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Sports, exercise and health science
Higher level
Paper 2

3 May 2023

Zone A morning | **Zone B** afternoon | **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 compared the physical characteristics of 55 experienced female rock climbers. They were divided into lower, advanced, and elite ability groups based on self-reported climbing experience. They completed a 10-minute warm-up prior to the testing sessions. The mean results (\pm SD) for some of the tests are shown.

Figure 1: (a) Forearm volume measurement, (b) counter movement jump, (c) power slap test, and (d) maximal finger strength test.

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(Question 1 continued)

- (a) (i) State the mean forearm volume, in ml, for the lower ability group. [1]

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- (a) (ii) Calculate the difference in distance achieved, in cm, for the mean power slap between the elite and the advanced ability groups. [1]

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- (b) Explain the importance of performing a warm-up prior to conducting a maximal test with respect to study design. [3]

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- (c) Describe the reasons for measuring the forearm volume (**Figure 1(a)**). [2]

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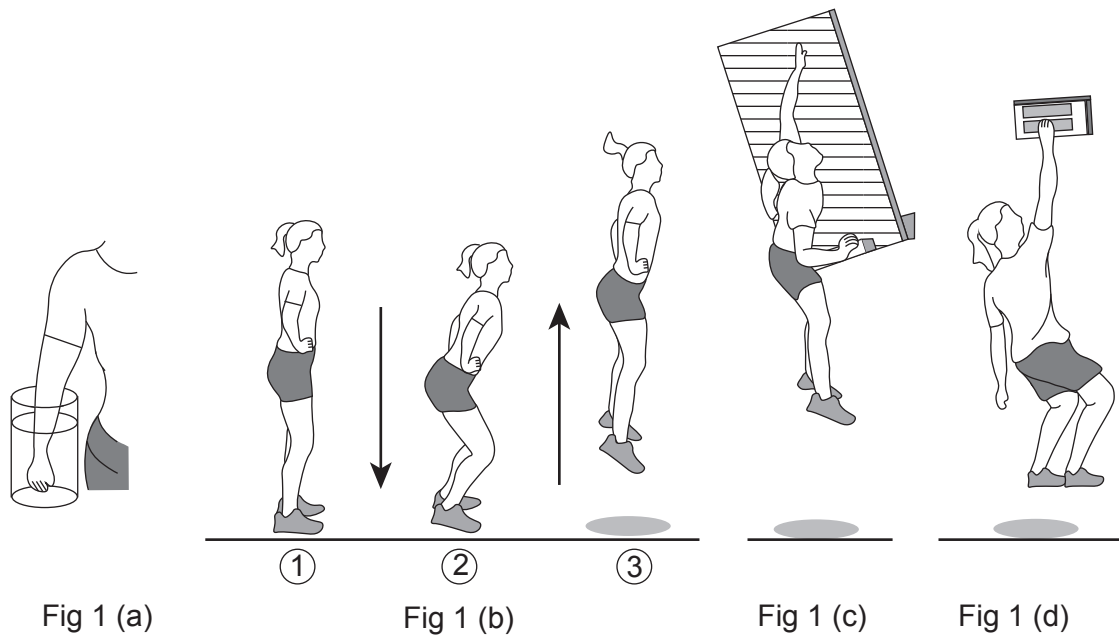


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Answers written on this page
will not be marked.



(Question 1 continued)



(d) Outline the characteristics of cardiac muscle.

[2]

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(e) Discuss the potential causes of peripheral fatigue that a participant might experience during the maximal finger strength test (**Figure 1(d)**).

[2]

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2. A study of 26 untrained 20–30 year old men investigated the potential health benefits of regular participation in team handball training. The participants were allocated randomly to either the handball group, which completed two training sessions each week for 12 weeks, or an inactive control group. $VO_2\text{max}$, fat percentage, blood pressure, resting heart rate and multistage fitness tests were carried out at the start and end of the study period and the mean results (\pm SD) are shown in the table.

	Handball group				Inactive control group			
	Week 0	SD	Week 12	SD	Week 0	SD	Week 12	SD
$VO_2\text{max}$ / $\text{ml min}^{-1}\text{kg}^{-1}$	41.9	6.7	46.5*	6.1	41.6	5.8	41.6	5.8
Fat percentage / %	27.9	10.6	26.2*	10.7	28.6	7.8	28.6	7.8
Systolic blood pressure / mmHg	111	11	113	10	113	8	113	10
Diastolic blood pressure / mmHg	67	7	68	8	67	6	69	5
Resting heart rate / bpm	56	9	53	9	60	5	57	6
Multistage fitness distance / m	1880	80	2480*	1069	1750	750	1750	750

* $p < 0.05$ from week 0

- (a) Identify the group whose results showed a significant improvement from week 0. [1]

- (b) Calculate the percentage difference in the $VO_2\text{max}$ for the handball group from week 0 to week 12. [1]

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(Question 2 continued)

- (c) Discuss the hypothesis that regular participation in recreational active team sports training provides beneficial effects for the cardiovascular system.

