

SPORTS, EXERCISE AND HEALTH SCIENCE

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 17	18 - 34	35 - 46	47 - 56	57 - 67	68 - 77	78 - 100

General comments

This was the third May session for the Sports, exercise and health science pilot course (SEHS) and it was a pleasure to moderate teachers who had clearly taken time and effort to act on the feedback provided in the May 2010 SEHS Report. Practical programmes once again were appropriate and in line with the Internal Assessment (IA) criteria. In most centres the criteria were applied rigorously.

Standard level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 8	9 - 16	17 - 22	23 - 27	28 - 33	34 - 38	39 - 48

General comments

Teachers who included the “complete”, “partial” and “not at all” breakdown of their marks were providing helpful information to the moderators. This, combined with comments and feedback to the candidates, made it very clear as to how the teachers were awarding marks. Clearly all teachers took a lot of time and trouble to prepare their IA sample. This effort is very much appreciated. It is a lot easier for a moderator to support a teacher’s marks when there are clear notes accompanying the sample.

Teachers must enclose all instruction sheets and/or summaries of oral instructions for the investigations in the moderation sample. Most centres complied with this requirement. When Data collection and processing (DCP) is being assessed, the method (designed by the candidate or provided by the teacher) is required. When Conclusion and evaluation (CE) is being assessed, all the steps in the scientific process are needed for moderation.

It would be helpful if the full IA title (candidate) was included on investigations on the 4/PSOW form as it would be easier for the moderator to match up the candidate work which was to be assessed. Forms were generally completed correctly, however, some cover sheets for candidates were not completed and this made it hard to see which marks/ experiments/ parts of experiments were to be moderated.

It was clearly evident that teachers linked and worked with other colleagues to ensure internal standardization had taken place. Centres should continue to link and work with the Biology Department to set a common standard and aid with the internal standardization process.

Overall, teachers entered several marks for each criterion from a variety of investigations. This is very encouraging to see. It implies that the candidates are receiving adequate feedback as they proceed through the practical scheme of work. One can even see the learning curves of candidates who pay attention to this feedback.

Some centres sent photocopies of the candidate work. Usually these were of good quality. The problem is that graphs and diagrams using colour can be confusing. It would be better to send the originals and keep back a photocopy.

Note: atypical candidates should be replaced in the sample. These include candidates whose work is incomplete or transfer candidates where a substantial part of their work has been marked by another teacher.

The areas of the programme that proved difficult for the candidates

The research question/focused problem is different to the teacher prompt and should include the dependent (you measure) and the independent (you change) variables. The variables stated in the research question must be those that are directly measured. The dependent and the independent variables were not always clear and it is ideal to have 3-5 repeats for each variable. Candidates must ensure that their investigations have the potential to generate sufficient data for substantial processing. A lack of data meant that individual averages could not always be processed. A minimum of five is also needed to undertake further statistical analysis in the form of standard deviation.

Many candidates were missing quite obvious conventional points such as indicating uncertainties in their data. Raw data was not always recorded as candidates recorded averages only (processed). Only processed data is to be presented graphically and the x and y-axis must be clearly labelled. When candidates use error bars on graphs, there needs to be an indication of what these values represent. Teachers are also missing these points and a few were marking over generously.

There was evidence that literature sources were being consulted to provide valuable background information in determining the initial research question and in the discussion of the results. Teachers could further challenge their candidates to add value to their own data findings by referring/comparing/contrasting with an existing data or theory reference. Candidates also need to be cautious when relying solely on websites regarding references. The Internet is to be used to complement more quality assured sources. Care is needed in the correct ways to present citations of references.

Many candidates failed to score full marks on the conclusion and evaluation component and this is an immediate area for attention. To maximize the marks in CE (aspect 1) candidates should include data from their results to back up findings and refer to the appropriate statistical test to discuss the significance of the data. When evaluating procedures (aspect 2) candidates were often commenting on mistakes rather than methodical errors or significant ways to improve the investigation. Candidates could focus on repeats or increasing the data range of the independent variable. Few candidates discussed the significance of the error and only identified relevant weaknesses.

