Sports, exercise and health science

Timezone 1

To protect the integrity of the assessments, increasing use is being made of examination variants. By using variants of the same examination, students in one part of the world will not always be responding to the same examination content as students in other parts of the world. A rigorous process is applied to ensure that the content across all variants is comparable in terms of difficulty and syllabus coverage. In addition, measures are taken during the standardisation and grade awarding processes to ensure that the final grade awarded to students is comparable.

Contents

Grade boundaries

Higher level overall

Grade:	1	2	3	4	5	6	7
Mark range:	0-12	13-22	23-33	34-45	46-58	59-71	72-100

Standard level overall

Grade:	1	2	3	4	5	6	7
Mark range:	0-12	13-22	23-33	34-45	46-57	58-69	70-100

Higher level and Standard level internal assessment

Grade:	1	2	3	4	5	6	7
Mark range:	0-3	4-6	7-10	11-13	14-16	17-19	20-24

Higher level paper one

Grade:	1	2	3	4	5	6	7
Mark range:	0-10	11-15	16	17-22	23-28	29-33	34-40

Standard level paper one

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-9	10-14	15-18	19-21	22-24	25-30

Higher level paper two

Grade:	1	2	3	4	5	6	7
Mark range:	0-6	7-13	14-23	24-35	36-49	50-62	63-90

Standard level paper two

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-9	10-12	13-18	19-25	26-31	32-50

Higher level paper three

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-9	10-16	17-20	21-24	25-30	31-50

Standard level paper three

Grade:	1	2	3	4	5	6	7
Mark range:	0-3	4-7	8-11	12-15	16-20	21-25	26-40

Higher level and Standard level internal assessment

The range and suitability of the work submitted

Despite best efforts to communicate ways to improve via the Subject Report, there continues to be a wide variety in the quality of the investigations, with many falling in the lower bands.

Many schools continue to permit investigations that either directly violate or violate the spirit of the *IB sciences experimentation guidelines*. These papers were related to the use of food, caffeine and/or nutritional supplements. These investigations are highly subject to the placebo effect. Most methods do not account for the time it takes to fully digest food.

Nutritional supplements in many countries are not regulated and may be contaminated and unsafe. On certain occasions, subjects are being made to take amounts of caffeine that exceed the safe limits established by the WHO. Students **must** be advised against experimentation that involves the ingestion of any substance.

From the *Guidelines:*

- 'Experiments that administer substances, including but not limited to alcohol, drugs, medicines or dietary supplements (including beverages containing caffeine and energy drinks), are not acceptable and must not be carried out.'
- The number of papers exceeding the 12-page limit and/or using tiny fonts and margins has decreased significantly. This is a positive trend. Unfortunately, many papers that exceeded the limit could easily have stayed within the limit with simple formatting changes.

Items for further consideration include:

- Annotations by the teacher directly on the paper is the best way to support the mark that has been awarded. Comments at the top of the document that require scrolling multiple times to read are not very helpful. Some applications, when adding comments in the margins, ruin the student's formatting and negatively impact the Communication mark.
- The use of database investigations has predictably dropped from the numbers seen during the height of the pandemic. Suggestions to improve the quality of these investigations can be found below.
- To build strong IA skills, teachers need to scaffold them over the duration of the course. The IA should be built over time, rather than approached as an afterthought.
- Literature reviews do not meet the criteria for this assessment. An investigation is required. Such papers generally score a 1 or 2. Teachers must recommend against such a plan to their students.
- It is a requirement of the IB sciences experimentation guidelines that human subjects provide written, informed consent. Parental consent is **required** for subjects under the age of 16. A PAR-Q or equivalent is required for moderate or strenuous physical activity. A single sample of all forms provided to the subject(s) should be included in an Appendix.
- At a minimum, sample raw data must be included in the body of the report.
- A strong, fully focused and contextualized research question forms the basis for an investigation with the potential to reach the upper bands. Teachers should work with their students on the development of their research questions.
- Teachers **must** take the time to verify that the samples have been uploaded correctly. Incorrectly uploaded samples have the potential to negatively affect the marks of every student from that school.

Student performance against each criterion

Personal engagement

The PE criterion was often over-assessed, as it is misunderstood as showing interest in, or having a link to the topic. Students had success where teachers seem to encourage and support student work with original research questions that are justified using scientific background information and provide depth across the entire report.

Personal engagement is shown over the entire report. In order to attain two marks for this criterion, students must fully engage with the topic. Students should choose a topic that is of genuine interest to them. It is usually obvious to an examiner when a student genuinely cares about their research topic. Students need not include a paragraph that explains why the topic was chosen.

- In Exploration, PE can be shown by developing a unique research question, with detail in the background research, the creation of a unique methodology, or by showing evidence of careful consideration of control and confounding variables.
- Within the Analysis, PE can be shown with rigour in the data collection or by taking the analysis of the data beyond the expectations of the Subject Guide, in a way that is justified.
- Under Evaluation, students can display PE via outlining the practical implication of their findings to the sporting/ health environment.

Exploration

A number of IAs failed to include adequate research for the background section. The reports of weaker students showed a lack of relevant, reliable and/or well-referenced sources. Experimental methods were adequate overall. The points below indicate areas for improvement:

- The RQ should be fully described and include both the independent and dependent variables (with units and unit uncertainties), along with a described context (the specific population of test subjects). Having students properly contextualise their research questions is the simplest way for the entire cohort of students to raise their grade on the IA.
- The conditions of the independent variable should be fully described, including units and unit uncertainties that are justified with a scholarly source. The dependent variable should also be fully described.
- The background information should describe, using **relevant, scholarly, cited sources**, the dependent and independent variables. It should then make a link between the two, providing context for the investigation.
- Most students who achieved at a higher level used the background information to justify their chosen method.
- The description of the controlled variables should describe how and why they are controlled. Students achieving in the upper band support their decisions with referenced sources.
- The description of confounding variables should describe how they could affect the data and justify why they could not be controlled. Attempts to minimise the effect of these variables are credited positively.
- Where subjects are completing multiple trials, students seem unaware that the act of completing said trials could affect results involving a novel task. Methods should include a method of controlling for the practice effect, such as the randomisation of the order of presentation of conditions.
- Fatigue or rest periods are often forgotten as a control variable.

- Collecting sufficient data would generally involve multiple trials in each condition of the independent variable. Single trials are generally deemed insufficient.
- Unit uncertainties should be justified, with a citation. For example, the actual uncertainty of measuring time with a stopwatch is greater than +/- 0.01 s, due to the human delay in response times.
- Papers should describe how the subjects were selected.
- Risk assessments are essential to achieve in the upper band. They should consider potential hazards (e.g. slipping on a surface) and state how those risks were mitigated (e.g. wearing athletic footwear). It should be noted that each methodology will have unique requirements.
- Investigations involving heavy resistance exercises and swimming often have key safety considerations ignored, such as the presence of a lifeguard.
- Ethical considerations should include informed consent, the right to withdraw and confidentiality, at a minimum.
- As mentioned above, when using human subjects, obtaining informed consent is required. A sample copy of all documentation given to the subjects should be shown in an appendix.
- Good practice for meeting minimum safety standards with human subjects includes a warm-up. The warm-up should be described.
- Many students stated that gender was a controlled variable, when in fact the controlled variable was the biological sex of the subjects.
- Investigations involving the implementation of a training plan should take place over a period of sufficient duration for the subjects to see a measurable improvement and include sufficient controls and explanation of the training method.

