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# Sports, exercise and health science

## Higher level

### Paper 3

7 November 2024

Zone A afternoon | Zone B afternoon | Zone C afternoon

Candidate session number

1 hour 15 minutes

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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 **[50 marks]**.

Option	Questions
Option A — Optimizing physiological performance	1 – 4
Option B — Psychology of sports	5 – 8
Option C — Physical activity and health	9 – 11
Option D — Nutrition for sports, exercise and health	12 – 17



**Option A — Optimizing physiological performance**

1. A study investigated the effects of different intensities of resistance training over a 12-week period. Participants engaged in resistance training at various intensities: 20 %, 40 %, 60 %, and 80 % of their one-repetition maximum (1RM).

Percentage change in muscle cross-sectional area (CSA) and strength of biceps brachii were recorded and presented in the graph shown.

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- (a) Identify which intensity of resistance training showed the greatest increase in muscle strength over the 12-week training period.

[1]

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- (b) Calculate the difference in percentage change in muscle CSA between 20 % of 1RM and 80 % of 1RM training intensities.

[1]

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**(Option A continues on the following page)**



**(Option A, question 1 continued)**

- (c) Using the data, discuss the hypothesis that lifting weights greater than 80% 1RM is necessary to increase muscle CSA. [3]

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- 2. (a) Explain how the three phases of periodization could be organised to optimise muscle strength and avoid overtraining in strength training. [4]

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- (b) Outline the possible harmful effects of using anabolic steroids. [3]

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**(Option A continues on the following page)**



**(Option A continued)**

3. Endurance athletes often use warm weather training at altitude to prepare for competitions in hot climates.

(a) State the normal physiological range for core body temperature in °C. [1]

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(b) Exercising in a hot climate can put athletes at risk of heat stress. Explain heat stroke. [3]

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(c) Outline altitude training. [2]

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(d) Describe how to prevent high-altitude illness for athletes. [3]

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**(Option A continues on the following page)**



**(Option A continued)**

4. (a) Define the term *active recovery*. [1]

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(b) Evaluate cryotherapy. [3]

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**End of Option A**



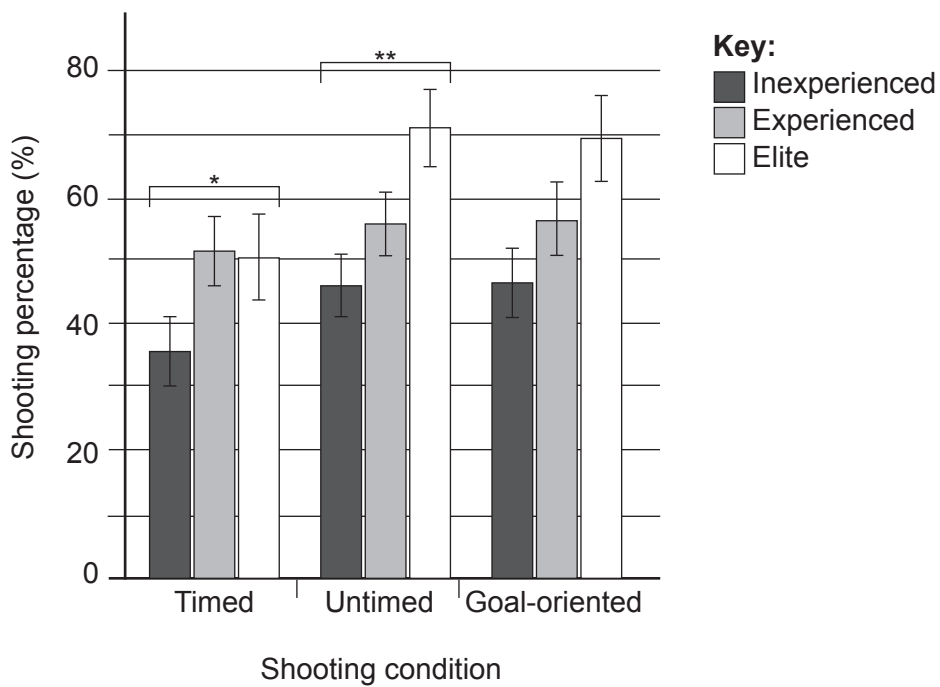
**Option B — Psychology of sports**

5. A study examined the effect of time constraints and goal-setting on the performance of basketball free-throw shooting. Participants were grouped into three categories based on their basketball skill level: elite, experienced and inexperienced.

Each group was assessed under three distinct shooting conditions:

- Timed condition: Successful free-throws recorded in a 30-second timeframe.
- Untimed condition: Attempt the same number of free-throws as in the Timed condition, without time pressure.
- Goal-oriented condition: Within a 30-second timeframe, players aimed to surpass their highest number of successful free-throws.

The graph shows the shooting percentages of the players for the three shooting conditions.



\*  $p < 0.05$  compared to goal-oriented condition  
\*\*  $p > 0.05$  compared to goal-oriented condition

(a) Identify the group that showed the smallest percentage change from the timed to the untimed condition.

