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Examiners' Report
October 2025

Pearson Edexcel International Advanced Subsidiary level In Chemistry
WCH12/01A

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October 2025
Question Paper Log Number P87419A
Publication Code WCH12_01A_2510_ER
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Introduction

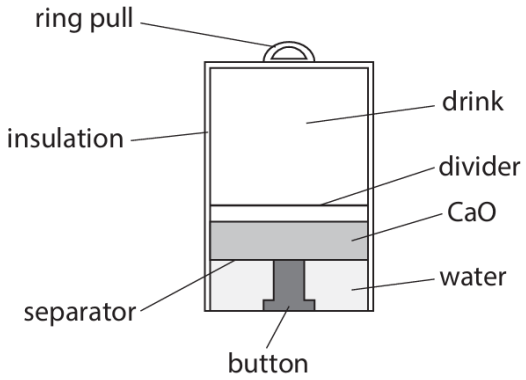
The mean score for this paper shows it provided opportunities for learners to show their knowledge and understanding of Unit 2
Learners were well prepared for calculations, laying out work clearly to ensure transferred error marks to be awarded. Minor errors with units persist. Mark scheme requirements for organic mechanisms were well understood but key marking points such as dipoles were not always translated across to less familiar questions such as representing hydrogen bonding.
It was pleasing to see many learners familiar with key reactions such as use of halogenating agents with alcohols and the reaction of Group 1 halides with concentrated sulfuric acid. This included accurate descriptions of the expected observations.
Centres have clearly spent time with learners to recognise the mark scheme requirements of key command words such as “compare and contrast” and the structuring of extended open response questions.
It is a challenge for some learners to explain the steps in a practical procedure, or the role of specifc reactants in equations. Weaker responses generally were unable to identify and use information provided in a question. Reference to the marks awarded for a question provides valuable information to learners about the expected depth and breadth of response.

Question 18(ai)

This question was designed for candidates across the ability range.

18 Salts have many uses.

(a) The reaction between calcium oxide and water to produce calcium hydroxide solution is exothermic, and is used to warm canned drinks.
A typical arrangement is shown.



The enthalpy change of reaction is $-65.1\,kJ\,mol^{-1}$.

(i) Calculate the mass of calcium oxide that would be required to raise the temperature of 200 cm^3 of drink by 40 °C.

[Data: Assume the specific heat capacity of the solution = $4.18\,J\,g^{-1}\,°C^{-1}$
density of solution = $1.00\,g\,cm^{-3}$]

Learners were well rehearsed in how to use the equation for energy transferred. It was pleasing to see many successful responses with well laid out calculations, exemplified in the 3 mark example below.

$m_{Ca(OH)_2} = pV = 1 \times 200 = 200g$ (3)

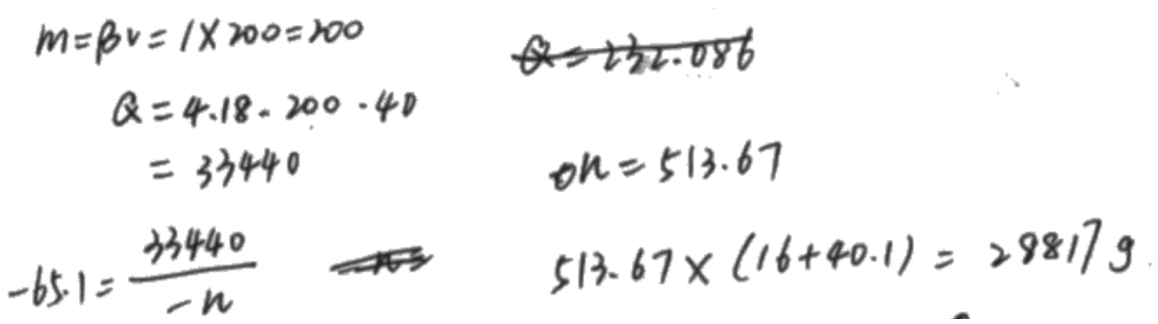
$Q = cm\Delta t = 4.18 \times 200 \times 40 = 33440\ J = 33.44\ kJ$

$\Delta H = -\frac{Q}{n} \rightarrow n = -\frac{Q}{\Delta H} = -\frac{33.44}{-65.1} =$ ~~0.5130~~ 0.5137 mol

$n_{CaO} = 0.5137$ mol

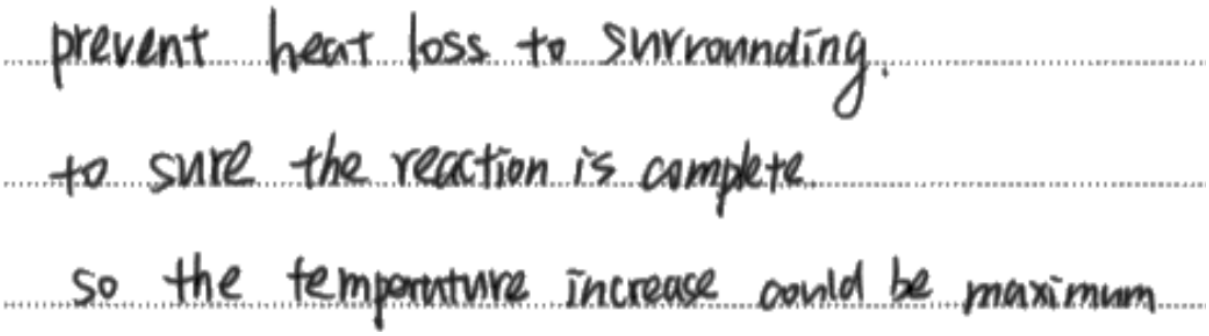
$n = \frac{m}{Mr} \rightarrow m = n \cdot Mr = 0.5137 \times (16+40) = 28.779$

Where errors were made, it was mainly due to the use of two different units ($kJ.mol^{-1}$ and $J.mol^{-1}$) as shown below. Learners are reminded to check all units are consistent prior to entering numbers into their calculators. This scores 2 marks as transferred error was allowed throughout.



Question 18(aii)

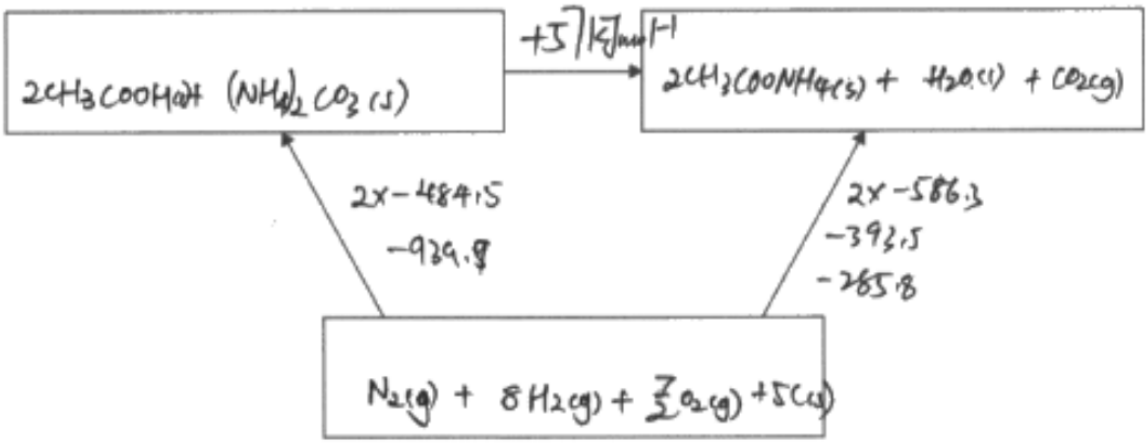
This question expected learners to link a safety feature (insulated container) to a hazard/risk. This proved challenging for many, who interpreted the diagram as experimental apparatus, rather than a product designed for a specifc use, missing what was outlined in the question.
Below shows a response typical of many learners, who successfully identified insulation as reducing heat loss/transfer to score the first marking point, without identifying the hazard/risk.



