Markscheme

November 2025

Sports, exercise and health science

Higher level

Paper 3

23 pages

Subject details: Sports, exercise and health science HL paper 3 markscheme

Mark Allocation

Candidates are required to answer **ALL** questions from two of the options **[2×25 marks]**.
Maximum total = **[50 marks]**.

Markscheme format example:

Question			Answers	Notes	Total
5	**c**	**ii**	this refers to the timing of the movements ***OR*** the extent to which the performer has control over the timing of the movement ✓. external paced skills are sailing/windsurfing/receiving a serve ✓. internal paced skills are javelin throw/gymnastics routine ✓.		**2 max**

1. Each row in the "Question" column relates to the smallest subpart of the question.

2. The maximum mark for each question subpart is indicated in the "Total" column.

3. Each marking point in the "Answers" column is shown by means of a tick (✓) at the end of the marking point.

4. A question subpart may have more marking points than the total allows. This will be indicated by "**max**" written after the mark in the "Total" column. The related rubric, if necessary, will be outlined in the "Notes" column.

5. An alternative word is indicated in the "Answers" column by a slash (*/*). Either word can be accepted.

6. An alternative answer is indicated in the "Answers" column by "***OR***". Either answer can be accepted.

7. An alternative markscheme is indicated in the “Answers” column under heading **ALTERNATIVE 1** *etc*. Either alternative can be accepted.

8. Words inside chevrons **« »** in the “Answers” column are not necessary to gain the mark.

9. Words that are underlined are essential for the mark.

10. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.

11. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect) in the “Notes” column.

12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

13. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point, then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points, then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script. “ECF acceptable” will be displayed in the “Notes” column.

14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

Option A — Optimizing physiological performance

Question			Answers	Notes	Total
1.	**a**	**i**	Day 9✓		**1 max**
1.	**a**	**ii**	36.9 - 36.4 = 0.5✓	*Accept +/- 0.2.* *Both calculation and answer must be present for a mark.*	**1 max**
1.	**a**	**iii**	Resting heart rate decreased✓ Exercise temperature decreased✓ Resting temperature decreased✓ Data is not shown to be statistically significant as no *p* value is given✓		**3 max**
1.	**b**		Training should replicate similar competition conditions (temperature, humidity)✓ Intensity should be lower at beginning and increase over time as the athlete acclimates✓ Most physiological adaptations occur within 10–14 days of heat exposure. (Accept answers within this range)✓ Athlete should progressively increase exposure to heat over 7–14 days✓ Maintain hydration and monitor core temperature and body mass✓ Allow sufficient recovery and avoid overexertion in the early stages✓ Sessions should last 60 to 100 min✓ Sweat response needs to be achieved in training✓ Sport-specific clothing should be used✓ Environmental chambers can be used to simulate different environments in an athlete's acclimation✓		**3 max**

Question			Answers	Notes	Total
2.	**a**		Training is performing exercise in an organised/ structured manner on a regular basis with a specific goal in mind✓		**1 max**
2.	**b**		Chronic overtraining can lead to changes in resting heart rate due to cardiac inefficiency✓ Persistent fatigue or tiredness that does not improve with normal rest✓ Athletes feel drained physically and mentally, leading to reduced motivation, performance✓ As training intensity is constant the athlete develops chronic muscle soreness as they are given no time to recover/ increased recovery time✓ Reduced immune function/ more susceptible to injuries due to fatigue/ increased stress training has put on the immune system✓ Overtraining can lead to increased sympathetic activity so it can be difficult to fall asleep✓ Fatigue due to decreased glycogen stores which are essential for muscle contraction and energy production✓ Overtraining can lead to increased GI issues increasing discomfort leading to decreased appetite✓ The athlete experiences a sudden and unexplained decrease in performance due to a combination of physiological factors✓ Loss of appetite, weight loss, or hormonal imbalances (e.g., reduced testosterone or cortisol changes)✓ Psychological indicators such as lack of motivation or increased irritability✓	*Max [1] for list of key words.*	**3 max**

