Course report 2025

National 5 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: 13,353

Number of resulted entries in 2025: 13,678

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	4,483	32.8	32.8	84
B	2,831	20.7	53.5	70
C	2,610	19.1	72.6	56
D	2,095	15.3	87.9	42
No award	1,659	12.1	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

All questions were answered correctly by at least a proportion of the candidates, and there was a spread of performance across the range of available marks.

The general feedback from centres and markers was that it was a fair question paper, which included a good balance of straightforward and more challenging questions to allow for discrimination of candidates performing across all grades.

Section 1 (objective test) performed as expected.

In Section 2 (restricted and extended-response questions), questions 4(b)(i), 7(b), 9(b), 10(b)(ii), and13(b) were more demanding than expected.

In light of this, the grade boundaries for this assessment were adjusted at the upper-A, grade A, and grade C boundaries.

It was evident that some candidates had been presented at an inappropriate level, as they found many of the questions challenging.

Assignment

Markers commented that candidates had the opportunity to achieve marks for all the skills, knowledge and understanding assessed. In addition, markers noted that many candidates achieved high marks, and few candidates achieved low marks.

The average marks for the assignment were very similar to those achieved in 2024.

No adjustments were made to grade boundaries for this part of the assessment.

Most candidates appear to be following the advice available to them in the 'Instructions for candidates' section of the Coursework assessment task for National 5 Physics, which details advice and guidance for the various stages of the assignment, and the marks available for each aspect of the report.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

In general, candidates coped particularly well with questions requiring the selection of a relationship, followed by a calculation and final answer.

Section 1: objective test

Question 1	Most candidates identified both a vector and a scalar quantity from the selection provided.
Question 3	Many candidates calculated the initial speed of the car, given information about its deceleration and final speed.
Question 4	Many candidates identified the reaction to the force of the cup on the table as being the force of the table on the cup.
Question 5	Many candidates determined the work done in lifting the crate through the stated height.
Question 6	Many candidates determined the maximum amount of heat energy released when an asteroid burns up completely on entering the Earth's atmosphere, given information about its mass and speed.
Question 7	Many candidates calculated the speed of the satellite, given the information and relationship provided.
Question 8	Most candidates calculated the weight of the astronaut on Mars, given information about their weight on Earth.

Question 9	Many candidates determined the equivalent distance in metres to the distance to the star stated in light-years.
Question 10	Most candidates identified the elements present in the star, given the spectra provided.
Question 11	Most candidates identified which trace represented an a.c. supply and which traces represented d.c. supplies.
Question 12	Many candidates identified the charges on the particle and points Q and R, given the path taken by the particle as it travelled through the electric field around the points.
Question 13	Many candidates determined the resistance of the resistor, given the information provided about the circuit.
Question 14	Many candidates determined the total resistance of the combination of resistors shown.
Question 15	Many candidates determined the power dissipated in the lamp, given the information provided about the circuit.
Question 16	Many candidates selected the appropriate fuses for the appliances identified in the question, given their power ratings.
Question 18	Many candidates identified the correct statements about the substance, given the graph of how its temperature varied with time as it cooled.
Question 21	Most candidates determined the wavelength and amplitude of the transverse wave, given the information provided in the diagram.
Question 22	Many candidates correctly selected infrared as being the band of the electromagnetic spectrum that diffracts round objects more than visible light and that has a greater frequency than microwave radiation.

Question 24 Many candidates calculated the equivalent dose rate received from a source, given the equivalent dose received and the duration of the exposure.

Question 25 Most candidates identified the release of energy when two small nuclei combine during a nuclear reaction to form a larger nucleus as being a description of nuclear fusion.

Section 2: restricted and extended-response questions

Question 1(a)(i) Many candidates determined the magnitude of the resultant displacement of the gardener.

Question 1(c) Many candidates determined the work done in moving the lawnmower between the two points.

Question 2(a)(i) Many candidates calculated the weight of the rocket and satellite. However, some candidates did not round their final answer to an appropriate number of significant figures (see Physics: general marking principles, issue 6, under the 'General marking principles' section of our website.).

Question 4(c)(ii) Many candidates identified that the orbital period of the spacecraft will decrease when it moves to an orbit closer to Psyche.

Question 5(a) Many candidates explained that the foil dishes are repelled from the metal dome, as they have the same charge (positive) as the metal dome.

Question 6(a) Many candidates completed the circuit diagram to show how the components are connected to allow the specified measurements to be taken.

