AS and A LEVEL
Exemplar Candidate Work

CHEMISTRY A AND B (SALTERS)

H032/H033
For first teaching in 2015

OCR GCE Chemistry A and Chemistry B (Salters) – Exemplar Learner Responses to Level of Response Questions

Version 1

www.ocr.org.uk/chemistry
Contents

Introduction 3

Question 1 - H032/02 Question 4(a) 5

Question 2 - H032/02 Question 5(c) 9

Question 3 - H033/02 Question 2(b)(iv) 14

Question 4 - H033/03 Question 4(d) 17
Introduction - General Commentary

Level of Response (LoR) questions have been used in OCR GCSE Chemistry examinations since 2011, and will be used in the reformed OCR GCE Chemistry examinations from 2016 onwards. This resource has been designed to aid teachers and learners in preparing for this style of question in their examinations.

LoR questions allow learners to be credited for both:

- their scientific knowledge, understanding and ability to apply these to familiar and unfamiliar situations, and
- their ability to communicate in a clear, coherent and logical manner.

Mark schemes for LoR questions therefore detail both the 'science content' and the 'communication' aspects of expected answers.

LoR questions are indicated in question papers with an asterisk (*) after the question number. These questions can generally be answered in many possible and equally credit-worthy ways, and therefore give learners a flexible opportunity to demonstrate their skills. As such, the indicative scientific points that are included in mark schemes are neither exhaustive nor a list of all of the scientific points that have to be included in an answer to gain a particular mark. Indeed, the mark schemes that are used to assess candidates’ responses in live examinations are finalised only after examiners have looked at and discussed candidates’ responses. This is a key aspect of ensuring that all candidates are awarded marks and final grades in a fair and credit-worthy manner. The senior examiner commentary included within this resource should therefore be seen within this context.

Further senior examiner commentary and guidance on answering all styles of questions is made available in Examiner's Reports via www.ocr.org.uk and in CPD materials published following each series of examinations (available securely to teachers via www.cpdhub.ocr.org.uk).

For this resource, learner responses and learner-style responses to the four LoR questions from the AS Chemistry Paper 2 Sample Question Papers (H032/02 http://www.ocr.org.uk/Images/171752-unit-h032-02-depth-in-chemistry-sample-assessment-materials.pdf and H033/02 http://www.ocr.org.uk/Images/171756-unit-h033-02-chemistry-in-depth-sample-assessment-materials.pdf) have been marked and commented on by senior examiners. As can be seen from these questions, a variety of different chemical concepts can be assessed by LoR question. For example, chemical analysis, organic reactions and structure, catalysis and spectroscopic analysis are covered in these papers. Additionally, the demand of the questions can vary across the range from low to high.

For each question, three responses have been selected, exemplifying a Level 1, a Level 2 and a Level 3 response. Commentary is provided on why the Level was selected and the mark awarded, and what extra was needed in the response to move to the next Level.


- Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates’ answers, but be prepared to recognise and credit unexpected approaches where they show relevance.
- Using a 'best-fit' approach based on the science content of the answer, first decide which set of Level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the Level descriptors in the mark scheme.
- Once the Level is located, award the higher or lower mark.
• The higher mark should be awarded where the Level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

• The lower mark should be awarded where the Level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

• In summary:
  • The science content determines the Level.
  • The communication statement determines the mark within a Level.

When answering LoR questions, learners are advised to approach the writing of their response systematically. The following ideas may prove useful:

• Read the question carefully including any accompanying data.

• Re-read the question, and identify the key aspects of chemistry that the question is asking about – underlining/circling keywords and phrases can be helpful.

• Analyse and/or interpret any data included, in the context of the question asked – for example, what are the reasons for trends seen within the data? Annotation of the data can be helpful.

• Think about the chemical knowledge and understanding that needs to be used to answer the question – making brief notes can be helpful. The points can then be arranged in a logical order.

• Write a clear and logical answer to the question, thinking carefully about the order in which points are presented, and how the answer links to the aspects of chemistry asked about in the question.

• Re-read the question and their answer, checking that the question has been fully answered, and that the answer doesn’t contain contradictions.

