Assessment in the Diploma Programme

General

Assessment is an integral part of teaching and learning. The most important aims of assessment in the Diploma Programme are that it should support curricular goals and encourage appropriate student learning. Both external and internal assessments are used in the Diploma Programme. IB examiners mark work produced for external assessment, while work produced for internal assessment is marked by teachers and externally moderated by the IB.

There are two types of assessment identified by the IB.

- Formative assessment informs both teaching and learning. It is concerned with providing accurate and helpful feedback to students and teachers on the kind of learning taking place and the nature of students' strengths and weaknesses in order to help develop students' understanding and capabilities. Formative assessment can also help to improve teaching quality, as it can provide information to monitor progress towards meeting the course aims and objectives.
- Summative assessment gives an overview of previous learning and is concerned with measuring student achievement.

The Diploma Programme primarily focuses on summative assessment designed to record student achievement at, or towards the end of, the course of study. However, many of the assessment instruments can also be used formatively during the course of teaching and learning, and teachers are encouraged to do this. A comprehensive assessment plan is viewed as being integral with teaching, learning and course organization. For further information, see the IB Programme standards and practices document.

The approach to assessment used by the IB is criterion-related, not norm-referenced. This approach to assessment judges students’ work by their performance in relation to identified levels of attainment, and not in relation to the work of other students. For further information on assessment within the Diploma Programme please refer to the publication Diploma Programme assessment: principles and practice.

To support teachers in the planning, delivery and assessment of the Diploma Programme courses, a variety of resources can be found on the OCC or purchased from the IB store (http://store.ibo.org). Additional publications such as specimen papers and markschemes, teacher support materials, subject reports and grade descriptors can also be found on the OCC. Past examination papers as well as markschemes can be purchased from the IB store.

Methods of assessment

The IB uses several methods to assess work produced by students.

Assessment criteria

Assessment criteria are used when the assessment task is open-ended. Each criterion concentrates on a particular skill that students are expected to demonstrate. An assessment objective describes what students should be able to do, and assessment criteria describe how well they should be able to do it. Using assessment criteria allows discrimination between different answers and encourages a variety of responses. Each criterion comprises a set of hierarchically ordered level descriptors. Each level descriptor is worth one
or more marks. Each criterion is applied independently using a best-fit model. The maximum marks for each criterion may differ according to the criterion's importance. The marks awarded for each criterion are added together to give the total mark for the piece of work.

**Markbands**
Markbands are a comprehensive statement of expected performance against which responses are judged. They represent a single holistic criterion divided into level descriptors. Each level descriptor corresponds to a range of marks to differentiate student performance. A best-fit approach is used to ascertain which particular mark to use from the possible range for each level descriptor.

**Analytic markschemes**
Analytic markschemes are prepared for those examination questions that expect a particular kind of response and/or a given final answer from students. They give detailed instructions to examiners on how to break down the total mark for each question for different parts of the response.

**Marking notes**
For some assessment components marked using assessment criteria, marking notes are provided. Marking notes give guidance on how to apply assessment criteria to the particular requirements of a question.

**Inclusive assessment arrangements**
Inclusive assessment arrangements are available for candidates with assessment access requirements. These arrangements enable candidates with diverse needs to access the examinations and demonstrate their knowledge and understanding of the constructs being assessed.

The IB document *Candidates with assessment access requirements* provides details on all the inclusive assessment arrangements available to candidates with learning support requirements. The IB document *Learning diversity within the International Baccalaureate programmes/Special educational needs within the International Baccalaureate programmes* outlines the position of the IB with regard to candidates with diverse learning needs in the IB programmes. For candidates affected by adverse circumstances, the IB documents *General regulations: Diploma Programme* and the *Handbook of procedures for the Diploma Programme* provide details on special consideration.

