Diploma Programme
Programme du diplôme
Programa del Diploma

# Sports, exercise and health science
# Higher level
# Paper 3

25 April 2024

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

Candidate session number

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

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 – 5 |
| Option B — Psychology of sports | 6 – 9 |
| Option C — Physical activity and health | 10 – 12 |
| Option D — Nutrition for sports, exercise and health | 13 – 15 |

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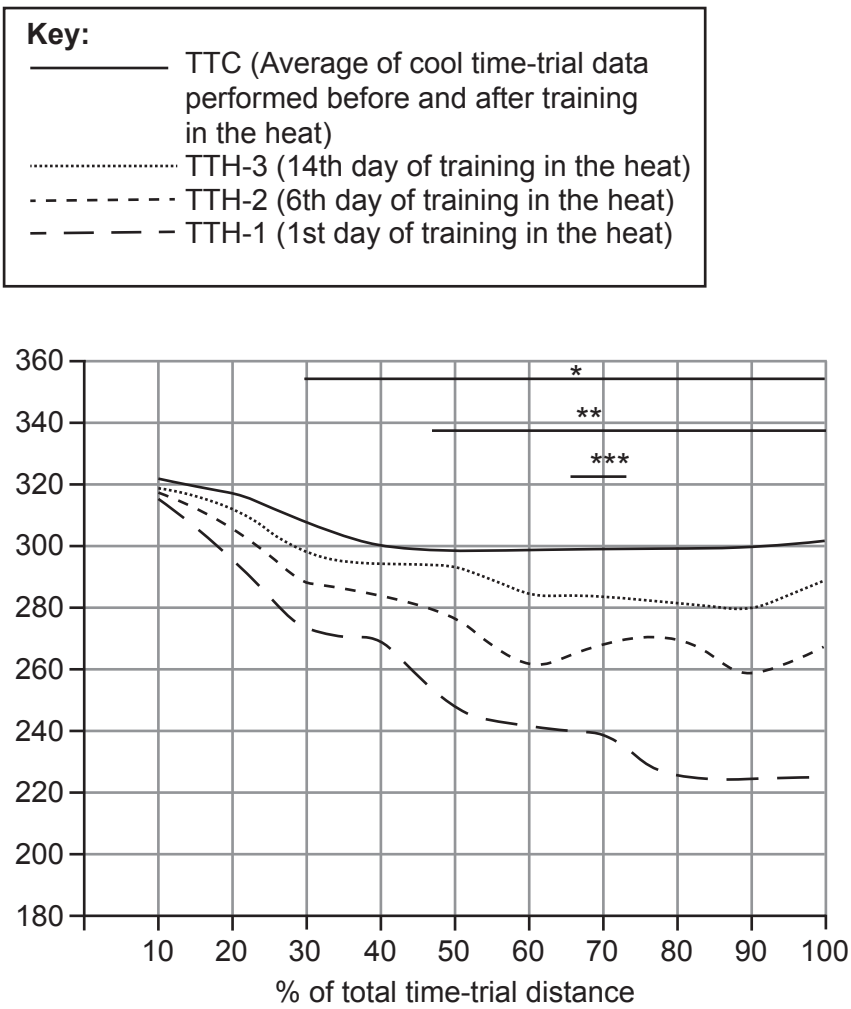
25 pages

**Option A — Optimizing physiological performance**

**1.** A study compared the performance of nine cyclists in hot and cool conditions. Cyclists performed a 43.4 km time trial in cool conditions (TTC) at the beginning and end of a 15-day training period. During the training period, the cyclists performed three time trials in hot ambient conditions (TTH).

Power output (W) was recorded every 4.34 km (10 % of the time-trial distance). Power data from the TTHs were compared with the average of the two TTCs.

**Figure 1: Power data recorded from the time trials in hot and cool conditions**




*TTH-1 vs TTC: $p < 0.001$
**TTH-2 vs TTC: $p = 0.003$
***TTH-3 vs TTC: $p = 0.042$

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

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

(a) State the power output (W) of TTH-2 at 45 % of time-trial distance. [1]

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(b) Using the data, discuss the power output during the time trials in hot conditions. [3]

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(c) Deduce the effect of the 15-day training period in hot conditions. [1]

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

**(Option A continued)**

**2.** An international multi-sport event takes place in a city where daytime temperatures commonly exceed 30 °C and humidity can be between 60 % and 80 %.