2.	**c**		Macrocycles – overarching plan leading into event/ yearly✓ Mesocycles – separated into post-season, pre-season and in-season/ monthly✓ Early stages of the periodization is given over to general training/ fitness and as the athlete adapts training can become more specific✓ Microcycles – specific weekly/ bi-weekly plans✓ Microcycles allow for intensity and recovery to be balanced✓ Periodization allows for the principle of progression to be followed✓	*Max [1] for list.* *Max [2] for each cycle.*	**3 max**

Question			Answers	Notes	Total
3.			A substance/ device/ phenomenon that can improve an athlete's performance✓		**1 max**
4.	**a**		**Physiological indicators** E.g. reduced blood lactate✓ **E.g replenishment of creatine phosphate** ✓ **Symptomatic indicators** E.g. reduced muscle soreness/ feelings of fatigue✓ **Psychological indicators** E.g. mentally prepared/ motivated for training/ sense of alertness✓	*Accept other appropriate examples.*	**2 max**
4.	**b**		Body cooling for therapeutic/ recovery purposes✓		**1 max**
4.	**c**		**Strengths** Analgesic effects✓ Anti-inflammatory effects✓ Perception of enhanced recovery✓ Perception of enhanced performance✓ Some methods are accessible e.g. cold ice baths/ ice packs✓ **Limitations** Risks associated with prolonged cold exposure✓ Cost/ availability of some methods e.g. cryotherapy chambers✓ Pressure to use methods that are unsafe in order to get results✓ Evidence is anecdotal✓	*Max [2] for strengths/ limitations.* *Reference to cost/ accessibility for both strengths and limitations needs reference to specific examples.*	**3 max**

Question			Answers	Notes	Total
5.	**a**		2000-3000✓	*Accept any sub-range within this range.*	**1 max**
5.	**b**		**Blood adaptations** Increased RBC/ increased EPO release✓ Increased hemoglobin/ hematocrit✓ **Muscle adaptations** Reduced lean body mass✓ Increased capillaries in the muscles✓ Increased mitochondrial density✓ Increase in aerobic enzyme concentration✓ **Cardiorespiratory adaptations** Increased pulmonary ventilation/ VO_2 max✓ Increased capillarization at the alveoli✓		**2 max**

Option B — Psychology of sports

Question			Answers	Notes	Total
6.	**a**	**i**	17✓		**1 max**
6.	**a**	**ii**	23+15+13=51✓	*Both calculation & answer must be present for a mark.*	**1 max**
6.	**a**	**iii**	Unchanged motivation was the most common response for individual and team sports✓ Higher motivation was the least common response for both, individual and team sports✓ The number of responses from athletes who play both individual and team sports were limited therefore difficult to draw a conclusion✓ Athletes in the both category responded equally to lower and unchanged motivation✓ Type of sport has little impact/ no evidence on the motivation of the athletes✓	*Award max [1] for theory that does not refer to data specifically.*	**3 max**
6.	**b**		The internal mechanisms and external stimuli which arouse and direct our behaviour «Sage 1974»✓		**1 max**

Question			Answers	Notes	Total
6.	**c**		Athletes seek challenges in order to extend themselves and develop their skills✓ By being persistent and pushing themselves as athletes when faced with adversity✓ Athletes ensure that their standards in training and performance are met. They consistently do more than required✓ Not afraid of failure and therefore take challenges that extend them as an athlete✓ When situations look ominous/ difficult athletes remain optimistic and still «expect themselves to» do their best✓ Athletes have high levels of confidence and expect themselves to do well in their given task✓ When feedback is given athletes accept it willingly and take on board suggestions for improvement✓ As athlete attributes performance internally, they don't make excuses if they perform poorly but rather look for personal improvement✓		**4 max**