**Responsibilities of the school**
The school is required to ensure that equal access arrangements and reasonable adjustments are provided to candidates with special educational needs that are in line with the IB documents *Candidates with assessment access requirements* and *Learning diversity within the International Baccalaureate programmes/Special educational needs within the International Baccalaureate programmes*. 
### First assessment 2016

<table>
<thead>
<tr>
<th>Component</th>
<th>Overall weighting (%)</th>
<th>Approximate weighting of objectives (%)</th>
<th>Duration (hours)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1+2</td>
<td>3</td>
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<tr>
<td>Paper 1</td>
<td>20</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Paper 2</td>
<td>40</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Paper 3</td>
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<td>10</td>
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<tr>
<td>Internal assessment</td>
<td>20</td>
<td></td>
<td>Covers objectives 1, 2, 3 and 4</td>
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### Assessment outline—HL

**First assessment 2016**

<table>
<thead>
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<th>Overall weighting (%)</th>
<th>Approximate weighting of objectives (%)</th>
<th>Duration (hours)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1+2</td>
<td>3</td>
</tr>
<tr>
<td>Paper 1</td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Paper 2</td>
<td>36</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Paper 3</td>
<td>24</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Internal assessment</td>
<td>20</td>
<td>Covers objectives 1, 2, 3 and 4</td>
<td>10</td>
</tr>
</tbody>
</table>
The method used to assess students is the use of detailed markschemes specific to each examination paper.

External assessment details—SL

Paper 1
Duration: 3/4 hour
Weighting: 20%
Marks: 30

- 30 multiple-choice questions on core, about 15 of which are common with HL.
- The questions on paper 1 test assessment objectives 1, 2 and 3.
- The use of calculators is not permitted.
- No marks are deducted for incorrect answers.
- A physics data booklet is provided.

Paper 2
Duration: 1½ hours
Weighting: 40%
Marks: 50

- Short-answer and extended-response questions on core material.
- The questions on paper 2 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.

Paper 3
Duration: 1 hour
Weighting: 20%
Marks: 35

- This paper will have questions on core and SL option material.
- Section A: one data-based question and several short-answer questions on experimental work.
- Section B: short-answer and extended-response questions from one option.
- The questions on paper 3 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.
External assessment details—HL

Paper 1
Duration: 1 hour
Weighting: 20%
Marks: 40
- 40 multiple-choice questions on core and AHL, about 15 of which are common with SL.
- The questions on paper 1 test assessment objectives 1, 2 and 3.
- The use of calculators is not permitted.
- No marks are deducted for incorrect answers.
- A physics data booklet is provided.

Paper 2
Duration: 2½ hours
Weighting: 36%
Marks: 95
- Short-answer and extended-response questions on the core and AHL material.
- The questions on paper 2 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.

Paper 3
Duration: 1¼ hours
Weighting: 24%
Marks: 45
- This paper will have questions on core, AHL and option material.
- Section A: one data-based question and several short-answer questions on experimental work.
- Section B: short-answer and extended-response questions from one option.
- The questions on paper 3 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.
Purpose of internal assessment

Internal assessment is an integral part of the course and is compulsory for both SL and HL students. It enables students to demonstrate the application of their skills and knowledge, and to pursue their personal interests, without the time limitations and other constraints that are associated with written examinations. The internal assessment should, as far as possible, be woven into normal classroom teaching and not be a separate activity conducted after a course has been taught.

The internal assessment requirements at SL and at HL are the same. This internal assessment section of the guide should be read in conjunction with the internal assessment section of the teacher support materials.

Guidance and authenticity

The work submitted for internal assessment must be the student's own work. However, it is not the intention that students should decide upon a title or topic and be left to work on the internal assessment component without any further support from the teacher. The teacher should play an important role during both the planning stage and the period when the student is working on the internally assessed work. It is the responsibility of the teacher to ensure that students are familiar with:

- the requirements of the type of work to be internally assessed
- the IB animal experimentation policy
- the assessment criteria—students must understand that the work submitted for assessment must address these criteria effectively.

Teachers and students must discuss the internally assessed work. Students should be encouraged to initiate discussions with the teacher to obtain advice and information, and students must not be penalized for seeking guidance. As part of the learning process, teachers should read and give advice to students on one draft of the work. The teacher should provide oral or written advice on how the work could be improved, but not edit the draft. The next version handed to the teacher must be the final version for submission.

