

November 2015 subject reports

Sports, exercise and health science

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 17	18 - 33	34 - 45	46 - 56	57 - 67	68 - 79	80 - 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 quality of internal assessment work from many candidates was very good with samples covering all aspects of the practical programme, which was great to see. Teachers are also to be commended for encouraging candidates to be creative with their own designs, even if some did lead to trivial results. There was a range of hands-on activity in most core topics along with a sound use of ICT. Most schools used appropriate investigations of a sound standard. Many candidates produced outstanding reports with very thorough background research and reference to ethical issues both in their design and again in their conclusion.

Candidate performance against each criterion

There does appear to be a lot of variability in how internal assessments are approached and marked, suggesting more training is needed to bring better understanding and consistency among teachers. 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. Schools that included internal moderation generally produced work of a higher quality and with marks being line with the Group 4 assessment criteria. Teachers who included

the “complete”, “partial” and “not at all” breakdown of their marks were providing helpful information to the examiners. When this was combined with comments and feedback to candidates, it was very clear how teachers awarded marks. It was a lot easier for an examiner to support a teacher’s marks when there were clear, readable notes accompanying the sample. Limited, or no written teacher comments on reports for candidates also make examiners wonder how they receive the necessary feedback to improve their performance.

Design (D)

Most designs were submitted followed the scientific method of conducting research and it was great to see that candidates were able to clearly identify the independent, dependent, control and confounding variables. Most candidates were very well trained in providing a list of the controlled variables and discussing how the impact of confounding variables could be reduced. Often, the research questions were insufficiently narrowed down and methods were not detailed enough, but generally this criterion was quite strong. Examiners commented that where standard protocols were used by candidates, they were often not referenced and significantly modified or applied to the candidate’s own investigation. The range of values of the independent variables and number of repeats (ideal to have 3-5 repeats for each variable) were not always sufficient to establish trends or permit statistical analysis. A minimum of five participants were also needed to undertake further statistical analysis in the form of standard deviation.

Some teachers were using established design prompts. However, in some 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 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.

Data collection and processing (DCP)

DCP varied from centre to centre. A common problem noticed by examiners was that some investigations did not generate sufficient quantitative data for adequate processing, with many candidates presenting raw data and not processed data. Associated qualitative data was generally evident and it was clear that teachers had taught candidates that observations made during the experiment will assist them in determining the validity of the data and in turn strengthen their conclusion.

Many candidates did not include descriptive titles for each data table. Errors or uncertainties still seemed an area of confusion. Every header requires appropriate units along with the error margin. The error margin could be human error as this is often more applicable (for example, ± 0.5 seconds, ± 0.5 cm). Examiners also look for a brief statement explaining why the candidate gave a particular value of uncertainty for both raw and processed data. The number of decimal places must reflect the precision of the measuring instrument. The processed data (to 2 decimal places) on occasions had a higher degree of precision than the raw data.

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 examiners understand this, however, if class data is used for DCP assessment, a number of precautions must be

respected. Candidates must present their own data which 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. Teachers who provide candidates with a pre-formatted data table should be prepared for marks to be moderated down by the examiner.

When calculations are made, the majority of candidates provided one or more worked examples. This does not always mean there has to be a worked example but a result that appears out of nowhere cannot be credited. Almost all candidates calculated the mean and standard deviation. Teachers should continue to remind candidates that a large standard deviation does not necessarily show that data is unreliable; it just shows a wider spread. Where assessment involves many different subjects, this large standard deviation is to be expected as there is the possibility of unreliability – where qualitative data from the experiment can help explain things. Most candidates seemed well coached in statistics and applied T-tests and correlation coefficients whenever appropriate, which was great to see.

Presenting processed data on a graph is expected and indeed required for full assessment under DCP. Teachers should be aware of this requirement and that computer generated graphs proved problematic in terms of the x- and y-axis, labels and plotting of data. Teachers must teach candidates how to add error bars for both line graphs and bar graphs, and to practice all of these in a software tool such as Excel. Many candidates did not include descriptive titles for each graph, or had two titles which stated the same thing.

