

Extended Essay. Comment and Assessment Rubric - Chemistry

Criterion A: Focus and method

This criterion focuses on the topic, the research question and the methodology. It assesses the explanation of the focus of the research (this includes the topic and the research question), how the research will be undertaken, and how the focus is maintained throughout the essay.

(Strands: Topic, Research question, Methodology)

The EE in chemistry must have a clear chemical emphasis and should focus on the chemistry aspect of the investigation.

It should incorporate chemical principles and relate to the study of matter and its chemical changes.

The topic can come from:

- the core
- the AHL topics or
- one of the IB chemistry options of the syllabus.

However, the emphasis should be on chemistry.

The research question must be formulated as an actual question, such as “Can the spectator ions influence the rate of oxidation-reduction reaction?”

To address the research question the student must research the existing literature on the topic and choose an appropriate methodology to pursue the investigation by:

- undertaking work in the laboratory or
- basing their research on existing data.

If practical work is undertaken, the rationale for choosing the procedure should be clearly explained.

If the investigation is undertaken in an external laboratory, students have to show clearly their understanding of the methods and materials, and their role in collecting the data.

Criterion A: Focus and method. *The Assessment Criteria*

Level	Descriptor
0	The work does not reach a standard outlined by the descriptors below.
1–2	<p>The topic is communicated unclearly and incompletely</p> <ul style="list-style-type: none">- Identification and explanation of the topic is limited; the purpose and focus of the research is unclear, or does not lend itself to a systematic investigation in the subject for which it is registered. <p>The research question is stated but not clearly expressed or too broad</p> <ul style="list-style-type: none">- The research question is too broad in scope to be treated effectively within the word limit and requirements of the task, or does not lend itself to a systematic investigation in the subject for which it is registered.- The intent of the research question is understood but has not been clearly expressed and/or the discussion of the essay is not focused on the research question. <p>Methodology of the research is limited</p> <ul style="list-style-type: none">- The source(s) and/or method(s) to be used are limited in range given the topic and research question.- There is limited evidence that their selection was informed.
3–4	<p>The topic is communicated</p> <ul style="list-style-type: none">- Identification and explanation of the research topic is communicated; the purpose and focus of the research is adequately clear, but only partially appropriate. <p>The research question is clearly stated but only partially focused</p> <ul style="list-style-type: none">- The research question is clear but the discussion in the essay is only partially focused and connected to the research question. <p>Methodology of the research is mostly complete</p> <ul style="list-style-type: none">- Source(s) and/or method(s) to be used are generally relevant and appropriate given the topic and research question.- There is some evidence that their selection(s) was informed. <p>If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than four marks can be awarded for this criterion.</p>
5–6	<p>The topic is communicated accurately and effectively</p> <ul style="list-style-type: none">- Identification and explanation of the research topic is effectively communicated; the purpose and focus of the research is clear and appropriate. <p>The research question is clearly stated and focused</p> <ul style="list-style-type: none">- The research question is clear and addresses an issue of research that is appropriately connected to the discussion in the essay. <p>Methodology of the research is complete</p> <ul style="list-style-type: none">- An appropriate range of relevant source(s) and/or method(s) have been applied in relation to the topic and research question.- There is evidence of effective and informed selection of sources and/or methods.

Criterion B: Knowledge and understanding

This criterion assesses the extent to which the research relates to the subject area/discipline used to explore the research question, or in the case of the world studies extended essay, the issue addressed and the two disciplinary perspectives applied, and additionally the way in which this knowledge and understanding is demonstrated through the use of appropriate terminology and concepts.

(Strands: Context, Subject-specific terminology and concepts)

Students are expected to show understanding of the relevant chemical principles and ideas and to apply them correctly.

Students must demonstrate clearly the underlying chemistry behind the research question and the techniques and apparatus chosen.

The source materials accessed should be:

- clearly relevant and appropriate to the research question
- effectively referenced and incorporated into the main body of the essay in a way that demonstrates the students' understanding.

Literature cited should predominantly come from acknowledged scientific sources.

Students must demonstrate the ability to apply their selected sources and methods effectively in support of their argument.