The levels of knowledge, understanding and skill demonstrated

The variety of investigations, and the duration and coverage of the practical programme were generally good. The quantity and type of data was very good in some centres and adequate in the majority.

Rules applied by the moderators

In the event of the teacher providing too much guidance to the candidates or ignoring the criteria the following scale is applied by the moderators:

Criterion	Problem	Teacher awards	Maximum moderator can award
Design	Teacher gives the problem or research question.	c; c; c = 6	p; c; c = 5 Candidates could have identified their own control variables.
Design	It is clear that the candidates have been told precisely what apparatus and materials they require and have not modified it.	c; c; c = 6	c; c; n = 4
Data collection & processing	The candidates have used a photocopied data table with headings and units.	c; c; c = 6	p; c; c; = 5 Candidates could have added uncertainties or relevant qualitative observations.
Data collection & processing	The candidates have been told, on the method sheet, to draw a graph from their raw data and which variables to plot or process the data in a particular way.	c; c; c = 6	c; n; c = 4
Conclusion and evaluation	The candidate has only indicated as a criticism that they ran out of time and their only suggestion as an improvement is that they should repeat the investigation.	c; c; c = 6	c; n; p = 3

The Criteria

Design (D)

The range and suitability of work was generally suitable, however, some designs were very simple such as the effect of exercise intensity on the heart rate or factors affecting the cardiovascular system. Teachers need to set general themes with plenty of scope for different investigations in order to avoid situations where the whole class is attempting the same investigation. Teachers should not be afraid to counsel candidates away from investigations that will lead to trivial results. It is good practice for candidates to follow through their own designs, which most centres seem to be doing.

The programme requires that the investigations assessed should contain quantitative data. There were no cases of centres presenting only qualitative data. Associated qualitative data is, however, to be expected.

The three categories of variables must be clearly identified. Candidates need to be taught what the different variables are and what their relationship is. The range of values of the independent variables was usually sufficient to establish trends. The number of repeats was not always sufficient to permit statistical analysis. The type of statistics being performed was of a good level in most cases.

Standard protocols will, no doubt, be used by the candidates when they design their investigations. However, these standard protocols must be significantly modified or applied to the candidate's own investigation. For example, if fitness is being investigated and the candidate uses the Harvard step test, this is legitimate. If the investigation is simply to determine the fitness of one person then it remains trivial and it repeats many textbook investigations. If the investigation is used to determine the effect of a particular training programme on fitness levels, the investigation becomes more substantial. When candidates design investigations that require different individuals as subjects they should consider the problems of obtaining a representative sample.

Data collection and processing (DCP)

It may be that class data is required in order for the candidate to gain access to sufficient data for significant data processing and the determination of uncertainties. If class data is to be used and DCP is to be assessed, a number of precautions must be respected. The candidates must present their own data and this can be achieved either by (1) presenting their own data first or (2) clearly identifying which is their own data in a pooled data table. The candidates must plan and produce their own data table. Copying a table from other candidates will be counted as collusion. Teachers who provide the candidates with a pre-formatted data table can expect their candidates to be moderated down.

When calculations are made it is important that the pathway to the answer is clear. This does not mean there has to be a worked example but a result that springs up out of nowhere will not be credited.

Where the moderators had to reduce the marks of the teachers it was for the following reasons:

- No uncertainties were given in the tables of data collected using measuring instruments
- There were inconsistent decimal places in tables
- The decimal places did not correspond to the precision of measurements
- The processed data (2 decimal places) on occasions had a higher degree of precision than the raw data
- Lack of data meant that individual averages could not always be processed
- There were no associated qualitative data
- Raw data were plotted in graphs that do not actually reveal anything (e.g. maxima, minima, optima or intercepts)
- Raw data were plotted when the mean should have been calculated and plotted

- There was no statistical treatment of the data
- There was no presentation of uncertainties in graphical data either by using trend lines or error bars
- The error bars, when used, were not identified or accompanied by an explanation of what these values mean
- Trend lines were not used to express uncertainties.
- Tables did not have a descriptive title containing both the dependent and independent variables.

