

2022 ASSESSMENT REPORT

SPT315118 – SPORT SCIENCE

This report is comprised of General Comments, regarding the paper as a whole, followed by specific Examiner's Comments with regard to each Section of the paper, then followed by Solutions for each Section.

GENERAL COMMENTS

The Marking Panel considered the 2022 paper to be one which allowed those students who could manage their time effectively, the opportunity to achieve a performance in line with their internal ratings; had they thoroughly revised and were able to answer questions concisely and succinctly. Being aware of the comments made in Reports such as this also helps students to know what to expect.

Every year examiners make the same comments about several recurring themes. This year was no exception. However, it is hoped that the message is slowly getting through on some matters as the number of students using pencil seemed to be lower, as did the number of students failing to use data and units when answering the questions related to Criterion 5. Many students still think they can put down as many answers as they can think of for a question and hope that if the correct answers are included, they will be marked as such. It must be made clear that if two answers are asked for and four are given, only the first two will be considered – even if they are incorrect and the last two are correct.

These fundamentals of exam technique go some way to help explain why there is such a difference between the level of achievement for those in year 11 compared to those in year 12. As this is rarely looked up, I would point out that 25% of year 11 students this year received a NN/PA, compared to only 10% for year 12 students. At the other end of the spectrum, only 12% of students in year 11 gained a HA, whereas nearly double that amount of year 12 students did (23%). For an EA, the difference was even greater, with only 2% of year 11 students achieving at this level, compared to 7% of year 12 students. Those wishing to perform well in this subject are strongly advised to do it in year 12 after having gained experience in undertaking other pre-tertiary studies.

With the continued emphasis on typed work in schools, it is critical that students remember they need to practice their handwriting in preparation for exams. Also, they must practice being able to both concentrate and write for extended periods of time, so that the 3-hour exam period is not a new condition to them. If not, mental, and physical fatigue sets in and students can make errors which impact their overall performance and make it difficult for Markers to read and understand the work in front of them.

Students aiming to achieve at the higher levels must ensure the language they use is of a more technical and specialised nature and is relevant to the question at hand. In addition, students

are reminded that there is a limited range of universally known and accepted abbreviations and acronyms suitable for exam use in Sport Science; many of which only have relevance when related to a specific context (e.g., ATP, VO₂ Max, LIP, EPOC, DOMS, etc). Most of these abbreviations occur in the Exercise Physiology Section of the exam. As a result, many acronyms and abbreviations developed by individuals or classes to assist in learning and recall, particularly in the Skill and Psychology sections, may not be suitable and may not be awarded marks (e.g. HIPS; VAMP; CAR).

Given the name of the subject is Sport Science, it is implicit that the information taught is about the science of sport. Thus, to succeed, students need to have a knowledge of both science and sport. While the option to apply knowledge to a sport of your choice is sometimes provided, having a strong general knowledge regarding as many different sports as possible would be advised. It is strongly recommended that teachers and students alike try to expose themselves to a wide range of sports throughout the year so they are better equipped to provide meaningful answers to the sports that may be presented to them in the exam.

The Criterion which continues to consistently cause the biggest challenge for students to gain a “C” standard in is Criterion 6, Cross-Discipline Links (CDL’s). While it is a very small minority, it still confounds why some students attempt all three questions in this section. It is pleasing to note that only six students in total failed to even attempt to answer any of these questions. However, it does seem that some students enter the exam with the specific plan of only doing the minimal work required to gain a “t” on this criterion.

In marking these questions, 4 out of the 7.5 marks for each link are allocated to the **relevance** and **application** of the theory to the specifics of the question - the sport, the athlete, the situation, etc, which includes the use of examples. Many students continue to score quite low on each link. Consequently, when students provide little more than vague or general theory with little relevance to the scenario, their mark for that link is usually no more than 3-3.5 out of the 7.5 marks on offer.

All students should ensure they leave enough time to complete this section to the standard required. They should be encouraged to make use of the reading time to consider the three questions and determine which two they could do best in and perhaps plan the two links they could use for each question. Some seemed determine to save time by entering the exam with ‘pre-prepared, generic links’ for their two preferred core unit links (often Phys – Psych and Psych – Skill). Such a method can be effective for stronger students with the knowledge and understanding to adapt and adjust these links to the respective athlete/sport. However, it seems to catch out those who lack that ability, especially when they cannot adjust the link to work with the scenario (particularly if their preferred link is an “own scenario” question), or their knowledge of the required sports is limited. Students with aspirations to perform highly on this criterion would do well to familiarise themselves more with the actual criterion standards and make greater use of the exemplars for each question provided in each years’ solutions. Invariably,

students who write good quality CDL's also do well on other criteria, as they need the breadth and depth of knowledge to provide detailed answers in the first place.

Section A – Exercise Physiology A/B

QUESTION 1 - CRITERION 1

- a) Most students were able to comfortably gain 1 mark by identifying the ATP-PC system and by relating it to the duration of the VWR time for the 100m. Few received full marks by also referring to the maximal intensity of the effort, as reflected in the Speed for the 100m compared to the other distances. Some students lost marks as they referred to the “ATP” system, which does not exist.
- b)
- i) Very few students gained full marks on this question, and it was generally not answered well. Far too many students simply mentioned the main energy system for each of the two distances, which does not consider interplay at all. Others only related the energy continuum concept, talking about the systems switching on at specific times and suggesting that Peter Bol would not use any aerobic energy system contribution because his race lasted less than 2 minutes; when it should be well-known that as an elite athlete, his aerobic system would be contributing from as early as 30 seconds into the race. Better answers mentioned how all systems would make some contribution at different times in both races, stating which system would be the most and least predominant overall, as well as stating how the % contribution of each system at any point in time changed depending on the duration, distance, and circumstances, such as during a surge, or up a hill, or sprinting to start/finish the races.
 - ii) Many students simply listed CHO's and fats when the question asked for a discussion. Better responses understood that Robinson, as an elite marathon runner, would have developed the chronic adaptation of glycogen sparing and would have used fats early on and for longer before utilising his glycogen stores. Far too many students suggested fats would not be used until **all** glycogen stores had been depleted. In addition, far too many students suggested protein would be a likely fuel source.
 - iii) This was generally answered well, and many students gained the full mark. Better answers suggested that the deficit occurred any time either athlete was producing energy anaerobically and suggested the start of the races or at times of increased intensity as being when this situation could arise.

QUESTION 2 - CRITERION 1

- a)
- i) Mostly answered well with most students gaining the full mark.

ii) Given the range of possible answers here, this was answered well.

b)

i) Not answered as well as expected. Many students could not give a complete definition of VO₂ max. Many mistakenly said it referred to maximal oxygen per breath. Others only mentioned oxygen intake rather than actual utilisation/consumption and many others did not refer to the concept relating to a maximal value. As for the inconsistencies with the statement, many only listed factors rather than discussing them, while others mentioned factors related to Skill or Psych instead of Physiology.

ii) Answered well.

c)

i) While many students gave two correct responses here, several left this and the follow up question blank. Far too many listed cardiovascular responses, such as increased heart rate or stroke volume. Others confused acute responses with chronic adaptations and suggested hypertrophy or increased capillarisation. The question also asked for factors which Luke “would” experience, not ‘might’, so responses such as cramping were not considered acceptable.

ii) If students were able to correctly identify an appropriate response in part i), they generally managed to explain why it occurred.

QUESTION 3 - CRITERION 1

a)

i) Most students suggested the appropriate fibre type. However, others added information that contradicted their first answer, such as saying Type I, Fast Twitch. Others got the fibre type completely wrong. There was an issue with several students referring to Type Ia fibres, which do not exist, only Type II fibres have an a/b. It is unclear if this was confusion on their part, or if the information was being taught incorrectly.

ii) For those who correctly identified the appropriate fibre type in a) i) most were able to give 3 characteristics and gain full marks.

b) Not answered as well as expected. Many students could not give a complete definition of LIP. Many mistakenly said it referred to the situation where lactate generated was equal to lactate removed – which is an explanation for steady state. The LIP specifically refers to the highest intensity or heart rate at which this can occur. It is also *not* the point where the accumulation of lactic acid occurs exponentially. This only occurs once the LIP has been crossed. Most students successfully identified that Kipchoge had trained to develop a very high LIP and could continue at the pace mentioned while still using his aerobic system. The better responses also identified that the 800m track runner likely had a lower LIP and when going at Kipchoge’s pace would have exceeded their LIP and started accumulating fatiguing by-products which would have caused them to stop after 1 km.

- c) Most students were able to identify that glycogen sparing meant not using glycogen stores. The better answers identified that it is the use of triglycerides which are used in its place. Most simply stated that it would be good for Kipchoge to have the extra glycogen for later, however the better answers recognised that this would delay the possibility of him “hitting the wall” and/or allow him to utilise his LA system for more sustained, higher intensity efforts later in the race.
- d) i) and ii) students were mostly able to identify two adaptations in the first part of the question, however some used VO_2 max or LIP, neither of which would be evident at rest. Fewer students were able to appropriately describe why the stated adaptations would occur. For example, many mentioned increased SV, but few could describe the increase the volume of the LV as a specific adaptation for the endurance athlete, usually simply referring to ‘cardiac hypertrophy’.

QUESTION 4 - CRITERION 2

- a) Not very well answered. Many students could not think of anything other than ‘overtraining’ or ‘having played too many games in such a short time’. Neither of which were related to the theme of the question – namely the physiological causes of fatigue. Many who did state an appropriate cause failed to relate it to the effect it had on team performance. Many students, having read the next question tried writing DOMS, which was not an acceptable answer.
- b)
 - i) The first point of note is that far too many students think DOMS is connected to LA build up. The “burn” of LA is not a cause of DOMS. In addition, too many described what DOMS is (often just writing the acronym out), rather than answering the question as written, and describing what causes it. As for the cause, many athletes undertake high intensity efforts and experience no DOMS at all, as that is what they usually do. Thus, DOMS usually results from extending your duration and/or intensity of effort above and beyond your normal training loads; or trying a new/different activity using muscles that are not used to that type of exercising.
 - ii) Mostly answered well although it should be noted that a ‘warmup’ is not a recovery strategy for “post-game”. Also, anything related to nutritional replenishment is not considered a physiological aid. The better answers fully addressed the question and did not just explain what the strategy was but how it aided in recovery.
- c) Most students were able to give a basic explanation as to what ‘tapering’ and ‘peaking’ were, although fewer were able to relate it to the notion of the Team having to play five games in a ten-day span. Better answers focused not on the taper before the tournament but that which occurred in the off days between games, where the emphasis would have been on recovery and short, sharp sessions to ensure they stayed fresh for each game and could play at their peak.

QUESTION 5 - CRITERION 2

- a) Most students were able to gain at least 1 mark here by giving a simple comment about being able to kick the ball harder and maintain equilibrium. Better answers related the benefit of muscular power to being able to kick further and with enough force to beat the opposition players/goalie. Better answers for balance focused on what having balance enabled Sam to do, such as being able to exert maximum force and precision into her strikes, rather than what it prevented – such as falling over.
- b)
- i) Most students gained at least a half mark for this question, with the majority recognising Session A as continuous/LSD/LISS and Session C as a form of short/sprint interval training. However, too many students thought Session B was a form of Fartlek training and a great number had no idea what Session D was – the range of options provided was very large!
 - ii) This question was answered very well with most students gaining the full mark.
 - iii) There were several issues with this question. The first was that many students simply stated what specificity and progressive overload (PO) were and made no effort to relate the concepts to those evident in any of the sessions from the Table, as required. Others related both concepts to all the sessions in general, rather than to a specific session. In addition, many students did not understand that the four sessions listed were separate sessions, but rather thought they followed on from each other and each had been overloaded from the previous one. This meant they never stated how a session could be overloaded but tried to explain how one session was already overloaded from the others. Those who did mention overload sometimes suggested increasing the run in Session B go from 3 x 10 to 5 x 20 minutes, or the sprints from 20 to 30. Both these values would have been excessive and an inappropriate example of **progressive** overload.
- c) Better responses answered this question in full – they named a method, related how undertaking it could contribute to Sam's performance and gave a satisfactory example. Weaker responses simply described the method without stating how it impacts on performance, while others did not give examples. A concerning number thought plyometrics was a method of training for flexibility!

