Diploma Programme
Programme du diplôme
Programa del Diploma

Sports, exercise and health science
Higher level
Paper 3

25 October 2023

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour 15 minutes

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 **[50 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

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International Baccalaureate
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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.

Key:

median is shown by the horizontal black line.
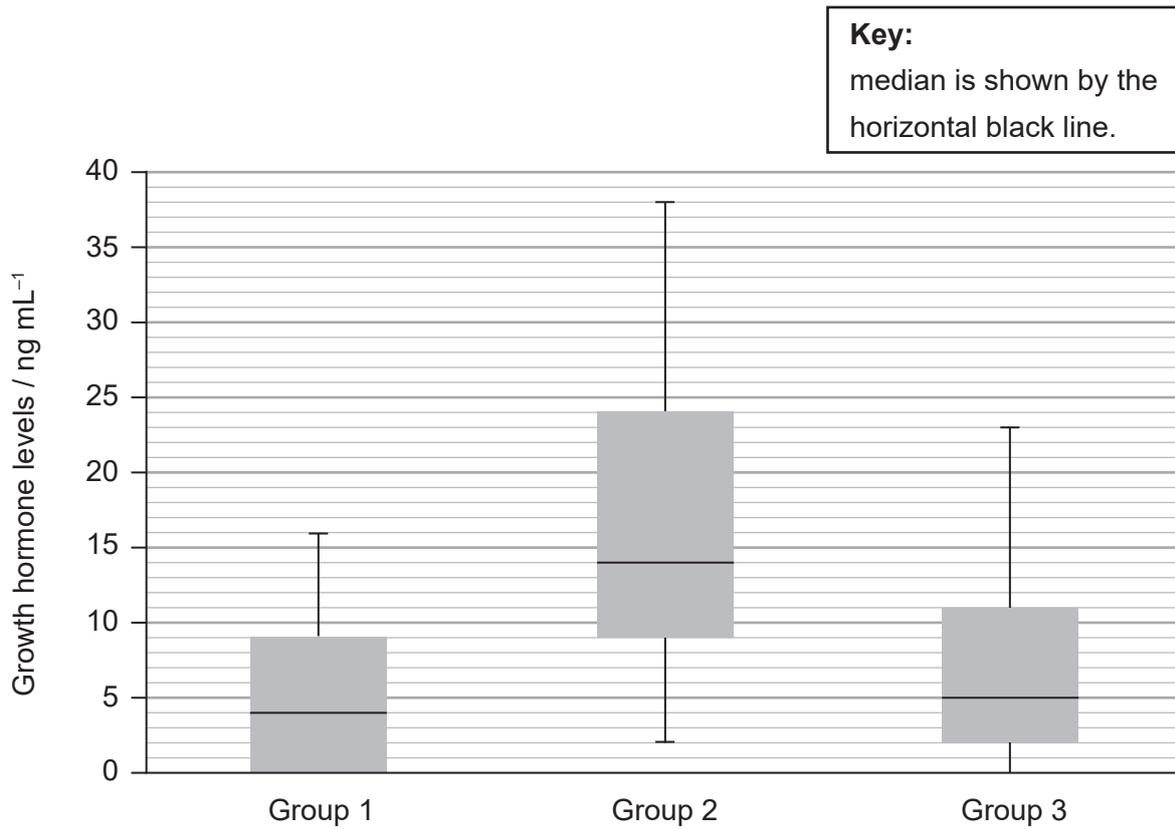
(a) (i) State the group with the lowest level of growth hormone.   [1]

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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]

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

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

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

(Option A continues on the following page)

(Option A continued)

2. (a) Outline clothing precautions for exercising in the cold. [2]

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(b) Outline proposed benefits of compression garments in sports. [2]

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(c) Discuss the use of cryotherapy after training and competition. [4]

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3. (a) State the range, in metres, that is classed as high altitude. [1]

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(Option A continues on the following page)

(Option A, question 3 continued)

(b) Identify the effects of hypoxia. [2]

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(c) Discuss approaches to altitude training. [4]