Conclusion and evaluation (CE)

As a rule, teachers were encouraging the candidates to collect sufficient data so that conclusions could be drawn from the results. On occasions, the statistical analysis was sufficient to reveal relationships between the variables and their degree of significance. However, candidates should include data from their results to back up findings and refer to the appropriate statistical test to discuss the significance of the data. Generally, literature values were consulted by the candidates.

Candidates in some centres show that they have developed a mature sense of criticism of the investigation. Their evaluation of their results is based upon a balanced critical analysis of the data. Candidates who have not developed this skill tend to remain superficial in their evaluation. The weaknesses they identify are hypothetical without evidence to back it up. For weaker candidates, the experimental weaknesses are restricted to having a limited amount of time or errors in their own manipulation that once again remains hypothetical (“I could have incorrectly measured the temperature”).

Candidates should describe at least three major errors and suggest a sensible improvement. The evaluation could also be presented as a table: (1) error, (2) significance of error and (3) suggested improvement. The inclusion of a separate column for the significance of the error helps draw candidates to the importance of discussing the significance of the error in addition to solely identifying weaknesses. Suggested modifications were superficial from weaker candidates and many teachers were marking over generously. Evaluation is a good discriminator of the high achieving candidates and teachers would do well to remember this when they are marking their candidates' work.

Manipulative skills (MS)

There is evidence that candidates are being exposed to a very good range of investigations. This ensures that the manipulative skills can be assessed correctly.

Ethics and Safety

SEHS will inevitably involve investigations using human subjects. Safety must be paramount to investigations. Using fellow candidates for investigations into the effect of exercise on the heart rate can be considered unsafe if the health status of the candidates is not determined first. The International Baccalaureate (IB) does not wish to inhibit investigations but it does want to stimulate a responsible attitude towards experimentation. If necessary, teachers may need to make adjustments to their Practical Scheme of Work especially where human volunteers are involved.

Candidates could also be encouraged to report briefly on any ethical issues, which arise during their investigations e.g. ensure confidentiality of participants. The animal experimentation policy and ethical practice poster can be found on the subject homepage on the Online Curriculum Centre (OCC).

ICT coverage

There was evidence of excellent ICT coverage by some centres.

Centres seem to have made an effort to equip themselves with the necessary materials to carry out data logging. However, the use of this material in investigations for internal assessment of the criteria needs to be carried out with care. Teachers and candidates are strongly advised to read the relevant section of the subject guide.

Graph plotting using software was perhaps the easiest and most widespread for centres to apply. However the signs are that some candidates still need to be taught the correct conventions of graphing.

There is a tendency to use bar charts for everything amongst the weakest candidates, perhaps because it is the default setting. Legends (keys) are not always necessary and some candidates do not seem to know how to de-select them. When they are needed the candidates often have difficulty labelling them appropriately – candidates often present the different curves as “series 1” and “series 2”. When candidates used a scatter plot, a trend line was not always used when it was appropriate.

The use of spreadsheets for data processing was less apparent in the moderated investigations. When spreadsheet tables are inserted into document files the conventions of presenting tabulated data still need to be ensured (e.g. Centring numbers, adjusting the number of decimal places, column headings).

The Group 4 Project

This project was used correctly for assessment of Personal Skills (PS) and no other criterion.

The type of assistance and guidance teachers should provide for future candidates

- Read the feedback from this session and act upon it.
- Consult the OCC for Teacher support material (TSM) for the IA component of the course. The TSM shows application of the criteria in the assessment of practical work. It consists of a series of investigations or part investigations by candidates that have been assessed by moderators using the assessment criteria.
- Apply the internal assessment criteria rigorously.
- Ensure that the open-ended theme that you set has enough scope to provide a variety of research questions.
- Give the candidates experience in identifying independent, dependent and controlled variables.
- Encourage the candidates to make additional observations about their experiment.