The number of dotted lines given in examination papers for the answers is indicative of the length of answer expected for the question. Learners can use the extra space provided within a paper if necessary. They should, however, be cautious about writing very long answers, as this can increase the possibility of contradicting themselves and can reduce the clarity and coherence of their answers. Finally, any rough working/notes should be clearly crossed out.
Question 1 - H032/02 Question 4(a)

AS Chemistry A Sample Question Paper 2 - Depth in Chemistry

4 Students work together in groups to identify four different solutions.

Each solution contains one of the following compounds:
• ammonium sulfate, \((\text{NH}_4)_2\text{SO}_4\)
• sodium sulfate, \(\text{Na}_2\text{SO}_4\)
• sodium chloride, \(\text{NaCl}\)
• potassium bromide, \(\text{KBr}\).

Your group has been provided with universal indicator paper and the following test reagents:
• barium chloride solution
• silver nitrate solution
• dilute ammonia solution
• sodium hydroxide solution.

(a)* A student in your group suggests the following plan:
• Add about 1 cm depth of each solution into separate test-tubes.
• Add a few drops of barium chloride solution to each test-tube.
• A white precipitate will show which solutions contain sulfate ions.
• Two of the solutions will form a white precipitate.

Describe how you would expand this plan so that all four solutions could be identified using a positive test result.

You should provide observations and conclusions that would enable your group to identify all four solutions.

6 marks – Level of Response – Medium demand
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (a)*</td>
<td>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</td>
<td>6</td>
<td><strong>Indicative scientific points may include</strong></td>
</tr>
</tbody>
</table>

**Level 3 (5–6 marks)**
Describes full details of all of the test procedures and observations that allows all four compounds identified.

There is a well-developed line of reasoning and the method is clear and logically structured. The information presented is relevant and substantiated by observations from the tests described.

**Level 2 (3–4 marks)**
Describes most of the tests in some detail including the observations that allows all four compounds to be identified.

There is a line of reasoning presented and the method has some structure. The information presented is in the most-part relevant and supported by some evidence of observations from the tests described.

**Level 1 (1–2 marks)**
Describes some of the tests but lacks details and observations to allow the identification of all four compounds.

The information is basic and the method lacks structure. The information is supported by limited evidence of the observations, the relationship to the evidence may not be clear.

0 marks
No response or no response worthy of credit.

**Details of tests**
To identify sulfates:
- **Ammonium ion test:** on the sulfates already identified; warm with NaOH(aq) followed by
- **Universal indicator test:** use of moist indicator paper on (ammonia) gas; correct observation (alkaline gas/high pH/blue or purple) for identification of (NH₄)₂SO₄ and by default of Na₂SO₄.

To identify halides:
- **Halide ion test:** addition of silver nitrate solution to remaining two solutions; correct observation (white precipitate/cream precipitate) followed by
- **Solubility of precipitate:** addition of dilute ammonia solution to halide precipitates; correct observation (silver chloride dissolves) enabling identification of NaCl and by default of KBr.
Question 1, sample answer 1

I would use a 1cm depth of each solution in 4 new test tubes and add silver nitrate. This detects if a halide is present, so a cream precipitate will form in the test tube with KBr, and a white precipitate will form in the test tube with NaCl, allowing you to identify two compounds. I could also add the dilute ammonia solution. If the precipitate dissolves, it's a chloride. If it doesn't dissolve it's a bromide.

I would use a 1cm depth of each solution in 4 new test tubes and warm with sodium hydroxide solution. This will react with (NH₄)₂SO₄ to form Na₂SO₄ and ammonia gas. Therefore you will see bubbling as the gas is given off, so you can identify (NH₄)₂SO₄. I would prove that the gas is ammonia by testing with wet pH paper which will turn blue. This is because ammonia is an alkali.

Commentary

This is a Level 3 response and has been awarded all 6 marks.

The candidate has provided full details of tests that would enable all four compounds to be identified.

The candidate has stated the necessary reagents and has described all observations. The details are such that the silver halide precipitates can be distinguished, not only by the subtle difference in appearance, but also by their different solubilities in dilute ammonia.

Commentary

This is a Level 2 response and has been awarded 3 out of 6 marks.

The candidate has provided tests that would enable all four compounds to be identified.

However the descriptions are incomplete and are lacking in detail. For example:

- The candidate has not shown how the addition of sodium hydroxide would allow ammonium sulfate and sodium sulfate to be distinguished. Specially, the need to warm the mixture, and the subsequent formation of ammonia gas, are not present in the answer.

- The candidate has described how the silver halide precipitates could be distinguished by their different solubilities in aqueous ammonia but the white and cream appearances of the precipitates have been omitted.

