Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 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**		8-Day heat acclimatization✓		**1 max**
1.	**b**		39.1 − 37.3 = 1.8 «c»✓	*Accept 1.5 to 2.1 «c» provided each point is within the range 39 – 39.4 and 37.2-37.6.* *Calculations must be shown for the mark.*	**1 max**
1.	**c**		Both interventions reduced heart rate compared (to baseline) – Students should identify that heart rate is lower than baseline for both conditions✓ Heat acclimatization results in the lowest heart rate – Students should state that heart rate is lowest in the 8-day heat acclimatization group across the time period✓ Aerobic training lowers heart rate but not as much as heat acclimatization – A correct comparative statement about heart rate responses between the two interventions✓ Heat acclimatization maintains the lowest rectal temperature – (Students must observe that rectal temperature remains around 37.5°C during the heat acclimatization condition)✓ Aerobic training allows a slower increase in rectal temperature (compared to baseline) – Students recognize that aerobic training slows but doesn't prevent temperature rise✓ Heat acclimatization is more effective at regulating body temperature and cardiovascular strain/ delay time to exhaustion – A clear evaluative statement that distinguishes effectiveness of the two interventions✓		**2 max**

1.	**d**		Enhanced sweat response, leading to more efficient body cooling✓ Quicker/ earlier onset of sweating during exercise, allowing for earlier thermoregulation✓ More dilute sweat concentration/ conserving sodium and other electrolytes✓	*Limit marks to physiological adaptations only.*	**2 max**
2.	**a**		Wear insulated clothing **«**each 0.6cm adds ~1 clo**»** to reduce conductive and convective heat loss✓ Use layered/ wind/ waterproof clothing for temperature management✓ Use moisture-wicking materials to draw water away from the skin✓ Cover extremities/ skin/ head/ hands/ feet/ face/ neck to minimize heat loss✓ Perform a warm-up to acclimate the body to cold conditions✓ Cover mouth and nose during warm-up to warm the air entering the respiratory tract✓ Adapt clothing layers as necessary to avoid overheating/ over-sweating✓ Athletes should regularly rehydrate to substitute liquids lost through sweat✓		**3 max**
2.	**b**		Establishes a base level of fitness/ endurance✓ Through gradual increase in training parameters utilizing the key principles of training/ intensity/ frequency/ specificity/ duration the body adapts for more intense training **«**the competition phase**»**✓ Slowly increasing workload minimizes the risk of injuries **«**common in more intensive training stages**»**✓ Incorporate breaks/ rest/ recovery to maximize training adaptation✓ Building up the athletes mental preparation/ psychological skills training for competition✓	*Justification of a training plan is required for the mark to demonstrate "importance of the preparation phase".*	**2 max**

2.	**c**		**Benefits:** EPO stimulates red blood cell production, enhancing oxygen transport✓ Raises hemoglobin levels, improving oxygen delivery to muscles✓ May increase VO_2 max, leading to better endurance/ performance✓ Could potentially shorten recovery times between training sessions✓ Some recent evidence suggests that EPO use may also have an effect on cognitive function (awareness, thought processes, ideas etc.)✓ **Risks:** Elevates blood viscosity, which can strain the cardiovascular system e.g. blood clots/ hypertension/ elevated blood pressure✓ Increases the chance of cardiac complications, e.g. heart attacks/ disease/ strokes/ seizure/ death✓ Use in sports is illegal and can result in bans/ penalties✓	*Max [3] for negatives/ positives.*	**4 max**
2.	**d**		Enhanced removal of lactic acid ***OR*** blood pH raises faster/ returns to normal quicker✓ Aids in reducing the effect of DOMS/ inflammation Maintains skeletal muscle/ respiratory muscle pump to support venous return✓ Replenishment of muscle glycogen/ phosphocreatine stores✓ Improves oxygen supply to the working muscles✓ Reduces the risk of blood pooling✓		**2 max**

