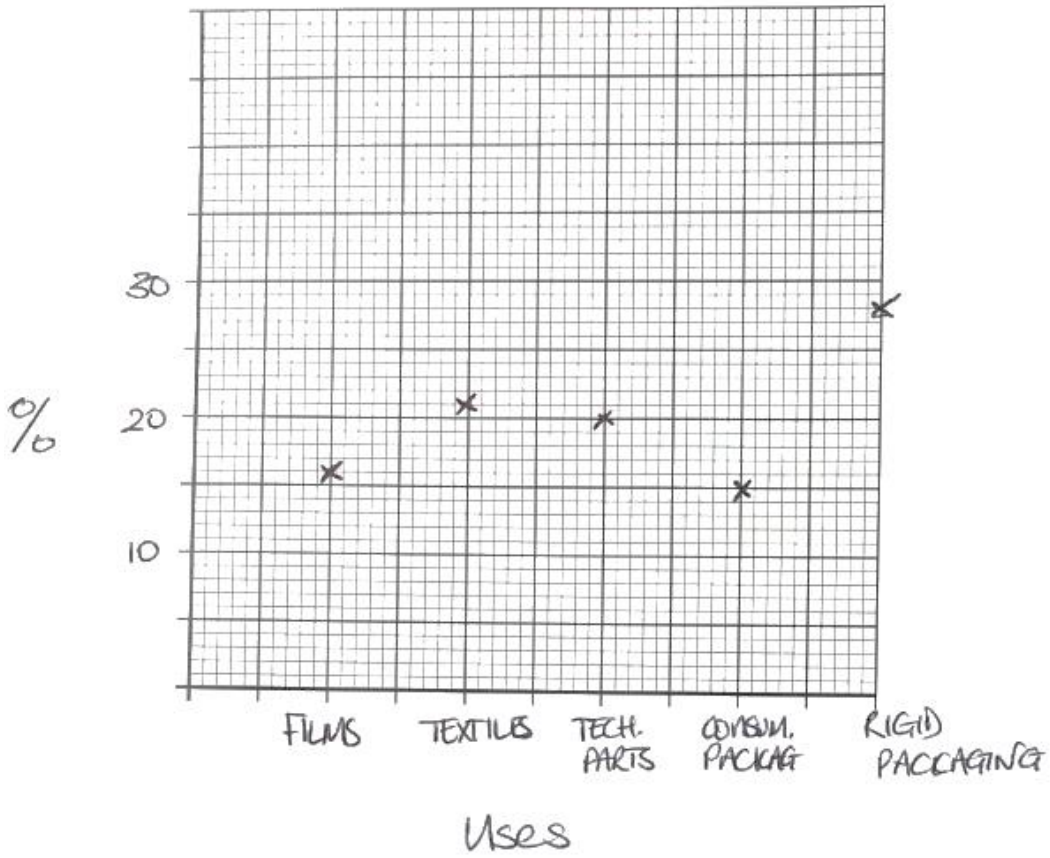
Graph 2



3 marks

1 mark for correct type – bars plotted.
0 mark for scales – last bar is not past the midway point of the graph paper
1 mark for labels
1 mark for plotting

Graph 3



3 marks

0 mark for correct type – points plotted rather than bars
1 mark for scales
1 mark for labels
1 mark for plotting

Exemplification of Question 8 (b)

Example 1

$\Delta T = \frac{76.32}{0.4 + 3.6}$

$= 53°$

Final temp $= 17 + 53°$

$= 70°$

3-marks.

1 mark deducted for incorrect unit (applied once in paper)

Example 2

$E_h = cm\Delta T$ $\quad m = \frac{400}{1000} = 0.4$

$\Delta T = \frac{mc}{E_h}$

$= \frac{0.4 \times 3.6}{76.32}$

$= 0.019$

$\Delta T = 17 + 0.019$

$= 17.019°C$

2 marks.

