Course report 2025

Advanced Higher Physics

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative, and to promote better understanding. You should read the report with the published assessment documents and marking instructions.

We compiled the statistics in this report before we completed the 2025 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2024: 2,254

Number of resulted entries in 2025: 2,117

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

Course award	Number of candidates	Percentage	Cumulative percentage	Minimum mark required
A	568	26.8	26.8	110
B	512	24.2	51.0	92
C	465	22.0	73.0	75
D	346	16.3	89.3	57
No award	226	10.7	100	Not applicable

We have not applied rounding to these statistics.

You can read the general commentary on grade boundaries in the appendix.

In this report:

- ‘most’ means greater than or equal to 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find statistical reports on the statistics and information page of our website.

Section 1: comments on the assessment

Question paper

The question paper performed as expected. However, there were still some candidates who appeared to find it challenging to access some of the questions.

There was a small number of questions that proved more challenging than anticipated — in particular, questions 2(c), 4(c), and 13(c)(i). In light of this, the grade boundaries were adjusted at the upper-A, grade A, and grade C boundaries.

There was evidence that some candidates found questions based upon experimental technique, data analysis, and uncertainties challenging. This might be due to a lack of exposure to practical work, and support at an appropriate level.

The standard of responses to both open-ended questions was similar to that in previous exam papers, and these remain demanding for candidates.

Project

The project performed as expected.

In some cases, it was evident that lack of exposure to appropriate practical work throughout the course might have had an impact on the ability of some candidates to undertake an appropriate project successfully.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Question 1(a) and (b)	Most candidates were able to differentiate and integrate the given relationship.
Question 2(a)(i)	Most candidates were able to calculate the angular velocity of the drum.
Question 2(a)(ii)	Most candidates were able to calculate the unbalanced torque required to produce the given acceleration.
Question 2(b)	Most candidates were able to state how the unbalanced torque required compared to the value in question 2(a)(ii), and many were able to justify their answer appropriately.
Question 3(a)	Most candidates were able to show the angular velocity of the neutron star.
Question 3(b)	Most candidates were able to calculate the moment of inertia of the neutron star.
Question 3(c)(ii)	Many candidates were able to determine the angular velocity of the core of the parent star immediately after it collapsed.
Question 4(a)(i)	Many candidates were able to determine the escape velocity of the Lucy spacecraft at the point of closest approach.

Question 5(a)	Most candidates were able to calculate the surface temperature of Sirius B.
Question 5(b)(i)	Most candidates were able to show the luminosity of Rigel.
Question 5(b)(ii)	Most candidates were able to state how the radius of Betelgeuse compared to Rigel, and many were able to justify their answer.
Question 6(b)(i)	Most candidates were able to determine the temperature of the black-body radiator.
Question 6(b)(ii)	Most candidates were able to calculate the power per unit area emitted from the black-body radiator.
Question 6(c)(i)	Many candidates were able to calculate the momentum of the photon.
Question 7(a)	Many candidates were able to state the origin of cosmic rays.
Question 7(c)(i)	Many candidates were able to determine the energy of the muon.
Question 7(c)(ii)	Many candidates were able to determine the lifetime of the muon — although there were some issues, including leaving the greater than or equals to sign in the final answer.
Question 9(a)	Many candidates were able to determine the magnitude of the force applied by the adult to keep the seesaw level.
Question 9(b)(ii)	Most candidates were able to calculate the period of the motion of the child.
Question 9(b)(iii)	Many candidates were able to calculate the maximum velocity of the child during the motion.

Question 9(b)(iv)	Many candidates were able to sketch the graph, although only some were able to do so correctly.
Question 10(a)	Most candidates were able to state the nature of the wave and justify their response by the inclusion of an appropriate calculation.
Question 11(a)(iii)	Many candidates were able to calculate the wavelength of the microwaves.
Question 11(b)(i)(A)	Many candidates were able to state the phase change experienced by the light wave when it reflects at the air-coating boundary.
Question 11(b)(i)(B)	Many candidates were able to state the phase change experienced by the light wave when it reflects at the coating-glass boundary.
Question 11(c)(i)	Many candidates were able to calculate the minimum thickness of the layer of ice.
Question 11(c)(ii)	Most candidates were able to suggest a reason why the student decided against carrying out the experiment.
Question 12(a)	Many candidates were able to state what is meant by plane-polarised light.
Question 12(b)(ii)	Many candidates were able to suggest a reason why the irradiance detected by the light meter did not reach zero.
Question 13(b)	Most candidates were able to show the electric field strength.
Question 13(c)(ii)	Many candidates were able to calculate the charge on the sphere.
Question 14(a)(i)	Most candidates were able to show how the given relationship is established.