2.	**e**		**Strengths:** Acts as an analgesic/ anti-inflammatory for soft tissue injuries common in marathon running✓ Some methods, like ice baths, are easily affordable/ accessible for most athletes✓ Placebo/ perceived enhanced recovery rate/ performance in subsequent training sessions/ events✓ Mood boosting effect/ release of endorphins✓ **Limitations:** Scientific research is limited ***OR*** Recommendations are anecdotal✓ Specialist equipment **«**e.g. chambers for whole-body cryotherapy**»** can be inaccessible/ costly to athletes✓ At risk of frostbite/ ice burn/ cold rash/ hypothermia **«**due to exposure to prolonged extreme cold**»** if not monitored✓ Risk of cold-water shock/ risk of drowning due to cardio-respiratory strain✓	*Max [2] for strengths/ limitations.*	**3 max**

3.	**a**		Hyperventilation✓ Elevated sub maximal heart rate✓ Altered metabolic response e.g. glycogen stores✓ Increased lactic accumulation/ reduced lactate response✓ Increase in EPO production/ red blood cells There is an increase in urine production / diuresis✓ Decreased plasma volume and VO_2 max✓ Altered sleep patterns/ insomnia✓ Decreased appetite ***OR*** Increase fluid loss/ weight loss✓ Coughing/ wheezing/ potential build-up of fluid on the lungs✓		**3 max**
3.	**b**		Leads to a reduction in lean body mass, which can decrease the energy cost of moving **«**lighter body weight**»** thereby improving running efficiency at sea level✓ Increased capillary and hemoglobin density in muscles improving oxygen and nutrient delivery to muscle cells **«**contributing to better endurance and performance**»**✓ Increased mitochondrial density in muscles improves aerobic respiration efficiency✓ Larger myoglobin levels increase oxidative capacity of the muscles✓ Increased buffering capabilities of muscles can cope with higher intensity work✓ Increase in aerobic characteristics of muscle fibres, increasing their resistance to fatigue✓	*Accept any suitable adaptation.*	**2 max**

Option B — Psychology of sports

Question			Answers	Notes	Total
4.	**a**		60**«**%**»**/ 70**«**%**»**✓	*One required for mark.*	**1 max**
4.	**b**		0.9–0.6 = 0.3 **«**sec**»**✓	*Calculations must be present for the mark.*	**1 max**
4.	**c**		Initial decrease in response time as arousal levels increase✓ Arousal improves from a low state, so does the performance in terms of quicker response✓ 60-70% HRR represents the fastest response time - indicates the optimal arousal level for performance✓ As arousal levels continue to increase beyond optimal, the response time starts to increase, impairing performance✓ High levels of arousal are not as detrimental to performance as low levels of arousal✓ The graph supports the Inverted-U theory, showing an optimal level of arousal for performance **«**deviations from this level, whether lower or higher, are associated with poorer performance**»**✓	*Answers must refer to data for a mark.*	**4 max**

<table>
<tr>
<td>5.</td>
<td>a</td>
<td></td>
<td>Players learn from observing teammates, with peer behaviour influencing team cohesion/ individual skill development e.g. adopting successful defence strategies seen in fellow defenders✓

The training environment/ team culture contributes to learning/ performance e.g. practicing in a high-energy environment simulates real game intensity✓

Behaviours/ skills learned through observation are applied in games e.g. a player implementing a new dribbling technique observed from a teammate✓

Coaches acting as role models demonstrate desired behaviours/ skills e.g. a coach showing respect and fairness✓

Positive reinforcement/ feedback from the coach is essential for encouraging effective team behaviours/ performance e.g. praising a player for excellent teamwork✓

Addressing/ recognising individual differences among players, e.g. tailoring coaching methods to individual players✓</td>
<td>No credit if no reference to examples.</td>
<td>2 max</td>
</tr>
<tr>
<td>5.</td>
<td>b</td>
<td></td>
<td>Individuals are motivated by the desire to succeed (NACH) and the fear of failure (NAF)✓

When new coaching methods are introduced, players with high NACH may see this as an opportunity to improve✓

Players with higher NAF might resist/ feel anxious about new methods «fearing negative outcomes»✓