The student must try to maintain a consistent linguistic style throughout the essay.

Chemical nomenclature and terminology should be used consistently and effectively throughout the essay. Students should also use appropriately and consistently:

- relevant chemical and structural formulas
- balanced equations with state symbols
- mechanisms of reactions
- significant digits
- SI units.

Criterion B: Knowledge and understanding. *The Assessment Criteria*

Level	Descriptor
0	The work does not reach a standard outlined by the descriptors below.
1–2	<p>Knowledge and understanding is limited.</p> <ul style="list-style-type: none">- The selection of source material has limited relevance and is only partially appropriate to the research question.- Knowledge of the topic/discipline(s)/issue is anecdotal, unstructured and mostly descriptive with sources not effectively being used. <p>Use of terminology and concepts is unclear and limited.</p> <ul style="list-style-type: none">- Subject-specific terminology and/or concepts are either missing or inaccurate, demonstrating limited knowledge and understanding.
3–4	<p>Knowledge and understanding is good.</p> <ul style="list-style-type: none">- The selection of source material is mostly relevant and appropriate to the research question.- Knowledge of the topic/discipline(s)/issue is clear; there is an understanding of the sources used but their application is only partially effective. <p>Use of terminology and concepts is adequate.</p> <ul style="list-style-type: none">- The use of subject-specific terminology and concepts is mostly accurate, demonstrating an appropriate level of knowledge and understanding. <p>If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than four marks can be awarded for this criterion.</p>
5–6	<p>Knowledge and understanding is excellent.</p> <ul style="list-style-type: none">- The selection of source materials is clearly relevant and appropriate to the research question.- Knowledge of the topic/discipline(s)/issue is clear and coherent and sources are used effectively and with understanding. <p>Use of terminology and concepts is good.</p> <ul style="list-style-type: none">- The use of subject-specific terminology and concepts is accurate and consistent, demonstrating effective knowledge and understanding.

Criterion C: Critical thinking

This criterion assesses the extent to which critical-thinking skills have been used to analyse and evaluate the research undertaken.

(Strands: Research, Analysis and Discussion and evaluation)

In a chemistry EE, the “research” refers to both literature sources and data collected by the students themselves. This research must be consistently relevant to the research question.

The student is expected to appropriately present and analyse the data. This analysis will often include:

- mathematical transformations
- statistical analysis
- tables of processed data and graphs.

If the data are analysed statistically, the student must clearly show understanding of why that particular test was chosen and what the results mean.

If graphs are used, they must be correctly selected and drawn to illustrate key elements of the analysis. They should only be included if they improve communication.

Students must analyse and present their data in such a way that they support and clarify the argument leading to the conclusion.

Students must make a particular effort to maintain a reasoned, logical argument that focuses on the research question. Essays that attempt to deal with a large number of variables are unlikely to be focused and coherent. A clear and logical argument can be achieved by making repeated reference to the research question.

An assessment of the extent to which the question is answered, either by the data or by information accessed, should form part of the argument.

The stated conclusion(s) must be based on and be consistent with the research presented in the essay.

The original research question need not be fully answered by the investigation. In these cases, the student should point out unresolved issues and make suggestions as to how these might be further investigated.

Inadequate experimental design or any systematic errors should be exposed. The uncertainties of the measurements should be evaluated and discussed.

The student must comment on the quality, balance and quantity of their sources. Students are expected to show an awareness of any limitations or uncertainties inherent in their approach. In particular, they should critically comment on the validity and reliability of their data relative to their management of variables within the investigation.

