

May 2015 subject reports

Sports exercise and health science (SEHS), standard level

Overall grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 14	15 – 27	28 – 40	41 – 50	51 – 62	63 – 72	73 – 100

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 candidates' practical work has increased and teachers should be congratulated for their efforts. Teachers are also to be commended for acting on the 2015 subject report, and for taking a lot of time and trouble to prepare their Internal Assessment sample. The variety of investigations, duration and coverage of the practical programme was varied and was excellent in some schools. 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. Some candidates produced outstanding reports with very thorough background research and reference to ethical issues both in their design and again in their conclusion.

The majority of candidates were allowed to conduct their own investigations with teacher prompt, however, insufficient latitude with designs continues to result in the whole class attempting the same investigation. Teachers should not be afraid to encourage candidates to carry out creative designs, which may lead to trivial results. It is good practice for candidates to

follow through their own designs, which most centres seem to be doing. Some teachers continue to provide too much information and as a result candidates cannot be awarded a complete for their design'. Some candidates need more freedom to choose their own area of investigation, with the opportunity to fail early on, which can prevent gross errors in final submissions. 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.

Candidate performance against each criterion

There does appear to be a lot of variability in how practicals 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 standardization 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 moderators. When this was combined with comments and feedback to candidates it was very clear how teachers awarded marks. It was a lot easier for a moderator to support a teacher's marks when there were clear, readable notes accompanying the sample. No or limited written teacher comments on reports for candidates also makes one wonder how these candidates receive the necessary feedback to improve their performance.

Design (D)

Most designs submitted followed the scientific method of conducting research, however, some candidates (and teachers) are having difficulty identifying independent, dependent, control and confounding variables. Variability is noted in the quality, and expectations of candidates from different regions around the world, and we hope that as teachers gain more experience and understanding, this will improve. Moderators commented that when 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) 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.

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.

Data collection and processing (DCP)

A problem relayed by moderators was that some investigations did not generate sufficient quantitative data for adequate processing. Unfortunately, there were occasions when candidates did not present any raw data and included only processed data. Associated qualitative data was also expected and teachers must teach candidates that observations made during the experiment must be included (where relevant) as they 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. Teachers who provide candidates with a pre-formatted data table can expect to have their candidates moderated down. 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, ± 0.5 cm). The number of decimal places must reflect the precision of the measuring instrument.

When calculations are made the majority of candidates are providing one or more worked examples. 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. Almost all candidates are showing the mean and standard deviation calculations. Teachers need to continue to remind candidates that a large standard deviation does not necessarily show data is unreliable; it just shows a wide spread. When practicals involve many different subjects, this large standard deviation is probably to be expected and 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 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.

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 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 failed to score full marks on the conclusion and evaluation component and this continues to be 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; horizontal rows may be more appropriate with regard to format. The inclusion of separate rows 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, more candidates referred to their actual data or backed 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 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 are advised 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, that they have several opportunities to be assessed (perhaps 3 or 4) from which the highest two marks awarded for each criterion are used towards their total IA mark.
- Read the feedback from this session and act upon it.
- Share the assessment criteria with their candidates and explain them.
- Apply the assessment criteria rigorously.
- Consult the OCC for Teacher Support Material (TSM) for the component. 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).
- 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.

- 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 Excel.
- 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 and organize work by candidate rather than by the criteria.
- 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 practical work titles (candidate) 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 standardization 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.

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 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. There seemed to be confusion about what the cross was for in the boxes under the different criteria and for each investigation; some schools used this to identify the practicals sent but several used this to show all the

practicals that had been assessed. The cross is to identify the top 2 grades and to identify the work being sent to the examiner as part of the sample. All assessed work should include the grade out of 6 if the teacher at some point throughout the course assessed that work. 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 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 candidates 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 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 that arise during their investigations e.g. confidentiality of participants. The IB animal experimentation policy and ethical practice poster can be found on the subject homepage on the 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 and possibly target ICT as an area to develop.

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. centring numbers, adjusting the number of decimal places, column headings).

Paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 7	8 – 11	12 – 15	16 – 18	19 – 21	22 – 24	25 – 30

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

The candidates were not well prepared for the following questions: 19, 23, 17, 13, 26, 14, 3, 6 and 4.

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

The candidates were very well prepared for the following questions: 30, 20, 25, 24, 28, 27, 9 and 11.

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

Question 1

This was a tricky question with nearly the same number of candidates answering B the correct answer as A. It was decided to accept A and B as the correct answer.

Question 2

This was a relatively easy question with a discrimination index 0.36 and D as the main distractor.