Question 7(c)(i) Many candidates correctly identified component X as a metal-oxide-semiconductor field-effect transistor (MOSFET) (or transistor).

Question 9(a)(ii) Many candidates calculated the minimum amount of time it takes to reduce the temperature of the water to 0 ºC, given the power rating of the ice maker and using the amount of energy removed from the water calculated in the previous part of the question.

Question 9(a)(iii) Many candidates made a suitable suggestion as to how the manufacturer could improve the ice-making machine to reduce the time it takes to reduce the temperature of the water to 0 ºC. Some candidates made suggestions (for example, 'place the ice maker in a colder room'), that were not improvements that the manufacturer could make.

Question 10(b)(i) Most candidates produced graphs with suitable scales, labels, and units. Most candidates were also able to plot their points accurately to within half a division. However, a few candidates used overly large markers or 'blobs' to indicate their points, the accuracy of which could therefore not be determined (the use of a neat '×' to indicate their points would avoid this). Some candidates were able to draw a suitable straight line through their points, which was appropriate for the data provided in the question. However, the lines some candidates produced were too carelessly drawn to be awarded any marks (for example, passing too far above or below many of the points, or having multiple or bifurcating lines).

Question 11(b)(ii) Most candidates calculated the average speed of the wave, given the length of the pool and the time taken for the wave to travel the length of the pool.

Question 11(b)(iii) Many candidates calculated the average wavelength of the waves, given the frequency of the waves and using the speed of the wave calculated in the previous part of the question.

Question 12(a)(ii) Many candidates stated that the GPS satellite is not geostationary, as well as providing a correct justification. As this is a 'must justify' question, candidates who did not attempt to justify their statement, or made incorrect statements of physics in their justification, were not awarded any marks (see Physics: general marking principles, issue 25b).

Question 13(a)	Many candidates stated the correct names given to angles X and Y.
Question 14(b)(i)	Many candidates stated a correct definition of the term ‘half-life’.
Question 14(c)(i)	Many candidates determined a value for the half-life of the radioactive source within the acceptable range, given the graph of how the activity of the source varies with time.
Question 14(c)(ii)	Many candidates predicted a value for the activity of the source within the acceptable range, at the time stated.
Question 15(c)	Many candidates made a suitable suggestion of a safety precaution the member of staff operating the X-ray scanner could take to minimise their exposure to the X-rays.

Assignment

Section 1: Most candidates were able to devise an appropriate aim for their investigation. There were a few examples of aims that could be answered with a simple yes or no conclusion (for example, ‘To find out if voltage affects current in a resistor.’); these are not acceptable as a National 5 assignment aim. There were a few assignments for which the aim was not at a level commensurate with National 5 Physics (for example, ‘To find out how the mass of an object affects its weight.’ or ‘To investigate how the height from which an object is dropped affects the time taken for it to reach the ground’). There were also a few assignments where the aim stated was not compatible with the experimental work carried out (for example, ‘To investigate Ohm’s Law’ when the experiment carried out involved measuring the current in and voltage across a lamp; or ‘To investigate how mass affects acceleration’ when the candidate actually changed the mass used to produce the unbalanced force, rather than the mass of the object being accelerated).

Section 3(a): Many candidates were able to provide a brief description of the approach used to collect experimental data. Some candidates produced overly long descriptions that amounted to a full procedure. A few candidates did not identify either what was being changed in their experiment or what was being measured.

Section 3(b): Most candidates included sufficient raw data from their experiment. A few candidates did not provide the raw results and only included their average values. There were also a few instances of candidates not making repeated readings. A few candidates did not include data that allowed calculation of quantities derived later in the report to be checked (for example, the mass of material being heated in an investigation to determine the specific heat capacity of the material).

Section 3(c): Many candidates obtained the mark for presenting data in a correctly produced table. A few candidates did not achieve this mark, as the overarching heading for the data columns did not extend to include the mean column. A few candidates omitted to provide units for all the columns in their table. A few candidates had missing or incorrect prefixes in the units for their data (for example, an Ohm's Law experiment where the candidate's data indicated measurements of current in the order of tens or hundreds of amps, rather than in milliamps).

Section 3(d): Many candidates calculated mean and/or derived values correctly. There were a few instances of candidates not rounding calculated values correctly or not stating calculated values to an appropriate number of significant figures. A few candidates who included derived variables in their aim did not calculate values for these derived variables (for example, resistance from experimental values of current and voltage). A few candidates who did not put their mean or derived values into a table did not include units with their calculated values. A few candidates who calculated the gradient of the line in their graph made incorrect substitutions, using values from their data rather than points on their line.