It is the responsibility of teachers to ensure that all students understand the basic meaning and significance of concepts that relate to academic honesty, especially authenticity and intellectual property. Teachers must ensure that all student work for assessment is prepared according to the requirements and must explain clearly to students that the internally assessed work must be entirely their own. Where collaboration between students is permitted, it must be clear to all students what the difference is between collaboration and collusion.

All work submitted to the IB for moderation or assessment must be authenticated by a teacher, and must not include any known instances of suspected or confirmed academic misconduct. Each student must confirm that the work is his or her authentic work and constitutes the final version of that work. Once a student has officially submitted the final version of the work it cannot be retracted. The requirement to confirm the authenticity of work applies to the work of all students, not just the sample work that will be submitted to the IB for the purpose of moderation. For further details refer to the IB publications Academic honesty (2011), The Diploma Programme: From principles into practice (2009) and the relevant articles in General regulations: Diploma Programme (2012).
Authenticity may be checked by discussion with the student on the content of the work, and scrutiny of one or more of the following:

- the student's initial proposal
- the first draft of the written work
- the references cited
- the style of writing compared with work known to be that of the student
- the analysis of the work by a web-based plagiarism detection service such as http://www.turnitin.com.

The same piece of work cannot be submitted to meet the requirements of both the internal assessment and the extended essay.

**Group work**

Each investigation is an individual piece of work based on different data collected or measurements generated. Ideally, students should work on their own when collecting data. In some cases, data collected or measurements made can be from a group experiment provided each student collected his or her own data or made his or her own measurements. In physics, in some cases, group data or measurements may be combined to provide enough for individual analysis. Even in this case, students should have collected and recorded their own data and they should clearly indicate which data are theirs.

It should be made clear to students that all work connected with the investigation should be their own. It is therefore helpful if teachers try to encourage in students a sense of responsibility for their own learning so that they accept a degree of ownership and take pride in their own work.

**Time allocation**

Internal assessment is an integral part of the physics course, contributing 20% to the final assessment in the SL and the HL courses. This weighting should be reflected in the time that is allocated to teaching the knowledge, skills and understanding required to undertake the work, as well as the total time allocated to carry out the work.

It is recommended that a total of approximately 10 hours of teaching time for both SL and HL should be allocated to the work. This should include:

- time for the teacher to explain to students the requirements of the internal assessment
- class time for students to work on the internal assessment component and ask questions
- time for consultation between the teacher and each student
- time to review and monitor progress, and to check authenticity.

**Safety requirements and recommendations**

While teachers are responsible for following national or local guidelines, which may differ from country to country, attention should be given to the guidelines below, which were developed for the International Council of Associations for Science Education (ICASE) Safety Committee by The Laboratory Safety Institute (LSI).

It is a basic responsibility of everyone involved to make safety and health an ongoing commitment. Any advice given will acknowledge the need to respect the local context, the varying educational and cultural traditions, the financial constraints and the legal systems of differing countries.
Using assessment criteria for internal assessment

For internal assessment, a number of assessment criteria have been identified. Each assessment criterion has level descriptors describing specific achievement levels, together with an appropriate range of marks. The level descriptors concentrate on positive achievement, although for the lower levels failure to achieve may be included in the description.

Teachers must judge the internally assessed work at SL and at HL against the criteria using the level descriptors.