Question 3

This was one of the difficult questions with a difficulty index 46.42, a low discriminator index 0.13 and B as the main distractor.

Question 4

A slightly difficult question with discrimination index 0.41 and D as the main distractor.

Question 5

A mid-difficulty question with discrimination index 0.52 and A as the main distractor. Three candidates chose not to answer this question.

Question 6

Tending towards being a difficult question with a discrimination index 0.46 and A as the main distractor.

Question 7

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

Question 8

Tending towards being a difficult question with a discrimination index of 0.37 and C was the main distractor. This should be a discriminator between higher and lower level candidates. There were some comments on the G2 forms but it is thought that this is a relevant question based on what is expected of candidates through the curriculum and IA.

Question 9

This is one of the easier questions with a discrimination index 0.35 and C as the main distractor. Three candidates chose not to answer this question.

Question 10

A mid-difficulty question with a discrimination index 0.27 and D as the main distractor. Three candidates chose not to answer this question. Feedback from the G2 forms say specific knowledge of individual vitamins and minerals is not required but there is overlap with several assessment statements and it was felt that candidates should be able to answer the question.

Question 11

This was one of the easier questions with a discrimination index 0.44 and D as the main distractor.

Question 12

A mid-difficulty question with a discrimination index 0.52 and B as the main distractor. Four candidates chose not to answer this question.

Question 13

This was a difficult question with a discrimination index of 0.44 and A as the main distractor. Six candidates chose not to answer this question. Feedback from G2 forms felt that because the assessment statement says “annotate”, candidates should not be required to know the functions of lysosomes, but the term “annotate” can also include brief description.

Question 14

A slightly difficult question with a discrimination index 0.45 and C as the main distractor.

Question 15

A mid-difficulty question with a discrimination index 0.53 and B as the main distractor. Three candidates chose not to answer this question.

Question 16

This was a slightly easy question with a discrimination index 0.44 and A as the main distractor.

Question 17

The third most difficult question in the paper with discrimination index 0.14 and A as the main distractor. Feedback from G2 forms questioned the diagram and label, however question and label refers to quadriceps so was felt to be clear.

Question 18

A relatively mid-difficulty question with a discrimination index 0.50 and C as the main distractor. Three candidates chose not to answer this question.

Question 19

The most difficult question on the paper with a discrimination index 0.24 and B as the main distractor. Four candidates chose not to answer this question.

Question 20

This was the second easiest question on the paper with a discriminator index 0.19 and B as the main distractor.

Question 21

This was a relatively easy question with a discrimination index 0.44 and B as the main distractor.

Question 22

This was mid-difficulty question with a discrimination index 0.30 and D as the main distractor.

Question 23

This is the second hardest question with a discrimination index 0.45 with most candidates choosing to answer option B. Three candidates chose not to answer this question.

Question 24

This was one of the easiest questions with a discrimination index 0.27 and A as the main distractor. Four candidates chose not to answer this question.

Question 25

This was one of the easiest questions with a discrimination index of 0.07 and B as the main distractor.

Question 26

This was one of the difficult question for candidates to answer with the majority of candidates opting for the distractor A. The discrimination index was 0.37.

Question 27

This was the sixth easiest question with a discrimination index 0.37 and C as the main distractor.

Question 28

The fifth easiest question with a discrimination index 0.25 and C as the main distractor. Four candidates chose not to answer this question.

Question 29

This was a mid-difficulty question with a discrimination index 0.24 and D as the main distractor. Five candidates chose not to answer this question.

Question 30

This was the easiest question on the paper with a discrimination index 0.18 and D as the main distractor.

Paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 5	6 – 11	12 – 16	17 – 22	23 – 27	28 – 33	34 – 50

General comments

Paper 2 was a very fair and overall straightforward paper, which covered many core aspects of the curriculum. This was backed up by the comments provided from schools that submitted the G2 form. Despite this a large number of candidates performed extremely poorly, with many candidates leaving vast sections either blank or providing totally inappropriate responses.

It was disappointing that not many teachers submitted G2 forms. Despite the number of schools taking this examination increasing significantly, there was a decrease in responses from previous years. The information provided by schools is vital in ensuring the quality assurance for not only the current marking period but for future examinations and marking processes. Schools can be assured that their opinions and insights into the paper are listened to and robustly debated by the senior examination team. The strength of the examination process is undermined when schools and staff fail to fulfil the critical step of providing feedback through the channel provided.