Players are encouraged to adopt growth/ learning development over immediate success or failure✓</td>
<td>Discussions exclusively referring to extrinsic/ intrinsic motivation are insufficient for marks.</td>
<td>3 max</td>
</tr>
<tr>
<td>6.</td>
<td>a</td>
<td></td>
<td>
<table>
<tr><th></th><th>Cognitive</th><th>Somatic</th><th></th></tr>
<tr><td>characterised by thoughts</td><td>Y</td><td>N</td><td>✓</td></tr>
<tr><td>characterised by physiological response</td><td>N</td><td>Y</td><td>✓</td></tr>
<tr><td>involves worry and self-doubt</td><td>Y</td><td>N</td><td>✓</td></tr>
<tr><td>involves butterflies, dry mouth, shaking etc.</td><td>N</td><td>Y</td><td>✓</td></tr>
<tr><td>typically increases immediately before performance</td><td>N</td><td>Y</td><td>✓</td></tr>
</table>
</td>
<td>Max [1] per line/ condition.</td>
<td>2 max</td>
</tr>
</table>

6.	**b**		Can only develop after they have learned the importance of psychological skills e.g. relaxation techniques✓ Skills are then applied to strategies that are tailored to individual needs✓ Use relaxation techniques to reduce somatic anxiety include e.g. breathing/ progressive muscular relaxation/ biofeedback/ visualisation/ self-talk (cognitive restructuring)✓ Refinement to techniques occurs through feedback✓		**2 max**
7.	**a**		A natural aptitude/ skill/ identified by characteristics that are both genetic and environmental✓	*Ensure that the candidate clearly states environmental and genetic for one mark.*	**1 max**
7.	**b**		**Traditional TI** Includes subjective assessments such as observations by coaches/ scouts evaluating skills and physical attributes✓ Involves objective testing, e.g., physiological aspects like aerobic capacity/ anthropometric measurements like height/ performance-based elements such as skill✓ **ALTERNATIVE:** **Multidimensional TID** Focuses on the athlete's interaction with their environment and includes monitoring their progress/ behaviour over time✓ Emphasizes the athlete's ability to adapt/ balance weaknesses and strengths/ development of psychological behaviours e.g. mental imagery/ goal setting/ performance arousal and control✓	*Credit examples of tests for [1] max.*	**2max**

7.	**c**		Injury may prevent continued participation in their current sport✓ Plateau in performance/ loss of motivation/ coaches lack of knowledge or expertise, leading athletes to seek new challenges/ renewed interests✓ Desire to prolong sporting career, if opportunities in the current sport are diminishing✓ Geographical reasons, such as relocation, that necessitate a change in sport/ training environment✓ Desire for greater success, which can motivate athletes to switch to a sport with better prospects✓ Financial reasons, e.g. better sponsorship/ earning opportunities in another sport✓		**2 max**

8.			Motivation in the forethought phase of self-regulated learning influences athletes' goal setting/ strategic planning✓ Athletes with higher self-efficacy are more inclined to use self-regulation strategies effectively✓ Motivated athletes are more likely to invest time and energy in learning and applying self-regulated learning skills✓ Successful application of self-regulation strategies can enhance an athlete's motivation for ongoing learning and improvement✓ Relationship between motivation and self-regulation creates a cycle of continuous learning and performance enhancement✓ **Monitoring phase** Intrinsic motivation determines the level of effort and commitment to the task✓ **«**The degree of**»** intrinsic motivation influences the persistence and consistency in using self-regulation strategies✓ **Reflection phase** Athletes analyze their performance outcomes and the effectiveness of their strategies✓ Athletes' causal attributions for success or failure impact their future engagement in similar activities✓ Positive causal attributions reinforce the use of successful self-regulation strategies in future tasks✓	*Max [1] for list of all processes.*	**5 max**

Option C — Physical activity and health

Question			Answers	Notes	Total
9.	**a**		A✓		**1 max**
9.	**b**		8–7=1**«**%**»**✓	*Accept 0.8 to 1.2* **«***%***»**. *Calculations must be shown for the mark.*	**1 max**
9.	**c**		Group B men have a higher percentage of diabetes than females✓ Overlapping error bars for group B men and women may indicate a lack of statistical significance **«**in the difference in diabetes prevalence**»**✓ A statistical test, such as a t-test, is necessary to confirm if the differences are statistically significant✓	*Answers must refer to data for a mark.*	**2 max**
9.	**d**		Obesity increases the risk of type 2 diabetes by causing insulin resistance✓ Physical inactivity contributes to the development of type 2 diabetes by leading to high blood sugar levels✓ Diets rich in saturated fats are linked to higher rates of type 2 diabetes **«**through their effect on insulin sensitivity**»**✓ Family history of type 2 diabetes can increase an individual's risk✓	*Physiological link must be included for a mark.*	**2 max**
10.	**a**		A condition that involves narrowing or blockage of blood **vessels/ arteries** that supply the heart «leading to heart attack/ angina»✓		**1 max**

