Course Report 2018

Subject	Physics
Level	National 5

This report provides information on the performance of candidates. 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. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

The statistics used in this report have been compiled before the completion of any Post Results Services.

Section 1: comments on the assessment

Summary of the course assessment

Component 1: question paper

The National 5 question paper consists of section 1, which is an objective test worth 25 marks, and Section 2, which contains restricted and extended response questions worth 110 marks. Section 2 is scaled to 75 marks.

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

The general impression of markers was that the question paper was of a similar standard to previous years and that the paper included appropriate questions to provide good discrimination for candidates performing at grades A and B. The statistical analysis indicates similar average marks compared to previous years.

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

Several markers observed that some responses suggest some candidates had not prepared effectively for the assessment or had been inappropriately presented. Statistical analysis shows that a substantial number of candidates achieved marks well below the grade C boundary.

Component 2: assignment

In the National 5 assignment, candidates carry out research on a topic and communicate the findings of their research in a report. The research stage of the assignment must involve an experiment that allows measurements to be made. Candidates must gather data from the internet, books or journals to compare with their experimental results.

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.

The majority of candidates appear to be following the advice available to them within 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. However, some candidates appeared to have a poor understanding of the requirements of the task.

Section 2: comments on candidate performance

Areas in which candidates performed well

Component 1: question paper

Section 1: objective test

Questions 1, 2, 4, 5, 6, 7, 8, 10, 14, 15, 18, 19, 21, 22 and 25 were answered particularly well with the majority of candidates selecting the correct response.

Section 2: extended answers

Many candidates coped well with questions requiring the selection of a relationship followed by a calculation and final answer.

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 1(b) the effect of fuel being used on the weight of the aircraft and the relationship between force, area and pressure).

Q1(a)(i)(A): Most candidates calculated the magnitude of the resultant of two forces acting at right angles.

Q3(a): The vast majority of candidates calculated the kinetic energy of an object, having been given its mass and speed.

Q3(b)(i): Most candidates applied the principle of conservation of energy to determine the maximum height of an object using the value of kinetic energy calculated in the previous part of the question.

Q3(c): Most candidates indicated that projectiles follow a curved path by adding a suitable curved line to a diagram.

Q4(a): The majority of candidates carried out a unit conversion from AU to metres, having been provided with appropriate information.

Q4(a)(ii): The majority of candidates determined the time taken for light from the Sun to reach Mars, using the distance determined in the previous part of the question.

Q6(a): The majority of candidates calculated the voltage across a resistor in a voltage divider circuit.

Q6(c): Most candidates calculated the charge supplied to a component given information about the current and the time, including the conversion of units of time from hours to seconds.

Q8(a)(i): The majority of candidates determined the specific heat capacity of a material using a range of information provided about an experimental activity, including the initial and final temperature of the material, energy supplied and mass of material.

Q10(a): Most candidates calculated the distance travelled by a microwave signal in a specified time.

Q11(c): The majority of candidates calculated the energy absorbed from a source of radiation, given information about the absorbed dose and the mass of the body absorbing the radiation.

Component 2: assignment

Section 1: The vast majority of candidates devised an appropriate aim for their investigation.

Section 3(b): The majority of candidates provided sufficient raw data from an experimental activity that covered a suitable range of values for their stated aim and, where appropriate, included repetition.

Section 3(e): The vast majority of candidates included in their report data from an internet/literature source relevant to their experiment.

Section 3(f): Most candidates provided a suitable reference for the source of internet/literature data included in their report; and either placed the reference next to the internet/literature data, or cited it and referred to it later in the report.

Section 4(a): The vast majority of candidates selected an appropriate format for the graphical presentation of their experimental data. In the majority of cases this was in the form of a scatter graph.

Section 4(b): Most candidates selected suitable scales for the axes of their graph that were linear across the data range.

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

Section 8(a): The vast majority of candidates provided an informative title for their report.

Section 8(b): The vast majority of candidates produced a clear and concise report.

Areas which candidates found demanding

Component 1: question paper

Section 1: objective test

Questions 3, 11, 12, 13, 17, 20 and 23 were answered incorrectly by over half the candidates.

Q3: Many candidates mistakenly thought that at the maximum height the forces on the ball became balanced.

Q11: Many candidates failed to identify that in an a.c. circuit, the size of the current varies with time.

Q12: Only some candidates determined the polarities of the charges on a particle and at points in an electric field, given the path of the particle as it moved through the field.

Q13: Only some candidates correctly identified the effects of decreasing the temperature of a thermistor in a transistor switching circuit, given a circuit diagram and information about the behaviour of the thermistor in response to a change in temperature.

Q17: Many candidates failed to identify that they were being asked to determine the outward force on the door due to the pressure difference, rather than just the outward pressure on the door due to the air inside the aircraft.

