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Sports, exercise and health science

Standard level

Paper 3

25 April 2024

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 – 4
Option B — Psychology of sports	5 – 7
Option C — Physical activity and health	8 – 10
Option D — Nutrition for sports, exercise and health	11 – 13

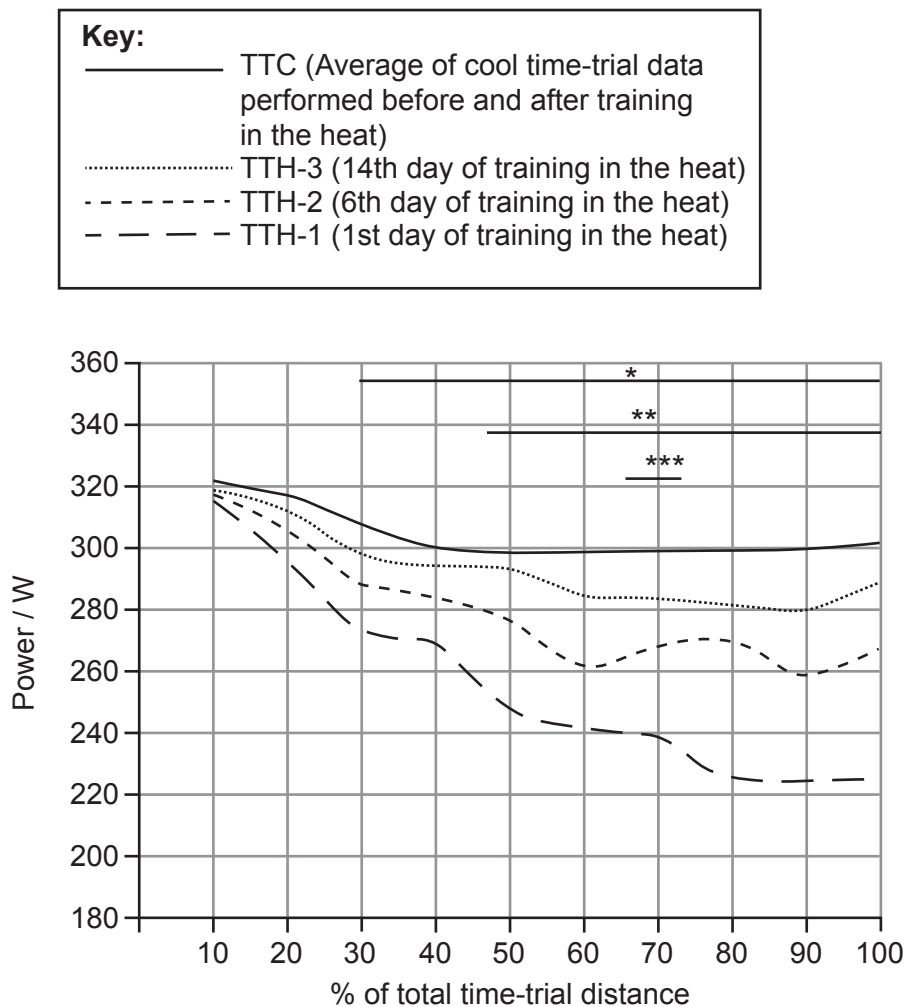


Option A — Optimizing physiological performance

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. Coaches strive to maximize athletic performance but must also manage athlete workload.

(a) Distinguish between overtraining and overreaching.

[1]

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(b) A swimmer has a sudden and unexpected decrease in performance. Outline **three** ways a coach could monitor the swimmer for indicators that their training programme may be too challenging.

[3]

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(Option A continues on page 7)



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(Option A continued)