Analysis

The Analysis section is open to improvement. Once data is collected, it should be processed via calculations and graphical display. One simple suggestion to increase achievement is to have students fully separate the sections of the paper where they analyse their data from the conclusion. Other suggestions for improvement are noted:

- A single trial will not produce sufficient data, given the small sample sizes generally used by high school students. Multiple trials are required to show reliability of data, and also allow for processing. In general, three trials are good, five are better.
- As a general guide, four to six hours of data collection is required for a mark in the upper band. Thus, if individual trials are of short duration, the number of subjects and/or trials should be increased to meet this threshold. As previously mentioned, this may also be a factor in assessing the evidence of personal engagement.
- Collecting qualitative data is important. For a higher grade, this data should be referred to in the analysis.
- The qualitative data needs to be relevant and should be specific to individual subjects where possible. General statements such as “it was cloudy” offer little value. Selecting appropriate qualitative data to collect is a part of a good design process.
- If the amount of raw data is voluminous, it should be appended, however, sample raw data must be included in the body of the paper.
- It is expected that students appropriately and properly calculate mean and standard deviation.
- Examiners need to be able to follow the process of analysis. Sample calculations are an excellent way of doing this.

- Raw data should generally not be graphed, unless a student is specifically trying to show a trend in the data. Many graphs were simply a visual representation of the raw data tables.
- Correlation studies require a scatter plot. When comparing two conditions of an independent variable, a bar graph is generally the best option.
- Error bars need to be used in graphs and explained to the reader.
- Independent variable (suspected cause for change) needs to be on the x axis and dependent (suspected change) on the y axis.
- Uncertainties need to be addressed and justified.
- Students need more support in selecting the appropriate inferential test (i.e. t-test, ANOVA, coefficient of determination).
- It should be noted that the Spearman correlation and the Chi-square test are valid only when the data in question is ranked. This should occur rarely in SEHS.
- Further processing of data needs to be relevant to the raw data.
- The discussion often reveals that students do not understand the meaning of their processed data. Inferential test results should be explained. For example, whether the t test was paired or unpaired, the intermediate values provided, etc.
- As mentioned above, to highlight their analysis skills to the examiner, it is suggested that a section on the interpretation of the processed data should be kept separate from a well-described conclusion.
- To achieve marks in the upper band, students should look for and discuss secondary trends in the data.
- The use of the interquartile rule or referring to a +/- 2 SD range to find outliers may be useful. Some students spoke of outliers without providing justification, or even stating whether or not the "outlying" data had been excluded.

Evaluation

This continues to be the most challenging section for many students. Many students still do not evaluate data in terms of its validity, strengths or limitations of the data collection procedure. Many of the students would be able to achieve ~2 marks more if they reflected critically on their method and the lack of detail in the variables. Marks are also easily achievable by simply including a section where the student compares their conclusion to the scientific context. Key findings and suggestions are:

- Conclusions should answer the research question directly.
- The reference to the processed data is too sparse. All conclusions should reference the processed data specifically.
- Many students did not compare their conclusion to the scientific context.
- A good comparison to the scientific context will introduce at least two new scholarly sources and use those papers to explain their findings using relevant scientific theories and models.
- Many students omitted the discussion of the investigation's strengths.
- Weaknesses should focus on the method (i.e. What errors did I make in selecting/ applying the control variables?) rather than the procedure (i.e. Not enough subjects or trials, should have had a better stopwatch.).
- Suggested improvements should relate directly to the identified weaknesses. A table format can be useful for this.
- Said improvements need to explain accurately how they would be implemented.
- A change in context (e.g. same method, different subjects) is an extension, not an improvement.
- Many students do not include extensions to the data or specifics of how the data can be applied in future work.

- Students should try to explain the findings with a biologically or physically viable explanation.
- For a mark in the upper band, students must accurately assess the relative impact of the weaknesses in the method.

Communication

Generally, students achieved a mark in the upper band on this component. In general, the key difference between scoring a 2 or a 3 is in the overall clarity of the paper (i.e. Do sections need to be re-read to be clearly understood?). A focused research question should allow the students to create a report of optimal length. Students need to be reminded to keep the report concise, and at 12 pages. The students can reference appendices where appropriate, such as for the inclusion of **additional** raw data and the provision of sample consent or PAR-Q forms. Note that examiners are under no obligation to read an appendix. The students struggle to use proper citations and annotations on the graphs. Areas for improvement and consideration:

- Font size should not be lower than 11 and margins no smaller than 2 cm. Single spacing is acceptable.
- To save words, there is no need for superfluous definitions, such as that of a dependent variable or of a standing long jump. The student can assume a certain level of knowledge on the part of the examiner.
- A table of contents, title page, or abstract should **not** be included in the paper.
- The use of non-SI units (inches, feet, psi, etc.) are not acceptable.
- Table headings must be fully descriptive and should include the names of the two variables.
- Tables should not be split across page breaks. If they must be due to size, a separate header should be included.
- Units and unit uncertainties should appear in the header row of the table.
- The precision of the data presented should stay constant. The precision of the processed data cannot exceed the precision of the raw data.
- Using a constant degree of precision (e.g. to one decimal point) is preferable to using significant figures.
- Lists of works cited should be checked. The list needs to be complete, alphabetical by author, and correctly formatted.
- Students should be reminded that the anonymity of the subjects, both in data tables and photos is standard practice and a demonstration of strong ethics.
- Footnotes take up excessive amounts of space within the 12 pages. Inline citations are preferred.

Papers Using Secondary Data

Although the number of investigations using secondary data is dropping, the following suggestions are included as a guide:

- Students should discuss the criteria they used to select their database. They can compare the possible options and rationally explain their choice.
- Students should describe the steps they used to extract their data.
- The uncertainty and validity of the data should be discussed.
- Sufficient data needs to be extracted from the database for the result of any data analysis to be valid. Working with 8 data points, for example, is vastly insufficient.
- The confidentiality of the data used should be maintained, as the subjects did not specifically consent to the use of said data in this particular way.