The start of a question provides important context and learners are advised to read all parts of the question carefully.

Question 18(b)

A pleasing number of learners made good progress with both the construction of the Hess cycle and their calculations. The best responses laid out calculations clearly, using the enthalpy change arrows on the diagram. This is shown in the 5 mark response below: labelling arrows proved to be a successful way to minimise errors.



$2 \times 484.5 + 939.8 - (2 \times 586.3 + 393.5 + 285.8)$

$= +J/kJ\ mol^{-1}$

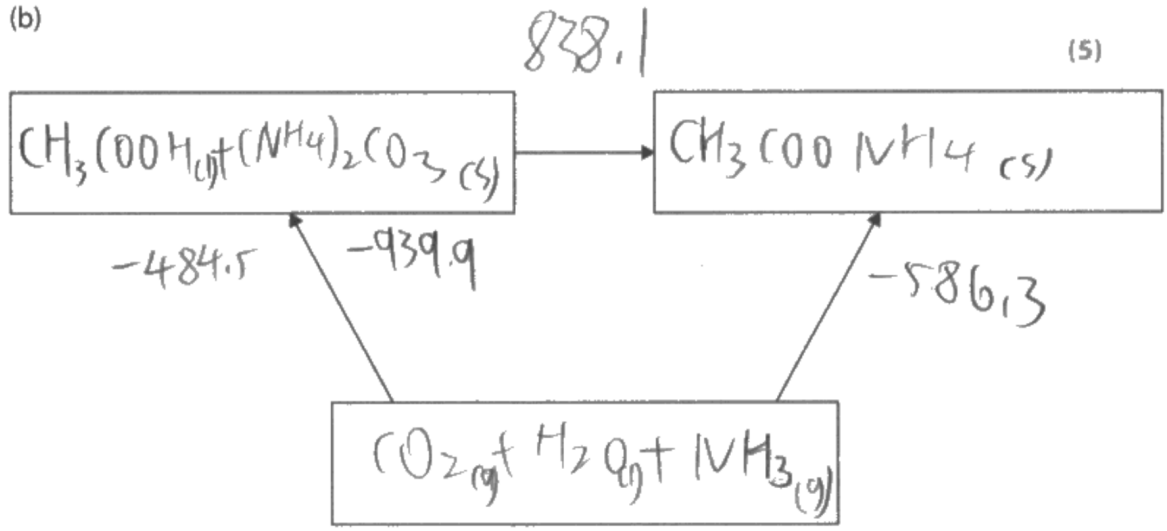
$\Delta_r H^{\ominus} = +J/kJ\ mol^{-1}$

Accurate construction of the Hess cycle proved to be a challenge for some learners, with errors including:

- omission of state symbols
- omission of the carbon dioxide and water products in this neuralisation equation
- incorrect calculation of the number of moles of products

It is useful to remember that there is no transferred error (TE) on incorrect Hess cycles to the final calculation, so checking that each equation is balanced will improve the success rate in these types of questions.

Thisresponse scored zero marks, as the products are inorrect and incomplete and, as was often seen, confusion over the standardenthalpy of formation definition.



Recalling the enthalpy change definitions is essential for the successful completion of these questions.

Question 18(c)

Many learners produced excellent responses to this question, showing confidence in their calculation of solution concentrations. Where errors were made, it was most commonly in the calculation of the RFM of ammonium carbonate, as shown below, which scores 1 mark as transferred error is applied.

$$n((NH_4)_2CO_3) = \frac{3.6}{52} = 0.0692 \text{ mol}$$

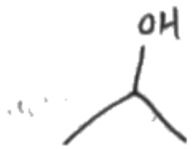
$$C = \frac{n}{V} = \frac{0.0692}{0.2 \text{ dm}^3} = 0.346 \text{ mol dm}^{-3}$$

Learners are advised to lay out their calculation of RFM clearly as shown, to reduce the likelihood of making this mistake.

$Mr = 2\times(14+4)+12+3\times16 = 96 \text{ g mol}^{-1}$.

Question 19(a)

Many learners were confident in their use of skeletal formulae and the classification and naming of alcohols.
The IUPAC naming system is designed to be unambiguos and centres should train learners in absolute precision of language. Some learners were unable to accurately recall the naming rules, as seen below. This scored 2 marks.

Skeletal formula	Name	Classification
	propane-2-ol	secendary alcohol
	propane-1-ol	primary alcohol

Question 19(bi)

The reduction of $Cr_2O_7^{2-}$ ions to Cr^{3+} ions is a common half equation. Many learners successfully recalled the species involved, which scored the first mark, but were unable to balance the equation correctly. Both these score 1 mark.

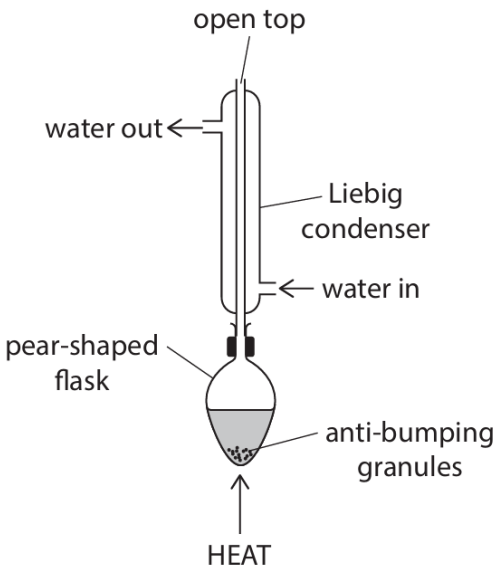
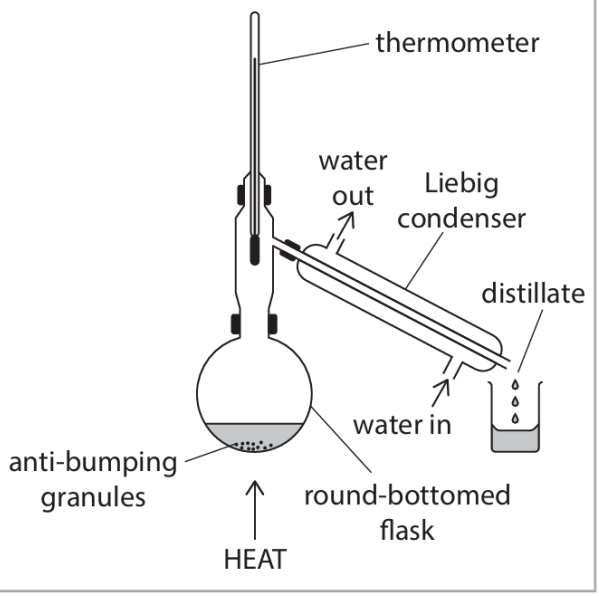
+ 14 H^+ + 9e$^-$ → Cr^{3+} + 7H_2O

+ 7 H^+ + 3e$^-$ → Cr^{3+} + 7H_2O

Learners should practise balancing equations with respect to charge and use the common equations frequently, to enable accurate recall.