4. (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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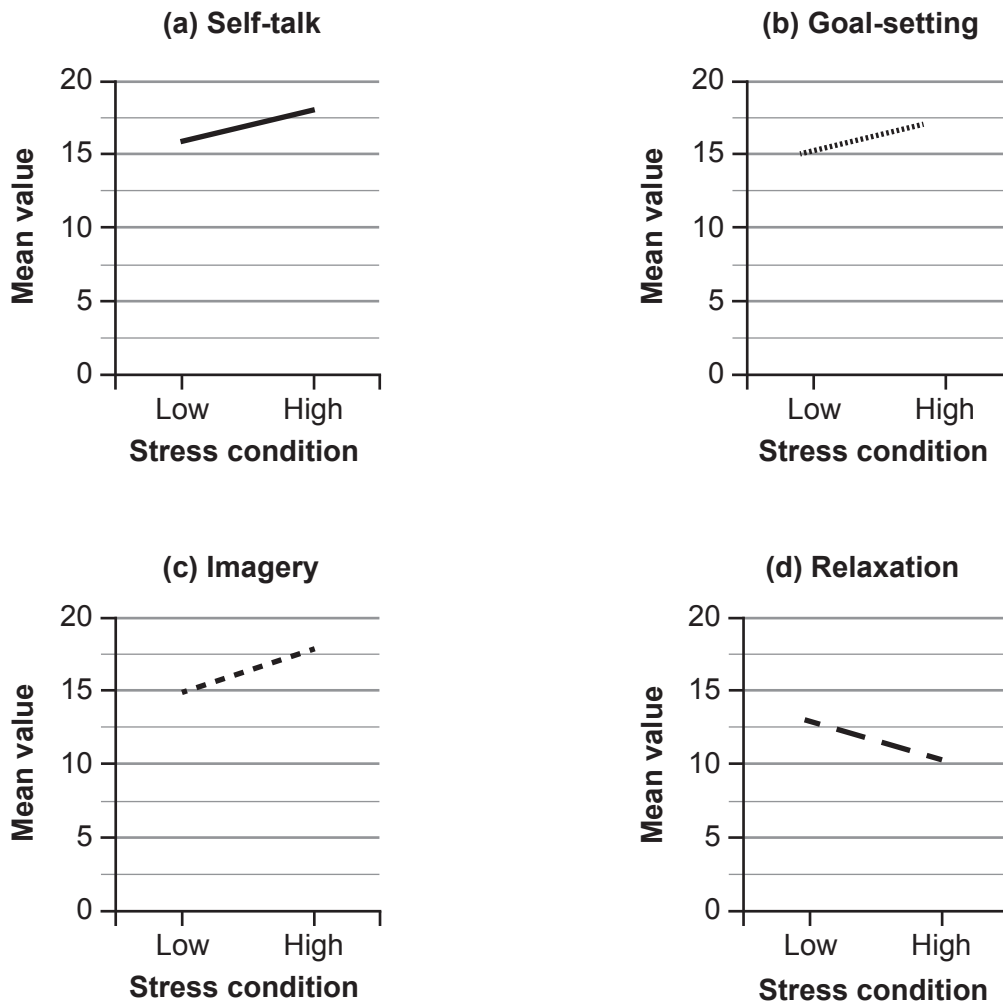
End of Option A



Option B — Psychology of sports

5. 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) (i) 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 5 continued)

- (ii) Calculate the difference between the mean values of imagery for low-stress and high-stress conditions.

[2]

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- (iii) 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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- (iv) 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, question 5 continued)

(b) Define the term *anxiety*.

[1]

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(c) Outline progressive muscular relaxation (PMR) as a technique that may be used by table tennis players to reduce anxiety.

[1]

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(d) Discuss the three phases of a psychological skills training (PST) programme.

[3]

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(Option B continues on the following page)



(Option B continued)

6. (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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7. Explain the issues in personality research and sports performance of athletes.

[4]

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End of Option B



24EP11

Turn over

Option C — Physical activity and health

8. 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 (\pm SD) data for the participants

	Aerobic exercise	Anaerobic exercise	<i>p</i>-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]

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

[3]

(Option C continues on the following page)



(Option C, question 8 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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- (e) Explain low levels of high-density lipoprotein (HDL) cholesterol as a risk factor for cardiovascular disease. [3]

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(Option C continues on page 15)



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(Option C continued)

9. Outline **two** effects of starting to train for a 5 km running race on the overall mood of an individual. [2]

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10. (a) State when the greatest gain in bone mass occurs during a human lifetime. [1]

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- (b) Explain why tall, slim people are more at risk of osteoporosis. [1]

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- (c) Discuss how the relationship between physical activity and bone health can improve bone development during adolescence. [4]