- Assessment criteria are the same for both SL and HL.
- The aim is to find, for each criterion, the descriptor that conveys most accurately the level attained by the student, using the best-fit model. A best-fit approach means that compensation should be made when a piece of work matches different aspects of a criterion at different levels. The mark awarded should be one that most fairly reflects the balance of achievement against the criterion. It is not necessary for every single aspect of a level descriptor to be met for that mark to be awarded.
- When assessing a student’s work, teachers should read the level descriptors for each criterion until they reach a descriptor that most appropriately describes the level of the work being assessed. If a piece of work seems to fall between two descriptors, both descriptors should be read again and the one that more appropriately describes the student’s work should be chosen.
- Where there are two or more marks available within a level, teachers should award the upper marks if the student’s work demonstrates the qualities described to a great extent; the work may be close to achieving marks in the level above. Teachers should award the lower marks if the student’s work demonstrates the qualities described to a lesser extent; the work may be close to achieving marks in the level below.
- Only whole numbers should be recorded; partial marks (fractions and decimals) are not acceptable.
- Teachers should not think in terms of a pass or fail boundary, but should concentrate on identifying the appropriate descriptor for each assessment criterion.
- The highest level descriptors do not imply faultless performance but should be achievable by a student. Teachers should not hesitate to use the extremes if they are appropriate descriptions of the work being assessed.
- A student who attains a high achievement level in relation to one criterion will not necessarily attain high achievement levels in relation to the other criteria. Similarly, a student who attains a low achievement level for one criterion will not necessarily attain low achievement levels for the other criteria. Teachers should not assume that the overall assessment of the students will produce any particular distribution of marks.
- It is recommended that the assessment criteria be made available to students.
Practical work and internal assessment

General introduction

The internal assessment requirements are the same for biology, chemistry and physics. The internal assessment, worth 20% of the final assessment, consists of one scientific investigation. The individual investigation should cover a topic that is commensurate with the level of the course of study.

Student work is internally assessed by the teacher and externally moderated by the IB. The performance in internal assessment at both SL and HL is marked against common assessment criteria, with a total mark out of 24.

**Note:** Any investigation that is to be used to assess students should be specifically designed to match the relevant assessment criteria.

The internal assessment task will be one scientific investigation taking about 10 hours and the write-up should be about 6 to 12 pages long. Investigations exceeding this length will be penalized in the communications criterion as lacking in conciseness.

The practical investigation, with generic criteria, will allow a wide range of practical activities satisfying the varying needs of biology, chemistry and physics. The investigation addresses many of the learner profile attributes well. See section on "Approaches to the teaching and learning of physics" for further links.

The task produced should be complex and commensurate with the level of the course. It should require a purposeful research question and the scientific rationale for it. The marked exemplar material in the teacher support materials will demonstrate that the assessment will be rigorous and of the same standard as the assessment in the previous courses.

Some of the possible tasks include:

- a hands-on laboratory investigation
- using a spreadsheet for analysis and modelling
- extracting data from a database and analysing it graphically
- producing a hybrid of spreadsheet/database work with a traditional hands-on investigation
- using a simulation, provided it is interactive and open-ended

Some task may consist of relevant and appropriate qualitative work combined with quantitative work.

The tasks include the traditional hands-on practical investigations as in the previous course. The depth of treatment required for hands-on practical investigations is unchanged from the previous internal assessment and will be shown in detail in the teacher support materials. In addition, detailed assessment of specific aspects of hands-on practical work will be assessed in the written papers as detailed in the relevant topic(s) in the "Syllabus content" section of the guide.

The task will have the same assessment criteria for SL and HL. The five assessment criteria are personal engagement, exploration, analysis, evaluation and communication.
Internal assessment details

Internal assessment component
Duration: 10 hours
Weighting: 20%

- Individual investigation
- This investigation covers assessment objectives 1, 2, 3 and 4.

Internal assessment criteria
The new assessment model uses five criteria to assess the final report of the individual investigation with the following raw marks and weightings assigned:

<table>
<thead>
<tr>
<th>Personal engagement</th>
<th>Exploration</th>
<th>Analysis</th>
<th>Evaluation</th>
<th>Communication</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (8%)</td>
<td>6 (25%)</td>
<td>6 (25%)</td>
<td>6 (25%)</td>
<td>4 (17%)</td>
<td>24 (100%)</td>
</tr>
</tbody>
</table>

Levels of performance are described using multiple indicators per level. In many cases the indicators occur together in a specific level, but not always. Also, not all indicators are always present. This means that a candidate can demonstrate performances that fit into different levels. To accommodate this, the IB assessment models use markbands and advise examiners and teachers to use a best-fit approach in deciding the appropriate mark for a particular criterion.

Teachers should read the guidance on using markbands shown above in the section called “Using assessment criteria for internal assessment” before starting to mark. It is also essential to be fully acquainted with the marking of the exemplars in the teacher support material. The precise meaning of the command terms used in the criteria can be found in the glossary of the subject guides.