1 mark for correct mass in kg and 1 mark for correct final temperature calculation using incorrect delta T. Concept mark not awarded.

Example 3

$E = mc\Delta T$ $\quad m = 0.4$, $c = 3.6$, $\Delta T = ?$, $E = 76.32$

$\Delta T = \frac{E}{mc}$

$= \frac{76.32}{3.6 \times 0.4}$

$= 41°C$

$\Delta T = 17°C + 41°C = 58°C$

3 marks.

Correct mass, concept and correct final temperature calculation using incorrect ΔT value.

Example 4

$E = mc\Delta T$

$m = 0.4$

$c = 3.6$

$\Delta T = ?$

$E = 76.32$

3 marks.

Final temperature not calculated.

$$\Delta T = \frac{E}{mc}$$

$$= \frac{76.32}{0.4 \times 3.6}$$

$$= \frac{76.32}{1.44}$$

$$= 53°C$$

Example 5

$$\Delta T = \frac{E}{mc}$$

$$= \frac{76.32}{0.4 \times 3.6}$$

$$= 53°C$$

Final temp $= 17 + 53$

$= 70°C$

4 marks.

Example 6

$$\Delta T = \frac{E}{mc}$$

$m = \frac{40}{1000}$

$$= \frac{76.32}{0.04 \times 3.6}$$

$$= \frac{76.32}{0.144}$$

$$= 530$$

$\Delta T = 530 + 17$

$= 547°C$

3 marks.

Incorrect mass used but concept and calculations are correct.