Recommendations and guidance for the teaching of future students

It cannot be overstated how important it is that students are supported in the process of completing their investigation. The following recommendations are made to teachers:

- The IA is an integral part of the course. The scientific method should be taught very early on, and students should begin to plan their research questions many months before the submission deadline.
- Ensure that the topic of the paper has a strong link to the SEHS course material.
- Students should be counselled regarding the establishment of their research question.
- All students should be counselled to avoid research questions involving the ingestions of substances, as these investigations typically involve too many confounding variables and/or a placebo effect.
- It may be helpful to review methods for referencing background literature. It is expected that students have several reliable background reading sources that are from scholarly sources, rather than internet blogs.
- The use of inline citations in APA format assists the examiner in quickly verifying sources when needed.
- Having students submit formal research proposals is a process that increases success.
- If time allows, students should undertake a preliminary investigation to allow for modification of their method if needed.
- Plan for data collection to take 4 to 6 hours.
- Ideally, standard lab protocols such as response time tests, ruler drop tests and shuttle run tests should be used to supplement students' own designs, not as the only data collection instrument.
- Have students practice being critical of methods used for demonstrations or activities in class.
- The Subject Guide allows for teachers to review and provide feedback on one draft of the work. Teachers should endeavour to do this.

Further comments

Too many centres don't follow the submission instructions. It must be re-emphasized to the centres that all work submitted should be anonymous, meaning, without identifying information of the student's name, centre identifiers (such as candidate number), and the date of the session. Including the candidate's personal code (e.g. abc123) is acceptable.

Comments on the submitted papers should be directed towards the examiner to justify the mark, not towards the student to provide feedback. These comments should be in a colour different from the student's own work.

Teachers should note that the best way to support the mark they have awarded the student is to annotate the paper in such a way that the annotations are visible at the same time as is the relevant section of the paper. Any method that does not require the frequent scrolling back and forth to look for information is recommended. Teachers are also reminded that the examiner can only see a PDF version of the student's work. Teacher notes that require a click to be opened do not function on a PDF.

Teacher comments that simply copy the words from the markscheme are not helpful.

Finally, teachers are reminded that should they have any questions regarding the IA, expert advice can be found by posting questions in the Community on My IB.

Higher level paper one

General comments

Similar to the SL paper, comments received through the G2 teacher feedback forms identified the HL paper as being of appropriate difficulty. HL students approached the common questions similarly to SL students. Disappointingly, in each question at least one candidate failed to submit a response. As this is a multiple-choice question, students are encouraged to provide an answer for every question.

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

- Anatomical terminology
- Principle structures of the respiratory system
- Chemical and neural control of the respiratory system
- Structure of unsaturated fat
- Role of insulin and muscle contraction on glucose uptake
- Role of antagonistic pairs when applied to sporting actions
- Types of skills

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

- Lung volumes
- Structures of the heart and their locations
- Examples of performers with a high functional capacity of oxygen transport
- Muscle fibre types

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

Question 1

SL common question. D is the correct answer, based on the anatomical position the ulna is medial whereas the radius is on the lateral side. A is not correct as the phalanges are inferior to the humerus. The humerus is proximal to the shoulder joint (clavicle and scapula), C is not correct.

Question 2

SL common question. A is the correct answer. It cannot be B because it is the calf lower leg muscle, it cannot be C as it is the muscle of the buttocks, it cannot be D as this is a deep calf muscle of the lower leg.

Question 3

Most students selected D, as lungs was the main distractor. Although the diaphragm is used in breathing it is not a principal structure. Therefore, B was the correct answer.

Question 4

SL common question. A is the correct answer as B is tidal volume, C is expiratory reserve volume & D is residual volume.

Question 5

SL common question. A is the correct answer. B is the main distractor. Exercise also causes an increase in ventilation therefore students needed to clearly apply the concept of blood acidity. When exercising, blood acidity rises due to an increase in carbon dioxide. This therefore lowers the pH value.

Question 6

SL common question. Students had a good understanding of the topic; most were able to collect accurately select C which accurately labelled the structures of the heart.

Question 7

SL common question. One of the easier questions of the paper and students were well prepared. The most popular answer was A, an elite marathon runner which was the correct answer, C (novice hiker) was the main distractor.

Question 8

SL common question. The most popular answer was D which was correct. Although C was the main distractor, this cannot be the correct answer as plants can contain unsaturated and saturated fats. Typically, most plants are high in unsaturated fats. However, this is not the main distinguishing feature. It is important that teachers recognise that students should recognise that examples are generalisations, but do not apply in all cases.

Question 9

The most popular answer was B which was correct. Aerobic means with the presence of oxygen and catabolism is the breakdown of molecules to form simpler ones. A is therefore anabolism, C is anaerobic catabolism, D is aerobic anabolism.

Question 10

SL common question. This was the most challenging question on the SL paper. A was the correct answer, although more students selected B and C having misunderstood the question. Insulin and muscle contraction both stimulate glucose uptake by the muscles. However, during exercise, the muscle contraction begins to inhibit insulin, and this is why students may have been distracted by B & C.

Question 11

SL common question. Option C, was the most popular and the correct answer. I. glycolysis through the lactic acid system is in the absence of oxygen.

Question 12

SL common question. The most popular answer was A which is the correct answer. This was a relatively straightforward question for students.

Question 13

The correct answer was B which was the most popular. The biceps brachii is the agonist and shortens in length during the upwards phase of the bicep curl. The antagonist is the triceps brachii which relaxes.

Question 14

SL common question. The correct answer was B, however the most popular was D. Students understood the action taking place at the knee joint (extension) however they lacked knowledge of contraction types. Students needed to understand which muscle (quadriceps) causes extension at the knee and shortens in length during contraction.

Question 15

SL common question. D was most popular answer and is correct. Typically, the Fosbury flop technique is used to attempt to keep the centre of mass under the bar allowing the performer to jump higher.

Question 16

C was the most popular answer. EFL = 1st class lever, ELF = 2nd class lever and FEL= 3rd class lever. Therefore ii. & iii. are the correct responses and C is the correct answer.

Question 17

C was the most popular and correct answer. D was not the correct answer as there was no movement. This was one of the more challenging questions.

Question 18

D was the most popular and the correct answer. Students appeared to be prepared for this answer. It was considered a relatively easy question.

Question 19

SL common question. D was the most popular and correct answer. Students were mainly distracted by intrinsic feedback,

Question 20

Most students selected B most which was correct.

Question 21

A was the most popular and the correct answer. Generally, students were well prepared, although B was the main distractor where they selected practice to performance.

Question 22

C is the correct answer, and was also the most popular. Students should ensure they are familiar with the terms related presentation and interpretation of data.

Question 23

SL common question. B was correct and the most popular answer.

Question 24

D was the correct answer, it was one of the most popular choices. This was one of the easiest questions on the paper.

Question 25

SL common question. D was the most popular choice and correct and A was the main distractor.

Question 26

C was the most popular and correct choice, students were well prepared for this question.

Question 27

A was the most popular choice and correct, as B supplies the heart, the pulmonary supplies the lungs and the renal artery supplies the kidneys.

Question 28

C was the most popular answer which was correct. This was one of the easiest questions on the paper.

