Sports, exercise and health science

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 15	16 - 31	32 - 43	44 - 54	55 - 66	67 - 77	78 - 100

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

The range and suitability of the work submitted

The variety of investigations, duration and coverage of the practical programme was varied and was very good in some schools. There was a range of hands-on activity in most core topics along with a sound use of ICT. Unfortunately, some schools included time for write-up of investigations (D, DCP & CE) in the hours allocated for practical work.

The quality of IA work was varied across schools. Some candidates produced outstanding reports with very thorough background research and reference to ethical issues both in their design and again in their conclusion. Most schools used appropriate investigations of a sound standard. There was a serious problem, however, in schools which set investigations for assessment that gave too much guidance or insufficient latitude which resulted in the whole class attempting the same investigation.

The moderators were concerned when the only marks appearing on the 4/PSOW form were the two marks required for internal assessment. There was often no indication that candidates were marked a number of times using the criteria. One wonders how these candidates receive the necessary feedback to improve their performance.

Candidate performance against each criterion

In some schools teachers applied the criteria rigorously and clearly, and moderators were able to make relatively small adjustments to the marks. In schools where the descriptors of the different aspects were ignored, moderation may have reduced the marks quite severely.

Teachers who included the "complete", "partial" and "not at all" breakdown of their marks were providing helpful information to the moderators. When this was combined with comments and feedback to candidates it was very clear how teachers awarded marks. There was a large number of teachers who took a lot of time and trouble to prepare their Internal Assessment sample. This effort was very much appreciated. They should be congratulated for their efforts. It was a lot easier for a moderator to support a teacher's marks when there were clear, readable notes accompanying the sample.

Design

Some schools were using established design prompts. However, in many cases, the prompts were not appropriate because the teacher gave the candidate the equipment, relevant formula and the independent variable. Teachers should avoid setting designs that are already covered completely in readily available literature such as the effect of running intensity on heart rate levels. The research question/focused problem is different to the teacher prompt and should include the dependent (you measure) and the independent (you change) variables.

Candidates need to be reminded that for a "complete" Design, the three categories of variables must be clearly identified (and vague statements like "I will measure the distance" need further clarification of how this will be done). The range of values of the independent variables and number of repeats (ideal to have 3-5 repeats for each variable) was not always sufficient to establish trends or permit statistical analysis. A minimum of five participants was also needed to undertake further statistical analysis in the form of standard deviation.

Standard protocols will, no doubt, be used by candidates when they design their investigations. However, these standard protocols must be referenced and 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.

DCP

A problem relayed by moderators was that some investigations did not generate sufficient quantitative data for adequate processing. Associated qualitative data was also expected and this was not always given. Candidates' need to be taught that observations made during the experiment will assist them in determining the validity of the data and will strengthen their conclusion.

It may be that class data is required in order for the candidate to gain access to sufficient data for significant data processing and determination of uncertainties. The moderators understand this; however, if class data is used for DCP assessment, a number of precautions must be respected. Candidates must present their own data and this can be achieved either by presenting their own data first or by clearly identifying which is their own data in a pooled data table. Candidates must plan and produce their own data table. Copying a table from other candidates could be seen as collusion. Teachers who provide candidates with a pre-formatted data table can expect to have their students moderated down. Unfortunately, there were occasions when subjects did not present any raw data and included only processed data. It should be understood that the use of pooled data is inappropriate for investigations assessed for Design as these are supposed to be the candidate's own individual effort. Moderators are also looking for a brief statement explaining why the candidate gave a particular value of uncertainty for both raw and processed data.

Some candidates did not include descriptive titles for each data table. Every header requires appropriate units along with the error margin. The error margin could be human error as this is often more applicable (e.g. ±0.5 seconds, ± 0.5cm). The number of decimal places must reflect the precision of the measuring instrument.

When calculations are made it is important that the pathway to the answer is clear. This does not always mean there has to be a worked example but a result that springs up out of nowhere will not be credited. Teachers need to remind candidates that a large standard deviation does not necessarily show data is unreliable; it just shows a wide spread. When IA involves many different subjects this large standard deviation is probably to be expected (depending on the variable being measured). Within subject standard deviation would show that there is the possibility of unreliability - this is where qualitative data from the experiment can help explain things.

Presenting processed data on a graph is expected and indeed required for full assessment under DCP. Teachers need to be aware of this requirement.

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

- Tables did not have a descriptive title containing both the dependent and independent variables.

- Units missing in the table column headings (note: decimal units should be used).

