Higher
Coursework
Assessment Task

Higher Physics

Assignment

Assessment task

This document provides information for teachers and lecturers about the coursework component of this course in terms of the skills, knowledge and understanding that are assessed. It **must** be read in conjunction with the course specification.

Valid from session 2019-20 and until further notice.

This edition: September 2019 (version 2.0)

Contents

Introduction

This document contains instructions for teachers and lecturers, marking instructions and instructions for candidates for the Higher Physics assignment. You must read it in conjunction with the course specification.

This assignment is worth 20 marks (scaled to 30). This contributes 20% to the overall marks for the course assessment.

This is one of three course assessment components. The other components are question papers.

Instructions for teachers and lecturers

General information

This information applies to the assignment for Higher Physics. The assignment assesses the application of skills of scientific inquiry and related physics knowledge and understanding.

The assignment gives candidates an opportunity to demonstrate the following skills, knowledge and understanding:

- applying physics knowledge to new situations, interpreting information and solving problems
- planning and designing experiments/practical investigations to test given hypotheses or to illustrate particular effects
- recording detailed observations and collecting data from experiments/practical investigations
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing information (using calculations, significant figures and units, where appropriate)
- drawing valid conclusions and giving explanations supported by evidence/justification
- quantifying sources of uncertainty
- evaluating experimental procedures and suggesting improvements
- communicating findings/information effectively

The assignment offers challenge by requiring candidates to apply skills, knowledge and understanding in a context that is one or more of the following:

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

Candidates research and report on a topic that allows them to apply skills and knowledge in physics at a level appropriate to Higher.

The topic must be chosen with guidance from teachers and/or lecturers and must involve experimental work.

The assignment has two stages:

- research
- report

The research stage must involve experimental work which allows measurements to be made. Candidates must also gather data/information from the internet, books or journals.

Candidates must produce a report on their research.

Conditions of assessment

Setting, conducting and marking the assignment

Setting

The assignment is:

- set by centres within SQA guidelines
- set at a time appropriate to the candidate's needs
- set within teaching and learning and includes experimental work at a level appropriate to Higher

Conducting

The assignment is:

- an individually produced piece of work from each candidate
- started at an appropriate point in the course
- conducted under controlled conditions

Marking

The report is submitted to SQA for external marking.

All marking is quality assured by SQA.

Assessment conditions

Controlled assessment is designed to:

- ensure that all candidates spend approximately the same amount of time on their assignments
- prevent third parties from providing inappropriate levels of guidance and input
- mitigate concerns about plagiarism and improve the reliability and validity of SQA awards
- allow centres a reasonable degree of freedom and control
- allow candidates to produce an original piece of work

There are two levels of control.

Under a high degree of supervision and control	Under some supervision and control
♦ the use of resources is tightly prescribed ♦ all candidates are within direct sight of the supervisor throughout the session(s) ♦ display materials which might provide assistance are removed or covered ♦ there is no access to e-mail, the internet or mobile phones ♦ candidates complete their work independently ♦ interaction with other candidates does not occur ♦ no assistance of any description is provided	♦ candidates do not need to be directly supervised at all times ♦ the use of resources, including the internet, is not tightly prescribed ♦ the work an individual candidate submits for assessment is their own ♦ teachers and/or lecturers can provide reasonable assistance

The assignment has two stages.

Stage	Level of control
♦ research	conducted under some supervision and control
♦ report	conducted under a high degree of supervision and control

Instructions

Teachers and lecturers must exercise their professional responsibility to ensure that the report submitted is the candidate's own work.

It is recommended that no more than 8 hours is spent on the **whole** assignment.

A maximum of 2 hours is allowed for the report stage.

Teachers and/or lecturers must ensure candidates understand the requirements of the task. The instructions for candidates outline the requirements for the assignment and teachers and/or lecturers must give these to candidates at the outset. These must not be altered, or supplemented by centre-devised materials.

Teachers and/or lecturers must not, **at any stage**, provide candidates with a template or model answers.

Research stage

The research stage is conducted under some supervision and control. See 'Conditions of assessment' section.

Choosing the topic

The teacher and/or lecturer must ensure that a **range** of topics is available for candidates to choose from.