Question 29

D was correct, with most students selecting this answer. The main distractor was A, where students identified the opposite role.

Question 30

D was the answer, which was also the most popular. This was one of the more challenging questions on the paper. A was the main distractor.

Question 31

Most students were able to access this question. The correct answer is C.

Question 32

A moderately difficulty question. A is the correct answer and the most popular response. B was the main distractor with students lacking the understanding of the terms perpendicular and parallel.

Question 33

One of the more challenging questions. D was correct and the most popular answer. The main distractor was C.

Question 34

A moderately difficulty question. B was the correct answer and the most popular. However, D was the main distractor.

Question 35

Students appeared to be under-prepared for this question. A was the most popular response, but C is the correct answer.

Question 36

One of the easier questions on the paper. B was the most popular response and it was the correct answer.

Question 37

C was the correct answer and the most popular response.

Question 38

Students were under-prepared for this question. D was the correct answer. However, C was the most popular response. It was one of the most challenging questions.

All three factors are affected by genetics.

Question 39

This was considered one of the most challenging questions on the paper. D was selected as the most popular response, but C was the main distractor. Cortisol decreases the function of the immune system during a high training load across a prolonged period.

Question 40

One of the easiest questions on the paper. A was correct and the most popular response.

Recommendations and guidance for the teaching of future students

Encourage students to attempt all questions in a multiple-choice question paper.

Continue to develop the ability to apply scientific principles to practical sport and exercise examples. This can be achieved through observing a range of sport and exercise actions and linking the scientific principles.

Develop student awareness of a range of sports and exercise activities. This can be through observing live observation and video examples.

Students need to have a sound understanding of key technical terms. Teachers should highlight terms that have similar spellings to ensure students take time to focus on the specific differences. For example, anaerobic and aerobic, saturated and unsaturated.

Standard level paper one

General comments

Comments received through the G2 teacher feedback forms suggest that the SL paper is of appropriate difficulty. SL students approached the common questions similarly to HL students. There were only two questions which were considered very easy (9 & 19) and no question was considered very difficult. However, 13 was the most challenging question on the paper. Students did not appear to be as prepared for this session as in previous years. Disappointingly, in each question, at least one candidate failed to submit a response. As this is a multiple-choice question students are encouraged to provide an answer for every question.

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

- Mechanisms of glucose uptake
- Muscle contraction types
- Presentation of skill
- Learning curves
- Fitness tests
- Interoceptors
- Factors affecting DOMS
- Energy systems
- Role of lipids and energy of macronutrients

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

- Lung capacities
- Application of maximal oxygen consumption
- Functions of the components of blood
- Structure of the heart
- Structure of unsaturated and saturated fatty acids
- Centre of Mass (COM)
- Bernoulli's principle
- Calculating mean

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

Question 1

A moderately difficulty question with a good discriminator index and a HL common question. The most popular answer was D which was correct. B was also a popular choice, however, B is incorrect as the carpals are next to the ulna but at the distal end, therefore distal. C was also popular, but the humerus is proximal in its relationship to the metacarpals and do not directly attach. A cannot be the correct answer as the phalanges are directly below the line of the humerus when considering the anatomical position or depending on the digit maybe lateral.

Question 2

The correct answer was C, as the origin of muscle attachment is typically a stationary bone during a particular action, e.g. the scapula is a stationary bone during flexion at the elbow and houses the origin tendon attachments for the biceps brachii. An insertion is a tendon attachment but is the attachment to the lever or moving bone. e.g. radius is the insertion point for the biceps brachii. B, the ligament is incorrect as it plays no role in muscle attachment as it connects bone to bone. D, the synapse plays no role in tendon attachment.

Question 3

HL common question. A was the most popular and correct answer. Although this was a mid-difficulty question, B was a favoured answer, but this is found in the lower leg (calf muscle). C is incorrect as this is the muscle of the buttock and D is the deeper muscle found in the lower leg.

Question 4

HL common question. A relatively easy question and A was the correct and most popular choice. The answer cannot be B as this is Tidal Volume. C is expiratory reserve volume and D is residual volume.

Question 5

HL common question. A mid-difficulty question with a good discrimination index. Most students selected A which was correct. Students needed to look at the comment related to the pH as well as the heading related to blood acidity. During sub-maximal exercise, ventilation increases and therefore so does CO_2 production. This causes blood acidity to rise and the pH to be lowered. C and D are incorrect because ventilation does not decrease with exercise. B is incorrect because the blood acidity levels do not remain low and normal during exercise.

Question 6

B was the correct and most popular choice. Students needed to understand the role of the three components of blood.

Question 7

HL common question. A relatively easy question, with a good discrimination index. C was the most popular response and the correct answer. Students may have struggled with understanding the diagram and remembering the labelling of the left and right when looking at a page. Also, students mainly confused the valves.

Question 8

B was the most popular choice and correct answer, although this was a mid-difficulty question with a good discriminator index. The most popular incorrect answer was C where students have confused the place of the AV node and may have confused the Purkinje fibres.

Question 9

HL common question and the easiest question on the SL paper. A was the most popular response and was the correct answer as a marathon runner would be expected to have the highest VO_2 max.

Question 10

This question was considered a mid-difficulty question. The correct answer is B which many students selected. However, the most popular response was C. Lipids are found within skeletal muscle but not used to build muscle tissue.

Question 11

HL common question. A relatively easy question on the SL paper. The most popular response was D which was correct. This area can sometimes be challenging for students as there is often the misconception that unsaturated fatty acids always have a plant origin and saturated fat only comes from animal products. Although in general this may be the case, there are several exceptions to this rule. For example, avocados

and cow's milk both contain unsaturated and saturated fatty acids. Therefore, it is important to highlight to students the typical sources of these fatty acids but explain there are exceptions and therefore the main distinguishing feature is the chemical bonds.

Question 12

A moderately difficult question, B is the correct answer and the most popular choice. C is the KJ for 100g carbohydrates and D is the KJ for 100g lipids.

Question 13

HL common question. This was the most challenging question on the SL paper. A is the correct answer, although more students selected B and C. Students misunderstood the question. Insulin and muscle contraction both stimulate glucose uptake by the muscles. However, during exercise, the muscle contraction begins to inhibit insulin, and this is why students may have been distracted by B & C.

Question 14

HL common question. C was the most popular response and the correct answer. A, B & D could not be correct because they all included I, glycolysis by the lactic acid system does not require the presence of oxygen. Only if oxygen is present is pyruvate oxidised as part of the Kreb's/ citric acid cycle.

Question 15

One of the easier questions on the paper. C was the most popular answer and is correct.

Question 16

HL common question. A is the correct answer and was the most popular response. Students were generally well prepared for this question and able to understand that Type I fibres have a high resistance to fatigue and therefore can maintain contractions over a period, however they cannot produce as much force as Type II fibres.