10.	**b**		Habitually physically inactive individuals are more at risk of CV disease ***OR*** CV disease is less prevalent in individuals who are habitually physically active compared with their inactive counterparts✓ Previously sedentary/ inactive individuals who increase their habitual physical activity can lower their risk✓ Physical inactivity can lead to increased blood pressure/ hypertension✓ Contributes to obesity due to an imbalance between calorie intake and energy expenditure✓ Obesity is linked to CV disease, as it can lead to fatty material buildup in the arteries✓ Type 2 diabetes can damage blood vessels/ nerves, affecting the heart and blood circulation, **«**increasing the risk**»**✓ Physical inactivity leads to lower levels of HDL are associated with a higher risk of heart disease✓ HDL helps remove other forms of cholesterol from the bloodstream reducing fatty clogged up arteries✓	*Accept in the converse.*	**3 max**

10.	**c**		Recommendations include at least 150 minutes of moderate-intensity ***OR*** 75 minutes of vigorous-intensity aerobic physical activity per week, in bouts of at least 10 minutes✓ Aim for moderate to low-intensity physical activity 3-4 days per week✓ Encourage working towards 300 minutes of moderate-intensity/ 150 minutes of vigorous-intensity aerobic physical activity per week✓ Include muscle-strengthening activities involving major muscle groups on two or more days per week✓ Physical activity includes leisure time activity/ transportation e.g. walking, cycling/ occupational work/ household chores/ play/ games/ sports/ planned exercise✓	*1 max mark Accept examples of physical/ lifestyle improvements.*	**2 max**
10.	**d**		Is associated with a lower risk of cardiovascular disease (CVD) and coronary heart disease (CHD) due to improved cardiovascular efficiency✓ Increases VO_2max, which enhances the heart's ability to pump blood and improves overall cardiovascular health✓ Increased energy expenditure through moderate exercise helps in maintaining a healthy weight, reducing the risk of CVD✓ Improved plasma lipid profiles from regular moderate exercise lower the risk of atherosclerosis and hence CVD✓ Decreased adiposity (body fat) as a result of moderate exercise contributes to reduced strain on the cardiovascular system✓ Regular moderate exercise decreases blood pressure, reducing the risk of hypertension **«**a major risk factor for CVD**»**✓	*Max [1] for list.*	**3 max**

10.	**e**		PAR represents the proportion of CHD cases attributable to specific risk factors e.g. smoking/ physical inactivity/ obesity✓ ***OR*** Indicates the proportion of deaths or illnesses that would not occur if the risk factor was removed e.g. smoking/ physical inactivity/ obesity✓ Quantifies the impact of these risk factors on CHD **«**such as the percentage of cases due to smoking**»**✓ Guides the prioritization of public health efforts by indicating which risk factors could most reduce CHD incidence✓		**2 max**
10.	**f**		Implement prompts such as reminders or scheduling to encourage regular exercise✓ Establish a contract outlining exercise commitments✓ Provide a sense of choice in the selection of exercise activities to enhance personal commitment✓ Accessibility to outdoor gyms/ fitness/ running equipment outdoors✓ Adopt reward systems to motivate adults to take part and achieve personal/ group goals/ targets✓ Promote adults to exercise with their friends/ family in a social environment✓		**2 max**
11.	**a**		Tendinosis✓ **«**Muscle**»** pull/ ruptures/ strains✓ **«**Ligament**»**/ ruptures/ sprains✓ Meniscus/ cartilage tears✓ Bursitis✓ Contusions/ abrasions/ lacerations✓ Concussion✓ Dislocations✓		**3 max**

11.	**b**		Development of a training program that includes proper warm-up and cool-down routines, progressive overload, and rest days to prevent overtraining✓ Incorporation of technique refinement sessions to ensure swimmers use proper form, reducing stress on joints and muscles✓ Hold workshops or briefings for swimmers on the importance of recognizing early signs of injury/ proper use of equipment/ role of nutrition and hydration etc.✓ Regular checks using training/ nutrition/ menstrual diaries to monitor health✓ Regular checks of the pool, starting blocks, and training equipment to ensure they meet safety standards✓ Ensuring that the pool deck is clear of hazards that could lead to slips and falls✓		**3 max**