[3]

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- (d) Explain the redistribution of blood during participation in a multistage fitness test.

[3]

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- (e) Deception is used in team sports such as handball to gain an advantage over the opposition. Using a sporting example, explain how an athlete manipulates the psychological refractory period to gain an advantage over an opponent.

[4]

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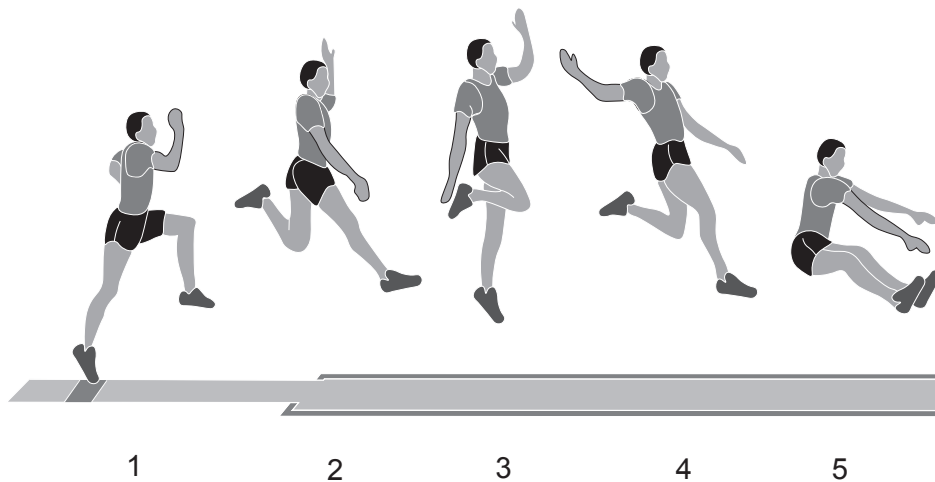
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3. The diagram shows five phases of long jump.



- (a) Describe the change in anatomical position of the right carpals in relation to the right clavicle moving from Phase 3 to Phase 4. [2]

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- (b) Apply the concept of reciprocal inhibition to the right leg at take-off in Phase 1. [3]

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(Question 3 continued)

- (c) Outline strategies to minimize infection between athletes travelling to a competition. [4]

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- (d) Using examples, explain how circulating hormones are regulated. [4]

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4. The diagram shows a person kayaking.



The flatwater 200 m (one-person kayak) world records are:

Male	33.380 seconds
Female	37.898 seconds

- (a) Describe the production of ATP by the predominant energy system used by an elite kayaker paddling during a flatwater 200 m race.

[3]

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(Question 4 continued)

- (b) Outline the variability in maximal oxygen consumption between arm ergometry and running.

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- (c) Using examples, describe **one** of Newton's laws of motion during a flatwater 200 m kayak race.

[3]

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(Question 4 continued)

(d) Analyse **two** factors that affect drag during the flatwater kayaking race.

[4]

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(e) Outline how genes influence human characteristics for elite athletic performance.

[2]

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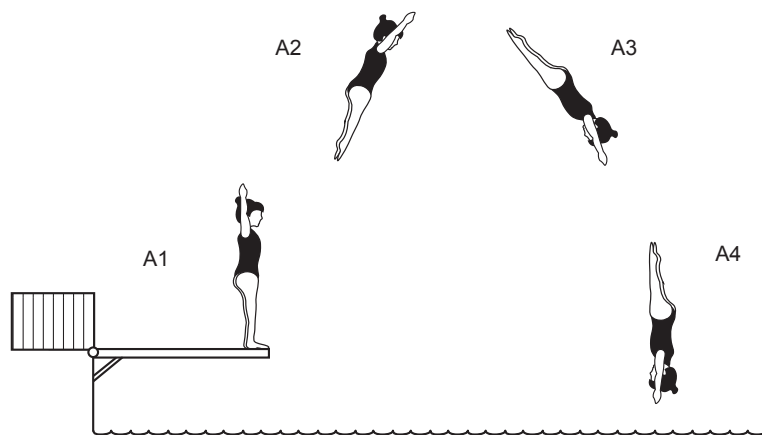
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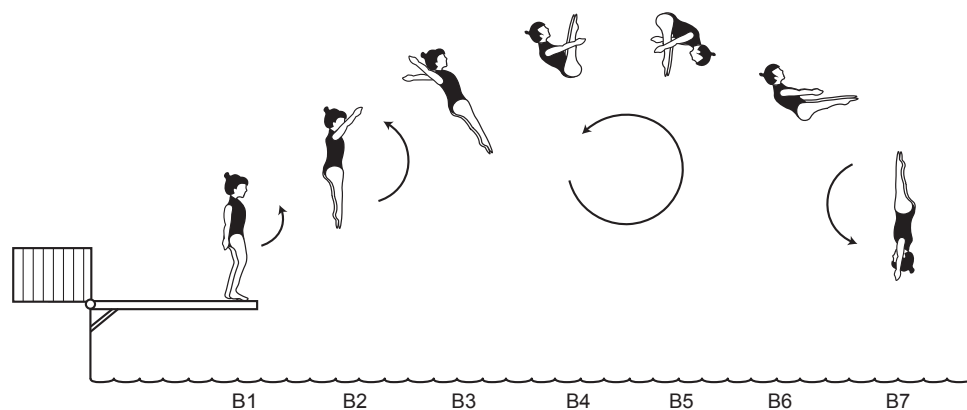
Section B