Question 14(a)(ii)	Many candidates were able to determine the velocity of an ion that passes through the velocity selector undeflected.
Question 14(c)	Many candidates were able to state the change to the paths of the ions in the deflection field.
Question 15(a)(iii)	Many candidates were able to calculate the maximum energy stored in the inductor correctly.
Question 15(c)	Many candidates were able to determine the frequency of the AC supply correctly.
Question 16(a)	Many candidates were able to determine Young's modulus of the steel. A few candidates calculated the gradient of the line on the graph rather than using the value stated in the equation of the line, which was acceptable. A common issue was choosing a single point to substitute into the relationship, which isn't valid as there is a non-zero y-intercept.

Project

Abstract

Many candidates clearly stated the aim(s) and findings of their project. There was a noted improvement in this section of the report.

Underlying physics

Most candidates were able to give at least a reasonable account of the physics behind their project, with sufficient depth and at an appropriate level, and some were able to give a good account.

Procedures

Many candidates scored well in the ‘level of demand’ section, although only some attained all 3 marks. In many cases, the procedures were at an appropriate level for Advanced Higher and indicated 10 to 15 hours of experimental work.

Many candidates were able to describe the procedures they used in their project, although many omitted key details and some used the incorrect tense. Most candidates commented on the repeated measurements made.

Results (including uncertainties)

Many candidates produced raw data that was sufficient and relevant to the aim(s) of their project, although there were issues in some reports where raw data was omitted for some quantities, with only processed data being included for some quantities.

Many candidates were able to produce suitable graphs of their data and perform relevant analysis using the gradient. To gain full marks in the analysis section, candidates must perform graphical analysis where possible and for a minimum of two of their experiments. Some candidates are using the likes of Excel but omitting to include minor gridlines.

Many candidates showed an awareness of scale reading, random, and calibration uncertainties and/or attempted appropriate combinations of uncertainties. Candidates’ use of the LINEST function in Excel again showed improvement; however, some did not present the raw ‘box’ data. However, few candidates were able to address all three elements of uncertainties successfully.

Discussion (conclusion(s) and evaluation)

Many candidates were able to write a conclusion(s) that was valid and related to the aim(s) of their project.

Many candidates were awarded the mark for a report that indicated a good, competent project, which was well-worked through.

There was a marked improvement in this section.

Presentation

Most candidates produced a well-structured report with an appropriate, informative title, contents page, and page numbers. Only a very small number of candidates exceeded the permitted word limit.

Areas that candidates found demanding

Question paper

Question 2(c)	Few candidates were able to explain, in terms of forces, why the people slide down the wall. Most candidates did not address the physics explaining that the friction no longer balanced the weight. Most candidates incorrectly discussed centripetal force and motion in the horizontal plane.
Question 3(c)(i)	Only some candidates were able to state the principle of conservation of angular momentum.
Question 4(a)(ii)	Few candidates were able to explain why the speed of the spacecraft should exceed escape velocity. Candidates incorrectly stated that the spacecraft needed to escape the Earth's orbit, as opposed to allowing the spacecraft to leave the gravitational field of the Earth.
Question 4(c)	Few candidates were able to state that the rate at which time passes increases. Candidates stated incorrectly that time 'ran faster', which does not address the rate.
Question 5(c)	Only some candidates were able to match each black-body spectra to the appropriate star.
Question 6(a)	Only some candidates were able to name the prediction as the ultraviolet catastrophe.

Question 6(a)(ii)	Only some candidates were able to add an appropriate line to the spectrum to represent that predicted by classical theory.
Question 6(b)(iii)	Few candidates were able to suggest a reason why the power per unit area emitted was less than calculated. Candidates stated incorrectly that this was due to energy loss to the surroundings.
Question 6(c)(ii)	Few candidates were able to explain the implication of the phrase ‘the momentum of a photon’.
Question 7(b)	Only some candidates were able to explain why the charged particles follow a helical path.
Question 9(b)(i)	Only some candidates were able to use calculus methods to show that the given relationship was consistent with simple harmonic motion (SHM).
Question 9(c)	Few candidates were able to explain why the vertical movement of the first child no longer approximated to SHM. Candidates did not address proportionality of displacement and force/acceleration.
Question 10(b)	Only some candidates were able to determine a relationship that fully described the reflected wave.
Question 10(c)	Few candidates were able to explain why a high frequency was needed. Candidates did not address the reactance of the capacitor.
Question 11(a)(i)	Only some candidates were able to state the two required conditions for the waves to produce regions of constructive interference.

