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An Chomhairle Náisiúnta Curaclaim agus Measúnachta
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Guidelines to support the Chemical and Physical Science in Practice Investigation

Leaving Certificate Chemical and Physical Science

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Introduction

This document, *Guidelines to support the Chemical and Physical Science in Practice Investigation* provides:

- details of the nature and scope of the Chemical and Physical Science in Practice Investigation as outlined in the curriculum specification for Leaving Certificate Chemical and Physical Science
- guidance for schools, teachers and students on undertaking, completing and submitting the Chemical and Physical Science in Practice Investigation
- information on the role of schools and teachers in supporting students with the Chemical and Physical Science in Practice Investigation
- descriptors of quality for the Chemical and Physical Science in Practice Investigation.

These guidelines should be used in conjunction with the curriculum specification for Leaving Certificate Chemical and Physical Science which can be accessed at Senior Cycle Subjects | Curriculum Online.

A brief for the conduct of the Chemical and Physical Science in Practice Investigation will be published annually by the State Examinations Commission (SEC) in Term 2 of Year 1.

Assessment for Certification in Leaving Certificate Chemical and Physical Science

Assessment for certification is based on the rationale, aim and learning outcomes of the Leaving Certificate Chemical and Physical Science specification. There are two assessment components: a written examination and an additional assessment component comprising a Chemical and Physical Science in Practice Investigation. The written examination will be at higher and ordinary level. The Chemical and Physical Science in Practice Investigation will be based on a common brief and will be assessed at the level at which the student sits the final written examination. Each component will be set and examined by the State Examinations Commission (SEC).

Table 1: Overview of assessment for certification

Assessment component	Weighting	Level
Chemical and Physical Science in Practice Investigation	40%	Common brief
Written examination	60%	Higher and Ordinary

Overview of the Chemical and Physical Science in Practice Investigation

The Chemical and Physical Science in Practice Investigation provides an opportunity for students to display evidence of their learning throughout the course, in particular, the learning set out as outcomes in the unifying strand. It involves students completing a piece of work during the course and, in Year 2, submitting for marking to the State Examinations Commission (SEC), evidence of their ability to conduct scientific research on a particular issue and to conduct an experiment on an aspect of that issue by generating appropriate primary data. The assessment has been designed to be naturally integrated into the flow of teaching and learning and to exploit its potential to be motivating and relevant for students, to draw together the learning outcomes and cross-cutting themes of the course and to highlight the relevance of learning in Chemical and Physical Science to their lives.

The senior cycle key competencies, developed by the students through all their learning in this course, will be applied through engagement with the Chemical and Physical Science in Practice Investigation. The Chemical and Physical Science in Practice Investigation provides opportunities for students to pursue their interests in Chemical and Physical Science, to demonstrate their skills in scientific inquiry and scientific communication, to make their own investigative decisions, acquire a depth of conceptual understanding as they apply their learning in a real-life context and self-manage their own learning.

Investigation Brief

An *Investigation Brief* will be published annually by the SEC in Term 2 of Year 1 of the course. As well as setting out the specific requirements of the Chemical and Physical Science in Practice Investigation, the brief will:

- allow students to develop their thinking and ideas on areas they would like to pursue, related to the brief
- facilitate teachers and students in their planning
- include stimulus material to set a context for the investigation
- allow students to develop an investigative log that they can draw upon as they complete their investigation.

Building on their learning to date, students will learn more about the nature of investigation through research and experimentation. Students should be empowered in realising that research and experimentation is more about engaging with and learning from the process, rather than focusing on the final product. Students should give an authentic account of how their investigative work unfolds, discuss and explain the outcomes of their investigation and how they might revise aspects of the process. In addition, they should make connections and link their learning to appropriate real-life applications of their learning.

To complete the Chemical and Physical Science in Practice Investigation, students carry out the following:

- scientific research on an issue related to the brief. They gather, process and evaluate information from secondary sources. The knowledge gained from this phase of the investigation may help to inform their experimental work
- An experiment related to an issue within the brief. They generate a hypothesis, plan, and design their experiment. They carry out their experiment and gather appropriate primary data. Once they have gathered their primary data, they analyse the data and form conclusions
- Make a concrete connection between their investigate findings within a real-life application.