At the start of the research stage, the teacher and/or lecturer must agree the choice of topic with the candidate to ensure that it:

- is appropriate for Higher Physics
- has associated experimental work that can generate numerical data
- allows the candidate the opportunity to access all of the available marks

Teachers and/or lecturers must minimise the number of candidates investigating the same topic within a class.

A range of topics chosen for investigation will create the climate in which candidates can produce original work within the conditions of assessment.

Once candidates have agreed the topic with their teacher and/or lecturer, they must formulate an aim.

Formulating the aim

- To ensure the candidate's aim is achievable the teacher and/or lecturer must provide advice on its **suitability**, taking into account:

- health and safety considerations

- availability of resources
- availability of internet/literature data

Teachers and/or lecturers must not provide candidates with an aim.

After the candidate has formulated an aim, they can progress through the research stage.

The candidate's research consists of gathering data **either** from one experiment and an internet/literature source, **or** from two experiments**.**

The candidate's research may also involve gathering extracts from internet/literature sources to support their description of the underlying physics.

Candidates can carry out their research in any order. They do not have to follow the order outlined below.

Experimental research

Teachers and/or lecturers can supply instructions for the experimental procedure(s). This must **only** be a basic list of instructions. These instructions must not include details of range and interval of measurements, and reference to repeats; candidates must decide on these for themselves. Where there is a safety issue, a maximum value for the range can be provided.

Teachers and/or lecturers are responsible for ensuring that appropriate risk assessment has been carried out and that candidates have guidance on the safe and correct use of equipment.

Teachers and/or lecturers must not provide candidates with experimental data.

Teachers and/or lecturers must not provide candidates with a blank or pre-populated table for experimental results.

Candidates must carry out the experimental work either individually or as part of a small group. (A small group is defined as having two, three or four candidates.)

Group work may be an appropriate approach in a number of circumstances, for example:

- to encourage diversity of research topic
- where experiments are labour- or time-intensive
- where resources are limited

Where candidates work in a group, teachers and/or lecturers must ensure every candidate participates in the experimental work. Within the small group, it is acceptable for candidates to share experimental data, but experimental data must not be shared between groups. Where candidates have the same raw data, any calculations and analysis must be done individually.

Teachers and/or lecturers must not provide feedback to candidates on their data. However, where **candidates** identify a problem with their results and indicate that they wish to repeat the experiment(s), they may do so.

Internet/literature research

The internet/literature research must be the work of the individual candidate; candidates cannot work in a group to carry out this research.

Candidates may carry out internet/literature research outwith the direct supervision of teachers and/or lecturers.

Candidates must undertake internet/literature research using **only** websites, journals and/or books.

Candidates whose research includes data from a **single** experiment must find further data relevant to their experiment from websites, books and/or journals and must record the source of this data.

Only in circumstances where there is difficulty in locating further data relevant to the candidate's experiment, teachers and/or lecturers may provide candidates with a wide list of URLs and/or a wide range of books and/or journals. (A wide list/range is specified as a minimum of six sources for each topic supported.) This list must have a sufficient range of sources to allow candidates to make decisions about which data is relevant.

Only where internet access is an issue, teachers and/or lecturers may provide candidates with a printed copy of the **full** content of **all** URLs given in the list.

Teachers and lecturers must ensure that the level of demand of the research task is the same for all candidates irrespective of the approach taken.

In addition, candidates whose research includes data from a single experiment may also gather extracts from websites, journals and/or books to support their description of the underlying physics.

Candidates whose research includes data from **two** related experiments must gather extracts from websites, books and/or journals to support their description of the underlying physics and must record the source of this information.

Teachers and/or lecturers must not provide feedback to candidates on their research.

Report stage

The report stage is conducted under a high degree of supervision and control. See 'Conditions of assessment' section.

Candidates must be given a maximum of 2 hours to produce the report.

- This can be a continuous period of time or split over a number of successive subject lessons.

- Centres are responsible for ensuring that candidates are given no more than the maximum time.
- If candidates produce the report over a number of lessons, then the teacher and/or lecturer must retain and store candidates' work securely between lessons.

Candidates may word-process their reports, and use appropriate software to produce graphs — providing that the assessment conditions are met.

