Course report 2023

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 in conjunction with the published assessment documents and marking instructions.

The statistics in the report were compiled before any appeals were completed.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022: 2,132

Number of resulted entries in 2023: 2,087

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	676	Percentage	32.4	Cumulative percentage	32.4	Minimum mark required	102
B	Number of candidates	546	Percentage	26.2	Cumulative percentage	58.6	Minimum mark required	84
C	Number of candidates	434	Percentage	20.8	Cumulative percentage	79.3	Minimum mark required	66
D	Number of candidates	260	Percentage	12.5	Cumulative percentage	91.8	Minimum mark required	48
No award	Number of candidates	171	Percentage	8.2	Cumulative percentage	100	Minimum mark required	N/A

Please note that rounding has not been applied to these statistics.

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

In this report:

- 'most' means greater than 70%
- 'many' means 50% to 69%
- 'some' means 25% to 49%
- 'a few' means less than 25%

You can find more statistical reports on the statistics and information page of SQA's website.

Section 1: comments on the assessment

Question paper

The question paper performed as expected, however there were some candidates who appeared to have been presented at an inappropriate level as they struggled to access many of the questions.

There were a small number of questions that proved more challenging than anticipated. In particular, questions 12(c)(ii) and 14(b). These questions were based upon experimental technique and data analysis. It was evident that there was a lack of understanding in this area of physics, owing to lack of exposure to practical physics. Grade boundaries were adjusted to take account of this.

The standard of responses to both open-ended questions was similar to that in previous exam papers.

Project

The project was removed for session 2022–23.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Questions 1(a), (b)	Most candidates were able to differentiate and integrate the given relationship.
Question 2(b)(i)	Most candidates were able to calculate the centripetal force acting on the pea.
Question 3(a)	Most candidates were able to show the moment of inertia of the disc.
Questions 4(a)	Most candidates were able to show the gravitational potential at the specified altitude.
Question 4(c)(i)	Most candidates were able to calculate the escape velocity from the surface of Mars.
Question 6(b)(i)	Most candidates were able to calculate the luminosity of the Sun.
Question 6(d)	Many candidates were able to determine the apparent brightness of the star Delta Ursae Majoris.
Question 6(e)	Most candidates were able to identify the star on the HR diagram.
Question 7(a)(ii)	Many candidates were able to determine the minimum uncertainty in the photon energy.
Question 7(a)(iii)	Many candidates were able to determine the minimum uncertainty in the frequency of the photon.
Question 7(b)	Most candidates were able to substitute into the given relationship and calculate the correct width of the spectral line.
Question 8(a)(i)	Most candidates were able to substitute into the given relationship and calculate the correct value for radius of orbit.
Question 8(b)(i)	Most candidates were able to show the given relationship for tangential speed.
Question 9(a)(i)	Most candidates were able to calculate the initial speed of the positron.
Question 10(b)(i)	Most candidates were able to show the correct angular frequency of the coil and cone.
Question 10(b)(ii)	Many candidates were able to calculate the maximum acceleration of the coil and cone.

Question 10(d)	Most candidates were able to calculate the speed of the sound wave.
Question 14(a)	Most candidates were able to show the correct value for μ_0.
Question 15(b)(i)	Most candidates were able to substitute into the given relationship and calculate the correct value for the time constant.

Areas that candidates found demanding

Question paper

Question 6(c)	Although many candidates were able to give a partial explanation for what happens to the radius of the Sun as it leaves the main sequence, few could give sufficient detail to be awarded 2 marks. Answers tended to lack the necessary precision or neglected to explain in terms of thermal pressure and gravitational forces, as instructed.
Question 9(a)(ii)	Few candidates were able to explain that the radius of the path of the positron decreases due to the loss of energy to the liquid.
Question 9(a)(iii)	Few candidates were able to explain the differences between the path followed by the ejected electron and the path followed by the positron. Many of those who attempted to answer the question simply listed two differences and made no attempt to explain them.
Question 10(f)	Few candidates were able to sketch a graph showing how the displacement varied with time during critical damping.
Question 11(c)(ii)	Most candidates were unable to explain why the protective glass has a purple tint. A common incorrect response was to refer to purple as being a single colour in the visible spectrum.
Question 12(c)(ii)	Few candidates were able to explain why the sunglasses reduced glare by considering the transmission axis of the sunglasses.
Question 12(d)	Few candidates were able to explain why the brightness of the rainbow varies when viewed through polarising sunglasses.
Question 13(c)(ii)B	Few candidates were able to state that the unbalanced torque decreases and justify this in terms of the component of the force.
Question 14(b)(iii)	Few candidates were able to calculate the absolute uncertainty in the value of μ_0
Question 14(b)(iv)	Most candidates were unable to suggest a source for the systematic uncertainty.
Question 15(a)	Few candidates were able to explain how the back EMF was induced.

Question 15(c)	Few candidates were able to explain why the back EMF produced is large enough to allow the neon lamp to flash.

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.

Questions assessing candidates' ability to select and use relationships to determine values were well done.

'Show' type questions were overall done well; however, candidates should be reminded that all steps of the calculation must be shown. The answer must start with a relationship and the correct final answer given 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.

'Justify' questions were well attempted and many candidates made a good attempt at using physics to explain their answer.

Questions requiring a 'sketch' were attempted by many without due care. Candidates should be encouraged to represent their sketch in a neat manner and as accurately as possible, taking into account any information given to them, such as scales on the axes of a graph.

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 centripetal force, stellar evolution, motion of charged particles, non-reflective coatings, polarisation, and self-inductance.

Open-ended questions from past SQA question papers could provide suitable prompts for candidates to practise explaining some of the more challenging concepts in the course. Candidates should be discouraged from simply stating three pieces of information in an effort to access the 3 marks. Candidates should be encouraged to make specific reference to the question and answer at a level appropriate to Advanced Higher Physics.

Candidates **must** be given the opportunity to take an active part in a wide range of practical work throughout the course and evaluate and analyse as appropriate, to develop the necessary knowledge and skills. While demonstration of experiments, videos, and computer simulations may be useful additional tools, they cannot replace active experimental work and do not develop the knowledge and skills associated with practical work. Opportunities to regularly practise experimental skills during classwork should enable candidates to answer questions assessing aspects of experimental technique, analysis of experimental data, and sources of uncertainty. In particular, candidates must be encouraged not to include the uncertainty in the y-intercept of a graph when calculating the overall absolute 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 take care and 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 the ‘Heisenberg uncertainty principle’ and ‘plane-polarised light’.

Candidates should be encouraged to make handwriting as clear as possible.

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 the SQA 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.

Appendix: general commentary on grade boundaries

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

For most National Courses, SQA aims 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, SQA holds 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 SQA's 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. SQA 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.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures was developed to support learners and centres. This included modifications to course assessment, retained from the 2021–22 session. This support was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic while recognising a lessening of the impact of disruption to learning and teaching as a result of the pandemic. The revision support that was available for the 2021–22 session was not offered to learners in 2022–23.

In addition, SQA adopted a sensitive approach to grading for National 5, Higher and Advanced Higher courses, to help ensure fairness for candidates while maintaining standards. This is in recognition of the fact that those preparing for and sitting exams continue to do so in different circumstances from those who sat exams in 2019 and 2022.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2023 and the ongoing impact the disruption from the pandemic has had on learners. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and the removal of revision support.

The grade boundaries used in 2023 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the National Qualifications 2023 Awarding — Methodology Report.