The details provided would be insufficient for someone else to carry out the tests and to identify the compounds from the observations.

This is an excellent response that is concise, clear and logically structured throughout.
Question 1, sample answer 3

Add about 1 cm depth of each solution and add a few drops of aqueous silver nitrate solution. The sodium chloride solution can be identified by a white precipitate while the potassium bromide solution will form a cream precipitate. To further clarify these, the white precipitate of silver chloride is soluble in dilute aqueous ammonia while the cream silver bromide precipitate will only be soluble in concentrated aqueous ammonia.

Commentary

This is a Level 1 response and has been awarded 2 out of 6 marks. The candidate has described in great detail the halide tests and they have shown how the sodium chloride and potassium bromide could be identified from the observations. However, the candidate has not described further tests that would allow the other two compounds to be identified. Only two of the four compounds could be identified, hence this response is incomplete.

The answer could be improved by checking that all aspects of the question have been answered. While the answer given matches the Level 3 communication statement, for example it is “clear and logically structured”, the incompleteness of the answer in terms of the science content limits this answer to a Level 1.
Question 2 - H032/02 Question 5(c)

(c)* Alcohols can be converted into alkenes in an elimination reaction.

The elimination of H₂O from pentan-2-ol forms a mixture of organic products.

Give the names and structures of all the organic products in the mixture.

Your answer should explain how the reaction leads to the different isomers.

6 marks – Level of Response – Medium demand
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (c)*</td>
<td>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</td>
<td>6</td>
<td>Indicative scientific points may include:</td>
</tr>
<tr>
<td></td>
<td>Level 3 (5–6 marks) Applies knowledge of elimination reactions to provide the correct names and structures of all three alkenes AND Full, detailed explanation of formation of both types of isomers linked to the reaction, with clear understanding of both types of isomerism The explanations show a well-developed line of reasoning which is clear and logically structured. The information presented is relevant to the compounds drawn/named.</td>
<td>Level 2 (3–4 marks) Applies knowledge of elimination reactions to provide the correct name and structure for pent-1-ene AND Correct structures of stereoisomers of pent-2-ene but full names missing or incorrect AND Explanation of formation of at least one type of isomers in some detail. The explanations show a line of reasoning presented with some structure. The information presented is in the most-part relevant to the compounds drawn/named.</td>
<td>Level 1 (1–2 marks) Applies knowledge of elimination reactions to name and draw the structures of organic products. Either name OR structure should be correct for two compounds. AND Attempts to explain formation of one type of isomer. The information about isomerism is basic and communicated in an unstructured way. The relationship to the compounds drawn/named may not be clear.</td>
</tr>
</tbody>
</table>
The dehydration reaction eliminates the –OH group and a H atom from the adjacent carbon. This forms structural isomers with the double bond in either the 1 or 2 position. Therefore both pent-1-ene and pent-2-ene are formed.

Pent-2-ene also has two stereoisomers, a cis/Z isomer with the priority groups on the same side of the double bond and a trans/E isomer with the priority group on opposite sides of the double bond. This is due to the pi and sigma bonds fixing the groups so there is limited rotation about the double bond.

**Commentary**

This is a Level 3 response and has been awarded all 6 marks.

The candidate recognises that a hydrogen atom can be eliminated from a carbon atom on either side of the C–OH group. The candidate then describes how this elimination leads to formation of two structural isomers, with pent-2-ene having two stereoisomers.

All three isomers are shown as correct diagrams and are correctly named as *cis* or *trans*.

The candidate shows their understanding of *E/Z* isomerism in terms of priority groups and their existence from limited rotation about the double bond.

While there is mis-spelling of a technical term (eliminates), this does not substantially interfere with the communication of the chemical concept, so award of the higher mark within the Level is still appropriate.

This is an excellent response that is clear and logically structured throughout.
Question 2, sample answer 2

This reaction leads to the formation of an alkene. Alkenes display E/Z isomerism, which forms stereoisomers. Stereoisomers have the same structural formula but a different arrangement of atoms in place.

Structural formula = CH$_3$CH=CHCH$_2$CH$_3$.

Commentary

This is a Level 2 response and has been awarded 4 out of 6 marks.

The candidate has recognised that elimination of water from pentan-2-ol leads to formation of two structural isomers, with pent-2-ene having two stereoisomers. The structures and names of the structural isomers are correct.