Students communicate their investigative findings using relevant scientific terminology and representations and develop an evidence-based argument in response to the brief. Upon completion, students submit a report of their investigation in Year 2 in a format prescribed by the SEC. Schools have a high degree of autonomy in planning and organising the completion of the investigation. This document, *Guidelines to support the Chemical and Physical Science in Practice Investigation*, gives guidance on a range of matters related to the organisation, implementation, and oversight of the investigation.

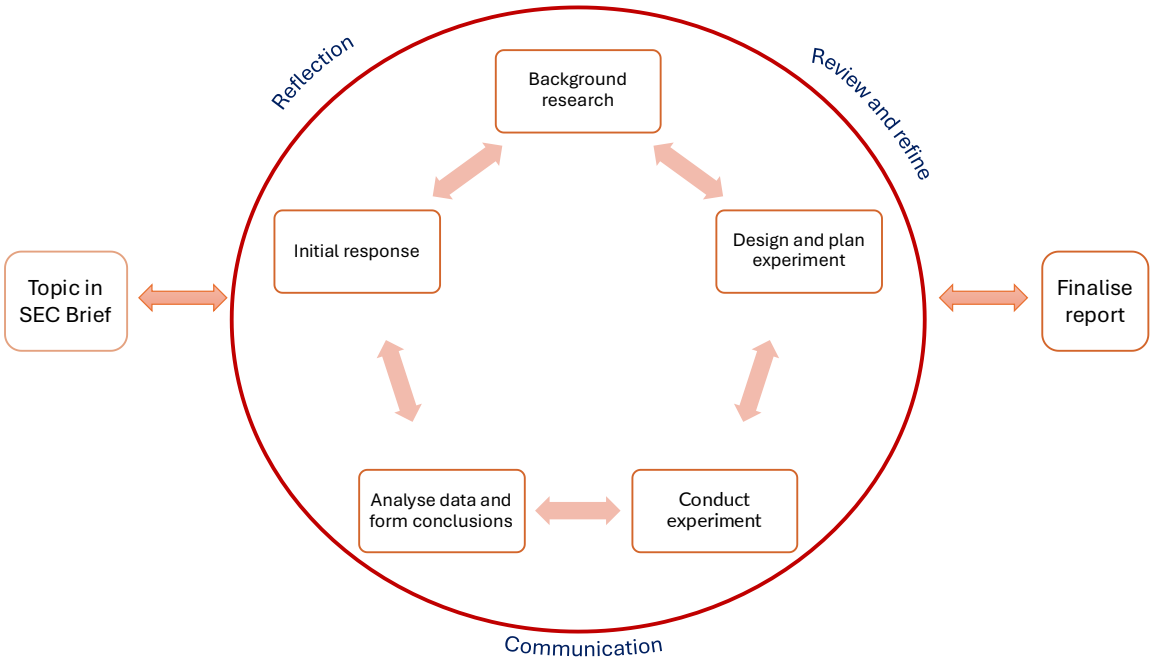

Figure 1. Overview of the process for completion of the Chemical and Physical Science in Practice Investigation

Investigation in Chemical and Physical Science

In the unifying strand students learn about investigating in chemical and physical science as a process that uses established procedures and practices to gather evidence, generate models and test their ideas on how the chemical and physical world works.

The specification promotes an investigative approach to the development of inquiry and practical skills. As part of ongoing teaching, learning and assessment of the learning outcomes for Leaving Certificate Chemical and Physical Science, students have opportunities to develop inquiry and practical skills as they realise various learning outcomes across strands, as appropriate; using secondary sources, generating and using models, gathering primary data, analysing primary and secondary data and exploring real-life application(s). Students, therefore, should be developing sufficient knowledge, skills and understanding over the duration of the course to allow them to engage with a Chemical and Physical Science in Practice Investigation.

