



Course Report 2014

Subject	Physics
Level	National 5

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

This report provides information on the performance of candidates which it is hoped will be useful to teachers/lecturers in their preparation of candidates for future examinations. It 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 and marking instructions for the examination.

Section 1: Comments on the Assessment

Component 1: Question paper

The National 5 Physics question paper consists of section 1, an objective test worth 20 marks, and section 2, containing restricted and extended response questions worth 90 marks, which is scaled to 60 marks.

The majority of marks available are awarded for applying knowledge and understanding. The remaining available marks are awarded for applying scientific enquiry, scientific analytical thinking and problem solving skills.

A variety of question types are used in the question paper, including:

- ◆ extended questions based upon an application of course content
- ◆ extended questions based upon practical/experimental work
- ◆ extended questions based on content not specified within the course, assessing skills
- ◆ extended questions based on content within the course, assessing skills
- ◆ open-ended questions
- ◆ extended questions assessing scientific literacy
- ◆ extended questions based upon course content
- ◆ multiple-choice questions

Candidates' responses to section 1 are marked electronically. Candidates' responses to section 2 of the question paper are electronically marked from image by markers.

This year, markers attended a briefing. Marking Instructions contained general marking principles, and also detailed marking instructions for specific questions.

Markers were supported by Team Leaders.

Most markers commented that the electronic marking process and experience was excellent or good.

Component 2: Assignment

As part of the National 5 Physics assessment, the assignment is a new component at this level for centres and candidates. Candidates have to investigate a relevant topic in physics and its effect on the environment and/or society and communicate the findings of their research in a report.

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

The general marking principles for the National 5 Physics assignment, in conjunction with detailed Marking Instructions, were used by markers when marking candidate responses. Additional guidance was supplied to markers by Team Leaders on the marking of specific

candidate responses which were not covered by either the principles or the detailed Marking Instructions.

Markers commented favourably that the additional notes to markers supplied in the detailed Marking Instructions proved to be very helpful in apportioning credit for different sections of the report.

Marking of the assignment was positive, ie marks were awarded for what was correct and not deducted for errors or omissions.

The assignment component of the assessment performed as expected.

Analysis of the results indicated a satisfactory spread of results across the range of marks available to candidates.

Also, analysis of the range of marks achieved by candidates confirmed that all of the marks for the assignment were accessible.

There were high scoring and low scoring assignments.

The marks achieved by candidates were recorded electronically by markers. The resulting data allowed an analysis of candidate performance. This analysis indicated areas which were well done or poorly done.

Section 2: Comments on candidate performance

Component 1: Question paper

The general impression of markers was that the question paper was fair, and had an appropriate number of questions accessible to 'C' grade candidates, and that the paper included appropriate questions to provide good discrimination for candidates performing at 'A' and 'B' levels.

Analysis of question paper results showed that all questions were answered correctly by at least a proportion of the candidates, and that there was a spread of performances across the range of available marks.

Many markers commented on the fairness of the question paper and its coverage of the coursework.

Some markers indicated that the responses from some candidates may suggest evidence that some candidates were either poorly prepared, or were presented at the wrong level.

Generally, candidates' responses were better when answering questions involving numerical calculations and poorer when answering questions requiring justifications, descriptions and explanations.

Some markers commented on the number of candidates who failed to round answers to the correct number of significant figures in their final answers.

Component 2: Assignment

Most markers commented that candidates had the opportunity to achieve marks for all of the skills and knowledge and understanding being tested. In addition, many markers commented that there was opportunity for well-prepared candidates to achieve high scores.

Some markers commented that some candidates were not so well prepared. In particular, markers commented that the content and layout of some assignments suggested that some candidates might not have had access to 'Appendix 1: Instructions for Candidates', which details advice and guidance for the various stages of the assignment, and the apportionment of marks available for each aspect of the report.

Also, markers commented that some candidates seemed to have a poor understanding of the requirements of the task. In addition, markers commented that some candidates had chosen to research topics or issues which did not allow marks to be accessed easily for some sections of the assignment.

Markers commented that a proportion of candidates had chosen to write an essay on the topic they selected, rather than producing a scientific report with appropriate data, and whilst some of these may be considered good essays, they did not demonstrate the skills being assessed in the Assignment report, so tended not to score well. Markers made considerable efforts to give candidates credit where they could in such circumstances.

It was noted that candidates who had chosen an appropriate experiment/practical activity as one of their data sources tended to perform well in the assignment.

Markers also indicated that the poor presentation skills of some candidates caused some marks to be unattainable to them.