Question 19(bii)

(b) Ethanol can be oxidised by acidified sodium dichromate(VI) to ethanal and then to ethanoic acid. The apparatus may be set up in two ways.

Reflux apparatus	Distillation apparatus
	

(ii) Describe how the reflux apparatus ensures that any ethanal initially produced is further oxidised to ethanoic acid.

(1)

This question proved to be one of the most challenging on the paper, as learners found it difficult to describe the liquid condensing *and* returning to the flask, as required by the mark scheme.

Question Number	Answer	Additional Guidance
19 (b)(ii)	An answer that makes reference to the following point: • any ethanal (that evaporates) is condensed back into the flask to be further oxidised (to ethanoic acid)	Allow any indication that a liquid is returning to the flask / mixture Ignore just (reflux) prevents any ethanal vapour from escaping Ignore any reference to ethanol

These responses are typical, where learners show understanding of the process, but lack the precision of language to score.

The liquid evaporated will be condense to liquid and been react completely

• The product will ~~fall~~ cool down and back to flask and the evaporated again.

It is important for all learners to be able to clearly explain the significance of every step of a practical procedure.

Question 19(biii)

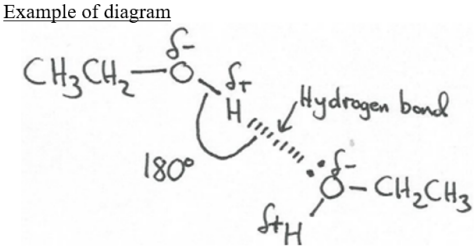
(iii) The distillation apparatus effectively separates ethanal from ethanol because of the large difference in boiling temperatures, which is a result of the hydrogen bonding between the molecules in ethanol.

Compound	Boiling temperature / °C
Ethanol, CH_3CH_2OH	79
Ethanal, CH_3CHO	21

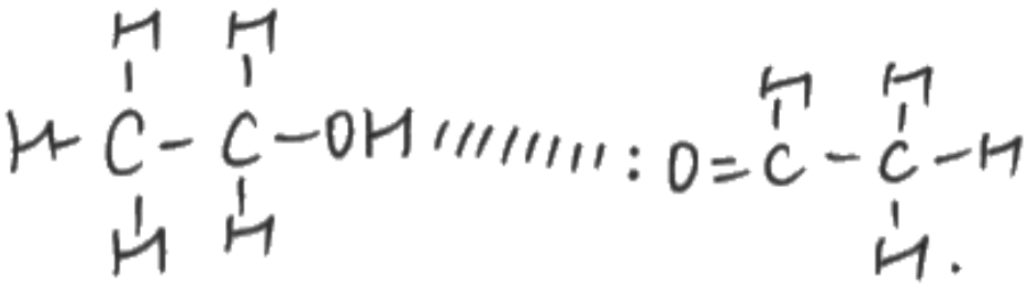
Draw a labelled diagram showing a hydrogen bond between two ethanol molecules.
Clearly indicate any relevant dipoles, lone pairs of electrons and relevant bond angles involved.

(3)

Some learners produced excellent diagrams in response to this question, having carefully read the question to include all necessary details, as outlined in the mark scheme.

Question Number	Answer	Additional Guidance
19 (b)(iii)	An answer that makes reference to the following points: • (bp1) diagram showing two **ethanol** molecules correctly aligned • (bp 2) (with) a stated bond angle of ~180° • (bp 3) hydrogen bond shown as hash or dotted line drawn between H of OH and O of a separate OH **only** • (bp4) lone pair on relevant O atom correctly aligned with the hydrogen bond • (bp5) dipole on the two atoms involved in the hydrogen bond (showing both δ+ and δ−) • (bp6) dipole on the two atoms bonded to the atoms involved in the hydrogen bond (showing both δ+ and δ−)	Example of diagram  6 correct points scores (3) 4-5 correct points scores (2) 2-3 correct points scores (1) Incorrect structures for ethanol loses bp 1 Ignore dipoles on any other than O or H atoms Ignore additional lone pairs on the oxygen atom(s) Ignore other bond angles given, even if incorrect

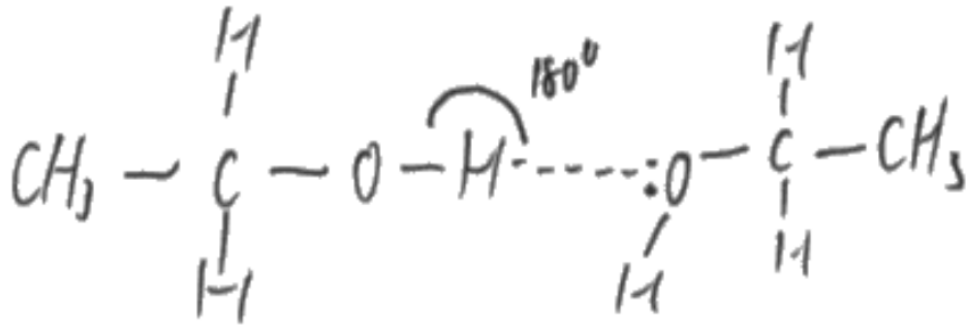
A number of learners misread the question and did not show hydrogen bonding between two ethanol molecules.This scores 1 mark.



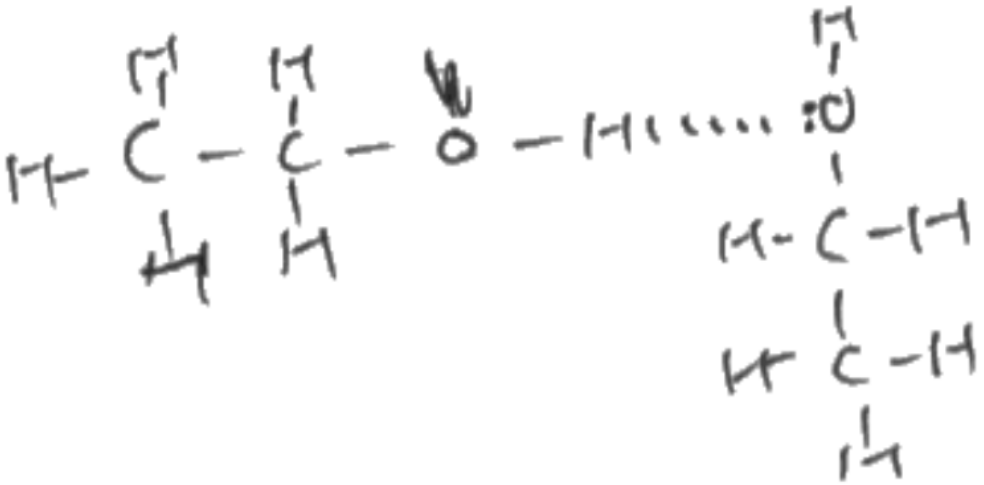
The names of many organic molecules differ by only one letter so careful reading is essential to be successful.

The question clearly outlined what was required for all three marks. However, many learners drew correct diagrams, but omitted features such as dipoles and bond angles, as seen in the examples below. It is good practice to check a response back against the question asked, to ensure all points have been covered. The number of marks allocated is also an excellent indicator of the level of detail required in a response.