Personal engagement
This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These could include addressing personal interests or showing evidence of independent thinking, creativity or initiative in the designing, implementation or presentation of the investigation.

<table>
<thead>
<tr>
<th>Mark</th>
<th>Descriptor</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>The student’s report does not reach a standard described by the descriptors below.</td>
</tr>
</tbody>
</table>
| 1    | The evidence of personal engagement with the exploration is limited with little independent thinking, initiative or creativity.  
The justification given for choosing the research question and/or the topic under investigation does not demonstrate personal significance, interest or curiosity.  
There is little evidence of personal input and initiative in the designing, implementation or presentation of the investigation. |
Internal assessment

2 The evidence of personal engagement with the exploration is clear with significant independent thinking, initiative or creativity.

The justification given for choosing the research question and/or the topic under investigation demonstrates personal significance, interest or curiosity.

There is evidence of personal input and initiative in the designing, implementation or presentation of the investigation.

Exploration

This criterion assesses the extent to which the student establishes the scientific context for the work, states a clear and focused research question and uses concepts and techniques appropriate to the Diploma Programme level. Where appropriate, this criterion also assesses awareness of safety, environmental, and ethical considerations.

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<tr>
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<tbody>
<tr>
<td>0</td>
<td>The student’s report does not reach a standard described by the descriptors below.</td>
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<tr>
<td>1–2</td>
<td>The topic of the investigation is identified and a research question of some relevance is stated but it is not focused.</td>
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<tr>
<td></td>
<td>The background information provided for the investigation is superficial or of limited relevance and does not aid the understanding of the context of the investigation.</td>
</tr>
<tr>
<td></td>
<td>The methodology of the investigation is only appropriate to address the research question to a very limited extent since it takes into consideration few of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.</td>
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<tr>
<td></td>
<td>The report shows evidence of limited awareness of the significant safety, ethical or environmental issues that are relevant to the methodology of the investigation*.</td>
</tr>
<tr>
<td>3–4</td>
<td>The topic of the investigation is identified and a relevant but not fully focused research question is described.</td>
</tr>
<tr>
<td></td>
<td>The background information provided for the investigation is mainly appropriate and relevant and aids the understanding of the context of the investigation.</td>
</tr>
<tr>
<td></td>
<td>The methodology of the investigation is mainly appropriate to address the research question but has limitations since it takes into consideration only some of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.</td>
</tr>
<tr>
<td></td>
<td>The report shows evidence of some awareness of the significant safety, ethical or environmental issues that are relevant to the methodology of the investigation*.</td>
</tr>
<tr>
<td>5–6</td>
<td>The topic of the investigation is identified and a relevant and fully focused research question is clearly described.</td>
</tr>
<tr>
<td></td>
<td>The background information provided for the investigation is entirely appropriate and relevant and enhances the understanding of the context of the investigation.</td>
</tr>
<tr>
<td></td>
<td>The methodology of the investigation is highly appropriate to address the research question because it takes into consideration all, or nearly all, of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.</td>
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<tr>
<td></td>
<td>The report shows evidence of full awareness of the significant safety, ethical or environmental issues that are relevant to the methodology of the investigation*.</td>
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</table>

* This indicator should only be applied when appropriate to the investigation. See exemplars in teacher support material.
**Analysis**
This criterion assesses the extent to which the student's report provides evidence that the student has
selected, recorded, processed and interpreted the data in ways that are relevant to the research question
and can support a conclusion.