Section 3: Areas in which candidates performed well

Component 1: Question paper

Section 1: Objective test

This section of the question paper was found to be straightforward by most candidates. A majority of candidates answered at least 12 questions correctly.

Questions 1, 2, 10, 11, 16, and 18 were answered particularly well (at least 70% of candidates choosing correct answers).

Section 2: Extended answers

Many candidates were successful 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 which was clear and relevant to the question being asked. They used correct terms and references to appropriate physics theory eg Newton's Laws of Motion.

- ◆ Question 1(a), (b)(i), (b)(ii): Most candidates answered this question correctly.
- ◆ Question 5(b) Many candidates were able to extract information and complete the table.
- ◆ Question 8(a)(i) and 8(a)(ii) were well answered, although for part (ii) some candidates failed to access the radiation weighting factor from the data sheet, or used the wrong unit for equivalent dose in their final answer.
- ◆ Question 10(a)(i), (a)(ii), (b)(i), (b)(ii) The majority of candidates were able to extract information from the velocity-time graph and process the information.
- ◆ Question 11(c) Many candidates were able to correctly calculate the answer.
- ◆ Question 12(a) Many candidates were able to correctly calculate the answer.

Component 2: Assignment

Section 1: Statement of Aim

Most candidates were able to devise an appropriate aim for an investigation.

Section 2: Describe an application of Physics and explain its effect on the environment/society

Many candidates were able to access the second mark for explaining a clear relationship between the application and its effect on the environment/society.

Section 3: Select relevant sources

Some candidates provided satisfactory explanations for their choice of sources. For example, candidates started by stating that a source was relevant or reliable followed by a reasoned explanation clearly indicating why it was relevant or reliable.

Section 4: Select relevant data/information from sources

Many candidates chose data which was relevant to the aim of the report.

These candidates presented and identified relevant data and clear statements of the sources of the data.

Section 5: Process and present data/information

(a) Processing of data/information

Some candidates provided two acceptable examples, in different formats, of accurately processed raw data from at least two sources.

(b) Presentation of data/information

Many candidates produced two satisfactory, different presentation formats. These formats included sufficient detail to convey the data/information.

(c) Complete labelling of graphs, tables, charts or diagrams

Many candidates successfully achieved this mark because of the consistent, correct labelling of their presentation formats.

(d) Comparison of data/information from at least two sources

A minority of candidates successfully accessed this mark by comparing data from two sources in their report, or by making a clear statement that the two sources of data could not be compared.

Section 6: Drawing a valid conclusion

Successful candidates related their conclusion to their stated aim. Also, candidates who stated multiple aims but correctly modified their aim in their report were able to access this mark.

Section 7: Apply knowledge and understanding of Physics

Some candidates were able to access full marks for a clear explanation which demonstrated a good understanding of the physics involved.

Many candidates were able to access the majority of marks by offering an explanation which demonstrated a reasonable understanding of the Physics involved.

Section 8: Structure of the report.

The majority of candidates were able to achieve most or the majority of the marks available for this section.

Section 4: Areas which candidates found demanding

Component 1: Question paper

Section 1: Objective test

Questions 4, 5, 6, 8, 12, 15, 19, 20 were answered incorrectly by over 50% of candidates.

In addition, questions 4 and 5 were answered incorrectly by over 70% of candidates, although it should be noted that some of these questions were intended to assess the A Grade Criteria.

Section 2: Extended answers

Some candidates failed to present the final answers to numerical questions to the correct number of significant figures.

Some 4-mark questions involved the use of a relationship to calculate a final answer. An initial value was required to be calculated for use in the relationship eg the voltage across a variable resistor, the total area of fins, the unbalanced upward force. Some candidates failed

to calculate this initial value and so failed to access the majority of the marks for this type of question.

- ◆ Question 2 (a)(i) To calculate the value of R, several candidates used the method of applying $V=IR$ twice, or the relationship

$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

However, some candidates failed to first calculate V_1 , using the supply voltage instead, restricting access to full marks.