Through the Chemical and Physical Science in Practice Investigation and guided by an Investigation Brief published annually by the SEC in Term 2 of Year 1 of the course, students pursue their own interests in chemical and physical science and make their own investigative decisions to demonstrate scientific investigative skills as outlined in the learning outcomes of the unifying strand. Completing this autonomous investigation is an opportunity for students to deepen their understanding of chemical and physical concepts within the specification, exploring the cross-cutting themes and making connections to real-life application(s). The Chemical and Physical Science in Practice Investigation will assess the students' ability to use, review and reflect on the skills and thinking used in carrying out investigations, as they apply their learning and skills to exploring an issue in an unfamiliar context.

The Investigation Brief will support and facilitate both teachers and students in planning for the investigation. It is crucial that students' investigations within the Chemical and Physical Science in Practice Investigation are understood as an integrated part of the teaching and learning of Chemical and Physical Science. The investigation should not just be viewed in terms of the production of a report to be submitted to the SEC for marking, but as a process that facilitates and supports good teaching and learning practices and enables students to fulfil the objectives of the specification. It is recommended that students keep an investigative log of learning activities that relate to and support the development of inquiry and practical skills, that they can draw upon as they complete their investigation. An investigative log is the student's working document, where they record and reflect on the process of their investigation. As this personal document is not submitted to the SEC for examination, its format, which may be digital or hard copy, is decided by the student.

Process for the completion of the Chemical and Physical Science in Practice Investigation

Over the course of approximately 20 hours, students will engage in activities that belong to six distinct stages of the investigative process. Whilst the length of time needed to complete each stage will depend on the nature of the brief in any given year, flexible timings for the completion of each is included in the relevant section of this document. These activities, which are outlined in this document, contribute to the generation of student evidence of learning and achievement in the Chemical and Physical Science in Practice Investigation.

The Chemical and Physical Science in Practice Investigation is intended to be integrated into the regular teaching and learning of the chemical and physical science classroom. As such, students will be planning for its completion from the very beginning of the course, developing the skills required to complete the investigation as they engage with the learning set out in the specification.

There is no expectation that students complete all of the stages of the Chemical and Physical Science in Practice Investigation in one continuous block, different stages of the investigation may occur at different moments over the course of the year. Nor is it intended that the stages are a rigid or linear process. Mistakes, errors and improvements are expected components of the investigative process and students should be prepared to iterate, that is move backwards and forwards between the stages and revisit investigative activities at different times, reflecting on and refining their work as they complete the investigation. Students are encouraged to work like scientists, with a focus on outlining assumptions and decisions made during each stage, and to explain how these assumptions and decisions impact on reliability, validity, accuracy, precision, error, fairness, safety and integrity. It is not necessary that students observe the results that they expected, but rather that the observations and data they recorded are interrogated and explained, in the context of equipment, materials and experimental design.

The indicative timings represent the estimated total time for each stage and it is envisaged that teachers would plan to engage with the stages of the investigation when it is most appropriate for their own context, during the year. To support integration into regular classroom practice, students may begin their work during class time and continue working on it outside of the classroom setting as is normal practice.

Stage 1: Initial Response to the Investigation Brief

This part of the investigation involves students engaging with an Investigation Brief which provides information about a context involving some chemical and physical phenomenon related to the learning in the specification. The brief is open-ended presenting an opportunity for creative interpretation. It is envisaged that this stage will take approximately 1 – 2 hours to complete.

An initial exploration of the Investigation Brief allows both students and teachers to understand the context, to make connections to learning outcomes within the specification and to consider any issue related to the cross-cutting themes. At this early stage, students can begin to consider their response to the brief, by firstly outlining some initial broad research and experimental areas they may like to explore

and then making connections to real-life application(s) or contexts through their own interests, experiences and prior learning within Chemical and Physical Science. Guiding or prompt questions that may support students in this process include:

- What do I already know about the topic and/or issue in the Investigation Brief?
- Do I need to understand more about the topic and/or issue and how will I do this?
- What kinds of real-life application(s) and/or contexts connect to the topic and/or issue in the Investigation Brief?
- What research and experimental activities in Chemical and Physical Science connect to the topic and/or issue in the Investigation Brief?
- What area of the topic and/or issue am I interested in researching? What sources of information will be useful and how will I maintain a record of the research?
- What experiment am I interested in completing? Could I extend or adapt an experiment I have already completed in Chemical and Physical Science, or could I develop an original approach to an experiment?