This response scores 2 marks.



This response scores 1 mark.

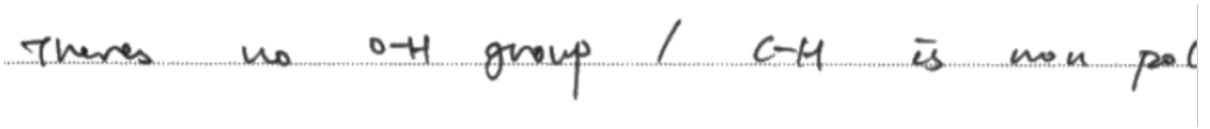


Question 19(biv)

(iv) State the reason why hydrogen bonds do **not** form between ethanal molecules.

Question Number	Answer	Additional Guidance
19 (b)(iv)	An answer that makes reference to the following point: • none of the hydrogen atoms in ethanal are bonded to an oxygen atom (or another highly electronegative atom)	Allow there is no OH bond in ethanal Allow hydrogen bonds only form if H is bonded to F, O or N Ignore the CH bond in the aldehyde group is non-polar Ignore H is bonded to C if no further qualification

Many learners made an excellent attempt at this question, with responses covering all points allowed on the mark scheme, as in this 1 mark answer.



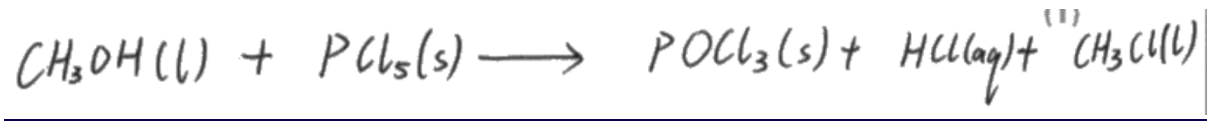
Some learners identified structural differences between ethanol and ethanal, but didn't show that this linked to the absence of hyfrogen bonding, meaning this example does not score.



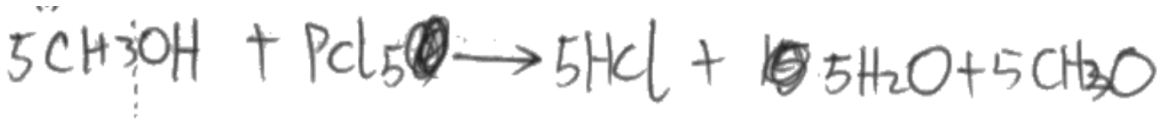
Linking to the earlier point about subtle differences in the names of different classes of organic molecules, it was not uncommon for learners to incorrectly name ethanol or ethanal, losing the mark for an otherwise correct statement. Learners should endeavour to be meticulous in their representation of organic molecules as names or structures.

Question 19(ci)

The reaction between phosphorous(V) chloride and an alcohol was accurately recalled by many learners, who produced correctly structured equations. State symbols were not required by the question, even though they were routinely included (often incorrectly) by learners, and were ignored in the markscheme, this scores 1 mark.



A significant number of learners produced equations containing multiples, presumably because of the 5 chlorines in PCl_5. Although the correct use of multiples was allowed in the mark scheme, it was unusual for them to be applied correctly. Most common was the production of incorrect products, usually water, as in this zero mark response,



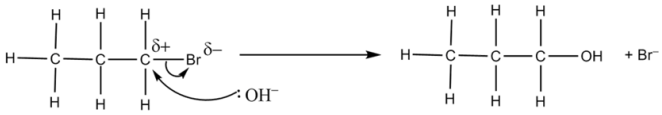
Question 19(cii)

Most learners were familiar with the expected observations of this reaction and, very importantly, how to express their answer to be awarded the mark, i.e. “fumes” must be stated. Centres have trained learners to use the phrase “misty fumes” although steamy or white fumes were also seen and credited. It was rare to see the incorrect answer of white smoke, showing improvement on previous years.

Question 19(di)

This reaction mechanism was familiar to many learners and most accessed at least one of the marking points. Many had been well rehearsed in the requirement for unambiguous start and end points for curly arrows and the positioning of lone pairs. Dipoles and lone pairs were routinely included, in contrast with those asked for in Question 19(biii), suggesting learners know what is expected from a mechanism question. Skeletal formulae were frequently and successfully employed.

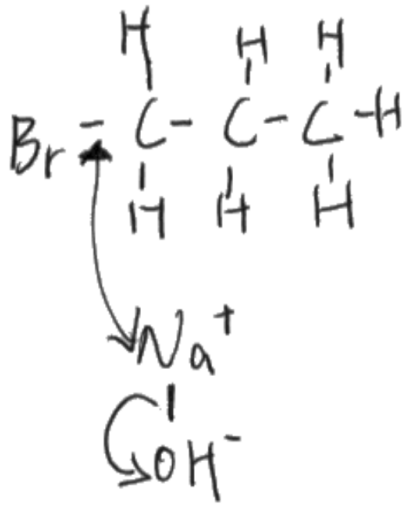
Similar to Question 19(biii) six points were required to achieve full marks.

Question Number	Answer	Additional Guidance
19 (d)(i)	An answer that makes reference to the following points: • dipole on C−Br bond • one curly arrow from the C−Br bond to Br or just beyond • lone pair on the **oxygen** of the hydroxide ion • one curly arrow (from the lone pair) to the C of the C−Br • structure of propan-1-ol product • bromide ion product with single negative charge	Accept displayed / structural / skeletal / hybrid formulae <u>Example of mechanism</u>  May be seen as an intermediate or a product 6 correct points scores (3) 4-5 correct points scores (2) 2-3 correct points scores (1) Allow S_N2 Allow NaBr / KBr as second product if NaOH / KOH used as reactant Allow 3 lone pairs on O atom of OH^- Penalise incorrect horizontal connectivity of -OH bond Fully correct mechanism using ammonia to form propylamine scores 1

Common errors included:

- omission of the bromide ion products – learners are reminded that reaction mechanisms should be balanced equations
- inaccurate drawing of the curly arrow from the C— Br bond to the Br.It is important that the start and end point of arrows are correct and unambiguous,

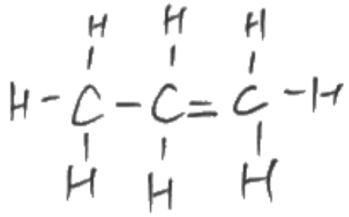
A small but significant number of the weaker responses represented sodium hydroxide as a covalently bonded molecular substance, as shown. This response does not score.



Question 19(dii)

Designed for learners across the ability range, most learners correctly identified the reaction type as “elimination”. It was pleasing to see “dehydration” used very rarely, showing learners understood what is meant by “reaction type”.

Overall, diagrams of propene were accurate, although a number of learners lost marks through the inclusion of an additional hydrogen, as shown, a reminder to check the number of bonds around each atom.



Question 20(a)

20 This question is about trends in the Periodic Table.

*(a) The boiling temperatures of some isoelectronic hydrides are shown.

Hydride	CH_4	NH_3	H_2O	HF
Boiling temperature / °C	−161	−33	100	20

Explain the differences in these boiling temperatures by considering all the intermolecular forces involved.
Detailed descriptions of the intermolecular forces involved are not required.