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<td>0</td>
<td>The student's report does not reach a standard described by the descriptors below.</td>
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</table>
| 1–2  | The report includes insufficient relevant raw data to support a valid conclusion to the research question.  
Some basic data processing is carried out but is either too inaccurate or too insufficient to lead to a valid conclusion.  
The report shows evidence of little consideration of the impact of measurement uncertainty on the analysis.  
The processed data is incorrectly or insufficiently interpreted so that the conclusion is invalid or very incomplete. |
| 3–4  | The report includes relevant but incomplete quantitative and qualitative raw data that could support a simple or partially valid conclusion to the research question.  
Appropriate and sufficient data processing is carried out that could lead to a broadly valid conclusion but there are significant inaccuracies and inconsistencies in the processing.  
The report shows evidence of some consideration of the impact of measurement uncertainty on the analysis.  
The processed data is interpreted so that a broadly valid but incomplete or limited conclusion to the research question can be deduced. |
| 5–6  | The report includes sufficient relevant quantitative and qualitative raw data that could support a detailed and valid conclusion to the research question.  
Appropriate and sufficient data processing is carried out with the accuracy required to enable a conclusion to the research question to be drawn that is fully consistent with the experimental data.  
The report shows evidence of full and appropriate consideration of the impact of measurement uncertainty on the analysis.  
The processed data is correctly interpreted so that a completely valid and detailed conclusion to the research question can be deduced. |
**Internal assessment**

**Evaluation**
This criterion assesses the extent to which the student’s report provides evidence of evaluation of the investigation and the results with regard to the research question and the accepted scientific context.

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<tbody>
<tr>
<td>0</td>
<td>The student’s report does not reach a standard described by the descriptors below.</td>
</tr>
</tbody>
</table>
| 1–2  | A conclusion is **outlined** which is not relevant to the research question or is not supported by the data presented.  
The conclusion makes superficial comparison to the accepted scientific context.  
Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **outlined** but are restricted to an **account** of the **practical** or **procedural issues** faced.  
The student has **outlined** very few realistic and relevant suggestions for the improvement and extension of the investigation. |
| 3–4  | A conclusion is **described** which is relevant to the research question and supported by the data presented.  
A conclusion is described which makes some relevant comparison to the accepted scientific context.  
Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **described** and provide evidence of some awareness of the **methodological issues** involved in establishing the conclusion.  
The student has **described** some realistic and relevant suggestions for the improvement and extension of the investigation. |
| 5–6  | A detailed conclusion is **described and justified** which is entirely relevant to the research question and fully supported by the data presented.  
A conclusion is correctly **described and justified** through relevant comparison to the accepted scientific context.  
Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are **discussed** and provide evidence of a clear understanding of the **methodological issues** involved in establishing the conclusion.  
The student has **discussed** realistic and relevant suggestions for the improvement and extension of the investigation. |

*See exemplars in teacher support material for clarification.*
Communication
This criterion assesses whether the investigation is presented and reported in a way that supports effective communication of the focus, process and outcomes.

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<tbody>
<tr>
<td>0</td>
<td>The student's report does not reach a standard described by the descriptors below.</td>
</tr>
</tbody>
</table>
| 1-2  | The presentation of the investigation is unclear, making it difficult to understand the focus, process and outcomes.  
      | The report is not well structured and is unclear; the necessary information on focus, process and outcomes is missing or is presented in an incoherent or disorganized way.  
      | The understanding of the focus, process and outcomes of the investigation is obscured by the presence of inappropriate or irrelevant information.  
      | There are many errors in the use of subject specific terminology and conventions*. |
| 3-4  | The presentation of the investigation is clear. Any errors do not hamper understanding of the focus, process and outcomes.  
      | The report is well structured and clear; the necessary information on focus, process and outcomes is present and presented in a coherent way.  
      | The report is relevant and concise, thereby facilitating a ready understanding of the focus, process and outcomes of the investigation.  
      | The use of subject-specific terminology and conventions is appropriate and correct. Any errors do not hamper understanding. |

*For example, incorrect/missing labelling of graphs, tables, images; use of units, decimal places. For issues of referencing and citations refer to the "Academic honesty" section.

Rationale for practical work
Although the requirements for IA are centred on the investigation, the different types of practical activities that a student may engage in serve other purposes, including:

- illustrating, teaching and reinforcing theoretical concepts
- developing an appreciation of the essential hands-on nature of much scientific work
- developing an appreciation of scientists' use of secondary data from databases
- developing an appreciation of scientists' use of modelling
- developing an appreciation of the benefits and limitations of scientific methodology.

