Diploma Programme
Programme du diplôme
Programa del Diploma

Sports, exercise and health science
Higher level
Paper 2

Thursday 19 May 2022 (morning)

Candidate session number

2 hours 15 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[90 marks]**.

2222 – 6602

19 pages

Section A

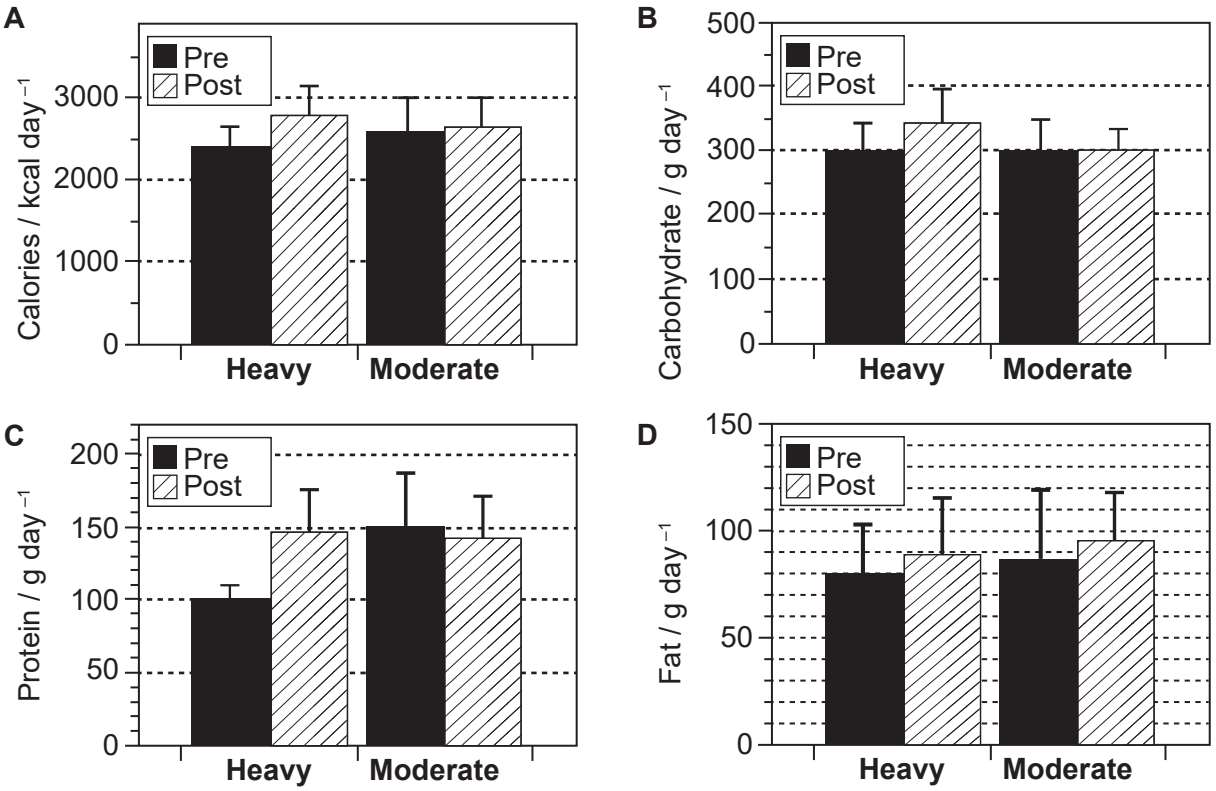
Answer **all** questions. Answers must be written within the answer boxes provided.

1. A study investigated the impact of heavy and moderate load-resistance training on nutritional intake. Nineteen resistance-trained athletes were randomly assigned to one of two groups:

- **Heavy training load** group: Trained in a loading range of 90–95% of 1 repetition maximum (1RM); 2–4 repetitions per set;
- **Moderate training load** group: Trained in a loading range of 80–85% of 1RM; 8–12 repetitions per set.

Both groups performed 3 sets of 7 exercises for the major muscle groups of the upper and lower body. Training took place 3 days a week for 8 weeks. The nutritional intake of participants was monitored during the study.