Section 3(e): Most candidates provided data from an internet/literature source that was comparable to their experimental data.

Section 3(f): Most candidates provided a suitable reference for the source of their internet/literature data. A few candidates, who chose to state their references elsewhere in the report, did not clearly identify which reference referred to their source of internet/literature data by citing it appropriately.

Section 4(a): Most candidates produced a graph of an appropriate format for their experimental data. A few candidates did not achieve this mark, as they connected their data points with straight-line segments to produce a line graph, when a scatter graph was the appropriate presentation format.

Section 4(b): Most candidates produced a graph with suitable scales. A few candidates produced graphs with non-linear scales that, in addition to not attracting any marks for this section, also made it impossible to award marks for accuracy of plotting points in section 4(d).

Section 4(c): Most candidates included suitable labels and units for the axes of their graph.

Section 5: Many candidates made a valid comparison between their experimental data and the data from their internet/literature. Some candidates made claims about the comparison that were not justified (for example, ‘both sources show that pressure is directly proportional to temperature’, where at least one of the sources did not support this claim).

Section 6: Although many candidates achieved the mark for stating a valid conclusion, a few candidates were not awarded the mark for this section because they did not address their aim in sufficient detail. For example, when candidates stated an aim of demonstrating a 'relationship' between two variables, they did not identify this relationship in their conclusion (for example, 'For a fixed mass of gas at constant temperature, pressure is inversely proportional to volume.' or 'The braking distance and velocity-squared of an object have a linear relationship').

A few candidates did not achieve this mark because their conclusion was not supported by all the data presented in their report.

A few candidates, whose aim was to find the value of a particular quantity, were not awarded the mark, as they did not acknowledge the value given in their internet/literature source, as well as the value they obtained experimentally.

Section 8(a): Most candidates provided an informative title.

Section 8(b): Most candidates produced a clear and concise report.

Areas that candidates found demanding

Question paper

In general, questions requiring justifications, descriptions or explanations are intended to be more demanding for candidates. There was often a lack of precision in candidates' responses, especially when using physics terminology and principles. Candidates who successfully answered questions that required justifications, descriptions or explanations were able to structure their answers to present information that was clear and relevant to the question being asked. They used correct terminology and referred to appropriate physics concepts (for example, in question 2(b)(ii), explaining, in terms of forces, how the parachute reduces the speed of the payload-fairing section).

The standard of written English was sometimes low. Some candidates were not using appropriate scientific terminology, and, in some cases, incorrect spelling or illegible handwriting made it difficult to interpret whether the candidate's response was correct.

Section 1: objective test

Question 2 — Only some candidates determined the displacement of the object given the graph of how its velocity varies with time.

Question 17 — Only some candidates identified both improvements to the experiment. Most candidates identified that insulating the beaker to reduce heat loss to the surroundings would be an improvement, and many identified that moving the immersion heater into the water would also be an improvement. However, many candidates were incorrect in identifying that using a stopwatch to measure the time for which the water was heated would be an improvement. Given the inclusion of a joulemeter in the experimental setup, no such measurement is required.

Question 19 — Only some candidates correctly determined the pressure exerted on the floor by the ballet dancer. Many candidates did not identify that the ballet dancer was standing on two feet, as shown in the diagram, and therefore the total area of contact between the ballet dancer and the floor is double the area of contact of the platform on each shoe.

Question 20 — Only some candidates determined the pressure of the air inside the ball following the increase in temperature. Some candidates did not convert the temperatures given in degrees Celsius to kelvin before carrying out the calculation.

Question 23 — Only some candidates calculated the number of nuclear disintegrations that occur in a period of time stated in hours, given the average activity of the source.

Section 2: restricted and extended-response questions

Question 1(a)(ii) Only some candidates determined the direction of the resultant of the displacement correctly. Some candidates did not express their answer as a three-figure bearing or as an angle relative to a compass point. There were a few examples of responses starting with incorrect statements of trigonometric relationships, for example, by stating $\theta = \tan\left(\frac{15}{36}\right)$, rather than $\theta = \tan^{-1}\left(\frac{15}{36}\right)$, for which no marks could be awarded.

Question 1(b) Although many candidates correctly determined the magnitude of the velocity of the gardener from point X to point Y, few also included the direction in their final answer, as is required for a vector quantity.