QUESTION 6 - CRITERION 2

- a) Most students were able to name the three training phases of the year and give a basic description of what the main focus would be in each. Better answers discussed rather than simply listed, and made their discussion relevant to Kristian as a triathlete.
- b) This was well answered as a wide range of variables could be accepted.

- c) Simply stating that a warmup prepares the body for exercise is not considered an appropriate physiological reason; nor is preparing the body psychologically. Many students also suggested a warmup prevented venous pooling, which is something that is achieved in a cool down.
- d) The key to this question was that Kristian had finished his race and that he was in the alactacid phase of recovery. Some students confused this with the lactacid phase and suggested he was trying to remove lactic acid or replenish his glycogen stores. Others thought he had “hit the wall”. Better answers outlined what was occurring in relation to the restoration and replenishment of phosphagen stores and oxyhaemoglobin and oxymyoglobin.
- e) This was not answered as well as expected. Some students mentioned two different resistance exercises rather than different types of resistance training. Many others simply referred to “weight” training without detailing a specific type. Many confused isometric and isotonic training and too many suggested that circuit training is a resistance training method, which it is not. The better answers fully addressed the requirements of the question by naming the method, explaining how it worked and related how it could specifically assist Kristian improve his performance as a triathlete.

QUESTION 7 - CRITERION 5

This question caused difficulties for many students and average scores were lower than usual. Much of the confusion relates to the understanding of the concept of what the LIP is and when it occurs. The specific issues relating to the difficulties are noted for 7 c) below. If people are looking for a source of information to clarify the latest understanding on content related to LIP, I would point them in the direction of [this resource](#) by the VCAA.

- a) Answered correctly by nearly every student.
- b) Left blank by many students. Too many others only gave a single digit value, despite being asked for a range (which includes a lower and upper value). Better answers acknowledged that for lactate clearance and production to be equivalent, the value for blood lactate had to remain the same over consecutive minutes/speeds.
- c) There were major issues with many answers provided for this question. Most stem from the fact that there is a lot of confusion about exactly what the LIP is and when it occurs. First, LIP is the last/highest point at which an athlete can achieve a steady state, so they are working **aerobically** at that point, not anaerobically. This means that once the heart rate/blood lactate levels have increased dramatically, the athlete has already passed their LIP. The point at which this occurs varies widely depending on a range of factors. Students are usually taught that a nominal value for the LIP is $85\% \times \text{MHR}$. It seems that many are also taught it to be standard at a blood lactate reading of 4mmol/L. Unfortunately, in this case, the data in the table showed dramatic increases in both heart rate at blood lactate levels

exceeding 2mmol/L, which should have been recognised as the LIP. A significant number of students were unable to make this interpretation from the data provided. Many also mistakenly stated the value for LIP was the next point above where the value rose sharply, the point at which it rose most sharply towards the end of exercise, or even the point at which exercise ceased. It is strongly recommended that both staff and students ensure they have a greater clarity on the concept of the LIP.

- d) Once again, many students didn't understand the concept that a "range" refers to two values, a lower and upper one. Consequently, many gave a single value for each athlete. Also, if trying to improve your LIP, it would not be suggested that athletes work at their MHR, a value suggested in many responses. Better answers recognised the most effective range is from approximately 80-90% MHR and gave an appropriate range based on this data.
- e) A number of students seemed unsure of how to answer this question so consequently left it blank. Many gained good marks for this question by referring to two bits of data and made the comparison between the two athletes as per the requirements. Although, some data provided did not relate to aspects above the LIP so were not considered.
- f) Many students gained good marks for this question, although a large number simply repeated the same data used in the previous question. Better answers made direct comparisons between the athletes at the same heart rate or speed or referenced the differences in final heart rates and blood lactate levels to support their answer.

Section B – Skill Acquisition

QUESTION 8 - CRITERION 3

- a) Most students were able to state one characteristic i.e., that a closed environment is predictable/unchanging; not many identified that the skill is internally paced/the performer has full control of the timing of the movements.
- b) As this question was a 4-mark question, better answers provided greater detail with their reason rather than just “listing” or providing context relating their reason to skiing. Some students didn’t make it clear how they were addressing the question and needed to state when each reason started and finished, and which were autonomous, and which were cognitive.
- c) Weaker responses referred to how bending the legs increases a person’s base of support rather than identifying that it lowers the skier’s centre of gravity. Most answers were able to outline the correct benefit of increasing her stability.
- d) The students who didn’t read the blurb at the start of Question 8 or read the actual question carefully, incorrectly identified the coach providing extrinsic feedback. Better answers identified Intrinsic Feedback and provided examples of sources relating to the information gained through the skier’s senses such as feeling your body being unbalanced. Unfortunately, some examples didn’t relate to feedback, rather they were identifying cues which relate to input.
- e) Overall, this question was well answered. Better answers directly related to the set theory, such as motivates them to improve, reinforces what they are doing well, regulates or changes the performances during the activity or informs and improves future performances.

QUESTION 9 - CRITERION 3

This question was not answered as well, in comparison to Question 8.

- a) Many students could not clearly identify the difference between orienting and selective attention. Some didn’t even use these two theory terms which made it difficult to distinguish what they were referring to. Better answers provided clear answers through definitions or applied definitions along with relevant examples relating to sailing.
- b) Very well answered. Most students understood this was noise/irrelevant information.
- c) Better answers referred to both the number of stimuli and number of responses with respect to the type of reaction time. Overall, students were able to provide a better understanding of simple reaction time compared to choice reaction time. Many students were unable to clearly provide reasons of why experience aids Slingsby’s ability to react.

- d) Most students were able to outline the importance of not overcommitting as it slows down the overall response time and related this to Slingsby's performance. Many students, however, referred to 'reaction' time when they should have referred to 'response' time as this was more relevant with regards to overcommitting. Not as many students were able to provide a thorough understanding of what anticipation is.
- e) This question was generally very well answered, demonstrating a good understanding of schema and how it could generally apply to sailing.

QUESTION 10 - CRITERION 3

- a) Better responses could recognise the rocking was a Starter Mechanism and in doing so could explain the benefit. Unfortunately, there were a few students who couldn't remember what the term starter mechanism was called, and some were unfamiliar with the term
- b) Generally, well answered. Some students' explanations of sub-routines, however, did need to be clearer. I.e., a small movement isn't a good description as a small movement could be a fine motor skill. Most students could identify important considerations relating to the timing and sequencing of the subroutines.
- c) To fully classify a skill, it must be done *all* three ways, i.e., in terms of the source (intrinsic or extrinsic), the nature (KP or KR) and the timing (continuous or terminal). Unfortunately, many students only classified using the one classification. Many answers stated the type of feedback was video analysis which is not a classification of feedback. Better answers were able to outline specific benefits of using video analysis.
- d) Most students were able to explain what muscle memory is and better answers demonstrated a clear understanding of how to develop it, other than by just stating practice.
- e) Quite a few students didn't have a clear understanding what a 'serial skill' is with many confusing it with a 'discrete skill'. They were, however, able to explain what part practice is and better answers clearly explained why part practice could be useful for Patterson. Unfortunately, many students didn't make the link between part practice and how it could help a beginner/cognitive performer. They mentioned the benefit of part practice more generally. Better responses were able to link well.

QUESTION 11 - CRITERION 5

This question was generally very well answered with most students including the relevant data and the appropriate units. Some students mistakenly thought a greater average distance from the hole/flag was a positive metric in golf.

- a) Most students were able to rank the accuracy data in the correct order. Some ranked from worst to best which was the incorrect order and were penalised for doing so. Some 'dumped' data and included consistency data which was not asked for or required.

- b) The occasional answer referred to the day instead of the actual type of feedback. Better answers also identified which referred to best and which referred to worst.
- c) Most students were able to make correct assumptions based on the second 50 balls hit had received feedback and thus would make improvements. Better responses supported their answers with relevant data from Day 2 and some also made reference to Days 1 or 3. This was a thorough answer, but a comparison to other days was not required.
- d) Most students made a correct comparison between Days 2 and 3, identifying that with feedback being provided more regularly performance improved. Some answers would have benefitted from further inclusion of data. Better responses were able to clearly support their answers with reference to both consistency and accuracy data from both days.
- e) A majority of answers referred to practice as being a different reason for why improvement occurred throughout the experiment. Weaker answers referred to aspects of feedback which was not relevant (as stated in the question) or didn't support their answer with Day 5's data.

Section C – Sport Psychology

Students in general did quite well answering the questions in this section. One issue that arose was that students perhaps didn't read the question thoroughly and therefore failed to address *all* aspects or parts of the question. Quite a few questions in this section were multi-pronged, requiring multiple parts to the answer. Students tended to answer part of the question without fulfilling all requirements.

QUESTION 12 CRITERION 4

- a) Generally answered well. Some students confused 'self-confidence' in a general sense with 'self-efficacy' in a specific sense. Most students were able to correctly identify and explain how ante-cedents would assist Tiger Woods (TW).
- b) Students had some difficulty relating their short-term process goal to TW' recovery. Better answers related the process to being able to physically walk and rehabilitate again. Long-term outcome goals were generally related to a long-term tournament win or success playing.
- c) Students generally were aware of self-determination but had trouble defining it succinctly. Many students had difficulty with explaining how autonomy related to TW. Many incorrectly referred to the autonomous stage of skill learning (incorrect core area). Those students who had difficulty with self-determination and autonomy, failed to relate to TW' need for autonomy since his accident. Better answers responded that TW needed autonomy (a desire to want to return to full health for his own purposes) to be self-guided and determined in his extensive rehabilitation. Not well answered in general.

- d) Most students were able to accurately provide reasons why TW would need to be intrinsically motivated during his rehabilitation process. The need to be self-guided and self-motivated during a period when there would be little extrinsic motivation meant he needed to rely on his own internal desire.

QUESTION 13 CRITERION 4

- a) Students tended to give some very generic explanations for what a game plan was. Better answers focussed on competition strategies such as set plays, key performance indicators and positional roles. How a game plan can be shaped by the players generally came up with two styles of answers – those who stated that the players' strengths and weaknesses would guide the game plan and the others who stated that players could have input into the game plan either before the game or during half time / time outs (thus shaping the game plan). Both schools of thought were acceptable.
- b) Again, the responses to what a task-relevant factor was, were generic. Students had trouble specifically relating to this terminology. Few could pinpoint when TRF's would be particularly useful in a game situation.
- c) Most students were able to identify four pre-competition strategies which players could engage in prior to arriving at the venue. Those who did not get this correct, usually gave factors which were not performed prior to arriving. Quite a range of specific responses were accepted – particularly in the use of spare time and mental preparation categories e.g., meditation, massage and stretching before leaving home.
- d)
 - i) Most students could identify what coping strategies were.
 - ii) Students gave a wide variety of examples of messages players could use to give themselves confidence in the team's coping strategies. Most common were comments such as: "we have done this before with our back to the wall, we can do it again", "we have done the preparation, we are ready", and "we have used this coping method before and it worked last time". Some very generic responses were given here. Better responses related the coping strategies to the main tall player being injured scenario.
- e) Most students were able to identify three components of de-briefing and were able to discuss one of these factors. Generally, very well answered.