Example 7

$c = 3600\ J\,kg^{-1}\,°C^{-1}$

$E = 76320\ J$

$m = \frac{400}{1000} = 0.4$

$\Delta T = \frac{E}{mc} = \frac{76320}{0.4 \times 3600}$

$\Delta T = \frac{76320}{1440} = 53°C$

Final temp $= 17 + 53°C$

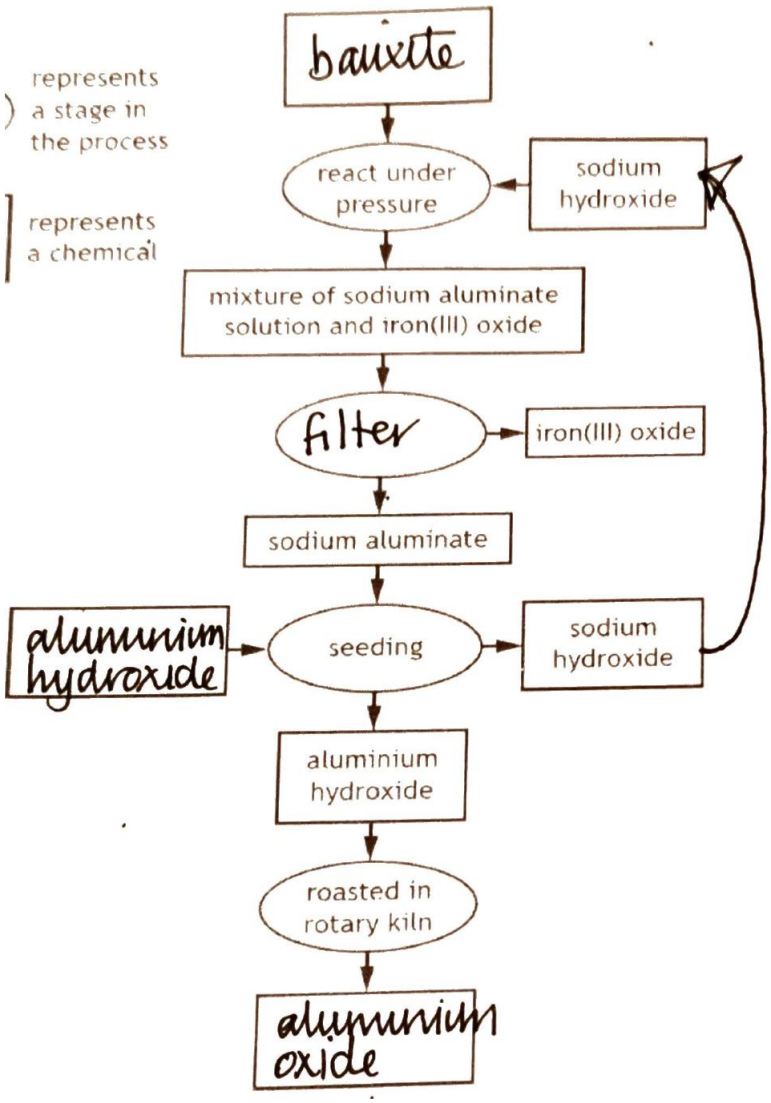
$= 60°C$

3 marks.

Final temperature calculation incorrect.

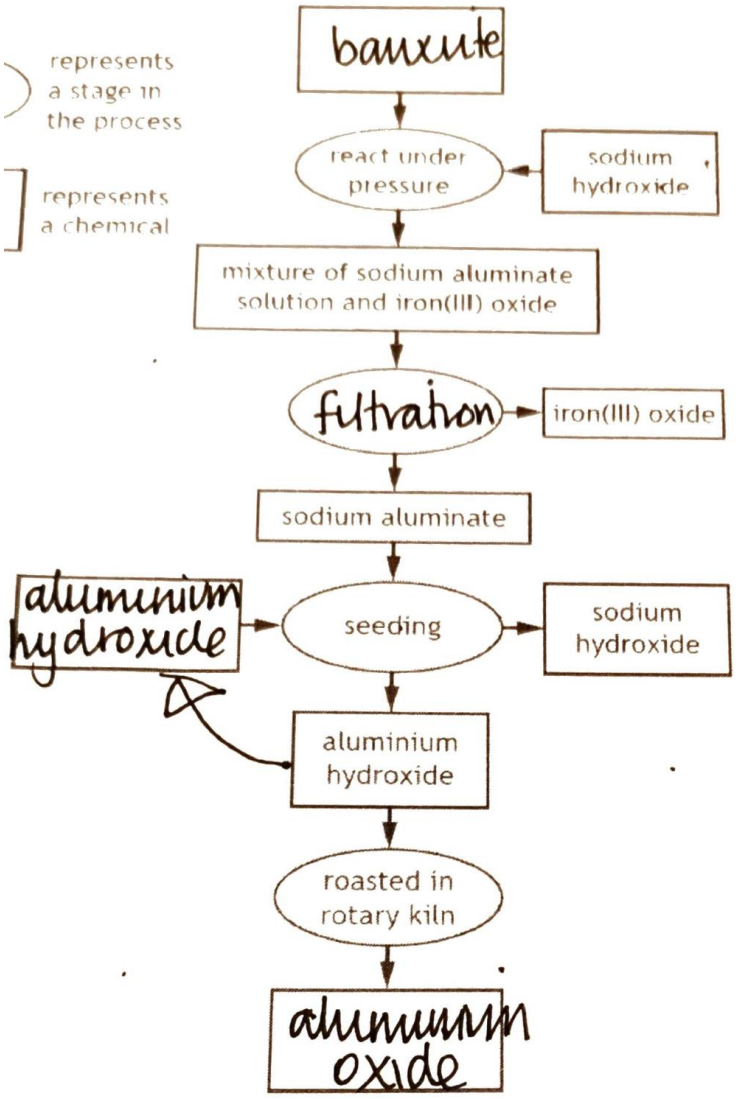
Exemplification of Question 9 (a) (ii)

Example 1



1 mark.

Example 2



1 mark.