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End of Option C



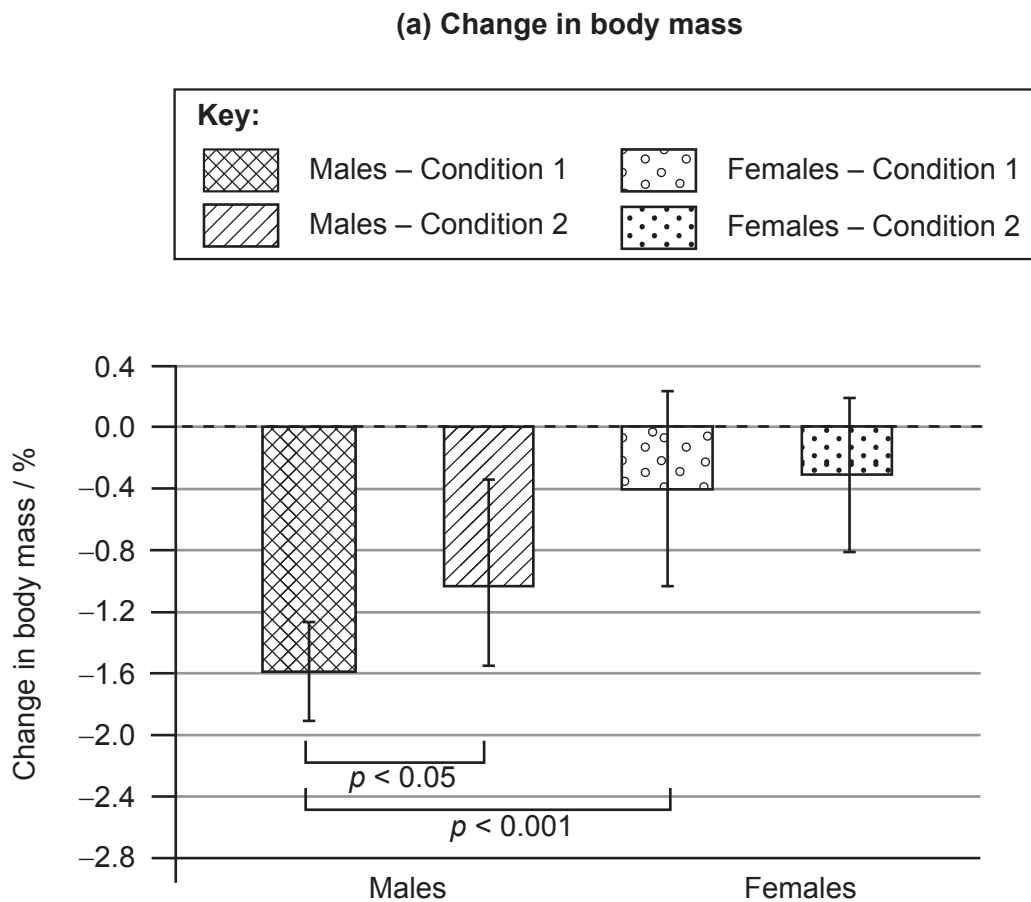
24EP15

Turn over

Option D — Nutrition for sports, exercise and health

11. 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

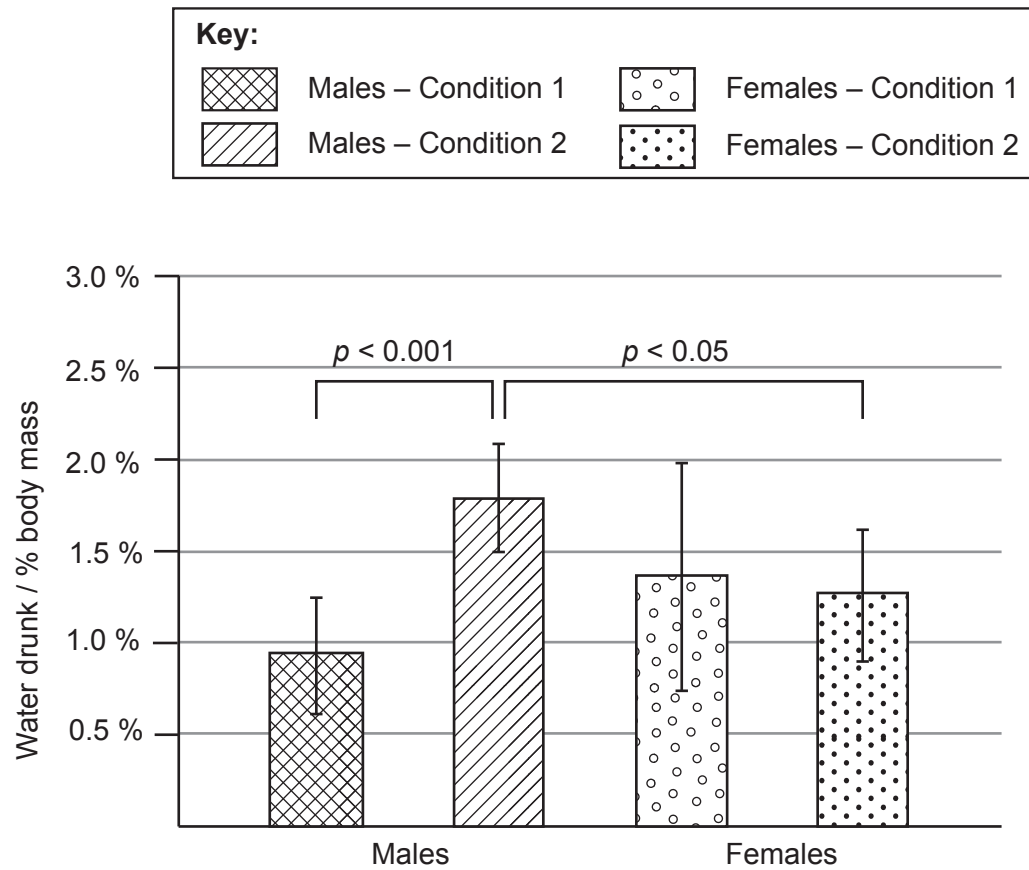


(Option D continues on the following page)