Practical scheme of work
The practical scheme of work (PSOW) is the practical course planned by the teacher and acts as a summary of all the investigative activities carried out by a student. Students at SL and HL in the same subject may carry out some of the same investigations.
Name of Student Investigation

Circle the best-fit indicator level for each descriptor.

**Personal Engagement @ total ___ / 2**

This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These could include addressing personal interests or showing evidence of independent thinking, creativity or initiative in the designing, implementation or presentation of the investigation.

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>evidence of personal engagement with exploration</td>
<td>standard not reached</td>
<td>limited with little independent thinking, initiative or insight</td>
<td>clear with significant independent thinking, initiative or creativity</td>
</tr>
<tr>
<td>justification given for choosing the research question and/or the topic under investigation</td>
<td>standard not reached</td>
<td>does not demonstrate personal significance, interest or curiosity</td>
<td>demonstrates personal significance, interest or curiosity</td>
</tr>
<tr>
<td>evidence of personal input and initiative in the designing, implementation or presentation of the investigation</td>
<td>standard not reached</td>
<td>little evidence</td>
<td>evidence</td>
</tr>
</tbody>
</table>
**Exploration @ total ___ / 6**

This criterion assesses the extent to which the student establishes the scientific context for the work, states a clear and focused research question and uses concepts and techniques appropriate to the Diploma Programme level. Where appropriate, this criterion also assesses awareness of safety, environmental, and ethical considerations.

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>0</th>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>topic of the investigation is identified and relevant research question described</td>
<td>standard not reached</td>
<td>some relevance is stated but it is not focused</td>
<td>relevant but not fully focused</td>
<td>relevant, fully focused and clearly described</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>background information provided for the investigation</td>
<td>standard not reached</td>
<td>superficial or of limited relevance and does not aid the understanding of the context of the investigation</td>
<td>mainly appropriate and relevant and aids the understanding of the context of the investigation</td>
<td>entirely appropriate and relevant and enhances the understanding of the context of the investigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appropriate of methodology of the investigation, consideration of factors for reliability and sufficiency of data</td>
<td>standard not reached</td>
<td>limited to research question, few if any factors considered</td>
<td>mainly appropriate but some limits on significant factors</td>
<td>highly appropriate, all or nearly all factors are considered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>evidence of awareness of the significant safety, ethical or environmental issues that are relevant to the methodology of the investigation</td>
<td>standard not reached</td>
<td>limited awareness</td>
<td>some awareness</td>
<td>full awareness</td>
<td></td>
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</tbody>
</table>
Analysis @ total ___ / 6

This criterion assesses the extent to which the student’s report provides evidence that the student has selected, recorded, processed and interpreted the data in ways that are relevant to the research question and can support a conclusion.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>raw data</td>
<td>standard not reached</td>
<td>insufficient to support a valid conclusion</td>
<td>relevant but incomplete. Could support a simple or partially valid conclusion</td>
<td>sufficient; could support a detailed and valid conclusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>data processing, accuracy and consistent with data</td>
<td>standard not reached</td>
<td>some basic but too inaccurate or insufficient to lead to a valid conclusion</td>
<td>appropriate and sufficient raw data carried out that could lead to a conclusion but with significant inaccuracies and inconsistencies in processing</td>
<td>appropriate and sufficient data processing with accuracy so as to enable a conclusion to the research question to be drawn that is fully consistent with the experimental data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>impact of uncertainties on the analysis</td>
<td>standard not reached</td>
<td>little evidence of the impact of uncertainties</td>
<td>some evidence of the impact of uncertainties</td>
<td>full and appropriate evidence of the impact of uncertainties</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>interpretation of processed data</td>
<td>standard not reached</td>
<td>incorrect or insufficient interpretation that may lead to an invalid or very incomplete conclusion</td>
<td>broadly valid interpretation leading to an incomplete or limited conclusion</td>
<td>correct interpretation allowing a completely valid and detailed conclusion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Evaluation @ total ___ / 6**

This criterion assess the extend to which the student’s report provides evidence of evaluation of the investigation and the results with regard to the research question and the accepted scientific context.