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

- Tables and graphs did not have a descriptive title containing both the dependent and independent variables;
- Units missing in the table column headings (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 (to 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 linear line of best fit was included 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 an explanation of what the values meant.

Conclusion and evaluation (CE)

Many candidates included data from their results to back up their findings and referred to the appropriate statistical test to discuss the significance of their data (CE aspect 1). Candidates, however, still should think beyond the given data in order to provide 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 could even give the overall relationship some physical interpretation. Teachers should look for this when awarding “complete” for aspect 1, examiners had to change a “complete” to a “partial”. Many 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 have been developed further through a discussion of the possible origin of these anomalies. CE continues to be best assessed when candidates have also designed and performed the investigation themselves.

Candidates often constructed three parallel columns corresponding to CE aspects 2 and 3: (1) error, (2) significance of error and (3) suggested improvement; horizontal rows may be more appropriate with regard to format. Candidates in some centres 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. Despite the inclusion of separate rows for the significance of the weakness which helped to draw candidates to the importance of discussing the significance in addition to just identifying the weaknesses, this continues to be an immediate area for attention. When discussing the significance of the weakness, the teacher should highlight that candidates must refer to their actual data or back up the issues they identified in order to justify their statements.

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 should be taught that they should describe at least three major weaknesses (or more if they are present). Evaluation is a good discriminator of high achieving candidates and teachers should 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 examiners noticed that some schools are attributing full marks 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 marks from each criterion are used for their total internal assessment mark;

- Teachers should read the feedback provided from this session and act upon it;
- Share the criteria with their candidates and provide explanation as necessary;
- Apply the internal assessment criteria rigorously;
- Consult the OCC for Teacher support material (TSM). The TSM demonstrates how the criteria should be applied. It consists of a series of investigations or part investigations by candidates that have been assessed by examiners using the assessment criteria;
- Ensure that investigations have the potential to generate sufficient data for substantial processing;
- 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 centres correctly appreciate errors and uncertainties, this remains one of the weaker areas. Teachers should 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 must be an indication of what these values represent;
- Teachers must teach candidates how to add error bars for both line and bar graphs, and to practice all of these in a software tool, such as Microsoft Excel;
- CE aspect 1 (concluding) should include data to back up findings and references to the appropriate statistical test used 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;
- Make sure that you are using the most up-to-date version of the 4/PSOW form;
- Check that all the parts of the 4/PSOW form are completed correctly. It is helpful if the full titles of investigations are included on the 4/PSOW form as this makes it easier for the examiner to match up the candidate work for assessment;
- Enclose all instruction sheets and/or summaries of oral instructions for the investigations in the sample. Most centres complied with this requirement. When 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 subject teachers for the sample. Cross moderation (standardization of marking) between teachers 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.

Teachers must ensure that the latest version of the 4/PSOW form (available on the OCC) is used and filled in correctly as this was often not the case. 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. There seemed to be confusion about what the cross was for in the boxes under the different criteria and for each investigation; some centres used this to identify the work sent but several used this to show all the work that had been assessed. The cross is to identify the top two grades and to identify the work being sent to the examiner as part of the sample. Some centres sent photocopies of candidate work. Usually these were of good quality. Photocopies of graphs and diagrams using colour can be confusing. Where possible, it would be better to send the originals and keep 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 centres 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 examiners commented on the absence of signed consent in investigations involving human subjects. The International Baccalaureate Organization (IBO) 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 that arise during their investigations, for example, 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 (for example, 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 - 12	13 - 17	18 - 20	21 - 23	24 - 26	27 - 30

General comments

This is the second mainstream November session for SEHS, which was a pilot course until May 2014. Each session teachers are invited to submit comments about each exam on the form G2. These forms can be downloaded from the OCC. These comments provide valuable evidence used by the principal examiners during the Grade Award meetings. It is hoped that more will be submitted in future sessions. For this session only two G2 forms were submitted. Both forms stated that the level of difficulty was appropriate, and a similar standard to last year’s paper, the clarity of wording and presentation of the paper was very good. In feedback to the suitability of the question paper in terms accessibility and cultural/religious/ethnic bias, both forms strongly agreed with suitability of the question paper based on religion/belief system and ethnicity. One form agreed with the suitability for learning support and gender bias, whilst one form strongly agreed with the suitability of the paper in terms of accessibility for learning support and gender bias. One G2 form provided additional comment regarding question 25 where they felt that there were two possible answers. This is addressed later in this report.