- Ensure that the investigations have the potential to generate sufficient data for substantial processing.
- Teach the candidates that plotting graphs of raw data is often insufficient.
- Encourage the candidates to carry out research into the background literature both before starting an investigation and once the results are complete.
- CE Aspect 1 (concluding) should include data to back up findings and reference to the appropriate statistical test to discuss the significance of the data.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 13	14 - 19	20 - 21	22 - 23	24 - 25	26 - 29

General comments

Each session teachers are invited to submit comments about each exam. These forms can be downloaded from the OCC. Unfortunately, not all centres submitted G2 forms, with only four G2 forms submitted. These comments provide some of the evidence used by the senior examining team during the Grade Award meetings, it is hoped that more will be submitted in future sessions. All four stated that the level of difficulty was appropriate and M11 was of a similar standard in comparison with last year's paper. Three reported that the clarity of wording was satisfactory and one reported that this aspect was good. One stated that the presentation of the paper was appropriate and three indicated that this aspect was good. There were a number of discriminating questions on the paper though some discriminated better than others. Candidates are reminded to attempt all questions, as there is no deduction for an incorrect answer.

The following topics/sub topics were done really well: 1.1.6 the function of connective tissue; 2.1.6 the role of haemoglobin in oxygen transportation; 2.2.12 the redistribution of blood during exercise; 3.1.4 the basic structure of a glucose molecule; the types of movement of synovial joints; 4.3.6 anatomical representations of levers; 5.3.3 different types of learning curves; 5.3.9 the spectrum of teaching styles; 6.3.3 evaluate a variety of fitness tests; 6.4.3 ways in which exercise intensity can be monitored.

In general, the following areas were good but could be improved upon:

2.2.3 anatomy of the heart; 2.2.4 regulation of heart rate; 2.2.13 cardiovascular adaptations resulting from endurance exercise training; 3.1.1 macronutrients; 4.3.7 Newton's laws of motion; 5.2.1 a simple model of information processing; 6.1.3 standard deviation; 6.3.1 concepts of health-related fitness.

The following areas evidenced some weaknesses and should/need to be improved upon: 1.2.3 the structure of skeletal muscle; 2.2.9 define diastolic blood pressure; 3.1.9 non-essential amino acids; 3.1.10 recommendations for a healthy balanced diet; 4.2.2 types of muscle contraction; 5.1.7 define the term technique; 5.2.8 define the term response time.

The strengths and weaknesses of candidates in the treatment of individual questions

The candidates were very well prepared for the following for the following questions: 1 (1.1.3); 4 (2.1.6); 7 (2.2.12); 14 (3.1.4); 16 (4.2.1); 18 (4.1.2); 19 (4.3.6); 24 (5.3.3); 25 (5.3.9); 28 (6.3.3); 29 (6.4.3).

The candidates were NOT well prepared for the following questions: 2 (1.1.9); 3 (1.2.3); 9 (2.2.9); 12 (3.1.9); 13 (3.1.10); 17 (4.2.2); 21 (5.1.7); 23 (5.2.8).

Question 2

This question had a good distractor (D).

Question 4

This question was answered well by candidates.

Question 12

This was one of the more difficult questions on the paper. Equal numbers of candidates wrongly chose Options B and D.

Question 13

This was the most difficult question on the paper and did not discriminate well between candidates. Option D was chosen as the correct answer by the majority of candidates, slightly less chose the correct option (B).

Question 16

This was the easiest question on the paper where almost all candidates chose the correct option (C).

Question 17

This was the second most difficult question in the paper which discriminated well.

Question 20

This question discriminated well and a high number of candidates answered this question correctly.

Question 21

Question 21 was disregarded for the purposes of grade award as neither response reflected the definition of technique stated in the SEHS guide. The examining team felt the options could have misled candidates and that neither option was the correct/ideal response.

Question 22

This question had a good distractor (option C).