<u>Exemplification of Question 11 (b) (i) and (ii)</u>

Example 1

11(b) (i)

5,000 years

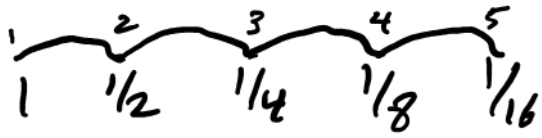
0 marks

11(b) (ii)

4 × 5,000
= 20,000

2-marks. Follow through of incorrect value with correct number of half-lives.

Example 2



= 5 ½ lives

= 5 × 5,700

= 28,500

1mark. Incorrect number of half-lives used.

Example 3

11(b) (i)

5,000 years

11(b) (ii)

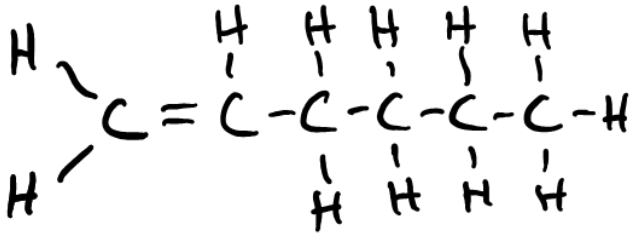
1/16 = 4 × ½ life

4 × 4,000

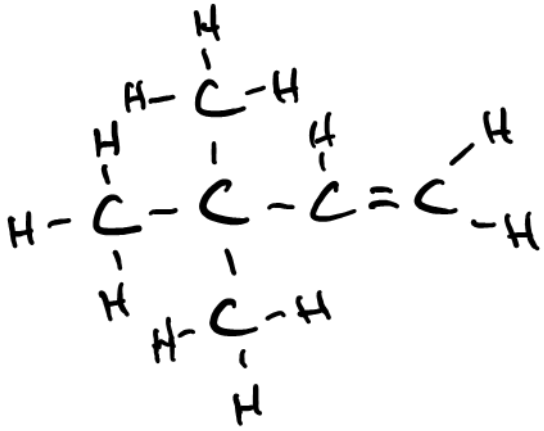
= 16,000

1 mark. Correct number of half lives, incorrect half-life used from b(i) should be 5,000.

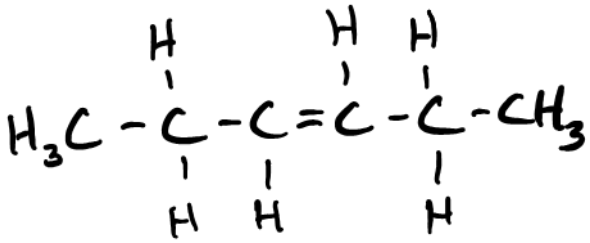
Exemplification of Question 12 b (ii)



1 mark



1 mark



1 mark

Exemplification of Question 12 (c)

Example 1

$$\frac{175}{\text{gfm } C_5H_{10}} = \frac{175}{60}$$

$$= 2.92 \times 2$$

$$= 5.84 \text{ moles of sodium}$$

$$\text{mass of sodium} = n \times \text{gfm(RAM)}$$

$$= 5.84 \times 23$$

$$= 134.32\text{g}$$

2-marks. Incorrect GFM of cyclopentane used, all other calculations correct.

Example 2

$$\frac{175}{70} = 2.5 \text{ mols}$$

$$2.5 \times 23$$

$$= 57.5$$

2-marks. Number of moles and concept mark but 2:1 ratio of sodium:cyclopentane not used. Unit not required.

Example 3

$$2Na \longrightarrow C_5H_{10}$$

$$23 \longrightarrow 70$$

$$x \longrightarrow 170$$

$$23x = 70 \times 170$$

$$x = \frac{70 \times 170}{23}$$

$$= 517.39\text{g}$$

1 mark.

Correct GFMs used. Incorrect concept.