Question 11(a)(ii) — Only some candidates were able to explain how the student was able to identify regions of constructive interference using the given experimental set up.

Question 11(b)(ii) — Few candidates were able to derive the relationship for the minimum thickness of a coating to be non-reflecting.

Question 12(b)(i) — Few candidates were able to determine the refractive index of the plastic. Most candidates did not take account of the angle θ being twice the angle of incidence.

Question 13(a) — Only some candidates were able to sketch a suitable electric field pattern. Candidates often drew field lines without the use of a ruler, had field lines crossing, multiple field lines emanating from the same point on the sphere, or lines that were far from being perpendicular to the surface of the sphere.

Question 13(c) — Few candidates were able to determine the magnitude of the electrostatic force acting on the suspended sphere.

Question 14(a)(iii) — Only some candidates were able to explain why different types of ion passing through the velocity selector undeflected have the same velocity.

Question 14(b) — Although most candidates were able to determine the respective radius for the path of each ion, few were able to then determine the separation Δx.

Question 15(a)(i) — Few candidates were able to explain why the current does not immediately reach its maximum value. Candidates did not address the changing magnetic field due to changing current.

Question 15(b) — Although many candidates were able to state how the time taken to reach maximum current, when the iron core

	was removed, compared to the time with the iron core present, only some were able to justify their answer.
Question 16(b)(i)	Few candidates were able to determine the absolute uncertainty in the value of Young's modulus. Candidates did not address the fact that the length measurement was to the power of three in the given relationship.
Question 16(b)(ii)	Few candidates were able to suggest a source for the systematic uncertainty.

Project

Underlying physics

Some candidates were unable to demonstrate a good understanding of the physics behind their project. Candidates frequently stated relationships but, in some cases, there was no attempt to define quantities or units. In some cases, relationships were simply stated without any attempt at their derivation. Some candidates attempted to reproduce derivations from textbooks or internet sites, and made a number of errors and omissions when doing so. Some candidates omitted explanatory diagrams. Some candidates included physics that was not relevant to their project.

Procedures

Some candidates did not include labelled diagrams and/or photographs of sufficient clarity. Candidates used schematic diagrams from textbooks on occasion; however, these are not sufficient on their own to be awarded marks. Circuit diagrams were omitted when they would have aided clarity. A number of candidates did not describe their procedures using the past tense, or include the range and interval of the independent variable.

Results (including uncertainties)

Some candidates did not include all raw data, which prevented them from accessing the data mark. Examples include the time for 10 oscillations, the measured dimensions of a ball bearing, the height of a slope, and the original length of a wire.

Some candidates used software packages to produce graphs that were not of a suitable size, did not include minor gridlines or used data points too large to allow for checking of accuracy of plotting. Some software packages have a default setting for minor gridlines that makes it difficult to check accuracy of plotting due to inappropriate intervals. In addition, some graphs had missing or incorrect labels on axes.

Some candidates did not show sufficient working in their analysis; they should be encouraged to show sample calculations throughout.

Some candidates showed incorrect averaging of calculated or derived values.

Discussion (conclusion(s) and evaluation)

Some candidates did not evaluate their experimental procedures in sufficient depth or with sufficient sophistication to score well. Some candidates' evaluations were too general in nature and not of an Advanced Higher level. Examples include 'the equipment was old and was not reliable', or 'the experiment worked well'. Candidates should, for example, identify the dominant source of uncertainty and suggest how this may be reduced.

Some candidates also did not evaluate the project as a whole, and simply repeated statements made in the evaluation of experimental procedures. Again, the language candidates used here was at times superficial — for example, 'the best result was experiment 2'. Few candidates suggested further work, and some made impractical suggestions such as 'do the experiments in a vacuum'.

Presentation

Although an improvement on previous years, only some candidates listed and cited references to at least three sources of information using either Vancouver or Harvard referencing systems.

There was a small number of cases where candidates appeared to have used Artificial Intelligence (AI) to generate sections of their report. This contravenes our guidance on generative artificial intelligence (AI) in assessments.

Section 3: preparing candidates for future assessment

Question paper

Candidates were, in general, well prepared for the question paper, and showed a good understanding of the majority of the concepts tested.

Candidates did well in completing questions assessing their ability to select and use relationships to determine values.

