GradeMax



Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Subsidiary Level In Chemistry
WCH12_01

GradeMax

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A

Question Number	Answer	Mark
1	**The only correct answer is D** (HCO_3^- (aq) + H^+(aq) → CO_2(g) + H_2O(l)) ***A** is incorrect because the spectator ion, CH_3COO^-(aq), has been included* ***B** is incorrect because the spectator ion, SO_4^{2-}(aq), has been included* ***C** is incorrect because the spectator ions, K^+(aq) and NO_3^-(aq), have been included*	**(1)**

Question Number	Answer	Mark
2	**The only correct answer is A** (ammonia) ***B** is incorrect because hydrogen bonds are not formed between hydrogen chloride molecules in the liquid state* ***C** is incorrect because hydrogen bonds are not formed between hydrogen cyanide molecules* ***D** is incorrect because hydrogen bonds are not formed between methane molecules*	**(1)**

Question Number	Answer	Mark
3	**The only correct answer is A** (chloromethane) ***B** is incorrect because ethene only forms London forces between molecules* ***C** is incorrect because sulfur hexafluoride is a non-polar molecule and only forms London forces between molecules* ***D** is incorrect because tetrachloromethane is a non-polar molecule and only forms London forces between molecules*	**(1)**

Question Number	Answer	Mark
4	**The only correct answer is B** (−1) ***A*** *is incorrect because oxygen does not have an oxidation number of −2 in* H_2O_2 ***C*** *is incorrect because oxygen only has an oxidation number of 0 in* O_2 *and* O_3 ***D*** *is incorrect because oxygen has an oxidation number of +2 only in* F_2O	**(1)**

Question Number	Answer	Mark
5	**The only correct answer is B** ((carbon) increase (hydrogen) no change (oxygen) decrease) ***A*** *is incorrect because the oxidation number of hydrogen does not increase* ***C*** *is incorrect because the oxidation number of oxygen does not increase and the oxidation number of carbon does not decrease* ***D*** *is incorrect because all the oxidation number changes are incorrect*	**(1)**

Question Number	Answer	Mark
6	**The only correct answer is A** (change in pressure, decrease; equilibrium shift, left) ***B*** *is incorrect because the pressure decreases when the volume is increased* ***C*** *is incorrect because the equilibrium shifts to the left with more moles of gas when pressure decreases* ***D*** *is incorrect because the pressure decreases when the volume is increased and the equilibrium shifts to the left with more moles of gas when pressure decreases*	**(1)**

Question Number	Answer	Mark
7	**The only correct answer is C** (low molar mass) ***A*** *is incorrect because primary standards must form stable solutions* ***B*** *is incorrect because primary standards must have high solubility in water* ***D*** *is incorrect because primary standards must react rapidly with other substances when used in titrations*	**(1)**

Question Number	Answer	Mark
8(a)	**The only correct answer is B** (Student 2) ***A*** *is incorrect because student 1 does not have the mean closest to the true value* ***C*** *is incorrect because student 3 does not have the mean closest to the true value* ***D*** *is incorrect because student 4 does not have the mean closest to the true value*	**(1)**

Question Number	Answer	Mark
8(b)	**The only correct answer is A** (Student 1) ***B*** *is incorrect because student 2 does not have narrowest range* ***C*** *is incorrect because student 3 does not have narrowest range* ***D*** *is incorrect because student 4 does not have narrowest range*	**(1)**

Question Number	Answer	Mark
9	**The only correct answer is B** (carbon dioxide) ***A*** *is incorrect because ammonia will not turn limewater cloudy but will extinguish a lighted splint and turn red litmus solution blue* ***C*** *is incorrect because nitrogen dioxide will not turn limewater cloudy but will turn blue litmus solution red* ***D*** *is incorrect because sulfur dioxide will not turn limewater cloudy but will extinguish a lighted splint and turn blue litmus solution red*	**(1)**

Question Number	Answer	Mark
10	**The only correct answer is C** (poly(ethene)) ***A*** *is incorrect because when diamond melts covalent bonds are broken* ***B*** *is incorrect because when magnesium oxide melts ionic bonds are broken* ***D*** *is incorrect because when silver melts metallic bonds are broken*	**(1)**

