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Sports, exercise and health science

Standard level

Paper 3

25 October 2023

Zone A afternoon | Zone B afternoon | Zone C afternoon

Candidate session number

1 hour

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Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the options.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.

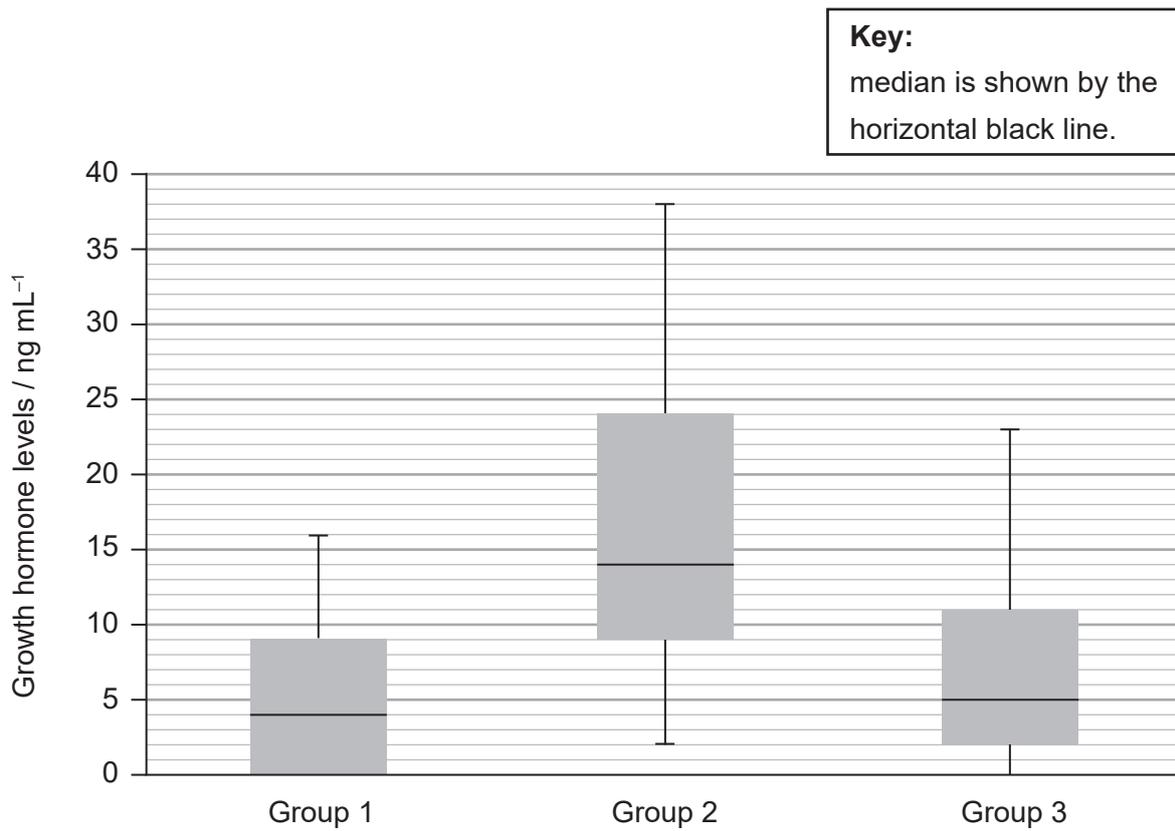
Option	Questions
Option A — Optimizing physiological performance	1 – 3
Option B — Psychology of sports	4 – 6
Option C — Physical activity and health	7 – 9
Option D — Nutrition for sports, exercise and health	10 – 12



Option A — Optimizing physiological performance

1. A study looked at growth hormone response to a non-exercise stress test in 51 participants with overtraining syndrome. The participants were divided into three groups:
- Group 1: Athletes with overtraining syndrome
 - Group 2: Healthy athletes
 - Group 3: Sedentary individuals.

Growth hormone levels (ng mL^{-1}) in the blood were measured 30 minutes after induced hypoglycemia. The median growth hormone levels for each group are shown.



(a) (i) State the group with the lowest level of growth hormone.

[1]

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(Option A continues on the following page)



(Option A, question 1 continued)

(ii) Calculate the difference in median growth hormone level (in ng mL^{-1}) between overtrained and healthy athletes. [2]

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(iii) Using the graph, deduce the effects of overtraining. [2]

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(b) Identify **two** other indicators of overtraining. [2]

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(c) Explain how periodization can be optimized to avoid overtraining. [3]

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(Option A continues on the following page)



(Option A continued)

2. (a) State the normal physiological core body temperature. [1]

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(b) Outline **two** physiological responses that maintain a body's core temperature in cold environments. [2]

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(c) Explain why an elite distance runner is more susceptible to hypothermia than an untrained athlete. [2]

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3. (a) Describe two physiological benefits an athlete hopes to gain by taking diuretics. [2]

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(Option A continues on the following page)



(Option A, question 3 continued)

- (b) Explain why the use of non-nutritional, performance-enhancing substances in sport is considered ethically wrong.