The difficulty index (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 (the extent to which a question distinguishes between the more able and the less able candidates) varied from .03 to 0.66. There are some questions which did discriminate well and some that did not seem to discriminate well. The mean mark was 25.1 (range 13 - 30). This is slightly up

compared to November 2014 when it was 24.87, but down from November 2013 when it was 26.52.

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

The following topics/sub topics were answered well:

- 1.1.1 – Distinguish anatomically between axial and appendicular skeleton;
- 1.1.5 – Apply anatomical terminology to the location of bones;
- 1.2.5 – Identify the location of skeletal muscles in various regions of the body;
- 2.1.1 – List the principal structures of ventilator system;
- 2.1.7 – Explain the process of gaseous exchange at the alveoli;
- 2.2.6 – Describe the relationship between heart rate, cardiac output and stroke volume at rest and during exercise;
- 2.2.9 – Define the terms systolic and diastolic blood pressure;
- 2.2.13 – Describe the cardiovascular adaptations resulting from endurance exercise training;
- 3.1.2 – Outline the functions of macronutrients and micronutrients;
- 3.1.3 – State the chemical composition of a glucose molecule;
- 4.3.7 – Define Newton's three laws of motion;
- 5.1.7 – Define the term technique;
- 5.3.1 – Distinguish between learning and performance;
- 5.3.7 – Outline the different types of practice;
- 6.1.2 – Calculate the mean and standard deviation of a set of values;
- 6.1.3 – State that the statistic standard deviation is used to summarize the spread of values around the mean, and that within a normal distribution 68% and 95% of the values fall within plus or minus one or two standard deviations respectively;
- 6.2.1 – Outline the importance of specificity, accuracy, reliability and validity with regard to fitness testing;
- 6.2.3 – Outline the importance of the Physical Activity Questionnaire (PAR Q).

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

The following areas evidenced some weaknesses and should/need to be improved upon:

- 1.2.3 – Annotate the structure of skeletal muscle;
- 2.1.3 – Define the terms vital capacity;
- 3.2.3 – State the major sites of triglyceride storage;
- 3.3.7 – Describe the production of ATP from glucose and fatty acids by aerobic system;
- 3.3.10 – Discuss the characteristics of the three energy systems and their relative contributions during exercise;
- 4.1.1 – Label a diagram of a motor unit;
- 4.2.1 – Outline the types of movement of synovial joints;
- 4.2.4 – Analyse movements in relation to joint action and muscle contraction;
- 4.3.5 – Distinguish between first, second and third class levers;
- 5.2.2 – Describe Welford's model of information processing;
- 5.2.10 – Evaluate the concept of the psychological refractory period (PRP);
- 6.4.3 – Outline ways in which exercise intensity can be monitored.

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

The candidates were very well prepared for the following questions: 5 (2.1.1); 9 (2.2.9); 11 (3.1.2); 12 (3.1.3); 24 (5.3.1); 26 (6.1.2); 27 (6.1.3); 28 (6.2.3); 29 (6.2.1).

The candidates were not well prepared for the following questions: 6 (2.1.3); 16 (4.2.1); 17 (4.2.1); 18 (4.2.4); 22 (5.2.10); 23 (5.2.2); 30 (6.4.3).

Question 1

This question was answered relatively well with a difficulty index of 85.71; with a poor discrimination index (0.20) i.e. both high and low ability candidates getting it correct.

Question 2

'B' was the main distractor but there is a low discrimination index (0.29). This question was perhaps one of the easier questions.

Question 3

Low discrimination index (0.23) and answered very well, 'B' proved to be the main distractor.

Question 4

This question was answered well, which suggests the diagram was easy to interpret with a discriminator index (0.29) and 'C' as the main distractor.