Figure 1: Nutritional intake pre- and post-intervention for the heavy and moderate training load groups, showing mean (±SD)



(a) (i) Identify the training method and nutritional component that indicated the greatest proportional change pre- and post-intervention. [1]

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(Question 1 continued)

(ii) Calculate the difference in fat intake pre- and post-testing for the heavy training load group. [2]

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(iii) With reference to **Figure 1**, discuss the effect of heavy and moderate training load on carbohydrate intake. [2]

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(iv) The results in **Figure 1** are inconclusive for fat intake in the moderate training load group. Outline the statistical reasons for this finding. [2]

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(v) Outline **two** reasons for differences in protein intake between the heavy and moderate training load groups. [2]

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(Question 1 continued)

(b) State the composition of a molecule of triacylglycerol. [1]

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(c) (i) Identify **one** fitness component that the study cited in Question 1 is designed to improve. [1]

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(ii) Explain the benefits of field fitness tests. [4]

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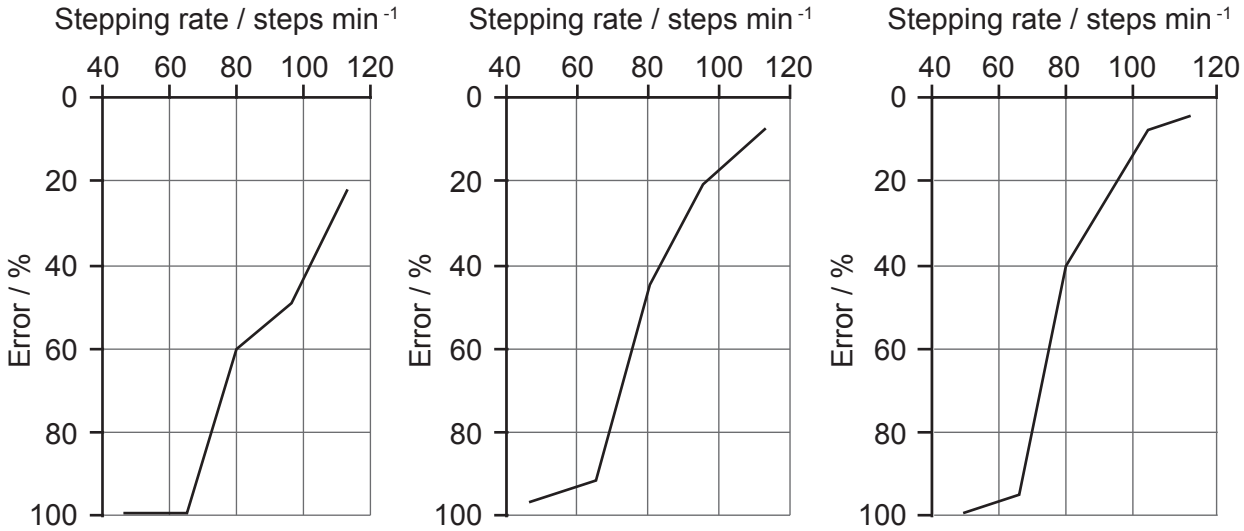
2. A study investigated the accuracy of a pedometer (a device used to record the number of steps) worn by ten participants during a bench-stepping exercise. Participants were also filmed during each exercise to obtain an accurate reading of steps for comparison with the pedometer data.

The participants performed stepping exercises on benches of 10, 20, and 30 cm height at rates of 40, 60, 80, 100, and 120 steps per minute. Error was calculated by comparing the actual steps taken with the pedometer estimates. The results are summarized in **Figure 2**.

Figure 2: Error percentage for stepping rate at each bench height



A Bench height: 10 cm **B** Bench height: 20 cm **C** Bench height: 30 cm

(a) Identify the bench height that has the greatest percentage error at 120 steps per minute. [1]

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(b) Calculate the percentage error difference between the 10 cm bench and the 30 cm bench at 80 steps per minute. [2]

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3. (a) Define the term *fatigue* in sport. [1]

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(b) Explain **two** possible physiological causes of fatigue during a maximal push-ups test. [2]

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(c) A chronic adaptation of aerobic training is an increase in hemoglobin. Outline how this adaptation would benefit an athlete running a marathon. [4]

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4. (a) Identify the bone type of the scapula. [1]

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(b) The diagram shows a gymnast holding a position called an iron cross.