(a) A road cyclist arrives in the city two weeks before their event. Describe **two** ways that they can prevent heat stress. [2]

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(b) Outline how a marathon runner's body can thermoregulate through evaporation when racing in a hot environment. [1]

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(c) Discuss heat exhaustion as a potential risk of competing in a triathlon when daytime temperatures exceed 30 °C. [3]

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

**(Option A continued)**

**3.** (a) Define the term *hypoxia*. [1]

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(b) Altitude training can be used to maximize performance. Describe live high, train low (LHTL) as a method of altitude training for individual athletes. [3]

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**4.** (a) Describe the effect of active recovery on lactate removal immediately after plyometric training. [2]

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(b) Many athletes use cryotherapy to aid their recovery and performance. Discuss the potential negative effects of using cryotherapy. [3]

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**(Option A continues on page 7)**

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will not be marked.

**(Option A continued)**

**5.** (a) Define the term *ergogenic aid*. [1]

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(b) Evaluate the effects of long-term caffeine use on a decathlete. [4]

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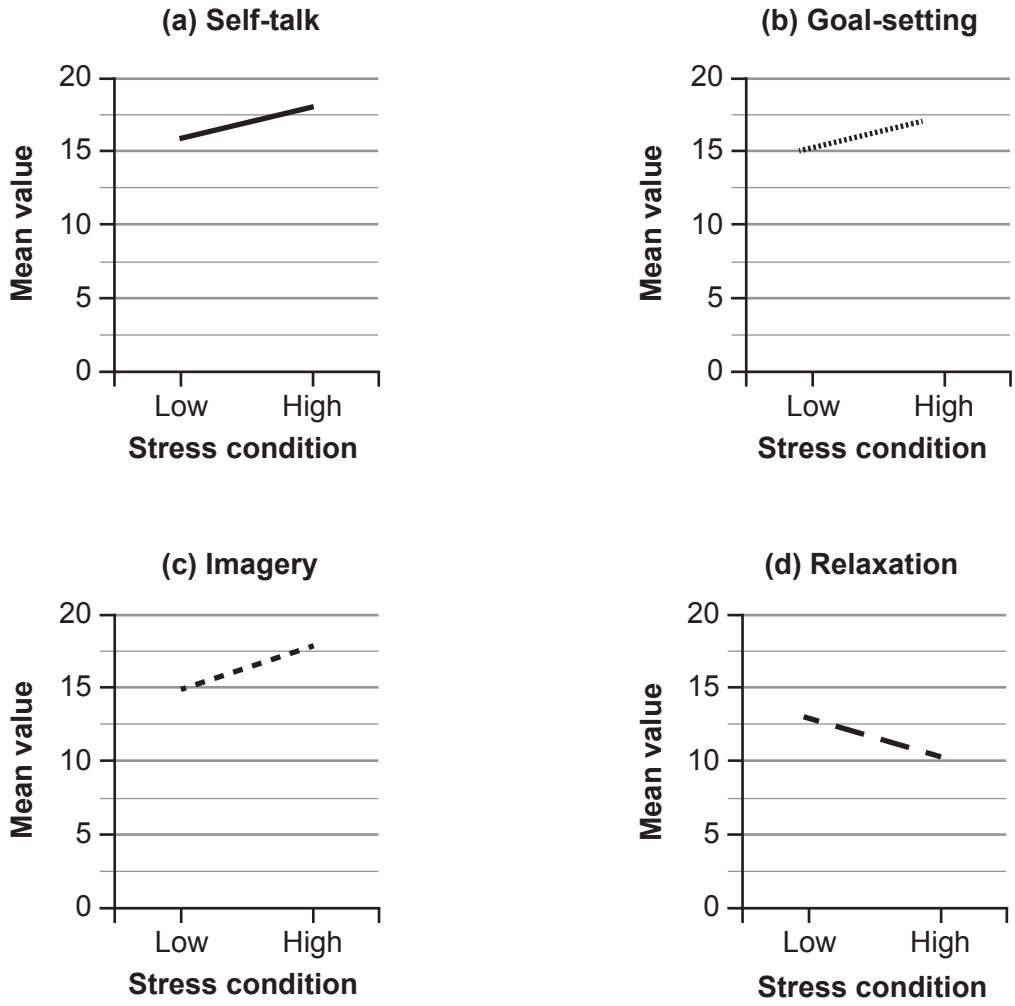
## End of Option A

**Option B — Psychology of sports**

**6.** A study investigated elite table tennis players' use of four psychological skills (relaxation, imagery, goal-setting and self-talk) during low- and high-stress situations in competition. Individuals completed a self-report questionnaire.