Q20: Some candidates incorrectly thought that diffraction occurs when waves pass from one medium into another, and some candidates incorrectly thought that microwaves diffract more than radio waves.

Q23: Only some candidates calculated an equivalent dose received by a tissue sample given an equivalent dose rate in mSv h^{-1} and a time in minutes.

Section 2: extended answers

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.

Q1(a)(i)(B): Although most candidates calculated an angle for the resultant of two forces acting at right-angles, many candidates were unable to express this angle as a bearing or compass direction.

Q1(b): Although many candidates identified the weight, or downward force, of the aircraft on the runway would decrease as it uses fuel, few extended this answer to include the relationship between force, area and pressure in order to explain why the pressure exerted by the tyres of the aircraft on the runway decreased.

Q2(a): Only some candidates clearly indicated the time taken for the card to pass through light gate X as the additional measurement required.

Q2(c): Only some candidates identified the trolley's velocity was negative after the trolley rebounds from the elastic. Fewer candidates were subsequently able to identify that at its maximum height back up the ramp the trolley's velocity would be zero.

Q3(b)(ii): Few candidates were able to explain why the actual height of the jump would be less than previously calculated, by connecting the friction/air resistance acting on the bike with the concept of energy loss.

Q3(c)(ii): A number of candidates who started the question with an incorrect equation (for example $v = at$ or $v = gt$) were unable to access any of the marks available for this question. The initial vertical velocity of the cyclist and bike is zero and, where an equation is included, it should be correct (ie $v = u + at$ or $a = (v - u) \div t$). Some candidates substituted the initial horizontal velocity of the cyclist and bike into the relationship instead of the initial vertical velocity.

Q5: Many candidates demonstrated little or no understanding of the effects of gravity on objects in space and it was concerning to see that many candidates thought there was no gravity in space. Of those who did identify that astronauts were not truly weightless on the ISS, few went on to develop their answer to explain how this related to their motion (for example by discussing satellite orbits in terms of projectile motion or the concept of freefall).

Q6(b)(i): Only some candidates were able to correctly state the purpose of a resistor connected in series with an LED.

Q6(b)(ii): Many candidates selected the correct relationship to determine the resistance of the resistor in series with an LED. However, few 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.

Q7: Only some candidates were able to apply their knowledge of physics to comment on the suitability of a filament lamp as a light source. Responses to this question revealed many misconceptions about principles of physics (for example ‘the thin coil of resistance wire in a lamp is there to prevent the fuse breaking’ or ‘the low pressure gas is used to keep the temperature of the filament low’). Successful candidates were able to develop their answer fully to demonstrate a good understanding of the operation of the lamp (for example, to explain when a current passes through the filament it heats up so much that it produces light. As the temperature increases the pressure of the gas increases, but starting at low pressure ensures that this increase in pressure does not cause the glass bulb to break). Many candidates were able to explain the physics behind a filament lamp in their assignments, but then could not do so in the question paper.

Q8(a)(ii): Only some candidates were able to explain the heat loss to the surroundings during the experiment would cause the value determined for the specific heat capacity of water to be different from the value quoted in the data sheet.

Q8(c): Many descriptions of the experiment identified the relationship required in order to determine the specific latent heat of vaporisation of water. However, few made it clear that the mass of water vaporised needed to be substituted into the relationship, rather than the total mass of water in the beaker.

Q9(a)(i): Only some candidates seemed familiar with the principle of how to establish a relationship using experimental data. Many candidates attempted to apply Boyle’s law using one set of data to calculate one of the values in another set of data, without recognising the discrepancy between the value calculated and the experimental value obtained.

For candidates who correctly attempted to calculate the ratio between the temperature and pressure of the gas, there were often instances of incorrect rounding and significant figure issues in the values calculated.

Some candidates did attempt to establish the relationship graphically, but as they only produced a sketch graph of the data (rather than an accurate graph, using graph paper), no marks were awarded.

Q9(a)(ii): Few candidates provided a complete explanation of why the pressure in a gas increases as its temperature increases, using the kinetic model. Many identified the speed of the gas particles increases as the temperature increases. Only some were able to describe how this affected the frequency of the collisions of the particles on the walls of the container and fewer still, how this affected the force of the individual collisions of the particles on the walls, as opposed to the overall force.

Q9(b): Few candidates were able to state a way in which the experimental set-up could be improved. Many simply identified a procedural change that they thought would improve the experiment.

Q10(b)(i): Few candidates were able to clearly state what is meant by the term longitudinal wave.

Q10(b)(ii): Many candidates seemed unfamiliar with how a longitudinal wave is represented diagrammatically and were consequently unable to determine the wavelength of the sound wave.

Q11(a): Few candidates were able to state a suitable detector of infrared radiation for the rain sensor.

