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**Sports, exercise and health science**  
**Higher level**  
**Paper 2**

26 April 2024

**Zone A** morning | **Zone B** morning | **Zone C** morning

Candidate session number

2 hours 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.
- 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]**.



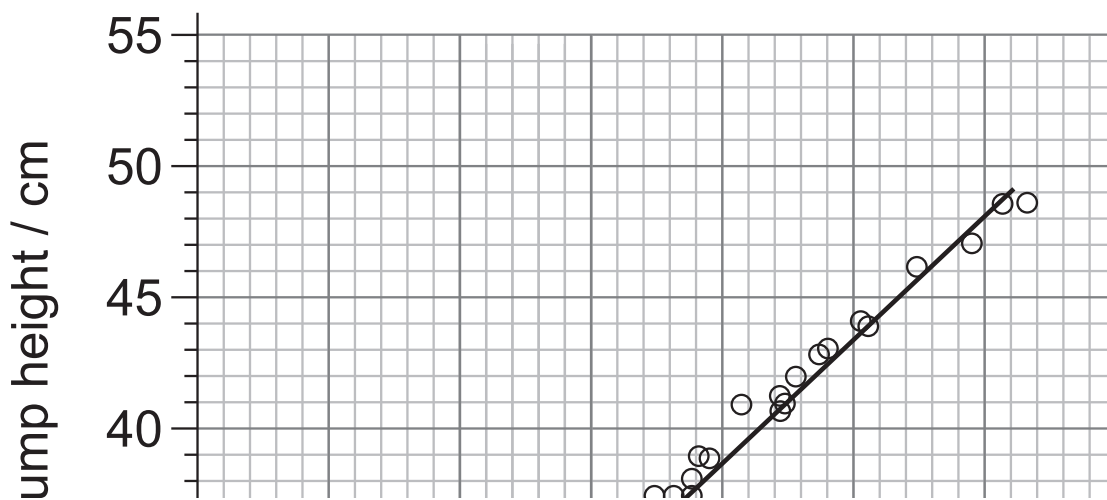
### Section A

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

1. A study investigated whether there was a relationship between weekly participation in physical activity (PA) and a person's  $VO_2$  max. The participants were boys and girls aged 14 and 19. Participants' physical activity involvement was categorized in the following way:
  - organized physical activity,
  - unorganized physical activity, or
  - no physical activity.

The results are shown in **Figure 1**.

**Figure 1**



- (a) Identify which group had the highest  $VO_2$  max at 19 years old. [1]

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- (b) Calculate the difference between no physical activity for boys and no physical activity for girls at 14 years old. [1]

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**(Question 1 continued)**

- (c) (i) Using **Figure 1**, distinguish maximal oxygen consumption ( $VO_2$  max) between males and females. [1]

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- (ii) Explain **two** reasons why maximal oxygen consumption ( $VO_2$  max) is different in males and females. [2]

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- (d) Identify the component of fitness that was measured in this study. [1]

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Answers written on this page  
will not be marked.



**(Question 1 continued)**

- (e)  $VO_2$  max was tested in the study using a laboratory test. Evaluate laboratory testing for gathering data. [3]

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- (f) At both age intervals, there were only two participants represented in the 'no physical activity' group. Describe how this impacts the reliability of the data. [2]

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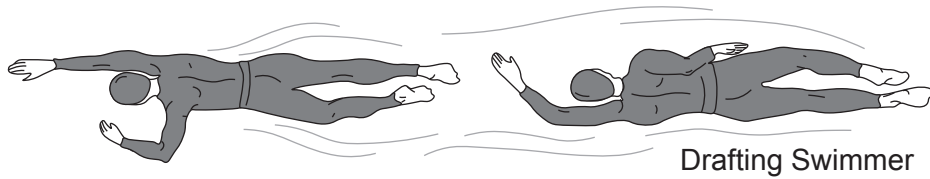
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2. A study investigated the effects of drag on elite swimmers. Data was collected for time to swim 400 m, stroke rate, stroke length and blood lactate using the following conditions:

Condition 1: Swimming while drafting behind another swimmer (D)



Condition 2: Swimming alone in a non-drafted position (ND)



Results are shown in the table:

Subject	400 m time/s		Stroke rate/ cycle min <sup>-1</sup>		Stroke length/ m cycle <sup>-1</sup>		Blood lactate/ mM	
	D	ND	D	ND	D	ND	D	ND
1	280.75	291.16	39.2	38.4	2.17	2.14	8.0	7.5
2	286.03	297.00	37.5	38.2	2.24	2.12	10.1	11.7
3	288.71	298.91	37.7	38.8	2.21	2.07	9.9	12.6
4	302.22	311.30	40.2	43	1.97	1.79	7.5	9.9
5	303.50	302.66	40.6	42.4	1.95	1.87	8.3	10.2
6	277.97	291.92	46.5	46.8	1.86	1.76	9.3	9.5
7	286.47	296.16	38.6	38.9	2.18	2.08	10.8	11.0
8	275.85	288.85	39.1	43.8	2.23	1.89	13.1	14.2
Mean	287.69	297.25*	39.9	41.3*	2.10*	1.97	9.6	10.8*
SD	10.35	7.24	2.9	3.2	0.15	0.16	1.8	2.0

\* Denotes significant difference between drafting and non-drafting position ( $P < 0.05$ )

- (a) Identify which group had the fastest mean 400 m time.

[1]

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**(Question 2 continued)**

(b) Using the data, identify the effect of drafting on the swimmers' mean stroke rate and mean stroke length. [2]

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(c) Describe the factors contributing to peripheral fatigue in this study. [3]

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(d) Define the term *drag* in sport. [1]

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(e) Explain the impacts of drafting on drag during swimming. [2]

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3. The diagram shows a football (soccer) player.



(a) Identify the type of synovial joint that enables flexion of the football (soccer) player's knee.

[1]

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(b) Identify the inferior bone that articulates at the hip joint.

[1]

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(c) Outline **two** functions of the skin during a soccer match.

[2]

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**(Question 3 continued)**

(d) Distinguish between the motor skill profile of a football (soccer) dribble and a dart throw. [2]



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(e) Using an example from sport, describe how a whole-part-whole presentation can be used to teach a skill to a novice athlete. [2]

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

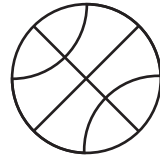
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(b) Two different balls of the same diameter are shown.



Ball A  
560 g



Ball B  
200 g

Explain how Newton's second and third laws of motion would influence each of the balls. [3]

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5. A 12-year-old student is beginning to learn the game of basketball in physical education class.

(a) Outline **two** benefits of using a non-linear approach to pedagogy. [2]

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(b) With reference to Newell's task constraints, suggest **three** ways to modify the basketball game for the beginner student. [3]

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(c) Distinguish between genotype and phenotype. [1]

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6. Explain the role of adenosine triphosphate (ATP) in providing energy for a sprinter's muscles at the beginning of a 100 m race. [3]

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7. (a) Outline the oxygen deficit experienced by an athlete when completing the multistage fitness test. [2]

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- (b) Outline the relative contributions of the three energy systems during the multistage fitness test. [3]

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- (c) Explain the mechanics of inhalation during an aerobic fitness test. [4]

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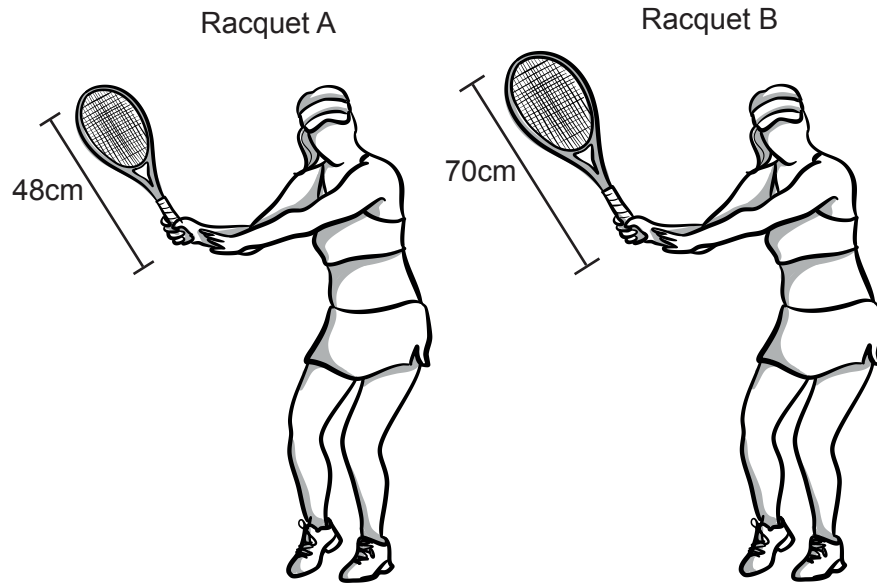
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### Section B

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

8. (a) The diagram shows two tennis players using different length racquets with identical mass.