**Figure 2: Overall mean results from the questionnaires**




(a) State the mean value for self-talk during the high-stress condition. [1]

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

**(Option B, question 6 continued)**

(b) Calculate the difference between the mean values of imagery for low-stress and high-stress conditions. [2]

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(c) Compare and contrast the effect of stress condition during competition on the mean values of the four psychological skills investigated in this study. [1]

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(d) The study investigated the use of self-talk during stressful situations. Identify **one** cognitive strategy that can be used to block distractions before playing a match-winning point. [1]

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

**(Option B continued)**

**7.** (a) Some professional athletes earn large sums of money. Discuss why this may not aid their performance. [3]

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(b) To maintain their confidence after a defeat, describe how a tennis player may shift the stability and locus of causality to attribute reasons for that defeat. [3]

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(c) Discuss the impact of motivation on the three phases of the self-regulated learning framework. [3]

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

**(Option B continued)**

**8.** (a) Define the term *talent*. [1]

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(b) A gymnast's performance has plateaued. Suggest how having the same coach for many years will influence the gymnast's progression through the stages of talent development. [3]

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(c) Outline the talent transfer of a gymnast to a second sport. [3]

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**(Option B continues on page 13)**

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**(Option B continued)**

**9.** Explain the issues in personality research and sports performance of athletes. [4]

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## End of Option B

**Option C — Physical activity and health**

**10.** A study compared lipid profiles and waist-to-hip ratios of participants who engaged in a minimum of 150 minutes of either aerobic or anaerobic exercise each week.

**Table 1: Mean (±SD) data for the participants**

| | Aerobic exercise | Anaerobic exercise | *p*-value |
|---|---|---|---|
| **Waist-to-hip ratio** | $0.83 \pm 0.05$ | $0.79 \pm 0.06$ | 0.038 |
| **Triglycerides / mg dl$^{-1}$** | $1.03 \pm 0.63$ | $1.16 \pm 0.48$ | 0.433 |
| **High-density lipoprotein (HDL) cholesterol / mg dl$^{-1}$** | $1.47 \pm 0.73$ | $1.86 \pm 0.86$ | 0.047 |
| **Low-density lipoprotein (LDL) cholesterol / mg dl$^{-1}$** | $2.18 \pm 0.89$ | $2.11 \pm 0.95$ | 0.746 |
| **Total cholesterol / mg dl$^{-1}$** | $4.12 \pm 0.86$ | $4.48 \pm 0.97$ | 0.119 |

(a) Calculate the percentage of low-density lipoprotein (LDL) cholesterol out of the total cholesterol for participants who engaged in anaerobic exercise. [2]

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(b) Using the data in **Table 1**, deduce the relationship between type of exercise and general health. [3]

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

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

(c) Distinguish body mass index (BMI) and waist circumference as measures of obesity. [2]

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(d) For many people, their fitness club usage decreases a few months after joining. Describe **two** approaches a fitness club can introduce to encourage members to exercise more regularly. [2]

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**(Option C continues on page 17)**

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

(e) Explain low levels of high-density lipoprotein (HDL) cholesterol as a risk factor for cardiovascular disease. [3]

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(f) Outline **two** risk factors for sudden cardiac death (SCD) in athletes. [2]

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

**(Option C continued)**

**11.** A study concluded that a link exists between lower testosterone levels attributed to age and the risk of injury in baseball players. For participants over the age of 70, vertebral fracture was attributable to age in approximately 46 % of women and 33 % of men.