Q11(b): This is a 'show' type question and many candidates did not show all the required stages of the calculation to access all the marks. These stages include starting with a correct formula, showing the correct substitutions and ending with the correct final value, including the unit. In particular, many candidates did not make reference to the relationship between frequency, number and time in their response. This meant they were unable to access marks beyond those for selecting the correct number of times the windscreen wipers move back and forth in a minute.

Q11(c)(i)(A): Few candidates were able to draw and label a suitable normal on the diagram provided. Many candidates drew lines representing the normal that were not perpendicular to the interface between the mediums.

Q11(c)(i)(B): This is a 'must justify' question and although a number of candidates stated a correct response, they either did not provide any supporting justification, or provided an incorrect justification (for example that the frequency of the infrared light changes as it travels between mediums) and were therefore unable to access any marks.

Q12(a): Only some candidates were able to clearly state what is meant by a beta particle.

Q12(b): Although many candidates identified that the activity of the tritium would decrease over time, few connected this to the idea that the torch would produce less light. In addition there were some candidates who were imprecise in their use of physics terminology (for example using the word ‘radioactivity’ in place of ‘activity’).

Q13(b)(i): Most candidates were able to produce graphs with suitable scales, labels and units, but errors in the plotting of points were fairly common. Many candidates failed to draw a best fit curve, preferring instead to connect the points with straight line segments to produce a line graph, rather than by a scatter graph, which was the appropriate format for the data provided.

Q13(c)(i): Although many candidates identified that the alpha source and Geiger-Müller tube would need to be placed closer together, not many clearly explained that this was required due to the short range of alpha radiation in air.

Component 2: assignment

Section 1: Although the vast majority of candidates were able to devise an appropriate aim for their investigation, there were some examples of candidates whose aims were not experimentally investigable or made it difficult to make a conclusion later in the report (for example 'how crumple zones affect the severity of injury during car crashes'). In addition there were a number of candidates who appeared to have a poor understanding of their aim. This led to difficulty in accessing marks later in the report (for example, candidates were confused about thinking, braking and stopping distances).

A small number of candidates stated aims that talked about the correlation between variables. However, it became clear that these candidates did not understand what correlation meant, and some clearly thought it was proof of causation. It also made accessing other marks, such as the conclusion, more difficult.

Section 2: Many candidates achieved one mark for demonstrating a limited understanding of relevant physics. Some candidates did not achieve marks for this section because they offered little or no relevant physics explanations and/or did not relate these to the topic being discussed. When candidates had selected topics for which the underlying physics was at a level above National 5 (for example semiconductor devices), it was often hard for them to demonstrate either reasonable or good understanding of the physics involved.

Section 3(a): Many candidates were unable to provide a brief description of the approach used to collect experimental data and instead produced a description that amounted to a full procedure. Some candidates failed to identify either what was being changed in their experiment or what was being measured.

Section 3(b): Although the vast majority of candidates included raw data, some candidates did not provide the raw results, and only included their average values. There were also some instances of candidates not providing repeated readings, when the experiment could have been repeated.

Section 3(c): Some candidates did not obtain the mark for presenting data in a correctly produced table, as the overarching heading for the data columns did not extend to include the mean column.

Section 3(d): There were many instances of candidates not rounding mean or derived values correctly, or not stating calculated values to an appropriate number of significant figures. Some 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). Some candidates who did not put their mean or derived values into a table did not include units with their calculated values.

Section 3(e): Some candidates did not provide data from an internet/literature source that was comparable to their experimental data.

Section 3(f): Some candidates, who chose to state their references later in the report, did not clearly identify which reference referred to their source of internet/literature data by citing it appropriately.

Section 4(a): Some candidates did not produce a graph of an appropriate format for their experimental data (for example by connecting their data points with straight line segments to produce line graph, when a scatter graph was the appropriate presentation format).

Section 4(b): Some 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): Some candidates did not include suitable labels and units for the axes of their graph.

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

Section 5: Some candidates did not make a valid comparison between their experimental data and the data from their internet/literature. Often this was because candidates were making claims about the comparison data 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: Some 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 failed to identify this relationship in their conclusion (for example: for a fixed mass of gas at constant temperature, pressure is inversely proportional volume; or for a fixed resistor, current is directly proportional to voltage).

Section 7: Many candidates did not identify a factor that could have been expected to have a substantive effect on the reliability, accuracy or precision of the experiment. 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, many 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 8: A few candidates did not provide an informative title.

Section 3: advice for the preparation of future candidates

Component 1: 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.

Section 1 is worth 20% of the marks available for the course assessment. At this level, candidates may spend too much time completing section 1 of the question paper, which then reduces the time left for completing section 2, which is worth 60% of the marks. Candidates should practise objective test items for section 1 and extended questions for section 2 to ensure they can complete them in a time proportionate to the mark allocation on the question paper.

