Course report 2024

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 2024 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2023: 13,237

Number of resulted entries in 2024: 13,353

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	4,596	Percentage	34.4	Cumulative percentage	34.4	Minimum mark required	86
B	Number of candidates	2,861	Percentage	21.4	Cumulative percentage	55.8	Minimum mark required	73
C	Number of candidates	2,408	Percentage	18.0	Cumulative percentage	73.9	Minimum mark required	60
D	Number of candidates	1,841	Percentage	13.8	Cumulative percentage	87.7	Minimum mark required	47
No award	Number of candidates	1,647	Percentage	12.3	Cumulative percentage	100	Minimum mark required	N/A

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 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. Statistical analysis indicates that average marks were higher than in the 2023 and 2022 question papers, and similar (if a little higher) than those in the 2019 paper.

The grade boundaries for this assessment were reduced below the notional values at the grade A boundary and grade C boundary.

In Section 2 (restricted and extended-response questions), questions 2(a)(ii), 2(c)(i) and 12(a) were more demanding than expected. The grade boundaries were reduced to take account of this.

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

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 4(c), explaining the effect on the acceleration of the transportation module as it returns to the orbiting spacecraft).

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

Assignment

The assignment assesses the application of skills of scientific enquiry and related knowledge and understanding of physics. 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.

Statistical analysis indicates that average marks for the assignment were very similar to those achieved in 2019, which was the last time the assignment formed part of the course assessment.

Most candidates appear to be following the advice available to them in the 'Instructions for candidates' section of the course assessment task document, 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

Section 1: objective test

Question 1 — Many candidates were able to identify the scalar or vector nature of speed, weight and energy.

Question 2 — Most candidates were able to identify the measurements that would allow the specified average and instantaneous speeds of the trolley to be determined.

Question 3 — Many candidates identified the reaction to the force of the rocket engines on the exhaust gases as being the force of the exhaust gases on the rocket engines.

Question 4 — Many candidates were able to calculate the minimum power required to raise a mass through the stated height in the stated time.

Question 5 — Many candidates correctly selected the statement that the horizontal speed of the satellite is constant. However, some also incorrectly selected the option that while orbiting the planet the satellite is weightless.

Question 7 — Most candidates were able to select the appropriate period for the satellite based on its altitude, given the information about altitude and period of the other satellites.

Question 8 — Most candidates were able to identify that the approximate age of the Universe is 13.8 billion years and that the ‘Big Bang’ theory describes the origin of the Universe.

Question 11 — Many candidates were able to calculate the reading on the voltmeter in the potential divider circuit shown.

Question 13 — Many candidates were able to determine the total resistance of the three resistors connected in parallel.

Question 14 — Most candidates calculated the power developed in the wire correctly.

Question 15 — Most candidates identified that placing insulation around the copper block would improve the accuracy of the experiment to determine the specific heat capacity of copper.

Question 16 — Many candidates identified the section of the graph that would provide the time required to allow the specific latent heat of vaporisation of the substance to be determined.

Question 17	Many candidates were able to calculate the new pressure inside the syringe. However, some candidates did not take into account that the volume was being reduced by the stated amount and instead used this value as the final volume of the air in the syringe.
Question 18	Most candidates were able to calculate the volume of the object that experiences the specified buoyancy force, given the information and relationship provided.
Question 19	Most candidates were able to determine the frequency of the wave from the stated speed of the wave and the information provided in the diagram that allowed the wavelength to be determined.
Question 20	Many candidates identified that infrared has a longer wavelength than visible light and that the speed of infrared is the same as visible light. However, some, incorrectly, thought that infrared diffracts less than visible light.
Question 21	Many candidates were able to determine the angle of incidence in glass and the angle of refraction in air from the diagram provided.
Question 22	Most candidates identified that ionisation can be described as the removal of an electron from an atom to form a charged particle.
Question 23	Many candidates determined the activity of the source correctly, given information about the number of decays in the time stated in hours.
Question 24	Many candidates were able to determine the total equivalent dose received by the sample of tissue given the information about the absorbed doses received from different types of radiation.

