



National
Qualifications

Physics

Project-report

General assessment information

This pack contains general assessment information for centres preparing candidates for the project-report Component of Advanced Higher Physics Course assessment.

It must be read in conjunction with the specific assessment task for this Component of Course assessment which may only be downloaded from SQA's designated secure website by authorised personnel.

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Introduction

This is the general assessment information for Advanced Higher Physics project-report.

This project-report is worth 30 marks out of a total of 130 marks available for this Course. The Course will be graded A-D.

Marks for all Course Components are added up to give a total Course assessment mark which is then used as the basis for grading decisions.

This is one of two Components of Course assessment. The other Component is a question paper.

This document describes the general requirements for the assessment of the project-report Component for this Course. It gives general information and instructions for assessors.

It must be read in conjunction with the assessment task for this Component of Course assessment.

Equality and inclusion

This Course assessment has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled candidates and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html

Guidance on inclusive approaches to delivery and assessment in this Course is provided in the *Course/Unit Support Notes*.

What this assessment covers

This project-report is worth 30 marks out of a total of 130 marks available for this Course.

The assessment will assess the skills, knowledge and understanding specified for the project-report in the *Course Assessment Specification*. These are:

- ◆ extending and applying knowledge of physics to new situations, interpreting and analysing information to solve complex problems
- ◆ planning and designing physics experiments/investigations, using reference material to test a hypothesis or to illustrate particular effects
- ◆ recording systematic detailed observations and collecting data
- ◆ selecting information from a variety of sources and presenting detailed information appropriately in a variety of forms
- ◆ processing and analysing physics information/data (using calculations, significant figures and units, where appropriate)
- ◆ making reasoned predictions from a range of evidence/information
- ◆ drawing valid conclusions and giving explanations supported by evidence/justification
- ◆ critically evaluating experimental procedures by identifying sources of uncertainty, suggesting and implementing improvements
- ◆ drawing on knowledge and understanding of physics to make accurate statements, describe complex information, provide detailed explanations and integrate knowledge
- ◆ communicating physics findings/information fully and effectively
- ◆ analysing and evaluating scientific publications and media reports

Assessment

Purpose

The purpose of this assessment is to generate evidence for the Added Value of this Course by means of a project-report.

Assessment overview

Assessment should take place when the candidates are ready to be assessed.

In this assessment the candidate will carry out an in-depth investigation of a physics topic. The topic will be chosen by the candidate, who will **individually** investigate/research the underlying physics of the topic. The candidate must discuss the selection of possible topics with the assessor to ensure that time is not wasted on researching topics that are unsuitable. This is an open-ended task which may involve a significant part of the work being carried out without close supervision.

The project-report offers challenge by requiring skills, knowledge and understanding to be applied in a context that is one or more of the following:

- ◆ unfamiliar
- ◆ familiar but investigated in greater depth
- ◆ integrating a number of familiar contexts

Prior to starting this assessment candidates should have started a physics investigation. This would normally be as part of their *Investigating Physics* Unit. In that Unit, candidates are required to plan and carry out a physics investigation. They should keep a record of their work as this may form the basis of their project-report. This record should include details of their research, experiments and recorded data. Typically, this should consist of **three to four** related experiments.

The project-report submitted to SQA must have a logical structure and should be clear, concise and easy to read.

The project-report should be between 2500 and 4500 words in length excluding the title page, contents page, tables, graphs, diagrams, calculations, references, acknowledgements and any appendices. The word count should be submitted with the project-report. If the word count exceeds the maximum by 10%, a penalty of 3 marks will be applied. It should be written in the past tense and the impersonal voice should be used.

Detailed advice on the content of the project-report is given in the *Advanced Higher Physics Project Assessment Task*.

Assessment conditions

Assessors must exercise their professional responsibility in ensuring that evidence submitted by a candidate is the candidate's own work.

This assessment will be carried out over a period of time. Candidates should start at an appropriate point in the Course. This will normally be after they have started work on the Units in the Course.

Evidence which meets the requirements of this Component of Course assessment will be between 2500 and 4500 words. The word count should be submitted with the project-report. If the word count exceeds the maximum by 10%, a penalty of 3 marks will be applied.