Question 17

HL common question. One of the more challenging questions on the paper. Although most students selected B which was the correct answer, many were distracted by D. Therefore, students struggled to apply the type of isotonic contraction to the example. Most accurately identified that the knee action was extension, however they needed to understand that the agonist for this movement was the quadriceps femoris which is shortening during contraction. This is why B was the answer and not D.

Question 18

A moderately difficult question. C is the correct answer and most popular response by students. A is incorrect because the method would not minimize DOMS, B and D are incorrect because it is typically the eccentric contraction which leads to DOMS.

Question 19

HL common question. One of the easiest questions on the paper. D was the correct answer and the most popular response. D is correct because of the shape of the body and technique being used (Fosbury Flop), aims to pass the COM below the high jump bar to increase height of jump.

Question 20

A is the correct answer and the most popular response. This was a relatively easy question on SL. Where the high pressure occurs, the ball will curve/ move towards the opposite side. Therefore, C and D could not be the correct answer and B has the high pressure on the same side as the movement.

Question 21

A more difficult question with a high discrimination index. The most common response was D which was the correct answer.

Question 22

A relatively easy question, students were able to answer confidently, demonstrating their knowledge of the equation of skill. B was the most popular response, and this was the correct answer.

Question 23

One of the more challenging questions on the paper. Students mostly selected D, which was the correct answer, however a large number were distracted by C. Students appear to find this topic challenging. Interreceptor monitor data from a range of visceral organs. Whereas proprioceptors are related to skeletal muscles, joints, and positioning.

Question 24

HL common question. A moderately difficult question. The swimmer sees the clock therefore this is external feedback and as they do this at the end of the race it is terminal. D was the most popular response and was the correct answer. The clock does not provide internal feedback, and a swimmer was not observing the clock during the swim therefore answer must be D.

Question 25

A moderately difficult question. The answer is B which was also the most popular response. Interestingly most students were distracted by D, plateau, suggesting that they read the question to suggest flattening no learning.

Question 26

Mid-difficulty question. B was the correct answer, and most students selected this option, but many were distracted by D and confusing Part and Whole presentations.

Question 27

An easier question, with most students able to accurately select B.

Question 28

A relatively easy question. HL common question. B was the correct answer. A would not be appropriate to describe a laboratory based VO_2 Max test, C and D, the limitations are not appropriate for this test.

Question 29

Moderately difficult question, as students were distracted by all the options. A is a measure of aerobic capacity; B is a measure of muscular endurance and C is a measure of strength. Therefore, Vertical Jump, D, was the only measure of power.

Question 30

HL common question. Students were distracted by A as these are considered best approaches for a healthy lifestyle. However, the correct answer was D, as warm up/ stretching, endurance, flexibility, resistance, cool down/ stretching and recreational activities are considered essential elements of a general training programme.

Recommendations and guidance for the teaching of future students

Encourage students to attempt all questions in a multiple-choice question paper.

Continue to develop the ability to apply scientific principles to practical sport and exercise examples. This can be achieved through observing a range of sport and exercise actions and linking the scientific principles.

Develop student awareness of a range of sports and exercise activities. This can be through observing live observation and video examples.

Students need to have a sound understanding of key technical terms. Teachers should highlight terms that have similar spellings to ensure students take time to focus on the specific differences. For example, anaerobic and aerobic, saturated and unsaturated.

Higher level paper two

General comments

Overall, many students were familiar with the presentation and format of the paper.

Some G2 forms were submitted by schools. In general, the presentation was deemed to be acceptable, with respect for gender, religion, and inclusivity. The questions have moved to a more applied and contextual approach and this is something for teachers to continue to factor into their delivery. It is also important to remember that Objective 3 and Objective 2 assessment statements can be assessed at lower objective levels. For example, Objective 1 style questions.

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

General

Addressing the questions in full and interpreting the requirements of the command term was the largest challenge for students. Often, responses were listed when they were required to explain. Many students did not attempt questions, leaving large sections of the paper blank, suggesting that they were underprepared for the paper.

Students struggled to apply their knowledge to the context of the question and were unable to expand their points with any depth and therefore were challenged when attempting to access the higher marks.

Topics

The areas of the programme and examination in which students did not appear well prepared.

Topic 1

Structure of a skeletal muscle.

Topic 2

Exchange of oxygen between alveoli and capillaries.

Cardiovascular adaptations to training.

Topic 3

Describing the production of ATP using the ATP-CP system.

Metabolism of ATP.

Concept of essential and non-essential amino acids.

Topic 4

Conservation of angular momentum and its application to a sporting action.

Topic 5

Describing the process of Psychological refractory period.

Analysing methods to improve memory.

Understanding of selection attention and the information processing models when it links to STM & LTM.

Topic 6

Understanding the use and application of the Karvonen method.

Topic 7

This still appears to be an area where students do not understand the energy requirements of the brain.

Analysing the principal parts of the diencephalon.

Topic 8

Identifying specific hormones released from the pituitary gland.

Topic 9

Factors affecting peripheral fatigue.

Topic 10

Application of friction in sport.

Understanding the concept of drag and the different types and how they impact on performance and can be manipulated.

Topic 13

Explanation of the J curve and training load.

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

Topic 2

Cardiac parameters and the differences between trained and untrained individuals.

Topic 4

Sliding filament theory.

Newton's Laws of motion.

Topic 6

Interpreting data from a source.

Topic 8

Role of hormones.

Topic 12

Benefits of genetic screening.

SECTION A

General

There are still some students who completed their responses for section A outside the boxes provided. Therefore, it is worth reminding students that if they cannot write their full answer within the box, they should use the additional paper provided.

Students appeared to understand the expectations of the data-based questions. Those who required additional paper were able to use the extension paper to extend their responses to address the questions in full. However, there were many students who used extension paper to answer section B. This is not required; students should use the blank lined pages available in their answer booklet to complete Section B questions and then when this has been completed extension paper is used.

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

Question 1

1(a)(i) & (ii) Students answered confidently and, in most part, were able to read the data accurately and provide the correct value. However, it was clear that this style of data presentation was less familiar to students which should be considered by teachers when delivering the course and developing SEHS skills. A reminder that for calculate questions, students are required to show their workings in full to gain the mark. Answers alone will not be credited.

1(a)(iii) The question required students to use the words valid/ similar to the standard/ force platform. Equally, they were required to use consistently/ reliable to the standard/ force platform. If students did not refer to the reliability or validity in respect to the standard/ force platform they did not receive credit.

1(b) Most students were able to access a mark through discussing the accessibility/ cost of the app. However, many were unable to make further points to access all three marks. A greater range of potential benefits was required.

1(c)(i) The concept of dominant energy systems is still a challenge for some students. The question was looking for the main energy system which was the ATP-CP system (alternative names of this system were accepted).

1(c)(ii) Although students were able to identify the dominant system in 1ci, many struggled with analysing how the system produced ATP. Focus on the stages/ mechanism of the system were required.