Criterion C: Critical thinking. *The Assessment Criteria*

Level	Descriptor
0	The work does not reach a standard outlined by the descriptors below.
1–3	<p>The research is limited.</p> <ul style="list-style-type: none">- The research presented is limited and its application is not clearly relevant to the RQ. <p>Analysis is limited.</p> <ul style="list-style-type: none">- There is limited analysis.- Where there are conclusions to individual points of analysis these are limited and not consistent with the evidence. <p>Discussion/evaluation is limited.</p> <ul style="list-style-type: none">- An argument is outlined but this is limited, incomplete, descriptive or narrative in nature.- The construction of an argument is unclear and/or incoherent in structure hindering understanding.- Where there is a final conclusion, it is limited and not consistent with the arguments/evidence presented.- There is an attempt to evaluate the research, but this is superficial. <p>If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than three marks can be awarded for this criterion.</p>
4–6	<p>The research is adequate.</p> <ul style="list-style-type: none">- Some research presented is appropriate and its application is partially relevant to the Research question. <p>Analysis is adequate.</p> <ul style="list-style-type: none">- There is analysis but this is only partially relevant to the research question; the inclusion of irrelevant research detracts from the quality of the argument.- Any conclusions to individual points of analysis are only partially supported by the evidence. <p>Discussion/evaluation is adequate.</p> <ul style="list-style-type: none">- An argument explains the research but the reasoning contains inconsistencies.- The argument may lack clarity and coherence but this does not significantly hinder understanding.- Where there is a final or summative conclusion, this is only partially consistent with the arguments/evidence presented.- The research has been evaluated but not critically.

7-9	<p>The research is good.</p> <ul style="list-style-type: none"> - The majority of the research is appropriate and its application is clearly relevant to the research question. <p>Analysis is good.</p> <ul style="list-style-type: none"> - The research is analysed in a way that is clearly relevant to the research question; the inclusion of less relevant research rarely detracts from the quality of the overall analysis. - Conclusions to individual points of analysis are supported by the evidence but there are some minor inconsistencies. <p>Discussion/evaluation is good.</p> <ul style="list-style-type: none"> - An effective reasoned argument is developed from the research, with a conclusion supported by the evidence presented. - This reasoned argument is clearly structured and coherent and supported by a final or summative conclusion; minor inconsistencies may hinder the strength of the overall argument. - The research has been evaluated, and this is partially critical.
10-12	<p>The research is excellent.</p> <ul style="list-style-type: none"> - The research is appropriate to the research question and its application is consistently relevant. <p>Analysis is excellent.</p> <ul style="list-style-type: none"> - The research is analysed effectively and clearly focused on the research question; the inclusion of less relevant research does not significantly detract from the quality of the overall analysis. - Conclusions to individual points of analysis are effectively supported by the evidence. <p>Discussion/evaluation is excellent.</p> <ul style="list-style-type: none"> - An effective and focused reasoned argument is developed from the research with a conclusion reflective of the evidence presented. - This reasoned argument is well structured and coherent; any minor inconsistencies do not hinder the strength of the overall argument or the final or summative conclusion. - The research has been critically evaluated.

Criterion D: Presentation

This criterion assesses the extent to which the presentation follows the standard format expected for academic writing and the extent to which this aids effective communication.

(Strands: Structure, Layout)

This criterion relates to the extent to which the essay conforms to accepted academic standards in relation to how research papers should be presented. It also relates to how well these elements support the reading, understanding and evaluation of the essay.

Students may use numbered and headed paragraphs to impose a clear structure. sub-headings should not distract from the overall structure of the essay or argument presented.

Use of charts, images and tables

Any charts, images or tables from literature sources included in the essay must be carefully selected and labelled. They should only be used if they are directly relevant to the research question, contribute towards the understanding of the argument and are of a good graphic quality.

Large tables of raw data collected by the student are best included in an appendix, where they should be carefully labelled. Tables of processed data should be designed to clearly display the information in the most appropriate form. Graphs or charts drawn from the analysed data should be selected to highlight only the most pertinent aspects related to the argument. Too many graphs, charts and tables will distract from the overall quality of the communication.

Only processed data that is central to the argument of the essay should be included in the body of the essay, as close as possible to its first reference. Tables should enhance a written explanation but not themselves include significant bodies of text. If they do, then these words must be included in the word count.

If an experimental method is long and complex, students may place the raw data in an appendix and include a summary of the methods in the body of the essay. Students who choose this option must be careful to ensure that the summary contains all elements that contribute to the quality of the investigation, since appendices are not an essential section of the EE and examiners are not required to read them.