Candidates completed ‘show’-type questions well, and showed a marked improvement from previous years; however, they should be reminded that all steps of the calculation must be shown. The answer must start with an explicit relationship and the correct final answer given, with units, to gain all the marks. When the answer to a ‘show’ question is used in subsequent parts of a question, candidates should be reminded to use the answer given, not an unrounded value they calculated.

Many candidates attempted questions requiring a sketch without due care. Candidates should be encouraged to represent their sketch in a neat manner and as accurately as possible. The use of a ruler, where appropriate, is expected.

Candidates made good attempts at ‘justify’ questions, and at using correct physics to explain their answer. Candidates should be reminded that many explanations should include what variables have remained constant when explaining why a dependant variable has changed.

In answering numerical questions, candidates should be discouraged from rounding numbers prior to the final answer (intermediate rounding). Candidates should also be strongly discouraged from including a penultimate line to their working, showing an unrounded or truncated final value. A number of candidates rounded incorrectly, or truncated the number, leading to errors in the final answer, resulting in the mark for the final answer not being awarded. The final answer should be rounded to the appropriate number of significant figures and given in decimal form.

Candidates should be given opportunities, either verbally or in writing, to practise explaining concepts and ideas from the course, such as consequences of general relativity, helical motion of charged particles, quantum tunnelling, conditions for interference, and systematic uncertainties in experimental measurements.

Open-ended questions in previous SQA question papers could provide opportunities for candidates to practise explaining some of the more challenging concepts in the course. However, candidates should be discouraged from simply stating three pieces of information to try and access the 3 marks. Candidates should be encouraged to reference both the text and diagrams in an open-ended question and answer in the context of the question and appropriate to the Advanced Higher course. Candidates should be discouraged from producing an answer which is simply a series of topical knowledge statements that do not address the question.

Candidates should be encouraged to use the correct physics terminology when answering questions assessing the knowledge of definitions. While some variation in wording may be acceptable in response to descriptive and explanatory questions, there is less scope for such variation when answering 'state what is meant by...' questions. For example, a number of candidates were unable to state what is meant by 'plane polarised light' or 'the conservation of angular momentum'.

The Advanced Higher Physics course is a practical course, and not a theoretical course. It cannot be delivered as a purely online course. Candidates **must** be given the opportunity to take an active part in a wide range of practical work **throughout** the course. This is in addition to any time allocated for candidates to undertake the experimental work associated with their project. They must also be given access to the evaluation and analysis of experimental work, as appropriate, to develop the necessary knowledge and skills. While the demonstration of experiments, videos and computer simulations may be useful additional tools, they cannot replace active experimental work. Opportunities to regularly practise experimental skills during classwork should enable candidates to answer questions assessing aspects of experimental technique, analysis of data, and sources of uncertainty.

Experimental work is best undertaken at the appropriate point in the course so that it links in with the theory and aids understanding, rather than being seen as a separate, standalone activity.

Candidates should be encouraged to make their handwriting as clear as possible. This is particularly important when using 'α' in angular motion relationships and 'τ' in rotational dynamics relationships.

Candidates should be encouraged to score through incorrect working and replace this with a new clear statement to avoid ambiguity.

In the examination, candidates should also be encouraged to refer to the data sheet and to the relationships sheet, rather than trying to remember data and relationships.

Centres should also refer to the Physics: general marking principles document on our website for generic issues related to the marking of question papers in SQA qualifications in Physics at National 5, Higher and Advanced Higher levels. Centres must adopt these general instructions for the marking of prelim examinations and centre-devised assessments for any SQA Physics courses.

Project

Topic choice

Centres are reminded that, unless they are presenting a large number of candidates (more than 10), candidates should not be allowed to choose a topic that may lead to experimental procedures similar to those being carried out by another candidate in the centre. Centres presenting a larger number of candidates (more than 10) must minimise the number of candidates investigating the same topic and have at least ten different topics available. There should be no need for candidates in a small class or group to be investigating the same topic. If two candidates in a centre are following the same experimental procedures, the teacher or lecturer must ensure that each candidate carries out research, including experimental work, individually. Centres are also reminded that candidates must work individually, and group work is not allowed.

To score well in the project, each candidate should be encouraged to choose a topic for which the underlying physics and experimental procedures present an appropriate level of challenge, and facilitates the opportunity to access marks for the introduction, procedures, results, and discussion. In particular, the experimental procedures should allow graphical analysis to be carried out and it should be commensurate with Advanced Higher level. Topics should involve 10 to 15 hours of experimental work for the candidate.

