

Instrument-specific marking guide: Research investigation (20%)

Criterion: Research and planning

2. apply understanding of <topic> to develop research questions
5. investigate phenomena associated with <topic> through research

The student work has the following characteristics:	Marks	Analysis
<ul style="list-style-type: none"> • informed application of understanding of <topic> demonstrated by a considered rationale identifying clear development of the research question from the claim • effective and efficient investigation of phenomena associated with <topic> demonstrated by <ul style="list-style-type: none"> - a specific and relevant research question - selection of sufficient and relevant sources. 	5–6	<p>Clear Development: Identify the key chemical aspects of the claim and define them. From these definitions discuss how these aspects of the claim could be developed into a research question. Background theory (explanations of key term definitions necessary to understand the claim and / or question) needs to be integrated into this discussion alongside explanations as to why you have dismissed certain aspects of the claim and why you have decided to pursue others.</p> <p>Specific: There should be no ambiguity in the question and a maximum of 2 (or 3 at the very most) factors that will be investigated. Include an explanation of any key terms or definitions necessary to understand the claim and question.</p> <p>Sufficient: Aim for 3 sets of data along with some supportive sources that assist you in writing your rationale and justifying your scientific arguments. Thus, around 5 sources in total. These should enable you to answer the research question.</p>
<ul style="list-style-type: none"> • adequate application of understanding of <topic> demonstrated by a reasonable rationale that links the research question and the claim • effective investigation of phenomena associated with <topic> demonstrated by <ul style="list-style-type: none"> - a relevant research question - selection of relevant sources. 	3–4	<p>Links the research question: You would move down to this performance level if you have included the correct theory about key terms and it does link claim to question – but you have not explained how it connects the claim to the research question.</p>
<ul style="list-style-type: none"> • rudimentary application of understanding of <topic> demonstrated by a vague or irrelevant rationale for the investigation • ineffective investigation of phenomena associated with <topic> demonstrated by <ul style="list-style-type: none"> - an inappropriate research question - selection of insufficient and irrelevant sources. 	1–2	
<p>☒ does not satisfy any of the descriptors above.</p>	0	

Criterion: Analysis and interpretation

3. analyse research evidence about <topic>
4. interpret research evidence about <topic>

The student work has the following characteristics:	Marks	Analysis
<ul style="list-style-type: none"> • systematic and effective analysis of qualitative data and/or quantitative data within the sources about <topic> demonstrated by <ul style="list-style-type: none"> – the identification of sufficient and relevant evidence – thorough identification of relevant trends, patterns or relationships – thorough and appropriate identification of limitations of evidence • insightful interpretation of research evidence about <topic> demonstrated by justified scientific argument/s. 	5–6	<p>Sufficient evidence: You need enough data to answer all parts of the research question (generally a minimum of 3 sources, plus supporting evidence, is required to attain this performance level)</p> <p>Thorough identification of trends (or patterns or relationships): You should have identified all aspects of the trends (or patterns or relationships) that are relevant to the research question and produced quantitative comparative statements that answer your question.</p> <p>Thorough and appropriate (limitations): You must identify all limitations relevant to your data. What does the data not show you? What is missing from the data that would be beneficial to answer the research question? What data did you need that is not present/tested/studied?</p> <p>Justified scientific argument: Explaining what the evidence is showing, with detailed links back to the scientific theory that you introduced earlier.</p>
<ul style="list-style-type: none"> • effective analysis of qualitative data and/or quantitative data within the sources about <topic> demonstrated by <ul style="list-style-type: none"> – the identification of relevant evidence – identification of obvious trends, patterns or relationships – basic identification of limitations of evidence • adequate interpretation of research evidence about <topic> demonstrated by reasonable scientific argument/s. 	3–4	<p>Basic identification (limitations): You would include at least two limitations that are correct across all pieces of evidence.</p> <p>Reasonable argument: You state what the evidence shows and include correct but vague connections to theory.</p>
<ul style="list-style-type: none"> • rudimentary analysis of qualitative data and/or quantitative data within the sources about <topic> demonstrated by <ul style="list-style-type: none"> – the identification of insufficient and irrelevant evidence – identification of incorrect or irrelevant trends, patterns or relationships – incorrect or insufficient identification of limitations of evidence • invalid interpretation of research evidence about <topic> demonstrated by inappropriate or irrelevant argument/s. 	1–2	