In other words, any important information that contributes to the evaluation of the method must be in the body of the essay and not the appendix. For experiments where numerical results are calculated from data obtained by changing one of the variables, it is generally good practice to show one example of the calculation in the main body of the essay. The remainder can be displayed in tabular or graphical form.

Any material that is not original must be carefully acknowledged, with specific attention paid to the acknowledgment and referencing of quotes and ideas. This acknowledgment and referencing is applicable to audio-visual material, text, graphs and data published in print and electronic sources. If the referencing does not meet the minimum standard as indicated in the guide (name of author, date of publication, title of source and page numbers as applicable), and is not consistently applied, work will be considered as a case of possible academic misconduct.

A bibliography is essential and has to be presented in a standard format. Title page, table of contents, page numbers, etc must contribute to the quality of presentation.

The essay must not exceed 4,000 words of narrative. Students should be aware that examiners will not read beyond the 4,000-word limit, nor assess any material presented thereafter. Graphs, figures, calculations, diagrams, formulas and equations are not included in the word count.

Criterion D: Presentation. *The Assessment Criteria*

Level	Descriptor
0	The work does not reach a standard outlined by the descriptors below.
1–2	<p>Presentation is acceptable.</p> <ul style="list-style-type: none">- The structure of the essay is generally appropriate in terms of the expected conventions for the topic, argument and subject in which the essay is registered.- Some layout considerations may be missing or applied incorrectly.- Weaknesses in the structure and/or layout do not significantly impact the reading, understanding or evaluation of the extended essay.
3–4	<p>Presentation is good.</p> <ul style="list-style-type: none">- The structure of the essay clearly is appropriate in terms of the expected conventions for the topic, the argument and subject in which the essay is registered.- Layout considerations are present and applied correctly.- The structure and layout support the reading, understanding and evaluation of the extended essay.

Criterion E: Engagement

This criterion assesses the student's engagement with their research focus and the research process. It will be applied by the examiner at the end of the assessment of the essay, after considering the student's *Reflections on planning and progress form*.

(Strands: Process, Research focus)

This criterion assesses the student's engagement with their research focus and the research process. It will be applied by the examiner at the end of the assessment of the essay, after considering the student's Reflections on planning and progress Form (RPPF).

Students are expected to provide reflections on the decision-making and planning process undertaken in completing the essay. Students must demonstrate how they arrived at a topic as well as the methods and approach used. This criterion assesses the extent to which a student has evidenced the rationale for decisions made throughout the planning process and the skills and understandings developed.

For example, students may reflect on:

- the approach and strategies they chose, and their relative success
- the *Approaches to learning* skills they have developed and their effect on the student as a learner
- how their conceptual understandings have developed or changed as a result of their research
- setbacks they faced in their research and how they overcame these
- questions that emerged as a result of their research
- what they would do differently if they were to undertake the research again.

Effective reflection highlights the journey the student has engaged in through the EE process. Students must show evidence of critical and reflective thinking that goes beyond simply describing the procedures that have been followed.

The reflections must provide the examiner with an insight into student thinking, creativity and originality within the research process. The student voice must be clearly present and demonstrate the learning that has taken place.

Criterion E: Engagement. *The Assessment Criteria*

Level	Descriptor
0	The work does not reach a standard outlined by the descriptors below.
1–2	Engagement is limited. <ul style="list-style-type: none">- Reflections on decision-making and planning are mostly descriptive.- These reflections communicate a limited degree of personal engagement with the research focus and/or research process.
3–4	Engagement is good. <ul style="list-style-type: none">- Reflections on decision-making and planning are analytical and include reference to conceptual understanding and skill development.- These reflections communicate a moderate degree of personal engagement with the research focus and process of research, demonstrating some intellectual initiative.
5–6	Engagement is excellent. <ul style="list-style-type: none">- Reflections on decision-making and planning are evaluative and include reference to the student’s capacity to consider actions and ideas in response to setbacks experienced in the research process.- These reflections communicate a high degree of intellectual and personal engagement with the research focus and process of research, demonstrating authenticity, intellectual initiative and/or creative approach in the student voice.