Question 5

This was the easiest question in the paper with a difficulty index (98.10) and discriminator (0.06). No candidates selected 'C' or 'D' as an answer. On reflection the question was probably too easy as the discrimination between candidates was very low.

Question 6

A good question. This proved to be a challenging question for candidates with a discrimination index (0.40) with 'B' as the main distractor.

Question 7

A mid-difficulty question with a discrimination index (0.20).

Question 8

A mid-difficulty question with a discrimination index (0.26), where 'D' was the main distractor.

Question 9

One of the easier questions with discrimination index (0.14). No candidate selected 'D' as a response.

Question 10

A mid-difficulty question with a discrimination index (0.29).

Question 11

The equal third easiest question where no candidate selected 'B' as a response. This question had the lowest discrimination index (0.03).

Question 12

The fifth easiest question where no candidate selected 'B' as a response. This question had a very low discrimination index (0.11).

Question 13

A mid-difficulty question, with 'C' as the main distractor and discrimination index (0.26).

Question 14

A mid-difficulty question with A, C & D as equal distractors and discrimination index (0.26).

Question 15

A mid-difficulty question, with a discrimination index (0.26).

Question 16

A good question, with a discrimination index (0.40) with 'B' and 'D' acting as equal distractors.

Question 17

A good question which posed a challenge for candidates. A reasonable discrimination index of (0.37).

Question 18

This was the most challenging question of the paper with 'B' as the main distractor. A discrimination index (0.66) that suggests all good candidates selected the correct answer.

Question 19

A mid-difficulty question, with a discrimination index (0.20).

Question 20

A mid-difficulty question, with the main distractors 'B' & 'C' and a discrimination index (0.31).

Question 21

A mid-difficulty question, with no candidate selecting 'C' and a discrimination index (0.31).

Question 22

A good question, this was the third most difficult question in the paper. 'B' acted as the main distractor. This question had a reasonable discrimination index (0.34).

Question 23

Candidates found this question challenging, the second most difficult question. No candidate selected 'A' as a response. This question had a discrimination index (0.31).

Question 24

An easy question, with a discrimination index (0.20).

Question 25

This question had a strong distractor 'B' with no candidates selecting 'C'. A mid-difficulty question, with a discrimination index (0.20). This question was raised within the G2 forms where Massed (B) was considered an accurate answer. This was discussed at the GA meeting. Massed is defined by Schmidt (1991) a practice schedule in which the amount of rest between trials is short relative to trial length. Fixed can be defined as a specific movement pattern is practised repeatedly often known as drill (David *et al*, 2000).

Question 26

The fourth easiest question, in the paper, with a low discrimination index (0.11) i.e. both high and low ability candidates getting it correct.

Question 27

An easy question, with the equal low discrimination index (0.17) i.e. both high and low ability candidates getting it correct.

Question 28

The second easiest question, with no candidates selecting 'C' or 'D' as a response. This question had the lowest discrimination index (0.03) i.e. both high and low ability candidates getting it correct.

Question 29

One of the easier questions with no candidates selecting 'A' as a response and discrimination index (0.20).

Question 30

The fourth most difficult question of the paper with a discrimination index (0.49).

Recommendations and guidance for the teaching of future candidates

Overall the paper was answered well. However, the questions where candidates faced challenges were applying knowledge and understanding for topic 4: Movement analysis in particular 4.1 Neuromuscular function and 4.2 Joint and movement type as well as sub topic 5.2: Information processing. This may be due to the use of schematics to present information and it would be advised to encourage candidates to label and understanding schematic depictions of key concepts.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 15	16 - 18	19 - 24	25 - 30	31 - 36	37 - 50

General comments

This paper was very similar to many recent papers in terms of style and difficulty. The data questions to start were straightforward and allowed candidates to get into the paper quickly. Students are using the data to assist with their answers to the more complex questions in this part of the paper, which is excellent. Each question section in section A provided some easy recall type question followed by questions which challenged candidates to apply knowledge in new situations. Question 6 was the most popular question in section B with question 7 the least.