Example 4

$$2Na \longrightarrow C_5H_{10}$$

$$2 : 1$$

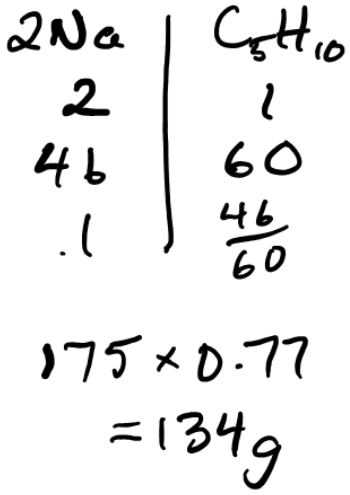
GFM 46 — 70 - GFM

175g

115g

3 marks.

Example 5



2 marks.

Incorrect GFM for cyclopentane used.

Concept mark awarded for applying concept of 174 x (2 x candidates GFM Na / candidates incorrect GFM of cyclopentane.)

2020 National 5 Chemistry Question Paper breakdown

This document provides the structure of the 2020 questions in Section 1 and Section 2 by Key Area; Knowledge/Skill; intended grade A marks.

Section 1

Question	Key Area of Course	Question Type	Grade A
1	Periodic Table and atoms	Applying knowledge to new situations, interpreting, solving problems	
2	Periodic Table and atoms	Applying knowledge to new situations, interpreting, solving problems	
3	Covalent bonding	Applying knowledge to new situations, interpreting, solving problems	
4	Chemical formulae	Applying knowledge to new situations, interpreting, solving problems	
5	Chemical formulae	Applying knowledge to new situations, interpreting, solving problems	
6	Chemical formulae	Applying knowledge to new situations, interpreting, solving problems	
7	pH	Applying knowledge to new situations, interpreting, solving problems	
8	pH	Applying knowledge to new situations, interpreting, solving problems	
9	pH	Applying knowledge to new situations, interpreting, solving problems	
10	Reporting experimental work	Drawing conclusions and giving explanations	
11	Alkenes	Drawing conclusions and giving explanations	1
12	Systematic carbon chemistry	Applying knowledge to new situations, interpreting, solving problems	
13	Alkanes	Applying knowledge to new situations, interpreting, solving problems	1
14	Systematic carbon chemistry	Applying knowledge to new situations, interpreting, solving problems	
15	Non-specific	Drawing conclusions and giving explanations	
16	Alkenes	Applying knowledge to new situations, interpreting, solving problems	
17	Carboxylic acids	Applying knowledge to new situations, interpreting, solving problems	
18	Neutralisation reactions	Applying knowledge to new situations, interpreting, solving problems	
19	General practical techniques	Applying knowledge to new situations, interpreting, solving problems	
20	Non-specific	Drawing conclusions and giving explanations	1
21	Redox	Applying knowledge to new situations, interpreting, solving problems	
22	Electrochemical cells	Applying knowledge to new situations, interpreting, solving problems	
23	Radiation	Knowledge and understanding - making statements	
24	Haber and Ostwald processes	Knowledge and understanding - making statements	1
25	General practical techniques	Processing information (using calculations and units)	