Teachers and/or lecturers must check that the only materials (in any format) that each and every candidate can use in the report stage are:

- the instructions for candidates, which must not have been altered
- the experimental method(s), if appropriate
- the candidate's raw experimental data (including any scale reading uncertainties), which may be tabulated; the table must not have additional blank or pre-populated columns for mean and derived values
- numerical and/or graphical data from an internet/literature source, which must not include sample calculations
- a record of the source(s) of data or extracts from the internet/literature
- extracts from internet/literature sources to support the description of the underlying physics, which must not include sample calculations

An extract must be:

- chosen by the candidate — they must select what information to extract
- verbatim — it must be a direct copy, which can be a printout, photocopy or handwritten (word for word)
- from an internet/literature source — not from centre-devised course material or class notes. Candidate notes of any description are not permitted
- checked by the teacher or lecturer to ensure that it is an extract (unannotated), and not notes or a draft

There is no limit to the size of an extract; however, it must be the extract and not the full document.

Candidates must not have access to a previously prepared draft of a report or any part of a report.

In addition, candidates must not have access to the assignment marking instructions during the report stage.

Candidates must not have access to the internet during the report stage.

Teachers and/or lecturers must not provide any form of feedback to candidates on their report.

Following completion of the report stage candidates must not be given the opportunity to redraft their report.

Teachers and/or lecturers must not read the reports before they are submitted to SQA.

Evidence to be gathered

The following candidate evidence is required for this assessment:

- a report

The report is submitted to SQA, within a given timeframe, for marking.

The same report cannot be submitted for more than one subject.

Volume

There is no word count.

Marking instructions

In line with SQA's normal practice, the following marking instructions for the Higher Physics assignment are addressed to the marker. They will also be helpful for those preparing candidates for course assessment.

Candidates' evidence is submitted to SQA for external marking.

General marking principles

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

a Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

Detailed marking instructions

Read the whole report before assigning any marks.

Section	Max mark	Expected response and marking instructions
1 Aim (1 mark)		
	1	**An aim that describes clearly the purpose of the investigation.** The word 'aim' is not required but the statement of the aim should be separate from the title. Acceptable versions of an aim could be: ♦ 'To investigate how the output voltage from a solar cell varies with the irradiance of incident light and with the area of the solar cell.' ♦ 'To establish a relationship between the switch on voltage of LEDs and the frequency of light produced.' Note: 'investigate solar cells' or 'the switch on voltage of LEDs' or 'To investigate **if** the switch on voltage of LEDs is affected by the frequency of the light produced' or 'To investigate **if** the output voltage from a solar cell varies with irradiance of incident light and with the area of the solar cell' would not be acceptable.

Section	Max mark	Expected response and marking instructions
2 Underlying physics (3 marks)		
	3	**An account of physics relevant to the aim of the investigation.** Mark this section holistically. Award marks for the quality of the underlying physics at a depth appropriate to at least Higher level. Underlying physics may be found anywhere in the assignment report but award the marks in this section. The candidate must demonstrate an understanding of relevant physics and use their own words wherever possible. They can however include complex diagrams from an internet/literature source. ♦ Award 3 marks for a good understanding of relevant physics. The account does not need to be what might be termed excellent or complete. ♦ Award 2 marks for a reasonable understanding of relevant physics. ♦ Award 1 mark for a limited understanding of relevant physics. ♦ Award 0 marks for demonstrating no understanding of relevant physics. Only award mark(s) for underlying physics, not general information such as historical or socio-economic information.

Section	Max mark	Expected response and marking instructions
3 Data collection and handling (5 marks)		
3 a	1	**A brief summary of the approach(es) used to collect experimental data.** Where the candidate has not demonstrated the ability to summarise the method do not award the mark. The summary must include the measuring instruments used and must contain sufficient detail to allow the nature of the experiment(s) to be visualised. Details such as the range of the independent variable(s) and the number of repeats do not need to be included in the summary. A diagram on its own is insufficient to gain this mark. Where a candidate has provided summaries for two experiments, only one summary need meet the required standard to gain the mark. Acceptable summaries of an experimental approach could be: ♦ 'Model exoplanets of different diameters were made to transit a model star, and the irradiance measured during transit. The diameter of the model exoplanets was measured using a metre stick and the irradiance measured using the Light Meter app on a smartphone.' ♦ 'The current in a battery and the voltage across the battery were changed by connecting the battery in a circuit with a variable resistor. The current was measured using an ammeter. The voltage was measured using a voltmeter.'