QUESTION 14 CRITERION 4

- a) Students tended to state that as arousal increases so does performance (and then forgot to mention that if arousal continues to increase past optimal levels, there is a subsequent decrease in performance). Some students drew a diagram, but many failed to use this in their answer to demonstrate their point. Of those who did explain the Inverted U Hypothesis well, quite a few did not relate the hypothesis to the rowers' performance early in the week

and then in the medal winning race. Better responses addressed all three aspects of the question.

- b) Most students were able to define what state anxiety was. Generic responses given as to why the rowers may have been overanxious early in the week were mainly interpretative, such as they felt outclassed, or they were nervous about it being a national championship. Most students were able to provide two behavioural signs to indicate anxiety. Poorer responses gave more psychological signs e.g., butterflies or negative thoughts, which were not behavioural.
- c)
 - i) Well answered generally. Most students were able to provide two benefits of visualisation. Some lost marks as their answers failed to “discuss” in sufficient detail as the question required.
 - ii) Students who related the kinaesthetic sense to a degree of ‘feel’ responded to this question more effectively.
- d)
 - i) Most students were able to correctly identify what attention was.
 - ii) Many students were able to identify that Narrow Internal was the correct dimension. Markers also accepted half marks if students used Narrow External OR Broad Internal as getting one of the 4 quadrants correct.
 - iii) Most students were able to identify a benefit and a disadvantage of the crew utilising the Narrow Internal dimension. Common answers included the benefit of being able to concentrate on their own performance well and the potential disadvantage that they may miss new environmental information as they are not focussed on what is going on around them.

QUESTION 15 CRITERION 5

While some students may have felt overwhelmed due to the amount of information to be taken in with this question, once they understood the table, generally, they were able to quite easily extract relevant information.

- a) Many students stated that there were four drivers who fell into this category, missing the fact that one driver’s DNF was due to an error by another driver (Perez). This showed a misunderstanding of the initial question which asked for those who made errors which ended their race. Most students identified the correct track and year.
- b) Most students did well at this question. The only issue that arose was when they failed to identify data which showed the link between visualisation and performance. They needed to support the statement with evidence.

- c) Students either did really well at this question or they failed to focus their data on Perez at Monza. They needed to also discuss the benefits of Perez's use of visualisation and relate this to his improved performance. In short, the greater use of visualisation was tied to improvements in performance for Perez.
- d) Students answered this question well, stating the finishing position and level of visualisation for all four drivers. Those who did not get this correct, failed to focus on Silverstone or 2021 data.
- e)
- Very well answered.
 - Students could readily give data as to why 2019 and 2020 were quite different in regard to visualisation. Most common response was the fact that in 2019, all drivers used at least v1 (the only year) and that there was only one occasion in 2020 where a driver used v0.

Cross Discipline Links (CDL)

GENERAL COMMENTS ON CDL

Students still seem to make common errors which have been mentioned in previous Examiner's Reports. These errors include:

- Only attempting one link per question – limiting themselves to a maximum of 7.5 marks out of a total possible 15;
- Inappropriately rewriting stimulus material without giving it context to their answer and the relevant theory, which adds nothing to the answer provided.
- Providing many definitions without relating the theory to the question.
- Not reading the question carefully and providing an answer that went in the incorrect direction. This was a particular issue with the Ash Barty question where the link **had** to be from Sport Psychology to Exercise Physiology.
- Many students appeared to go into the exam with pre-prepared links that did not fit the question; i.e., Ash Barty is a tennis player with multiple major events throughout the year for which she must peak and is not a team sport player with a regular weekly game schedule and a gradual build up to a single season peak for finals.
- Many answers were not structured as well as they could be missing paragraphs and jumping from one link to the next. Many students omitted an initial linking sentence for an easy loss of 0.5 marks.

- Some answers made several vague mentions of different theory elements rather than being concise with the link between something specific from each of the relevant core areas.
- Answering all three questions and hoping to get the best two marks. As previously outlined, the markers will only mark the first two responses and allocate scores based on them.
- Using the incorrect core area (e.g., addressing Sport Psychology in the Buddy Franklin question when the question asked for Skill Acquisition and Exercise Physiology).
- Using links from within the same core (*Intra*-relationships) as opposed to the required links between cores (*Inter*-relationships).

Better responses:

- Are well set out, typically following the recommended structure.
- Apply the concepts and reflect the depth of understanding required.
- Are concise and efficient, with good spacing and the use of appropriate, specialised terminology. (The student clearly prepared well.)
- Refer to the question details throughout including background theory, or as a combination of theory and examples blended into one.
- The best answers had a clear, logical structure and explained within the application how theory inter-related and not just happened ‘side by side’.
- Related to the scenario set out in the question.
- Used examples to show deeper understanding.
- Comprehensively demonstrated how the core areas affect one another.

QUESTION 16 CRITERION 6

Approximately 78% of students answered Q16.

This question was not answered as well at the other two questions; most likely because many students did not properly interpret that the question had to be addressed from a specific direction namely from Psych to Phys. Alternatively, some students may have come into the exam with pre-prepared links that were from Phys to Psych and they could not do them the other way around. Others used links in the correct direction, but they would have made more sense if they were able to go from Phys to Psych, such as suggesting that having great self-efficacy helps Ash Barty (AB) obtain a higher LIP; or that having motivation will assist in adding variety into training sessions. Neither of these links work as well when written from Psych to Phys.

A great number of students used the link that 'AB would have been highly motivated to recover'; however, it was a poorly answered link. The link was often just stated and not explained, and this made it difficult to see how this link really worked. Students possibly need more understanding of *elite* athlete routines, etc. There were statements suggesting AB would need high motivation to do a couple of slow laps of the court after matches and then some static stretching. Better answers explained that the motivation would assist with pain from Cryotherapy as an example.

A few students mentioned that AB would need a high arousal level rather than using the terminology of "optimal" arousal.

Students need to be mindful of making value statements like "Specificity is the MAIN training principle" without including relevant examples in the link to demonstrate why and how it is the main one.

Another issue with incorrect theory was found in relation to many students talking about AB using SMARTER guidelines for goal setting and then proceeding to give examples which did not conform to the guidelines. Others used two letters which meant the same thing, such as "A" for achievable as well as "R" for realistic.

QUESTION 17 CRITERION 6

A common concept used in answering such questions relates to the stages of learning and, in this case, suggesting that Buddy Franklin (BF) would become an autonomous learner. This was not an appropriate choice for this scenario as he is clearly already autonomous after 17 years of playing elite AFL and kicking 1000 career goals.

A common link used related to the concept of reducing or improving reaction time with speed/power training or the use of principles of training/training methods. While such a link could have been done well, many students incorrectly referred to Reaction Time when they should have referred to Response Time.

Unfortunately, some students discussed BF receiving feedback after matches to help him to do the best recovery or the best training in response. However, KP/KR is generally about the skill execution and not a De-Brief as many students attempted to explain.

Stronger links included: Variety in training enhances Schema Development; An improved LIP/Vo2max assists with selective attention, and Improved speed/power assist in reducing movement and response time when executing skills.

QUESTION 18 CRITERION 6

A broad range of athletes and sports were used in responses to this question.

Approximately 33% answered this question, which was the smallest number of all three questions; however, a higher percentage of students gained a “C” or better on Question 18 than for Q16 or Q17.

Surprisingly, there were still errors in the application to the scenario, despite students being able to design their own link and scenario. For example, choosing Michael Jordan and then explaining that he would dribble the ball up the field; or where a student wrote their question about a Rowing scenario but then gave examples from Darts and Netball within their explanation with limited information about Rowing.

Many students made mention of “Arousal Control” strategies and then often simply mentioned how the athlete would “**play music**”. It is important to understand that this might not be applicable or preferable for the athlete and there needs to be other suggestions to complement this for a higher standard answer.

Students would also be advised to avoid choosing a very specific sporting example that could potentially highlight your school or individual identity to a marker, for example, “<School Name> Rowing 8, <School Name> Football Team”.

SPT315118 - SPORT SCIENCE

2022 SOLUTIONS

Solutions

Section A – Exercise Physiology

Question 1 (7 minutes)

This question assesses **Criterion 1**.

Table 1 below shows the men's World Record times and corresponding average speeds in a number of running events.

Event	World Record time	Average speed
100 m	9.58 s	10.44 m/s
800 m	1 min 40.91 s	7.93 m/s
1500 m	3 min 26.00 s	7.28 m/s
42 km marathon	2 h 1 min 39.00 s	5.78 m/s

- a) **With reference to Table 1, identify and explain which system is the dominant supplier of energy for the male world record holder during the 100-metre event. (1.5 marks)**

The ATP-PC system. The intensity is indicated by the fastest speed at 10.44m/s. Time for the 100m is 9.58s which is within the time frame for which this system functions.

- b) i) **Peter Bol is an Australian 800-metre runner and Brett Robinson is an Australian marathon runner. With reference to Table 1, explain the difference in energy system interplay for the two athletes in their events. (3 marks)**

800m runner: The ATP-PC system would supply the least amount of energy for the event, perhaps for a sprint finish. Then the lactic acid system would supply the majority of ATP for the remainder of the event as it lasts up to 2 minutes and the WR is 1.40.91. The aerobic system would provide the second most energy, although because of the elite level, it may provide the most as it could start supplying energy from as early as 30 seconds. (1 ½ marks)

The marathon runner: They also use the ATP-PC system the least, perhaps at the start and end of the race. Then the lactic acid system would supply a small amount, although more than the ATP-PC system; perhaps for surges and when going up hills and the race for a longer sprint to the line. The aerobic system will be the predominant supplier of ATP based on the WR time of 2hrs 1 minute and 39secs. This system supplies ATP for activities lasting longer than 3-5mins at a sub-maximal intensity. (1 ½ marks)

ii) **For Robinson, discuss the likely fuels used for energy production during the marathon event. (1.5 marks)**

Robinson would be fuelled by a combination of carbohydrates (glycogen broken into glucose) and fats due to the longer duration of this event and it being at sub-maximal intensity. The % contribution of glycogen and fats would vary depending on many factors; he may also rely on CP for small amounts of energy; he may also rely on the intake of fuels during the race from foods and liquids.

iii) **Provide one (1) reason why Bol and Robinson would both experience oxygen deficit. (1 mark)**

Both athletes would have times where they are NOT working at a steady state, whether at the start of the race or when changing intensity. At any such time, both would be creating an oxygen deficit as oxygen supply must be met by anaerobic means.

Question 2 (8 minutes)

This question assesses **Criterion 1**.