- No uncertainties were given in the column headings of tables of data collected using measuring instruments.

- Data (raw or processed) were inadequately presented.

- There were inconsistent decimal places in tables.

- The decimal places did not correspond to the precision of measurements.

- Lack of data meant that individual averages could not always be processed.

- The processed data (2 decimal places) on occasions had a higher degree of precision than the raw data.

- The absence of associated qualitative observations where they were valuable.

- The absence of statistical treatment of the data when it was possible.

- A majority put a linear line of best fit even when the data was clearly S-shaped or had some other non-linear pattern.

- Raw data was plotted in graphs that did not actually reveal anything (Note: raw data can be plotted to derive maxima, minima, optimal rates, intercepts or to reveal correlations).

- Raw data was plotted when the mean should have been calculated and plotted (often the mean was actually calculated and then ignored by the candidate when plotting graphs).

- There was no presentation of uncertainties in graphical data either by using trend lines or error bars or uncertainty ranges on the axes.

- Error bars, when used, were not identified or accompanied by a explanation of what the values meant.

Conclusion and evaluation (CE)

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 must include data from their results to back up their findings and must refer to the appropriate statistical test to discuss the significance of their data. Candidates need to think beyond the given data in order to provide a justification based on a reasonable interpretation of the data. Such insight might look at the extremes of the data range, the origin of the graph or the y-intercept for some physical meaning. Candidates might even give the overall relationship some physical interpretation. Teachers need to look for this when awarding aspect 1 a "complete", as many times moderators had to change a "complete" to a "partial". Stronger candidates added value to their own data findings by referring to or comparing and contrasting with existing data or theory.

Anomalies were sometimes identified and excluded, however, this could be developed further through a discussion of the possible origin of these anomalies. CE is best assessed when candidates have also designed and performed the investigation themselves.

Candidates in some schools show that they have developed a mature sense of criticism of their investigation. Their evaluation of results was based upon a balanced critical analysis of the data. Many candidates constructed three parallel columns corresponding to CE aspects 2 and 3: (1) Error, (2) Significance of error and (3) suggested improvement. The inclusion of a separate column for the significance of the weakness helped to draw candidates to the importance of discussing the significance in addition to just identifying the weaknesses. When discussing the significance of the weakness, few candidates referred to their actual data or

backed up the issues they identified in order to justify their statements. For example a comment such as "students took inconsistent rest periods" needed the candidate to show the effect of this on their results, which student had this as a problem and what effect it had on the data? If it had no effect on the data, it was not significant.

When evaluating procedures, weaker candidates often commented on mistakes and lack of numbers in their sample rather than methodical errors or ways to improve the investigation. Suggested modifications were often superficial and yet marked over generously by teachers. Candidates need to be taught that they should describe at least 3 major weaknesses and more if there are more present. Evaluation is a good discriminator of high achieving candidates and teachers would do well to remember this when they are marking their candidates' work.

Manipulative skills (MS)

Evidence on the 4/PSOW forms indicates that candidates are being exposed to a sufficient range of investigations. This ensures that manipulative skills can be assessed correctly. However, a large number of moderators notice that some schools are attributing 6/6 for the whole sample for this criterion. There is no discrimination between candidates.

Recommendations for the teaching of future candidates

- Many schools allow candidates only two opportunities to earn their best marks. It is recommended that after candidates become familiar with the expectations of IA they have a number of opportunities to be assessed (perhaps 3 or 4) from which the highest two of each criterion are used for their IA mark.

- Because the IA mark is part of a candidate's overall IB grade, it is important that candidates work on their own. Candidates must collect their own data, decide how to process it and write the report on their own.

- Read the feedback from this session and act upon it.

- Share the IA criteria with their candidates and explain them.

- Apply the internal assessment criteria rigorously.

- Consult the OCC for Teacher support material (TSM) for the IA component of the course. The TSM shows how the criteria should be applied 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.

- Guide candidates away from repeating classic investigations or working on the same research question when they design their own investigations.

- Set open-ended themes with enough scope to provide a variety of research questions for the whole class.

- Ensure that investigations have the potential to generate sufficient data for substantial processing.

- Teachers should give candidates experience in identifying independent, dependent and controlled variables.

- Encourage candidates to make additional observations about their experiment (qualitative data).

- Ensure candidates keep their students' anonymity and refer to them by a number and not personal names.

- Teach candidates that each data table should include a descriptive title containing both the dependent and independent variables. Every header also requires appropriate units along with the error margin.