[3]

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End of Option A

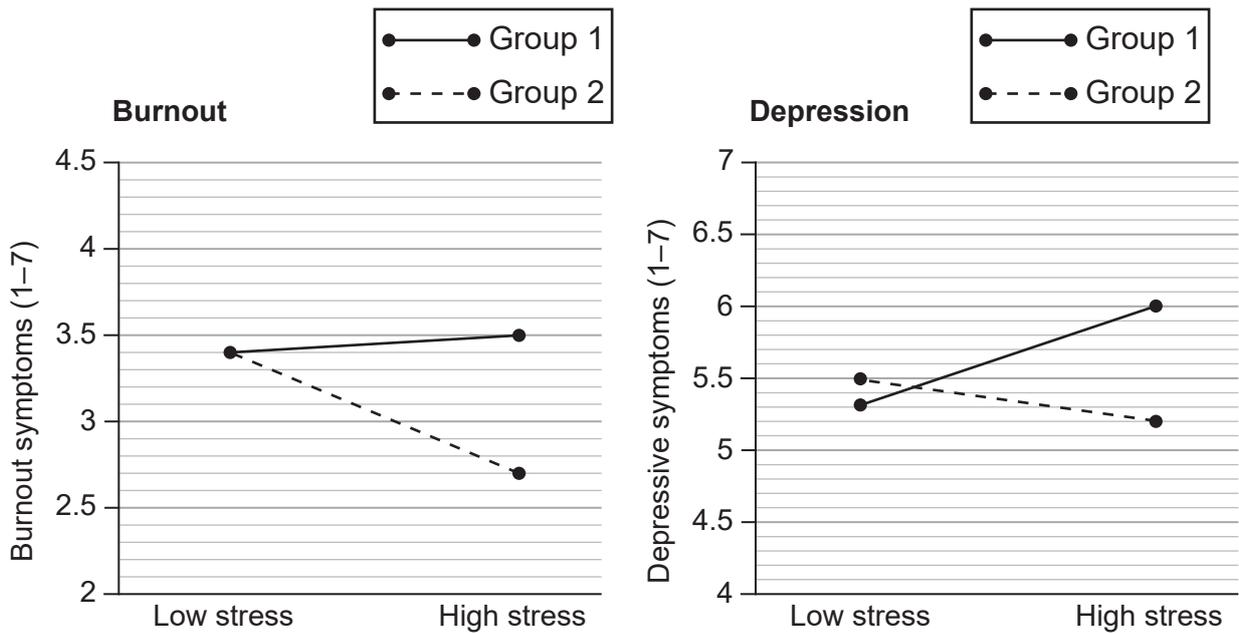


Option B — Psychology of sports

4. A study examined the effect of mental toughness on burnout and depression in young elite athletes experiencing stress. In total, 197 athletes completed questionnaires to measure mental toughness, burnout, and depressive symptoms in low stress and high stress conditions. The athletes formed two groups:

- Group 1: Low mental toughness
- Group 2: High mental toughness.

The mean results are shown. (A higher score records increased symptoms.)



(a) (i) State the group with the fewest depressive symptoms in the high stress condition. [1]

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(ii) Calculate the difference in burnout symptoms for athletes with high mental toughness in periods of high stress compared to periods of low stress. [2]

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(Option B continues on the following page)



(Option B, question 4 continued)

(iii) Using the graph, deduce the effect of mental toughness on burnout. [2]

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(b) Describe the inverted-U hypothesis as it relates to sports performance. [2]

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(c) Explain why a highly emotional athlete might be more inconsistent in performance than a more emotionally stable athlete. [3]

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5. (a) Define *personality*. [1]

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(Option B continues on the following page)



(Option B, question 5 continued)

(b) Discuss the “nature versus nurture” argument with reference to personality.

[3]

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(Option B continues on the following page)



(Option B continued)

6. (a) Using an example, explain how extrinsic rewards can influence intrinsic motivation. [3]

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(b) Identify an example for each of the following types of goal:

(i) outcome [1]

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(ii) performance [1]

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(iii) process. [1]