1(d)(i) Answer confidently by most students.

1(d)(ii) Some students struggled to provide a comment for both factors identified in the stem of the question. Students needed to state that the caffeine group had the lowest relative or highest energy deficit AND the highest enjoyability. Students needed to refer to the highest/ lowest where appropriate, only stating high or low with no comparison to both sets of data was not specific enough.

1(e) Many students were unable to outline the Karvonen Method. This was poorly answered, and a majority was not prepared.

1(f) Students continue to confuse the difference between peripheral and central fatigue. When considering peripheral fatigue, they should describe the factors that lead to a reduction in muscle cell force and contraction. A deeper understanding of this concept is required.

Question 2

2(a) In general, this was answered well by most. However, there were students who were under-prepared and included elements that are not found in any of the macronutrients discussed in topic 3.

2(b) A challenging question for many. A third of students understood the main difference and accurately identified the main differences between essential and non-essential amino acids. However, the remaining students either did not respond or confused the meaning of the terms and did not apply them correctly.

2(c) Students were required to identify the change in the requirements of the macronutrients. Therefore, they needed to state higher or lower. If they only stated high or low with no reference to the change they could not be credited.

Question 3

3(a) Students understand that glucose is required for energy. However, linking its use to the blood brain barrier is often not discussed, although many students are generally able to identify a symptom of low blood supply to the brain.

3(b) Students often failed to respond to this question. Many were only able to identify the structures. The most confident responses were related to the hypothalamus.

3(c) In general students were able to identify one hormone. However, many students provided hormones that were not relevant. The mark scheme was predominantly expected ADH or GH. However, the pituitary does release other hormones, so credit for credible hormones released from this gland was given.

Question 4

4(a) Similar to the responses for 1Cii students struggled to explain the metabolism of ATP. Most who accessed marks focused on how adenosine gained a phosphate.

4(b) In general, students appeared to have a good understanding of the sliding filament theory and the role of calcium. However, there was some confusion around the role of troponin and tropomyosin and how they interact with calcium during muscle contraction.

Question 5

5(a) The word mechanism may have been a barrier to students as very few understood what was being asked of them. Students needed to discuss oxygen exchange between the alveoli and capillaries and causes of this, many discussed breathing mechanics. Students should understand the differences in partial pressures, diffusion, and net movement of gases.

5(b) Most students were able to access marks in this question and correctly distinguished between Q and HR of trained and untrained individuals.

5(c) Whilst most students were able to access marks to 5b, very few were able to make the link between the two questions and struggled to access two marks.

5(d) As the stem of the question focused on a trained individual, many students focused on the long-term responses to blood pressure. However, the question was focusing on the difference between rest and exercise. Many students were able to identify that systolic blood pressure rises with exercise. However very few were able to distinguish the response of diastolic pressure due to the mode of exercise.

SECTION B

General comments

Students should be made aware that the lined paper at the end of the exam booklet is to be used to respond to the questions in section B. Students are reminded to label the question number and letter to

allow examiners to allocate marks accurately. Many used additional paper to complete their responses to Section B without using the lined paper provided in the answer booklet. Additional paper is only required once the exam booklet is full.

A reminder that students should read and act on the instructions related to the questions in Section B. Students are required to choose two questions, answering all parts from each of the two selected. Some continue to select parts from all of the questions in Section B which may prevent them accessing marks. Students should understand the difference between the question and section.

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

Question 6

6(a) Generally students were able to define Newton's 3 laws. It was evident that most learn the three laws through repetition and more focus on the application of the three laws is required. Students found it more challenging to accurately apply the three laws to football (soccer).

6(b) This was answered confidently, and students accessed many of the marks.

6(c) Cardiovascular drift is still an area that is not fully understood by students. Many were able to explain that HR increased over time. However, they were unable to fully describe or discuss the factors that contribute to this drift.

6(d) This was poorly answered by students. Many focused on training helping to fight infection, but too much training may make them susceptible. However, there was little explanation of the J curve.

Question 7

7(a) Students struggled to access a range of marks for this question. Principles of training are key elements of SEHS, yet many were unable to identify the principles or apply them to the concept of a training programme to enhance performance.

7(b) Most students were able to offer the role of a hormone and give some mechanism of release.

7(c) Students were poorly prepared for this question. Many described PRP as a state of readiness for competition. Describing it as a psychological training strategy to deal with stress and to be used during a period of reflection on performance. Very few students were able to focus on the single channel hypothesis. This area needs specific review.

7(d) Students were able to understand ways to maximise and minimise friction but were unable to give a range of methods.

Question 8

8(a) Students are unfamiliar with the command term "annotate" and did not offer more than a label of the structures. Students were required to provide a brief annotation alongside the label, many were only familiar with actin and myosin and struggled with the larger structures.

8(b) Students demonstrated an understanding of genes and human characteristics. However, they struggled to discuss the relationship in any detail.

8(c) Many students were able to identify methods and give a brief outline of methods to aid memory, but few were able analyse how the methods improved memory. Most students lacked analysis in their responses and therefore scored poorly in this section.

8(d) This was quite an open question where students could analyse the concept quite broadly to access marks. However, they appeared to be poorly prepared. There is a strong link between Topic 3 and Topic 9 in relation to EPOC & Fatigue, consideration of the factors that speed up and aid recovery, as well as the factors that contribute to fatigue. This area may need to be taught more holistically for students to have a better depth of understanding and appreciation for the topic.

Question 9

9(a) Students understood how to approach this question but struggled to provide sufficient detail at times to fully outline the concept of conservation of angular momentum. Student should be able to demonstrate their understanding of how the body position of the figure skater impacts their moment of inertia and therefore their angular velocity and how this relates to angular momentum. However, students lack the understanding of how angular momentum is generated.

9(b) Students can often provide strategies/ methods to reduce drag. However, few were able to outline how drag was reduced. Typically, these questions are often a list of examples rather than a demonstration of deeper understanding of the concepts. There also appears to be a misconception around wave drag and surface drag.

9(c) Most students can identify a factor related to selective attention. However very few can make the link between STSM, STM & LTM and are therefore unable to access the higher marks.

9(d) Some students displayed good understanding of the use of flow charts and were able to access a range of marks. However, in general this was an area where limited explanation was provided and responses were superficial. Students were required to specific focus on how information gathered from a flow chart during an invasion game could be used to aid performance.

Recommendations and guidance for the teaching of future students

Further develop revision strategies to support recall of key concepts.

Support students to analyse or discuss or explain. Working on developing their responses beyond superficial details will allow them to access greater marks and help them have a deeper understanding of the theory and apply it to their own practise and observations.

Teachers must continue to provide a range of examples of data in varied styles of presentation. This will help students develop the ability to analyse, comment and draw a conclusion from the data presented.

Continued application of theory into contextual scenarios will enhance students' understanding of the topics covered.