Question 23

This question did not discriminate well (i.e. both less and more able getting it wrong). The difficulty index indicated that this was a harder question. Option B appears to have been a good distractor.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 6	7 - 13	14 - 19	20 - 25	26 - 30	31 - 36	37 - 50

General comments

Only four G2 forms were received for paper 2, and this means that one should be cautious about drawing any firm conclusions. The level of difficulty was reported as appropriate by two centres and too difficult by the other two. In comparison with last year's paper one centre reported that this year's paper was a little easier and three that it was a little more difficult. The clarity of wording was rated satisfactory by three centres and good by one. The presentation of the paper was rated as good by the majority.

Comments on individual questions suggested that the question on 'impulse' (section A question 1) was very challenging, but this concept is expected to be covered in the syllabus (4.3.2). Importantly, candidates actually performed very well on this question. Some concern was expressed on the format of section B where each question focused on one topic. However, it is expected that all of the core must be covered in Paper 2, and section B questions can either be within one topic or can be a 'mix & match' of topics.

The areas of the programme that proved difficult for the candidates

There were some disappointing papers giving some cause for concern. In section A the following areas seem to have proved difficult for some candidates:

Q1(d) analysis of force-time graphs [4.3.2]; Q1(e)(ii) analyze movement in relation to joint action and muscle contraction [4.2.4]; Q1(f) explain the concept of reciprocal inhibition [4.2.3]; Q2 (a)(ii) explain how glucose molecules can combine to form disaccharides and polysaccharides [3.1.5]; Q2(c) discuss the characteristics of the three energy systems and their relative contributions during exercise [3.3.10]; Q3(b) identify the location of skeletal muscles in various regions of the body [1.2.5]; Q3(c) distinguish between the different types of joint in relation to movement permitted [1.1.8].

In section B it was pleasing to find that all three questions were attempted. However, it is of concern that one candidate attempted to answer all three questions in section B, when only one question of three should be answered.

The following areas challenged some candidates: Q4(c) describe nervous and chemical control of ventilation during exercise [2.1.5]; Q5(c) outline the different approaches to classifying motor skills [5.1.3]; Q5 (e) compare motor programmes from both open and closed perspectives [5.2.12]; Q6 (d) (ii) outline a variety of fitness tests [6.3.3]; Q6 (e) discuss the importance of study design in the context of sport and exercise sciences [6.2.2]. Answers to question 4(a) list the principal structures of the ventilatory system [2.1.1] were sound. Question 4(e) analyse cardiac output, stroke volume and heart rate for different populations at rest and during exercise [2.2.7] could be improved upon. It is very pleasing to see that some candidates attempted question 6, because on reflection this question contained, perhaps, more conceptually demanding aspects.

The levels of knowledge, understanding and skill demonstrated

On the whole, the candidates seemed to have a reasonable understanding of what was expected of them in this paper. However, a few candidates really struggled.

The examining team anticipated candidates would have a firmer grasp of knowledge and understanding of:

type of muscle contraction; reciprocal inhibition; how glycogen is formed fuel source and by-products of anaerobic glycolysis & the aerobic system; identifying the location of the biceps femoris muscle; the type of joint found between the ribs and the sternum.

There were candidates who demonstrated a high level of knowledge and understanding of these topics in their answers.

The strengths and weaknesses of candidates in the treatment of individual questions

Question 1

Part questions (a), (b), and (c), were done well, but (d), (e) & (f) could be improved. Q1 (d) was a good question but very challenging.

Question 3

(d) It is important that candidates are able to differentiate between 'structural' and 'functional' when answering questions about muscle 'characteristics'. Some candidates lost marks because of this misunderstanding.

Question 4

At face value appears to contain good, straightforward sub-questions. However, the phrase 'answer the question' is pertinent for sections (d) and (e).

Question 5

There some good examples from sport presented in the candidate responses; candidates appear to have a good grasp of the application of concepts.

Question 6

It is surprising that some candidates struggle with 6(c). Question 6(e) was a demanding part question with a high number of marks allocated.