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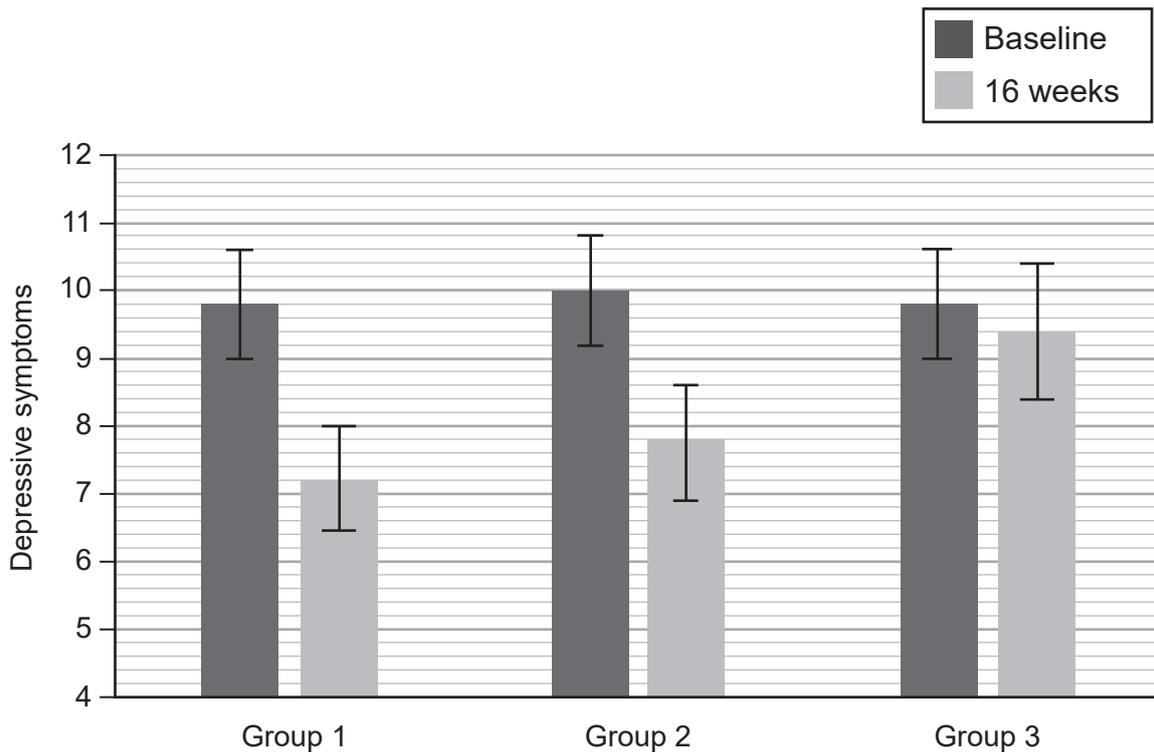
End of Option B



Option C — Physical activity and health

7. A study tested the effectiveness of exercise and antidepression medication on depressive symptoms in 95 patients. Depressive symptoms were measured by questionnaire at baseline and after 16 weeks. Participants were randomly assigned to one of three groups:
- Group 1: Exercise (3 supervised group sessions per week)
 - Group 2: Medication (50 mg of antidepression medication each day)
 - Group 3: Placebo (50 mg sugar pill each day).

The mean results are shown.



(a) (i) State the group with the largest decrease in depressive symptoms. [1]

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(Option C continues on the following page)



(Option C, question 7 continued)

- (ii) Calculate the difference in depressive symptoms at 16 weeks between the placebo and medication groups. [2]

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- (iii) Using the graph, deduce the effectiveness of the three interventions to reduce depression. [2]

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- (b) Outline how physiological responses to exercise enhance psychological well-being. [2]

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- (c) Suggest how exercise should be undertaken when used as treatment for depression. [3]

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(Option C continues on page 13)



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(Option C continued)

8. (a) List **two** modifiable risk factors for cardiovascular disease. [2]

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(b) Explain why it is important to look at **all** risk factors in cardiovascular disease. [3]

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9. (a) Describe **two** methods of determining obesity. [2]

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(b) Individuals diagnosed as obese may struggle to complete prescribed exercise programmes. Discuss the barriers preventing adherence. [3]