Continue to encourage students to understand the format and presentation of the examination papers so they feel confident in the final examination and are able to access marks available.

Standard level paper two

General comments

Overall, the students appeared prepared for the exam paper. They were familiar with the structure of the content and appeared prepared for the questions.

The questions have moved to become more applied in nature, something that teachers need to take into account in advance of the new subject guide.

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

- Application of the terms reliability and validity
- The energy continuum
- The description of how ATP gains and loses a phosphate molecule
- The mechanism of gas exchange
- The psychological refractory period
- Selective attention and short-term memory
- Cardiovascular drift

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

- Describing energy systems
- Recalling the elements that make up proteins
- comparing the macronutrient needs of athletes and non-athletes
- Sliding filament theory
- Cardiovascular adaptations from prolonged exercise
- The mechanics of ventilation
- Describing Newton's laws and their application to sporting movements

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

Section A

Some students continue to write outside the space provided. It is worth reminding students that they can ask for additional paper should they need to do so.

Students appeared prepared for the data analysis section but often, misunderstood the application of the command term used.

Question 1

1(a)(i) Most students were able to correctly identify the value within the acceptable range.

1(a)(ii) A significant number of students did not show any workings and thus did not receive the mark. They must be reminded to show their workings out for the command term calculate.

1(a)(iii) Few students were able to use the data provided to outline the validity and reliability of the test.

1(a)(iv) It appeared that many students confused their response from 1aii with 1aiv here and did not correctly apply the p value given in the question.

1(a)(iv) Most students answered correctly'

1(b)(ii) A significant number of students incorrectly answered this question.

1(b)(ii) A significant number of students incorrectly answered this question.

Question 2

2(a) Most students answered this question correctly.

2(b) Most students answered this question correctly. Often 2 marks were awarded as students did not correctly identify the increase in fat.

Question 3

3(a) A significant number of students were unable to answer this question correctly.

3(b) A significant number of students were unable to answer this question correctly.

Question 4

4(a) Most students were able to achieve some marks for this question. However, there was often a lack of depth in the answers expected at this level.

4(a) Most students were able to answer this question correctly.

4(b) Most students were able to answer this question correctly.

Section B

Question 4

5(a) When attempted, often 5a achieved the highest number of marks. However, a significant number of students did not answer this question. Rather they referred to the pathway of air into the lungs or gas exchange.

5(b) Many students were able to explain the psychological refractory period but few were able to evaluate its use within a sporting context.

5(c) Many students correctly labelled the parts of the muscle but a significant number offered no annotations.

5(d) Most students were able to correctly answer this question.

Question 6

6(a) Few students were able to discuss the difference in blood pressures at rest and during exercise.

6(b) Few students were able to answer this question.

6(c) Students often produced a great deal of irrelevant information in answering this question. There also appeared to be many students who hold misconceptions about the scientific terminology within this question.

6(d) Very few students were able to answer this question.

Question 7

7(a) When attempted, most students achieved some marks for this question but often their answers were not applied to figure skating or incorrectly using Newton's laws.

7(b) Many students were able to outline the methods, but few were able to suggest how they helped improvements to memory.

7(c) Many students were able to correctly answer this question. However, the application of Newton's 1st law often was missed. E.g. many correctly stated that a football/ soccer ball will not move until an unbalanced force is applied to it, but few were able to state that the ball will continue to move until another force (e.g. friction) was applied to the ball.

7(d) Few students were able to correctly answer this question.

Recommendations and guidance for the teaching of future students

- Students should attempt all questions.
- Students should be given exposure to the command terms, so that they fully understand what is being asked within a question.
- Continue to provide students with a wide range of data that supports them in analysing, interpreting and drawing conclusions.
- Students need to be able to apply their knowledge to a range of questions. Often, they appeared to struggle to apply their conceptual understanding. Understanding how theory can be applied to different sport, exercise and health contexts is critical for the course.

Higher level paper three

General comments

The general achievement level for most students was low. Many students appear to be ill-prepared coming out of the pandemic, this was evidenced by the lack of depth and scope of the HL options the students answered.

Option A was popular, Option B and D also popular in comparison to previous years.

Students' conceptual understanding seemed quite poor and needed to focus more on the technical language and application of ideas.

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

The standard was evenly distributed this session with no single problematic section standing out.

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

Option A

Students generally appeared well prepared for this option.

Question 1

1(a) Answered well.

1(b) Answered well.

1(c) This was answered poorly, as students used data but not had not read the question properly.

Question 2

2(a) Answered well.

2(b) Answered well.

2(c) Answered well.

Question 3

3(a) Answered well.

3(b) Answered well.

Question 4

4(a) Answered well.

4(b) Answered well.

Question 5

5(a) Answered well.

5(b) Answered well.

Option B

Students found critical analysis and conceptual thinking difficult.

Question 6

6(a) Answered well.

6(b) Answered well.

6(c) Answered well.

6(d) Answered well.

Question 7

7(a) Answered well.

7(b) Few students provided comprehensive responses, while the majority merely provided fragmented information related to the MS.

7(c) Students struggled to give examples for self-regulated theory and gave generic answers.

Question 8

8(a) Answered well.

8(b) Answered well. Some repetition between 8b and 8c

8(c) Answered well. Some repetition between 8b and 8c

Question 9

Few students provided comprehensive responses, the majority merely provided fragmented information related to the MS.

Option C

Question 10

10(a) Answered well.

10(b) Answered well.

10(c) Students struggled with this question.

10(d) Answered well.

10(e) Some students mixed up HDL and LDL so did not achieve the marks.

10(f) Answered well.

Question 11

11(a) It was clear that the students did not read the question stem so did not answer the question fully.

11(b) Answered well.

11(c) Answered well.

Question 12

12) Answered well.

Question 13

13(a)(i) Answered well.

13(a)(ii) Answered well.

13(a)(iii) Answered well.

13(iv) Answered well.

13(b) Answered well.

13(c) Answered well.

13(d) Answered well.

Question 14

Students found it challenging to achieve all 3 marks.

Question 15

15(a) Answered well.

15(b) Answered well.

15(c) Answered well.

Recommendations and guidance for the teaching of future students

Ensure that students are aware of the course guide for the HL elements. Students should be taught how to answer command terms. Students should be taught to not repeat the question in the answer space as this leads to limited space.

Ensure that students are writing in the language of SEHS with improved levels of critical analysis and comprehensive understanding.

Standard level paper three

General comments

The cohort appears to have had greater challenge accessing the course material than in previous sessions. This seemed to be throughout the paper, with many students having difficulty with the analysis required to achieve higher marks. Selection of the options to answer in paper three disproportionately favoured Option A. The other three options were chosen relatively proportionately. As with many past sessions, students could not provide greater depth and analysis in their answers; however, they could recall basic concepts. There appears to be difficulty in fully understanding the command terms to provide the requisite depth needed for higher marks.