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

- Delayed onset muscle soreness was not always well understood by candidates and is an area where looking at the markscheme in conjunction with the literature this will help;
- The areas of oxygen deficit and debt during exercise. Candidates got these mixed up at times;
- A few candidates mixed up agonist and antagonist. Also candidates indicated that the antagonist contracted rather than that it was relaxing;
- Candidates either did not provide enough detail on the systemic system to warrant the mark or they got it confused with the pulmonary system;
- Candidates really struggled with the explanation of maximal oxygen consumption;
- Candidates frequently confused open and closed loop motor programmes with open and closed skill classification;
- Candidates seemed less familiar with interoceptors;
- Candidates had variable specific knowledge of the various types of joint beyond the fact that they varied in the amount of movement they provided;
- Candidates really struggled to pinpoint recommendations for a balanced diet;
- Many candidates did not have a good grasp of the training heart rate range.

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

- Data questions in question 1, for example, question 1d, where candidates needed two aspects indicated in the question – candidates generally got this right. All data questions were generally done well and this indicates that candidates and teachers have worked hard to understand what is expected;

- Types of bones was very well understood as well as the other anatomy question on agonist/antagonist;
- For some questions candidates started with a basic definition which generally did not gain any marks as this was not what the question was asking;
- Types of blood cells was very well understood;
- With correlation, most candidates were able to gain a mark for the fact that it does not show causation;
- General understanding of the reasons for a difference in VO_2 max between different populations is good;
- Understanding of exteroceptors and proprioceptors is good;
- The detection of signals through the detection–comparison–recognition process was generally well done;
- Candidates had a good grasp of the differences in different joints;
- Candidates generally could recall the equation for angular momentum;
- The recall of steps in muscle contraction was good;
- Candidates generally knew that the combination of glucose molecules was a condensation reaction;
- Candidates could evaluate aspects of field and laboratory experiments;
- Candidates usually could recall features of the Karvonen method.

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

Section A

Question 1

- a. Very few candidates missed these ones;
- b. Very few candidates missed these ones;
- c. Most candidates could see that there was a pattern and then provide evidence from the data to show this. These questions are the general format that is to be expected where candidates are asked to analyse the data and to use the data to show understanding;
- d. Similarly here candidates generally had no issues here;
- e. Similarly here candidates generally had no issues here;
- f. Despite a wide range of responses most candidates were able to get 3 marks here.

Question 2

- a. Candidates rarely got the types of bone wrong;
- b. Some candidates were a little confused here with regard to the antagonist muscle – thinking that it contracted during the action. They would correctly indicate that the agonist contracted concentrically;
- c. Candidates generally understood that the swimmer relied on anaerobic processes to generate the ATP required. Some mixed the two components up;
- d. Question was understood really well.

Question 3

- a. Question was understood really well;
- b. This question had mixed levels of depth and understanding provided. Candidates must try and be as clear as possible with these questions providing heart chambers and blood vessels;
- c. Very few candidates were able to get full marks with this question and this will provide an area for teachers to explore with students in order to boost understanding.

Question 4

- a. Candidates struggled to get full marks here; frequently because they forgot to put the feature for both aspects;
- b. Candidates were good at indicating the fact that a correlation doesn't mean causation. The other features were less likely to be picked up on;

Section B

Question 5

- a. While many candidates could identify that there were differences in VO_2 max between males and females; children and adults – they could not identify these reasons why;
- b. Features of cardiovascular drift were generally well understood and some candidates were able to consider the link with measuring training intensity;
- c. The one sensory receptor that candidates repeatedly struggled with was interoceptors – getting 2 marks for this one was difficult;
- d. Candidates generally performed well with the DRC process and were able to articulate a number of key features with an example.

Question 6

- a. Candidates were very good at distinguishing between movements of each joint but they then tended to provide examples which did not award further marks. The markscheme will provide further points for students and staff to consider;
- b. While many had a good understanding of the interplay of what happens during the somersault; many mistakenly thought that angular momentum changed along with the other two variables as they changed position;
- c. Candidates generally could provide four solid points involving the sequence of actions resulting from acetylcholine;
- d. While many did well with this question many others were confused with inhalation. It is critical that candidates read the question carefully.