Students are strongly encouraged to compile an investigative log, which they can use to keep a record of their approach to the investigation and gather resources that they may use in the completion of their investigation.

For the teacher, an initial exploration of the Investigation Brief can help inform planning for the coming year by identifying learning outcomes that relate to the context and chemical and physical phenomena contained in the brief. In addition, opportunities to highlight relevant issues may be pinpointed in their plan as well as opportunities to point out to students how planned experimental, research activities and real-life application(s) relate to the brief. This initial response to the brief supports the integration of the Chemical and Physical Science in Practice Investigation within the regular teaching and learning of the classroom.
Both the student and teachers' initial response to the Investigation Brief complement one another. Interacting with the students at this stage provides an opportunity to familiarise themselves with their initial idea and to identify any gaps in understanding, or in some cases misunderstanding. The teacher should use this information to support students to consider amendments or adaptations to their plans, to ensure the integrated development of both conceptual understanding and investigative skill development over the coming year.

As teachers begin to understand the broader plans students may have for both the research and experimental components of the Chemical and Physical Science in Practice Investigation, they can plan how they will engage with students, either on a one-to-one basis or in a group setting, to support their approach. Feasibility of an investigation is an important consideration during normal classroom practice and is particularly relevant for this stage of the process; discussions therefore, on potential limitations and how students overcome them is an important aspect of their engagement with the Investigation Brief.

Stage 2: Background Research

Once students have decided on an issue related to the Investigation Brief they are ready to embark on the next stage of the process completing background research, which is envisaged to take approximately 2 – 3 hours to complete. Whilst background research may help the design of the experiment, the research

involved in this stage of the process is envisaged to be more far reaching and should involve broader areas of scientific relevance prompted by the topic of the Investigation Brief.

Students now draw on their research and prior learning, making connections between Chemical and Physical Science and real-life contexts in the world around them. Depending on the nature of the topic in any given year, this could include but not be restricted to research on the wider areas of scientific interests, relevant socio-scientific implications and media-based arguments associated with the topic. During this stage of the process, students develop a research question on a particular issue in response to the Investigation Brief and informed by their background research into the topic. Good research practice involves reviewing, summarising and evaluating evidence from different viewpoints. This allows an informed and justified opinion to be made in response to the research question.

Students are encouraged to maintain a record of their research findings in their investigative log, which could include extracts from research sources, secondary data, student reflections, download dates and relevant references (Appendix 1). Maintaining a good record of research findings will support students as they begin to develop their evidence-based argument and compile their report. It is advisable that the students' investigative logs are shared with the teacher, to facilitate regular check-ins with the students' work, supporting the teacher in the ongoing process of authentication.

Stage 3: Designing and Planning the Experiment

During this stage, which is envisaged to take approximately 2 – 3 hours to complete, students design and plan an experiment to be completed in the laboratory, that will generate appropriate primary data, in response to the Investigation Brief. This may involve students designing an original experiment, or extending/adapting an experiment they have already encountered, to explore the issue they are investigating. Whatever approach students decide, this stage will involve students using insights from their background research to pose a testable hypothesis and develop experimental strategies for investigating it. Flexibility during this stage supports students working individually or collaboratively towards the design of their individual experiment.

As they develop their plan, students will consider factors including: reliability, validity, accuracy, precision, error, fairness, safety and integrity. Students will also consider what materials and equipment they may need, the concentrations and supporting preparation of chemicals and what practical steps need to be taken to ensure that these materials and equipment are available to them when needed, in addition to health and safety considerations. Discussions between the teacher and student on the feasibility and manageability of their proposed plan supports an understanding of limitations such as safety, lack of equipment or time.