(6)

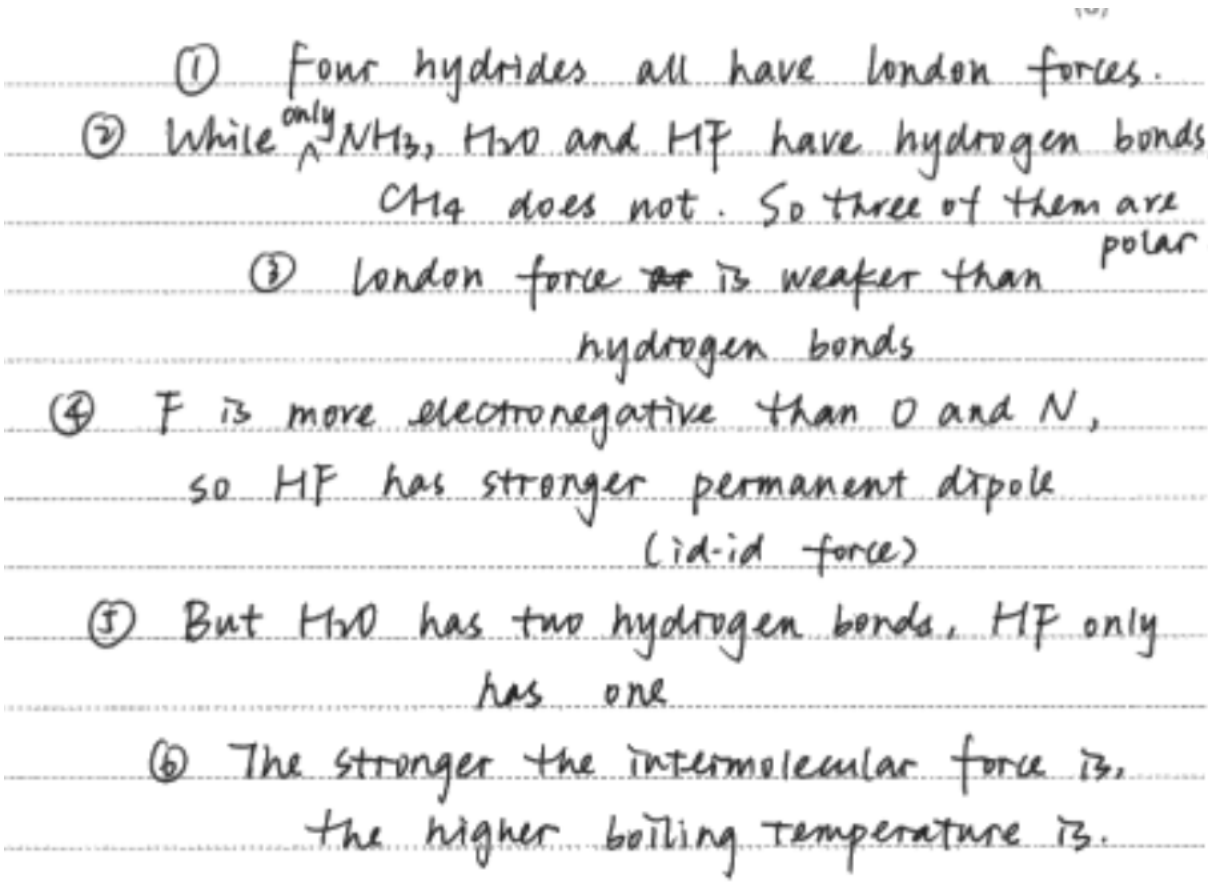
The style and content of the question seemed familiar to many learners. Most were able to identify the presence of hydrogen bonds in HF, NH_3 and H_2O and include statements about hydrogen bonding being the strongest intermolecular force. It was pleasing to see inclusion of bullet points / numbering, showing that learners understand the requirement for six separate points, and good training from centres in how to approach extended response questions.

Indicative content	
IP1 methane has (only) London forces	Accept dispersion forces / Accept instantaneous dipole – induced dipole Ignore id-id Allow all have London forces (but NH_3, H_2O, HF have additional intermolecular forces) Allow van der Waals' forces
IP2 London forces are weak**er** than hydrogen bonds (so boiling point of methane is lowest)	Accept reverse argument Allow reference to more energy required to break H bonds
IP3 NH_3 **and** H_2O **and** HF have hydrogen bonds	All 3 must be mentioned to score IP3
IP4 London forces are same/similar as they have the same number of electrons	Lose IP4 for incorrect statement about different numbers of electrons / any reference to differences in London forces
IP5 the hydrogen bond is strong**er** in HF than H_2O/NH_3 (so HF has a higher boiling point than ammonia) or fluorine has high**er** electronegativity than N or O / is the most electronegative element / H–F bond is the most polar	Allow hydrogen bond is weakest in NH_3 providing the H-bond in H_2O is not referred to as "strongest" Do not award H-F bond is stronger than H-N / H-O
IP6 water has **more** hydrogen bonds (than ammonia / HF) (so boiling point of water is the highest)	Allow description of ratio of 2:1 in H_2O with NH_3/HF

Indicative Points 1-3 were most commonly scored by learners. It is expected that learners give the full name of intermolecular forces and

should be reminded that abbreviations such as id-id will be ignored in marking. It was sometimes not possible to award IP2, as learners described Londin Forces as weak rather than weaker.

The inclusion of “isoelectronic” in the question was missed by many learners and therefore IP4 was rarely awarded. This is seen in the otherwise excellent 5 mark response below. The learner has understood the requirement for six points, but point 6 is repetitious of point 3.



Learners were challenged in accurately describing the relative strength of hydrogen bonding in water, ammonia and hydrogen fluoride. Many responses referred to differing strengths of the H—F, H—N and H—O bond, which will not impact boiling temperatures. Centres shoud encourage precise, unambiguous language when referring to the intermolecular forces.

Question 20(b)

Many learners recognise the command term "compare and contrast". A significant number divided their responses into "similarities" and "differences" showing familiarity with layout of the mark scheme.

Question Number	Answer		Additional Guidance
20 (b)	An answer that makes reference to four of the following points: Any two from: (Similarities)		Both similarities and differences can be shown in equations or with observations
	• **both** produce hydrogen halides	(1)	Accept NaX + H_2SO_4 → HX + $NaHSO_4$ Allow 2NaX + H_2SO_4 → 2HX + Na_2SO_4
	• formation of hydrogen halides is protonation	(1)	
	• **both** give off misty/steamy/white fumes	(1)	Do not award white smoke
	Any two from: (Differences)		
	• only the reaction of sodium bromide is redox / bromide ions are stronger reducing agents (than chloride ions)	(1)	
	• (red-) brown fumes / gas / liquid produced with sodium bromide	(1)	Do not award rotten egg smell / references to yellow solid
	• sulfur dioxide (colourless choking gas) / bromine given off with sodium bromide	(1)	Accept 2HBr + H_2SO_4 → Br_2 + SO_2 + $2H_2O$ Apply list principle

It was common to see the use of equations to describe the production of hydrogen halides, although a small number identified the production of sodium hydrogensulfate / sodium sulfate as the similarity, as below, which was not credited.



The second and third marking points for the differences were most commonly seen, with many learners using correct equations. The most successful responses included observations alongside identification of sulfur dioxide and bromine.