Section 2: restricted and extended-response questions

Question 1(a)(ii)	Most candidates stated that the bus is moving at a constant speed between B and C.
Question 1(b)	Many candidates were able to calculate the acceleration of the bus between C and D. However, a few candidates confused the final and initial velocities of the bus in the substitution stage of their calculation.
Question 1(c)	Many candidates were able to determine the distance travelled by the bus between A and D using the area under the graph method.
Question 2(b)	Most candidates were able to suggest one way in which the triathlete could reduce the frictional forces acting against them when cycling.
Question 3(a)(i)	Many candidates were able to determine the decrease in kinetic energy of the skateboarder and board. A few candidates substituted the difference in speed into the kinetic energy relationship, resulting in an incorrect final answer. As the speed is squared in the relationship, the substitutions must

be made independently. (The difference between the squares of two numbers is not the same as the square of the difference between those numbers.)

Question 3(a)(ii)	Many candidates were able to calculate the average frictional force between the rail and the skateboard using the relationship for work done, force and distance. A few candidates were able to calculate the average frictional force by an acceptable alternative method involving determining the average speed of the skateboarder, the time taken for the slide, the acceleration of the skateboarder and the $F = ma$ relationship.
Question 3(b)	Many candidates were able to sketch the path of the skateboarder and board between leaving the rail and reaching the ground.
Question 4(a)	Many candidates calculated the weight of the astronaut at the specified altitude correctly, given their mass and the graph of gravitational field strength against altitude.
Question 6(a)	Many candidates were able to state an advantage of a space-based telescope compared to ground-based telescopes. A few candidates made vague statements such as 'it gets a clearer image', without clarifying the reason for this. A common misconception was that a space-based telescope would be closer to what is being viewed when, on an astronomical scale, the difference in distance would be irrelevant.
Question 6(b)(i)	Many candidates were able to describe what is meant by the term exoplanet. A few candidates gave incorrect responses, such as 'a planet that no longer orbits a star' or 'a planet that is outside our galaxy'.
Question 6(b)(ii)	Many candidates were able to determine the distance to the star in metres, given its distance in light-years. A few candidates overly rounded intermediate values in their calculations leading to an incorrect final answer.
Question 6(c)	Most candidates were able to determine the elements present in the star from the information provided in the spectra.
Question 7(b)	Many candidates were able to calculate the charge supplied to the charger in the stated time. Most candidates selected the correct relationship for this calculation, but a few did not convert the time stated into seconds to arrive at a correct final answer in coulombs.

Question 8(a)(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 have avoided this). Some candidates were able to draw a suitable best fit curve through their points, which was appropriate for the data provided in the question. However, the curves produced by some candidates were too carelessly drawn to be awarded any marks (for example, passing too far away from many of the points, having multiple lines or having significant inflections in their curves). A few candidates attempted to draw a ‘best-fit’ straight line through their points, which was incorrect for the data provided in the question.

Question 8(a)(ii) Many candidates were able to use their graph to determine the voltage across the lamp at the stated current. 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 8(b) Many candidates sketched a correct graph for voltage against current for a fixed resistor.

Question 9(a)(i) Most candidates selected the correct relationship and made the correct substitutions to determine the energy required to heat the water. However, some candidates did not round their final answer to an appropriate number of significant figures.

Question 9(a)(ii) Most candidates selected the correct relationship to calculate the energy required to change the stated mass of water at its boiling point to steam. Many then went on to substitute in the correct value for the specific latent heat of vaporisation and arrive at a correct final answer.

Question 9(b)(i) Most candidates calculated the total energy used by the microwave correctly, given the information about its power and the time for which it was switched on.

Question 10(b) Most candidates selected the correct relationship to determine the force applied by the tyres to the ground (the weight of the cyclist and bike) and many went on to correctly determine the mass of the cyclist and bike. A few candidates attempted to use the $F = ma$ relationship in the second stage of their calculation (rather than the $W = mg$ relationship), which was incorrect physics, as there is no unbalanced force acting on the cyclist and bike in the vertical direction, and no acceleration in that direction.

Question 11(b)(i) Most candidates were able to calculate the frequency of the wave, given the time taken between the crests of the wave passing a point.

Question 14(a)	Many candidates were able to determine the activity of the source after the stated duration, from the information given about its initial activity and half-life.
Question 14(b)(i)	Many candidates were able to determine the length of time that the masks remain in the steriliser, given information about the absorbed dose received each second and the total absorbed dose required.
Question 14(b)(ii)	Many candidates were able to calculate the energy absorbed by each face mask.

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 appropriate to 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).
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.
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.