It is considered good practice for students to have gained experience with the apparatus necessary to complete the experiment during the normal classroom experience, as this will support them in understanding the limitations of their design. Students should reflect on any difficulties they experienced during the planning stages and record in their investigative log or research log how they overcame them. It is here, where students can note and reflect on any compromises they need to make as a result of limitations with equipment. Students are encouraged to keep a record of key investigative decisions that

were made with justifications, to support them when they begin to compile their report. Unanticipated outcomes are a valid and important part of the scientific process and should be recorded by the student and reflected upon appropriately in their report.

While the teacher may provide a sounding board for students in planning their experiment, it is important that students have ownership of their experimental design and the teacher should only intervene when a student's design is likely to be unsafe.

Stage 4: Conducting the Experiment

During this stage, under the supervision of the teacher in a school laboratory, each student carries out the experiment they designed. Whilst each student will complete their own individual Chemical and Physical Science in Practice Investigation, they may have additional support from their peers during this stage of the process to support the physical manipulation of equipment. Playing a supportive role in another students experiment, in this manner, is beneficial and provides further opportunity for the development of practical investigation skills, set out in the unifying strand and necessary for the completion of the experiment within the Chemical and Physical Science in Practice Investigation.

As students conduct their experiment, they should record all relevant observations made and data (both qualitative and quantitative) produced, maintaining a record of same in their investigative log. They should also record (by means of photographs, if appropriate, or otherwise) the arrangement of apparatus and any observations or results, whether anticipated or not. It is envisaged that a typical experiment related to the Chemical and Physical Science in Practice Investigation can be set up, completed and tidied away within approximately 1 – 2 hours of total laboratory time. Depending on the school context, it may not be feasible to have any more than eight experiments happening at any one time and so three experiment sessions may be needed for this stage of the process. Students not involved in an experiment during a specific session might undertake other aspects of their Chemical and Physical Science in Practice Investigation, such as refining their plan, completing background research or engaging in data analysis.

While the presence of the teacher in the laboratory is necessary at all times when experiments are taking place, the teacher should not intervene if a student is:

- using equipment incorrectly (but safely)
- not properly recording observations
- making experimental errors.

An important part of the ongoing authentication process is that the teacher is satisfied to give an undertaking that the experiment conducted by a student is in line with their research and planning, which has been shared with them during the stages of the process.

Stage 5: Data Analysis and Conclusions

Once the experiment is complete, students are ready to critically analyse their data and draw justifiable conclusions. During this stage, which it is envisaged will take approximately 1 – 2 hours to complete, students can use their investigative log to record their data analysis which they will use to justify conclusions. Data analysis may include:

- evaluating data in terms of accuracy, precision, repeatability and reproducibility
- calculations and/or graphs to facilitate the identification of patterns and relationships
- justifications for any iterations of the process
- the identification of and explanation for any initial anomalous results or observations.

Once a conclusion is arrived at, students should reflect on whether or not their data and conclusions support the hypothesis they posed and on the relevance of the connections made between their investigate findings and a noted real-life application(s). Again, sharing the data analysis with the teacher is an important step in the ongoing authentication process. The teacher must be satisfied to give an undertaking that the analysis and conclusions are aligned with the experiments that took place under their supervision.

Stage 6: Finalising the Chemical and Physical Science in Practice Investigation Report

During this final stage, which, it is envisaged to take up to 4 hours to complete, students draw upon their investigative log, which outlines all the stages of their investigation, to compile their final report. This is the final step in a multi-step process that helps the teacher have full confidence to sign-off on an authentic piece of student work. Teachers should not engage in corrections of the report for redrafting by the student.

Since this is the only document which students will submit to the SEC for marking it is important that in writing their report, students give an authentic account of all aspects of the investigative process they engaged with for the Chemical and Physical Science in Practice Investigation. It is advisable that they show their understanding and scoping of the issue, including relevant research with appropriate sources, identifying any relationships to learning in the strands and the crosscutting themes. Their report should describe the investigative activities they undertook - both research and experimental. Students may wish to outline any relevant research questions they developed or hypotheses posed, as well as sources and methods used to gather data and support conclusions. In presenting data and analysis of findings in their report, it is advisable that they link conclusions and judgements to any hypotheses and research questions posed and make relevant connections between their investigative findings and a real-life application(s).