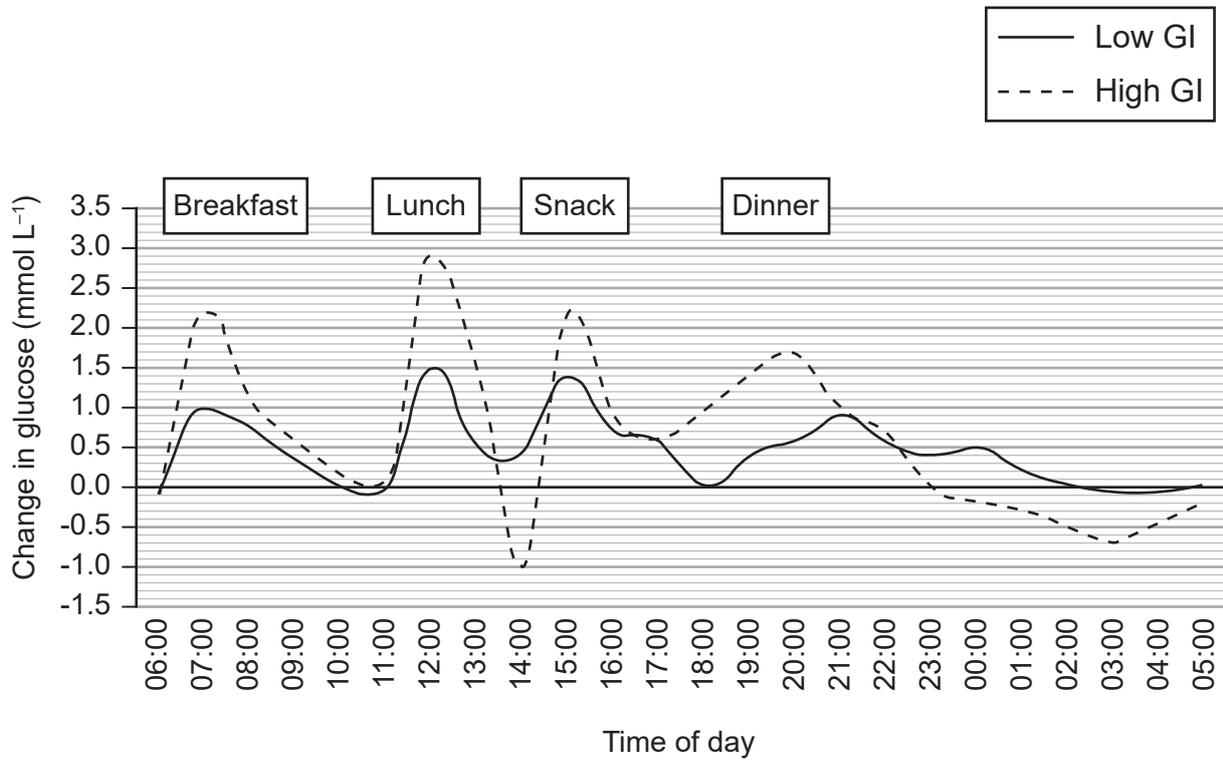
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End of Option C



Option D — Nutrition for sports, exercise and health

10. A study examined the impact of high and low glycemic index (GI) diets on blood glucose. Twelve participants followed both a high GI diet and subsequently a low GI diet for three days while having their blood glucose monitored continuously. The mean change in blood glucose (mmol L^{-1}) over 24 hours is shown.



- (a) (i) State the time of peak blood glucose for the high GI diet. [1]

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- (ii) Calculate the difference in blood glucose between high GI and low GI at 07:00. [2]

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(Option D continues on the following page)



(Option D, question 10 continued)

(iii) Using the graph, deduce the effect of a low GI diet compared to a high GI diet over a 24-hour period. [2]

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(b) Identify an example of a high GI food and a low GI food. [2]

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(c) Suggest how an ultra-endurance athlete might use high and low GI foods before, during and after competition. [3]

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(Option D continues on the following page)



(Option D continued)

11. (a) State which enzymes are responsible for the digestion of proteins. [2]

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(b) Explain the role of enzymes in the breakdown of carbohydrates and fats. [3]

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(Option D continues on the following page)



(Option D continued)

12. (a) State **two** locations in the body where extracellular fluid is found. [2]

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(b) **Explain** the differences in water distribution between a sedentary individual and an Olympic rower. [3]

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End of Option D



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20EP18

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20EP19

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References:

1. Reprinted from *Journal of Science and Medicine in Sport*, Volume 21, Issue 7 2018, Hormonal response to a non-exercise stress test in athletes with overtraining syndrome: results from the Endocrine and metabolic Responses on Overtraining Syndrome (EROS) — EROS-STRESS by Flavio A. Cadegiani, Claudio E. Kater, pages 648–653, Copyright 2018, with permission from Elsevier.
4. Reprinted from *Journal of Science and Medicine in Sport*, Vol. 21, Issue 12, Markus Gerber, Simon Best, Fabienne Meerstetter et al., Effects of stress and mental toughness on burnout and depressive symptoms: A prospective study with young elite athletes, pages 1200–1205, Copyright 2018 with permission from Elsevier.
7. Reprinted from *Journal of the American College of Cardiology*, Vol 60, C. Blumenthal, J. A., et al., Exercise and Pharmacological Treatment of Depressive Symptoms in Patients with Coronary Heart Disease, pp. 1053–1063, Copyright 2012, with permission from Elsevier.
10. Reprinted from *Journal of Clinical & Translational Endocrinology*, Vol. 4, Bhupinder Kaur, Rina Quek Yu Chin et al., The impact of a low glycaemic index (GI) diet on simultaneous measurements of blood glucose and fat oxidation: A whole body calorimetric study, pp. 45–52, Copyright 2016 with permission from Elsevier.

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