Section	Max mark	Expected response and marking instructions
3 b	1	**Sufficient raw data from the candidate's experiment.** Repeated measurements must be included. The number and range of values must be appropriate to the aim**.** While a minimum of five values will be appropriate in many investigations, the number will depend upon the aim of the investigation. For example, where the aim was to establish a relationship between the switch on voltage of LEDs and the frequency of light produced, at least five values would be required. In this section, do not penalise errors in the presentation of the data, such as missing headings or units from tables. Award this mark for raw, unprocessed data and not for mean or derived values calculated from raw data. Where a candidate provides raw data from two experiments, only one need meet the required standard to gain the mark.

Section	Max mark	Expected response and marking instructions
3 c	1	**Data, including any mean and/or derived values, presented in correctly produced table(s).** Experimental data must be tabulated. Every column must have a clear heading. Units must be indicated in the column headings or given after every data entry. Where measurements have been repeated, all mean values must be calculated correctly and tabulated. Any derived values required for graphing must be calculated correctly and tabulated. Where a candidate has provided tabulated data for two experiments, only one set of tabulated data need meet the required standard to gain the mark.
3 d	1	**Data relevant to the experiment from an internet/literature source or data relevant to the aim of the investigation from a second experiment.** Where a candidate provides data from a second experiment, it must meet the standard described in section 3 b for this mark to be awarded.

<table>
<tr><th>Section</th><th>Max mark</th><th>Expected response and marking instructions</th></tr>
<tr><td>3 e</td><td>1</td><td>
A citation and reference for a source of internet/literature data or information.

The candidate must cite the internet/literature source within the body of the report and give the reference later in the report.

<table>
<tr><th>Source</th><th>Reference</th></tr>
<tr><td>Website</td><td>Full URL for the page(s) with date accessed
The URL ‘www.bbc.co.uk (Feb 2018)’ is not acceptable, but https://www.bbc.co.uk/education/guides/z9499j6/revision (Feb 2018) is acceptable.</td></tr>
<tr><td>Journal</td><td>Title, author, journal title, volume and page number</td></tr>
<tr><td>Book</td><td>Title, author, page number and either edition or ISBN</td></tr>
</table>

If the candidate includes data from a single experiment, the reference must be to the source of the internet/literature data relevant to the experiment.

If the candidate includes data from two experiments, the reference must be to a source of information gathered to assist with the description of the underlying physics.
</td></tr>
</table>

Section	Max mark	Expected response and marking instructions
4 Graphical presentation (3 marks)		
		A scatter graph is the only appropriate format for presentation of data in this section. Graphs must be based on the candidate's experimental data. Mark computer-generated graphs in the same way as hand-drawn graphs. Graphs should be of a size that allows the scaling and labelling of the axes, and the accuracy of the plotting of the data points, to be readily checked. It may not be possible to check the accuracy of plotting if data points are excessively large, minor gridlines are omitted or the candidate has not used graph paper. Where a candidate has graphed data from two experiments, both graphs should be marked, and the mark associated with the higher-scoring graph awarded.
4 a	1	**The axes of the graph have suitable scales.**
4 b	1	**The axes of the graph have suitable labels and units.** Do not penalise spelling mistakes or the use of abbreviations if the meaning of an axis label can be clearly understood within the context of the investigation. Appropriate abbreviations may be used for units.
4 c	1	**Accurately plotted data points and, where appropriate, a line of best fit.** Do not award this mark if it is not possible to check the accuracy of plotting.

Section	Max mark	Expected response and marking instructions
5 Uncertainties (2 marks)		
	2	**Scale reading uncertainties and random uncertainties.** Where a candidate has included analyses of uncertainties from two experiments, mark both analyses and award the mark associated with the higher-scoring analysis. ♦ Award 2 marks if the candidate includes **all** appropriate scale reading uncertainties **and** correctly calculates random uncertainties. ♦ Award 1 mark if the candidate includes **all** appropriate scale reading uncertainties **or** correctly calculates random uncertainties.
6 Analysis (1 mark)		
	1	**Analysis of experimental data.** The candidate must include a discussion of their experimental data, which may include the calculation of a gradient, the calculation of a constant, and/or the calculation of an absolute uncertainty in a final value. Where a candidate has analysed data from two experiments, mark both analyses and award the mark associated with the higher-scoring analysis. Do not award this mark for the calculation of mean values and/or derived values required for graphing as analysis of data within this section.