The process for the completion of the Chemical and Physical Science in Practice Investigation is iterative and reflection is key to informing decision making as the investigation progresses. As students review and refine their investigation at different stages, they may reflect on aspects such as choice of equipment, accuracy of results, types of sources used, etc.. Providing a clear account of their reflections on different aspects of the process in their report, and how these informed their decision making, may help to enhance the authenticity of their report.

The final report should be a clear and consistent body of work. Students will have to consider how best to communicate the different aspects of the process in a coherent manner, such as how data is presented, its links to any research questions and hypotheses posed, the extent to which the research questions and hypotheses were answered, descriptions of any limitations in research and experimental design, reflections on refinements to the investigation, and supporting references.

Format and Submission of the Chemical and Physical Science in Practice Investigation Report

Students will be required to develop and submit a report as part of their Chemical and Physical Science in Practice Investigation. The report will be presented in a digital format prescribed by the State Examinations Commission (SEC).

All work completed as part of the Chemical and Physical Science in Practice Investigation must be concluded by a set date. This date will be set by the SEC and communicated to schools and will also be included in the brief that issues in Term 2 of Year 1 of the course.

The report must be submitted in line with instructions provided by the SEC. These instructions will contain specific information, such as the word count, number of images permissible, the required structure and section headings, file size, etc.

Students may choose to support, clarify or provide evidence of either the process or outcomes of their Chemical and Physical Science in Practice Investigation through the use of images such as illustrations, sketches, graphs, charts, tables, photographs, etc.

Students are required to engage in referencing to acknowledge the use of any work included in their project that is not their own. Details on referencing and using references can be found in Appendix 1.

It is extremely important that all of the work submitted by students for assessment is their own. The submission of work by any student not entirely completed by that student is a significant breach of regulations. Submitting such work may lead to the imposition of penalties, up to and including the withholding of related results.

A robust authentication process is central to ensuring the integrity of any assessment process. School-based authentication by teachers of students' work on their Chemical and Physical Science in Practice Investigation is essential to the fair and equitable assessment of that work. While it is neither practicable nor necessary for teachers to witness all aspects of students' work, teachers need to be satisfied that students have carried out the work themselves. Regular, comprehensive engagement with each student's work on their Chemical and Physical Science in Practice Investigation will enable teachers to confidently and legitimately authenticate any work being submitted for assessment.

The SEC provides detailed guidance on the authentication of coursework and the conditions for its acceptance. Information as to how this applies in the case of the Chemical and Physical Science in Practice Investigation will be provided in the brief, and also in other documentation which may be issued by the SEC.

Descriptors of Quality for the Chemical and Physical Science in Practice Investigation

The descriptors below, relate to the learning achieved by students in the Chemical and Physical Science in Practice Investigation. In particular, the investigation requires students to:

- consider issues related to real-world applications of physics and chemistry
- demonstrate research and experimental investigative skills
- relate their investigative work to real-life chemical and physical science contexts
- communicate their investigative findings appropriately and effectively.

Table 2: Descriptors of Quality for the Chemical and Physical Science in Practice Investigation

	Students demonstrating a high level of achievement	Students demonstrating a moderate level of achievement	Students demonstrating a low level of achievement
Research investigation	use relevant research to identify and explore the issue(s) in the brief and evaluate a wide range of appropriate sources; use a large number of varied, balanced and referenced sources; engage thoroughly with the physical and chemical concepts being investigated; summarise research findings through a critical lens; develop a clear and concise research question that can be tested experimentally.	use research to identify and explore the issue(s) in the brief and evaluate a range of appropriate sources; use a number of balanced and referenced sources; engage with the physical and chemical concepts being investigated; summarise research findings; develop a research question that can be tested experimentally.	use research that may be somewhat relevant to the issue(s) in the brief to be explored; use some referenced sources; engage in a limited way with the physical and chemical concepts being investigated; make some reference to research findings; demonstrate a tentative connection between a research question developed and experimental investigation.
Experimental investigation	develop and pose a testable hypothesis underpinned by chemical and physical science concepts; generate high quality primary data through appropriate investigative design and methods; analyse primary data and draw valid and justified conclusions, related to the research question and hypothesis; evaluate the investigation with an acknowledgement of the limitations of the investigation.	pose a testable hypothesis underpinned by chemical and physical science concepts; generate primary data through appropriate investigative design and methods; analyse primary data and draw valid and justified conclusions, with some link to the related research question and hypothesis; evaluate the investigation with some acknowledgement of limitations of the investigation.	pose a testable hypothesis; generate some primary data through investigative design and methods; analyse primary data and draw conclusions, with a tentative link to the related research question and hypothesis; evaluate the investigation somewhat.