(a) Discuss these data in terms of the overall population attributable risk (PAR). [3]

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(b) Outline a possible cause of a compression injury in baseball. [1]

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(c) Explain how coaches and officials have a role to play in reducing the risk of sports-related injuries for baseball players. [4]

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

**(Option C continued)**

**12.** Doctors commonly prescribe exercise for older people to help them maintain good health. Describe **three** health hazards faced by older people when participating in cross-country skiing. [3]

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## End of Option C

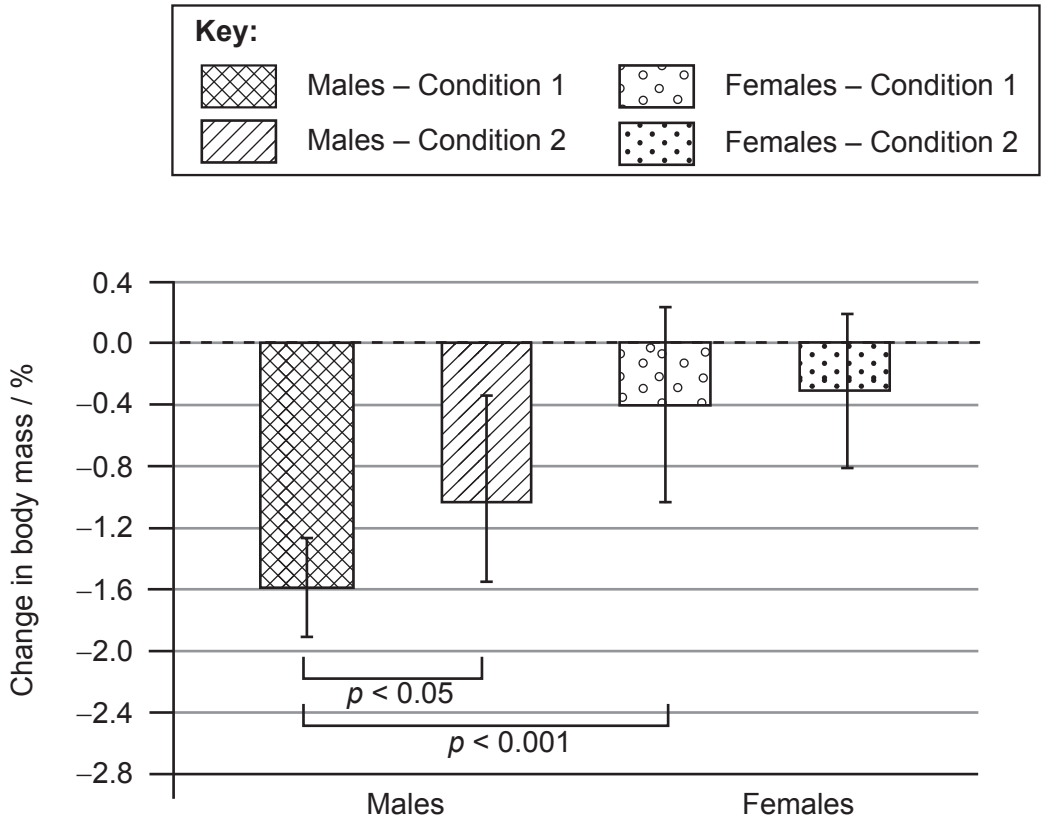
**Option D — Nutrition for sports, exercise and health**

**13.** A study compared the hydration status of 7 female and 7 male 16-year-old elite soccer players after two training sessions. Fluid loss was measured by change in body mass.

- **Condition 1:** Participants drank as much water as they wanted during the first training session.
- **Condition 2:** Participants drank water equivalent to 70 % of the water lost through sweat during the first training session.