Abstract

Candidates should state a clear overall aim(s) for their project and state findings clearly. If the aim is to measure a physical constant using a number of procedures, candidates should name, or briefly describe, each procedure, stating the value obtained for the constant, complete with unit and preferably the uncertainty, for each procedure. If the aim is to compare methods, candidates should be clear which aspects are being compared, for example, accuracy, precision, ease of measurement, number of uncertainties, rather than stating 'method A was better than method B'. If the aim is to confirm a relationship between variables, candidates should be wary of stating that a relationship shows direct proportionality in their findings if the line of best fit does not pass through the origin, unless reference is made to the uncertainty in the y-intercept compared to the y-intercept.

Underlying physics

To score well in this section, candidates should demonstrate a good understanding of the physics of their chosen topic. Simply stating a number of relationships without any derivation or reproducing information from sources without input from the candidate, would not demonstrate a good understanding. Candidates should be encouraged to use referenced diagrams and illustrations in this section. The inclusion of historical, socio-economic or other non-physics information may be of interest but does not contribute towards demonstrating an understanding of physics and is not given credit.

Procedures

Candidates should include clear, uncluttered, labelled photographs or diagrams to help describe the relevant apparatus. Attempts to sketch apparatus electronically using drawing packages sometimes produces diagrams lacking the clarity necessary for replication. It may be quicker and clearer to produce a sketch using pencil and paper and scan it into the report. A circuit diagram should support the description of apparatus used in a procedure involving an electrical circuit. Values of electrical components should be included. Candidates should describe their procedures, using past-tense passive voice, in sufficient detail to allow replication. Candidates should be encouraged to include the following details: the number of repeats and the range and interval of the independent variable.

The number of procedures will depend on the chosen topic, but the experimental phase of the project normally consists of three or four related experiments. In any event, candidates should be advised to spend approximately 10 to 15 hours in the laboratory obtaining their experimental data.

Results

For data to be considered sufficient, candidates should ensure the number of repeats, and the range and interval of the independent variable, are appropriate for the experiments. Candidates should include all their raw data in the report, not just mean or derived values. If the volume of raw data is large, it should be included in appendices.

Candidates should explicitly state all measurements made, rather than simply substituting values into relationships.

Additional opportunities to practise graphical analysis and the estimation and combination of uncertainties as part of classwork may support appropriate analysis of raw data, including uncertainties. Candidates should be encouraged to use graphs of an appropriate size with the use of minor gridlines and small data points.

Candidates should be encouraged to quantify all sources of uncertainty in measurements, in particular scale reading uncertainty, calibration uncertainty, and random uncertainty, where appropriate.

Candidates should be reminded to include sample calculations for both analysis of data and uncertainties.

Discussion

In their evaluations of experimental procedures, candidates should be encouraged, as appropriate, to comment on the accuracy and precision of their measurements; the adequacy of repeated readings; the adequacy of the range over which variables are altered; the adequacy of control of variables; any limitations of their equipment; the reliability of their methods; and on sources of uncertainties.

In their discussion and critical evaluation of the project as a whole, candidates should be encouraged, as appropriate, to comment on the reasons for selection of procedures; problems encountered during planning; modifications to planned procedures; interpretation and significance of findings; suggestions for further improvements; and suggestions for further work.

Presentation

References to at least three sources of information, listed at the end of the report, should also be cited in the report where information is quoted from the sources. Both the listing and citing of references should use either Vancouver or Harvard referencing. In addition to support in the 'Instructions for candidates' section, many internet sites offer guidance and support in referencing in Vancouver or Harvard style.

Maximum word count

The project report should be between 2500 and 4500 words in length — excluding the title page, contents page, tables of data, graphs, diagrams, calculations, references, and acknowledgements. It is possible to produce a high-scoring report using considerably fewer words than the maximum permitted.

Centres must ensure that candidates are familiar with the [guidance on generative artificial intelligence (AI) in assessments] available on our website so that they are clear on what constitutes acceptable and unacceptable use of generative AI tools in assessments.

Appendix: general commentary on grade boundaries

Our main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and to maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, we aim to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject, at every level. Therefore, we hold a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of our Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. We can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Every year, we evaluate the performance of our assessments in a fair way, while ensuring standards are maintained so that our qualifications remain credible. To do this, we measure evidence of candidates' knowledge and skills against the national standard.

For full details of the approach, please refer to the [Awarding and Grading for National Courses Policy].