The type of assistance and guidance teachers should provide for future candidates

- Teachers should consult the online curriculum centre (OCC) frequently for teacher support materials
- Familiarise candidates with the format and types of questions used in paper 2
- Teach drafting/planning with a focus on the command terms, especially those set at objective level 3
- Try to improve knowledge and understanding of: the term 'net' i.e. net impulse; type of muscle contraction; reciprocal inhibition (both conceptual underpinning and applied i.e. use of a sporting example); how glycogen is formed; fuel source metabolic by-products; the difference between structural and functional characteristics of muscle fibre types; the control of ventilation during exercise; motor programmes from open & closed loop perspectives; the importance of study design.
- Teach drafting/planning, particularly for sections of questions set at objective level 3.
- Continue to provide candidates with and even wider range of sporting examples to highlight concepts.
- Ensure that all candidates follow the 'instructions to candidates' i.e. section B: answer ONE question.
- Teach the candidates to 'answer the question'.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 6	7 - 13	14 - 16	17 - 21	22 - 25	26 - 30	31 - 40

General comments

There were four G2 forms received for paper 3. All four supported that the level of difficulty was appropriate. In comparison with last year's paper, three indicated that M11 was of a similar standard, and one recorded that the paper was a little more difficult. In terms of the suitability of this question paper, two centres stated that clarity of wording was satisfactory and two stated that this aspect was good. The presentation of this question paper was reported as good by the majority, and satisfactory by one school.

The examining team were impressed with the responses of candidates in this paper, with some excellent papers scoring high marks. The paper generated a range of responses demonstrating very sound knowledge and skills within a high percentage of candidates.

The responses indicated that appropriate information and teaching had been made available to candidates. In many cases candidates were able to respond well to Objective 1 and 2 questions and also on Objective 3 questions. Interpretation of data provided in questions was dealt with confidently by candidates who were in most cases were able to extract specific data information and relate this to concepts.

The areas of the programme that proved difficult for the candidates

Following the trend of the past two years, option A was the favoured option. It is re-assuring that the four options are attempted by candidates, and it is especially pleasing to observe that option C is being addressed. Generally, the impression is that candidates were well prepared for this examination. However, the following areas seem to have been difficult for some candidates: QA2 (d) explain why the body surface area-to-body mass ratio is important in terms of heat preservation [A.2.12]; QB3 (a) outline issues associated with the measurement of personality [B.1.4]; QC2 (b) discuss the concept of energy balance [C.3.3]; QD2 (d) explain why endurance athletes require a greater water intake [D.2.7].

The levels of knowledge, understanding and skill demonstrated

In general the candidates demonstrated a very good knowledge and understanding of the options. Candidates had a solid grasp of the expectations for this paper and there were some excellent responses to several questions. The data set questions were answered very well by the majority of candidates and some candidates evidenced a comprehensive knowledge and understanding throughout their paper.

The strengths and weaknesses of candidates in the treatment of individual questions

Option A

This option was generally answered very well by many of the candidates.

Option B

An added-value aspect of answers to questions within this option is the apparent readiness of candidates to use sporting examples to clarify and strengthen their answers. This is to be encouraged.

Option C

There were some focused answers, concisely and specifically answering the question.

Option D

Some candidates are slightly less secure in their knowledge and understanding of Option D. For example, some candidates struggled with D2 (b). Teachers should refer to the teacher's notes in assessment statement D.1.2 of the guide.

It was disappointing that some candidates struggled with D2(c), an objective level 1 question. Teachers should refer to the teacher's notes in assessment statement D.2.2 of the guide.

The type of assistance and guidance teachers should provide for future candidates

- Consult the online curriculum centre (OCC) frequently for teacher support materials.
- There were some outstanding papers and they were a joy to assess. To build on this try to ensure all candidates have a slightly firmer grasp of some areas:
 - environmental factors and physical performance i.e. cellular metabolism and the production of heat in the human body, and why the body surface area-to-body mass ratio is important in thermoregulation;
 - individual differences i.e. measures of personality in sporting situations;
 - physical activity and obesity i.e. the concept of energy balance;
 - digestion and absorption i.e. typical pH values found throughout the digestive system.
- Continue to encourage candidates to draft key elements of possible answers.