**Figure 3: Mean results for (a) change in body mass; (b) amount of water drunk as a proportion of body mass; (c) sweat loss as a proportion of body mass**

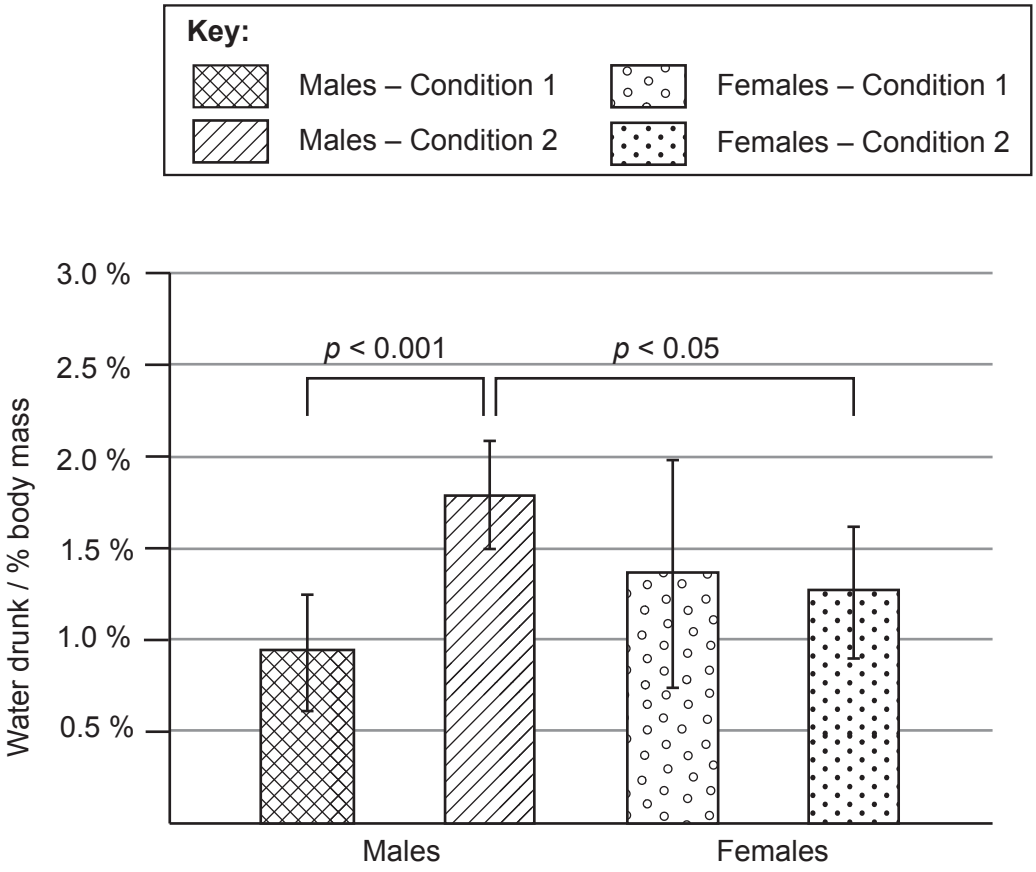
**(a) Change in body mass**




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

**(Option D, question 13 continued)**

**(b) Amount of water drunk as a proportion of body mass**

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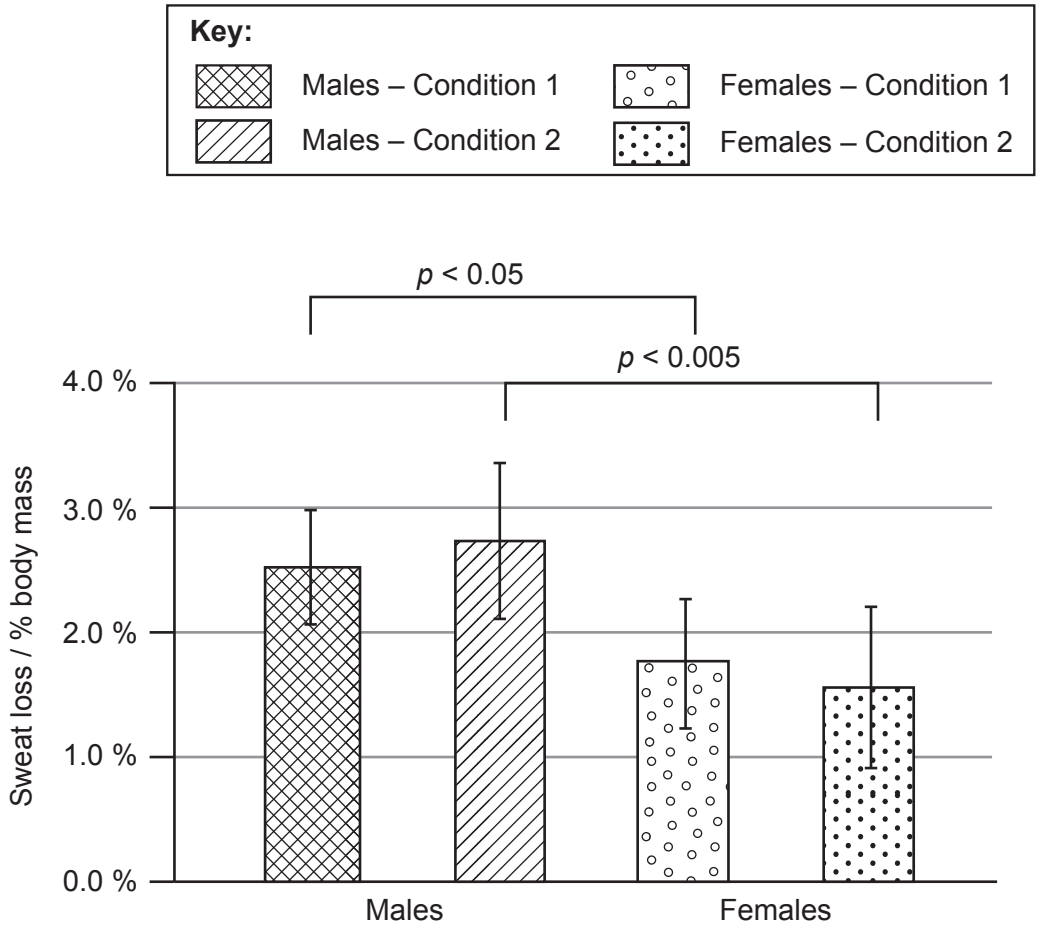
**(Option D, question 13 continued)**

**(c) Sweat loss as a proportion of body mass**




(a) (i) Identify which of the two conditions created the larger change in body mass. [1]

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(ii) Calculate the difference in percentage of body mass loss between Condition 1 and Condition 2 for the males in the study. [2]

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

**(Option D, question 13 continued)**

(iii) Using the data in **Figure 3**, suggest the relationship between the water drunk and the overall level of dehydration. [2]

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(iv) State **one** method for monitoring the hydration status of an athlete that was not used in this study. [1]

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(b) A soccer game lasts 90 minutes, with a break in the middle. Explain why soccer players require a high water intake during a game. [3]

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

**(Option D, question 13 continued)**

(c) At the end of a 90-minute match, a soccer player consumes a sports drink with a high sodium content. Discuss the effectiveness of this drink on the hydration levels within the body. [2]

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(d) Outline **three** short-term effects of excess alcohol consumption on athletic performance. [3]