- Teach candidates that the number of decimal places must reflect the precision of the measuring instrument and all decimal places must be consistent in raw and processed data.

- Although many schools correctly appreciate errors and uncertainties, this remains one of the weaker areas for some other schools. Teachers need to address the appropriate treatment of uncertainties in lab work.

- Teach candidates that plotting graphs of raw data is often insufficient if nothing can be derived from them.

- Only processed data is to be presented graphically and the x and y axes must be clearly labelled. When candidates use error bars on graphs, there needs to be an indication of what these values represent.

- 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.

- Further challenge candidates to add value to their own data findings by comparing and contrasting with existing data or theory before starting an investigation and again once the results are complete.

- Reinforce to candidates that they should not rely solely on websites as references; the Internet should be used to complement more quality assured sources.

- Citations of references should be presented correctly; Extended Essay guidelines give very helpful information.

- Encourage candidates to report briefly on ethical issues in their design and again in their conclusion.

- Bind or staple candidates' work.

- Make sure that you are using the most up-to-date version of the 4/PSOW form

- Check that all the parts of the 4PSOW form are completed correctly. It is helpful if the full IA titles (candidate) of investigations are included on the 4/PSOW form as this makes it easier for the moderator to match up the candidate work for assessment.

- Enclose all instruction sheets and/or summaries of oral instructions for the investigations in the moderation sample. Most schools 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.

- Complete one 4/IA form signed by all the teachers for your school's sample. Cross moderation between colleagues is essential.

Further comments

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

Clerical

Many schools did not include complete information about their investigations and this directly affected the progression of moderation. Teachers MUST enclose all the instruction sheets and/or adequate summaries of oral instructions for the investigations in the moderation sample. Most schools complied with this requirement for investigations involving DCP assessment. It was also necessary, however, for investigations where Design is being assessed. A significant number of teachers either did not include this information or provided very limited information.

The latest versions of the 4/PSOW form (available on the OCC) should be used, only one 4/IA form is required per school. The 4/IA form and list of candidates was often absent in the samples received. Teachers need to ensure that the 4/PSOW form is filled in correctly as this was often not the case. The hours allocated for practical work should not include time allocated for write-up of investigations (D, DCP & CE). The hours allocated should be recorded only once on the form and grades, where appropriate, (on the same line for a single investigation) awarded for D, DCP & CE.

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

Ethics and Safety

SEHS will inevitably involve investigations using human subjects and teachers should carefully consider the approach to experiments on human physiology. Safety must be paramount in investigations. Using fellow candidates for investigations into the effect of exercise on heart rate can be considered unsafe if the health status of the candidates is not

determined first. Some schools already expect their students to use a pro-forma to obtain signed consent from participants in experiments. This is good practice but it was too rare and moderators commented on the absence of signed consent in investigations involving human subjects. 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 should also be encouraged to report briefly on any ethical issues which arise during their investigations e.g. 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 sound ICT coverage and some schools have made an effort to equip themselves with the necessary materials to carry out data logging. However, data loggers must be used with care in investigations. 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 schools to apply. However some candidates still need to be taught the correct conventions of graphing. There was 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 did not seem to know how to de-select them. When they were needed candidates often had difficulty labelling them appropriately – candidates often presented the different curves as "series 1" and "series 2".

ICT is an area that candidates could explore further with regard to the presentation of their data; candidates could make wider use of spreadsheets and databases and further develop their presentation of processed data. Conventions of presenting tabulated data still need to be followed when spreadsheet tables are inserted into document files (e.g. centering numbers, adjusting the number of decimal places, column headings).

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 - 24	25 - 26	27 - 30

General comments

Each session teachers are invited to submit comments about each exam. These forms can be downloaded from the OCC. 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. Unfortunately, not all schools submitted G2 forms, with only 22 G2 forms submitted. All 22 G2 forms stated that the level of difficulty was appropriate. Four stated that M14 was of a similar standard in comparison with last year's paper, three reported that it was more difficult and two suggested that it was a little easier in comparison with M13. Thirteen reported N/A i.e. it is likely that these were schools with candidates sitting SEHS for the first time. For clarity of wording, two reported that the clarity of wording was fair, six reported good, ten were very good and four that this aspect was excellent. For the presentation of the paper, two reported that the presentation of the paper was fair, five reported good, nine were very good and six that this aspect was excellent. One school somewhat disagreed that the questions were accessible to all candidates with learning support and/or assessment access requirements, and the majority of schools (i.e. 86% to 99% of schools) reported that the questions were accessible to all candidates irrespective of their religion/belief system, their gender and ethnicity. The G2 teacher comments were very useful and enhanced the grade award process, especially with regards to questions 13 and 15. 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 0.12 to 0.59. There were no questions with a negative discrimination index (i.e. those to which the more able candidates tended to get the wrong answer). There are some questions which did discriminate well and some that did not seem to discriminate well.