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

5. Dive A



Dive B

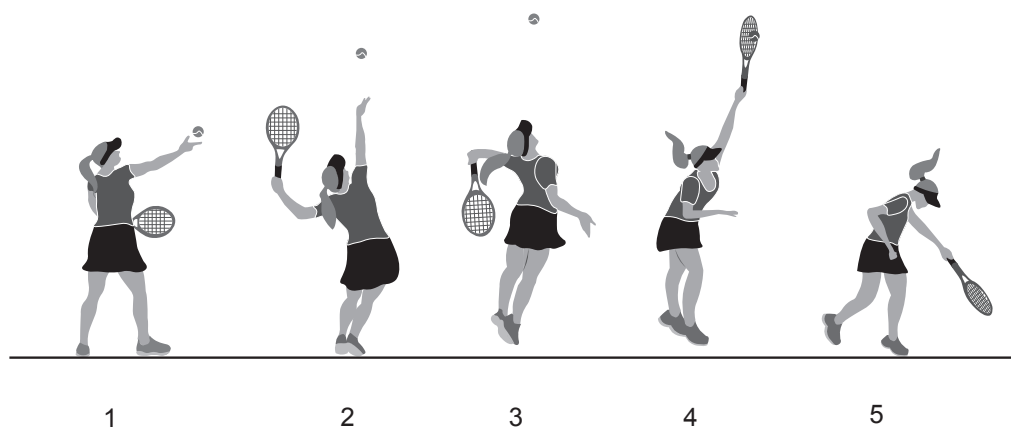


- Compare and contrast how a diver uses the concept of angular momentum to perform dives A and B. [5]
- Explain **three** variables that can be manipulated to improve signal detection for a novice performer when learning a new skill. [3]
- Compare and contrast the relative contributions of energy systems during a 400 m sprint and 10 000 m run. [4]
- Describe the purposes of scheduling recovery into a weekly training programme. [5]
- An elite triathlete has trained over a long time at a high intensity. Outline reasons why this athlete may be more susceptible to respiratory infections. [3]



6.
 - (a) Outline the chemical control of ventilation from rest to exercise. [3]
 - (b) Explain how the hypothalamus and the pituitary gland operate to maintain homeostasis in the body. [4]
 - (c) Describe how heart rate can be used to monitor exercise intensity. [4]
 - (d) Using sporting examples, describe how coaches can manipulate constraints to improve skill learning for a group of 10-year-old children. [5]
 - (e) Discuss **four** factors that could affect the rate of learning a new sporting skill. [4]

7. The diagram shows phases of a tennis serve.



- (a) Explain how the cerebellum contributes to the performance of a tennis serve. [4]
 - (b) Apply the phase analysis model to a tennis serve. [4]
 - (c) Describe the consequences of fasting on the brain. [3]
 - (d) Discuss how memory and selective attention interact in the cognitive phase of learning a skill. [4]
 - (e) Describe the relative importance of genetic and environmental factors to an athlete's sporting performance. [5]
8.
 - (a) Compare and contrast the excess post-exercise oxygen consumption for a trained athlete and an untrained individual. [3]
 - (b) Using the sliding filament theory, explain the changes that occur at the sarcomere during a concentric isotonic contraction. [6]
 - (c) Describe the intrinsic regulation and sequence of excitation of the heart rate. [4]
 - (d) Describe how adenosine can gain a phosphate molecule during a short high intensity exercise such as performing a vertical jump. [3]
 - (e) Using sporting examples, discuss how friction can be increased to enhance performance. [4]



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References:

2. Material from: Hornstrup, H., et al., Cardiovascular, muscular, and skeletal adaptations to recreational team handball training: a randomized controlled trial with young adult untrained men. *Eur J Appl Physiol* published 2019. Springer Link reproduced with permission of SNCSC.

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