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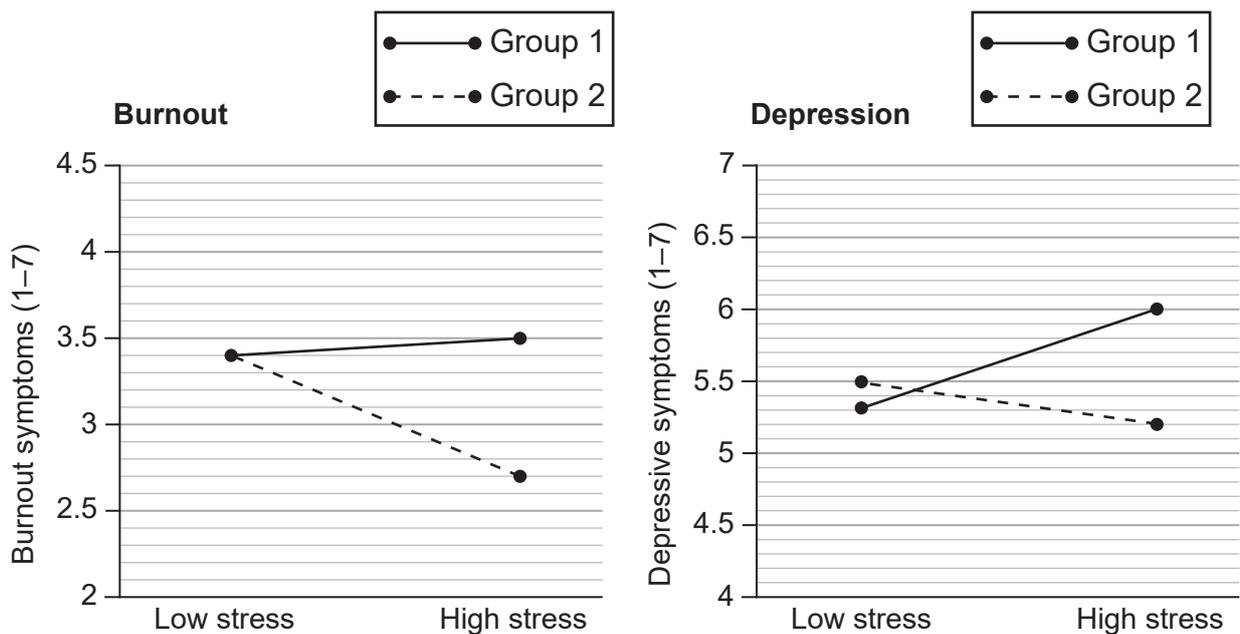
(a) (i) State the group with the fewest depressive symptoms in the high stress condition. [1]

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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]

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

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

5.   (a)   Using examples, distinguish between intrinsic and extrinsic motivation.   [2]

(Option B continues on the following page)

(Option B, question 5 continued)

(b) Outline the key features of self-determination theory. [3]

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(c) Explain why athletes with high intrinsic motivation are able to use self-regulated learning more successfully. [3]

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(Option B continues on the following page)

(Option B continued)

6. (a) Analyse the **four** stages of elite athlete development. [4]

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(b) Outline **three** reasons for the quick progression in talent development when an elite athlete transfers to a new sport. [3]

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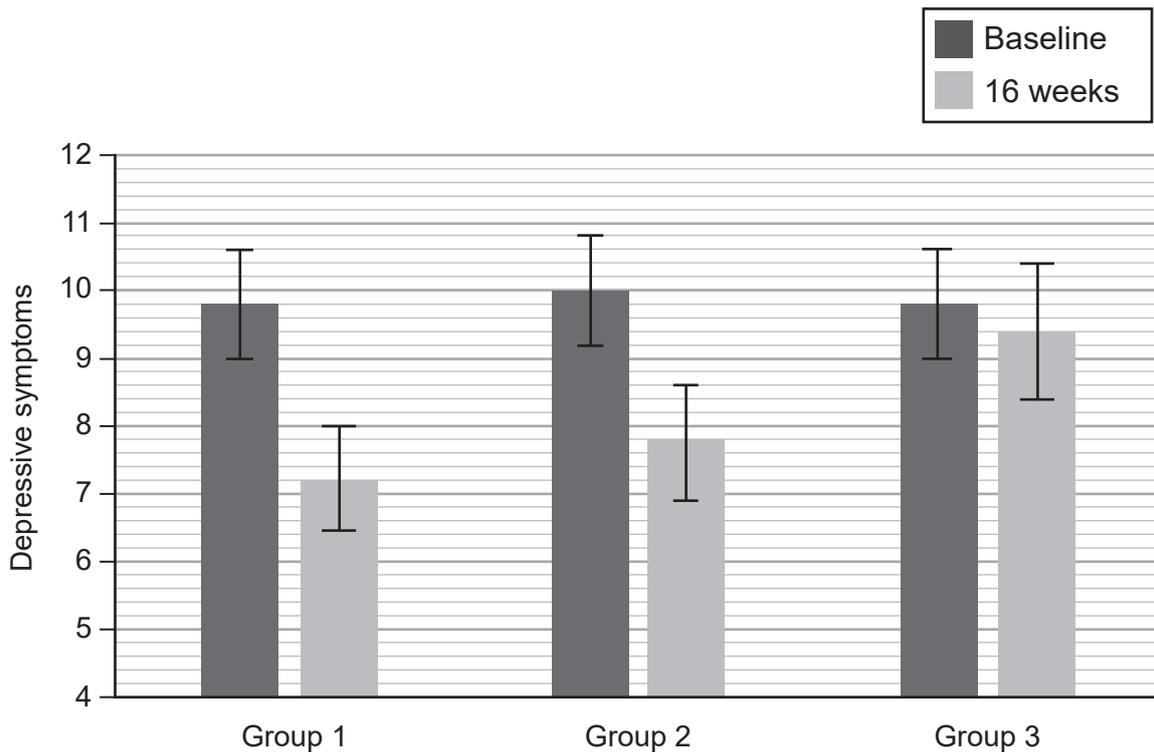
    (a) (i)   State the group with the largest decrease in depressive symptoms.   [1]