There are no restrictions on the resources to which candidates may have access.

Candidates must undertake the assessment, whatever the nature, independently. However, reasonable assistance may be provided prior to the formal assessment process taking place. The term 'reasonable assistance' is used to try to balance the need for support with the need to avoid giving too much assistance.

Coursework in Advanced Higher may involve candidates undertaking a larger amount of autonomous work without close supervision than they have previously undertaken. Assessors may provide guidance and support as part of the normal teaching and learning process. However, assessors should not adopt a directive role or provide specific advice on how to re-phrase, improve responses or provide model answers.

Assessor comments on the selection of a topic are appropriate before the candidate starts the task.

The requirements of the project-report should be made clear to candidates at the outset.

The project-report will be conducted under some supervision and control. This means that although candidates may complete part of the work outwith the learning and teaching setting, assessors should put in place processes for monitoring progress and ensuring that the work is the candidate's own and that plagiarism has not taken place.

Assessors should put in place mechanisms to authenticate candidate evidence. For example:

- ◆ regular checkpoint/progress meetings with candidates
- ◆ short spot-check personal interviews
- ◆ checklists which record activity/progress
- ◆ photographs

Evidence to be gathered

The following candidate evidence is required for this assessment:

- ◆ a project-report

The project-report will be submitted to SQA, within a given timeframe, for marking. The same project-report cannot be submitted for more than one subject.

General Marking Instructions

In line with SQA's normal practice, the following general Marking Instructions are addressed to the marker. They will also be helpful for those preparing candidates for Course assessment.

Evidence will be submitted to SQA for external marking.

All marking will be quality assured by SQA.

General Marking Principles for Advanced Higher Physics project-report

This information is provided to help you understand the general principles you must apply when marking candidate responses to this project-report. These principles must be read in conjunction with the Detailed Marking Instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

<ul style="list-style-type: none"> — suggestions for further improvements to procedures — suggestions for further work ◆ overall quality of the investigation 	1 (8)
Presentation <ul style="list-style-type: none"> ◆ appropriate structure, including informative title, contents page and page numbers ◆ references cited in the text and references listed in standard form, acknowledgements, where appropriate 	1 1 (2)
Total marks	30

Detailed Marking Instructions for the project-report

These Detailed Marking Instructions provide the basis on which the General Marking Principles should be applied. The following table shows how the 30 marks are allocated to each of the categories against which the evidence will be assessed. The project-report should be between 2500 and 4500 words in length. The word count should be submitted with the project-report. If the word count exceeds the maximum by 10%, a penalty of 3 marks will be applied.

Category	Expected response	Max mark	Additional guidance
Abstract	<ul style="list-style-type: none"> ◆ a brief abstract (summary) stating the overall aim(s) and finding(s)/conclusion(s) of the investigation 	1	<ul style="list-style-type: none"> ◆ A brief abstract (summary) must immediately follow the contents page and should be under a separate heading. The ‘abstract’ must contain a clear statement of the main aims(s) and overall finding(s)/conclusion(s) of the investigation and must be separate from and placed before the ‘introduction’. <p>The overall findings must be consistent with the conclusion(s) given in the ‘discussion’ and should relate to the aim(s).</p>
Introduction	<ul style="list-style-type: none"> ◆ relevant to the investigation ◆ demonstrating an understanding of the physics theory underpinning the investigation ◆ of an appropriate level (ie commensurate with the demands of Advanced Higher Physics) 	4	<ul style="list-style-type: none"> ◆ This section is marked holistically and is an opportunity to give marks for ‘quality’. Think in terms of 4/3/2/1/0 marks. (Markers will have to use professional judgement and comments from markers on the record sheet would be helpful here.) ◆ 0 marks may be awarded here. It should be fairly easy for candidates to get 1 mark here but progressively more difficult to get 2, 3 or 4 marks. ◆ Look for some interesting information which the candidate has obviously found out from doing some background reading/research. ◆ Candidates must include an account of the underlying physics that is relevant to the investigation. All terms

