

SPORTS, EXERCISE AND HEALTH SCIENCE

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 16	17 - 30	31 - 42	43 - 52	53 - 64	65 - 75	76 - 100

General comments

This was the first November 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 trouble to make sure their practical programmes 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

Clerical procedure

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 of SEHS took a lot of time and trouble to prepare their (IA) sample. This effort is very much appreciated. They should be congratulated for their efforts and their candidates will reap the benefits. 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. Furthermore, 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.

If only one member of staff is delivering the SEHS course a valuable exercise could be to link and work with the Biology Department within the centre to ensure internal standardization has taken place.

Overall teachers entered several marks for each criterion from a variety of investigations. This is very encouraging to see. Where several marks appear 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.

No transcription errors between the marks indicated on the work and the mark on the 4/PSOW form were noted.

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 would 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

Candidates are missing quite obvious conventional points (e.g. indicating uncertainties in their data). 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. Care is needed in the correct ways to present citations of references.

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.

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 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 were usually sufficient to establish trends and the number of repeats was not always sufficient to permit statistical analysis. The type of statistics being performed was of a high level in most cases.

Research question/focused problem is different to the teacher prompt and should include the dependent and the independent variables. The variables stated in the research question must be those that are directly measured.

Teachers need to set general themes with plenty of scope for different investigations. Teachers need 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.

Standard protocols will, no doubt, be used by the candidates when they design their investigations. We are not expecting them to re-invent the wheel. 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. The moderators understand this. 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 and the centre's IA work will be subject to an enquiry. Teachers who provide the candidates with a pre-formatted data table can expect their candidates to be moderated down.

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 has a higher degree of precision than the raw data e.g. candidate can not score 4.8 baskets, goals etc
- 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.

Complete may not mean perfect but when the mistakes are consistent they will have an impact on the moderated marks.

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.

Teachers should discourage the use of non-metric units (e.g. teaspoon or °F). Joules should be used in preference to calories. Conversion programmes exist that are easily available online.

Conclusion and evaluation (CE)

As a rule the teachers were encouraging the candidates to collect sufficient data so that conclusions could be drawn from the results. This is a good sign and it is to be hoped that it continues. Furthermore, the statistical analysis was sufficient to reveal relationships between the variables and their degree of significance.

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 remain hypothetical (“I could have incorrectly measured the temperature”). 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.

For every error, candidates could suggest a sensible improvement. The evaluation could also be presented as a table: (1) Error, (2) significance of error and (3) suggested improvement. Suggested modifications were superficial from weaker candidates but the teachers were in general identifying this and marking appropriately.

Manipulative skills (MS)

There is evidence of the candidates being exposed to a sufficient 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. The safety and ethics of science investigations have been reviewed and a new animal experimentation policy has been posted 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. Evidence of participation in the project does not need to be presented unless it is specifically requested by the IB.

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

- Read the feedback from this session and act upon it.
- Consult the Online Curriculum Centre (OCC) for Teacher support material (TSM).
- 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.

- **Do not** use the Group 4 Project for assessment of D, DCP CE or MS. Only use it for Personal Skills. Inappropriate use will be sanctioned in subsequent sessions.
- Make sure the current version of the 4/PSOW form (available on the OCC) is used.
- Check to be sure that all the parts of the 4/PSOW form are completed correctly.
- Only the work for the candidates selected through IBIS is required to send for moderation.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 9	10 - 12	13 - 15	16 - 19	20 - 22	23 - 29

General comments

Each session teachers are invited to submit comments about each exam. These forms can be downloaded from the OCC. The feedback was that this was a fair and balanced paper and the level of difficulty was appropriate. The syllabus coverage and the presentation of paper were satisfactory or good. The clarity of wording of the paper was regarded as good.

The difficulty index (i.e. the proportion of candidates giving the correct answer for each question) supports that there is a good spread of marks across the paper. The discrimination index (i.e. the extent to which a question distinguishes between the more able and the less able candidates) varied from -0.11 to 0.89. There were three questions with a negative discrimination index (i.e. those which the more able candidates tended to get the wrong answer). There appear to be a good number of discriminating questions on this paper, with a smaller number that did not seem to discriminate well.

The following topic areas were done really well:

- Topic 1 the skeletal system (1.1.1 distinguish anatomically between the axial and the appendicular skeleton & 1.2.1 outline the general characteristics common to muscle tissue)
- Topic 2 exercise physiology (2.1.5 the significance of carbon dioxide in the control of pulmonary ventilation & 2.2.2 the functions of leucocytes)
- Topic 3 energy systems (3.1.1 list macronutrients, 3.2.1 outline anabolism, 3.3.6 the ATP-CP system & 3.3.9 EPOC)
- Topic 4 movement analysis (4.1.4 structure and function of muscle fibre type & 4.2.1 types of movement of synovial joints)
- Topic 5 skill in sport (5.3.2 the phases of learning & 5.3.6 types of transfer)
- Topic 6 statistical analysis (6.1.2 calculate the mean).