Questions that require justifications, descriptions or explanations always feature in the assessment but are often answered poorly. These types of questions are frequently based on practical coursework and data obtained from experiments. Candidates should, where possible, have the opportunity to experience practical work specified in the course content that may help to improve understanding of concepts, procedures and apparatus. Frequent use of physics terms and ‘language’ may help candidates develop their communication skills when answering such questions.

Candidates should be made 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 formula, 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 earn marks.

For questions requiring calculations, the final answer sometimes had the wrong or missing unit. 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 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 some 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 strongly 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. Such responses can either be generated by their peers or are available from sources such as the SQA Understanding Standards website.

The published marking instructions contain general marking principles, and also 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 SQA website for generic issues related to the marking of question papers in SQA qualifications in Physics at National 5, Higher and Advanced Higher levels. Centres are advised to adopt these general instructions for the marking of prelim examinations and centre-devised assessments for any SQA Physics courses.

Component 2: assignment

Centres are advised to consult the *National 5 Physics Course Specification* document on the SQA website in conjunction with *Course Assessment Task for National 5 Physics* document. 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* for clarification and exemplification on acceptable conduct during coursework assessments.

Further support and candidate evidence with commentary for the assignment task is available on the SQA 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 availability of internet/literature data, in order to ensure that all aspects of the assessment task are achievable.

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 (for example the orbits of satellites by rotating masses on the end of a piece of string).

In future years, aims that can be answered with a simple yes or no conclusion (for example ‘To find out **if** voltage affects current in a resistor.’) will not be 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).

It is not appropriate to have ‘correlation’ in an aim. Correlation is a measure of the numerical relationship between the variable values and has nothing to do with causality. Candidates should be looking for a relationship between variables that can be explained in terms of the underlying physics.

Section 2: Successful candidates were able to access these marks by showing a good understanding of the relevant physics, and providing an explanation that included a discussion of some of the physics involved at a depth appropriate to National 5.

Again, careful advice on the choice of topic is essential here. It was clear that some candidates chose topics for which the underlying physics was at a level above National 5, for example LEDs. Consequently, they struggled to explain the physics involved or ended up copying verbatim from references.

Section 3(a): It was clear that some candidates were unfamiliar with the requirement to produce a brief description of the approach used to collect experimental data. It is suggested that candidates should be made familiar with this skill in preparation for the assignment by practising during normal classroom activities.

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 should also ensure that, when appropriate, 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 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 SQA website for further details on these issues.

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

Section 3(e): Candidates should be able to find suitable internet/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.

Centres are also reminded that where internet access is an issue and they are providing a minimum of six sources for candidates to select appropriate data from, this must be to websites, journals or books. Centres cannot ‘cherry pick’ data from websites to give to candidates, it must be the URL for the appropriate website and it cannot be one appropriate source and five irrelevant sources. Centres should also note that a website such as BBC bitesize is one source, so another five different sources would need to be provided rather than links to six different pages of BBC bitesize.

The experience for a candidate who is provided with at least six sources must mirror as much as possible the experience of the majority of candidates who are doing their own internet/literature research, so that the candidate is having to make real choices about which data they will use.

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 text book 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/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/literature source, or from a simulation, in a graphical format.

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.

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.

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 activities.

Section 6: Candidates should be aware that their conclusion must relate to their aim and must be supported by the data in the 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 direct 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 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' in order to produce a clear and concise report. The use of headings can often assist markers when identifying where to award marks.

Centres are also advised to consult the generic document *Guidance on Conditions of Assessment* for clarification and exemplification on acceptable conduct during coursework assessments.

Whilst it was pleasing to see that the conditions of assessment for coursework were adhered to in the majority of centres, there were a small number of examples where this may not have been the case. Following feedback from teachers, we strengthened the conditions of assessment criteria for National 5 subjects and Higher and will do so for Advanced Higher. The criteria are published clearly on our website and in course materials and must be adhered to. SQA takes its obligation to ensure fairness and equity for all candidates in all qualifications through consistent application of assessment conditions very seriously and investigates all cases where conditions may not have been met.

Grade boundary and statistical information:

Statistical information: update on courses

Number of resulted entries in 2017	14165

Number of resulted entries in 2018	13699

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

Distribution of course awards	Percentage	Cumulative %	Number of candidates	Lowest mark
Maximum mark				
A	31.2%	31.2%	4274	86
B	23.3%	54.5%	3194	72
C	20.5%	75.0%	2806	58
D	14.6%	89.6%	1995	44
No award	10.4%	-	1430	-

General commentary on grade boundaries

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

SQA aims to set examinations and create marking instructions which allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional 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 every year for each subject at each level to bring together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- Where standards are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from exam papers in the same subject at the same level tend to be marginally different year to year. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set by centres. If SQA alters a boundary, this does not mean that centres should necessarily alter their boundary in the corresponding practise exam paper.