	Students demonstrating a high level of achievement	Students demonstrating a moderate level of achievement	Students demonstrating a low level of achievement
Applications of learning in real-life contexts	relate their research and experimental investigative findings to appropriate real-life chemical and physical science contexts; locate real-life application(s) within broader societal and scientific issues relating to the brief.	relate their research and experimental investigative findings to real-life chemical and physical science contexts; locate real-life application(s) within the issues relating to the brief.	relate their investigative findings to a real-life context; may not locate real-life application(s) within the issues relating to the brief.
Communication	present the findings of their investigation in a clear and coherent manner; use appropriate scientific terminology and a variety of engaging formats to communicate their evidence-based findings; communicate clearly the links between the investigative findings and real-life applications.	present the findings of their investigation in a clear manner; use appropriate scientific terminology and engaging formats to communicate their evidence-based findings; communicate the links between the investigative findings and real-life applications.	present the findings of their investigation, unclear at times; use some scientific terminology and communicate their findings; communicate the investigative findings and real-life applications.

Role of the teacher

The teacher has an important role in supporting and supervising student work on the Chemical and Physical Science in Practice Investigation. Teaching and learning related to the additional assessment component should be integrated into ongoing classroom practice to maximise opportunities for students to achieve the learning outcomes of the specification and support the development of key competencies.

The release of the common brief by the SEC in Term 2 of Year 1 allows teachers to signpost the requirements and content of the brief from an early stage of learning in the subject. It will also facilitate teachers in planning for the integration of the Chemical and Physical Science in Practice Investigation, as appropriate, into the natural flow of teaching and learning in the classroom.

Support may include:

- clarifying the requirements of the Chemical and Physical Science in Practice Investigation Brief
- helping students to understand how the Brief issued by the State Examinations Commission for the Chemical and Physical Science in Practice Investigation links to the Leaving Certificate Chemical and Physical Science specification
- identifying any particular areas of the specification that students may need to engage with in order to undertake the Chemical and Physical Science in Practice Investigation
- ensuring students are aware of the descriptors of quality associated with the Chemical and Physical Science in Practice Investigation
- offering prompt questions, such as those supplied on p. 6 to stimulate and support students' planning and critical thinking throughout the process
- encouraging students to focus on the requirements of the brief and to relate their work to the learning outcomes in the specification
- guiding students in the continued development of their research skills
- helping students to appreciate the importance of good referencing practices and the necessity to avoid any form of plagiarism
- facilitating access to appropriate resources
- providing appropriate access arrangements for students with additional learning needs, in accordance with the State Examinations Commission provision of reasonable accommodations
- making students aware that they must comply with any relevant mandatory regulations or requirements such as those relating to health and safety, General Data Protection Regulations (GDPR), accessing public or private property etc.
- using feedback appropriately to promote a reflective approach to work on the Chemical and Physical Science in Practice Investigation
- providing instructions at strategic intervals to facilitate the timely completion of the Chemical and Physical Science in Practice Investigation
- drawing students' attention to any requirements in relation to the submission of the Chemical and Physical Science in Practice Investigation Report specified in the brief
- promoting opportunities afforded by the Chemical and Physical Science in Practice Investigation to develop Senior Cycle key competencies.

In order to facilitate the authentication process, teachers should engage regularly with students' work on the Chemical and Physical Science in Practice Investigation.

Teachers should be aware that only work which is the student's own can be submitted for assessment to the State Examinations Commission and that each student must submit their work on an individual basis.

Where more than one student within a class is working on a similar Chemical and Physical Science in Practice Investigation, it is important that each student takes an individualised approach to work.