Section 2

Question	Area of Course	Question Type	Grade A
1a(i)	Periodic table and atoms	Knowledge and understanding - making statements	
1a(ii)	Periodic table and atoms	Applying knowledge to new situations, interpreting, solving problems	
1b	Periodic table and atoms	Applying knowledge to new situations, interpreting, solving problems	
1c	Covalent bonding	Applying knowledge to new situations, interpreting, solving problems	1
2a	General practical techniques	Planning or designing experiments	
2b(i)	Rates of reaction	Applying knowledge to new situations, interpreting, solving problems	
2b(ii)	Rates of reaction	Applying knowledge to new situations, interpreting, solving problems	
2c(i)	Rates of reaction	Applying knowledge to new situations, interpreting, solving problems	
2c(ii)	Rates of reaction	Drawing conclusions and giving explanations	
2c(iii)	Rates of reaction	Knowledge and understanding - descriptions and explanations	1
3a	Rates of reaction	Knowledge and understanding - making statements	
3b(i)	Commercial production of fertilisers	Knowledge and understanding - making statements	
3b(ii)	Commercial production of fertilisers	Applying knowledge to new situations, interpreting, solving problems	
3c(i)	Percentage composition	Applying knowledge to new situations, interpreting, solving problems	1
3c(ii)	Common chemical apparatus	Planning or designing experiments	
4a	Non-specific	Selecting information	
4b	Covalent bonding	Applying knowledge to new situations, interpreting, solving problems	
4c	Calculations involving the mole and balanced equations	Processing information (using calculations and units)	1
4d	Alcohols	Knowledge and understanding - making statements	
4e(i)	Carboxylic acids	Drawing conclusions and giving explanations	
4e(ii)	Alkanes	Drawing conclusions and giving explanations	
4f	Alkenes	Knowledge and understanding - making statements	
5	Metallic bonding, reactions of metals, extraction of metals	Knowledge and understanding - descriptions and explanations	2
6a(i)	Addition polymerisation	Applying knowledge to new situations, interpreting, solving problems	
6a(ii)	Non-specific	Presenting information appropriately in a variety of forms	1
6b(i)	Addition polymerisation	Knowledge and understanding - making statements	

Section 2 (continued)

Question	Area of Course	Question Type	Grade A
6b(ii)	Representation of the structure of monomers and polymers	Drawing conclusions and giving explanations	1
7a(i)	Carboxylic acids	Applying knowledge to new situations, interpreting, solving problems	
7a(ii)	Neutralisation reactions	Making predictions and generalisations based on evidence/information	
7b(i)	Neutralisation reactions	Knowledge and understanding – making statements	
7b(ii)	Analytical methods	Knowledge and understanding – making statements	
7c(i)	Analytical methods	Selecting information	
7c(ii)	Chemical formulae	Applying knowledge to new situations, interpreting, solving problems	
8a(i)	Analytical methods	Knowledge and understanding - making statements	
8a(ii)	Systematic carbon chemistry	Knowledge and understanding - making statements	
8a(iii)	Calculations involving the mole and balanced equations	Applying knowledge to new situations, interpreting, solving problems, Presenting information appropriately in a variety of forms	
8b	Energy from fuels	Applying knowledge to new situations, interpreting, solving problems	2
9a(i)	Non-specific	Processing information (using calculations and units)	1
9a(ii)	Non-specific	Suggesting improvements to experimental procedures	
9b(i)	Extraction of metals	Knowledge and understanding - making statements	1
9b(ii)	Extraction of metals	Knowledge and understanding - descriptions and explanations	1
9b(iii)	Ionic compounds	Knowledge and understanding - making statements	
9b(iv)	Redox	Applying knowledge to new situations, interpreting, solving problems	1

Section 2 (continued)

Question	Area of Course	Question Type	Grade A
10a	Non-specific	Selecting information	
10b	Chemical formulae	Applying knowledge to new situations, interpreting, solving problems	
10c	Non-specific	Drawing conclusions and giving explanations	
10d	Non-specific	Selecting information, Processing information (using calculations and units)	1
11a	Nuclear equations	Drawing conclusions and giving explanations	1
11b(i)	Half-life	Processing information (using calculations and units)	
11b(ii)	Half-life	Applying knowledge to new situations, interpreting, solving problems	
11b(iii)	Use of radioactive isotopes	Drawing conclusions and giving explanations	1
12a	Systematic carbon chemistry	Knowledge and understanding - making statements	
12b(i)	Alkenes	Applying knowledge to new situations, interpreting, solving problems	1
12b(ii)	Systematic carbon chemistry	Processing information (using calculations and units)	1
12c	Calculations involving the mole and balanced equations	Applying knowledge to new situations, interpreting, solving problems	1
12d	Cycloalkanes	Processing information (using calculations and units)	
13	Neutralisation reactions used to prepare soluble salts, analytical methods, reporting experimental work	Knowledge and understanding - descriptions and explanations	2