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 or literature source that was comparable to their experimental data.
Section 3(f)	Most candidates provided a suitable reference for the source of their internet or 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 or 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 or literature source. 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 had a stated 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 as their conclusion was not supported by all the data presented in the 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 or 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

Section 1: objective test

Question 6	Some candidates were able to calculate the distance from the Earth to the Moon using the information provided. However, many did not take into account that the time stated in the stem of the question was the time for the pulse of light to travel from the Earth to the Moon and back (that is, a reflection).
Question 9	Some candidates were able to determine the charges on the particle and the point charges from the path of the particle shown in the diagram.
Question 10	Only some candidates provided a correct response to this question. Although most candidates identified that the plug of the toaster should be fitted with a fuse rated at 13 A, a few also thought, incorrectly, that either the heating element transfers 12 000 J of electrical energy each second, or that the charge passing through the heating element each second is 230 C.
Question 12	Some candidates were able to determine the effect on the readings on the ammeters when the light level incident on the LDR decreases in the circuit shown. Some candidates thought, incorrectly, that the current in the parallel branches of the circuit would stay the same.
Question 25	Only some candidates identified that taking readings of the count rate over a longer period of time would allow the technician to more easily determine the half-life of the radioactive source. Some candidates

thought, incorrectly, that moving the radioactive source closer to the Geiger-Müller tube would improve the experiment.

Section 2: restricted and extended-response questions

Question 1(a)(i) Only some candidates described the motion of the bus between A and B as constant acceleration. Many candidates simply stated that the bus was accelerating and didn't identify that the acceleration was constant.

Question 2(a)(i)(A) Some candidates determined the magnitude of the resultant of the forces correctly. However, some accompanied their answer with an incorrect vector diagram, indicating a poor understanding of how to add forces as vectors. These candidates were not able to achieve all the marks available in this part of the question.

Question 2(a)(i)(B) Some candidates determined the direction of the resultant of the forces correctly. However, as in the previous part of the question, some accompanied their answer with an incorrect vector diagram. Again, these candidates were not able to achieve all the marks available in this part of the question. 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

$\theta = \tan\left(\frac{12}{25}\right)$, rather than

$\theta = \tan^{-1}\left(\frac{12}{25}\right)$, for which no marks could be awarded.

Question 2(c)(i) Only some candidates were able to determine the average speed of the triathlete for the running stage of the triathlon. Although most candidates selected the correct relationship, many did not take account of the fact that this stage of the triathlon consisted of four laps, as stated in the stem of the question.

Question 2(c)(ii) Only some candidates stated that the magnitude of the average velocity for the running stage of the triathlete was zero. Although a unit was not required in the response to this question, a few candidates did not gain the mark available by stating an incorrect unit for velocity (for example, '0 m').

Question 4(b) Only some candidates described a physics-related challenge astronauts will face while on the surface of the Moon (for example, exposure to radiation, pressure differential or lower gravitational field strength). Some candidates gave non-physics-related challenges including a lack of food, water or oxygen. A few candidates made incorrect statements about there being 'no gravity on the Moon', or that the astronauts were in danger of 'floating away'.

Question 4(c)	Only some candidates identified that the acceleration of the transportation module would increase during its return to the orbiting spacecraft. Few candidates were able to justify this effect by describing how either the mass of the module decreases as fuel is used, or that the gravitational field strength decreases with altitude. Even fewer then went to describe how these factors affect the weight or unbalanced force acting on the module. As this is a 'must justify' question, candidates who did not attempt to justify the effect, or made incorrect statements of physics in their justification, were not awarded any marks (see issue 25b in the Physics: general marking principles document, available on the National 5 Physics subject page).
Question 5	Although many candidates identified that the Copernican model of the Universe is incorrect in stating that the Sun is not motionless or that the stars are not in a fixed position, only a few went on to develop their responses and demonstrate any depth of understanding. A few candidates made incorrect statements about the relative motion of different celestial objects, such as 'stars orbit planets' or 'galaxies orbit stars'. A few candidates demonstrated good understanding, such as describing the motion of the Sun around the galaxy due to the gravitational attraction between objects in the galaxy (including the supermassive black hole at its centre), or that the Universe is expanding and that galaxies (and therefore stars) are moving away from each other.
Question 7(a)	Only some candidates were able to explain what is meant by direct current, in terms of electron flow. Some candidates made no reference to electrons in their response, as required in the stem of the question, and stated that it was a current that moves in one direction, which was insufficient to gain the mark available.
Question 7(c)	Few candidates explained how the circuit shown operates to turn on the fan when the temperature of the charger increases above a certain level. Many candidates did not state that the voltage across the thermistor would decrease or that the voltage across the resistor would increase, and many candidates did not clearly indicate that the transistor would switch 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. A few candidates made the incorrect statement that 'the resistance of the resistor increases'. A few candidates also incorrectly described voltage as 'passing through' components.