Question 2(a)(ii) Only some candidates calculated the initial acceleration of the rocket and satellite correctly. Although most candidates selected the correct relationship, some did not determine the value of the unbalanced force to be substituted into this relationship (the thrust of the rocket less the weight of the rocket and satellite).

Question 2(b)(i) Only some candidates correctly named the forces acting on the payload-fairing section and showed their directions. There was often a lack of precision in the naming of the downward force (for example, simply 'gravity', or 'gravitational field strength').

Question 2(b)(ii) Although many candidates stated that opening the parachute increases air resistance, few went on to explain that this then results in an unbalanced upward force acting on the payload-fairing section. It was clear that some candidates had a poor understanding of this area of the course by talking about things like forces becoming 'more balanced', or that opening the parachute 'decreases the unbalanced force'.

Question 2(b)(iii)	Only some candidates correctly stated the magnitude of the total upward force acting on the payload-fairing section at the specified point, as well as providing a correct justification. As this is a ‘must justify’ question, candidates who did not attempt to justify their statement, or made incorrect statements of physics in their justification, were not awarded any marks (see Physics: general marking principles, issue 25b).
Question 3	Although many candidates identified a factor that affects the length of a jump made by a ski jumper, only a few went on to develop their responses and demonstrate any depth of understanding. Most responses focused on the position and/or clothing of the ski jumper and how that affected air resistance. A few candidates demonstrated good understanding by discussing the relative effects of air resistance on the horizontal and vertical motion of the ski jumper. A few candidates demonstrated a good understanding of the physics involved in the curved ramp by discussing the significance of gravitational potential energy and kinetic energy, and how they affect the length of the jump. A few candidates made incorrect statements about how the weight of the ski jumper would affect the length of the jump (for example, ‘a heavier skier will fall faster’), without any reference to the effect of air resistance.
Question 4(a)	Only some candidates provided a complete explanation as to how passing close to Mars will reduce the journey time to Psyche, by linking together the concept of a ‘gravitational slingshot’ with an increase in speed of the spacecraft.
Question 4(b)(i)	Few candidates explained that applying a small, unbalanced force for a long period of time can result in a large increase in speed. Many candidates appeared to misinterpret the question by explaining how the lack of friction in space would allow the ion drive engines to provide a small, unbalanced force in the first place.

Question 4(b)(ii) Only some candidates explained why the solar cells produce less power as the spacecraft approaches Psyche, in terms of the energy received by the solar cells from the Sun. Some candidates simply stated that the spacecraft was further from the Sun, without any reference to the energy received.

Question 4(c)(i) Only some candidates correctly determined the orbital period of the satellite. Common reasons for incorrect responses to this question included incorrectly rounded intermediate or final answers (see Physics: general marking principles, issue 8), and incorrect conversion of the period to units of time other than days.

Question 5(b)(i) Only some candidates calculated the average current during the discharge of the Van de Graaff generator. Although most candidates selected the correct relationship, some did not deal appropriately with the 'milli' prefix stated in the value of the time (see Physics: general marking principles, issues 5a and 5b).

Question 5(b)(ii) Only some candidates determined the number of electrons transferred during the discharge process.

Question 6(b) Few candidates determined the resistance of the resistor, using the gradient of the graph as indicated in the question. Many candidates simply substituted values of voltage and current taken from a single point on the graph into the Ohm's Law relationship, without appreciating that the graph provided did not pass through the origin and therefore did not demonstrate direct proportionality. A few candidates misaligned the subscripts in the gradient relationship so that they became superscripts, and, as a result, were not awarded any marks (see Physics: general marking principles, issue 11).

Question 6(c) Only some candidates stated a correct conclusion about the resistance of the filament lamp, given the graph of voltage across the lamp against current in the lamp provided. A few candidates made no reference to the resistance at all and only described the effect of voltage on current.