Australian cyclist, Luke Plapp won the 2022 National Road Race Championships over a distance of 185.6km.

a) i) **Luke would likely ride at a steady state for periods in this race. What is a steady state? (1 mark)**

Steady state occurs any time there is a balance between the amount of energy needed for activity and the amount of energy being supplied aerobically by the body. It is signified by a plateau on a graph of heart rate, breathing rate or blood lactate levels.

ii) **What is one (1) reason or situation in the race when Luke may not be riding in steady state? (.5 mark)**

Any increase in intensity e.g., to start the race, to make a breakaway/attack, going up an incline, getting back to the group after a crash/flat tire, working at the front of the peloton/group of riders, sprinting for the finish (any **plausible** reason for ½ mark)

b) i) **Define VO2 MAX. Use your understanding of VO2 MAX to discuss two (2) physiological inconsistencies with the following statement:**

“Luke won the race, so he must have the highest VO₂ MAX in comparison to his competitors”. (3 marks)

VO₂ MAX is the highest rate of oxygen consumption attainable during maximal or exhaustive exercise **(1 mark)**. There are many factors to consider for success in aerobic based sports, therefore physiological inconsistencies with the statement include (any two of the following for 1 mark each):

- The ability for your body to use available oxygen during that given race
- The ability to recruit muscle fibres during that given race
- The ability to generate more force while minimising energy cost during that given race
- May tolerate LA better than competitors
- Body size which affects how much work each athlete must use to run
- Heredity which can affect the % FT/ST fibres an athlete may have
- Age of competitors, as VO₂ MAX peaks at different ages for each athlete
- Poor cycling economy – body doesn’t metabolise fuels efficiently to produce power during that given race
- Race conditions e.g., altitude and humidity during that given race causing physiological difficulties
- Nutritional status of competitors, etc.

ii) Identify how Luke could most accurately compare his VO₂ MAX with his competitors who are of different body sizes? (½ mark)

Luke should use relative VO₂ Max measurements rather than absolute which takes body size into account **OR** he would use the units millilitres per kilogram of body weight per minute (mL/kg/min) instead of litres per minute (L/min.)

c) i) What are two (2) acute muscular responses to exercise that Luke would experience when cycling? (1 mark)

Acute muscular responses to exercise that Luke would experience when cycling are (any two of the following for ½ mark each):

- An increased number of muscle contractions (to provide the energy needed for the cycling)
- Increased Motor Unit activation (so that more fibres are fired to contract, and the muscles make more forceful contractions)
- Increased recruitment of muscle fibres in a motor unit (to produce more force)
- Increased Blood Flow to the muscles (through vasoconstriction to the internal organs and vasodilation to the working muscles)

- *Increased Muscle Temperature (due to increased blood flow and as a by-product of ATP production)*
- *Increased muscle enzyme activity (to produce increased amounts of ATP)*
- *Increased Oxygen extraction at the muscles (as myoglobin delivers more oxygen to the working muscles)*
- *Depletion of muscle energy stores (ATP-PC stores, glycogen and triglycerides)*

ii) **Explain why the two (2) responses in c) i. occur. (2 marks)**

Explanation dependent on answers given. (Such as those in brackets above – any two for 1 mark each)

Question 3 (10 minutes)

This question assesses **Criterion 1**.

In 2019, Eliud Kipchoge, with assistance, became the first person to run under two hours for a marathon (42.2 km), clocking 1 hour 59 minutes and 40 seconds. His average pace was 2 minutes 50 seconds per kilometre throughout the run. A well-trained 800 m track runner attempted to hold Kipchoge's average pace. They had to run at maximal intensity and, due to fatigue, they were unable to continue after 1 km.

a) i) **What is the likely predominant muscle fibre type Kipchoge would have in his legs? (1/2 mark)**

Type I, Slow twitch or red fibres

ii) **List three (3) different characteristics of this muscle fibre type to support your answer to item a) i. (1.5 marks)**

Characteristics of Type I fibres are: (any three of the following for ½ mark each)

Colour	Red (no marks if red used as name of fibre type)
<i>Characteristics (Aerobic/Anaerobic)</i>	<i>Aerobic</i>
<i>Speed of action</i>	<i>Slow</i>
<i>Force production</i>	<i>Low</i>
<i>Resistance to fatigue</i>	<i>High</i>

<i>Fibre diameter</i>	<i>Small</i>
<i>Capillary supply</i>	<i>High</i>
<i>Number of Mitochondria</i>	<i>High</i>
<i>Glycolytic Capacity (ability to use LA system)</i>	<i>Low</i>
<i>Oxidative Capacity (ability to use aerobic system)</i>	<i>High</i>
<i>Size of motor nerve</i>	<i>Small</i>
<i>Major storage fuel</i>	<i>Triglycerides</i>
<i>Location where fibres are abundant</i>	<i>Postural muscles – e.g., back and neck</i>
<i>Primary functions of fibres</i>	<i>Maintain posture and aerobic endurance activities</i>

- b) With reference to Lactate Inflection Point (LIP), define and explain how Kipchoge could maintain an average pace of 2 minutes 50 seconds per kilometre for 42.2 km, whereas the 800 m track runner could only run at this pace for 1 km. (3 marks)**

LIP is the last point where blood lactate accumulation and removal are equal OR LIP is the highest steady-state exercise intensity.

Due to chronic adaptations from specific training, Kipchoge has exposed his body to a larger volume of training at higher intensities, therefore increasing his LIP, so he can run at a higher intensity and still be working aerobically and also improving his ability to buffer LA over longer distances.

Whereas the 800m runner likely has a lower LIP and at the same intensity as Kipchoge they were working anaerobically and could only tolerate the LA build up for 1 km, as they had generated too many fatiguing by-products.

- c) Because Kipchoge is an elite endurance runner, physiologically he may be able to spare glycogen. What does this mean and how would it benefit him? (2 marks)**

Glycogen sparing is the process whereby glycogen stores are not used early in an exercise bout due to the increased ability to use triglycerides to produce energy.

This delays depletion of these stores, and thereby delays the time to exhaustion due to glycogen depletion **OR** This means that at any given exercise intensity, Kipchoge has an increased capacity of the aerobic system to metabolise fats and rely less on glycogen, thereby 'sparing' their glycogen stores for later in the event or for moments of increased intensity.

d) i) State two (2) chronic circulorespiratory adaptations as a result of Kipchoge's training that would be observed at rest. (1 mark)

Chronic circulorespiratory adaptations that Kipchoge would have developed include (any two of the following for ½ mark each):

- *Decreased resting Heart Rate (HR) (due to cardiac hypertrophy and an increased SV)*
- *Cardiac Hypertrophy (as an endurance athlete, he would have developed a larger volume in the LV, enabling more blood to be pumped with each beat)*
- *Increased Stroke Volume (SV) (as the LV volume increased, it was able to expand more and expel more blood out the LV with each beat)*
- *Increased Blood Volume & Haemoglobin (this enabled more oxygen to be transported about the body when at rest, so less need for as many bpm)*
- *Increased a-vO₂ Diff (more oxygen extracted by the muscles means more efficient use of oxygen, so less needed to perform the same functions)*
- *Increased Capillarisation of skeletal muscle (providing more oxygen to the working muscles so they become more efficient)*
- *Decreased Respiration Rate (RR) (fewer breaths per minute needed as more air is inhaled with each breath)*
- *Increased Tidal Volume (TV) (with stronger and more efficient respiratory muscles you can take in more air with each breath)*

ii) Describe why the chronic circulorespiratory adaptations stated in item d) i. occur.

Explanation dependent on answers given. (Such as those in brackets above – any two for 1 mark each)

Question 4 (7 minutes)

This question assesses **Criterion 2**.

Earlier this year, the Australian women's cricket team beat England to win the World Cup. This demonstrated good form leading into the Birmingham Commonwealth Games in August 2022. During this tournament the team played five games of Twenty20 cricket in 10 days.

Note: Twenty20 cricket = the two teams have a single innings to bat for 20 overs each.

a) Explain one (1) physiological cause of fatigue that could have affected the cricket team's performance in the Commonwealth Games. (1 mark)

Physiological causes of fatigue are (any one of the following for 1 mark):

○ **Fuel Depletion**

- *In intense activities which rely on the ATP-PC system, fatigue results when our stores of PC are depleted—this usually occurs at about the 10 second mark.*
- *When working using the LA system, the fuel is glycogen. It is unusual that glycogen will be sufficiently depleted to prevent work at this intensity level; it generally only occurs at the end of an endurance event and stops a person from sprinting for more than the time available using their ATP-PC system.*
- *In endurance events, the body can usually store sufficient fuel for several hours of work. It tends to use sources of glycogen and then stored forms of fat. As this process occurs, the intensity must slow down due to the increased amount of oxygen needed to breakdown fat into ATP (Hitting the Wall).*

○ **Metabolic by-products**

- *Too many hydrogen ions (H^+), generated from anaerobic glycolysis, decreases the pH in the muscles and plasma (increasing the acidity) to the point where the muscles can no longer contract (Acidosis)*

○ **Dehydration and increased body temperature**

The loss of as little as a couple of percent of body fluids, through sweating can be enough to impact on physical performance. A range of factors can lead to or contribute to dehydration and an increased body temperature.

b) i) Due to playing a large volume of games across a condensed period of time in the Commonwealth Games, the cricket players may have experienced DOMS. Physiologically, why is DOMS thought to occur? (1 mark)

Physiologically, DOMS is thought to occur because of a number of different situations. It could be because exercise with a heavy eccentric component, where the muscle lengthens under contraction has been undertaken **OR** where exercise of an unusually higher duration has occurred **OR** where exercise of an unusually higher intensity has occurred **OR** where a new/different activity to normal has been undertaken.

ii) **Identify three (3) recovery strategies the cricket players might have used post-game to help combat fatigue or DOMS. Explain how each strategy may physiologically aid recovery. (3 marks)**

Any three of the following for 1 mark each:

stretching/yoga/Pilates – to help realign the muscle fibres after they have been shortened through exercise.

massage – has shown potential to provide relief of muscle tension and stiffness; faster healing of strained muscles and sprained ligaments; reduced muscle pain, swelling, and spasms.

CWI – leads to vasoconstriction which limits blood flow to muscles which can help to reduce inflammatory pathways and provide some analgesic (pain relieving) effects.

CWT or contrast therapy - alternating between hot and cold water dilates and constricts your blood vessels increasing blood circulation, reducing inflammation and helps to flush out lactic acid and other toxins.

Others may have included: more of the same exercise that caused the DOMS in the first place but done at a gentler intensity; or low intensity, non-load-bearing activity such as swimming or cycling; HWI; compression boots/clothing, etc.

c) **Explain how the cricket team would have needed to taper and peak for their multiple cricket games. (2 marks)**

Peaking result in players reaching their optimum state of readiness to perform. The Australian cricket team would use in-season peaking – peaking for specific matches/competitions during the in-season period. This requires adequate rest from training (tapering) or at least easing up to allow complete recovery (mini taper). The cricket team will do light training with a focus on recovery (foam rolling, CWT, CWI, massage, etc.,) in between matches to get ready quickly for their next match.

Question 5 (8 minutes)

This question assesses **Criterion 2**.

Samantha (Sam) Kerr is one of Australia's leading soccer players. As of 2022, Kerr is the all-time leading Australian international scorer, of any gender. A soccer game is approximately 90

minutes in duration (2 x 45-minute halves, plus any extra time). The figure below shows Sam striking the ball.

- a) **When striking the ball towards the goal, Sam needs to use a number of fitness components. Briefly explain why the following fitness components are necessary for striking a ball. (2 marks)**

*Muscular Power: Sam requires this to kick the ball the distance required and get it to the target without being intercepted (it is the ability to produce maximal force as quickly as possible in a contraction **OR** it combines speed and strength). (1 mark)*

Balance: Sam requires this when passing, dribbling, or shooting for goal in order to achieve the stability needed to impart max power and accuracy onto the ball while maintaining a state of equilibrium. (1 mark)

- b) **At various times throughout the training year, Sam incorporates the following four (4) training sessions.**

Table 2

Session	Training activity	Intensity
A	45-minute steady-pace run	70–75% MHR*
B	3 x 10-minute runs (5minute recovery between each repetition)	80–90% MHR*
C	20 x 5-second sprint (30second recovery between each repetition)	95% MHR*
D	20 mins of activation and mobility exercises	40% MHR*

***MHR = Maximum Heart Rate**

- i) **Identify the training method Sam is using in: (1 mark)**

Session A: *Continuous/ LISS/ LSD*

Session B: *Interval/LIP interval/LT Interval*

Session C: *Interval/Speed Interval/Short Interval*

Session D: Flexibility/Circuit

ii) List one (1) phase of the training year where Sam could incorporate the training method mentioned in session A and identify one (1) reason why this training would be of benefit to Sam during this phase. (1 mark)

Sam could incorporate continuous training into her **Preparatory** phase to:

- gradually increase her general fitness by developing her aerobic energy system
- improve aerobic capacity
- raise the LIP
- improve local muscular endurance.
- Improve ability to reach aerobic steady state faster
- accumulate less lactic acid
- recover more rapidly between efforts or after exercise.