<table>
<tr><th colspan="3">Question</th><th colspan="3">Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td rowspan="4">7.</td><td rowspan="4">a</td><td rowspan="4"></td><td>State</td><td>Trait</td><td></td><td rowspan="4">Award only [1] mark for both components.</td><td rowspan="4">2 max</td></tr>
<tr><td>Refers to the response to a specific situation</td><td>Refers to the general level of stress an individual experiences/ personality</td><td>✓</td></tr>
<tr><td>Often temporary</td><td>Relatively stable/ enduring</td><td>✓</td></tr>
<tr><td>Player’s state anxiety may change within a game</td><td>Player’s trait anxiety would remain the same throughout a game</td><td>✓</td></tr>
<tr><td>7.</td><td>b</td><td></td><td colspan="3">Strengths
Data can be used by coaches to reduce worry/ build confidence/ aiding in psychological training/ intervention before competitions✓
Reliable/ valid/ specific self-report survey✓
Easy/ simple/ quick to administer/ conduct✓
Cheap✓
Has been used widely in sport psychology research, allowing for comparison across studies and sports✓
Limitations
Athletes have individualized responses which coaches need to take into consideration e.g. one approach is not suitable for all✓
Can’t be given during competition✓
Relies on self-report therefore susceptible to bias✓
Measures trait anxiety (general tendency), not state anxiety (situation-specific), so may not reflect actual competitive feelings✓
Cultural or language differences can affect interpretation of questions✓
Limited depth – doesn’t explore underlying causes of anxiety or situations that change✓</td><td>Max [2] for just strengths or limitations.</td><td>3 max</td></tr>
</table>

Question			Answers	Notes	Total
8			Education, period when psychological skills need to be learned, developed and refined✓ Acquisition, period when different psychological strategies are tailored✓ Practice, psychological skills are applied from practice to competition✓ Focus is on integration and automation✓	*Max [1] per phase.*	**2 max**

Question			Answers	Notes	Total
9	a		Self talk/ breathing/ mental imagery can be used to develop cognitive skills, enhance motivation, or build confidence✓ Realistic goal setting to maintain focus/ motivation✓ Effective evaluation of performance to monitor progress✓ Self-reinforcement to maintain/ build confidence✓ Motivation - high intrinsic or extrinsic motivation drives consistent effort, persistence and commitment to long-term improvement✓ Training to a high intensity enables an athlete to push themselves outside their comfort zone✓ Handling failure enables the athlete to become more resilient✓ Performance arousal control enables the athlete to better manage emotion during performance✓ Self-reinforcement/ belief to succeed to maintain/ build confidence✓	*Any other PST examples should be accepted.*	**2 max**

9	**b**		**Initiation/ sampling** High levels of play/ fun/ enjoyment and limited practice✓ Broad participation in many sports/ Focus on developing fundamental social skills✓ Focusing on multi skill acquisition/ developing fundamental movement rather than specialization✓ **Development/ specializing** Specialization of sporting skills/ Sports Deliberate play and deliberate practise✓ Enjoyment is still key✓ **Mastery/ investment** Involves limited play and high levels of practise✓ Focus is on specific skill acquisition✓ **Maintenance/ perfection** Athlete maintains high proficiency through high levels of practise✓ Athletes may regress (return to earlier stages) after burnout, injury, or motivational loss✓ **Psychological factors** (Loss of confidence, motivation drop) can cause temporary or permanent reversal✓	*Reference to name of stage is required for each MP.* *Max [1] per stage.*	**4 max**

Question			Answers	Notes	Total
10			Autonomy ability to make one's own choices and do something they find satisfying✓ Competency feeling accomplished at a task and see the benefits of practice✓ Relatedness feeling a shared connection with others/ social circle/ team✓		**2 max**