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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]

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

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

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

(Option C continues on the following page)

Turn over

(Option C continued)

8. (a) Discuss modifiable risk factors for type 2 diabetes. [2]

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(b) Using examples, distinguish between communicable and non-communicable diseases. [2]

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(c) A national health service wants to reduce the country's incidence of lung cancer from smoking. Outline how population attributable risk can be used to influence public health. [3]

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(Option C continued)

9. (a) Identify **two** common causes of running-related injuries. [2]

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(b) Suggest how a coach can reduce the risk of injury to soccer players during training. [3]

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(c) Discuss the health benefits of exercise. [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.
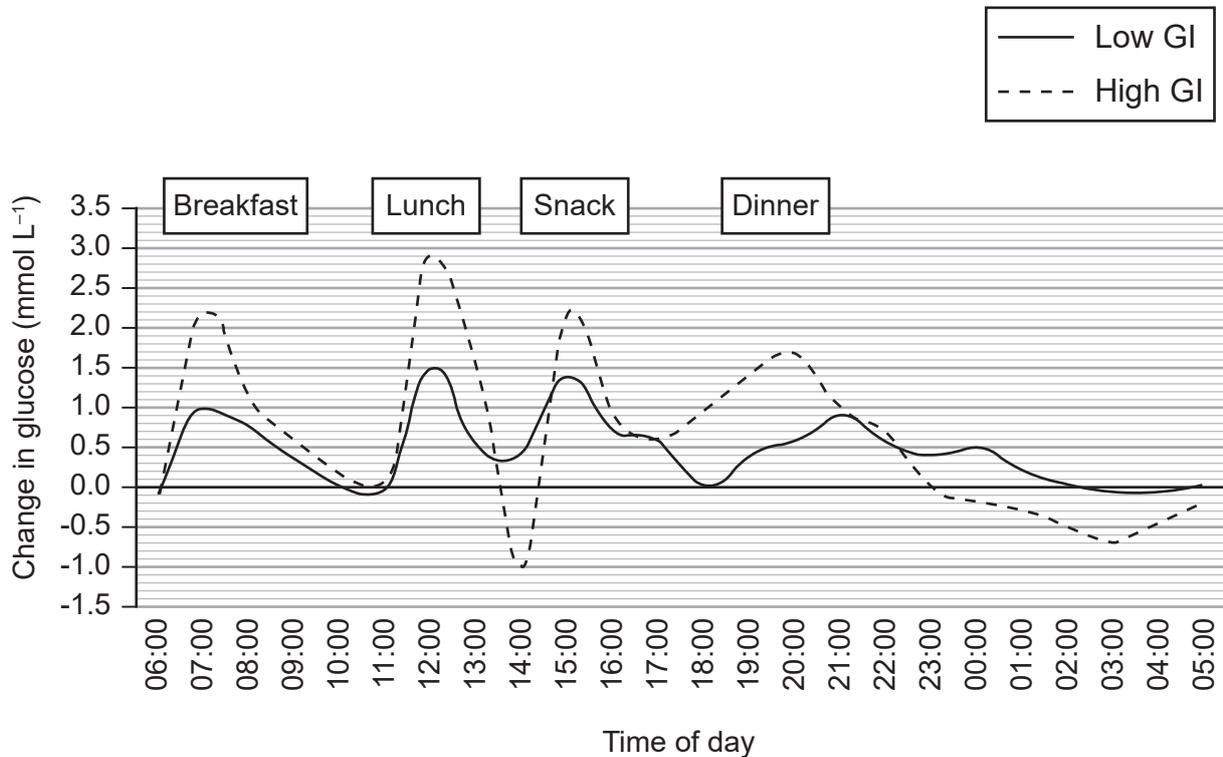
(a) (i) State the time of peak blood glucose for the high GI diet. [1]

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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]

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

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

(Option D continues on the following page)

Turn over

(Option D continued)

11. (a) Describe the absorption of glucose into the capillary network. [2]

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(b) Identify **two** causes of hypoglycemia. [2]

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(c) Describe the effect of endurance training on the cellular transport of glucose. [3]

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(Option D continues on the following page)

(Option D continued)

12. (a) State **one** food that is high in antioxidants. [1]

(b) Explain the harmful effects of free radicals at the cellular level. [3]

(c) Evaluate a nutritionist's advice to increase consumption of foods rich in antioxidants. [4]

End of Option D

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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.