Criterion: Conclusion and evaluation

4. interpret research evidence about <topic>

6. evaluate research processes, claims and conclusions about <topic>

The student work has the following characteristics:	Marks	Analysis
<ul style="list-style-type: none"> • insightful interpretation of research evidence about <topic> demonstrated by justified conclusion/s linked to the research question • critical evaluation of the research processes, claims and conclusions about <topic> demonstrated by <ul style="list-style-type: none"> – insightful discussion of the quality of evidence – extrapolation of credible findings of the research to the claim – suggested improvements and extensions to the investigation that are considered and relevant to the claim. 	5–6	<p>Justified conclusion: Your conclusion has been linked directly to the question and to the analysis of data included in your report.</p> <p>Insightful discussion: Overall, can I trust my data? Consider: limitations already discussed, bias, recency, has the data been peer-reviewed, is it supported by multiple other studies etc. Here you are showing an understanding of a situation or process; an understanding of relationships in complex situations; informed by observation and deduction</p> <p>Extrapolation of findings to claim: How much of the claim can you address from your conclusion to your specific research question – don't worry if you cannot fully address the claim (you are not supposed to), if you did, your question would not be specific.</p> <p>Considered (improvements and extensions): Why would your improvements/extensions help you to better investigate the research question/claim? To demonstrate thought and consideration – think justification. Improvements should be linked to any identified limitations in the data you have analysed Extensions should be linked to what aspects of the claim you identified as not being addressed by your research question</p>
<ul style="list-style-type: none"> • adequate interpretation of research evidence about <topic> demonstrated by reasonable conclusion/s relevant to the research question • basic evaluation of the research processes, claims and conclusions about <topic> demonstrated by <ul style="list-style-type: none"> – reasonable description of the quality of evidence – application of relevant findings of the research to the claim – suggested improvements and extensions to the investigation that are relevant to the claim. 	3–4	<p>Reasonable conclusion: Conclusion is based on the theory/data but has not been properly justified.</p> <p>Application: You have not considered the whole claim, just linked it to the one aspect that has been researched.</p>

<ul style="list-style-type: none"> • invalid interpretation of research evidence about <topic>demonstrated by inappropriate or irrelevant conclusion/s • superficial evaluation of the research processes, claims and conclusions about <topic>demonstrated by <ul style="list-style-type: none"> - cursory or simplistic statements about the quality of evidence - application of insufficient or inappropriate findings of the research to the claim - ineffective or irrelevant suggestions. 	1-2	
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Criterion: Communication

7. communicate understandings and research findings, arguments and conclusions about the properties and structure of organic materials or chemical synthesis and design

The student work has the following characteristics:	Marks	Analysis
<ul style="list-style-type: none"> • effective communication of understandings and research findings, arguments and conclusions about chemical reactions and energy changes demonstrated by <ul style="list-style-type: none"> - fluent and concise use of scientific language and representations - appropriate use of genre conventions - acknowledgment of sources of information through appropriate use of referencing conventions. 	2	<p>It is almost impossible to get less than 2 in this section, unless you have not written in reasonable English, spelled things wrongly throughout (turn on spell check!) and you didn't include a list of references.</p> <p>Obviously, use scientific terminology wherever appropriate; otherwise use normal, everyday spoken English. DO NOT look up fancy words in a Thesaurus; it is far better to write as you would speak.</p>
<ul style="list-style-type: none"> • adequate communication of understandings and research findings, arguments and conclusions about chemical reactions and energy changes demonstrated by <ul style="list-style-type: none"> - competent use of scientific language and representations - use of basic genre conventions - use of basic referencing conventions. 	1	
<ul style="list-style-type: none"> • does not satisfy any of the descriptors above. 	0	