(Option D, question 11 continued)

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

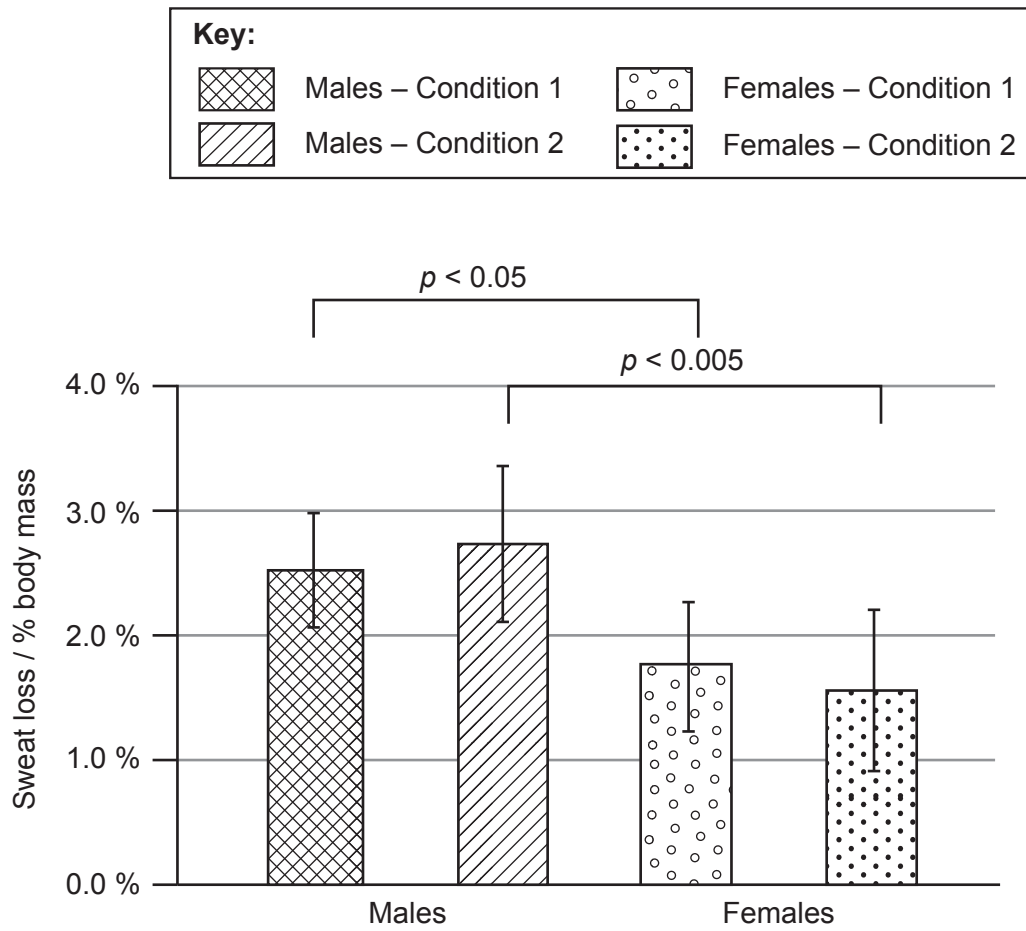


(Option D continues on the following page)



(Option D, question 11 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 11 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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- (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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(Option D continues on the following page)



(Option D continued)

12. (a) Basal metabolic rate and amount of physical activity are components of daily energy expenditure. State the third component. [1]

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- (b) Compare and contrast the body composition of sprint athletes and endurance athletes. [2]

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(Option D continues on the following page)



(Option D continued)

13. The digestive system plays a role in providing essential nutrition for athletes.

- (a) The mouth, esophagus and stomach are principal components of the digestive system. Outline the roles of **four** other principal components of the digestive system. [4]

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- (b) Giving an example, explain the role of an enzyme in the lower digestive system. [2]

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End of Option D



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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.
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8. 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.
11. 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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24EP22

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24EP23

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