Question Number	Answer	Mark
11	**The only correct answer is C** ($\Delta_r H^\ominus$) ***A*** *is incorrect because by definition* $\Delta_c H^\ominus$ *refers to the combustion of one mole of substance* ***B*** *is incorrect because by definition* $\Delta_f H^\ominus$ *refers to the formation of one mole of substance* ***D*** *is incorrect because by definition* $\Delta_{neut} H^\ominus$ *refers to the formation of one mole of water*	**(1)**

Question Number	Answer	Mark
12	**The only correct answer is D** (II and III) ***A*** *is incorrect because catalysts do always decrease energy consumption and do not always increase atom economy to 100%* ***B*** *is incorrect because catalysts do always increase the rate of reaction and do not always increase atom economy to 100%* ***C*** *is incorrect because catalysts do not always increase atom economy to 100%*	**(1)**

Question Number	Answer	Mark
13	**The only correct answer is C** (NH_3) ***A*** *is incorrect because* NH_4^+ *cannot act as a nucleophile as it does not have a lone pair of electrons* ***B*** *is incorrect because* Cl_2 *cannot act as a nucleophile as it does not have a donatable lone pair of electrons* ***D*** *is incorrect because* CO_2 *cannot act as a nucleophile as it does not have a donatable lone pair of electrons*	**(1)**

Question Number	Answer	Mark
14	**The only correct answer is C** (4) ***A*** *is incorrect because there are 4 structural isomers of* C_4H_9Br ***B*** *is incorrect because there are 4 structural isomers of* C_4H_9Br ***D*** *is incorrect because there are 4 structural isomers of* C_4H_9Br	**(1)**

Question Number	Answer	Mark
15	**The only correct answer is A** ($C_2H_4 + H_2 \rightarrow C_2H_6$) ***B*** *is incorrect because it is a neutralisation reaction with no change in oxidation number* ***C*** *is incorrect because it is a substitution reaction with no change in oxidation number* ***D*** *is incorrect because it is a neutralisation reaction with no change in oxidation number*	**(1)**

Question Number	Answer	Mark
16 (a)	**The only correct answer is D** (Y) ***A*** *is incorrect because calcium reacts with water instead of slightly dissolving in it* ***B*** *is incorrect because calcium reacts with water instead of dissolving in it and forms an alkaline solution* ***C*** *is incorrect because calcium reacts with water instead of slightly dissolving in it and forms an alkaline solution*	**(1)**

Question Number	Answer	Mark
16(b)	**The only correct answer is D** (Z) ***A*** *is incorrect because barium sulfate is not slightly soluble in water so no alkaline solution is formed* ***B*** *is incorrect because barium sulfate is not soluble in water so no neutral solution is formed* ***C*** *is incorrect because barium sulfate does not react with water so no alkaline solution is formed*	**(1)**

Question Number	Answer	Mark
16(c)	**The only correct answer is A** (V) ***B*** *is incorrect because calcium hydroxide is only slightly soluble and forms an alkaline solution* ***C*** *is incorrect because calcium hydroxide does not react with water but dissolves to form an alkaline solution* ***D*** *is incorrect because calcium hydroxide is slightly soluble in water and forms an alkaline solution*	**(1)**

Question Number	Answer	Mark
17	**The only correct answer is D** ($CH_3CH_2C(CH_3)_2CH_2CH(CH_3)CH_3$) ***A*** *is incorrect because the isomer has no branching* ***B*** *is incorrect because this isomer has only one branch* ***C*** *is incorrect because this isomer has only two branches*	**(1)**

TOTAL FOR SECTION A = 20 MARKS

Section B

Question Number	Answer	Additional Guidance	Mark
18(a)(i)	• equation	$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$ Accept NaClO Allow multiples Ignore state symbols even if incorrect	**(1)**

Question Number	Answer	Additional Guidance	Mark
18(a)(ii)	An answer that makes reference to the following points: • chlorine has been both oxidised from zero to (+)5 in $NaClO_3$ **(1)** • and chlorine has been reduced from zero to −1 in NaCl **(1)**	$Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$ Oxidation Number: 0 → −1 and 0 → (+)5	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>18(b)</td><td>An answer that makes reference to three of the following points:

• calculation of percentage oxygen (1)

• calculation of moles of Na, Br and O (1)