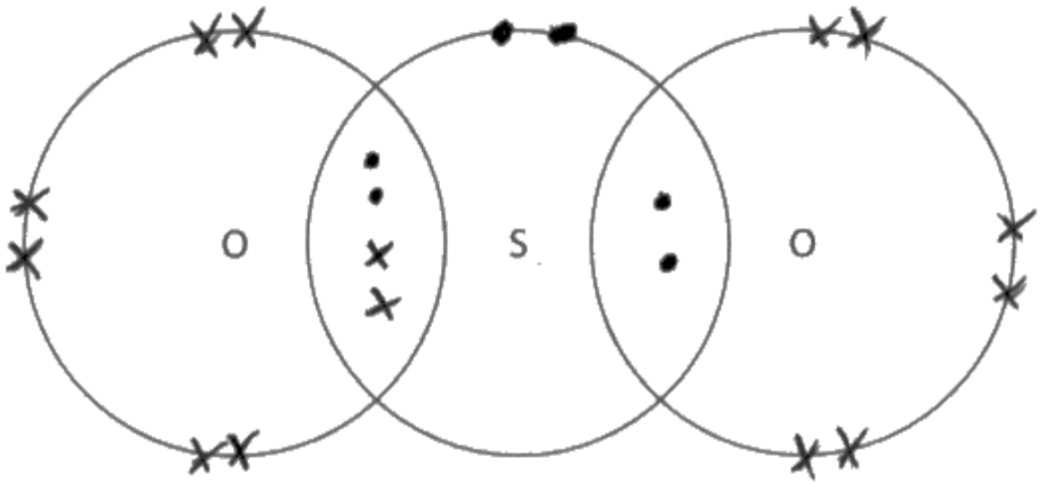
In a topic that seemed well understood by many learners, there was a temptation to include multiple points, beyond the four required. Centres are reminded of the list principle, where incorrect points are penalised if the total points included exceeds the marking requirement of the question. In the example below, inclusion of H_2S will be penalised to score 3 marks overall.

The NaCl ~~react with~~ and NaBr react with concentrated H_2SO_4. Both of ~~they~~ them will form misty fumes. and $NaHSO_4$.
The NaCl ~~is~~ reacts with concentrated H_2SO_4 is not a redox reaction.
And the NaBr reacts with concentrated H_2SO_4 is a redox reaction.
In NaBr reaction, it will see the brown-gas (Br_2), ~~s~~ smell the choking gas (H_2S) and misty fumes (HBr)

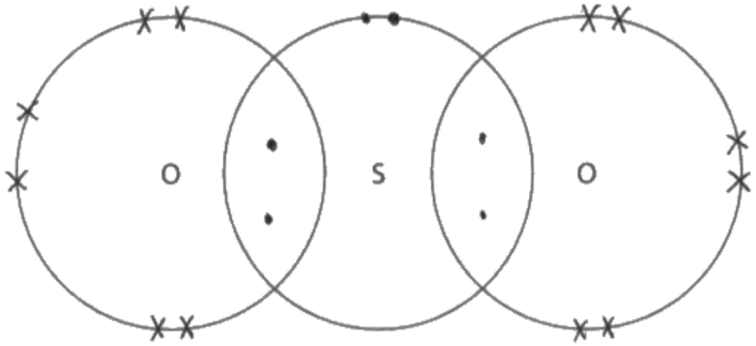
- $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$
- $NaBr + H_2SO_4 \rightarrow NaHSO_4 + HBr$
- $2HBr + H_2SO_4 \rightarrow SO_2 + H_2O + Br_2$

Question 21(ai)

This question proved challenging for many learners, although the neatness of the diagrams produced is worthy of credit, Most correctly read the question to avoid being penalised for having dots and crosses the wrong way round.The mark scheme gave several options for the first marking point. The most common error was an incorrect number of electrons shown in at least one of the oxygen atoms, as below. This example scores 1 mark.



A small number of learners produced diagrams where the sulfur formed two dative bonds. This example scores 1 mark.



Question 21(ai)

This question was one of the most challenging on the paper for learners, with most unable to identify the three bonding regions and link to the trigonal planar shape. The mark scheme gave a range for the correct answer (117 to 123°) to account for the presence of the lone pair on sulfur. However, most learners gave bond angles of 180°, presumably confusing with CO_2 or 104.5°, confusing with H_2O.

Centres are encouraged to train learners to identify the number of bonding regions to determine molecular shape and that double (and triple) bonds count as a single bonding region.

Question 21(bi)

This was another challenging question for learners, who struggled to link the data provided to the question.

The results are shown in the table.

Titration	1	2	3
Final volume / cm^3	22.55	44.70	22.05
Initial volume / cm^3	0.00	22.55	0.00
Titre / cm^3	22.55	22.15	22.05

The mean titre is 22.10 cm^3.

(i) Give a reason why a further titration was not carried out.

(1)

Responses such as those below were commonly seen, which lacked the precision of language to score

Because they are already precise.

three times is sufficient

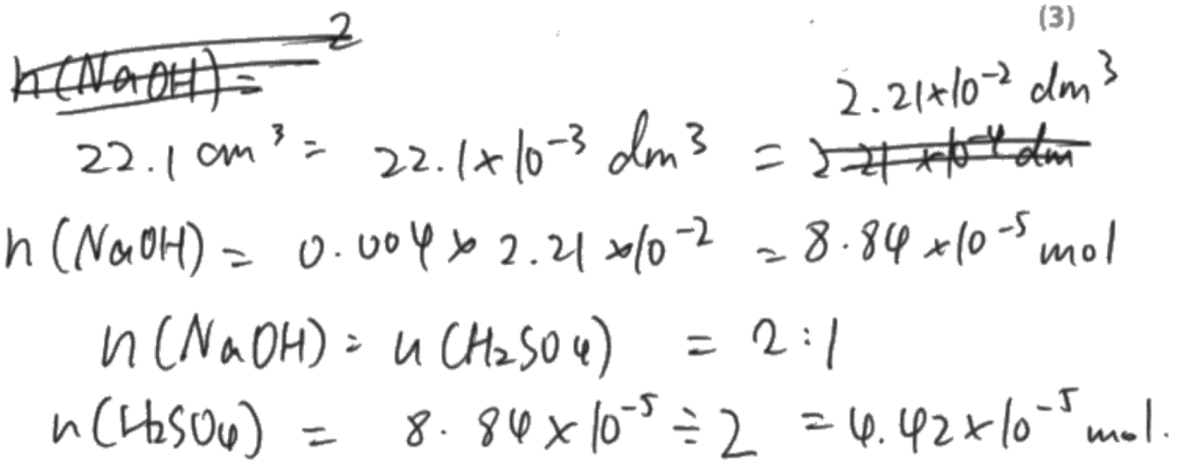
It is good practice to train learners in the reasons for each step of a practical procedure. Learners should also be encouraged to link responses to any data provided, as is seen in the example below, awarded 1 mark.

Results 2/3 are concordant.
within 0.1 cm^3.