Sam could incorporate continuous training into her **Competitive** phase to:

- recover after a match
- complete a Time Trial for in-season fitness test.

Sam could also incorporate continuous training into her **Transition** phase to:

- not lose all effects of chronic adaptations
- not see the effects of detraining
- to maintain some level of aerobic fitness
- partake in activities she normally may not do, e.g., cycling, swimming etc.

(any phase with appropriate justification for 1 mark)

iii) Using Table 2, provide one (1) example of how Sam is applying the training principle of Specificity and one (1) example of how Sam might use the training principle of Progressive Overload. (2 marks)

Sam is using **Specificity** by completing a continuous run of 45 minutes as a half of soccer is 45 minutes in duration; therefore this assists her to have the aerobic base to do this (session A). **OR** A soccer game involves many periods of work and rest, therefore by Sam incorporating interval training into her program she is specifically replicating a game (session B). **OR** Many times throughout a game, Sam would also be required to do many short explosive sprints to receive the ball or tackle, therefore Session C replicates this. **OR** Many skills in soccer also require flexibility therefore by Sam incorporating session D she is specifically training an aspect of her game that is important. (1 mark = plausible application of specificity).

Sam could use **progressive overload** by increasing duration gradually in session A. **OR** Shortening recovery time between reps in session B. **OR** Increasing number of sprints in session C. (1 mark = plausible application of progressive overload).

- c) **Sam must be flexible to strike a ball. Name and explain how two (2) different flexibility training methods could contribute to Sam's performance. Provide one (1) example for each method. (2 marks)**

Any **two** of the following for 1 mark each:

Dynamic (active) stretching – Dynamic stretching involves Sam performing a gradually intensifying series of movements which replicate those specific to soccer. This is the best form of stretching prior to training/competition i.e., to be used in a warm-up, and should follow a whole body, low intensity aerobic activity. Example: leg swings.

Proprioceptive Neuromuscular Facilitation (PNF) – Involves the contraction and stretching of muscles to improve ROM. Sam could use this as a separate flexibility session, or as part of a cool down. Example: Partner-assisted lying hamstring stretch.

Static (passive) stretching – Involves Sam taking a muscle to its greatest range and holding this position for 30-45 seconds. Best form of stretching after Sam has trained as part of a cool down. Example: Standing quadricep stretch.

Question 6 (10 minutes)

This question assesses **Criterion 2**.

In 2021, Kristian Blummenfelt made history by becoming the first male triathlete to win the Olympic and World titles in the same year. Both of these races involve a 1500m swim, 40km cycle and 10km run and were only four weeks apart. Notably, 8.5 months later he became ironman world champion. This race is considerably longer, involving a 3.8km swim, 180km cycle and 42.2km run. These performances would require appropriate periodisation.

- a) **Discuss how Kristian's training year would be divided into phases.**

List one (1) appropriate focus for Kristian for each phase of the training year. (3 marks)

Kristian's training year would be divided into the following phases:

1. **Preparatory (Pre-Season)** - During the general preparatory or fitness foundation phase, emphasis is placed on developing general fitness as a solid aerobic base on which to build and specialise in the following phases. Kristian's focus: develop his aerobic energy system through continuous running, cycling and swimming.

2. **Competitive (In-Season)** - Training should work on a hard–easy cycle. Sessions early in the training week should be longer and more intense. Sessions later in the week should be lighter and less intense so that athletes are not still recovering from fatigue on competition day. Kristian's focus: maintaining the high aerobic levels of pre-season fitness.
3. **Transition (Off-Season)** - Psychological and physical break from training and competition, whilst avoiding any de-training effects. Kristian's focus: low intensity cross training/variety e.g., bush walking or work on a weakness in the gym.

b) It is assumed that Kristian and his coaching team correctly periodised the training program, as overtraining syndrome was prevented. What is one (1) variable that could contribute to overtraining syndrome? (.5 marks)

Too much overload; Too little recovery; Reaching too far in one training cycle; Not taking a break between training segments; Too many intense speed workouts; Heart rate variability changes; Moodiness; Increased susceptibility to sickness/injury; Disturbed sleeping patterns; Low Energy Availability (LEA), nutritional deficiencies.

(any plausible answer for ½ mark)

c) Before competing, Kristian would complete an extensive warm up. Provide two (2) physiological reasons why this is beneficial. (1 mark)

Any two of the following for ½ mark each.

- *Increase Blood Flow to the muscles (vasodilation/vasoconstriction)*
- *Increase Muscle Temperature (due to increased blood flow and ATP production)*
- *Increase muscle enzyme activity (in order to produce increased amounts of ATP)*
- *Increase Oxygen extraction at the muscles as myoglobin delivers more oxygen to the working muscles*
- *Decreased viscosity of synovial fluid*
- *Reduced risk of injury, etc.*

d) Kristian can be seen in Image 2, lying on the ground after finishing the Olympic Triathlon. Explain what is happening here in relation to lactic acid debt. (2 marks)

The first physiological processes that take place during lactic acid or rapid recovery phase of EPOC are the re-saturation of myoglobin and haemoglobin with oxygen. In addition, the replenishment of phosphagens (stored ATP and PC) occurs.

- e) **Strength and conditioning are used to complement Kristian's swimming, cycling and running. Choose two (2) types of resistance training. Explain each method and how they would improve performance. (2 marks)**

Any **two** of the following for 1 mark each:

Isotonic Resistance Training - occurs when joints are moved under load, and the load or weight remains constant throughout the range of movement. Isotonic weight training can be used to develop muscular strength, muscle bulk, power or local endurance.

Isometric Resistance Training - involves contracting a muscle against an immovable resistance. There is no joint movement, but the muscle does exert force. Useful to develop core strength.

Isokinetic Resistance training - Isokinetic resistance training is a type of strength training. It uses specialised exercise machines that produce a constant speed no matter how much effort is expended. Develop muscular strength and muscular endurance.

Exercise Ball (Fit Ball) Training - a major benefit of the exercise ball training is that it can develop your core stability. Many strength programs can be performed on a fit ball as due to it being an unstable base of support it engages your core muscles and stabilisers.

Bodyweight Resistance Training (Calisthenics) – where you use your own weight to provide resistance against gravity, therefore using no equipment to create resistance. Bodyweight resistance training can be used to develop muscular strength, flexibility, and balance.

- f) **Kristian's ironman triathlon took him 7hrs 49mins to complete. Discuss three (3) post-exercise refuelling and/or hydration considerations for effective recovery. (1 ½ marks)**

Any **three** examples for ½ mark each. Examples could include:

- In the immediate post exercise period, Kristian should consume a high GI carbohydrate-rich snack within the first hour of finishing, as this is when rates of glycogen synthesis are greatest.
- Low GI meal within 2-3 hours to replenish glycogen stores.
- A protein shake, or protein included with the meal to help resynthesise damaged muscles
- It can take up to 24 hours to fully rehydrate after very intense activities, therefore water and electrolytes are essential for Kristian to consume post his ironman.

Question 7 (10 Minutes)

This question assesses **Criterion 5**.

Table 3 presents blood lactate concentration and heart rate data, obtained from two 21-year-old hockey players (Athlete A and Athlete B), during an incremental treadmill test to exhaustion at the end of their pre-competition phase of the training year. The speed was increased by 1 km/h every minute.

Table 3: Blood lactate concentration and heart rate data from two hockey players following an incremental treadmill test.

	Speed (Km/h)	Blood Lactate (mmol/L)	Heart Rate (bpm)
Athlete A	10	2	110
	11	2	122
	12	2	130
	13	2	141
	14	4	159
	15	4	163
	16	4.5	171
	17	5	180
	18	5.5	192
	19	6	199
	20	6.2	200
Athlete B	21	7	201
	10	2	152
	11	2	154
	12	4	169
	13	4.5	173
	14	5	179
	15	6.5	185
	16	7	187
	17	8.3	190
	18	10.9	192
	19	12.3	194

All responses to this question must make reference to Table 3 above.

**a) i) At a speed of 19km/hr, which athlete is producing more blood lactate?
Provide data. (½ mark)**

Athlete B 12.3mmol/L

**ii) Which athlete is accumulating more blood lactate at a heart rate of 192bpm?
Provide data. (½ mark)**

Athlete B 10.9mmol/L

- b) State the range of speeds where lactate clearance is equivalent to lactate production for: (1 mark)**

Athlete A = 10 – 13km/hr **OR** 10-13km/h **and** 14-15km/h

Athlete B = 10 – 11km/hr

- c) At what speed and heart rate does the Lactate Inflection Point (LIP) occur for: (2 marks)**

Athlete A = 13km/hr and 141bpm **OR** 15km/h and 163bpm and

Athlete B = 11km/hr and 154bpm

- d) At what heart rate range should each athlete train to improve their LIP? (1 mark)**

Athlete A = 85-105% of 141bpm so **120-148bpm** **OR** for 163bpm so **139-171bpm**

Athlete B = 85-105% of 154bpm so **131-162bpm**

- e) The ability of both athletes to sustain exercise effort when LIP is exceeded differs. Provide two (2) comparisons, using data. (2 marks)**

Any two points that show a comparison between the athletes, be it related to a HR, blood lactate level or duration, as long as it is related to **once** LIP is crossed. For example:

- Athlete A can sustain speeds of up to 21 km/h, whereas B can only go to 19 km/h.
- Both A and B continue for 8 minutes beyond their LIP, but A's HR continues to increase for 60bpm, whereas B's can only increase for another 40bpm before stopping.

- f) Using data, explain which athlete would be able to work at a higher intensity for longer. (3 marks)**

Athlete A can work at higher intensities for longer. This is evident in their ability to achieve a speed of 21 km/hr compared to Athlete B who only achieved 19 km/hr. This is also evident in the fact that Athlete A was able to exceed their theoretical MHR of 199 bpm, reaching 201 bpm whereas Athlete B could only reach 194 bpm, well below theirs. At Athlete B's point of exhaustion, Athlete A was only producing half the blood lactate (at 19 km/hr A=6 mmol/L v B=12.3mmol/L).

Solutions

Section B – Skill Acquisition

Question 8 (10 Minutes)

The recent Winter Olympic Games in Beijing showcased downhill skiers demonstrating great balance when moving very quickly, having to change direction and avoiding hitting the gates which guide them down the course. They do not have access to their coach or know the time they have taken until they complete a run.

a) Downhill skiing is carried out in a closed environment. What are two (2) characteristics of this type of environment? (1 Mark)

Highly predictable environment/the environment does not change; the performer has full control of the timing of the movements; performer can commence the action when they are ready; skills are internally paced etc.

b) If a skier is thinking about controlling their speed, following the course and avoiding hitting gates, provide two (2) reasons why their skills need to be autonomous. Also, provide two (2) reasons why a beginning skier in the cognitive stage of learning would struggle to perform well in this event. (4 Marks)

- *Autonomous*
 - *Can perform the skill without thinking while going around the gates*
 - *Has automatic timing of subroutines when skiing*
 - *Performer can carry out another skill simultaneously, as in, looking further down course*
 - *Repeatable and consistent performance*
 - *Perform with high speed and high efficiency whilst skiing*
 - *Little 'thinking' about how to ski is required*
 - *Performer identifies and corrects their own errors when getting off balanced*
 - *Can accept other plausible characteristics that are applied to skiing*
- *Cognitive*
 - *Sub-routines are poorly timed when skiing*
 - *Makes many errors when going around the gates and falls*
 - *Devotes attention to step-by-step procedures which slows them down*
 - *Has a high attentional demand on the skill on how to ski*
 - *Rarely repeats the skill the same*
 - *Performs the skill slowly and thus goes around the gates very slowly*
 - *(Can accept other plausible characteristics)*

- c) **With consideration of the centre of gravity, why is the skier bending their legs? What is the benefit of doing this? (2 Marks)**

*The skier is bending her legs to **lower** the centre of gravity in order to increase her stability or dynamic balance.*

- d) **What type of feedback is a downhill skier dependent on during a run? What are two (2) possible sources of information for this type of feedback? (2 Marks)**

- *Intrinsic/internal/inherent or knowledge of performance or continuous.*
- *Vision/seeing they hit a gate, audition/hearing they hit a gate, touch/feel their skis lift off the ground, proprioception/kinaesthesia feeling balanced, forces.*

- e) **Identify one (1) reason why feedback works and briefly explain this benefit. (1 Mark)**

One application/explanation/benefit from the selection under each heading.