Category	Expected response	Max mark	Additional guidance
			<p>and symbols used should be clearly defined. Simply stating equations is not sufficient – derivation of formulae should be given. Candidates must demonstrate a good understanding of the physics behind these equations.</p> <ul style="list-style-type: none"> ◆ Candidates may draw on a variety of sources of information when researching their chosen topic. ◆ In the candidate’s account of the underlying physics, terms must be used accurately and ideas must be explained clearly. Diagrams and relationships should also be included, as appropriate. In general, allow minor errors but not if fundamental to the physics behind the investigation. ◆ Downloading directly from the internet or copying directly from books may suggest that the candidate has not understood the physics involved and will be considered as plagiarism. Where the vast majority is believed to have been copied verbatim then the candidate is not demonstrating understanding and should be marked accordingly. ◆ Complicated diagrams copied and pasted from an internet source are perfectly acceptable, especially when the reference is cited in the text and listed at the back of the project-report.
Procedures	<ul style="list-style-type: none"> ◆ labelled diagrams and/or descriptions 	7	<ul style="list-style-type: none"> ◆ In broad terms, the procedures should allow the aim(s) to be achieved. If there is no stated aim(s), this mark may still be awarded if the aim(s) is obvious from the title of the project-report. ◆ Candidates must include labelled diagrams and/or descriptions of the apparatus that they used for

Category	Expected response	Max mark	Additional guidance
	<p>of apparatus, as appropriate (2)</p> <ul style="list-style-type: none"> ◆ clear descriptions of how the apparatus was used to obtain experimental readings (2) ◆ procedures are at an appropriate level for Advanced Higher complexity, ie appropriate level of demand (3) 		<p>experimental work. Photographs of assembled apparatus, with appropriate labelling, are acceptable. A satisfactory photograph showing clear detail should be labelled. Labelled circuit diagrams should be included where appropriate.</p> <ul style="list-style-type: none"> ◆ Candidates must also give clear descriptions of how they used the apparatus to obtain their experimental results. The procedure should be described well enough for another competent Advanced Higher Physics candidate to be able to repeat the procedure from the description. Factors to be considered include: <ul style="list-style-type: none"> — range of procedures — control of variables — accuracy — originality of approach and/or experimental techniques — degree of sophistication of experimental design and/or equipment ◆ Range of reading and number of repetitions should also be included, where appropriate. ◆ The procedures should be written in the past tense and impersonal voice. If the procedures are not written in past tense and impersonal voice, eg if written as a set of instructions in the imperative voice, then a maximum of 1 mark can be given for description of how apparatus was used. Consider the use of first person on one occasion only as a minor error. ◆ Bulleted/numbered points are only acceptable if statements are in sentences and are meaningful and

Category	Expected response	Max mark	Additional guidance
			<p>coherent, ie must make sense if numbers or bullet points were to be removed, but must not be a list of instructions.</p> <ul style="list-style-type: none"> ◆ Note that the experimental procedures that candidates use in their investigation must be at an appropriate level of demand for Advanced Higher Physics; factors to be considered in assessing the adequacy of a candidate's procedures will include: <ul style="list-style-type: none"> — range of procedures — control of variables — accuracy, precision — originality of approach and/or experimental techniques — degree of sophistication of experimental design and/or equipment
Results (including uncertainties)	<ul style="list-style-type: none"> ◆ data sufficient and relevant to the aim(s) of the investigation (1) ◆ appropriate analysis of data, eg quality graphs, lines of best fit, calculations (4) ◆ uncertainties in individual and final results (3) 	8	<ul style="list-style-type: none"> ◆ The experimental data that candidates collect must be relevant to the aim(s) of their investigation. Also, the data candidates collect and present in their project-report must be sufficient in quantity and with a degree of accuracy and precision appropriate to their investigation – ie it must show all readings and not just the mean values. ◆ A candidate's project-report must include analysis of their experimental data that is appropriate to the investigation. This may involve drawing graphs or calculating and tabulating numerical values. ◆ Candidates must include uncertainties in the values of each of the physical quantities that they measure and in the final result(s) of their investigation. Their analysis should show clearly how they have calculated/estimated

