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Sports, exercise and health science
Higher level
Paper 2

Friday 4 November 2022 (morning)

Candidate session number

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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]**.

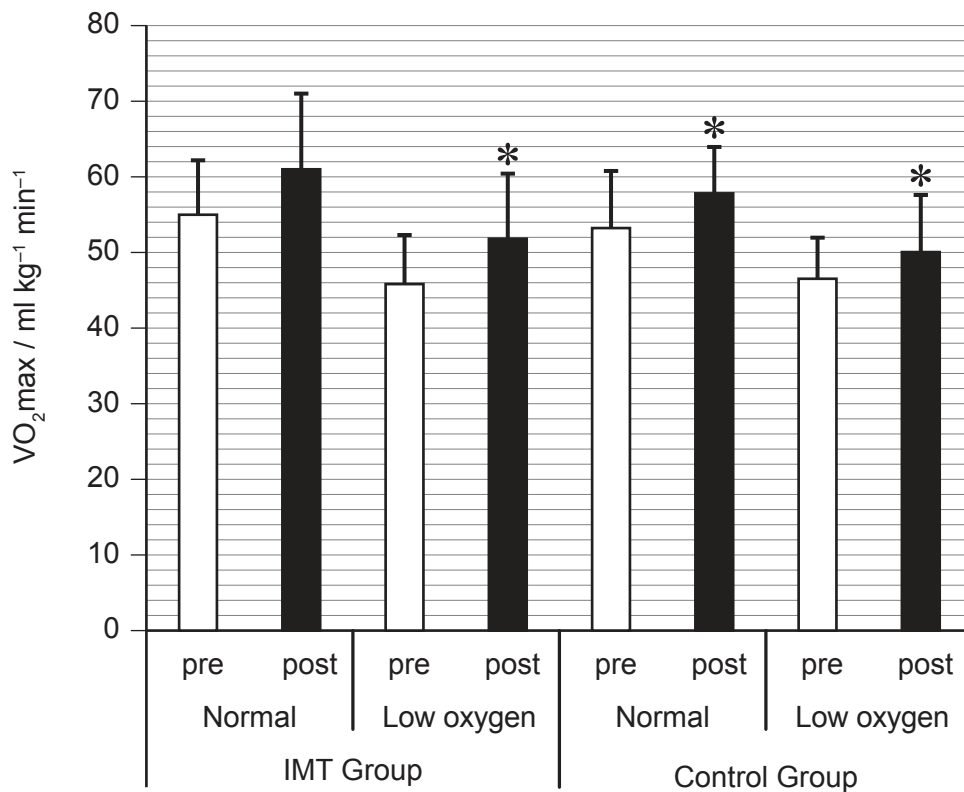


Section A

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

- 1. A study investigated the effect of a 4-week period of inspiratory muscle training (IMT) on $VO_2\text{max}$ performance. Participants completed a cycling programme and were randomly allocated to either a control group or the IMT group. Each week, both groups completed 3x20 minutes cycling (60 rpm) at 60% $VO_2\text{max}$.

$VO_2\text{max}$ was measured before (pre) and at the end (post) of the cycling programme under normal oxygen and low oxygen conditions. The results (mean and standard deviation) are presented in the graph.



* $p < 0.05$ versus pre-cycling $VO_2\text{max}$

- (a) State the $VO_2\text{max}$, $\text{ml kg}^{-1} \text{min}^{-1}$, for the IMT group post-cycling in the low oxygen condition.