Question 7

- a. Candidates really struggled to have correct figures for the different portions suggested. Teachers and candidates can learn a lot from the mark scheme provided;
- b. Candidates generally understood this question really well;
- c. Field and laboratory testing was generally well understood by candidates;
- d. While the Karvonen method was well understood in general, candidates really struggled with the training heart rate zone. This is an easy aspect for teachers to take their students through.

Recommendations and guidance for the teaching of future candidates

- Candidates must provide as much detail as possible about various areas questioned. If there is not enough space for their answer, they can continue on additional paper. In this case, it is helpful to note that the answer continues;
- Candidates are advised not to leave an answer blank. They will not be penalised for writing wrong answers; additionally the writing process may trigger their memory of the required knowledge;
- Candidates must also be careful that they come back to the question and think carefully about what is being asked of them. Providing a basic definition will not necessarily gain marks – however keeping the previous point in mind – starting with a definition may help to start them thinking along the correct lines and they certainly do not lose marks for doing this;
- If a question requires them to discuss concepts in relation to an example, candidates must ensure that they don't neglect this as the general rule of thumb will be that the example is required for full marks.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 6	7 - 13	14 - 18	19 - 23	24 - 27	28 - 32	33 - 40

General comments

There were three G2 forms received for paper 3. All three supported that the level of difficulty was appropriate. In comparison with last year's paper, all three indicated that November 2015 was of a similar standard. In terms of the suitability of this question paper, one of the G2 forms stated that clarity of wording was "good", another reported "very good", and the third indicated that this aspect was "excellent". The presentation of this question paper was reported as "very good" on two of the G2 forms, and "excellent" on the third. The suitability of the question paper in terms of accessibility and cultural/religious/ethnic bias was positively presented as either 'agree' or 'strongly agree'.

The mean score/mark was 26.6 (range 11 – 39), which was up when compared to November 14 (mean 24.36; range 12 – 37). The overall performance of many of the candidates was impressive, and there appeared to be more candidates toward the upper end of the range.

The paper generated a wide range of responses demonstrating very sound knowledge and skills within a significant number of candidates. The question paper responses of the candidates

support that appropriate information and teaching had been made available to candidates, with only a few questions that generated consistently 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 able to extract specific data information and relate this to concepts. Once again it was a pleasure to assess this paper.

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

Following the trend of recent years, options A was the most favoured option, followed by D then B, with the fewest number of candidates opting for C. It continues to be re-assuring that the four options were attempted. Generally, there is the impression that most (but not all) candidates were very well prepared for this exam. However, the following areas seem to have been difficult for some candidates:

- Question A1c: describe various methods of training [A.1.2];
- Question 2a: state the normal physiological range for core body temperature [A.2.2];
- Question 2c: discuss the health risks associated with exercising in the heat [A.2.7];
- Question 6a: outline relaxation techniques [B.4.4];
- Question 6b: outline self-talk techniques [B.4.5];
- Question 7b: describe attribution theory and its application to sport and exercise [B.2.6];
- Question 11a: outline the coronary circulation [C.2.1];
- Question 11c: describe the aims of exercise in individuals with a hypokinetic disease [C.6.2];
- Question 12a: describe how obesity is determined [C.3.1];
- Question 12b discuss the concept of energy balance [C.3.3];
- Question 15b explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood [D.2.5];
- Question 16b: describe, with reference to exercise intensity, typical athletic activities requiring high rates of muscle glycogen utilization [D.4.2].

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

Most of the candidates demonstrated a good knowledge and understanding of their options, and there were some excellent papers. However, there is a very wide spread of my total marks for this paper. On the whole most candidates have a good grasp of the expectations for this options paper. The data set questions were answered well by the majority of candidates and 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

Option A

Question 1

- a. very well answered;
- b. for the most part, candidates were secure in their interpretation and analysis;
- c. some candidates did not respond to the command term.

Question 2

- a. there were some disappointing answers, and some candidates gave a single mean/average value rather than a 'range';
- b. generally well answered, but just to highlight that some candidates need to remain focused on answering the question;
- c. some candidates could improve their answer by including electrolyte deficiency/acclimatization.