- ◆ 2(b)(i): Many candidates showed a poor understanding of the operation of this circuit. There was often no logical or structured method of working through the explanation.
- ◆ Question 2(b)(ii): Most candidates were able to state the effect of increasing the resistance of R, but were unable to provide a suitable justification for the answer, often using imprecise or loose Physics language in the explanation.
- ◆ Question 5(c): Many candidates failed to answer this question, possibly because of a failure to read to the end of question 5.
- ◆ Question 6(b)(i): A poor understanding of coursework relating to this experiment was evident from candidates. Several candidates described use of a ratemeter instead of a description using only the apparatus provided.
- ◆ Question 7 & 9 (open-ended questions): Many candidates simply provided one undeveloped answer to these questions, which was not sufficient to show a good understanding of the physics involved. Candidates often failed to provide a fuller answer where appropriate or commensurate with the marks available.
- ◆ Question 11(b): Many candidates were able to calculate the correct combined total weight but incorrectly added an additional force to determine the minimum upward force.
- ◆ Question 12(c): The majority of candidates were unable to explain the launch of the rocket correctly by referring to Newton's Third Law. There were many incorrect explanations which described forces acting on the ground.
- ◆ Question 12(d): Many candidates failed to calculate the unbalanced force acting on the rocket for use in Newton's Second Law, and so were unable to access the majority of the marks.
- ◆ Question 12(e): Many candidates were unable to use standard, correct physics language in their explanation, such as increased mass/weight or reduced unbalanced force.

Component 2: Assignment

Section 1: Statement of Aim

Some candidates failed to state an appropriate aim for an investigation.

Some candidates mentioned several aims in the statement. Sometimes only one of these aims was investigated, leading to a difficulty in accessing the conclusion mark which refers to the stated aim.

Section 2: Describe an application of Physics and state its effect on the environment/society

Many candidates failed to access the first available mark because they were unable to provide an appropriate application and use a physics explanation to describe its characteristics and/or features.

Section 3: Select relevant sources

Many candidates failed to provide a sufficient explanation for the choice of sources. For example, many stated 'my source was relevant' or 'my source was reliable' with no/insufficient explanation of why it was relevant or reliable. A number of candidates did not use the words relevant or reliable, making it unclear whether the candidate was referring to the reliability or relevance of the source. Some candidates clearly did not understand the difference between relevance and reliability and answers such as 'my first source was reliable because it contained information about my chosen topic' were not uncommon.

Section 4: Select relevant data/information for inclusion in the report

Some candidates chose data which was not relevant to the aim of the report.

Several candidates did not make clear what was relevant data, and the sources of this data. Some sources identified as 'raw' data had in fact been processed by the candidate. For example, the website referenced by the candidate provided the data in the form of a graph; the candidate had included this data in tabulated form as the 'raw' data and had then drawn a graph, similar to the one on the website, as their processed/presented data.

The relevant 'raw' data must be included in the report and clearly identifiable to allow subsequent access to the marks for section 5.

Some candidates only supplied one source of data.

Section 5: Process and present data/information

(a) Processing of data/information

Some candidates only provided one example of processed data.

Some candidates produced examples of processed data from only one source.

Many candidates failed to present the information clearly enough to attract the relevant marks. For example, some graphical presentations were poorly drawn, with inaccurate scales and sometimes not drawn on graph paper, making it difficult to plot points accurately.

(b) Presentation of data/information

Some candidates produced only one presentation format or the same format twice.

Some candidates produced an inappropriate presentation format, eg a pie chart for a continuous variable.

(c) Complete labelling of graphs, tables, charts or diagrams

Some candidates failed to achieve this mark because they did not completely label the relevant presentations.

(d) Comparison of data/information from at least two sources

Most candidates failed to make any statement regarding comparison of two sources. This was often due to the fact that they had chosen two (or more) disparate data sources that did not allow comparison, although a statement from the candidate to this effect would have been credited by markers.

Section 6: Drawing a valid conclusion

Several candidates failed to relate their conclusion to their stated aim.

Some candidates stated multiple aims, but only offered a conclusion for one of these aims.

Section 7: Apply knowledge and understanding of physics

Many candidates achieved one mark for demonstrating a limited understanding of the physics involved.

Some candidates failed to achieve marks for this section because they offered little or no relevant physics explanations.

Some candidates failed to achieve marks because they had copied text verbatim from websites or text books or other sources.

Section 8: Structure of the report

Some candidates failed to access the majority of marks.

Some candidates failed to give an appropriate and informative title related to the report content. The title 'National 5 Assignment' is neither an appropriate nor informative title.

Some candidates failed to give sufficiently detailed references to the sources which would allow them to be retrieved by a third party. Truncated website addresses such as www.bbc.co.uk were quite common.

Some candidates failed to produce a clear and concise report.

Section 5: Advice to centres for preparation of future candidates

Component 1: Question paper

Each year, the question paper samples the course content of each unit in approximately equal proportions. This means that candidates should be familiar and rehearsed in *all* aspects of the coursework.

Candidates sometimes failed to provide any response to particular questions, which may suggest unfamiliarity with the coursework to which the questions referred. The question paper tests the application of knowledge and understanding, and the application of the skills of scientific enquiry, scientific analytical thinking and problem solving skills.

Candidates should have the opportunity to practise these skills regularly to familiarise themselves with the type and standard of questions which may be asked.