[1]

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(This question continues on the following page)



(Question 1 continued)

- (b) Calculate the difference in $VO_2\text{max}$, $\text{ml kg}^{-1} \text{min}^{-1}$, for the IMT group from pre-cycling to post-cycling during normal oxygen conditions. [1]

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- (c) Using the data, deduce the effects of training on $VO_2\text{max}$. [4]

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- (d) Define *maximal oxygen consumption*. [1]

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- (e) Discuss the variability of maximal oxygen consumption between cycling and arm ergometry. [3]

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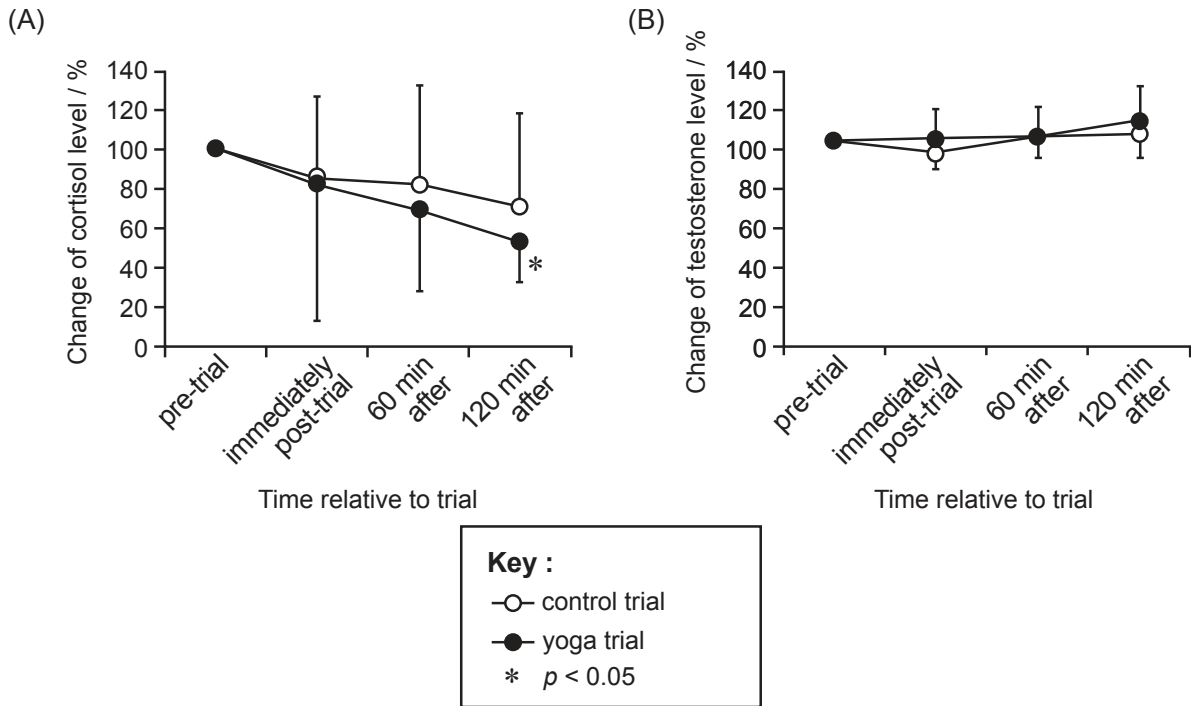
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2. A study investigated the effect of yoga stretching on salivary stress hormones in 10 men. Participants rested for 90 minutes in a seated position in the control trial and performed yoga for 90 minutes in the yoga trial.

Changes in participants' cortisol and testosterone levels were measured pre-trial, immediately post-trial, and at 60 minutes and 120 minutes after rest or yoga. The results (mean and standard deviation) are shown in graphs (A) and (B).



- (a) (i) State what the error bars represent on the graph. [1]

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- (a) (ii) Distinguish between the error bars in graphs (A) and (B). [1]

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(Question 2 continued)

(b) Comment on the effect of yoga on salivary stress hormones.

[3]

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(c) An elite athlete is completing a one-year intensive training programme in preparation for a triathlon competition. Outline the changes in the athlete's cortisol levels and their risk of infection as a result of the training.

[2]

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20EP05

Turn over

3. (a) Outline **one** role of hormones.