The following topics/sub topics were done really well:

1.1.1 distinguish anatomically between the axial and appendicular skeleton; 1.2.5 identify the location of skeletal muscles in various regions of the body; 2.2.1 state the composition of blood; 3.3.7 describe the production of ATP by the lactic acid system; 4.1.1 label a diagram of a motor unit; 4.3.9 state the relationship between angular momentum, moment of inertia and angular velocity; 5.1.1 define the term skill; 5.1.7 define the term technique; 5.1.2 describe the different types of skill; 5.2.2 describe Welford's model of information processing; 6.4.1 describe the essential elements of a general training programme.

The areas of the programme and examination which appeared difficult for the candidates

2.1.3 define the terms pulmonary ventilation, TLC, VC, TV, ERV, IRV and RV; 2.2.3 describe the anatomy of the heart with reference to the heart chambers, valves and major blood vessels; 3.2.3 state the major sites of triglyceride storage; 3.1.7 distinguish between saturated and unsaturated fatty acids; 3.3.2 annotate a diagram of the ultrastructure of a mitochondrion; 3.3.9 describe the production of ATP from glucose and fatty acids by the aerobic system; 4.3.1 define the terms force, speed, velocity, displacement, acceleration, momentum and impulse; 6.4.3 outline ways in which exercise intensity can be monitored.

The areas of the programme and examination in which candidates appeared well prepared

1.2.4 define the terms origin and insertion of muscles; 2.2.13 describe the cardiovascular adaptations resulting from endurance exercise training; 2.1.5 describe nervous and chemical control of ventilation during exercise; 2.1.2 outline the functions of the conducting airways; 3.1.8 state the chemical composition of a protein molecule; 4.3.11 outline the Bernoulli principle with respect to projectile motion in sporting activities; 4.2.2 outline the types of muscle contraction; 5.3.1 distinguish between learning and performance; 6.1.5 outline the meaning of coefficient of variation; 6.1.3 state that the statistical standard deviation…….respectively; 6.3.3 outline and evaluate a variety of fitness tests.

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

The candidates were VERY well prepared for the following for the following questions: 1 (1.1.3); 3 (1.2.2); 10 (3.1.4); 11 (3.1.1); 25 (5.3.7); 26 (5.3.9)

The candidates were NOT well prepared for the following questions: 7 (2.2.3); 8 (2.2.4); 12 (3.2.3); 13 (3.3.9); 14 (3.1.11); 23 (5.3.6); 24 (5.1.6); 29 (6.1.1).

Question 1

Tending toward one of the easier questions, with A as the main distractor (then B followed by C), with a low discrimination index (0.22) i.e. both high and low ability candidates getting it correct.

Question 2

This was a mid-difficulty question. D was the main distractor (followed by A & B almost equally). This question had a good discrimination index (0.45).

Question 3

This was one of the easier questions, with a low discrimination index (0.22) i.e. both high and low ability candidates getting it correct. D and A were almost equal as distractors.

Question 4

The 4th most difficult question in the paper. A was the main distractor and there was a good discrimination index (0.45).

Question 5

 The 6th most difficult question in the paper. A proved to be the main distractor (followed by D then C) and there was a good discrimination index (0.59).

Question 6

One of the mid-difficulty questions in the paper, with a good discrimination index (0.47), with B as the main distractor (followed by A then D).

Question 7

The 3rd easiest question in the paper. with an almost acceptable discrimination index (0.31). The main distractor was A (then B followed by D).

Question 8

This proved to be a mid-difficulty question from the perspective of the candidates and it had a good discrimination index (0.41). The main distractor was B (followed by C then D).

Question 9

This proved to be a mid-difficulty question from the perspective of the candidates and it had a good discrimination index (0.39). The main distractor was D (closely followed by A then B).

Question 10

The 7th easiest question in the paper, with a good discrimination index (0.46), and A as the main distractor (then D followed by C).

Question 11

A challenging question – the 2nd most difficult in the paper, with an almost acceptable discrimination index (0.28). The main distractor was A (then D followed by B).