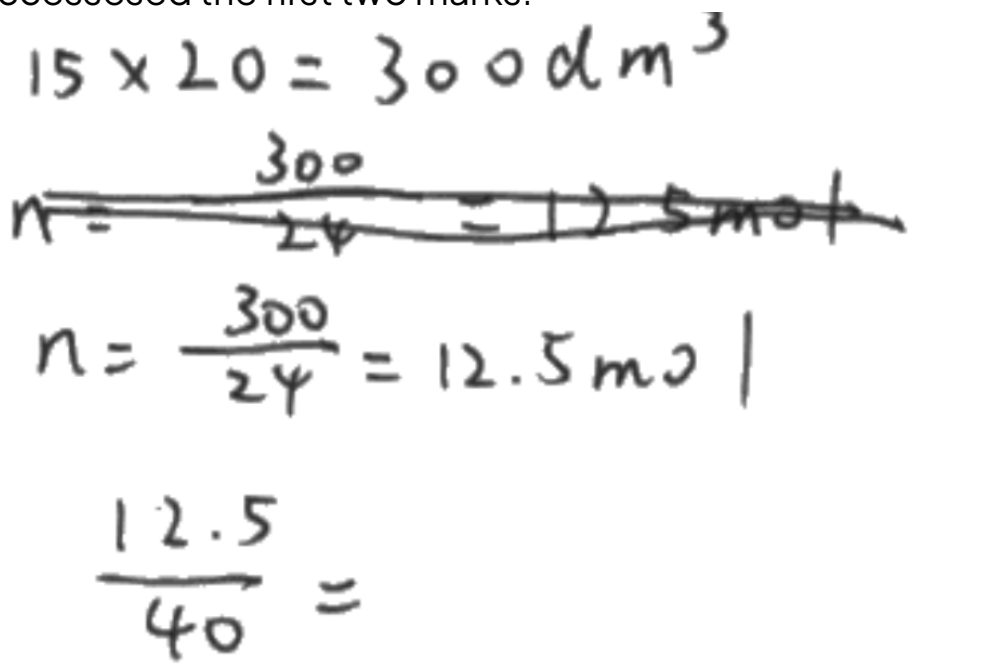
Question 21(bii–iv)

Learners approached these calculations with confidence and, as with other calculation questions, it was very pleasing to see them clearly laying out their work. Both equations provided were used correctly by most learners.

The most common error in the 21(bii) was not multiplying by 4 to reflect the total volume of 40cm^3. This scores 2 marks



Overall, the calculation of concentration and subsequent conversion to ppm in Question 21(biv) proved challenging for many learners, who often left this step of the calculation unattempted, having successfully accessesed the first two marks.



The technique for convesrion to ppm from concentration needs more teaching by centres.

Question 21(ci)

Many learners produced an excellent response to this question and the combining of multiple equations into a single overall equation had been thoroughly taught by centres.

(c) (i) During a volcanic eruption, hydrogen chloride gas is also released into the upper atmosphere. This produces some chlorine free radicals that react with ozone as shown.

$$Cl\bullet + O_3 \rightarrow ClO\bullet + O_2$$

$$ClO\bullet + O_3 \rightarrow Cl\bullet + 2O_2$$

Deduce the overall equation for this reaction of ozone.
State symbols are not required.

(1)

In an improvement on previous series, it was relatively rare for learners to include uncancelled species. Centres are reminded to stress to learners the importance of this when combining all types of equations.

Question 21(cii)

(ii) Give two reasons why the presence of a small number of chlorine free radicals in the upper atmosphere causes a large decrease in the amount of ozone.

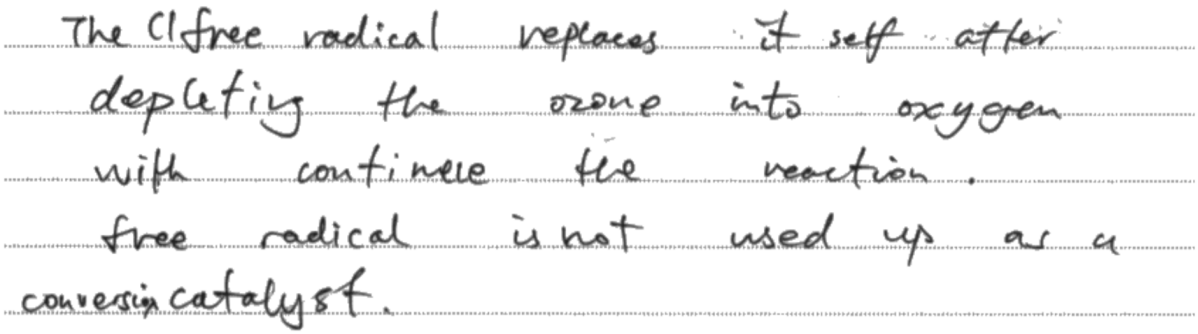
(2)

This proved a tricky question for many learners, who found it challenging to exress their responses to access the marking points, making it one of the most difficult questions on the paper.
It was common for learners to rewrite the question, rather than contrasting the relative number of radical vs ozone molecules as required by the mark scheme, as typified below. This scores zero marks.

because the presence of a small number of chlorine free radicals in the upper atmosphere causes a large decrease in the amount of ozone

Question Number	Answer	Additional Guidance	Mark
21(c)(ii)	An answer that makes reference to two of the following points: • many ozone molecules decompose for each free radical formed / a single free radical breaks down a large number of ozone molecules **(1)** • the chlorine free radical is regenerated / recycled / does not get used up (in the reaction) **(1)** • chlorine free radicals cause a chain reaction / reaction can be repeated many times / reaction produces another free radical **(1)**	Ignore references to O_2 Must be clear that the free radical breaks down or decomposes ozone Ignore chlorine free radical acts as a catalyst Allow reaction is unstoppable Allow reaction continues (on) Ignore references to skin cancer Ignore references to global warming	**(2)** **Expert**

Many learners recognised that the chlorine free radical acted catalytically, but struggled to explain what this meant sufficient to score. Learners also missed stating that the reaction is a chain reaction. The response below scores 2 marks.



Key features of these radical substituion reactions, beyond recall of specific equations need to be taught explicitly.

Question 21(di)

(d) (i) Sulfur dioxide is converted into sulfur trioxide in the upper atmosphere in the presence of ultraviolet radiation.

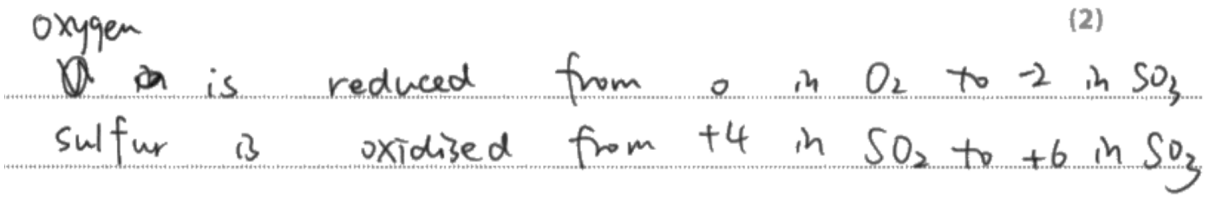
$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

Show, by use of all the relevant oxidation numbers, that this is a redox reaction.