The following areas could be improved upon:

- Topic 1 (origin and insertion of muscles),
- Topic 2 (2.2.3 anatomy of the heart & 2.2.1 composition of blood)
- Topic 5 (information processing).

The following areas evidenced weaknesses and should be improved upon:

- Topic 2 (2.1.1 structure and 2.1.2 function of the ventilatory system),
- Topic 4 (4.1.3 neuromuscular function – sliding filament theory),
- Topic 5 (the characteristics and classification of skill – Fleishman's taxonomy of motor abilities);
- Topic 6 (6.3.3 principles of training programme design – ways in which exercise intensity can be monitored – Borg scale);

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

The candidates were well prepared for questions: 1, 3, 8, 10, 13, 15, 16, 17, 19, 20, 26, 27 and 28. The candidates were NOT well prepared for questions 4 & 18 (4.1.3 sliding filament theory), 6 (2.1.3 inspiratory reserve volume), 23 (5.1.6 perceptual motor ability) and 30 (6.3.3 rating of perceived exertion).

Some questions performed in a predictable way and no comments need to be made about them. The comments that follow relate to questions where candidate performance was very good or very poor or questions that aroused comment from teachers on G2 forms.

Question 2

The correct answer was D (bursae – which is a closed fluid-filled sac that functions to reduce friction between tissues of the body), though some candidates answered either B (articular capsule) or C (synovial membrane). An articular capsule is an enveloping membranous structure, and a synovial membrane is a layer of lubricating connective tissue that lines the cavities of joints (and tendon sheaths and bursae).

Question 7

37% of candidates chose the wrong answer to this question. The question perhaps would have been clearer if it had read '..... the possible relationship between volume and pressure *inside the lungs* when exhaling'.

Question 11

This question had a discrimination index of 0.89. 44% of candidates chose the wrong answer, possibly due to misinterpretation of the schematic diagram.

Question 12

This question had a negative discrimination index (-0.11). Traditional textbook sources would support 'A' as the correct answer, but there are some research papers that show some slight change in diastolic blood pressure (e.g. Brett *et al* (2000) *Circulation* 101, pp. 611-615; Banerjee *et al* (2004) *Nephrology Dialysis Transplantation* 19, pp. 1528-1532). It is possible that some of the high achieving candidates are engaging with this type of research.

Question 13

Over 80% of candidates chose C (lipid) as their answer, with the remaining candidates choosing B (water). This was a mistake in the SEHS guide which was corrected as a result of the curriculum review in July 2009. The updated guide lists water as a macronutrient. Both B and C were accepted as answers to this question.

Question 14

This question had a negative discrimination index (-0.11), and just under half the candidates chose the wrong answer. It is unfair to expect candidates to remember an exact figure for recommended salt intake. As indicated in the guide: *Recommended intakes of nutrients have been published in some countries. The recommendations vary and this raises questions about how the levels are decided.* For this reason, the question was deleted.

Question 22

Some candidates answered D. Both playing soccer and tennis involve skills more towards the open end of the continuum. Soccer is an invasion game, whereas tennis is a net-barrier game. It is a fair assumption of this question that defenders would be sharing the same playing area as the team in possession of the ball, adding comparatively to the externally paced demands, for example. Furthermore, the soccer player is operating within 360 degree demands, whereas the tennis player playing a forehand shot will always have their opponent in front of them (within 180 degree demands), and so forth.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 14	15 - 20	21 - 26	27 - 31	32 - 37	38 - 50

General comments

Feedback was received from three centres. Teachers thought the level of difficulty was appropriate. Syllabus coverage was regarded as satisfactory or good. The clarity of wording and the presentation of the paper was regarded as 'good'.

The areas of the programme that proved difficult for the candidates

In section A, the following areas seem to have proved difficult for some candidates:

- 2.2.8 cardiovascular drift
- 4.1.2 explain the role of acetylcholine in muscle contraction
- 4.3.12 Bernoulli principle;
- 4.3.9/4.3.10 concept of angular momentum;
- 5.1.9 differences between skilled and novice performer.

In section B, the majority of candidates answered question 6, with very few opting for questions 5 or 7. Those who answered question 5 (a) nutrition and energy systems [3.3.1] were sound with the labelling, but use of the action verb 'draw' challenged the artistic skills of the candidates. Question 6 (a), (b) & (c) were answered quite well. Interestingly, the applied part of this question 6, part (d) principles of training programme design [6.3.2] provided some difficulty for some candidates, with several being repetitive in their answers. Question 7 (a) and 7 (b) indicated a firm grasp of statistical analysis/standard deviation [6.1.3 & 6.1.4] and information processing/response time factors [5.2.8 & 5.2.9].

Information processing [5.2.13] can be a difficult concept to grasp and it is recommended that candidates engage with McMorris, T (2004) *Acquisition & performance of sports skills*, p.146, pp.177-179 & p.193, to enhance their knowledge, understanding and application of Schmidt's schema theory. The evaluative aspect of question 7 (d) [6.2.7] could be improved upon.