Question 7(a)	Only some candidates described an advantage of connecting the spotlights as shown in the circuit. Some candidates stated that all the spotlights would have the same voltage across them, but were not awarded the mark as they did not make it clear that all the spotlights would operate at the correct voltage.
Question 7(b)	Only some candidates determined the total current drawn from the supply correctly. Some candidates failed to identify that there were four spotlights connected in parallel, and therefore that the total current was four times that in a single spotlight.
Question 7(c)(ii)	Few candidates provided a complete explanation of the transistor switching circuit in terms of the effect of the light level on the resistance and voltage across the LDR, and how this resulted in the transistor switching on. Some candidates demonstrated a poor understanding of transistor switching circuits by attempting to explain the operation of the circuit in terms of currents, rather than voltages.
Question 8	Although many candidates were able to identify certain aspects of the student's statement that were correct or incorrect, only a few went on to develop their responses and demonstrate any depth of understanding. Some candidates focused on the effect of adding another lamp to the circuit, but only a few of these were able to demonstrate a good understanding by discussing the relative effects on the brightness of the lamps of connecting lamps in series and parallel, in terms of the voltages and currents involved. Other candidates focused on the student's description of the movement of electrons in the circuit, or how the lamp produces light. Again, only a few of these were able to demonstrate a good understanding by using appropriate terminology (for example, current and voltage) and referring to appropriate physics concepts

(for example, the movement of electric charges in conductors due to electric fields, and energy transformations).

Question 9(a)(i) Only some candidates calculated the amount of energy removed from the water correctly. Some candidates did not round their final answer to an appropriate number of significant figures (see Physics: general marking principles, issue 6).

Question 9(b) Few candidates calculated the maximum mass of ice cubes produced correctly. Although most candidates selected the correct relationship, and many made correct substitutions, some candidates rounded their final answer to one significant figure. Given that the data provided in this question was all stated to three significant figures, such a response fell outwith the allowable range of significant figures (see Physics: general marking principles, issue 6).

Question 10(a) Only some candidates described how the kinetic model accounts for the pressure of the air in the syringe, by indicating that this is due to the collisions of the air particles with the walls of the syringe.

Question 10(b)(ii) Few candidates stated a conclusion about the relationship between the volume of a fixed mass of air at constant pressure and its pressure. Many candidates simply stated the effect of volume on temperature (for example, ‘as volume decreases, pressure increases’) without reference to proportionality or linearity, as is required when describing the relationship between quantities. A few candidates did not appreciate the significance of the values of the inverse of the volume stated in the question, rather than the values of the volume itself, and as a result made incorrect statements about the relationship, such as ‘pressure is directly proportional to volume’.

Question 10(b)(iii) Although some candidates used their graph to determine a value of the inverse of volume at the stated pressure, few went on to determine the corresponding volume, together with an appropriate unit. A few candidates without a line on their graph, or with a non-linear scale on their graph, were unable to access this mark.

Question 10(c) Only some candidates suggested a suitable way in which the experimental procedure could be improved to give more reliable results. Some candidates simply stated that measurements should be repeated, without any reference to averaging (or identifying outliers), which was insufficient to be awarded the mark. A few candidates used the terms ‘accuracy’ and ‘precision’ incorrectly in their description of their suggestion, and were therefore not awarded the mark.

Question 11(a) Only some candidates correctly stated what is meant by the term ‘transverse wave’.

Question 11(b)(i) This question required candidates to show that the frequency of the waves is 0.28 Hz. Although most candidates stated a correct relationship, as is required to gain any marks in this type of question, only some were able to show all the stages of the calculation together with the stated final answer and unit. Common issues included not showing the conversion of the time stated in minutes to seconds and intermediate rounding errors in the calculation (for example, a penultimate line stating ‘$f =$ 0.277777’, rather than rounding correctly, using an ellipsis, or using a recurrence dot or recurrence bar above the final 7).

Question 12(a)(i) This question required candidates to show that the time taken for a microwave signal to travel from the satellite to the GPS device is 0.067 s. Although most candidates stated a correct relationship, as is required to gain any marks in this type of question, only some showed the distance converted from kilometres (as given in the question) into metres at the substitution stage.

Question 12(b)(i) Few candidates identified a suitable detector for infrared radiation in the rangefinder. Common incorrect responses included ‘photographic film’ and ‘black bulb thermometer’, which, although being detectors of infrared radiation, are not suitable for the application described in the question.