Question 7(d) Most candidates selected the correct relationship to determine the resistance of the resistor in series with the LED. However, only some identified the voltage to be substituted into the relationship was the voltage across the resistor, which was determined by subtracting the voltage across LED from the supply voltage. A few candidates did not gain all the marks available in this question due to rounding and significant figure errors in their intermediate working and/or final answers.

Question 8(a)(iii) Some candidates were able to describe how the student obtained a range of values of current and voltage using the circuit shown. Although many candidates identified that the variable resistor was involved, only some indicated clearly that the resistance of the variable resistor should be varied.

Question 9(a)(iii) Some candidates were able to determine the minimum energy required to produce the stated mass of steam from the water at its initial temperature, by adding together the answers to the previous two parts of the question. A common misconception was to subtract the answers to the previous two parts from each other.

Question 9(b)(ii) Some candidates correctly identified that either heat was lost to the surroundings or that some energy was used in other parts of the microwave (for example, to rotate the turntable or power the display). Some candidates did not make it clear that heat was lost to the surroundings, rather than just energy, and a few did not make it clear where the heat was going.

Question 10(a)(i) Although most candidates selected the correct relationship to determine the pressure of the gas inside the tyre at the new temperature, only some converted the temperatures to kelvin at the substitution stage. Many candidates substituted the values in °C and, as a result, did not gain any more than the mark available for selecting the correct relationship. A few candidates misaligned the subscripts in their relationships so that they became superscripts, and, as a result, were not awarded any marks (see issue 11 in the Physics: general marking principles document, available on the National 5 Physics subject page).

Question 10(a)(ii) Some candidates were able to explain, using the kinetic model, how the decrease in temperature affects the pressure of the gas inside the tyres. A few candidates omitted to state that ‘gas particles collide with the walls of the container’ in their response. A few candidates did not make it clear that these collisions were less frequent (rather than there just being ‘fewer’). A few candidates attempted to explain how increasing the temperature of the gas would increase the pressure in tyres, without making any attempt to address the situation described in the stem of the question of the temperature decreasing. These responses were not awarded any marks.

Question 11(a) Few candidates were able to state what is meant by the term transverse wave.

Question 11(b)(ii) Some candidates were able to suggest how the accuracy of the frequency of the waves determined by the engineer could be improved. A few candidates stated that more measurements should be taken, but did not state that these measurements should then be averaged. A few candidates made unfeasible suggestions for the situation described, such as using light gates and an electronic timer.

Question 11(c) Some candidates correctly determined the average electrical power produced by the converter for the stated amplitude of the wave. Some candidates did not take into account that the wave height was double the amplitude before using the graph to determine the power produced.

Question 11(d) Many candidates drew diagrams showing diffraction of the wave behind the harbour wall, but only some gained all the marks available by showing consistent wavelengths before and after the harbour wall. A few candidates drew diagrams showing diffraction as if it were through a gap (by including curved sections above the harbour wall), which was incorrect.

Question 12(a) Although many candidates stated that the speed of sound was required to calculate the distance between the student and the firework when it explodes, some stated that the speed of light was also required, which is incorrect. The time for the light to reach the student would be negligible compared to that of the sound.

Question 12(b)(i) Few candidates were able to explain why the ray of red light passing through the centre of the lens does not change direction.

Question 12(b)(ii) Only some candidates stated that the frequency of the red light in the lens is equal to the frequency of the red light in air.

Question 12(c) Some candidates identified that the amplitude of the second bang from each explosion would be less than that of the first bang, but few were able to justify this in terms of a decrease in energy. As this is a 'must justify' question, candidates who did not attempt to justify the effect, or made incorrect statements of physics in their justification, were not awarded any marks (see issue 25b in the Physics: general marking principles document, available on the National 5 Physics subject page).

Question 13	Most candidates were able to demonstrate at least a limited understanding of physics by simply making correct statements about the dangers of different types of radiation. Candidates who were awarded marks for reasonable or good responses were able to make comparisons between the relative dangers of different types of radiations (for example, nuclear and electromagnetic) as well as commenting on the shortcomings of the statements made by the students in the question.
Question 15(a)	Few candidates were able to explain why solar cells may not be a suitable source of power when exploring distant parts of the Solar System.
Question 15(b)	Few candidates were able to explain why the decay of plutonium to uranium is described as a nuclear fission reaction. Often candidates did not make it clear that it is nuclei that are split in a fission reaction (rather than 'atoms' or 'elements').
Question 15(c)	Few candidates were able to describe the role of neutrons in a nuclear fission chain reaction. Although some candidates indicated that neutrons were released from one fission reaction, few made it clear that these neutrons went on to cause further fission reactions (rather than just 'hit' further nuclei). A few candidates indicated in their responses that it is the neutrons that are repeatedly split.
Question 15(d)	Some candidates were able to explain why the power output of the RTGs on Voyager 2 have decreased over time, in terms of the decrease in activity of the source.