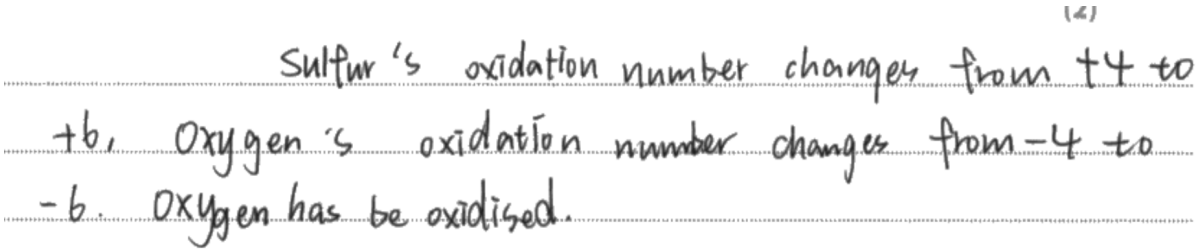
(2)

It was clear that centres had trained learners well in answering this type of question. Most learners were careful to refer to “sulfur / S” and

"oxygen / O" when referring to oxidation number changes, a marked improvement on previous series. This response scores both marks.



A common error was referring to oxidation number changes only, without specifying whether this constituted oxidation or reduction. The potential mark available in this zero mark response was not awarded as the oxidation of sulfur was not mentioned.



Learners are reminded that full descriptions should be provided, specifically linking changes in oxidation number to either reduction or oxidation.

Question 21(dii)

(ii) Sulfur trioxide reacts with water to form sulfuric acid.

$$SO_3(g) + H_2O(l) \rightarrow H_2SO_4(aq) \qquad \Delta_r H = -200\,kJ\,mol^{-1}$$

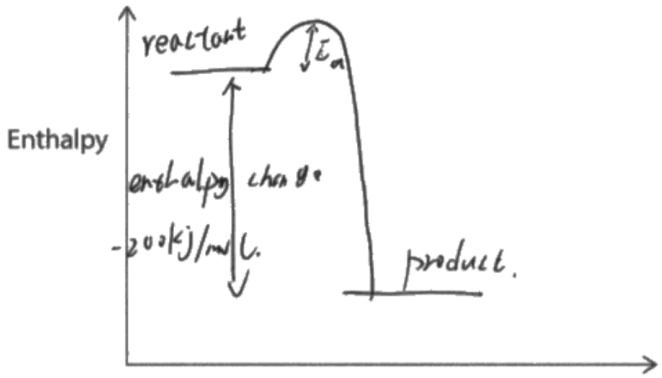
Draw an enthalpy level diagram to show the enthalpy change for this reaction.

(2)

Almost all learners identified this as an exothermic reaction from the enthalpy change data provided. This meant that reactant and product lines were drawn in the correct relative positions.

However, it proved challenging for many to produce enthalpy level diagrams of sufficient accuracy to score both marks.

The example below illustrates where the detail is insufficient to score.



Reactants and products should be identifed from the equation provided and written on (not below) the line.
Arrows ahould be single headed (pointing downwards) and must touch both the reactant and product lines.

Question 21(diii)

(iii) Droplets of sulfuric acid are formed when sulfur trioxide reacts with water in the upper atmosphere. These droplets reflect ultraviolet radiation from the Sun back into space.

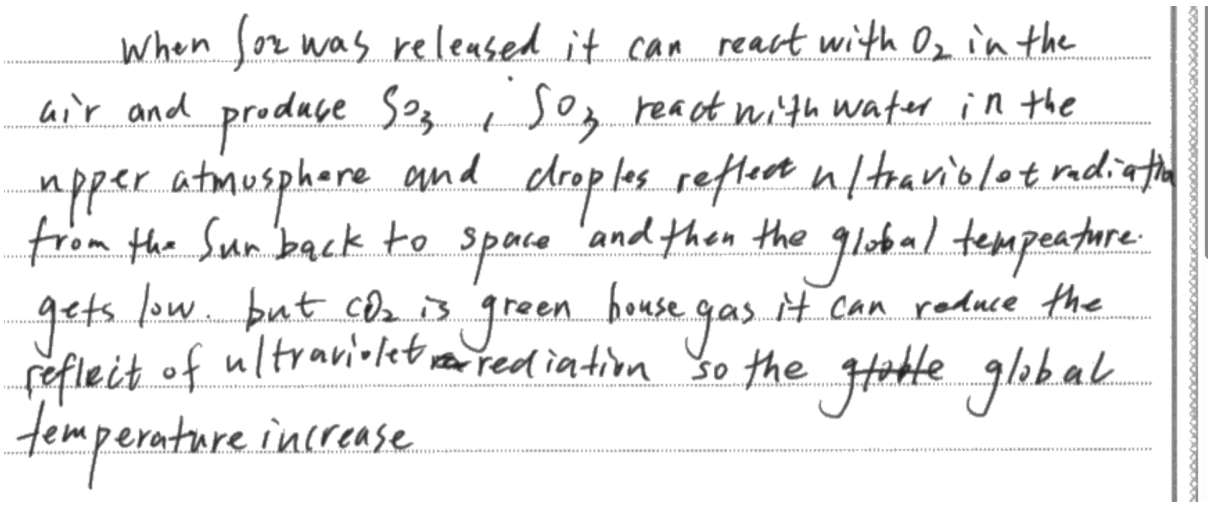
In the volcanic eruption in Indonesia in 1815, large amounts of both carbon dioxide and sulfur dioxide were released.
During the following year, there were global low temperatures.

Explain the relative effect of both gases on global temperatures after the volcanic eruption.

(3)

Question Number	Answer	Additional Guidance
21(d)(iii)	An explanation that makes reference to the following points: • carbon dioxide causes a rise in temperature **(1)** • (sulfur dioxide results in the formation of) sulfuric acid which causes global cooling / causes a decrease in temperature **(1)** • the effect of sulfur dioxide is greater than that of carbon dioxide (because the global temperature decreased) **(1)**	Allow carbon dioxide is a greenhouse gas/ causes global warming Ignore references to formation of carbonic acid / H_2CO_3 Allow sulfur dioxide / sulfur trioxide for sulfuric acid Ignore references to acid rain/ ozone depletion Ignore sulfur dioxide / sulfur trioxide does not cause global warming Ignore sulfur dioxide is a greenhouse gas Ignore reference to endothermic/exothermic reaction

This proved a very challenging question for many learners, particularly with respect to identifying the requirement to explain the relative effect of both gases. This example shows a 2 mark response which missed the instruction to state the relative effect.


When SO_2 was released it can react with O_2 in the air and produce SO_3, SO_3 react with water in the upper atmosphere and droples reflect ultraviolet radiation from the Sun back to space and then the global tempeature gets low. but CO_2 is green house gas it can reduce the reflect of ultraviolet ~~ra~~ radiation so the ~~gtable~~ global temperature increase

Learners often linked the contribution of SO_2 to global temperatures based on the enthalpy change data given in part (ii), rather than to the reflection of UV light by sulfuric acid (the product of both equations). It was also common to link SO_2 to acid rain, which was not relevant to the question. This response scored 0 marks.

SO_2 can cause the acid rain, and it will form SO_3 and SO_3 react with H_2O will ~~real~~ release energy, as this is a exothermic reaction, so the temperature will nherense.

The more successful responses linked information given in the question to their answer. These responses show careful reading of the information provided and a clear understanding of what the question is looking for, as in this 3 mark response.

The ~~carbon dioxide and~~ sulfur dioxide will decrease the global temperature. Sulfur dioxide will react with oxygen to produce sulfur trioxide. Then sulfur trioxide reacts with water to form droplets of sulfuric acid. These droplets reflect of ultraviolet radiation from the Sun back into space. Carbon dioxide may increase temperature as they absorb sun. As the Global temperatures decrease, the sulfur dioxide has a larger effect on temperature compared with CO_2.