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

Section A

- Measuring data points on graphs.
- Outlining clearly how to monitor intensity.
- There was variable knowledge of basic anatomy – key bones of the body AS 1.1.
- Defining stroke volume – many mixed it up with breathing rate or amount.
- Pulmonary and systemic circulation.
- Blood distribution and redistribution during rest and exercise.

Section B

- The ability to clearly identify and outline specific differentiating features between a skilled and novice performers: this then prevented them from relating these aspects to the performer e.g. fluency, efficiency. Many incorrectly thought that features such as fitness or motivation were differing aspects.
- Clearly defining health and skilled related fitness – or identifying 2 or more components for each.
- Identify types of presentation – these were sometimes confused with types of practice.

- Missed some key aspects to distinguish blood cells which prevented full marks being given e.g. rbc carry CO₂ also.
- Struggled to clearly outline max oxygen consumption.
- Failure to identify types of stretching and principles of training.
- Clearly outlining and applying centre of mass.
- Showing understanding of key aspects of the Bernoulli principle seemed very difficult.

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

Section A

- Candidates were able to identify general trends in graphs.
- Could define Newton's laws with clarity.
- Defining "joint" and distinguishing key skeletal aspects e.g.: axial versus appendicular.
- Outline features of the three types of muscle.
- That more blood was distributed during exercise versus rest and that the rate also increased.
- Skill classification categories involved with sports.

Section B

- Many understood that there was a "learned" difference between novice and expert as well as "consistency".
- Signal detection was affected by "noise" and what noise could be.
- Glycogenolysis involving glycogen being broken down into glucose and the role of glucagon in this.
- Basic aspects of the role of each type of blood cell.
- That VO₂ max is different for different populations and that training influences performance.
- That muscle contraction triggers glucose uptake into a muscle.

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

Section A

1a). The candidates generally got the percentage maximum running speed for the marathon correct but struggled to state the running mean speed. If they had used a straight piece of paper or ruler (as there was not a grid on the graph) they would have easily identified this figure.

1b). The vast majority of candidates got this correct.

1c). Most candidates were able to achieve 1 mark here, however they struggled beyond discussing the general trend that an increase in distance led to a decrease in mean running speed. They seemed to lack further analytical skills such as the differing trend between 100 and 200m.

1d). Generally candidates were able to define Newton's two Laws with success. The application of the 3rd Law was done the best; candidates struggled more with the 2nd Laws.

1e). Often the candidates forgot to compare in their answers and did not relate to the values and the data collected. Often when they did refer to data they were inaccurate despite a grid being provided.

1f). This was answered really poorly especially for an outline question. The answers were very vague and generally just identified heart rate. Clearly candidates are unfamiliar with ratings of perceived exertion or the reference of heart rate to maximum levels, which then takes into account a person's age.

2a). While this was generally answered well there were a number of candidates who confined their answer to it being where two bones meet; or incorrectly indicate that it was something that attached muscle to bones.

2b). This was an area in which candidates were very strong.

2c). This was answered extremely poorly. Many candidates struggled to use the correct terminology let alone put the answers into the correct order.

2d). Generally answered confidently and accurately

3a)(i). This question was often answered well, however some candidates did get confused about tidal volume and some candidates lacked detail in their definition and were often a little vague and failed to indicate that it was for a single heartbeat.

3a)(ii). This question really confused a lot of candidates. This was due to them not reading the question and taking care with their response. Many candidates referred to differences between rest and exercise and did not look at the chronic affects but the acute effects. This was a good discriminator as many candidates could identify the change but not discuss and explain the reasons behind the change.

3b). Generally, candidates understood what the question was asking for, however their responses were very vague and lacked the level of detail required for each system.

3c). Generally, candidates did not compare enough details to be awarded full marks, often only scoring one mark.

4. This was a great discriminator with many candidates not understanding the classifications of skill, or failing to understand that they would be awarded one mark for one comparison, more work needs to be done to develop the candidates' understanding of the term "compare" as well as understanding skill classifications.

Section B

Overall many candidates answered section B poorly. Many answered questions from a multiple number of question areas, for example 5a), 6b), 7c) and 7d). Equally, candidates would have a blank for a number of question parts. Candidates must have practice at working under

pressure to select and answer the question block that suits their knowledge area. Also candidates need to ensure that they lay out the questions clearly so that they can be distinguished from each other. This section requires candidates to:

1. Read the question carefully.
2. Check the marks that are allocated for each question – this should determine which question block they complete.

Questions 5 and 7 were the most popular question choices.