The levels of knowledge, understanding and skill demonstrated

In general, there appears to be a spread of marks across both sections A and B. On the whole, the majority of candidates seemed to have an understanding of what was expected of them in this paper. It is surprising to see that candidates did not have a firmer grasp of knowledge and understanding of cardiovascular drift, the role of acetylcholine in muscle contraction, the Bernoulli principle, and the concept of angular momentum. However, there were some 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

Parts (a) to (e) were done well, but part (f) could be improved. There was possibly confusion in 1 (c) as to whether candidates were being asked to compare low versus high calcium intake *or* compare within low and compare within high calcium intake. Both interpretations were accepted.

Question 3

There was a poor quality of answers to part (c), possibly as many candidates may lack personal experience of playing golf.

Question 4

(a) (i) A lack of practical experience of the demands of the 800m event may have disadvantaged some candidates.

Question 5

(a) Candidates clearly demonstrated knowledge of the ultrastructure of a typical animal cell, yet struggled to meet the requirements of the action verb 'draw'.

Question 6

This was a popular question and candidates showed evidence of sound knowledge and understanding in part (a) and part (c). Part (b) could be improved upon and part (d) tended to be repetitively descriptive.

Question 7

Parts (a) and (b) were answered well, however some candidates struggled with the action verb 'evaluate' in part (d).

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
- Make use of past/specimen papers and mark schemes for exam preparation
- Familiarise candidates with the action verbs
- Teach drafting/planning for sections of questions set at objective level 3, particularly if the action verb is 'evaluate'
- Try to improve the candidates knowledge and understanding of:
 - the association between cardiovascular drift and stroke volume;
 - acetylcholine is a chemical/transmitter between nerve ending and muscle/diffuses across a synapse;
 - the Bernoulli principle, specifically what causes a ball to lift/travel further;
 - the law of conservation of angular momentum;
 - how to explain Schema theory by providing application examples.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 16	17 - 20	21 - 24	25 - 28	29 - 40

General comments

Feedback was received from three centres. This means that one should be cautious about drawing any firm conclusions. The level of difficulty was regarded as appropriate by all. It is re-assuring to note that teachers indicated good suitability of the question paper for the syllabus coverage, clarity of wording and presentation of the paper.

Candidates avoided Options B (Psychology of sport) and C (Physical activity and health). It is concerning that option C has not been attempted in either May 2009 or November 2009. With current lifestyle trends it is a very important area to be covered and candidates should engage with some of the very important content of this option.

The paper generated a range of responses demonstrating sound knowledge and skills. The responses indicated that appropriate information and teaching had been made available to candidates. Many candidates were able to respond well to Objective 1 and Objective 2 questions but not so well to Objective 3 questions. However, there were several candidate responses to paper 3 that were excellent. Interpretation of data provided in questions was well dealt with by candidates who were in most cases able to extract the specific information and demonstrate their knowledge and understanding of underpinning concepts.

The areas of the programme that proved difficult for the candidates

The following area seems to have been difficult for some candidates:

- water and electrolyte balance [D.2.2]; [D.2.3]; [D.2.6].

The levels of knowledge, understanding and skill demonstrated

In general, the candidates demonstrated a sound knowledge and understanding of the options. There is a spread of total marks for this paper and, on the whole, candidates have a grasp of the expectations for paper 3. In particular, a sound understanding was evident of:

- training [A.1.3; A.1.4]
- environmental factors & physical performance [A.2.16; A.2.8 & A.2.9; A.2.11 & A.2.15; A.2.13]
- non-nutritional ergogenic aids [A.3.1; A.3.4; A.3.6]

The answers given to Objective 3 questions ranged from excellent, comprehensive answers that remained focused on the questions and provided authoritative responses to the questions; satisfactory answers, generally accurate, but presented rather descriptively; answers that contained inaccuracies, omissions and/or misunderstandings.

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

All candidates answered option A and option D. Generally, candidates scored higher on option A suggesting that candidates are less secure in their knowledge and understanding of Option D.

Option A

A1 One G2 comment was “that knowledge of macrocycle, mesocycle and microcycle is not a requirement”. However, the questions stemming from the stimulus were about training principles.

Option D

D2 (b) Some candidates struggled with this question, which hopefully will be improved upon as a result of introduction of a teacher’s note in D.2.3. and D.2.5.

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

Teachers should

- Try to ensure candidates have a firmer grasp of the water and electrolyte balance aspects, specifically:
 - the comparison of water distribution in trained and untrained individuals;
 - the role of the kidney in maintaining water balance of the blood.
- Ensure that candidates understand that the action verbs suggest, discuss, explain, outline, describe, distinguish require different treatments
- Try to ensure candidates can explain `why` rather than just describe for Objective 3 questions
- Encourage candidates to draft key elements of possible answers, to help contribute to clarity of response, especially for Objective 3 questions
- Emphasise to candidates the importance of remaining focused on answering the specifics of the question
- Make use of past/specimen papers and mark schemes for exam preparation
- Consult the online curriculum centre (OCC) frequently for teacher support materials.