Question 12(b)(ii)	Only some candidates calculated the frequency of the infrared radiation emitted by the rangefinder correctly. Although most candidates selected the correct relationship, some did not deal appropriately with the ‘nano-’ prefix stated in the value of the wavelength (see Physics: general marking principles, issues 5a and 5b).
Question 12(b)(iii)	Only some candidates correctly determined the distance of the target from the golfer. Although most candidates selected the correct relationship and made correct substitutions to determine the total distance travelled by the beam of infrared radiation, some did not appreciate the distance to the target was half of this value, as the beam was being reflected from the target.
Question 13(b)	Although many candidates identified that refraction takes place as the ray of red light enters the circular glass block (or that there is a change in frequency, wavelength or optical density), few went on to explain that the direction only changes as the angle of incidence is greater than 0º.
Question 13(c)	Only some candidates completed the diagram correctly to show the path of the ray of red light after it exits the block.
Question 14(a)	Only some candidates explained why a tracer that emits gamma radiation is used for the investigation, rather than one that only emits alpha or beta radiation. Many candidates made generic statements about the absorption or penetrative abilities of the different types of radiation, without any reference to the materials involved in the context of the question.
Question 14(b)(ii)	Only some candidates selected the appropriate radioactive source for the investigation, as well as providing a correct justification in

terms of both the half-life and type of radiation emitted. As this is a 'must justify' question, candidates who did not attempt to justify their statement, or made incorrect statements of physics in their justification, were not awarded any marks (see Physics: general marking principles, issue 25b).

Question 15(a)(i) Only some candidates calculated the absorbed dose received by the passenger correctly. Although most candidates selected the correct relationship, some incorrectly substituted the value of equivalent dose into the relationship.

Question 15(a)(ii) Although most candidates selected the correct relationship, only some went on to calculate the energy absorbed by the passenger correctly. This was often due to the incorrect treatment of the 'micro-' prefix given in the stem of the question.

Question 15(b) Only some candidates stated what is meant by the term 'half-life'.

Assignment

Section 2: Few candidates achieved all the marks available for this section. Many candidates only demonstrated a limited understanding of relevant physics. Candidates achieving marks for reasonable or good understanding were able to relate relevant physics concepts and/or principles to their topic and provide explanations that indicated a depth of understanding of these concepts and/or principles. When candidates had selected topics for which the underlying physics was at a level above National 5 (for example, light-dependent resistors (LDRs), thermistors or solar cells), it was often hard for them to demonstrate either reasonable or good understanding of the physics involved. The same was true when candidates had selected topics for which the underlying physics was at a level below National 5 (for example, the time taken for objects to fall).

Section 4(d): Only some candidates achieved the mark for this section. There were often errors in plotting data points and a few candidates used overly large markers for their data points that made it impossible to determine their accuracy. Some candidates did not draw a suitable line of best fit: either by drawing a straight line when a curve was more appropriate; by forcing a straight line through the origin; by drawing a 'wobbly' curve that did not show a consistent trend; or by drawing overly heavy or 'hairy' lines.

Section 7: Only some candidates were able to identify a factor that could have been expected to have a significant effect on the reliability, accuracy or precision of the experiment, and explain this factor. Many candidates simply stated that they would repeat the experiment more often or that they would take more data points in order to improve it, without recognising that there was little evidence for this statement in their experimental results. In addition, a few candidates did not use the terms 'reliability', 'accuracy', and 'precision' correctly in their explanation of the factor they identified. There is no requirement to use these terms, but, when used, candidates must use them correctly.

Section 3: preparing candidates for future assessment

Question paper

Each year, the question paper samples the full range of course content. This means that candidates should be familiar with all aspects of the course.

Candidates sometimes did not give any answer to particular questions, which may suggest lack of familiarity with the relevant course content. The question paper assesses application of knowledge and understanding, and application of the skills of scientific enquiry, scientific analytical thinking, and problem solving. Candidates should have the opportunity to practise these skills regularly to familiarise themselves with the type and standard of questions that may be asked.

Candidates **must** be given the opportunity to take an active part in a wide range of practical work to develop the necessary knowledge and skills. This will help candidates with questions that ask about experiments and practical contexts. 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.

Frequent use of physics terms and 'language' will help candidates develop their communication skills when answering questions.

Candidates should be familiar with the various 'command words' used in physics questions and how to respond to them. For example, when candidates are asked to 'show' a particular answer is correct, they should start their response with an appropriate relationship, show the correct substitutions and end with a final answer, including the correct unit, to obtain all the marks available. In a 'must justify' question, they must not only state or select the correct response, but also provide supporting justification to be awarded marks.

For questions requiring calculations, the final answer sometimes had the wrong unit, or the unit was missing. Centres should remind candidates that a final answer usually requires both a value and a unit. Candidates should also be familiar with the full range of units used for quantities covered in the National 5 Physics course.

In calculations, some candidates were unable to provide a final answer with the appropriate number of significant figures (or to round these correctly). It was evident that a few candidates confused significant figures with decimal places. Centres should ensure that candidates understand and can use significant figures correctly.