<table>
<thead>
<tr>
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<th>0</th>
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</tr>
</thead>
<tbody>
<tr>
<td>conclusion statement</td>
<td>standard not reached</td>
<td>outlined but not relevant to the research question or not supported by the data presented</td>
<td>described, relevant to the research question and supported by the data presented</td>
<td>described in detail and justified, entirely relevant to the research question and fully supported by the data presented</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>conclusion and accepted theory</td>
<td>standard not reached</td>
<td>superficially compared to the accepted scientific context</td>
<td>some relevant comparison to accepted scientific context</td>
<td>correctly described and justified through relevant comparison to the accepted scientific context</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are discussed and provide evidence to a clear understanding of the methodological issues involved in establishing the conclusion</td>
<td>standard not reached</td>
<td>outlined but are restricted to an account of the practical or procedural issues faced</td>
<td>described and provide evidence of some awareness of the methodological issues involved in establishing the conclusion</td>
<td>discussed and provide evidence of a clear understanding of the methodological issues involved in establishing the conclusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>realistic and relevant suggestions for the improvement and extension of the investigation</td>
<td>standard not reached</td>
<td>very few outlined</td>
<td>some described</td>
<td>are discussed</td>
<td></td>
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</tbody>
</table>
Communication @ total ___ / 4

This criterion assesses whether the investigation is presented and reported in a way that supports effective communication of the focus, process and outcomes.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>presentation of the investigation</td>
<td>standard not reached</td>
<td>unclear, making it difficult to understand the focus, process and outcomes</td>
<td>clear, any errors do not hamper understanding of the focus, process and outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>report structure</td>
<td>standard not reached</td>
<td>not well structured and is unclear: the necessary information on focus, process and outcomes is missing or is presented in an incoherent or disorganized way</td>
<td>well structured and clear: the necessary information on focus, process and outcomes is present and presented in a coherent way</td>
<td></td>
<td></td>
</tr>
<tr>
<td>report relevance</td>
<td>standard not reached</td>
<td>the understanding of the focus, process and outcomes of the investigation is obscured by the presence of inappropriate or irrelevant information</td>
<td>relevant and concise thereby facilitating a ready understanding of the focus, process and outcomes of the investigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>terminology</td>
<td>standard not reached</td>
<td>there are many errors in the use of subject specific terminology and conventions</td>
<td>the use of subject specific terminology and conventions are appropriate and correct; any errors do not hamper understanding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Syllabus coverage
The range of practical work carried out should reflect the breadth and depth of the subject syllabus at each level, but it is not necessary to carry out an investigation for every syllabus topic. However, all students must participate in the Group 4 project and the IA investigation.

Planning your practical scheme of work
Teachers are free to formulate their own practical schemes of work by choosing practical activities according to the requirements outlined. Their choices should be based on:

- subjects, levels and options taught
- the needs of their students
- available resources
- teaching styles.

Each scheme must include some complex experiments that make greater conceptual demands on students. A scheme made up entirely of simple experiments, such as ticking boxes or exercises involving filling in tables, will not provide an adequate range of experience for students.

Teachers are encouraged to use the online curriculum centre (OCC) to share ideas about possible practical activities by joining in the discussion forums and adding resources in the subject home pages.

Flexibility
The practical programme is flexible enough to allow a wide variety of practical activities to be carried out. These could include:

- short labs or projects extending over several weeks
- computer simulations
- using databases for secondary data
- developing and using models
- data-gathering exercises such as questionnaires, user trials and surveys
- data-analysis exercises
- fieldwork.

Practical work documentation
Details of the practical scheme of work are recorded on Form 4/PSOW provided in the Handbook of procedures for the Diploma Programme. A copy of the class 4/PSOW form must be included with any sample set sent for moderation.

Time allocation for practical work
The recommended teaching times for all Diploma Programme courses are 150 hours at SL and 240 hours at HL. Students at SL are required to spend 40 hours, and students at HL 60 hours, on practical activities (excluding time spent writing up work). These times include 10 hours for the Group 4 project and 10 hours for the internal assessment investigation. (Only 2-3 hours of investigative work can be carried out after the deadline for submitting work to the moderator and still be counted in the total number of hours for the practical scheme of work.)