Option D — Nutrition for sports, exercise and health

Question			Answers	Notes	Total
12.	**a**		Large✓		**1 max**
12.	**b**		1750–1850 **«**kcal/d**»**✓	*Accept in the given range. Calculations must be shown for the mark.*	**1 max**
12.	**c**		There is a positive correlation between FFM and REE ***OR*** As FFM increases, REE increases ***OR*** Athletes with greater FFM are more likely to have higher REE✓ The correlation coefficient (r) is 0.84, which indicates a strong positive relationship between FFM and REE✓ The relationship between FFM and REE is statistically significant **«**as indicated by the p-value (P<0.001)**»**✓	*Max [1] for any correct point mentioned.*	**2 max**
12.	**d**		A higher proportion of FFM, generally aids athletic performance across a range of sports ***OR*** Increased FFM **«**being primarily muscle**»**, enhances overall physical capabilities in various athletic activities✓ Fat contributes nothing to force production✓ Higher FFM increases the energy cost of movement✓ Different sports may require different levels of FFM e.g., sprinter vs 5K runner✓	*Max [1] max for any correct point mentioned.*	**2 max**

13.	**a**		GI is a measure of the rate at which carbohydrates raise blood glucose levels after being consumed✓ Low-GI foods are absorbed slowly, causing a gradual increase in blood sugar✓ This provides consistent energy, beneficial for maintaining endurance during the event/ prevent premature fatigue for endurance athletes✓	*Accept only marks for low GI.*	**2 max**
13.	**b**		At rest and during physical exercise, GLUT4 transporters are stored inside intracellular vesicles and translocate to the cell membrane✓ At rest and in exercise GLUT4 transporters facilitate the movement of glucose into muscle cells **«**enhanced during endurance activities**»**✓ **Contrast:** At rest, GLUT4 is stimulated by insulin following a meal, while during exercise, it's activated without insulin **«**due to stimuli like calcium ions**»**✓	*Max [1] for comparison.*	**2 max**
13.	**c**		Dehydration triggers aldosterone/ ADH release✓ Promotes water and sodium reabsorption in the kidneys✓ Endurance exercise activates the renin-angiotensin system, aiding blood pressure regulation/ fluid maintenance✓ The electrolyte concentration is impacted by their pre-swim nutritional status✓		**2 max**
14.	**a**		Low slow twitch/ type I✓ Medium fast twitch/ type IIa ✓ High fast twitch/ type IIb✓		**3 max**

14.	**b**		Liver damage e.g. jaundice/ cirrhosis/ liver cancer/ liver failure Damage to the kidneys✓ Heart disease/ cardiomyopathy/ high blood pressure/ stroke✓ Alcohol-related brain damage/ confusion/ depression/ forgetfulness/ coordination✓ Chronic pancreatitis✓ Digestive problems✓ Weaker immune system - increasing your chances of getting sick✓	*Accept other relevant answers.*	**3 max**
15.	**a**		Produced as a by-product of normal cell function ***OR*** Free radicals can create oxidative stress✓ Exhaustive exercise generates high levels of free radicals✓ Exposure to polluted air can generate higher levels of free radicals✓		**2 max**
15.	**b**		Free radicals can damage cell and mitochondrial membranes, enzymes, and DNA, impacting cell function✓ Antioxidants neutralize free radicals by donating electrons without becoming destabilized **«**reducing cellular damage**»**✓ Athletes may increase antioxidant intake to defend against increased oxidative stress **«**from training, however, evidence is anecdotal**»**✓ Antioxidants are predominantly found in fruits and vegetables and are consumed as part of a balanced diet✓ Antioxidant supplements pose a risk of consuming banned substances due to lack of regulation✓ Excessive intake of antioxidants, beyond RDA, may have negative effects on the body✓		**3 max**

16.			They operate as a catalyst/ break down/ speed up reactions✓ They are specific to each macronutrient «e.g. amylase helps with the breakdown of CHO»✓ They increase the solubility/ hydrolysis of the food for absorption/ diffusion✓	*Examples Should refer to any enzyme for max [1].*	**2 max**