Question 12

This was one of the mid-difficulty questions, with a good discrimination index (0.59), and B was the main distractor closely followed by C.

Question 13

A good question (3rd most difficult in the paper), with a lower discrimination index of 0.26. During the grade award, following discussion, we decided to accept both B and D answers.

Question 14

This was one of the easier questions with an almost acceptable discrimination index (0.32), and D was the main distractor (then B followed by A).

Question 15

The most difficult question in the paper with a low discrimination index (0.23). During the grade award, following discussion, we decided to accept both A and B answers.

Question 16

The 4th easiest question in the paper with a discrimination index of 0.33. The main distractor was B (then D followed by A).

Question 17

One of the more difficult questions, with A as the main distractor (then B followed by D) and a discrimination index of 0.35.

Question 18

This question could be described as one of the easier questions, with a low discrimination index (0.27), and the main distractor was D (closely followed by B, then C).

Question 19

This question could be described as a mid-difficulty question, with an acceptable discrimination index (0.34), and the main distractor was B (followed by C, then A).

Question 20

A mid-difficulty question with A as the main distractor (followed by C then D). There was an acceptable discrimination index (0.36).

Question 21

The 5th easiest question in the paper, with D as the main distractor and a low discrimination index (0.23).

Question 22

The easiest question, with a poor discrimination index, and A as the main distractor.

Question 23

One of the easier questions with an acceptable discrimination index and A as the main distractor.

Question 24

The 2nd easiest question in the paper with a low discrimination index (0.14) and A as the main distractor.

Question 25

Tending toward being one of the more difficult questions with a good discrimination index (0.44) and B as the main distractor.

Question 26

Tending toward being one of the more difficult questions with an almost acceptable discrimination index (0.32) and C as the main distractor.

Question 27

A mid-difficulty question with an acceptable discrimination index (0.36) and A as the main distractor.

Question 28

The 5th most difficult question in the paper with a lower discrimination index (0.26) and B as the main distractor.

Question 29

A mid-difficulty question with an acceptable discrimination index (0.41) and B as the main distractor.

Question 30

A mid-difficulty question with a lower discrimination index (0.27) and A as the main distractor.

Recommendations and guidance for the teaching of future candidates

No information provided

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 14	15 - 20	21 - 27	28 - 33	34 - 50

General comments

Twenty two 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 20 schools, and too difficult by 2 schools. In comparison with M13 this year's paper was considered much easier by 1 school, of a similar standard by 7 schools, much more difficult by 1 school, and N/A by 13 schools (probably schools new to SEHS). The clarity of wording was rated poor by 1 school, fair by 3 schools, good by 7 schools, very good by 8 schools and

excellent by 3 schools. The presentation of the paper was rated fair by 2 schools, good by 8 schools, very good by 6 schools, and excellent by 6 schools. One school somewhat disagreed that the questions were accessible to all candidates with learning support and/or assessments were accessible to all candidates irrespective of their religion/belief system and their gender and ethnicity. There was a nil response in the G2 form from teachers i.e. they did not provide any further comments about the paper. There may be evidence that a number of new schools were not sufficiently familiar with the SEHS exam format as there were several questions where candidates across the board did not respond appropriately to the command term(s). The examining team felt that the data analysis question was slightly more demanding this session.

A significant number of candidates were poorly prepared for this exam and were not able to use basic terminology correctly – very disappointing.

The areas of the programme and examination which appeared difficult for the candidates

Within the papers I marked there was a wide range of marks for this paper. In section A the following areas seem to have appeared difficult for some candidates:

Qu.1b, calculate the mean difference…….[data analysis]; qu.1c, define health-related fitness [6.3.1]; qu.2b, evaluate the re-synthesis of ATP via the ATP-PC system [3.3.6]; qu.3a, state the name of the thigh muscle indicated by label X….[1.2.5]; qu.4a, list the two stages of learning a motor skill that occur before progression to the autonomous stage [5.3.2]; qu.4b, distinguish between Fleishman's two broad categories of human abilities [5.1.6].

In section B it was pleasing to find that all three questions were attempted. The following areas challenged some candidates: qu.5c, distinguish between the role of insulin and glucagon…….[3.2.7]; qu.6b, distinguish between the Fosbury Flop and the scissors technique………[4.3.4]; qu.6d, explain the mechanics of pulmonary ventilation……..[2.1.4]; qu.7b, identify elements you would expect to find in a motor programme for performing the backstroke in swimming [5.2.11]; qu.7c, distinguish between open loop and closed loop motor programmes [5.2.12].