Candidates should be discouraged from copying down answers from their calculator containing a large number of significant figures, or using ellipses, as a penultimate stage in their response before stating their final answer, as often this can introduce transcription or rounding errors into their calculations. They should be encouraged to show only the selected relationship, the substitution, and then the answer, including units, to the appropriate number of significant figures.

Candidates should be given the opportunity to practise open-ended questions at appropriate points during the course. They should be encouraged to both state relevant physics concepts and relate them to the situation described in the question. Having attempted such questions, it may be beneficial for them to then consider a range of responses and to discuss how marks would be awarded for these responses. Such responses can either be generated by their peers or are available from sources such as our Understanding Standards website.

Candidates should ensure that they write as neatly as possible so their answers can be clearly interpreted by markers. They should also check their spelling, particularly for scientific terms such as ‘refraction’, ‘reflection’, ‘diffraction’, ‘fission’, and ‘fusion’.

The published marking instructions contain general marking principles, as well as detailed marking instructions for specific questions. Candidates should be encouraged to become familiar with the allocation of marks and the importance of complete final answers when answering numerical questions. Candidates should have access to specific marking instructions when practising exam-type questions. The marking instructions published on our website illustrate how marks are apportioned to responses.

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 are advised to adopt these general instructions for the marking of prelim examinations and centre-devised assessments for any SQA Physics courses.

Centres must ensure candidates are entered at an appropriate level.

Assignment

Centres are advised to consult the National 5 Physics Course Specification document in conjunction with Coursework assessment task for National 5 Physics, both available on our website. The latter document contains full details of the nature of the assignment task, together with advice to teachers and lecturers, detailed marking instructions, and instructions to candidates.

Centres are also advised to consult the generic document Guidance on conditions of assessment in the 'Coursework' section on our website for clarification and exemplification on acceptable conduct during coursework assessments.

Further support and candidate evidence with commentary for the assignment task is available on our Understanding Standards website.

Centres must ensure that a suitable range of topics is available to candidates. For example, in a class of 20 with candidates working in groups of 4 (the maximum permitted), a minimum of five different topics must be available. Teachers and lecturers must minimise the number of candidates in each class investigating each topic. This may mean that candidates do not get to investigate their first choice of topic if another group has already chosen it. It is not appropriate for a teacher or lecturer to allow two groups in the same class to investigate the same topic.

When choosing a topic, teachers or lecturers **must** provide advice on the suitability of the candidate's aim, taking into account health and safety considerations, the availability of resources and availability of internet and/or literature data, in order to ensure that all aspects of the assessment task are achievable. The topic chosen should be at a level commensurate with National 5 Physics.

For the reporting stage of the task, the following points should be noted:

Section 1: The aim should be one that is either experimentally investigable or one that can be modelled by an experiment (for example, the orbits of satellites by rotating masses on the end of a piece of string).

Aims that can be answered with a simple yes or no conclusion (for example, 'To find out if voltage affects current in a resistor') are not acceptable as a National 5 assignment aim.

Candidates should be made aware that when they choose to investigate the relationship between two variables, they must establish the relationship in order to be awarded the conclusion mark later in the report (for example, direct proportionality or linear relationship).

Section 2: To allow candidates to access all the marks for this section, careful advice on the choice of topic is essential. It was clear that some candidates chose topics for which the underlying physics was at a level above National 5 (for example, solar cells). Consequently, they struggled to explain the physics involved or ended up copying verbatim from references.

Section 3(a): Candidates should be made familiar with the skill of producing brief descriptions of experiments in preparation for the assignment by practising during normal classroom activities. Brief descriptions should include, as a minimum, an indication of what was being changed and what was being measured.

Section 3(b): Candidates should be made aware of the need to provide the actual raw results of their experiment, rather than just their average values. Candidates must also ensure that they include repeated measurements.

The data provided in this section must be from an experimental activity, carried out either individually or as part of a small group. Data that is produced from a (computer) simulation, such as half-life or stopping distance of cars for various road conditions, is not acceptable as experimental raw data.

Section 3(c): Centres should advise candidates to check thoroughly that they have included all appropriate headings and units for their data presented in tables. In particular, they should ensure that columns for mean values are not separated from overarching headings.

Centres are not permitted to provide a blank or pre-populated table for experimental results.

Section 3(d): Candidates should be made familiar with the requirement to calculate mean and/or derived values accurately, both in terms of stating the value to an appropriate number of significant figures and in terms of rounding. Centres are advised to consult the Physics: general marking principles document on our website for further details on these issues.