Question 3

- a. a significant number of candidates were less secure with this question – this could be a good discriminating question;
- b. this question was generally well answered.

Question 4

Most candidates had a firm grasp of the proposed and actual benefits from using beta blockers.

Option B

Question 5

- a. straightforward interpretation of data;
- b. some candidates did not answer the question using the data;
- c. there was a wide range of acceptable answers;
- d. generally, candidates had a firm grasp and were able to distinguish between trait & state anxiety.

Question 6

- a. some candidates struggled with this question beyond the simple concept of sequenced tension-relaxation;
- b. some disappointing answers, with even strong candidates having difficulty articulating that this technique involves concentrating on the negative thought briefly;
- c. this is not conceptually difficult – but there were a number of candidates who struggled to appropriately discuss the acquisition phase.

Question 7

- a. this question was generally well answered;
- b. some candidates confused this question with Bandura's social learning theory.

Question 8

Beyond the basic premise around nature or nurture and although candidates picked up marks, many answers could be described as 'higher order' i.e. if the answer included something about the complexity of this theory beyond the co-determinant aspect – such as it is not a consistent theory or the impact on prediction of behaviour or association with goal setting.

Option C

Significantly few candidates answered this option.

Question 9

- a. well answered;
- b. this is a very good question; some good and varied answers that evidenced candidates were really engaging with interpreting and analysing the data;
- c. most candidates scored well, with many potential answers.

Question 10

- a. should have been straightforward but some of the answers, particularly re habitual physical activity, were disappointing;
- b. generally a well answered question with some candidates linking their answers to core knowledge.

Question 11

- a. surprisingly there were some poor answers despite clarity within the teacher's notes for this AS. For example, some candidates simply responded with 'coronary artery' rather than left coronary artery or right coronary artery – this detail is important considering the word 'coronary' is in the question;
- b. a well answered question;
- c. this question could be a good discriminator - some students struggled with this question. No candidate distinguished between modifiable and non-modifiable risk factors.

Question 12

- a. some candidates did not achieve full marks because they failed to state BMI is calculated by dividing an individual's weight in kilograms by their height in meters **squared** – i.e. they presented this part of their answer as BMI is calculated by dividing an individual's weight in kilograms by their height;
- b. some answers tended to reflect only surface learning – there was little indication of deep learning e.g. that metabolic rates affect energy balance.

Option D

Question 13

- a. straightforward interpretation of data – well answered;
- b. this is a good question and candidates interpreted the data with insight and in varied ways – the stimulus was excellent and this could be an ideal example of data type questions;
- c. generally well answered but some candidates should have looked more carefully at the question i.e. it refers to 'practices' – meaning plural/more than one.

Question 14

- a. generally well answered, but a few candidates mistakenly stated that the gallbladder produces bile;
- b. this question was generally well answered – however some candidates missed out on the mark linked to 'breakdown'. Stronger candidates included temperature and/or pH aspects as well– when they already had full marks for the 'rate' and 'breakdown' components.

Question 15

- a. this question was well answered;
- b. some candidates presented good 'outline' answers but the command term was 'describe' i.e. give a detailed account i.e. the descending and or ascending limb/arm and permeable/impermeable re water and active/passive re sodium and chloride.

Question 16

- a. this was an easy question;
- b. a more challenging question and some candidates struggled to gain full marks – possible a good discriminator. Some candidates are confused re energy systems and single bout high-intensity short duration activity (e.g. 100 m running sprint);
- c. mostly well answered, however there were some disappointing answers where candidates were completely off the mark.

Recommendations and guidance for the teaching of future candidates

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: health risks associated with exercising in the heat; why swimming in cold water represents a particular challenge to the body's ability to thermo-regulate; PMR; the three phases of a PST programme; attribution theory; the interactionist approach to personality; the concept of risk factors in cardiovascular disease; how obesity is determined; the role of the loop of Henle (from a more detailed perspective); with reference to exercise intensity, typical athletic activities requiring high rates of muscle glycogen utilisation; the use of bicarbonate in sport.