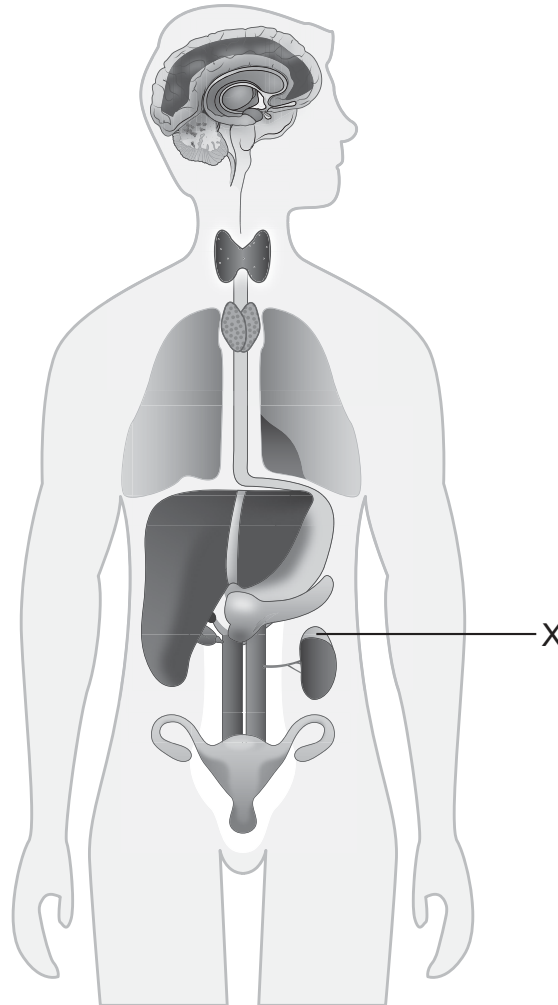
[1]

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(b) Label structure X shown on the diagram.

[1]



Structure X:

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(This question continues on the following page)



(Question 3 continued)

(c) Outline the hormonal regulation of the heart during exercise. [2]

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(d) Field hockey is a high-intensity team sport. Explain the role of muscle contraction on glucose uptake during a hockey game. [3]

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(e) In basketball, teams have to shoot within 24 seconds of gaining possession of the ball. Describe the production of ATP during a short, intense period of possession. [3]

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4. Usain Bolt set a world record time of 9.58 seconds for the men's 100 m sprint.

(a) It is important for a sprinter to have a good start. Define *response time*. [1]

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(b) Identify physiological factors that affect a sprinter's response time. [2]

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(c) Explain how a sprinter uses selective attention to optimize their start time and improve their performance in a race. [3]

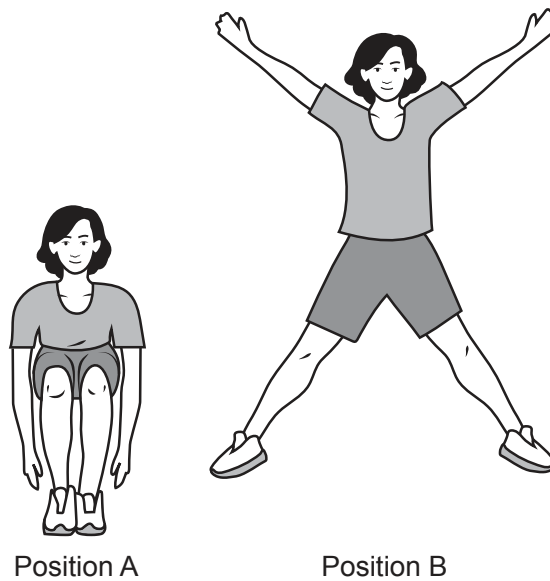
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(d) Explain how friction may improve a sprinter's performance. [3]

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5. The diagram shows someone performing a star jump.



(a) Analyse the main action of the hips and knees when moving from Position A to Position B in the diagram.

[4]

Joint	Joint action	Muscle contraction
Hips
Knees

(b) HIIT (High-Intensity Interval Training) is a popular exercise method, often incorporating activities such as star jumps. Distinguish between the predominant energy system during a HIIT class and when competing in a 10 km race.