Section	Max mark	Expected response and marking instructions
7 Conclusion (1 mark)		
	1	**A valid conclusion that relates to the aim and is supported by all the data in the report.** Where no aim has been stated, do not award this mark.
8 Evaluation (3 marks)		
	3	**Evaluation of the investigation.** Award 1 mark for each valid evaluative statement supported by appropriate justification, to a maximum of 3 marks. The evaluative statements could relate to experimental procedures, results, uncertainties or data from an internet/literature source. A maximum of 1 of these marks is available for an evaluation of **data** from an internet/literature source.
9 Structure (1 mark)		
	1	**A clear and concise report with an informative title.** The structure of the report does not need to follow the structure suggested in the marking instructions or instructions for candidates, but should flow in a logical manner. Note: 'Higher Physics assignment' alone is not acceptable.
Total	**20**	

Instructions for candidates

This assessment applies to the assignment for Higher Physics.

This assignment is worth 20 marks. This contributes 20% to the overall marks for the course assessment.

It assesses the following skills, knowledge and understanding:

- applying physics knowledge to new situations, interpreting information and solving problems
- planning and designing experiments/practical investigations to test given hypotheses or to illustrate particular effects
- recording detailed observations and collecting data from experiments/practical investigations
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing information (using calculations, significant figures and units, where appropriate)
- drawing valid conclusions and giving explanations supported by evidence/justification
- quantifying sources of uncertainty
- evaluating experiments/practical investigations and suggesting improvements
- communicating findings/information effectively

Your assignment has two stages:

- research
- report

Your teacher or lecturer will let you know if there are any specific conditions for doing this assessment, and tell you how the assignment will be carried out.

In this assignment, you have to investigate a topic in physics by doing research.

Your research involves gathering data **either** from one experiment and an internet/literature source, **or** from two experiments**.**

In addition, you may gather extracts about the underlying physics from internet/literature sources.

You then produce a report on your investigation.

Your teacher or lecturer will not mark your report at any point. It is sent to SQA for marking.

Research stage

Choosing your topic

- You need to choose a relevant topic in physics to investigate.
- You must agree your topic with your teacher or lecturer.

Deciding your aim

- Once you have chosen your topic, you need to decide what the aim of your investigation is.
- Remember that:
  - — you need to carry out and collect data from a single experiment and find data from an internet/literature source which is relevant to your experimental data.

  Or

  - — you need to carry out and collect data from two experiments related to your aim.
- Your teacher or lecturer will provide advice on the suitability of your aim, in terms of safety and availability of resources. They will not assess your aim.

Experimental research

- When choosing your experiment(s), remember that it/they must allow measurements to be taken.
- When carrying out your experiment(s), you must work either on your own or as part of a small group. If you are working as part of a small group, you must take an active part.
- Make sure you take a sufficient number of measurements over a wide enough range to meet the aim of your investigation.
- You must repeat measurements.
- Your raw experimental data may be tabulated. However tables must not have additional blank or pre-populated columns for mean and derived values.
- You must estimate the scale reading uncertainty in all the measurements you make.
- You will use your raw experimental data during the report stage.

Internet/literature research

You must carry out your own internet/literature research.

- If you have gathered experimental data from a single experiment, you need to find data from websites, books and/or journals that is relevant to your experimental data. This could be a table or a graph.
- In your report, you will need to describe the physics relevant to your aim. You can gather extracts from websites, books and/or journals to help you write your description of the underlying physics. Extracts must be from an internet/literature source — not from centre-devised course material or class notes. An extract must be a direct copy, which can be a printout, photocopy or handwritten (word for word) and must not be annotated. There is no size limit on an extract, but it must be an extract and not the full document.
- Your extracts can include any formulae or relationships you may need but must not include sample calculations.

- During the report stage you will need to show your understanding by writing your description of the physics relevant to your aim using your own words.
- It is important that you record where you get your data or extracts from in enough detail that another person could find it. This is known as a reference.