Question 5

- a). Many candidates have little knowledge or clear understanding of features that make a skilled performance. They were unable to refer to the key defining points and generally answers were vague with not enough points to cover the 6, which were asked for in the question.
- b). Candidates cannot define the terms accurately and struggled to accurately identify the different components, this was extremely poorly answered.
- c). Candidates had some understanding, but often answers were vague and repetitive.
- d). A lot of candidates ignored this question and had no understanding of skill presentation. They regularly confused this aspect with types of practice.

Question 6

- a). Generally this was answered quite well, but there was a lack of depth in many of the answers and candidates struggled to get full marks.
- b). Candidates struggled to recognise that there were 6 marks available and therefore each cell will need possibly 2 or 3 functional aspects.
- c). Many candidates do not know the definition and were unable to add depth to their answer. Many of them struggled to identify how it was measured the units of measurement, the methods of testing and how these can produce differing results depending on the quality of the test, how training affects the body and therefore VO_2 or factors affecting VO_2 max.
- d). Candidates often wrote detailed answers, but missed what the question was asking and focused on describing the energy systems rather than how muscle contraction affects the hormonal and situational factors which lead to an increase in glucose uptake.

Question 7

- a). Long answers were regularly provided, however with little depth or were repetitive. Candidates achieving full marks was rare.
- b). This was very poorly done. Candidates displayed little knowledge of what the principles of training were and so, could not then apply them to the programme.

c). Candidates were generally unable to define COM, however they had an inkling into how it changes with the Fosbury flop in that it moved the COM outside the body. They regularly indicated that it moved the wrong way however which was disappointing and indicates that they do not fully understand the relationship between their body's movement and the movement of the COM.

d). The Bernoulli principle is not well understood, candidates have really struggled to answer this, in fact many candidates failed to even attempt it. Many candidates failed to understand that the spinning of a ball was the result of the type of impact provided to the ball and that this spinning causes the changes in air pressure and velocity.

Recommendations and guidance for the teaching of future candidates

1. Have candidates use a table layout for “compare” questions to ensure that they cover *both* aspects for each point. This must not prevent them from providing suitable detail however when examples may be required.
2. With the data questions – try and use the data to help describe what they are observing.
3. Where they list key features they need to return to them with examples so that the intent of the question and command term is fulfilled.
4. They must check the marks for the question and then ensure that they have that number of points as a minimum.
5. They need to clearly number their answers in section B. There were a number who merged all answers in this section into one paragraph.
6. Ensure that candidates read the questions carefully before responding (see reference to question 3a)(ii) above).

Paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 14	15 – 18	19 – 23	24 – 27	28 – 40

General comments

In comparison to previous years it would appear that candidates found the paper a little more difficult, with the mean grade slightly lower.

There appears to have been an even spread of candidates attempting the full range of options.

Candidates need to be mindful of the requirements stipulated by the command terms e.g. a common error was with the use of the command term “calculate”, where both the working and answer are required for a correct response.

Candidates mostly attempted all questions with very few questions left blank.

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

Option A

- Candidates found difficulty in linking “Placebo effect” with the design of an exercise science experiment.
- Effect of cold on muscle function response was sometimes confused with the health risks associated with exercising in the cold.

Option B

- Discussing how emotions that may influence an athlete’s performance and linking these with performance outcomes.
- Atkinson’s Model of Achievement Motivation was very poorly understood. Very few candidates gained full marks on this question.
- How extrinsic rewards can influence intrinsic motivation to continue exercise. Most candidates considered the positive correlation and did not consider the negative “controlling” aspect.
- Explain the education and practice phase of a psychological skills training programme. This was often very vague and involved a description of PST techniques.

Option C

- Candidates demonstrated an understanding of the role of exercise in reducing the effects of depression, but at times the information presented was a little vague meaning that full marks were seldom awarded.

Option D

- The discussion of carbohydrate loading often lacked the link with training programme modification, treating these aspects separately.
- The role of ADH in maintaining water balance was often lacking in sufficient detail.
- Candidates failed to consider dietary practices adopted by athletes. The focus was often on dietary practices adopted by non-athletes, i.e. reducing energy intake is not applicable for athletes with high energy demands.

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

Option A

- Understanding of periodization and distinguishing between macrocycle and mesocycles.
- Body surface area to body mass ratio and the implications for heat loss appeared well

understood.

Option B

- Candidates struggled with this option. It is difficult to identify questions which were well answered across the board by candidates.

Option C

- Barriers to physical activity.
- The explanation of type 1 and type 2 diabetes was very clear.
- Outlining how bone density changes from birth to old age.
- The description of how an osteoporotic fracture can impact long-term on an individual.

Option D

- Candidates clearly demonstrated an understanding of how the hydration status of athletes can be monitored.