Motivates them to improve:

Example of benefit:

- *To improve their future performances/execution of a skill.*
- *KR and KP makes the task seem more interesting.*
- *Keeps the learner alert.*
- *Results in learners setting higher performance goals.*
- *Makes tasks more enjoyable.*

Reinforces what they are doing well:

Benefit:

- *Feedback can reinforce efficient motor programs and schema.*
- *KR will reinforce to the learner that the movement they have developed is working efficiently.*

Regulates or changes the performance during the activity:

Benefit:

- *Feedback guides the learner on ways to move more efficiently.*
- *Feedback acts to specifically instruct the learner about aspects of a movement which need changing during the movement.*

Informs and improves future performance:

Benefit:

- *Future execution will be performed at a higher level.*
- *Assists execution of future sub-routines.*
- *Refining technique.*

Question 9 (Criterion 3)

This question assesses **Criterion 3**.

In March, Australian sailor, Tom Slingsby, skippered Australia's Sail GP yacht to victory in a series, sailed all around the world, by winning the final.

They had to battle elite opponents, rapidly changing weather conditions, a whale crossing the course in San Francisco Bay whilst sailing as quickly as they could around buoys (floating markers) in the correct order.

- a) Using examples from sail racing, describe why Slingsby would need good orienting and selective attention in order to race well. (3 Marks)**

Orienting – *knowing where in an environment to look for information. Looking at the water's surface or water in general. Other answers could be looking at the sail; looking at other boats.*

Selective Attention – *attending only to relevant information in the environment. Looking for change in wind direction and speed. Others answers: feeling the wind; looking at the sail; looking at other boats; looking at the buoy.*

- b) If the whale did not cross the course, but could be seen by the competitors, what sort of information would it be? (1 Mark)**

Noise; Unimportant information; Irrelevant information.

- c) Define simple reaction time and choice reaction time. Provide two (2) reasons why experience assists Slingsby to react quickly to stimuli when racing. (4 Marks)**

Simple Reaction Time – *The interval of time that elapses between the presentation of one stimulus and the beginning of a response to it.*

Choice Reaction Time - *The interval of time that elapses between the presentation of one of several possible stimuli and the beginning of one of several possible responses.*

Any two of the following:

- *Know the presence or absence or warning signals which will reduce decision making.*
- *Selective attention to identify the stimulus more quickly.*
- *Past experience enables them to apply schema to reduce RT.*

- Past experience enables them to identify cues more quickly.
- Can anticipate/plan ahead/reduce DM time.
- Knowing what to look for/identify the correct cues.
- Could refer to benefit of spatial anticipation and/or temporal anticipation.
- Other answers accepted if applicable.

d) What is anticipation? Why does Slingsby have to be careful not to over commit to anticipated events. (2 Marks)

*Anticipation - the process by which a performer prepares to **initiate a particular response before the appearance of the appropriate signal.***

Problem - sometimes the anticipated event will not occur, or it occurs at a different time than he may have expected/or the environment may change, therefore delaying his response.

e) Schema is essential to sail racing. Define schema and provide one (1) example of its use in sailing. (2 Marks)

*Schema – are **rules/knowledge/known** which we learn/access from LTM in order to **execute/performance/apply skills** in **differing environments/situations.***

Question 10 (13 Minutes)

This question assesses **Criterion 3.**

High jumper, Eleanor Patterson, continues to improve. This year Patterson has cleared two metres for the first time and is now ranked in the World's top five for this event.

a) Prior to commencing the run-up Patterson rocks back and forth, arms moving as if running. What are these movements called and why are they important? (2 Marks)

Starter mechanism. They serve to establish a rhythm which leads into the skill or accepts a set routine to help with physical movement//to focus attention on the input/skill. Accept Arousal control/improve concentration.

b) What is a skill sub-routine? Identify two (2) important considerations to ensure sub-routines contribute to good skill performance. (2 Marks)

Sub-routines are the component parts of a skill. They need to be executed in the correct sequence and at the correct time for a skilled performance to occur.

- c) **When reviewing jumps, Patterson's coach regularly uses video to assist them. How is this form of feedback classified and what are two (2) benefits of its use? (3 Marks)**

Extrinsic/External/Augmented, KP and Terminal Feedback

*Benefits: (any **two** of the following for 1 mark each)*

- *The video footage can be replayed to be viewed multiple times.*
- *It can be paused to view a particular body position to analyse.*
- *It can be played in slow motion to view each sub-routine at a slower pace.*
- *It can be viewed by athlete so they can see their own performance to improve understanding.*
- *It can be uploaded into analysis software for further biomechanical analysis, etc.*

- d) **Prior to each jump, Patterson relies on muscle memory to prepare. What is muscle memory and how do athletes develop it? (2 Marks)**

Muscle memory is the ability to perform a skill without thinking/conscious effort.

Occurs through repetitive practice in order that it becomes encoded information/a part of LTM.

- e) **High jump is a serial skill requiring great consistency in execution of each sub-routine. Define serial skill. Describe part practice and explain why it may have been useful to Patterson when first learning to jump. (3 Marks)**

A serial skill is a number of discrete skills performed in a movement sequence.

Part Practice is the learning of skills broken down into parts or sub-routines (i.e., You learn the parts before bringing them together).

Suitable reasons:

- *Part practice is useful as HJ has a number of distinct sub-routines. Eleanor could focus on each in turn so as not to be overloaded with information*
- *Part practice is used as high jump is complex and has clearly defined components.*
- *As Eleanor is learning the skill/Cognitive stage of learning by learning in parts enables greater understanding of the skill.*
- *Learning individual subroutines separately to bring components together to establish correct sequence/timing, rhythm etc.*

- f) **Describe Newton's Third Law of Motion as it applies to Patterson when planting the take-off foot. (1 Mark)**

For every action there is an equal and opposite reaction. As her foot strikes the ground the ground exerts an equal force through her foot to elevate her.

Question 11 (10 Minutes)

This question assesses **Criterion 5**.

As a way to improve junior golfer coaching, Golf Australia conducted research into the benefits of different types of feedback. Competent junior golfers had to hit balls as close to the hole/flag as possible and were scored on distance from the target and consistency. Scores were averaged for the group each day.

The golfers hit 100 balls with the same club each day, from the same distance, for five successive days under the following feedback conditions.

Day 1 – No feedback from a coach.

Day 2 – Verbal feedback from a coach after hitting 50 balls.

Day 3 – Verbal feedback from a coach after each 10 balls.

Day 4 – Video replay after each 10 balls.

Day 5 – Video replay with verbal feedback from a coach after each 10 balls.

Table 1: Average Golf Distance from Target and Consistency Data Under Different Feedback Conditions for Competent Junior Golfers

	Day 1	Day 2	Day 3	Day 4	Day 5
Accuracy	15.70m	15.30m	14.40m	15.50m	13.30m
Consistency	47/100	54/100	65/100	48/100	78/100

Note: Accuracy: distance (m) from the hole/flag.

Consistency: number of balls on the green out of 100.

Responses to this question must make reference to Table 1 above.

- a) **Rank accuracy performance from best to worst for the five days. Include the data for each day. (2 ½ Marks)**

1. D5 13.30m, 2. D3 14.40m, 3. D2 15.30m, 4. D4 15.50m, 5. D1 15.70m

- b) **Which feedback condition produced the best average consistency? Which feedback condition produced worst average consistency? Include the relevant data for each. (2 Marks)**

Best: Video replay with verbal feedback from a coach after each 10 balls - 78/100

Worst: No feedback from a coach - 47/100

- c) **With reference to Day 2 accuracy and consistency, briefly discuss the likely difference in the average accuracy and consistency between the first 50 balls and the second 50 balls. Include the relevant data. (2 Marks)**

Day 2's accuracy is 15.30m and the consistency is 54/100

Expect that both accuracy and consistency would improve in the second 50 balls given that there was no verbal feedback available in the first 50 balls.

- d) **If a coach wanted to improve accuracy and consistency, using only verbal feedback, what change/s could they make to feedback conditions on Day 2? Justify the decision with reference to relevant data. (2 ½ Marks)**

Increase the frequency of verbal feedback. As on Day 2 with feedback provided after 50 shots the accuracy was 15.30 away from the hole and the consistency was 54/100.

With verbal feedback available after every 10 shots on Day 3, the accuracy improved to 14.40m and consistency improved to 65/100.

- e) **What is another factor, apart from feedback, that may have contributed to the golfers' improved performance on Day 5? Include the relevant data. (1 Mark)**

Day 5 has the best accuracy of 13.3m and/or consistency of 78/100. The cumulative influence of practice over five days. Practice. Progression through the stage/s of learning; the development of muscle memory, etc. Any relevant application to day 5.

Solutions

Section C – Sport Psychology

Question 12 (10 Minutes)

This question assesses **Criterion 4**.

In February 2021, Tiger Woods broke legs in a car crash. It was thought that Woods may never walk again, and would certainly not play golf. In April 2022 Woods was once again able to play and was competitive on returning to competition.

- a) **What is self-efficacy? Identify two (2) antecedents of self-efficacy and explain how they could assist Woods on his return to competition. (3 Marks)**

Self-efficacy is a situational form of self-confidence or the belief that one is confident and can perform within a specific situation.

PLUS - Any two of the following four for 1 Mark each:

- **Performance accomplishments:** *If we have succeeded in a certain activity in the past, we are confident we can do it again.*
- **Vicarious experiences (or modeling):** *This relates to when we see someone succeed and we think 'If they can do that, I can too'.*
- **Verbal persuasion:** *When a coach or external source convinces us we can do something.*
- **Physiological states (Arousal control):** *This relates to the way we feel physiologically as an indication of how confident we are. For example, if we are aware of having butterflies in our stomach, we might lose confidence.*

- b) **To recover and return as he has, Woods would have relied, to a great degree, on appropriate goal setting. Provide one (1) example for each of the goal types below that would assist Woods. (2 Marks)**

Short term process goal to assist recovery:

E.g., seek medical guidance, such as seeing a physio regarding returning to walking

Long term outcome goal to provide focus on future career:

E.g., any outcome goal that has a focus on the result of a competitive event and can be achieved independently of others, such as 'win a tournament in 12 months'.

- c) **Woods' effort to return to playing indicates significant self-determination. Define self-determination and provide an example of how it may have met Woods need for autonomy since the accident. (3 Marks)**

Self-determination has to do with the degree to which your behaviours are chosen and self-initiated. (Self-motivation) Individual is the causal agent.

Autonomy is the need to know/feel that you are responsible for whatever it is you do or achieve. TW is the only one who can decide to recover and the only one who can commit to the necessary process to do so.

- d) **During rehabilitation Woods was most likely intrinsically motivated. Provide two (2) reasons to support this statement. (2 Marks)**

Yes. Had to persist without reward or recognition; he wants to be as good as he can be again; he will derive satisfaction from overcoming his injuries; his need for influence is driven by his own efforts etc.