Report stage

Producing the report

- The report must be all your own work.
- When producing your report, you will be supervised at all times.
- You have 2 hours to complete your report.

Resources

During the report stage you are only allowed to have certain materials.

You can have:	You cannot have:
♦ these instructions for candidates ♦ extracts you have gathered from websites, books and/or journals to help you describe the physics relevant to your aim ♦ the experimental method(s) ♦ your raw experimental data, including any scale reading uncertainties, which may be tabulated ♦ data from websites, books and/or journals that is relevant to your experimental data, if you have data from **a single** experiment ♦ the references to the sources of data or extracts	♦ a draft of your report ♦ a draft of any part of your report ♦ sample calculations from any source ♦ a previously prepared table containing additional blank or pre-populated columns for mean and derived values.

Your teacher or lecturer cannot provide you with feedback or tell you how to improve your report.

Guidance on producing your report

Your report must be easy to follow.

You may find that using headings will help to make your report clear.

Title

- Your title must tell the reader what your report is about.

Aim

- Your aim must describe clearly the purpose of your investigation.

Underlying physics

- You must describe the physics relevant to your aim.
- You must use your own words as much as possible.
- You may choose to include:
  - relationships or equations
  - definitions of symbols used
  - explanations or justifications of relationships or equations
  - explanations of physical properties
  - copies of diagrams which you would find difficult to draw
- You can quote from sources as long as you give a description or explanation showing that you understand the physics.
- Do not include a passage copied directly from your extracts. This would not show that you understand the physics.

Description of experiment(s)

- You must give only a **brief** description of the experiment you carried out.
- If you carried out two experiments, you should give a brief description of both. You will be awarded the mark if one of the two descriptions is acceptable.
- You must show that you can summarise your experimental method(s) and must not give a full description.
- Your description must include the measuring instruments you used, although you don't need to give details of the range of measurements or the number of repeats.

Experimental data

- You must include a table showing **all** of the measurements you recorded in your experiment.
- If you carried out two experiments, you should include a table of measurements from each experiment. You will be awarded the mark if one of the two tables is acceptable.
- Make sure you include column headings. You must also include units, where appropriate.
- You must calculate mean values for your repeated measurements. These must be included in your table.
- Any derived values needed for graphing must be included in your table.

Graphical presentation

- You must produce a scatter graph of your experimental data.
- If you carried out two experiments, you should include scatter graphs of your data from both experiments. In this case, both graphs will be marked, and you will be awarded the mark for the better of your graphs.
- You must use graph paper or graphing software. If you are using graphing software, you must include both major and minor gridlines, and use plotting symbols that are clear but not too large.
- A line or curve of best fit should usually be drawn. However, if there is no obvious pattern to your plotted data points, you should not try to draw a line or curve of best fit.
- The graph(s) must be large enough to allow points to be read accurately and have suitable scales. It/they must also have labels and units on the axes.

Uncertainties

- You must include scale reading uncertainties for **all** the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
- If you carried out two experiments, you should include the uncertainties in the measurements from both experiments. Both sets of uncertainties will be marked, and you will be awarded the mark for the better set.

Data from an internet/literature source or second experiment

- If you carried out a single experiment, you must include data from an internet/literature source that is relevant to your experimental data.
- If you carried out two experiments, you must include the data from your second experiment. In this case, you must not include data from an internet/literature source.

Citation and reference for a source of data/information from the internet/literature

- You must include a reference to a source of data/information.
  - If you carried out a single experiment, your reference must be to the source of data obtained from the internet/literature, which is relevant to your experimental data.
  - If you carried out two experiments, your reference must be to a source of information gathered to support your description of the underlying physics.
- You must cite the internet/literature source within the body of the report, near to the relevant data/information.
  - If you carried out a single experiment and have included data from an internet/literature source in your report, you must cite this source next to the data.
  - If you carried out two experiments, you must cite your source(s) of the information that supports your description of the underlying physics. This must be cited next to the information.

— You can cite a source in many ways. One way is to put a number, for example (1), next to the data/information and the same number beside the reference included later in the report. A URL cannot be a citation.