• calculation of ratio and empirical formula (1)</td><td>Example of calculation

%O = (100 – (52.9 + 13.3)) = 31.8

<table><tr><td>Element</td><td>Na</td><td>Br</td><td>O</td></tr><tr><td rowspan="2">moles</td><td>15.3 ÷ 23</td><td>52.9 ÷ 79.9</td><td>31.8 ÷ 16</td></tr><tr><td>= 0.665</td><td>= 0.662</td><td>= 1.9875</td></tr><tr><td>ratio</td><td>1</td><td>1</td><td>3</td></tr></table>
$NaBrO_3$
Allow elements in any order

Allow (1) for correct formula with no working
Allow (1) for omission of O with working to give NaBr
TE from calculation of O error</td><td>(3)</td></tr>
</table>

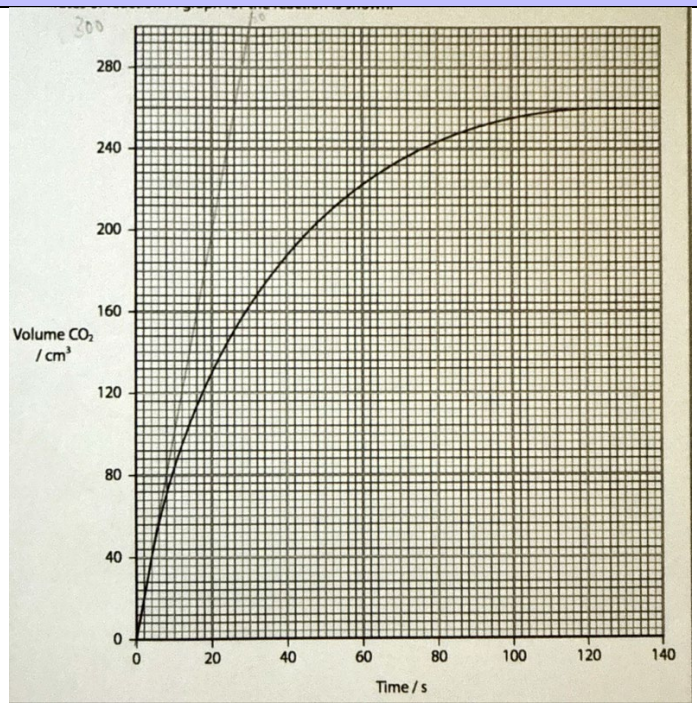
Question Number	Answer	Additional Guidance	Mark
18(c)(i)	An answer that makes reference to the following point: • a base	Do not award reference to alkali	**(1)**

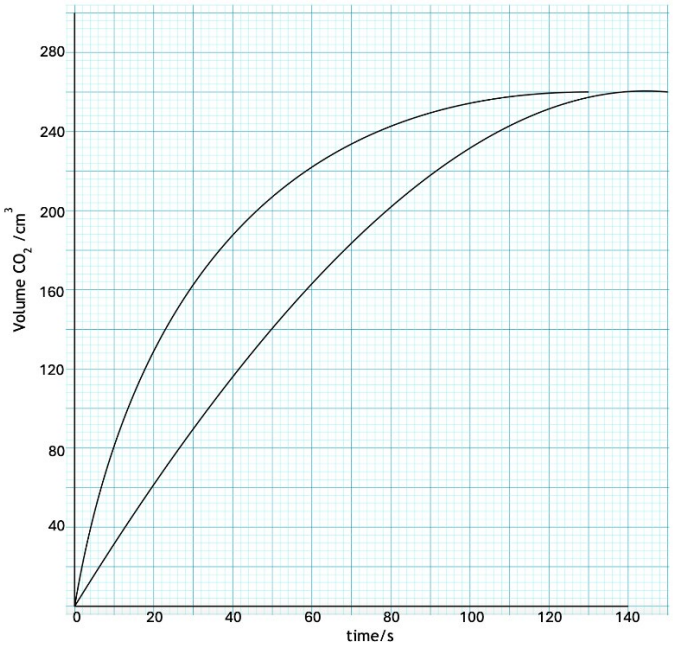
Question Number	Answer	Additional Guidance	Mark
18(c)(ii)	An answer that makes reference to the following point: • redox	 Allow oxidation-reduction	**(1)**