Question 13 (12 Minutes)

This question assesses **Criterion 4**

The Tasmanian NBL basketball team, the Jack Jumpers, has stunned many involved in basketball with its consistently good performances, including winning many matches at its opponents' venues. Coach Scott Roth is considered pivotal to this success.

- a) Roth has often said the team is trying to improve week by week by focusing on the execution of its game plan. What is a game plan and how can it be shaped by the players? (2 Marks)**

These are the set plays, positional roles to be followed and the responsibilities of those involved.

Strategies need to be devised that work well for an individual or team. They will usually be devised to maximise the use of strengths and/or personnel available.

- b) Coach Roth would have identified a range of task-relevant factors for players to use during a game. What are task-relevant factors and when is it likely they would be used during a match? (2 Marks)**

TRFs are the skill, strategy and effort requirements needed by each player for competition and quality performance OR the fundamentals of mental preparation for competition that need to be carried into the contest. Used especially during times of fatigue, anxiety, boredom and/or loss of concentration and/or a "drop off" in performance.

- c) Identify four (4) pre-competition strategies players may engage in prior to arriving at the competition venue. (2 Marks)**

Rest, Diet, Equipment check, Use of spare time, When to travel, Mental preparation (1/2 Mark for each of any four)

- d) The Jack Jumpers' main tall player was injured mid-season and did not play again.**

The team implemented coping strategies, including adjusting its structure, and kept playing well.

- i) Define coping strategies. (1 Mark)**

Coping strategies can be thought of as a secondary plan or behaviour which is in place for each primary or preferred behaviour should it fail or be inappropriate.

ii) **Identify two (2) messages players need to believe in to give them confidence in a team's coping strategies. (2 Marks)**

1. *There is someone who is able to make necessary changes to meet the demands of a situation.*
2. *They have been prepared mentally and physically to implement coping strategies, etc.*

e) **Identify three (3) necessary components of effective de-briefing. For one (1) component you have chosen, discuss why it is important and how it is applied. (3 Marks)**

As Soon After Performance as Possible – De-briefing should occur when the performance is still fresh in the athletes' and coaches' minds. Decisions made as a result of de-briefing need to be included in time for the preparation for the next contest.

Identify Performance Factors Which Were Omitted – A good strategy can prove ineffective if certain elements are not adhered to by athletes. If the strategy is to be persisted with, these omissions must become a major focus for inclusion in the next competition. Similarly, well executed elements need to be reinforced for continued inclusion.

Identify Positive and Negative aspects of Performance – Strategy needs to be altered if certain elements are clearly ineffective. In some cases, the strategy may not be appropriate to counter the opposition or is inappropriate due to the ability of the athlete. The reason for its failure needs to be clearly identified so that necessary changes can be implemented. Basically, what went right? What went wrong?

Involve the Athlete – It is very easy for a coach to “tell” the athlete about his performance. This breeds an athlete dependent on a coach, who may not always be there, and an athlete unable to analyse their own performance (a process which will often need to occur **during** a contest). Athletes must be encouraged to involve themselves in and take responsibility for an effective de-briefing procedure.

Question 14 (13 Minutes)

This question assesses **Criterion 4**.

At the 2022 National Rowing Championships, the smallest rowing club to be represented won a medal. As the week progressed their performances improved until their medal winning row on the final day. Their coaches kept reinforcing the need for positive thoughts and a focus on those things the crew could control.

a) **Describe the basic theory presented in the Inverted U Hypothesis. How could this theory be applied to explain the rowing crew's performance early in the**

week when they rowed poorly and then to explain their medal winning performance? (3 Marks)

As arousal increases so too will the quality of performance until arousal passes beyond an optimal level. Beyond this optimal range of arousal performance will diminish. Early in the week members of the crew could have been under-aroused due to a lack of expectation or over-aroused due to great uncertainty. As performance improved arousal levels were more consistently closer to optimal when realising they belonged in that standard of competition.

b) Define state anxiety and provide one (1) reason why members of the crew may have been over-anxious early in the week. Identify two (2) behavioural signs that may have been evident to the coaches to indicate some rowers were over-anxious. (3 Marks)

State anxiety: the anxiety inherent in the situation as perceived by the participant OR certain levels of anxiety related specifically to a particular situation.

They may have perceived the high level of competition as a threat to their confidence and reputation.

*Any **two** of the following for ½ mark each: Biting fingernails; lethargic movements; inhibited posture; playing safe; going through the motions; introversion; uncharacteristic displays of extroversion; fidgeting; avoidance of eye contact; covering face with hand, etc.*

c) The coaches reminded the crew to maintain their regular use of visualisation each evening.

i) Briefly discuss two (2) benefits to the rowers of using visualisation. (2 Marks)

Any two of the following for 1 mark each:

- **Aid concentration** and therefore the ability to maintain focus on the task at hand and exclude distractions
- **Reduce anxiety and physical tension** which can assist athletes to achieve optimal arousal and performance
- **Suggest a possible course of action.** 'Problem solving' visualisation techniques can assist players/athletes to determine a response or outcome of a movement/skill or game strategy.
- **Accelerate the learning process** by assisting the brain with organisation and coordination of movement.

- **Increases self-confidence / self-efficacy** – athletes can feel they have done it before and therefore feel more confident with performing, etc.

ii) Why is the rower's kinaesthetic sense so important during mental rehearsal? (1 Mark)

Kinaesthesia provides a feel for the movement and the speed in which it is carried out. Both are essential in effective mental rehearsal.

d) The coaches asked the rowers to focus their attention on their technique and the speed of their strokes for the first 500m of the 2000m final.

i) Define attention. (1 Mark)

Attention is the ability to be able to concentrate on the correct cues/stimuli during performance.

ii) In which attentional dimension would the rowers be in if they followed this advice? (1 Mark)

Narrow Internal.

iii) Identify one (1) benefit and one (1) potential disadvantage for this crew of being in the attentional dimension identified above. (2 Marks)

Benefit

Athletes can concentrate on their performance; Enhanced kinaesthetic (body) awareness; Able to focus on a single thought etc. (Any one for 1 Mark)

Disadvantage

Athletes can become overly critical of their performance; Fail to attend to and incorporate new information; Not sensitive to what is going on around them; May result in the athlete becoming distracted by how they feel etc. (Any one for 1 Mark)

Question 15 (10 Minutes)

This question assesses **Criterion 5**.

Formula One motor racing is conducted on 23 different racetracks around the world. Each has distinct characteristics, and some drivers now rely on visualisation to support their preparation to drive at each track. Others use visualisation occasionally.

The data below indicates the performance of four drivers at five tracks over the past five years, using different methods of preparation.

Table 1: Finishing Position of Drivers at Five Tracks 2017 – 2021 and Use of Visualisation.

Driver	Track	Position 2017	Position 2018	Position 2019	Position 2020	Position 2021
Sebastien Vettel	Baku	4 th v1	3 rd v3	7 th v1	3 rd v3	DNF 1 v1
	Singapore	1 st v1	DNF 2 v3	3 rd v1	7 th v3	DNF 1 v3
	Monza	3 rd v1	13 th v3	8 th v1	14 th v3	10 th v1
	Silverstone	2 nd v3	7 th v3	3 rd v1	9 th v3	9 th v0
	Spa	9 th v3	2 nd v1	10 th v3	13 th v1	12 th v0
Daniel Ricciardo	Baku	1 st v2	5 th v2	DNF 2 v2	7 th v3	DNF 1 v0
	Singapore	4 th v2	3 rd v2	6 th v2	12 th v2	9 th v0
	Monza	4 th v2	4 th v2	9 th v3	11 th v1	7 th v1
	Silverstone	6 th v2	3 rd v2	4 th v3	8 th v1	10 th v0
	Spa	3 rd v2	6 th v2	12 th v3	10 th v0	DNF 1 v2
Sergio Pérez	Baku	8 th v0	12 th v0	4 th v1	2 nd v3	DNF 2 v3
	Singapore	13 th v0	DNF 1 v0	4 th v1	5 th v3	2 nd v3
	Monza	DNF 1 v0	7 th v0	5 th v1	3 rd v3	3 rd v3
	Silverstone	16 th v0	DNF 1 v0	DNF 2 v2	3 rd v3	3 rd v3
	Spa	DNF 1 v0	DNF 1 v0	4 th v3	2 nd v3	4 th v3
Lewis Hamilton	Baku	3 rd v3	7 th v1	1 st v3	4 th v3	DNF 1 v0
	Singapore	2 nd v3	1 st v3	5 th v2	2 nd v3	4 th v3
	Monza	1 st v3	1 st v3	3 rd v3	2 nd v3	2 nd v3

	Silverstone	1 st v3	1 st v3	2 nd v3	1 st v3	2 nd v3
	Spa	4 th v3	3 rd v3	1 st v3	DNF 2 v3	9 th v1

Note: v3 = Visualisation used each day for the three days immediately prior to race day.

v2 = Visualisation used each day for the two days immediately prior to race day.

v1 = Visualisation used on the day prior to race day.

v0 = Visualisation not used.

DNF 1 = Did not finish due to own error

DNF 2 = Did not finish due to error by another driver

Responses to this question must make reference to Table 1 above.

- a) Which track in which year had the most drivers making errors which ended their race? Include data in your answer. (2 Marks)**

Baku, 2021. 3 drivers.

- b) Lewis Hamilton is aware of the strong link between visualisation and performance. Provide two (2) pieces of data to support this statement. (1 Mark)**

Any two of the following for ½ mark each:

- *Used v3 in 21 of 25 GP*
- *Used v3 each time he came 1st*
- *Finished top 3 in 17 of 25 GP*
- *Always finished in top 4 when using v3*
- *Had least DNF 1s of all drivers*
- *Only DNF 1 occurred when v0*
- *Worst completed GP 9th with v1*
- *Marker note - May be others*

- c) Using data from three (3) years, identify and discuss the benefits of Sergio Pérez using visualisation before racing at Monza. (3 Marks)**

2017 – v0 DNFI, 2018 – v0 7th, 2019 – v1 5th, 2020 – v3 3rd & 2021 – v3 3rd.

Select any 3 and identify that as visualisation improved so too did performance/placing (with reference to selections).

- d) Silverstone is a fast and technical track. Using the data for this track in 2021 comment on the preparation for and performance at Silverstone for the four (4) drivers. (2 marks)**

Hamilton and Pérez each used v3 and finished 2nd and 3rd respectively. Vettel and Ricciardo each used v0 and finished 9th and 10th respectively.

- e) i) In which two (2) years did no driver fail to finish due to their own error. (1 mark)**

2019 and 2020 (1/2 Mark for each)

- ii) With reference to visualisation data, explain why these years were different to other years. (1 Mark)**

In 2019 there was no v0 and in 2020 only one v0. (They may also mention that in every other year there were 5 or 6 v0).

In 2019, each driver used at least v1 and in 2020 there was only one instance of v0.

A lot more v3 used in 2020. Prevalence of v3 in 2020 was high.

Solutions

Section D – Cross Disciplinary Links

It should be noted that the following exemplars represent the upper level for each rating and are meant to act as a guide for students who aspire to achieve at the respective rating levels.

Question 16 (15 minutes)

This Question Assesses **Criterion 6**.

Ashleigh Barty recently retired from professional tennis whilst still the number one female player in the world, winning Wimbledon in 2021 and the Australian Open in 2022. In order to perform at such a high level, Barty said “I had to give everything I had mentally and physically. I have nothing more to give.”