Option C — Physical activity and health

Question			Answers	Notes	Total
11.	**a**	**i**	D✓		**1 max**
11.	**a**	**ii**	3.7 - 3.6 = 0.1«%»✓	*Both calculation and answer must be present for a mark.*	**1 max**
11.	**a**	**iii**	Hypothesis cannot be accepted as the country with the 2nd highest % of the rural population (C) has the lowest levels of % of deaths from diabetes✓ Hypothesis can be accepted as the country with the highest % of the rural population (E) has the highest levels of % of deaths from diabetes✓ (B) has the 3rd largest % of the population living in rural areas ***OR*** (B) has the 2nd lowest level of % of deaths from diabetes✓ Data shows no correlation between the countries % of the rural population and % of deaths from diabetes✓	*Award max [1] for theory that does not refer to data specifically.*	**3 max**
11.	**b**		Is any bodily movement produced by contraction of gross/ skeletal muscles that «substantially» increases energy expenditure✓ Can occur spontaneously/be organized/ regularly as part of everyday life✓ Activity can be leisure/ occupational/ transport based e.g. walking to school, doing household chores, or cycling to work✓		**2 max**

Question			Answers	Notes	Total
11.	**c**		Increase in use of motor vehicles reducing the amount of activity undertaken✓ Changes to working patterns, e.g. working shifts may mean sleeping in the day/ too tired to exercise/ means people cannot be at training sessions✓ The use of technology to communicate so people can communicate from their room to others reducing the need to walk ***OR*** Labour saving devices reduce physical activity as part of day-to-day life✓ The rise of fast food/ deliveries means that people are not as active in their making of food✓ Nature of occupations has changed so fewer people work in manual jobs ***OR*** More work in jobs aligned with sedentary behaviour✓	*Zero credit for a list.*	**3 max**
12.			A state of emotional or affective arousal of varying, and not permanent, duration✓	*Accept any suitable definition, but there must be reference to a semi-permanent arousal state that is more than a momentary feeling.*	**1 max**
13.			Social commitments such as family make it hard to access✓ Physical environment/ availability to safe places to be physically active✓ Time/ due to busy schedules people are unable to make time for physical activity✓ Characteristics of physical activity offered can at times not be appealing to some✓ Leader qualities of instructors can be conflicting for some✓ Social and cultural norms within various ethnic groups can prevent people from accessing✓ Gym memberships, equipment, or travel costs can make participation difficult for individuals or families, particularly in low socioeconomic groups✓		**3 max**

Question			Answers	Notes	Total
14.			Stomach✓ Small intestine✓ Adipose tissue✓		**2 max**
15.	**a**		Improved metabolic rate/ improved insulin sensitivity and glucose metabolism✓ Improved VO_2 max due to strengthening of the heart and improving circulation✓ Increased energy expenditure when walking regularly which can help with weight management✓ Regular walking has been shown to increase HDL «good» cholesterol and decrease «bad» LDL cholesterol✓ Regular walking can improve sleep quality and prevent any sleep disorders✓ Decreased blood pressure as blood vessels are able to dilate more easily✓ Reduced risk of skeletal injuries as muscles, bone and connective tissues are strengthened✓		**3 max**
15.	**b**		Genetic mutations can increase susceptibility✓ «High» intensity exercise can induce cardiac issues✓ Limited aerobic conditioning/ risk factors of coronary artery disease✓ High levels of habitual exercise at high intensity ***OR*** Elevated troponin levels due to training✓ Arrhythmia/ abnormal heart rhythm✓		**3 max**

Question			Answers	Notes	Total
16.	**a**		Injuries that affect the muscles/ bones/ joints/ ligaments, tendons, or other connective tissues of the body✓	*Reference to at least two muscular skeletal tissues should be made.* *E.g. injury to muscles and ligaments.*	**1 max**
16.	**b**		Constant impact and repetition of running movement can cause stress injuries ***OR*** Lower running cadence can increase impact forces✓ Biomechanical/ muscular imbalances/ weaknesses creates unwanted stress on the musculoskeletal system✓ Insufficient planned recovery between training can lead to overuse ***OR*** Rapid increase in training intensity/ distance prevents body adjusting to exercise stresses ***OR*** Limited running experience/ poor technique/poor biomechanics can create unwanted stress on the musculoskeletal system✓ Poor technique can create unwanted stress on the musculoskeletal system✓ History of previous injuries/ ignoring pain/ symptoms can cause further injury✓ Hard running surface can lead to stress fractures ***OR*** Regularly twists and turns/ uneven surface can lead to slips/ trips/ unwanted movements✓ Regularly changing between different shoes can affect technique/ shock absorption✓		**2 max**