Although the candidate has referred to E/Z isomerism and has drawn structures for the isomers, the diagrams are not identified as being E or Z, either within the diagrams or within the text.

The candidate has not described details of why structural and E/Z stereoisomers have been formed.

A more detailed response would apply basic knowledge and understanding to “explain how the reaction leads to different isomers”, detailing why the structural and stereoisomers are formed, for example:

- elimination of water linked to the loss of an H atom from either side of the C–OH group leading to the structural isomers pent-1-ene and pent-2-ene, and
- limited rotation about the double bond and the presence of two different groups on the carbon atoms of the C=C bond in pent-2-ene leading to E and Z stereoisomers.
The OH group on pentan-2-ol can combine with a hydrogen on one of the carbons next to it to form a molecule of water. A new bond then forms between the 2 carbons to form an alkene group. This can form pent-1-ene or pent-2-ene depending on whether the OH group combines with the H on carbon 1 or 3.

Commentary
This is a Level 1 response and has been awarded 2 out of 6 marks.

The candidate has described in detail the elimination of water linked to the loss of an H atom from either side of the C–OH group, leading to the structural isomers pent-1-ene and pent-2-ene. The structures and names of these isomers are correct.

Although this description shows communication at Level 3, the candidate has not identified that pent-2-ene would be formed as a mixture of E and Z stereoisomers. This omission restricts the candidate to Level 1. The answer could therefore be improved by discussing the formation of and reason for the two stereoisomers formed by pent-2-ene (see previous commentary).
Question 3 - H033/02 Question 2(b)(iv)

AS Chemistry B (Salters) Sample Question Paper 2 - Chemistry in depth

(iv)* Platinum is used as a heterogeneous catalyst in cordless hair straighteners.

Describe a simple model to illustrate how a substance such as platinum can act as a catalyst. Include a definition of the terms heterogeneous and catalyst in your answer.

6 marks – Level of Response – Medium/low demand
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
</tr>
</thead>
</table>
| 2 (b) (iv)* | Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.  

**Level 3 (5–6 marks)**  
Gives a detailed definition of heterogeneous **AND** catalyst **AND** clearly describes the detailed steps involved in the catalysis model.  

The definitions are fully correct. There is a well-developed description which is clear and logically structured. The steps are relevant and detailed and in a logical order. Candidate demonstrates a clear and confident knowledge of relevant technical language (bonds, phase/state, adsorption).  

**Level 2 (3–4 marks)**  
Gives clear definition of catalyst **AND** heterogeneous **AND** describes the steps in catalysis model.  

The definitions are clear. There is a good description presented with some structure. The steps are in the most-part relevant and have a suitable order. Some indications of a sound grasp of technical language.  

**Level 1 (1–2 marks)**  
Defines heterogeneous **AND** catalyst **OR** describes the steps in the catalysis model.  

The definitions are simple. The descriptions are basic and communicated in an unordered way. Basic grasp of relevant technical language.  

|   |   | 6 | Indicative scientific points may include: Definitions  
|   |   |   | • heterogeneous – different phase (state)  
|   |   |   | • catalyst – speeds up a reaction, unchanged at end **OR** provides a route of lower $E_A$  
|   |   |   | Steps  
|   |   |   | • reactants attach to surface  
|   |   |   | • bonds re-arrange  
|   |   |   | • products leave.  
|   |   |   | Detailed steps  
|   |   |   | • reactants **adsorbed** onto surface (subsumes 3rd main bullet)  
|   |   |   | • bonds within reactants **weaken and break**  
|   |   |   | • **new bonds form** (this and above subsume 4th main bullet)  
|   |   |   | • products **diffuse** away (subsumes 5th bullet).  
| 0 marks | No response or no response worthy of credit. | |

**Total** 14
Question 3, sample answer 1
Platinum adsorbs a gas onto its surface. A catalyst provides a route of lower activation enthalpy therefore speeding up the reaction. Bonds within the reactants weaken and break and new bonds form. Heterogeneous means that catalyst and reactants are in different phases, e.g. solid platinum and the gas it is catalysing here.
Products diffuse away from the surface.

Commentary
This is a Level 3 response and has been awarded 5 out of 6 marks. This answer matches all the indicative scientific points in detail. Therefore it matches the science requirements for Level 3.
It uses technical terms correctly. However, it lacks a clear logical sequence therefore the final mark is 5.