Section 1 is worth 20% of the course award. At this level, candidates may spend too much time completing section 1 of the question paper, reducing the time left for completing section 2, which is worth 60% of the course award. Candidates should practise objective test items of section 1 and the extended questions of section 2 to ensure that they can complete them in a time proportionate to their appearance in the question paper.

Areas where candidates frequently lost marks:

- ◆ Questions which require justifications, descriptions or explanations always feature in the assessment, and were often poorly answered. These types of questions are frequently based on practical coursework and data obtained from experiments. Candidates should, where possible, have the opportunity to experience exposure to key practical work which may help to improve understanding of concepts, procedures and apparatus. Frequent exposure to the use of Physics terms and 'language' may help candidates develop their communication skills when answering such questions.
- ◆ For questions requiring calculations, the final answer sometimes had the wrong or missing unit. Also, some candidates were unable to provide a final answer with the appropriate number of significant figures, and it was evident that some confuse significant figures with decimal places. Centres should remind candidates that a final answer (usually) requires both a value and a unit. Centres should ensure that candidates understand and can apply the rules concerning significant figures.

The published marking instructions contain general marking principles, and also detailed marking instructions for specific questions. Candidates should be familiarised with the apportionment 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.

Component 2: Assignment

Many markers commented on the unpreparedness of some candidates regarding the requirements of the assignment report.

As mentioned earlier, some candidates produced assignments which were essays that simply offered discussions about particular areas of Physics, with little or no research. Such essays failed to relate to the application of skills of scientific enquiry and related Physics knowledge and understanding which the assignment assesses. Candidates should be encouraged to produce a suitable scientific report and advised not to produce essays as their Assignment report.

It is important for candidates to receive the appropriate guidance when undertaking the assignment.

The 'Physics Assignment General Assessment information' document advises assessors to give reasonable assistance during the research stage which might include:

- ◆ Directing candidates to the 'Instructions for Candidates'
- ◆ Clarifying instructions/requirements for the task.
- ◆ Advising candidates on the choice of topic or issue.

Also, at the communication stage of the assignment, assessors may continue:

- ◆ Directing candidates to the 'Instructions for Candidates'
- ◆ Clarifying instructions/requirements for the task.

Centres are advised to detach the copy of the 'Instructions for Candidates' document, which appears in Appendix 1 of the National 5 National Qualifications publication 'Physics Assignment Assessment task', and issue this Appendix to candidates.

Centres should also share the Marking Instructions with candidates, so that they understand what they will be awarded marks for.

Presentation of the report

Many successful candidates presented their report in the order of appearance of each section. This meant that interpretation of the report was sequential and easy to follow. Many candidates placed helpful headings before each section of the report to help identify each section.

Some candidates lost marks because the structure of their report was not in any sequence, which meant some of the sections were difficult to identify.

Candidates should be encouraged to follow the structure outlined in the Candidates' Guide.

Choosing the topic for research

Centres are permitted to offer advice to candidates on the choice of topic or issue for research.

Successful candidates chose topics where:

- ◆ The topic was related to content of one or more of the course units.
- ◆ They were at a level of understanding consistent with National 5.
- ◆ The sources of data and the data itself were understandable at National 5 level and able to be processed by the candidate.

Poor choices of topic by some candidates meant that they had chosen:

- ◆ A topic which had limited or no published data, making it difficult to achieve marks for later sections of the report.
- ◆ A topic which required an understanding of physics at a level greater than National 5, causing some marks, for example the underlying physics, to be unattainable.

Centres should encourage candidates to choose topics that lend themselves to the type(s) of data processing and presenting being assessed, and advise against researching topics for which little or no data can be accessed. Centres should also consider taking an approach where candidates can include and compare their own experimental data with literature research, rather than simply pure literature research.

Statement of Aim

Successful statements of the aim of the research related to relevant research data within the report and to the conclusion. Some candidates stated an aim which did not relate to the data or to the conclusion. Statements of multiple aims should be avoided.

Description of an application of physics and its effect on the environment/society

Many successful candidates achieved both marks by:

- ◆ Describing an application for their research, and providing an explanation of its characteristics and/or its features. This explanation could use a short discussion of the physics involved to describe how the application works or is achieved.
- ◆ Making a clear statement of the relationship between the chosen application and its effect on the environment or society. The stated relationship can be a positive or negative, depending on the application.

Centres should advise candidates on the suitable choice of topics to allow these marks to be accessed.

Select relevant sources

Successful candidates explained their choice of sources by:

- ◆ Stating whether the source was relevant, followed by their explanation of why this was the case.
- ◆ Stating whether the source was reliable, followed by their explanation of why this was the case.