Question Number	Answer	Additional Guidance	Mark
18(c)(iii)	An answer that makes reference to two of the following points: • correct species **(1)** • balanced equation **(1)**	 $6HI + H_2SO_4 \rightarrow 4H_2O + S + 3I_2$ Allow Ionic equation $6I^- + H_2SO_4 + 6H^+ \rightarrow 4H_2O + S + 3I_2$ Allow multiples Ignore state symbols even if incorrect	**(2)**

(Total for Question 18 = 10 marks)

Question Number	Answer	Additional Guidance	Mark
19(a)	• formula of acid	Examples of formulae H_2SO_3 H_2SO_4 HNO_3 Allow HNO_2 H_2CO_3	**(1)**

Question Number	Answer	Additional Guidance	Mark
19(b)(i)	An answer that makes reference to the following points: • tangent drawn at **time 0s** **(1)** • calculation of rate **(1)** • units **(1)**	 ($300\ cm^3 \div 30s =$) 10.0 Allow Range between 17.0 and 8.0 Ignore SF $cm^3\ s^{-1}$ Allow alternative units if they match the rate value TE from incorrect tangent	**(3)**

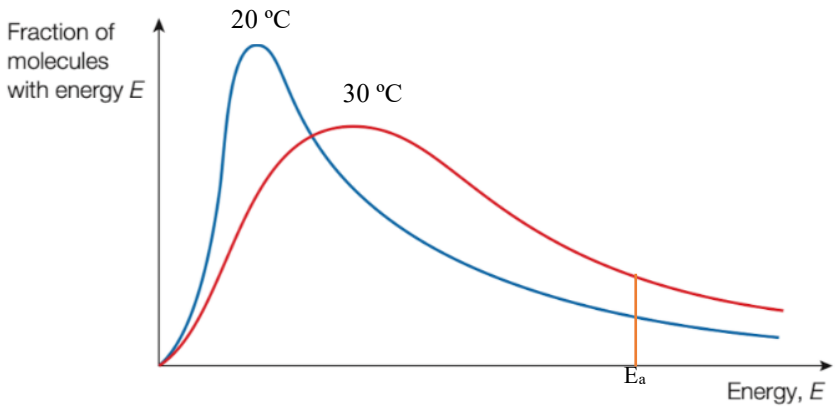
Question Number	Answer	Additional Guidance	Mark
19(b)(ii)	An explanation that makes reference to the following points: • a similar shaped curve below the original line **(1)** • the larger marble chips have a (total) smaller surface area, so a decreased rate of reaction **(1)** • the line will finish at 260 cm^3/ final volume is the same **and** particle size is the only change or the mass / moles stay the same **(1)**	 Do not award either a line that drops back down or is clearly sigmoidal	**(3)**

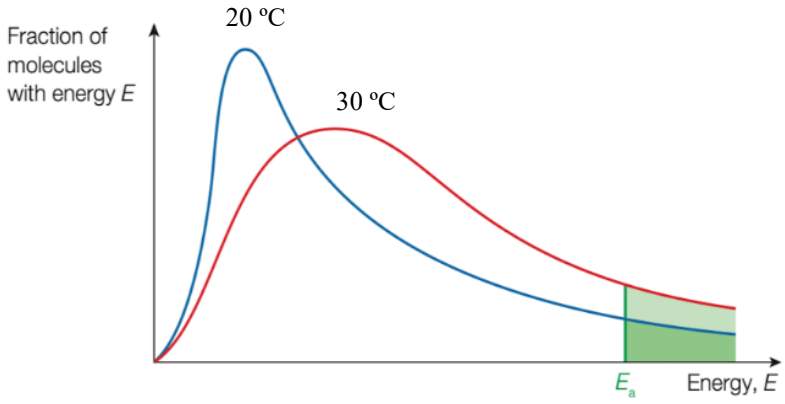
Question Number	Answer	Additional Guidance	Mark
19(c)	An explanation that makes reference to the following points: • increasing thermal stability down the group **(1)** • the cations increase in size **and** are less polarising **(1)** • which weakens the C−O bond in carbonate ion less (to form the more thermally stable oxide ion) **(1)**	Allow reverse argument Allow increasing ionic radius Allow reference to charge density decreases Allow less distortion of the electron cloud for polarisation Do not award atomic radius Allow C=O Ignore distortion of carbonate ion	**(3)**