The candidate would have been advised to:
- note down the points in the margin before starting,
- arrange the points in a logical sequence before commencing the answer,
- cross out the draft points before moving on.

Question 3, sample answer 2
A catalyst is something which speeds up a chemical reaction without being used up in the overall reaction itself. Heterogeneous means that the catalyst is in a different state to the reactants in the reaction it catalyses. Platinum can act as a catalyst when the reactants are adsorbed onto its surface, this weakens the bonds in the reactants and the chemical reaction takes place. The products are then desorbed from the catalyst.

Commentary
This is a Level 2 response and has been awarded 4 out of 6 marks. This is a good answer, is logically constructed and makes effective use of technical terms. It fits into Level 2 because it describes the 'steps' but not the 'detailed steps' in the catalysis model.

To move to Level 3 and score 6 marks, the candidate would have needed to mention 'new bonds forming' to match the third detailed step in the model.

Question 3, sample answer 3
A catalyst is a substance that increases the rate of a reaction without being used up in the process. The heterogenous catalysis means that the state of the catalyst is different to the state of the reactants.
Platinum absorbs gases onto its surface holding them there and reducing the enthalpy of the reaction by weakening the bonds.

Commentary
This is a Level 1 response and has been awarded 2 out of 6 marks. This answer has the definitions correct but does not match Level 2 as it does not describe all the steps in the catalysis model. Therefore it is Level 1.

In order to be considered for Level 2, the answer would have had to include the bonds re-arranging (not just weakening) and the products leaving the catalyst. In order to be considered for Level 3, the answer would have had to mention the bonds breaking and new bonds forming as well as the products diffusing away. It is arranged in a logical sequence and most technical terms are correct. Therefore it scores 2 marks. With the additions for Level 2 above, it would have scored 4 marks.

However, to be considered for 6 marks, the candidate should have written about the 'activation enthalpy of the reaction' in the last line (as well as meeting the requirements for Level 3 above).
Question 4 - H033/02 Question 4(d)

AS Chemistry B (Salters) Sample Question Paper 2 - Chemistry in depth

(d)* A combination of mass spectrometry and infrared spectroscopy can be used to determine whether pure pivalic acid has been made.

Spectroscopic data for the final product mixture are shown below.

<table>
<thead>
<tr>
<th>Mass spectrum information for product mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
</tr>
<tr>
<td>Base peak</td>
</tr>
<tr>
<td>Peak of largest m/z</td>
</tr>
</tbody>
</table>

IR spectrum of product mixture:

The student claimed that the combination of the mass spectrum information and the IR spectrum show that pure pivalic acid had been made.

Analyse the evidence from the IR spectra (use the Data Sheet), the mass spectrum data and the nature of the compounds involved in the synthesis to comment on the validity of the student’s claim.

6 marks – Level of Response – High/medium demand
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (d)*</td>
<td>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</td>
<td>6</td>
<td>Indicative scientific points may include:</td>
</tr>
<tr>
<td></td>
<td><strong>Level 3 (5–6 marks)</strong></td>
<td></td>
<td><strong>Evidence from mass spectra</strong></td>
</tr>
<tr>
<td></td>
<td>Analyses the evidence and uses detailed pieces of evidence from IR spectra AND mass spectra to fully support the conclusion that pivalic acid is made. Must state the evidence suggests it is contaminated with alcohol.</td>
<td></td>
<td>• $m/z$ 102 is $M_r$ of pivalic acid</td>
</tr>
<tr>
<td></td>
<td>The conclusion is well-developed, clear and logically structured. The evidence is relevant and substantiates the student's claim as being partially correct due to the contamination.</td>
<td></td>
<td>• (Base) peak at 57 is fragment ion due to loss of COOH</td>
</tr>
<tr>
<td></td>
<td><strong>Level 2 (3–4 marks)</strong></td>
<td></td>
<td><strong>Evidence from IR spectra</strong></td>
</tr>
<tr>
<td></td>
<td>Analyses the evidence and uses evidence from IR spectra AND Mass spectra, to support the conclusions that pivalic acid has been made. Links evidence to the students claim.</td>
<td></td>
<td>• IR absorption just below 3000 indicates presence of carboxylic OH</td>
</tr>
<tr>
<td></td>
<td>There is a clear conclusion with a line of reasoning and structure. The evidence is in the most-part relevant and supports the student's claim.</td>
<td></td>
<td>• absorption at 1700–1725 (allow a number in this range) indicates presence of C=O (in carboxylic acid).</td>
</tr>
<tr>
<td></td>
<td><strong>Level 1 (1–2 marks)</strong></td>
<td></td>
<td><strong>Compounds involved in synthesis</strong></td>
</tr>
<tr>
<td></td>
<td>Analyses the evidence and uses evidence from IR spectra OR mass spectra to support the conclusion that an acid is made. Comments whether this agrees or disagrees with the claim.</td>
<td></td>
<td>• (But very broad) absorption above 3000 (allow numbers in range 3200–3640) suggests/indicates alcoholic OH. (from step 2 of synthesis)</td>
</tr>
<tr>
<td></td>
<td>The conclusion is basic but agrees with the claim. Evidence is used to support the conclusion but it is limited and may not be clear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>0 marks</strong></td>
<td></td>
<td>No response or no response worthy of credit.</td>
</tr>
</tbody>
</table>
**Question 4, sample answer 1**