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**14.** Analyse the effect of training on an athlete's ability to take in glucose at the cellular level. [3]

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

**(Option D continued)**

**15.** Many foods are sources of antioxidants that are consumed as part of a balanced diet.

(a) Identify **one** vitamin that has antioxidant properties. [1]

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(b) Describe oxidative stress. [4]

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

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## End of Option D

**Disclaimer:**

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**References:**


**1.** Racinais, S., Périard, J. D., Karlsen, A. and Nybo, L., 2015. Effect of heat and heat acclimatization on cycling time trial performance and pacing. *Medicine and Science in Sports Exercise*, 47(3), pp. 601–606. Source adapted.

**6.** Hagan, J. E. Jr., Pollmann, D. and Schack, T., 2017. Elite athletes' in-event competitive anxiety responses and psychological skills usage under differing conditions. *Frontiers in Psychology*, 8(2280). doi: 10.3389/fpsyg.2017.02280. Source adapted.

**10.** Ikekpeazu, J. E., Oranwa, J. C., Ogbu, I. S., Onyekwelu, K. C., Esom, E. A. and Ugonabo, M. C., 2017. Lipid profile of people engaged in regular exercise. *Annals of Medical and Health Sciences Research*, 7, pp. 36–39. Source adapted.

**13.** Francescato, M. P., Venuto, I., Buoite, A., Stel, G., Mallardi, F. and Cauci, S., 2019. Sex differences in hydration status among adolescent elite soccer players. *Journal of Human Sport and Exercise*, 14(2), pp. 265–280. Source adapted.

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