- You must include a reference at, or near, the end of the report.
- You must include the following information in the reference:

Source	Reference
Website	full URL for the page or pages, with date accessed
Journal	title, author, journal title, volume and page number
Book	title, author, page number and either edition or ISBN

Analysis

You must include a discussion of the data from your experiment. In physics this usually involves the calculation of a gradient, the calculation of a constant and/or the calculation of an absolute uncertainty in a final value. You should state the physical significance of any gradient or constant you calculate. If you carried out two experiments, you should include an analysis of both experiments. Both analyses will be marked, and you will be awarded the mark for the better analysis.

Conclusion

You must state a conclusion that relates to your aim **and** is supported by **all** the data included in your report.

Evaluation

You must make three statements, supported by justification, which evaluate the data/information you have included.

The statements can relate to

- your experimental procedures
- your results
- your uncertainties
- data from your internet/literature source

Two or three of the statements can evaluate your experiment(s). No more than one of your statements can evaluate **data** from your internet/literature source.

You could make your evaluative statements include, as appropriate, comments on:

- the accuracy and precision of your experimental measurements
- the adequacy of your repeated readings
- the adequacy of the range over which you altered variables
- the adequacy of how you controlled variables
- any limitations of the equipment you used
- the reliability of your methods
- sources of uncertainty in your measurements

Summary

You can use this table to check you have covered all the sections in your report.

Section	Description	Marks
Title and structure	An informative title and a structure that can easily be followed.	1
Aim	A description of the purpose of your investigation.	1
Underlying physics	A description of the physics relevant to your aim, which shows your understanding.	3
Data collection and handling	A brief description of an approach used to collect experimental data.	1
	Sufficient raw data from your experiment.	1
	Data from your experiment, including any mean and/or other derived values, presented in a table with headings and units.	1
	Numerical or graphical data relevant to your experiment obtained from an internet/literature source, **or** raw data relevant to your aim obtained from your second experiment.	1
	A citation for an internet/literature source and the reference listed later in the report.	1
Graphical presentation	The axes have suitable scales.	1
	Suitable labels and units on the axes.	1
	All data points plotted accurately and, where appropriate, line or curve of best fit drawn.	1
Uncertainties	Scale reading uncertainties shown for all measurements and random uncertainty in measurements calculated.	2
Analysis	Discussion of experimental data.	1
Conclusion	A conclusion relating to your aim based on all the data in your report.	1
Evaluation	Three evaluative statements supported by justifications.	3
Total		**20**

Once complete, give your report to your teacher or lecturer to submit to SQA.

Administrative information

Published: September 2019 (version 2.0)

History of changes

Version	Description of change	Date
2.0	'Instructions for teachers and lecturers' section: ♦ 'Instructions' sub-section: — clarification that instructions for candidates must not be altered or supplemented by centre-devised materials ♦ 'Choosing the topic' sub-section: — information added that there must be a range of topics available for candidates to choose from and that teachers/lecturers must minimise the numbers investigating the same topic within a class ♦ 'Experimental research' sub-section: — candidates can be given only a basic list of instructions for the experimental procedure and must decide on range, interval and number of repeats for themselves ♦ 'Internet/literature research' sub-section: — this must be the work of the individual candidate — candidates must undertake research using only websites, journals and/or books — provision of a wide list of URLs or a wide list of journals and/or books should be the exception — provision of the full content of a wide list of sources should be the exception ♦ 'Report stage' sub-section: — teachers/lecturers must check the materials of each and every candidate — information added to the bullet points about raw experimental data, internet/literature data and extracts — information added on extracts — list of items that candidates cannot have access to in the report stage replaced with 'Candidates must not have	September 2019

	access to a previously prepared draft of a report or any part of a report.' 'Instructions for candidates' section: ♦ amended throughout to reflect the changes in the course specification and the 'Instructions for teachers and lecturers' ♦ when using graphing software, candidates must include both major and minor gridlines ♦ 'Citation and reference' sub-section: — information reordered — URLs can't be used as the citation — the reference needs to be listed at or near the end of the report ♦ 'Analysis' and 'Evaluation' sub –sections: — additional advice added	

Note: you are advised to check SQA's website to ensure you are using the most up-to-date version of this document.

Security and confidentiality

This document can be used by SQA approved centres for the assessment of National Courses and not for any other purpose.