Question Number	Answer	Additional Guidance	Mark
19(d)(i)	An answer that makes reference to the following points: • moles of HCl **(1)** • moles of $Ca(OH)_2$ **(1)** • mass of $Ca(OH)_2$ **(1)** • mass of $Ca(OH)_2$ in 100 cm^3 of limewater **and** answer to 3SF **(1)** Alternative steps 3 and 4 • moles of $Ca(OH)_2$ in 100 cm^3 of limewater **(1)** • mass of $Ca(OH)_2$ **and** answer to 3SF **(1)**	<u>Example of calculation</u> $n(HCl) = 23.35 \times 0.05 \div 1000 = 1.16750 \times 10^{-3}$ (mol) $n(Ca(OH)_2) = 1.16750 \times 10^{-3} \div 2 = 5.83750 \times 10^{-4}$ (mol) $m(Ca(OH)_2) = 5.83750 \times 10^{-4} \times 74.1 = 0.043256$ (g) Mass of $Ca(OH)_2$ in 100 cm^3 of limewater = $0.043256 \times 4 = 0.17302$ g/100 cm^3 of limewater m = 0.173 (g) Correct answer with no working scores (4) Allow TE throughout $n(Ca(OH)_2) = 2.335 \times 10^{-3}$(mol) mass $Ca(OH)_2$ = 0.173023 (g) m = 0.173 (g)	**(4)**

Question Number	Answer	Additional Guidance	Mark
19(d)(ii)	An explanation that makes reference to the following points: • mass of calcium hydroxide dissolved at 70°C **(1)** • concentration in mol dm^{-3} **(1)** **or** • using the moles from step 3 (in di) to find moles in $100cm^3$ **(1)** • concentration in mol dm^{-3} **(1)**	<u>Example of calculation</u> $m = 0.173 \times (1 - 0.345) = 0.11332$ (g) $c = 0.11332 \times 10 \div 74.1 = 0.015293 / 0.0153$ (mol dm^{-3}) $n = 2.335 \times 10^{-3} \times 10 = 2.335 \times 10^{-2}$ (mol) $c = 2.335 \times 10^{-2} \times 0.655 = 0.015293 / 0.0153$ (mol dm^{-3}) Correct answer with no working scores (2) Allow TE from part (d)(i) Ignore SF except 1SF	**(2)**

(Total for Question 19 = 16 marks)

Question Number	Answer	Additional Guidance	Mark
20(a)(i)	An answer that makes reference to the following points: • second broader distribution curve drawn for 30 ºC **(1)** • activation energy (E_a) labelled to the right of both peaks **(1)**	 Lines must cross only once and do not touch on the right Penalise any line that goes up at the end	**(2)**

Question Number	Answer	Additional Guidance	Mark
20(a)(ii)	An explanation that makes reference to the following points: • at 30 ºC the distribution curve has a greater area under the curve after E_a (than the 20 ºC distribution curve) **(1)** • (so) there is a larger number of particles present with energy ⩾ the activation energy (E_a) (resulting in more successful collisions per second) **(1)**		**(2)**

Question Number	Answer		Additional Guidance	Mark
20(b)	An answer that makes reference to the following points: Hydrogen iodide has a higher boiling point because • hydrogen iodide has more electrons (than hydrogen chloride) • hydrogen iodide has stronger/ more London forces (requiring more energy to break) Hydrogen iodide has a lower boiling point because • hydrogen fluoride has hydrogen bonding (between molecules) • hydrogen bonding is the strongest intermolecular force **or** hydrogen bonding requires more energy to break	**(1)** **(1)** **(1)** **(1)**	Allow iodine has more electrons than chlorine Ignore permanent dipole-permanent dipole interactions Allow dispersion forces/ instantaneous dipole - induced dipole/ van der Waals' forces for London forces Allow hydrogen iodide does not have hydrogen bonding Ignore fluorine is more electronegative than iodine Accept London forces are weaker than hydrogen bonds or less energy is required	**(4)**

(Total for Question 20 = 8 marks)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>*21</td>
<td>
This question assesses the student's ability to show a coherent and logically structured answer with linkages and fully sustained reasoning.

Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.

The following table shows how the marks should be awarded for indicative content.

<table>
<tr><td>Number of indicative marking points seen in answer</td><td>Number of marks awarded for indicative marking points</td></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5–4</td><td>3</td></tr>
<tr><td>3–2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>

The following table shows how the marks should be awarded for structure and lines of reasoning.

<table>
<tr><td></td><td>Number of marks awarded for structure of answer and sustained lines of reasoning</td></tr>
<tr><td>Answer shows a coherent logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr>
<tr><td>Answer has no linkages between points and is unstructured</td><td>0</td></tr>
</table>
</td>
<td>
Guidance on how the mark scheme should be applied.

The mark for indicative content should be added to the mark for lines of reasoning. For example, a response with five indicative marking points that is partially structured with some linkages and lines of reasoning scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning).

If there were no linkages between the points, then the same indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).

In general, it would be expected that:
5 or 6 indicative points would get 2 reasoning marks
3 or 4 indicative points would get 1 reasoning mark
0, 1 or 2 indicative points would get zero reasoning marks.

If there is any incorrect chemistry, deduct mark(s) from the reasoning. If no reasoning mark(s) awarded, do not deduct mark(s).

Comment: Look for the indicative marking points first, then consider the mark for the structure of the answer and sustained line of reasoning.
</td>
<td>(6)</td>
</tr>
</table>

	Indicative content **IP1** 2-bromobutane reacts by both (nucleophilic) substitution and elimination. **IP2** (nucleophilic substitution occurs in) an aqueous solution of potassium hydroxide **and** (elimination occurs in) an ethanolic solution of potassium hydroxide **IP3 (**under aqueous conditions) butan-2-ol is formed **IP4** under ethanolic conditions structural **and** geometric isomers are formed **IP5** but-2-ene has two geometric isomers *E*-but-2-ene **and** *Z*-but-2-ene **IP6** the final isomer formed is but-1-ene	Allow correctly drawn structures for the four structures May be expressed anywhere in the answer Allow 1IP for one correct reaction type linked to correct condition if neither IP1 or IP2 scored IP3 – butan-2-ol by name or formula DNA butan-1-ol Allow trans/cis for *E*/*Z* IP6 – but-1-ene by name or formula Accept structural/skeletal/displayed or hybrid formulae. If both name and structure given both must be correct. Ignore reference to optical isomerism Ignore mechanisms even if incorrect	

(Total for Question 21 = 6 marks)