The feedback provided to students should be general and nondirective in nature. Teachers should not provide any excessive or inappropriate support to students, such as editing draft work or providing model text or answers to be used in the students' evidence of learning.

Appendices

Appendix 1: Guidelines to Support Referencing

Referencing is an important aspect of the AAC as it allows those reading the Chemical and Physical Science in Practice Investigation to better engage with the content and to verify the information provided in the reference. It is the most appropriate way for students to acknowledge the source of any information, ideas, material or images not their own which they have included in their Chemical and Physical Science in Practice Investigation Report.

Referencing allows students to provide evidence of the research they have engaged in, it helps to support and give weight to arguments and conclusions, and it can be used to demonstrate that different perspectives have been considered and explored by the student.

Students should engage in referencing both within the body of their work (in-text citation) and also in the reference section of the Chemical and Physical Science in Practice Investigation Report. The use of in-text citation provides a direct link between what students write and the research on which their work is based.

Example:

A student using material from page 57 of the book *Inclusion: effective practice for all students?* would use the in-text citation (p. 57, McLeskey, 2013) and then go on to also add details to the list of references as McLeskey, J. (2013) *Inclusion: effective practice for all students?* 2nd edn.

In the reference section of their document, students should provide the appropriate details of any sources they have used during the course of their Chemical and Physical Science in Practice Investigation such as:

- books, newspapers, magazines
- professional journals and government reports
- online sources including videos, podcasts etc.
- material from specialist organisations and relevant individuals
- material generated by artificial intelligence (AI) software and AI applications. Specific information will be issued around this in the Chemical and Physical Science in Practice Investigation brief and in related documentation from the SEC.

The reference section is not included in the word count. Comprehensive referencing helps to show that students have engaged in honest and ethical research practices and have avoided plagiarism. Referencing should be as specific as necessary to communicate the particular research source, such as a page number or chapter in a book, a section in a website, timestamp on a podcast or video etc.

Plagiarism is a serious offence and occurs when work other than the student's own is used without clear acknowledgement of the source of the work. This includes the use of material generated using artificial intelligence (AI) software or AI applications. Direct copying of material from any source without proper acknowledgement is not permitted and may incur penalties, up to and including the withholding of related results.

When referencing the sources students used in their report they should ensure that, regardless of the type of source, there is enough accurate detail to enable the reader to authenticate the reference. No particular, formal style of referencing is required.

How students should reference different sources

- Where students are citing written sources or information in print, they should give the author's name, the title of the publication, year of publication, and, if necessary, the page number or chapter/section of the publication.
- Where students wish to refer to an internet site or online source, there should be enough accurate detail to enable the reader to authenticate the reference, including the hyperlink and date read or downloaded.
- Where students have used material generated by artificial intelligence (AI) software and AI applications this must be acknowledged. The reference should include the name of the AI tool used, the date the content was generated and provide a brief explanation of how it was used. Many Generative AI tools generate shareable URLs that set out the content of chat sessions that took place. Where such a tool has been used, the URL should be included in the list of research sources. Where an AI tool does not generate a sharable URL, student should include the name of the tool and the prompt used.

Examples of in-text Citations for different types of sources
Book: (p. 57, McLeskey, 2013)
Newspaper/magazine article: (Hearne, J., 30/08/2024)
Text/image accessed online: (thelatinlibrary.com/101/RhetoricalDevices)
Audio accessed online: (Ep. 10, rte.ie/radio/podcasts/22093250)
Video accessed online: (3:20 to 5:45, youtu.be/yCv4iyPqZKQ)

AI Tools (with shareable url): (chat.openai.com/share/f45a1e23-2217-4443-a244-d56ab26ae940)
AI Tools (without shareable url): (OpenAI (2023) ChatGPT, 20/10/2023)

Examples of references for different types of sources
Book in list of references: McLeskey, J. (2013) *Inclusion: effective practice for all students?* 2nd edn.
Newspaper/magazine article Hearne, J. (30/08/2024) 'How bad driving habits cost Irish motorists hundreds every year', Irish Examiner
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