Use two (2) cross-discipline links to demonstrate how Barty’s strong mindset (Sport Psychology) positively influenced her physical condition (Exercise Physiology) throughout her career. (15 Marks)

- The two core units are: **Sport Psychology – Exercise Physiology**
- Links **MUST** go from Sport Psychology to Exercise Physiology.
- Links must be made from a **positive** perspective, for example, what psychological strategies did AB use and how did these positively impact on her Physiology throughout her career?
- 2 Links are to be completed, worth 7.5 marks each, according to the CDL Marking Guide.
- Examples of possible links could include:
 - AB was motivated to undertake effective recovery so she could play seven games in two weeks at the Grand Slams.
 - Goal setting enabled AB to periodise and plan her annual schedule to peak for the major events like the Grand Slams.
 - AB was motivated to utilise effective training principles and methods to perform at her best when it counted.

The main “pre-prepared” links revolved around recovery strategies and motivation, goal setting and the training year or training session.

Exemplars

“C” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “C” rating.

Motivation – LIP

Motivation is a drive or force that directs an athlete’s effort. AB was extrinsically motivated by Grand Slam titles and world number 1 rankings. However, for AB to train at the intensity needed to achieve an improved LIP she would rely on her intense intrinsic motivation to be the best tennis player she can be.

AB’s Motivation would ensure that she persists through the difficult training sessions needed to raise her LIP to perform so successfully on the world tennis circuit.

The LIP is the highest point of exercise intensity where Lactate produced is equal to Lactate removed. This ability to work her Aerobic system at a higher intensity means she will compete harder in long baseline rallies without experiencing the effects of fatigue.

If AB is in a long rally and has to sprint from side to side on the baseline returning forehand and backhand ground shots, she will benefit from being able to utilise her aerobic system for longer.

“B” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “B” rating.

Ash Barty (AB) must draw on Motivation to train adequately to achieve the chronic adaptation of an improved and high LIP.

Motivation is a drive or force that stimulates the athlete’s effort. Elite athletes like AB utilise motivation to help guide their efforts, help them to persist whilst experiencing fatigue and drive them to improve their success rate. AB has had many tangible rewards like Grand Slam titles and world number 1 rankings, complemented by intangible ones such as media praise and coach reinforcement. However, for AB to be really driven to train at the intensity needed to achieve improved LIP she would rely on her intense intrinsic motivation. Her desire to be the best tennis player she can be is her most obvious driver.

AB’s Motivation would ensure that she persists through the difficult gym and court sessions needed to raise her LIP to perform so successfully on the world tennis circuit. When training, AB would benefit from LT training to raise her LIP. The LIP is the last point of exercise intensity where the rate of Lactate produced is matched by Lactate oxidised by the aerobic system. It is at approximately 85% of AB’s maximum heart rate and the higher she can make this, the harder she can work in a match at high intensity, before fatigue becomes a factor. This ability to work her Aerobic system at higher intensity means she will compete harder in long baseline rallies without experiencing the effects of fatigue. After the LIP is reached and intensity continues, hydrogen ions create acidic conditions in the muscle and contractions are impacted consequently.

If AB is in a long rally and has to sprint from side to side on the baseline returning forehand and backhand ground shots, she will benefit from being able to utilise her aerobic system for longer.

“A” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “A” rating.

High levels of Motivation positively influence the development of a high Lactate Inflection Point (LIP)

Ash Barty (AB) is an elite athlete who must draw on Motivation to train adequately to achieve the chronic adaptation of an improved and high LIP. Motivation is a drive or force that stimulates the athlete’s effort. Motivation can be positive or negative and the source can be

internal or external. Without motivation athletes can appear bored or disinterested with training. Elite athletes like AB utilise motivation to help guide their efforts, help them to persist whilst experiencing fatigue and drive them to improve their success rate. AB has had many tangible rewards like Grand Slam titles and world number 1 rankings, complemented by intangible ones such as media praise and coach reinforcement. However, for AB to be really driven to train at the intensity needed to achieve improved LIP she would rely on her intense intrinsic motivation. Her desire to be the best tennis player she can be is her most obvious driver.

Deci would suggest that Self-Determined motivation (the highest form of intrinsic motivation) where AB's needs for Autonomy, Relatedness and Competence are being met, would ensure that she persists through the difficult gym and court sessions needed to raise her LIP to perform so successfully on the world tennis circuit. Her desire to complete intense training sessions of the highest standard would fulfill her competence need. The fact that AB is elite and making many decisions about the quality of her training, the methods and techniques that would best suit her needs satisfies autonomy. The fact that she is a member of an elite circuit of players and is highly respected by media and opponents assists her with relatedness needs.

When training, AB would benefit from LT training to raise her LIP. Her training could include interval training and circuits where the intensity and rest mirrors that of the intermittent tennis match. Ratios of work to rest 4:1 and HR 85-95% MHR would benefit her. The LIP is the last point of exercise intensity where the rate of Lactate produced is matched by Lactate oxidised by the aerobic system. It is at approximately 85% of AB's maximum heart rate and the higher she can make this heart rate, the harder she can work in a match at high intensity, before fatigue becomes a factor. Workloads higher than this will cause an exponential rise in blood lactate. This ability to work her Aerobic system at higher intensity means she will compete harder in long baseline rallies without experiencing the effects of fatigue. Another fatiguing factor after the LIP is reached and intensity continues is the results of hydrogen ions creating acidic conditions in the muscle and contractions being impacted negatively. If AB is in a long rally and must sprint from side to side on the baseline returning forehand and backhand ground shots, she will benefit from being able to utilise her aerobic system for longer.

Question 17 (15 minutes)

This Question Assesses **Criterion 6**.

Lance "Buddy" Franklin plays Australian Rules Football (AFL) for the Sydney Swans team. He has played AFL for 17 years and recently kicked his 1000th goal, becoming the sixth player in AFL history to do so.

Use two (2) cross-discipline links between Exercise Physiology and Skill Acquisition that have assisted Franklin to develop and maintain his very high playing standard. (15 Marks)

- The two core units are: Exercise Physiology – Skill Acquisition

- Links can go in either direction.
- Links must be *positive* in nature – e.g.: what Exercise Physiology aspects has BF utilised to be able to play for so long and kick his 1000th goal?
- 2 Links are to be completed, worth 7.5 marks each, according to the CDL Marking Guide.
- Examples of possible links could include:
 - The use of effective feedback enabled the application of the correct training principals and methods.
 - A high LIP from delayed fatigue allowed BF to selectively attend and kick goals late in games.
 - Effective use of goal setting enabled the appropriate periodisation of BF's training year so he could peak for big matches and finals.
 - Improved strength and power enabled BF to reduce his movement time/response time to the ball so he could take more marks/break more tackles and kick more goals.

Exemplars

“C” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “C” rating.

BF would utilise the training principle of specificity to work on the speed of execution of his motor skills.

BF trains to improve his speed. He does high intensity interval work. He would avoid lots of long duration training being an older athlete, and he would really focus on muscle groups and energy systems for speed.

When he improves the power and diameter of his white muscle fibres it means he is faster to move to the ball when leading and more powerful in marking contests. These physiological improvements from Specificity enable BF to execute skills with a reduced Movement Time (MT) and Response Time (RST). When an AFL player completes a lead and a mark it is crucial that they beat their opponent to the ball and avoid being “spoiled” in the marking contest. The time from when BF initiates a movement in response to the cue until the completion of the mark is call MT. The faster BF can make his MT the more time he has to complete it and make his next decision. The faster overall RST means BF has more time and space to receive and

pass the ball effectively in a game. He will be tackled less, and he will be able to kick more goals with a faster RST.

“B” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “B” rating.

Specificity ↔ Movement Time

By utilising the training principle of specificity Buddy Franklin (BF) has been able to decrease his movement time and his overall response time.

Specificity is one of several training principles that governs the planning of training programs. It suggests that training should use the relevant energy systems, muscle groups, movement patterns/skills predominant in the sport. For BF and his position as a forward, he would be looking to work on his anaerobic energy systems to enable him to work at high intensity adapting to the acidic conditions. This would also target the Type IIb fibres to further improve power, speed and agility.

When executing skills, the movement time is the time taken from the first initiation of movement to the completion of movement. An example would be from the time BF starts his move to make a lead, until he leads and marks the ball. The response time is the total time taken from the presentation of a stimulus and in this case a teammate in a position to pass the football, to the completion of the movement, BF taking a mark.

BF is guided by the Specificity training principle which assists him with training adaptations. BF may use Interval training, resistance training (plyometrics) to improve power and speed. An example of an interval training session for BF (full forward) would be 3-4 sets of 10 reps of 30m sprints at 90% with a 1:4 work to rest ratio. Whilst ensuring that he is working the energy systems and muscle fibres essential for a full forward in AFL, he ultimately has improvements in speed and power.

BF's improved power and speed would assist him to reduce movement time (MT) and outperform his opponents when executing skills. When BF receives a stimulus or cue, he can lead to space, and mark the ball because of his physiological adaptations. His reduced MT and RST achieved through specific training has enabled him to kick 1000 goals throughout his career.

“A” Standard

The following is an example of a link that could have been made. If two links of a similar standard were written, the student would have received a “A” rating.

Specificity positively impacts on Movement time.

Specificity is one of several training principles that governs the planning of training programs. Along with frequency, intensity and progressive overload coaches and athletes aim to promote chronic training adaptations that will improve their performance. Specificity guides the athletes' training to include intensity and methods to stress appropriate muscle groups and energy systems to match the requirements of the sport. For BF and his position as a forward, he would be looking to work on his anaerobic energy systems to enable him to work at high intensity, adapting to the acidic conditions. This would also target the Type IIb muscle fibres to further improve power, speed, and agility - all important to a power forward in the AFL.

When executing skills, the movement time is the time taken from the first initiation of movement, in response to the cue detection, to the completion of movement. An example would be from the time BF starts his move to make a lead, until he completes the lead and marks the ball. The response time is the total time taken from the presentation of a stimulus and in this case a teammate in a position to pass the football, to the completion of the movement, BF taking a mark. If an athlete can reduce the time it takes them in the movement phase, they will be more efficient in their skill execution. In BF's case it enables him to take more marks unopposed, evade more tackles and have more time to get a shot away if he is faster in his MT.

BF is guided by the Specificity training principle which assists him with training adaptations. BF may use Interval training, resistance training (plyometrics) to improve power and speed. An example of an interval training session for BF (full forward) would be 3-4 sets of 10 reps of 30m sprints at 90% with a 1:4 work to rest ratio. Whilst ensuring that he is working the energy systems and muscle fibres essential for a full forward in AFL, he ultimately makes chronic improvements in speed and power.

BF's improved power and speed would assist him to reduce his movement time (MT) and outperform his opponents when executing skills. When BF receives a stimulus or cue (ball in midfield's hands in space) BF can lead to space, outspurt his opponent and mark the ball because of his physiological adaptations. He can play at high intensity with his leads, marks, tackles and off-the-ball running to a high level. His reduced MT and RST is directly related to his specificity in training. This has led to BF maintaining his very high playing standard and being the 6th player to kick 1000 goals.

Question 18 (15 minutes)

This Question Assesses **Criterion 6**.

All sports provide a platform for athletes to develop a range of skills including self-confidence, perseverance, discipline, teamwork, and resilience. These skills are developed to improve their mindset/mental wellbeing and skill execution.

Select an athlete or team, specify their sport and use two (2) cross-discipline links between Sport Psychology and Skill Acquisition to demonstrate how they can improve their performance.

My sport is:

My athlete or team is:

Optional background information: (you may wish to consider a specific scenario: e.g. lead up to a major match/competition, during pre-season; returning to team after being dropped/injured etc.) (15 Marks)

- The two core units are: Sport Psychology – Skill Acquisition
- Links must be **positive** in nature – improving and gaining an advantage / improve performance.
- Links can go in either direction. i.e., from Sport Psychology to Skill Acquisition OR from Skill Acquisition to Sport Psychology.
- 2 Links are to be completed, worth 7.5 marks each, according to the CDL Marking Guide.
- Links would be completely dependent on the students' choices.