Discuss the response of systolic and diastolic blood pressure to this static position. [3]

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5. (a) Define the term *centre of mass*. [1]

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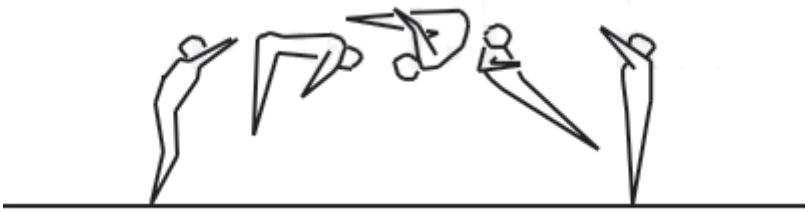
(b) The diagram shows a gymnast performing a piked somersault.



Explain the manipulation of the moment of inertia during the flight and landing phases. [4]

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(Question 5 continued)

(c) The diagram shows a speed skater.

Apply the concept of the coefficient of static friction and dynamic friction to the start of a speed-skating sprint. [2]

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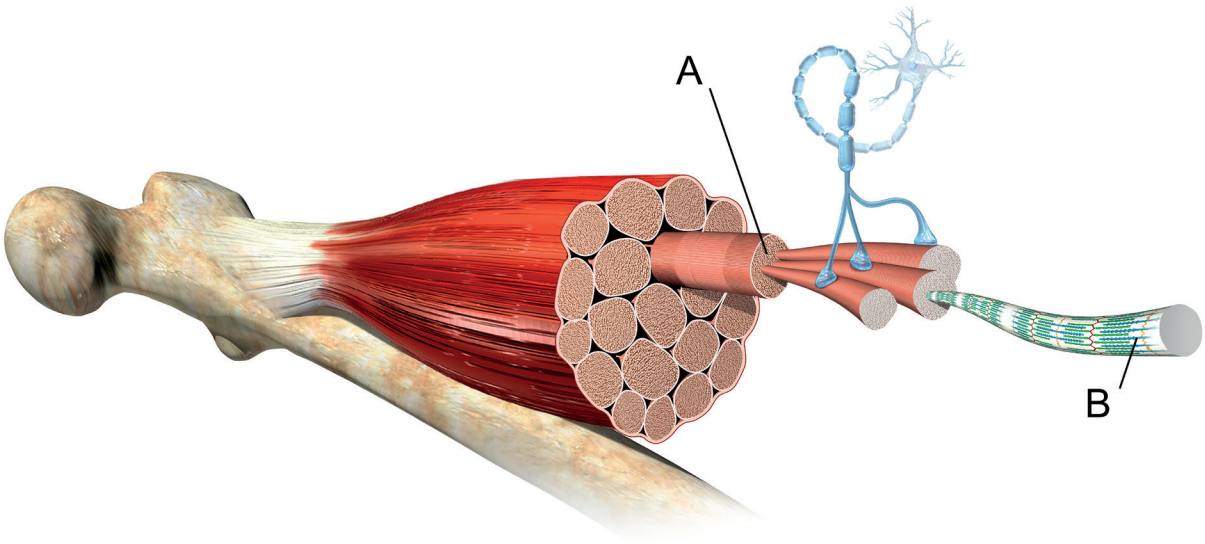
6. (a) The diagram shows skeletal muscle.



Identify the parts labelled A and B. [2]

A: . . . . . .

B: . . . . . .

(b) Describe the sequence of excitation of the heart muscle. [3]

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7. (a) A beginner participated in a seven-week tennis programme. Each week, they recorded their successful serves out of 50 attempts. Identify the type of learning curve represented by the data. [1]

	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**
Successful serves (out of 50)	1	2	4	7	15	30	46

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(b) The diagram shows a field hockey player.

With reference to Newell's constraints-led approach, explain **two** reasons for using a smaller field in junior field hockey. [2]

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(Question 7 continued)

(c) Suggest **two** task constraints that could be introduced to encourage motivation in junior field hockey training. [2]

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8. (a) Identify the main fuel source of energy for the brain. [1]

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(b) Using sporting examples, discuss the contribution of genetic factors to potential success. [3]

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Section B

Answer **two** questions. Answers must be written within the answer boxes provided.

9. (a) Describe nervous control of ventilation during exercise. [3]

(b) Using examples, outline why identical twins share some human characteristics whereas others are very different. [3]

(c) Using the characteristics of the three phases of learning, describe the skill development of a child learning to walk. [4]

(d) Explain the relationship between the hypothalamus and the pituitary gland, with specific reference to effective bodily functions. [4]

(e) Discuss the structure and function of the leg muscle fibres of an elite long jumper and a marathon runner. [6]

10. (a) The diagram shows a shot putter.