Candidates should also be encouraged to check their calculations carefully, as simple transcription errors often prevented the awarding of the mark for this section.

Candidates should be made aware that all the data they process in the report is considered when awarding the mark for this section; this includes any calculations of gradients, as well as all mean and derived values.

Section 3(e): Candidates should be able to find suitable internet and/or literature data to compare against their experimental data. Ideally, the choice of topic would allow access to a wide range of sources.

Centres must not provide candidates with a set of experimental data to compare with the candidate's own data or direct candidates to specific sources.

Section 3(f): Centres should ensure that candidates know that 'in sufficient detail to allow them to be retrieved by a third party' means candidates must give the full URL for a website; and for a textbook give the title, author, page number, and either edition number or ISBN.

Candidates should also be familiar with the requirement that the reference appears beside internet and/or literature data or is cited and then referenced later in the report.

Section 4(a): Candidates should be familiar with selecting an appropriate format for the graphical presentation of their data:

- A scatter graph is appropriate when both the dependent and independent variable are continuous and any change in the dependent variable is brought about by a change in the independent variable. This is usually the case in physics experiments.

- A line graph is appropriate when both the dependent and independent variable are continuous and any change in the dependent variable is not directly brought about by a change in the independent variable. This is not usually the case in physics experiments.

- A bar graph should be used when the independent variable is discrete. This is not usually the case in physics experiments.

Candidates should be made aware that there are no marks available for presenting the data obtained from an internet and/or literature source, or from a simulation, in a graphical format.

When candidates are hand-drawing graphs, they should be provided with graph paper that includes major and minor gridlines; squared paper is not appropriate.

Section 4(b): Candidates should be encouraged to double check that graph axes have suitable scales. In particular, they should ensure the scales are linear over the data range and that some values have not inadvertently been omitted.

Candidates should be advised to use scales that allow the accuracy of plotting to be readily checked.

Section 4(c): Candidates should be familiar with the requirement to provide suitable labels and units for the axes of their graph. These can often simply be transcribed from their data table.

Section 4(d): Candidates should be familiar with the requirement to plot data points accurately to within half a minor division on the scale.

Candidates should be advised to avoid using overly large data markers (to avoid large ‘blobs’ and use a neat ‘×’ or ‘+’) when plotting points on their graph.

Candidates should be given the opportunity to practise their graph drawing skills using real experimental data — in particular, the skill of drawing a line of best fit that is appropriate for the data.

When using Excel or other software packages to draw graphs, candidates should ensure that the accuracy of the data points can be ascertained by markers by using small data point markers, making the graphs a suitable size, and including both major and minor gridlines.

Section 5: Candidates should be familiar with the skill of making valid comparisons between sets of data. Again, this is a skill that can be rehearsed during normal classroom activities.

Section 6: Candidates should be aware that their conclusion must relate to their aim and must be supported by **all** the data in their report. Where the data included in their report provides conflicting results, candidates should acknowledge this in their conclusion (for example, ‘The internet data shows that the specific heat capacity of water is 4180 J kg^{-1} $^{o}C^{-1}$, but my experiment gave a value of 5600 J kg^{-1} $^{o}C^{-1}$.’).

As mentioned previously, candidates should be made aware that when they choose to investigate the relationship between two quantities, this will require them to establish the relationship for the conclusion mark to be awarded later in the report (for example, direct proportionality or a linear relationship).

Section 7: Centres should ensure that candidates are provided with opportunities to develop the skill of evaluating experimental procedures during the course. This can be achieved by regular exposure to practical activities, together with appropriate questioning related to these activities.

It should be made clear to candidates that blanket statements, such as 'repeat more often' or 'increase the number of data points' are unlikely to attract any marks for the evaluation, unless they are justifiable in terms of the candidate's experimental results.

Centres should make candidates aware that evaluative statements must be relevant and appropriate to their experimental procedure. Teachers and lecturers should advise candidates not to copy or memorise Understanding Standards materials, as these may not match or be appropriate to the experimental set up or procedure the candidates used.

Candidates should be able to use the terms 'reliability', 'accuracy', and 'precision' correctly in their explanations.

Section 8: Although not a requirement, candidates should be encouraged to follow the structure suggested in the 'Instructions to candidates' section of the Coursework assessment task for National 5 Physics in order to produce a clear and concise report. The use of headings can often assist markers when identifying where to award marks.

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.