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

Option A

1a). The vast majority of candidates got this correct.

1b). The calculation was simple. Candidates could potentially lose marks for not including working or units.

1c). The vast majority of candidates were able to identify two correct trends from the data.

1d). Generally, candidates could identify that humidity presented a thermoregulatory challenge due to excessive moisture in the atmosphere.

2a). Candidates need to refer to the subject guide. "Blood doping" was often mentioned and was not awarded a mark.

2b). This question was easy for most candidates.

2c). Candidates had difficulty linking the placebo effect with experimental design.

3a). In what should be a fairly straight forward question some candidates got confused identifying the "Sit and reach" test and describing general stretching methods.

3b). Candidates were generally able to distinguish between macro and mesocycles.

4a). Candidates struggled to identify the physiological responses to exercise, with little evidence of identifying the issues in regard to muscle function and metabolic responses (e.g. slowing nerve and muscle function velocity, loss of flexibility, decrease in efficiency).

4b). Most candidates were proficient in clearly identifying the link between body surface area to body mass ratio.

Option B

5a). Most candidates achieved full marks.

5b). “Calculate” requires the working.

5c). This question was poorly answered. Candidates spoke in generalities regarding emotions experienced in this situation but did not effectively link to course content.

6a). Most candidates scored one mark for this question. The usual reference was to the Sage definition.

6b). This question was very poorly answered. Even the best candidates tended to only identify personality factors (motive to achieve success or avoid failure). Very few were able to identify situational factors or resultant tendencies.

6c). A lot of candidates failed to identify the negative influence extrinsic rewards can have on intrinsic motivation.

7a). A fairly straight forward question with progressive muscle relaxation and breath control most commonly identified.

7b). The best responses in this question used an example, in addition to a definition, to distinguish the difference between a performance and process goal.

7c). There was often ambiguity apparent in the responses to this question. Too often candidates outlined PST strategies.

8. Candidates often outlined personality tests without really considering ethical issues.

Option C

9a). Most candidates scored one mark for this data question.

9b). N/A

9c). A range of responses were possible in this question and subsequently a large proportion of candidates achieved full marks.

10a). Candidates tended on the whole to categorise sport as a competitive activity to achieve a mark. Many spoke in generalities with regard to exercise failing to identify the planned and structured component of this activity.

10b). Most candidates tended to get 1–2 marks here identifying the role of endorphins and improved self-esteem. Few candidates achieved full marks on this question.

11a). Most candidates achieved 1 mark on this question. Some confused atherosclerosis with osteoporosis.

11b). This question was well answered by the majority of candidates, a large proportion of whom scored full marks.

12a). The vast majority of candidates answered this question correctly.

12b). Candidates tended to mention the impact of osteoporotic fractures on the quality of life. The better candidates mentioned secondary medical complications like phenomena.

Option D

13a). Vast majority of candidates scored one mark.

13b). This was quite a simple question, well answered by candidates.

13c). Candidates displayed a limited knowledge in this area. They identified the role of carbohydrate loading in increasing energy/glycogen reserves. However, they often failed to make connections between exercise modifications and dietary manipulation. In most cases they failed to refer to accepted carbohydrate loading protocols.

14a). Some candidates understood the role of the mouth in digestion but were a little vague in their explanation, i.e. spoke of “breaking up” food rather than mechanical digestion. There needs to be an emphasis on scientific terminology where possible.

14b). This was an area in which candidates were very strong.

14c). A broad understanding of this topic was apparent. A large proportion of candidates failed to provide detailed responses. Inclusion of the role of ADH in increasing permeability in the renal tubules and collecting ducts to increase water absorption was often not mentioned.

15a). A generally well answered question.

15b). Candidates struggled with this question. In most cases they identified practices employed by the general population, not athletes. The dietary practices most applicable are identified in the teacher notes in the subject guide.

16a). Candidates often referred to sodium being replenished as it is lost in sweat. In many cases this was the only valid information supplied.

16b). Generally, a well answered question, with a vast number of possible responses accepted.

16c). Many candidates struggled here believing that high GI foods were best prior to competition. These candidates failed to note the adverse effects of these foods particularly for endurance athletes due to excessive blood sugar and insulin release.

Recommendations and guidance for the teaching of future candidates

Candidates must be mindful of reflecting two years of academic study in this subject when responding to questions. They should avoid speaking in generalities and use scientific terminology when appropriate.

Candidates must have an awareness of the command terms. It is also important for candidates to be aware of the number of marks required per question. This, together with the command term, can provide a very useful guide to the level of detail required to successfully answer the question.