Identify **two** possible benefits of genetic screening in shot put. [2]

(b) Using sporting examples, distinguish the physiological characteristics of high-intensity and endurance activities. [4]

(c) A 1500 m runner accelerates at the start of a race until they reach their desired speed. In the final stage, they sprint towards the finish line. After the race, they perform an active recovery. Explain the phenomena of oxygen deficit and oxygen debt (EPOC) during and after the race. [4]

(d) Explain why an elite basketballer would be able to process relevant sporting signals more effectively than a novice. [4]

(e) Using examples, describe how **three** different types of drag can be reduced in swimming. [6]

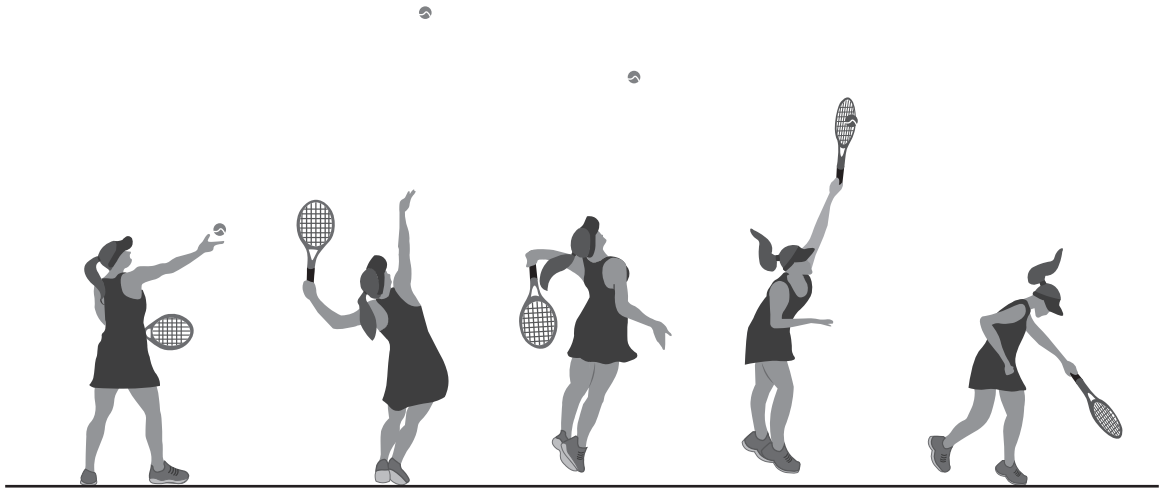
11. (a) Explain why elite athletes are generally more susceptible to infection than sedentary individuals. [2]

(b) Explain how a complex feedback loop regulates blood glucose. [3]

(c) Explain the phenomenon of cardiovascular drift and **one** method of reducing it. [5]

(d) A table-tennis ball is hit with topspin. Apply the Bernoulli principle to the projectile motion of the ball. [4]

(e) The diagram shows a tennis player serving.



Explain how a coach would use both the phase analysis model and the performance outcome model to teach the tennis serve. [6]

12. (a) Distinguish the characteristics of smooth and cardiac muscle. [2]

(b) Describe the resynthesis of adenosine triphosphate (ATP) by the lactic acid (anaerobic glycolysis) system. [4]

(c) Outline how the body responds when an athlete's skin is exposed to injury or infection. [4]

(d) An attacking football player moves in one direction and immediately changes to the opposite direction. This deceives the defender.

Explain the concept the attacking player is using to evade the defender. [4]

(e) Explain the function of the diencephalon. [6]

References:

Figure 1. Schoenfeld, B. J., Contreras, B., Vigotsky, A. D., and Peterson, M., 2016. Differential effects of heavy versus moderate loads on measures of strength and hypertrophy in resistance-trained men. *Journal of Sports Science and Medicine*, 15, pp. 715–722

Figure 2. Ayabe, M., Aoki, J., Ishii, K., Takayama, K., and Tanaka, H., 2008. Pedometer accuracy during stair climbing and bench stepping exercises. *Journal of Sports Science and Medicine*, 7, pp. 249–254.

4. (b) Gwoeii / Shutterstock.

5. (b) www.gymdrills4profs.com.

6. (a) HENNING DALHOFF/SCIENCE PHOTO LIBRARY.

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