TOTAL FOR SECTION B = 40 MARKS

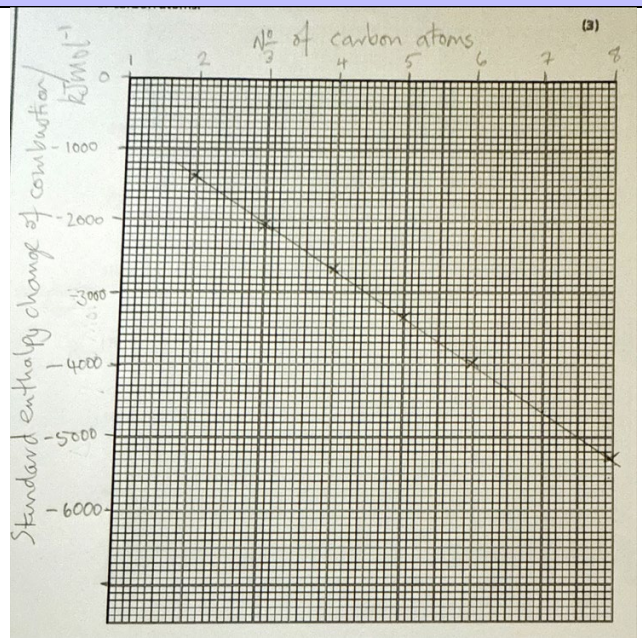
Section C

Question Number	Answer	Additional Guidance	Mark
22(a)	An answer that makes reference to two of the following points: • non-toxic (in small amounts) **(1)** • evaporates easily **(1)** • dissolves the perfume molecules easily **(1)** • has a low odour / little aroma **(1)** • antiseptic nature means that the perfume will last (for a long time) **(1)**	Allow not harmful (in small amounts)/ non-irritant on skin Highly volatile Allow a description of dissolving Not masking smell of perfume Ignore reacts to form esters or carboxylic acids Ignore references to cost, renewability, sustainability	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(b)(i)	An answer that makes reference to the following point: • balanced equation with state symbols	$CH_3OH(l) + 1½O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ If more than one equation given both must be correct. Do not award multiples	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(b)(ii)	An explanation that makes reference to the following points: • change in energy substitution and evaluation **(1)** • M_r and mol of methanol **(1)** • enthalpy change of combustion **(1)** • answer correct to 2/3SF with the sign **(1)**	<u>Example of calculation</u> $\Delta T = 26.9 - 22.2 = 4.7$ (°C) $Q = 150 \times 4.18 \times 4.7$ $Q = (-)2946.9$ (J) M_r methanol $= 12 + 4(1) + 16 = 32$ n methanol $= (0.26 \div 32 =) \ 8.125 \times 10^{-3}$ (mol) $\Delta_c H = (-2946.9 \div 8.125 \times 10^{-3} =) \ (-)362695$ (J mol^{-1}) −363 (kJ mol^{-1})/ −360 (kJ mol^{-1}) Correct answer with no working scores (4) TE throughout	**(4)**

Question Number	Answer	Additional Guidance	Mark
22(b)(iii)	An answer that makes reference to the following point: • heat (energy) loss (to the surroundings) or incomplete combustion	Do not award non-standard conditions / evaporation	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(b)(iv) **clip with 22(b)(v)**	An answer that makes reference to the following points: • axes labelled with number of carbon atoms on the x axis and standard enthalpy change of combustion with units on the y axis **(1)** • all points correctly plotted ± ½ small square **(1)** • suitable scale so points cover half the graph paper for both axes **and** straight line of best fit through the points **(1)**		**(3)**

Question Number	Answer	Additional Guidance	Mark
22(b)(v)	An answer that makes reference to the following point: • value for 7 carbons interpolated from graph	Value from correctly drawn graph for heptan-1-ol −4600 to −4700 (kJ mol^{-1}) Value on line supersedes the value in the box	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(c)(i)	An answer that makes reference to the following points: • from orange to (more) yellow **(1)** • the equilibrium will shift in the exothermic direction (towards the chromate (VI) ion) **(1)**	Allow colour goes less orange / goes yellow Allow reference to the forward reaction being endothermic so equilibrium shifts left	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(c)(ii)	An answer that makes reference to the following point: • skeletal formula of propanal	 View other formulae of propanal as working	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(c)(iii)	An answer that makes reference to the following points: (Reaction (ii) forms propanal) • C=O (stretching vibration) at 1740 – 1720 (cm^{-1}) or C−H (stretching vibration) absorption at 2900 – 2820/ 2775 – 2700 (cm^{-1}) **(1)** (Reaction (iii) forms propanoic acid) • O−H (stretching vibration) at 3300 – 2500 (cm^{-1}) or C=O (stretching vibration) absorption at 1725 – 1700 (cm^{-1}) **(1)**	The correct bonds must be shown The bond must be shown between C−H The bond must be shown between O−H Penalise lack of bond shown between the atoms once only Penalise single value within the range once only	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>22(c)(iv)</td><td>An answer that makes reference to the following points:

<table>
<tr><th>Name of functional group</th><th>Test</th><th>Positive result</th></tr>
<tr><td>aldehyde</td><td>Warm with Fehling's or Benedict's solution</td><td>brick red ppt/red ppt</td></tr>
<tr><td>carboxylic acid</td><td>Add sodium carbonate solution</td><td>fizzing, bubbles, effervescence</td></tr>
</table>
(1)

(1)</td><td>Award (1) for either one correct row or one correct column

Allow orange ppt
Ignore carbonyl

Ignore formulae of functional group must be name</td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
22(d)	An answer that makes reference to the following points: • the pure alcohol can react with the screen / dissolves the lens coating	Accept reverse arguments Allow mixed solvent cleans the screen better Ignore just damages the screen Ignore reference to cost Ignore any reference to corrodes Do not award reference to more hazardous	**(1)**

(Total for Question 22 = 20 marks)
TOTAL FOR SECTION C = 20 MARKS
TOTAL FOR PAPER = 80 MARKS