- Referring to angular momentum, discuss why the length of Racquet A is more appropriate for a child during a tennis match. [4]
- (b) Describe the phase analysis model using a sporting skill of your choice. [4]
- (c) A 5km runner is about to warm up for their race. Analyse systolic and diastolic blood pressure before they begin their warm-up **and** during their race. [5]
- (d) The runner is involved in intense and long-term training. Describe the effects of this on the immune system. [4]
- (e) Explain how insulin is regulated by chemical changes in the blood. [3]



9. (a) With reference to specific hormones, discuss the relationship between the hypothalamus and the pituitary gland. [4]
- (b) A player is trying to throw a frisbee as far as they can in a game of Ultimate Frisbee. The diagram shows the trajectory of a long frisbee throw to begin a game of Ultimate Frisbee.



- Outline how Bernoulli's principle acts on the frisbee whilst in flight. [5]
- (c) A football (soccer) player is learning a number of new free kick routines. Suggest **five** different methods the player could use to remember these in a match. [5]
- (d) Discuss the influence of genetic factors on sporting performance. [3]
- (e) Outline **three** ways surface drag could be reduced in a sporting activity. [3]
10. (a) Suggest **four** factors that contribute to the different rates of learning an Olympic lifting technique. [4]



- (b) Using examples from a sport of your choice, suggest **four** factors that can minimize or maximize friction. [4]
- (c) Describe the role of adrenaline during exercise. [4]
- (d) Outline **four** mechanisms the body uses to prevent infection. [4]
- (e) Using examples from volleyball, explain the functions of the cerebellum and the temporal lobe during a game. [4]



11. (a) A runner recorded their mean heart rate during a training session while in hot and humid conditions. They maintained the same steady pace throughout.

Distance interval	5 km	10 km	15 km	20 km	25 km	30 km
Heart rate / bpm	155	157	170	170	175	180

Explain the reasons for the increase in heart rate at the 15 km mark. [5]

- (b) During a triathlon, outline why brain cells need a continuous supply of fuel. [3]

- (c) Explain **four** causes of peripheral fatigue in a long-distance swimmer. [4]

- (d) Analyse **three** potential benefits of genetic screening for sport. [3]

- (e) While running in basketball, an athlete's muscles contract to enable movement.

Outline **five** other general characteristics which are common to muscle tissue. [5]



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20EP17

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#### References:

- Figure 1** Lagestad, P. and Mehus, I, 2017. The Importance of Adolescents' Participation in Organized Sport According to VO<sub>2</sub> peak: A Longitudinal Study. *Research Quarterly for Exercise and Sport*, 89(2), pp. 143–152.
2. Chatard, J., Chollet, D. and Millet, G., 1998. Performance and drag during drafting swimming in highly trained triathletes. *Medicine & Science in Sports & Exercise*, 30(8), pp. 1276–1280.
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3. (d) AdrianHillman, 2023. *Women playing football.* [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/women-playing-football-royalty-free-illustration/478673174?phrase=football+dribble&adppopup=true> [Accessed 13 June 2023]. Source adapted.
- A-Digit, 2023. *Dartboard And Player.* [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/dartboard-and-player-royalty-free-illustration/496548270?adppopup=true> [Accessed 13 June 2023]. Source adapted.
8. (a) A-Digit, 2023. *Female Tennis Player Forehand.* [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/femaletennisplayerforehand-royalty-free-illustration/1274558122?adppopup=true> [Accessed 13 June 2023]. Source adapted.
9. (b) 4x6, 2023. *Silhouettes of people playing frisbee.* [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/silhouettes-of-people-playing-frisbee-royalty-free-illustration/472301629?adppopup=true> [Accessed 16 June 2023]. Source adapted.
10. (a) msan10, 2023. *Weightlifting, woman lifting big barbell, isolated vector silhouette, ink drawing.* [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/weightlifting-woman-lifting-big-barbell-royalty-free-illustration/1167946015?phrase=weightlift&adppopup=true> [Accessed 25 July 2023].

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