The areas of the programme and examination in which candidates appeared well prepared

On the whole, the candidates seemed to have a reasonable understanding of what was expected of them in this paper. Whilst there were some candidates who struggled with this paper, indeed there were some extremely disappointing papers, other candidates displayed comprehensive knowledge of factual information in the syllabus and a thorough command of concepts and principles. These candidates demonstrated a high level of knowledge and understanding and constructed detailed explanations of topics in their answers. Generally, candidates were well prepared for questions on: objective level 2 data analysis; analyse movements in relation to joint action and muscle contraction; explain how slow and fast twitch fibre types differ in structure and function; explain the role of neurotransmitters in stimulating skeletal muscle contraction; discuss the variability of maximal oxygen consumption with

different modes of exercise; discuss factors that contribute to the different rates of learning; discuss …….dietary macronutrients differs between endurance athletes and non-athletes; explain the phenomena of oxygen deficit and oxygen debt; explain how Newton's three laws of motion apply to sporting activities; outline the role of haemoglobin in oxygen transportation; discuss the key principles of training programme design; discuss the relationship between selective attention and memory; discuss the differences between a skilled and a novice performer.

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

Question 1

Sections a and e were done well, but section b could be improved by responding to the command term.

I think questions d and f were really good questions demanding an application of data analysis and knowledge to evidence understanding of concepts. There were some really disappointing answers to c – which I thought was a straightforward question. For 1c, candidates struggled to recall a basic definition and the fitness components for this category. With regards to 1d, many candidates attempted to explain why the hypothesis would be rather than discussing how that data could be interpreted to support/reject the hypothesis. With 1f, it was evident that some candidates did not know basic muscles of a region and the action that they cause – perhaps the wording of question made it difficult for candidates to realise the importance of stating the specific muscles involved.

Question 2a

There was a range of responses, and some candidates answered this nutrition and energy systems question adequately whilst others did not respond to the command term evaluate. Candidates rarely achieved full marks and some were confused between the 3 main energy production systems.

Question2b

There were some really excellent answers – but equally there were some poor answers, primarily because the candidates did not respond to the command term.

Question 3a

Factual information about the muscular system needs to be improved as many candidates were not able to recall the correct muscle.

Question 3b

Identification within movement analysis (neuromuscular function – muscle fibre type function) was sound.

Question 3c

There were some really good answers, with some candidates showing excellent knowledge and understanding of the neurotransmitter acetylcholine and the enzyme cholinesterase.

Question 3d

Some candidates responded showing knowledge and understanding, but there were some poor responses. Generally, many candidates did not appear to understand that maximal oxygen consumption depends upon activated muscle mass. The use of the word variability in the question may have confused some candidates.

Questions 4a & 4b

There were some disappointing responses to these fairly straightforward questions.

Question 4c

Most candidates were able to explain factors that contribute to the different rates of learning, but some candidates merely listed the factors rather than explaining the factors.

Question 5

Candidates gave some good answers to 5d and for 5e (although the difference between oxygen deficit and oxygen debt was not always clear for some candidates). It was disappointing to find a wide range in the quality of answers to 5a. For 5b, a number of candidates tended to outline the characteristics rather than the structure. For 5c, some candidates were clearly confused between the role of insulin and glucagon – as well as confusion between glucose, glycogen and glucagon.

Question 6

There is good evidence in the answers given that many candidates have a firm grasp of the fundamentals of biomechanics (6ai and 6aii).   However, there was some consistent misunderstanding of the scissors technique in terms of the position of the centre of mass of the jumper (6b) – there were a number of candidates who did not appear to understand how the position of the centre of mass gives an advantage to a high jumper using the Fosbury Flop. There was a wide range in the quality of answers to 6c, and it is possible that some candidates were confused by the term distribution. Most candidates who answered 6d could explain well, however some misinterpreted and explained how oxygen is acquired and transported throughout the body during exercise (i.e. correct information but not answering the specific question re the mechanics of pulmonary ventilation). Generally, 6e was soundly answered, but there were some poor answers – and candidates were less able to outline the role of haemoglobin in transporting carbon dioxide.

Question 7

Many candidates presented good answers to 7a and 7e, but there were some disappointing answers to 7b, 7c and 7d. For 7a, some candidates described overload as a risk rather than its application in a training programme. Some candidates found it difficult to include specific subroutines that could be part of a backstroke programme (7b). Candidates struggled to distinguish between open and closed loop motor programmes (7c), and they tended to generalise when discussing memory and selective attention (7d).