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

Students had difficulty demonstrating the application of knowledge across options on the paper. In most cases, the students could illustrate concepts but had difficulty providing examples or connections to explain the greater understanding required for marks on the application-based questions.

Conceptual Limitations:

- A.2.3 Outline how the body thermoregulates in hot and cold environments.
- A.2.7 Discuss the health risks associated with exercising in the heat.
- A.3.5 Discuss the proposed and actual benefits that some athletes would hope to gain by using anabolic steroids, erythropoietin (EPO), beta-blockers, caffeine, and diuretics.
- B.1.4 Outline issues associated with the measurement of personality.
- B.2.3 Discuss the issues associated with using intrinsic and extrinsic motivators in sports and exercise.
- B.3.5 Define the term anxiety.
- B.4.1 Discuss psychological skills training (PST). Consider the three phases of a PST program: (i) education, (ii) acquisition (iii) practice.
- C.5.1 Outline how bone density changes from birth to old age.
- C.5.5 Discuss the relationship between physical activity and bone health.
- C.7.2 Outline the effects of exercise on changing mood states.
- D.3.4 Discuss the association between body composition and athletic performance.
- D.3.2 State the components of daily energy expenditure.
- D.4.8 State the reasons for adding sodium and carbohydrates to water for the endurance athlete

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

Clear conceptual understandings:

- A.1.1 Distinguish between training, overtraining, and overreaching.
- A.2.9 Describe how an athlete should acclimatize to heat stress.
- A.3.1 Define the term ergogenic aid.
- B.4.4 Outline relaxation techniques.
- B.4.5 Outline self-talk techniques.
- C.2.3 List the major risk factors for cardiovascular disease.
- C.6.3 Discuss the potential barriers to physical activity.
- D.2.6 Describe how the hydration status of athletes can be monitored.
- D.2.7 Explain why endurance athletes require a greater water intake.
- D.1.1 Outline the features of the principal components of the digestive system.
- D.1.3 Describe the function of enzymes in the context of macronutrient digestion

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

Question 1

1(a) Generally answered well.

1(b) Many students just described the lines on the graph rather than discussing the relationship.

1(c) Students demonstrated a general understanding of the effect of training in hot conditions but made no direct reference to acclimatization.

Question 2

2(a) Too many students' responses included answers that lacked description beyond a list. The command term required a description of how athletes could prevent heat stress.

2(b) This proved to be a more difficult question than it should have been. Students could not describe how sweat draws energy away from the skin. Predominantly, answers were limited to just a description of sweat production.

2(c) Students generally answered this question well but struggled to obtain three marks. Some chose to focus on the symptoms rather than the potential resultant effects of heat exhaustion on exercise.

Question 3

3(a) Generally answered well.

3(b) Students had difficulty obtaining three marks on this question. Many answers provided were just memorized responses that lacked the requisite depth to obtain more marks. Suggestions were required rather than just a list of overtraining symptoms.

Question 4

4(a) Generally answered well.

4(b) Students struggled to apply the correct command term in this question. There seemed to be a reasonable understanding of the effects of caffeine use but a lack of ability to evaluate how this may alter athletic performance. A discussion of the positive and negative effects of caffeine was needed. Many answers focused only on the negative effects of caffeine use with little explanation beyond a list.

Option B

Question 5

5(i) Generally answered well.

5(ii) Generally answered well.

5(iii) Generally answered well.

5(iv) A lack of conceptual understanding was demonstrated with this question.

5(b) Many students demonstrated a general understanding but could not define anxiety thoroughly.

5(c) Definitions lacked a degree of clarity that the students fully understood progressive muscular relaxation.

5(d) This was another area where the question was not answered well despite being straightforward. Students were often unable to define the three phases, much less differentiate them.

Question 6

6(a) Full marks were rare for this question, and responses were discussed in very limited terms. Some also indicated that it would help performance, which is not what the question asked.

6(b) This proved to be a challenging question. It was not often clear whether students understood the locus of causality or stability. Many students were able to provide some basic descriptions to award a mark or two, but very few achieved three marks.

Question 7

This was another question that was difficult to achieve the maximum marks. Often, responses focused on the difficulty of fully defining sport-related personality. Comparisons about the challenges with personality research were far more uncommon. Ethical dilemmas with personality research were outside the question's scope but addressed by many students. This is likely due to past papers looking at the ethical issues of personality research.

Option C

Question 8

8(a) Generally answered well.

8(b) Most students paid no attention to statistical significance. Very few came to the right conclusion from the data that there was no difference or that the difference was hard to ascertain.

8(c) Students could identify BMI and waist circumference but struggled to compare the issues to distinguish the two measures of obesity.

8(d) Generally answered well.

8(e) This question demonstrated a lack of conceptual understanding. Many responses just reiterated the question, saying it generated a risk of CVD. Few students could provide the greater depth required by the mark scheme.

Question 9

9(a) Mostly a well-answered question, but some students gave answers unrelated to the question.

Question 10

10(a) This question was not well answered. Far too many students answered between 35- 45 years of age. The answers ranged far across the spectrum, with many not responding correctly.

10(b) Students exhibited general knowledge but lacked specific understanding. Some responded that there is not enough “protection” for the bones from fat and muscle or that if someone is slim, it means they don’t exercise.

10(c) Many responses contained vague references to how physical activity improves bone health, making it challenging to award more than two marks. Some students spent time talking about nutrition and not physical activity.

Option D

Question 11

11(i) Generally answered well.

11(ii) Generally answered well.

11(iii) Most students struggled to provide valid analysis to obtain marks for this question.

11(iv) Generally answered well.

11(b) Most students answered this in a basic manner; marks were missed due to insufficient depth in responses for an explain as the command term.

11(c) This question was very similar to the previous question. Many students just stated that sodium loss requires sodium replacement. Few could connect the physiological demands with the need for sodium replenishment.

Question 12

12(a) Very few students were able to answer this correctly. The thermic effect of food seemed to be a conceptual gap for this cohort.

12(b) Most students did not answer this correctly. Some discussed fast and slow twitch fibres here, which is understandable for students who are not reading the question clearly.

Question 13

13(a) Generally answered well.

13(b) Generally answered well.

Recommendations and guidance for the teaching of future students

- Students may access the highest marks in SEHS by applying contextual situations to their knowledge in the course. It is not enough to know the concepts. A student must apply this knowledge across the course to access the highest marks on papers.
- Students must learn how to respond to the command terms to ensure they access all available marks.
- Students need to ensure that they have sufficient responses to a question to match the number of marks possible for the questions.
- Encourage students to answer all questions even if they are unsure of their response.
- Thoroughly reading and fully understanding a question is often the primary step in accessing higher marks.
- If the question has p-values, students should know to consider these.
- If the question says "using the data," students should refer to it, not recite some general answer they have memorized.
- Students in SEHS would greatly benefit from a greater concentration on learning scientific principles and how to analyse/ apply them in addition to the conceptual material.