Category	Expected response	Max mark	Additional guidance
			the uncertainty in their final result(s). The candidate's treatment of uncertainties must be appropriate for Advanced Higher level and so the project-report must include evidence that relates to the Content Statements for uncertainties detailed in the Advanced Higher Physics Course. Candidates must quantify all (calibration, scale reading and random) uncertainties that have a bearing on the accuracy of their experimental work.
Discussion (conclusion(s) and evaluation)	<ul style="list-style-type: none"> ◆ conclusion(s) is/are valid and relate to the aim(s) of the investigation (1) ◆ evaluation of experimental procedures to include, as appropriate, comment on: <ul style="list-style-type: none"> — accuracy of experimental measurements — adequacy of repeated readings — adequacy of range over which variables are altered — adequacy of control of variables — limitations of equipment — reliability of methods — sources of errors and uncertainties (3) ◆ coherent discussion of overall conclusion(s) and critical evaluation of the investigation as a whole to include, as appropriate, comment on: <ul style="list-style-type: none"> — problems overcome — modifications to procedures — significance/interpretation of 	8	<ul style="list-style-type: none"> ◆ Candidates must include overall conclusion(s) that are relevant to the aims(s) of their investigation and supported by data in the project-report and which are valid for the experimental results obtained. ◆ Candidates must also include a critical evaluation of each experiment. It is often appropriate to include this after the 'procedures' and 'results' of each experiment. This should be a significant part of the candidate's project-report and should focus on the quality of their experimental work. Candidates should include as many factors as possible and suggest improvements to procedures. ◆ Candidates must include a discussion of their overall conclusion(s) together with a critical evaluation of the investigation as a whole. This should be a more wide ranging discussion of the investigation. It is an opportunity to explain what the candidate has learned as a result of the investigation and the significance of their findings. Candidates could also demonstrate the depth of

Category	Expected response	Max mark	Additional guidance
	<p>findings</p> <ul style="list-style-type: none"> — suggestions for further improvements to procedures — suggestions for further work (3) <p>◆ overall quality of the investigation (1)</p>		<p>their understanding of the physics related to the investigation.</p> <p>◆ This is a final quality mark for the standard of the investigation – not just the ‘discussion’ part of the project-report. This is for a good investigation well worked through, taking particular account of the physics involved and synthesis of argument.</p>
Presentation	<p>◆ appropriate structure, including informative title, contents page and page numbers (1)</p> <p>◆ references cited in the text and references listed in standard form using either Vancouver or Harvard style, acknowledgements where appropriate (1)</p>	2	<p>◆ The project-report structure should be easy to follow.</p> <p>◆ A title, contents page and structure are essential – the contents page must show page numbers and the pages throughout the project-report must be numbered. Occasional missing page numbers (eg on hand-drawn graphs) should not be penalised.</p> <p>◆ At least three references must be cited correctly in the main body of the project-report and the same ones also listed correctly at the back of the project-report. Any additional references cited or listed incorrectly should not be penalised. Candidates must use either Vancouver or Harvard style referencing.</p> <p>◆ References must be relevant to the investigation and specific. References must be cited within the text of the candidate’s project-report and in many cases these will occur in the ‘Underlying Physics’ section. At the end of the project-report, the candidate must include details on all of the references (eg books, journals/periodicals and websites) that they cited. Candidates must include sufficient information to allow a reader to consult the original work to confirm its relevance to the investigation. Candidates should only include details on</p>

Category	Expected response	Max mark	Additional guidance
			<p>references; do not include information on materials that were part of background reading but are not cited as references in the project-report.</p> <p>The candidate must find at least three references, ideally at the planning stage.</p> <ul style="list-style-type: none"> ◆ If a candidate puts in 'et al' wrongly, then ignore, as most candidates are unlikely to have been taught Latin.
	Total marks	30	

Administrative information

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History of changes

Version	Description of change	Authorised by	Date
1.1	Marking instructions updated. Word count and word count penalty updated.	Qualifications Manager	September 2016

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