Recommendations and guidance for the teaching of future candidates

- Try to improve knowledge, understanding AND application of: identify the location of skeletal muscles in various regions of the body; explain the mechanics of ventilation in the human lungs; explain the role of insulin and muscle contraction on glucose uptake during exercise; evaluate the relative contributions of the three energy systems during different types of exercise; explain that a change in body position during sporting activities can change the position of the centre of mass; distinguish between Fleishman's physical proficiency abilities and perceptual motor abilities; describe a motor programme; compare motor programmes from both open and closed loop perspectives; describe the phases of learning; distinguish between the concepts of health-related fitness and performance-related fitness.

- Try to work towards and achieve a greater understanding of the meaning of the action verbs/command terms (this is key to exam performance) used in questions. For example, question 1b is 'calculate' and question 2b was 'evaluate' – some candidates did not answer based on these two command terms and unfortunately lost out on marks. Also, ensure that candidates know that there are marks available for showing their work when the command term is calculate.

- In year 1, during formative assessment put the definition for the command term with the command term either with the question or as an appendix for the candidates to refer to.

- Teach drafting/planning for questions, especially questions set at objective level 3.

- Continue to provide candidates with an even wider range of sporting examples to highlight concepts – this enhances responses.

- Teach candidates to answer the question. For example, question 6d is asking about the mechanics of pulmonary ventilation – it is not about the process of gaseous exchange at the alveoli (for example).

- Always ensure that all candidates follow the 'instructions to candidates' before attempting to answer questions.

- Introduce candidates to the command terms in the MYP PHE programme – or equivalent.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 6	7 - 12	13 - 18	19 - 23	24 - 27	28 - 32	33 - 40

General comments

Twenty two G2 forms were received for paper 3, and this means that one should be cautious about drawing any firm conclusions. The level of difficulty was reported as appropriate by 21 schools, and too difficult by 1 school. In comparison with M13 this year's paper was considered a little easier by 1 school, of a similar standard by 7 schools, much more difficult by 1 school, and N/A by 13 schools (probably schools new to SEHS). The clarity of wording was rated fair by 2 schools, good by 6 schools, very good by 11 schools and excellent by 3 schools. The presentation of the paper was rated fair by 2 schools, good by 6 schools, very good by 7 schools, and excellent by 7 schools. One school somewhat disagreed that the questions were accessible to all candidates with learning support and/or assessment access requirements, and the majority of schools (i.e. 95%+ of schools) reported that the questions were accessible to all candidates irrespective of their religion/belief system, their gender and ethnicity.

I was very impressed with the overall performance of many of the candidates. However, I am deeply concerned about the performance of some of the candidates who were scoring nil or very few marks.

The paper generated a range of responses demonstrating very sound knowledge and skills within a significant number of candidates, but I am concerned about the long tail at the low end of the range of marks. The question paper responses of the candidates show that appropriate information and teaching had been made available to many of the candidates (but possibly not all candidates), with only a few questions that generated poor responses. In many cases candidates were able to respond well to Objective 1 and 2 questions, but some could still improve on Objective 3 questions. Interpretation of data provided in questions was dealt with confidently by most candidates who were (in most cases) able to extract specific data information and relate this to concepts. Once again it was a pleasure to assess this paper, but I must highlight my serious concerns about the low-scoring candidates and how well prepared they were to sit this exam.

The areas of the programme and examination which appeared difficult for the candidates

Following the trend of recent years option A was the favoured option, along with options C and D. However the four options were all attempted and it was pleasing to note that more

candidates were attempting option C. Generally, I have the impression that the majority (but not all) candidates were well prepared for this exam. Options A, C and D were generally answered well, but there was a range of answers. A number of students struggled with Option B, especially the questions on cognitive anxiety and goal orientation, where students tended to answer poorly. However, the following areas seem to have been difficult for some candidates: qu. 1c suggest how periodization should be organized to optimize performance and avoid overtraining [A1.4]; qu. 2c describe two health risks associated with exercising in the heat [A2.7]; qu. 3a list four classes of non-nutritional ergogenic aids that are currently banned [A3.3]; qu. 5b outline the negative effects of an outcome orientation when judging your own success in sport [B2.5]; qu. 6c explain how PST can be used to improve performance [B4.1]; qu. 7c discuss the concept of energy balance [C3.3]; qu. 9a outline how chemical signals affect appetite regulation [C3.4]; qu. 12c discuss the regulation of electrolyte balance during prolonged exercise [D2.8]; qu. 13a explain why foods with different GI values influence carbohydrate intake for a professional soccer player after a game [D4.6].