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, 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 the accuracy of plotting. 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. Candidates are not required to use these terms, but if they do, they must use them correctly.

Section 3: preparing candidates for future assessment

Centres are reminded that National 5 Physics is a practical course that requires the development of knowledge, understanding and skills related to practical work.

Candidates must be given the opportunity to take an active part in a wide range of practical work throughout the course to develop the necessary knowledge and skills. This will help candidates with questions that ask about experiments and practical contexts. This should also enable candidates to improve their performance in the assignment.

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.

Centres are reminded that in the assignment teachers and lecturers must ensure a range of topics is available for candidates to choose from and minimise the number of candidates in a class investigating the same topic. For example, in a class of 20 and given that candidates can work in groups of up to four, there should be a minimum of five different topics available, with each group investigating one of the topics. While it was evident that some centres had offered up to seven or eight different topics and ensured each group in a class was investigating a different topic, others had offered only two or three and had not minimised how many in a class were investigating the same thing. For clarity, a topic is something such as specific heat capacity or Boyle’s law. Having groups in the same class investigate the specific heat capacity of different materials would still mean that the groups were investigating the same topic.

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 could 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.

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 missed the unit out. 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 National 5 Physics.

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 confuse significant figures with decimal places. Centres should ensure that candidates understand and can use significant figures correctly.

Candidates should be strongly 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 have sight of a range of responses and to discuss how marks would be awarded for these responses. These responses can either be generated by their peers or are available from sources such as SQA's 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 SQA's website illustrate how marks are apportioned to responses.

Centres should also refer to the Physics: general marking principles document on the National 5 Physics subject page for generic issues related to the marking of question papers. Centres must 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 in conjunction with the National 5 Physics coursework assessment task document (both on the National 5 Physics subject page). The coursework assessment task 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. The coursework assessment task document also details clearly the conditions of assessment that must be adhered to during both stages of the assignment.

Centres are also advised to consult the generic document Guidance on conditions of assessment, available on the National 5 Physics subject page, for clarification and exemplification on acceptable conduct during coursework assessments.

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

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 the availability of internet or literature data to ensure that all aspects of the assessment task are achievable. The topic chosen should be at a level commensurate with National 5 Physics.

As far as the reporting stage of the task is concerned, 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.

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, this will require them to establish the relationship for the conclusion mark to be awarded later in the report (for example, direct proportionality).

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. Some chose topics that were at National 4 or even National 3 level, and they struggled to include physics that was appropriate to National 5 level.

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 practical 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. They 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 the National 5 Physics subject page 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 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 or literature data or is cited and 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.

Candidates should be made aware that there are no marks available for presenting the data obtained from an internet 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 the use of overly large data markers (ie, 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, they should practise 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 (for example, by using small data point markers 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 practical 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 provided in the report provides conflicting results, this should be acknowledged in the candidate's 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.

Candidates should be reminded that they do not need to use the terms 'reliability', 'accuracy' and 'precision' in their report, but if they do, they must be able to use them correctly.

Section 8: Candidates should be encouraged to follow the structure suggested in the 'Instructions to candidates' to produce a clear and concise report. Using headings can often assist markers when identifying where to award marks.

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.

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.

During the pandemic, we modified National Qualifications course assessments, for example we removed elements of coursework. We kept these modifications in place until the 2022–23 session. The education community agreed that retaining the modifications for longer than this could have a detrimental impact on learning and progression to the next stage of education, employment or training. After discussions with candidates, teachers, lecturers, parents, carers and others, we returned to full course assessment for the 2023–24 session.

SQA's approach to awarding was announced in March 2024 and explained that any impact on candidates completing coursework for the first time, as part of their SQA assessments, would be considered in our grading decisions and incorporated into our well-established grading processes. This provides fairness and safeguards for candidates and helps to provide assurances across the wider education community as we return to established awarding.

Our approach to awarding is broadly aligned to other nations of the UK that have returned to normal grading arrangements.

For full details of the approach, please refer to the National Qualifications 2024 Awarding — Methodology Report.