Successful candidates also chose to accompany the source selection explanation with identification of the source of the information. (Many candidates included full URLs or text book references at this stage).

Centres should encourage candidates to follow the guidance above, which is also contained in the Candidates' Guide, and ensure that candidates know what makes a source relevant and/or reliable.

Select relevant information from sources

Many successful candidates selected and presented relevant information (data) from at least two different sources clearly, and indicated which source the data had come from.

The data selected from each source should be unprocessed by the candidate and clearly identified as source data.

Some candidates lost marks because they processed some or all of the data transferred from the source to the report. The source data should be 'raw' data.

Candidates who failed to present any data at this stage were not able to access marks for the next processing stage because the accuracy of the processing could not be verified, unless the source of the data could be accessed.

Centres should remind candidates that they must include the raw data from their sources in the report.

Processing information

Many successful candidates were able to process the information carefully in the chosen presentation format. Where graphs were drawn, graph paper and rulers were used, suitable scales were drawn and points accurately plotted. Tables had appropriate headings and units where applicable. Summaries of graphs or tables were accurate and any stated quantities or values had units where appropriate.

Note that candidates who did not select relevant information in the previous stage would not be able to access these processing marks, unless the source of the data could be accessed.

Centres should ensure that candidates use the appropriate tools for producing graphs etc, eg graph paper so that they can accurately plot points and the accuracy can be checked. Where graphing packages are used, the centre should ensure that the candidates know how to use them properly ie suitably sized graphs, minor and major gridlines, small data points, lines of best fit etc.

Presenting information

Successful candidates chose at least two appropriate and different formats to present the processed data. An indication or heading identified each presentation format.

Some candidates lost presentation marks because they used only one format, or the same format for both presentations, or did not include a graph, table, chart or diagram for one presentation format.

Centres should ensure that candidates are able to choose an appropriate presentation format for the type of data being presented. Candidates should be reminded that they must use two different presentation formats, eg a line graph and a bar chart and not two line graphs.

Labelling of graphs, tables, charts or diagrams

Successful candidates achieved a mark for including appropriate units, headings, labels etc. for all of the presented, processed data.

Candidates who omitted, for example, to label axes, or include table headings failed to achieve this mark.

Centres should advise candidates to check thoroughly that they have included all appropriate labels, units, etc.

Comparison of the data from at least two sources

Successful candidates compared the data from at least two different sources, whether processed or unprocessed, and commented, where appropriate, on any similarities or differences; or whether no comparison could be made between the sources.

In advising candidates on the choice of research topic, centres should encourage candidates to select ones that lend themselves to sourcing data which can be compared.

Drawing a valid conclusion

Successful candidates accessed this mark for giving a conclusion which related to the aim. Also, the conclusion was supported by relevant evidence within the report.

Some candidates failed to state a valid conclusion because it did not relate to the stated aim of the report, or was not supported by relevant evidence within the report.

Some candidates failed to state a valid conclusion because it only related to the one part of the stated aim of the report.

Centres should advise candidates not to be 'over ambitious' with the aim of their Assignments and to avoid multiple aims.

Apply knowledge and understanding of physics

Successful candidates were able to access these marks by showing a full and competent understanding of the research and application by providing an explanation which 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. Whilst many candidates may wish to choose an area that really interests them, it was clear that some chose topics for which the background physics was well above their level and consequently they struggled to explain the physics or ended up copying verbatim from references.

Structure of the report

Successful candidates who achieved all available marks:

- ◆ had a heading or title at the start of the report
- ◆ included at least two references to the sources used in the report in sufficient detail to allow them to be retrieved by a third party.
- ◆ produced a report that was clear and concise

Some candidates lost marks because:

- ◆ they failed to include a heading or title at the start of the report
- ◆ they failed to provide least two references to the sources used in the report in sufficient detail to allow them to be retrieved by a third party
- ◆ they provided references which were incomplete
- ◆ their report was not clearly or logically presented, making it difficult to identify each section of the report

Some candidates provided a report that was not concise because, for example, it contained great amounts of written text which was not relevant to the aim of the research.

Centres should ensure that candidates know what is meant by 'in sufficient detail to allow them to be retrieved by a third party' ie it must be the full URL for a website, or for a textbook it should have title, author, page number, and either edition number or ISBN.

Statistical information: update on Courses

Number of resulted entries in 2013	0
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Number of resulted entries in 2014	11932
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Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark 100				
A	24.9%	24.9%	2968	68
B	23.2%	48.0%	2765	57
C	20.4%	68.5%	2440	47
D	8.9%	77.4%	1059	42
No award	22.6%	-	2700	-