[1]

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(c) Distinguish between a fibrous and a cartilaginous joint.

[1]

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(This question continues on the following page)



(Question 5 continued)

- (d) The hip and the knee are synovial joints. Outline **two** features that aid movement at a synovial joint.

[2]

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- 6. (a) Identify the coaching pedagogy in which learning is collaborative, creative and process-orientated.

[1]

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- (b) Using an example from sport, explain whole-part-whole skill presentation.

[3]

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(This question continues on the following page)



(Question 6 continued)

- (c) A basketball player attempts to shoot 10 free throws and scores 1 basket. They practise shooting every day for four weeks and assess their performance out of 10 free throws at the end of each week.

Week	Successful free throws out of 10
1	6
2	8
3	9
4	9

Draw a curve that represents their learning.

[2]



Section B

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

7. (a) Using examples, outline **five** methods that a soccer coach can use to manipulate constraints for novice performers. [5]
- (b) Evaluate the use of a 40 m sprint, drop test and standing broad jump test to assess and monitor a basketball player's performance. [6]
- (c) Explain the effect of a soccer player faking to shoot. [4]
- (d) Outline how characteristics of an elite basketball player can be influenced by their genes. [5]
8. (a) (i) Define *drag*. [1]
- (ii) Describe **four** effects of surface drag on a cyclist. [4]
- (b) A cyclist is training for the ultra-distance IncaDivide race across Ecuador and Peru. Explain the effect of the training load on the cyclist's susceptibility to infection. [5]
- (c) Explain the mechanism of blood redistribution during a long-distance cycle ride. [5]
- (d) An individual medley race requires a swimmer to swim the four main competitive strokes (butterfly, backstroke, breaststroke, freestyle). Using examples, outline **five** types of movements of synovial joints during an individual medley race. [5]
9. (a) Apply **five** roles of the skin whilst an athlete is competing in a marathon. [5]
- (b) (i) Outline the role of the pulmonary circulation. [1]
- (ii) Outline the pathway of blood as it leaves the capillaries of skeletal muscle and arrives at the lungs. [5]
- (c) Explain the contribution of the aerobic energy system for an athlete running in a 10 km race. [4]
- (d) (i) Outline **one** factor that may affect how fatigue is perceived by a soccer player. [1]
- (ii) In preparation for the season, a soccer player participates in endurance training. Explain the physiological causes of reduced muscle cell force due to their endurance training. [4]



10. (a) Characteristics of muscle tissue include being controlled by nerve stimuli and fed by capillaries. Outline **four** other general characteristics common to muscle tissue. [4]
- (b) Calcium is required to help with muscle contraction. Explain how an athlete's muscle contracts quickly once calcium ions bind to troponin. [6]
- (c) Identify the percentage contribution of genetic characteristics inherited from each of the athlete's birth parents. [1]
- (d) Evaluate the implications of genetic screening for a young, aspiring triathlete. [4]
- (e) Describe the relationship between the hypothalamus and the pituitary gland in regulating water. [5]



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20EP14

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20EP15

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20EP16

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20EP18

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20EP19

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References:

1. Ogawa, T., Nagao, M., Fujii, N., et al., 2020. Effect of inspiratory muscle-loaded exercise training on peak oxygen uptake and ventilatory response during incremental exercise under normoxia and hypoxia. *BMC Sports Sci Med Rehabil*, [e-journal] 12(25). <https://doi.org/10.1186/s13102-020-00172-1>.
2. Eda, N., Ito, H. and Akama, T., 2020. Beneficial Effects of Yoga Stretching on Salivary Stress Hormones and Parasympathetic Nerve Activity. *Journal of Sports Science and Medicine*, 19, pp. 695–702.
- 3.b *Endocrine system*, n.d. [online] Available at: <https://www.epa.gov/endocrine-disruption/what-endocrine-system> [Accessed 28 March 2022].

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20EP20