Option D — Nutrition for sports, exercise and health

Question			Answers	Notes	Total
17.	**a**	**i**	Calcium ion✓		**1 max**
17.	**a**	**ii**	35.9010 - 35.6547 = 0.2463✓	*Accept 0.25.* *Both calculation & answer must be present for mark.*	**1 max**
17.	**a**	**iii**	All electrolyte calcium and sodium values increase post-consumption✓ Chloride and potassium decreased post-consumption✓ Hematocrit does not increase✓ However, all *p* values>0.05✓ This suggests that no data is statistically significant✓ Hematocrit data is the least significant✓ Potassium data is almost statistically significant with a *p*-value of 0.051✓	*Award max [1] for referring correctly to data.*	**3 max**
17.	**b**		Monitor urine colour, the darker the colour indicates dehydration✓ Urine osmolarity measures the concentration of urine/ greater osmolarity indicates dehydration✓ Assessing body mass/ weight loss may be indicative of a change in hydration✓	*Award max [1] for list*.	**2 max**

17.	**c**		Sweating leads to reduced blood plasma✓ Loss of blood plasma results in increased blood osmolality✓ The hypothalamus is stimulated by lower fluid levels✓ The hypothalamus stimulates the pituitary gland to release ADH✓ ADH increases re-absorption of water from the kidneys✓ ADH increases water permeability of the renal tubules/ reduce urine volume/ collecting ducts✓ The Loop of Henle maintains the osmotic gradient that supports this process✓ Water balance is restored, ADH secretion decreases/ completing a negative feedback loop✓		**4 max**

Question			Answers	Notes	Total
18.			Thermic effect of physical activity✓ Thermic effect of feeding/ food✓ Non-exercise activity thermogenesis (NEAT)✓		**1 max**
19.	**a**		**Strengths** Can help replace lost water from sweat✓ Can replace lost electrolytes✓ Easily replaced glucose during training/ competition✓ **Limitations** Can be hard to digest whilst exercising✓ Can cause stomach cramps/ nausea✓ Commercial/ pre-made can be costly✓ Requires in-training usage to find optimal consumption✓	*Max [2] for strengths/ limitations.*	**3 max**
19.	**b**		0.8g kg^{-1} bodyweight✓	*The correct number and unit is required.*	**1 max**

Question			Answers	Notes	Total
20.	**a**		Insufficient food intake/ fasting✓ Excessive exercise✓ High insulin levels for diabetics✓		**2 max**
20.	**b**		Exercise increases the amount of GLUT4 transportation protein in the cells✓ This enables a higher rate of glucose uptake into cells to use a fuel✓ Increased contraction during training will increase the effectiveness of the GLUT4 transporters✓		**2 max**

Question			Answers	Notes	Total
21.			**Strengths** Can reduce hand tremors✓ Can provide a source of carbohydrate✓ Temporarily reduce anxiety or increase confidence before competition (psychological relaxation)✓ May create a false sense of reduced pain or fatigue✓ **Limitations** Can reduce reaction time✓ Can reduce coordination/ vision✓ Can cause dehydration✓ Can cause aggression✓ Can impair muscle recovery✓ Can impair nutrient absorption✓ Reduced glycogen resynthesis and muscle recovery post-exercise✓ Decreased focus, decision-making, and motivation affecting tactical performance✓		**3 max**
22.			These create damage by removing electrons from parts of cells in order to pair electrons in their own structure✓ Removing electrons from cell and mitochondrial membranes can thereby affecting their permeability✓ Remove electrons from molecules such as enzymes and DNA, thereby impairing their function✓		**2 max**