The areas of the programme and examination in which candidates appeared well prepared

Many of the candidates demonstrated a very good knowledge and understanding of their options. On the whole most candidates have a good grasp of the expectations for this options paper. The data based questions were answered well by the majority of candidates and, without doubt, some candidates evidenced a first class knowledge, understanding and application throughout their paper.

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

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 how the candidates really show the application of their knowledge and understanding – very well done.

Option A

This option was generally answered very well by many of the candidates. It is really pleasing that the candidates seem to be comfortable with application of concepts and principles, as evidenced in their examples from sporting/exercise situations.

Question 1a and bii

Data based, the majority of candidates were secure in their interpretation and analysis;

Question 1c

Some candidates based their answers around individual training bouts and HIT/LIT as opposed to how periodization should be organized;

Question 2a and 2b

Most answers evidenced a firm grasp of their subject. However, in 2a, some candidates were mistakenly drawn into nutritional/acclimation longer term aspects rather than DURING a distance run;

Question 2c

Some candidates were vague in their answers and did not respond to the command term 'describe';

Option B

Question 4a and b

Data based, the candidates were secure in their interpretation and analysis;

Question 4c and 5a

Candidates showed a sound grasp of their subject, and I thought there were some really good answers to both questions;

Question 6a

Generally very well answered, but some candidates attempted to answer from a physiological perspective;

Question 6b

There were some excellent applied examples given to enhance answers;

Option C

Question 7a and b

Data based, candidates were secure in their interpretation and analysis;

Question 7c

Some candidates showed a good knowledge and understanding of their subject, but too many candidates repeated the 3 possible IN-OUT equations;

Question 8a

There were some disappointing answers to this question, and many candidates were more secure in their knowledge about exercise than habitual physical activity;

Question 8b

Generally very well answered;

Question 8c

It is important to emphasise the need to stay focused on answering the specific question;

Question 8d

Very well answered by the majority of candidates, again with sound application evident;

Question 9a

A significant number of candidates need to be more secure in their knowledge and understanding of this area;

Question 9b

Generally very well done, with some excellent answers to this question;

Option D

Question 10a and c

Data based, interpretation and analysis responses were sound;

Question 10b

Data based, a significant number of students did not provide the correct answer (e.g. not presenting the 'negative' sign or not showing the relevant stages of the working or both);

Question 11a

Many candidates have this knowledge, but some candidates appeared to be guessing;

Question 11b

Many candidates were secure in their responses, but some only knew the function of one of the enzymes;

Question 12a and b

Most candidates showed they know and understand these assessment statements;

Question 12c and 13a

I was surprised to find that some candidates were less secure on these topics;

Question 13

There was a full range of responses, and there were some really excellent answers.

Recommendations and guidance for the teaching of future candidates

- Ensure that all candidates follow the 'instructions to candidates'. For example, more than one candidate answered all 4 options – this is of concern.

- There were some outstanding papers presented and they were a joy to assess. To build on this, try to ensure all candidates have a slightly firmer grasp of some areas:

- training eg describe various methods of training and avoid overtraining and injury, discuss how periodization should be organised to optimise performance and avoid overtraining;

- environmental factors and performance eg health risks associated with exercise in the heat, be able to describe heat cramps, heat exhaustion and heat stroke;

- motivation eg goal orientation theory, negative aspects of outcome orientation;

- cardiovascular disease eg how a lifestyle of physical inactivity increases the risk factors for cardiovascular disease;

- physical activity and obesity eg outline how chemical signals arising from the gut and from the adipose tissue affect appetite regulation;

- water and electrolyte balance eg discuss the regulation of electrolyte balance during acute and chronic exercise.

- Also, please ensure candidates answer the question e.g. Qu.3a is about 'classes of' not 'types of'.

- Continue to encourage candidates to draft key elements of possible answers, to help with clarity and structure of response to questions. I find following the guideline of knowledge – understanding – sport/exercise/health application of assessment statements useful as a guide for revision in preparation for exams/assessment.

Further comments

It is still of concern that some candidates attempted to answer all four options and this must be addressed by the teachers. Further, I need to highlight again that I am deeply concerned about the performance of some of the candidates who were scoring nil or very few marks.