The mass spectrum data supports the learner’s claim since the molecular ion peak at m/z 102 is the same as the relative molecular mass of pivalic acid, and the base peak at m/z 57 due to the (CH₃)₂C⁺ ion, however this fragment can also be obtained from the starting reagent and intermediate step compounds. The IR spectra shows a broad peak from 2500-3600cm⁻¹ which indicates the O-H bond present but as the peak covers the range for alcohols and carboxylic acids, this conflicts with the learner’s claim of pure pivalic acid as this is likely to be alcohol left from its synthesis.

**Commentary**

This is a Level 3 response and has been awarded all 6 marks.

This answer analyses the evidence and uses detailed pieces of evidence from the IR spectrum and mass spectrum to fully support the conclusion that pivalic acid is made. It also states that the evidence in the O-H absorption indicates the presence of alcohol. It is well-developed, clear and logical, so it scores a maximum of 6 marks.

**Question 4, sample answer 2**

2500-3300 broad peak → carboxylic acid group present
1640-1750 peak → C=O bond present
1000-1300 peaks → C–O bonds present

Largest m/z is 102 which is the relative formula mass of pivalic acid. The fragment at m/z 57 is likely to be C₄H₉⁺. The result of the IR spec and MS do not contradict the learner’s claims so they are valid, however further tests could be taken to ascertain the purity of the pivalic acid. There is a slim probability the compound made may be slightly impure.

**Commentary**

This is a Level 2 response and has been awarded 3 of 6 marks.

The candidate has analysed the evidence from both IR and MS. There is lack of detail in the attribution of the 2500-3300 peak to carboxylic acid rather than ‘O-H in carboxylic acid’ and the discussion of the fragment does not add much.

The evidence is linked to the learner’s claim, though this is followed by some vague ‘hedging of bets’ which does not contribute anything. There is no consideration of the O-H peak in detail to point to the impurity. Therefore, this answer matches Level 2.

The line of reasoning is not particularly clear, for example not all of the evidence for –COOH is explicitly given. Therefore it is worth the lower mark of 3 within Level 2.

To reach 4 marks, the candidate would have had to describe the evidence for the carboxyl group more clearly.

To reach Level 3, analysis of the O-H peak was necessary to show that some parts of it were from an alcohol. Finally, a clear statement of the impurity would have been needed.
Question 4, sample answer 3

There are no peaks for the C-X bonds so this would show that the bromine is gone. There is a broad peak between 3200-3600 which indicates an OH, but this could show a carboxylic acid group. The peak at about 1750, showing a C=O bond would support this. The evidence supports the learner’s claim.

Commentary

This is a Level 1 response and has been awarded 2 of 6 marks. This answer only uses evidence from the IR spectrum to test the validity of the learner’s claim. It gives some detail so this answer matches Level 1.

Evidence is used to support the conclusion and the conclusion is explicitly stated and agrees with the claim. Therefore the answer is worth the higher mark of 2 within Level 1.

To be considered for Level 2, the candidate would have needed to consider the Mass Spectrum information.
We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: the small print
OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

This resource may be freely copied and distributed, as long as the OCR logo and this small print remain intact and OCR is acknowledged as the originator of this work.

OCR acknowledges the use of the following content:
Square down and Square up: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?
There is now a quick and easy search tool to help find free resources for your qualification:
www.ocr.org.uk/i-want-to/find-resources/