[1]

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(Option B continues on the following page)



**(Option B, question 5 continued)**

- (b) Calculate the difference in shooting percentage for the elite players between the timed and goal-oriented conditions.

[1]

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- (c) Using the data, discuss the effect of a goal-oriented condition on shooting performance under time constraints.

[3]

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**(Option B continues on the following page)**





**(Option B continued)**

6. (a) Describe **five** principles of effective goal-setting in sports performance. [5]

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(b) Outline the role of goal-setting in the process of self-regulated learning (SRL) for athletes. [3]

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**(Option B continues on the following page)**



**(Option B continued)**

7. (a) Define the term *personality*. [1]

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(b) Discuss the Interactionist Theory and how it relates to the reactions of players in competitive sports. [4]

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**(Option B continues on page 11)**



Please **do not** write on this page.

Answers written on this page  
will not be marked.



**(Option B continued)**

8. (a) Outline the term *talent*.

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(b) Discuss the potential opportunities, behaviours and obstacles during evolution of talent for athlete development.

[6]

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**End of Option B**



**Option C — Physical activity and health**

9. A study investigated the effect of three 16-week treatments on people with mild to moderate depression. Participants were divided into three treatment groups:
- Medication Only: Patients were given a type of antidepressant medication.
  - Exercise and Medication: Patients did regular exercise and also took antidepressant medication.
  - Exercise Only: Patients only did regular exercise.

At the end of the 16-week treatment, participants were monitored for a six-month period.

The graph shows the percentage of patients who experienced depression during the six-month period post-treatment.

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- (a) State the percentage of patients who experienced depression within six months post-treatment for the Exercise and Medication group. [1]

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- (b) Calculate the difference in the percentage of patients who experienced depression within the six-month period post-treatment between the Medication Only group and the Exercise Only group. [1]

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**(Option C continues on the following page)**



**(Option C, question 9 continued)**

- (c) Using the data, discuss the hypothesis that exercise lowers the percentage of patients experiencing depression six months post-treatment.

[3]

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**10.** Hypokinetic diseases are a growing concern in modern society. Understanding effective strategies for their prevention and management is essential for promoting overall health.

- (a) Define the term *hypokinetic disease*.

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- (b) Discuss the concept of energy balance as it relates to hypokinetic disease.

[3]

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**(Option C continues on the following page)**



**(Option C, question 10 continued)**

(c) Outline **three** aims of exercise for individuals with a hypokinetic disease. [3]

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(d) Outline the purpose of calculating population attributable risk (PAR). [1]

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(e) Explain **six** major societal changes that have led to an increase in hypokinetic disease. [6]

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**(Option C continues on the following page)**



**(Option C continued)**

**11.** In competitive sports, athletes often face a range of physical challenges and risks.

(a) Outline **four** common causes of running-related injuries in football (soccer). [4]

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(b) Identify **two** potential causes of sudden cardiac death in athletes. [2]

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**End of Option C**





**Option D — Nutrition for sports, exercise and health**

12. Researchers investigated how elite cyclists’ bodies utilize carbohydrates during exercise by comparing carbohydrate oxidation rates from an energy bar, against an energy drink.

Cyclists were divided into two groups:

- Group 1: Energy bar
- Group 2: Energy drink

The graph shows the carbohydrate oxidation rate ( $\text{g min}^{-1}$ ) for both bar and drink groups during exercise.

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- (a) State the group with the highest carbohydrate oxidation rate ( $\text{g min}^{-1}$ ) at 15 minutes of exercise.

[1]

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- (b) Calculate the difference in carbohydrate oxidation rates ( $\text{g min}^{-1}$ ) between the energy bar group and energy drink group at 120 minutes.

[1]

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(Option D continues on the following page)



**(Option D, question 12 continued)**

- (c) Using the data, discuss the hypothesis that consuming an energy drink leads to a greater carbohydrate oxidation rate ( $\text{g min}^{-1}$ ) than an energy bar. [3]

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- 13.** Following on from the study, the researchers considered introducing caffeine. Outline why they hypothesised that pre-exercise caffeine improves endurance cycling performance. [2]

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**(Option D continues on the following page)**



**(Option D continued)**

**14.** (a) State **two** reasons why humans cannot live without water for a prolonged period of time. [2]

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(b) Explain how a negative feedback mechanism maintains water balance when a person is dehydrated. [4]

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(c) Dehydration is a negative acute side effect of alcohol consumption, outline **two** other negative effects of alcohol on the body. [2]

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**15.** Describe the function of enzymes in the context of macronutrient digestion. [2]

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**(Option D continues on the following page)**



**(Option D continued)**

**16.** Explain how training influences an athlete's ability to take in glucose at the cellular level. [3]

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**17. (a)** Describe free radical production during exercise. [2]

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**(b)** Discuss the use of antioxidant supplementation for combating the effects of free radicals. [3]

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**End of Option D**



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**References:**

5. Kostrna, J., June 28, 2022. Effects of Time Constraints and Goal Setting on Basketball Shooting. *Frontiers in Psychology*, vol. 13. Available at: <https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2022.923061/full> [Accessed 1 December 2024]. Source adapted.

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