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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]**.

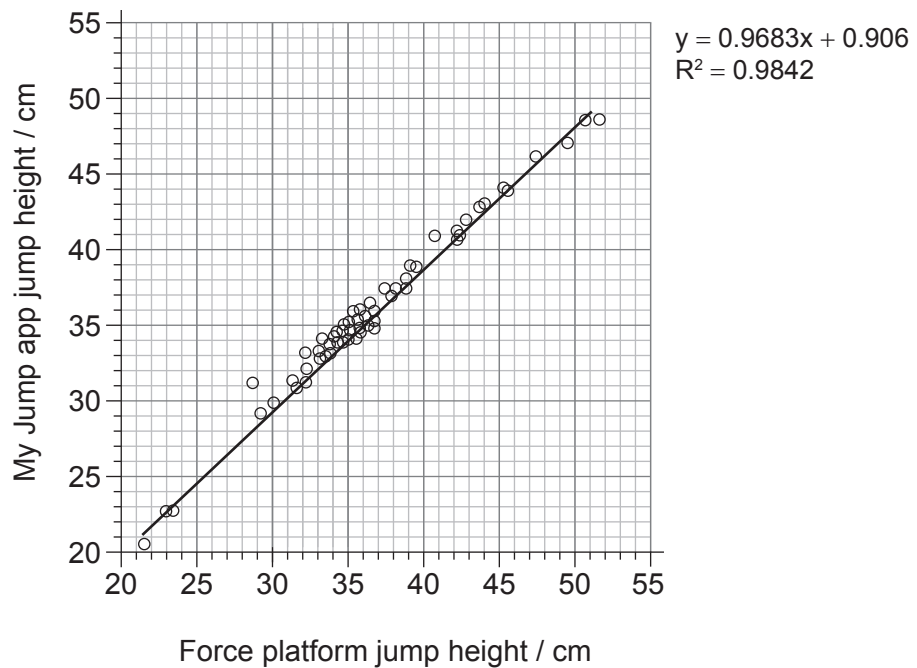


### Section A

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

- 1. A study examined reliability and validity of the My Jump iPhone application in measuring jump height. Each participant performed 5 vertical jumps on a force platform while simultaneously being assessed using the My Jump app. A force platform is a standard device for measuring jump height.

The graph shows the correlation between jump height recorded by the My Jump app and the force platform.



- (a) (i) State the greatest jump height value as measured by the force platform. [1]

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- (ii) Calculate, in cm, the difference between the greatest values recorded by the force platform and the My Jump app. [1]

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(This question continues on the following page)



**(Question 1 continued)**

(iii) Using the data, outline the validity and reliability of the My Jump app. [3]

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(iv) A two-tailed, paired *t*-test was conducted. The calculation yielded  $P < 0.001$ . Comment on the meaning of the results from the *t*-test. [1]

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(b) Discuss the potential benefits of using software applications such as the My Jump app in sports analysis. [3]

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**(This question continues on the following page)**



**(Question 1 continued)**

(c) Muscles require adenosine triphosphate (ATP) during the vertical jump.

(i) Identify the dominant energy system in ATP production. [1]

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(ii) Analyse how this system contributes to ATP production. [3]

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Another study examined the effects of clinically safe levels of caffeine consumption on energy balance and exercise enjoyment. Data was collected during 3 trials on the same group of participants with healthy body mass indexes (BMIs):

- Control trial: no exercise, no placebo, no caffeine intake.
- Exercise with placebo trial: exercise and placebo intake.
- Exercise with caffeine trial: exercise and 3 mg/kg caffeine intake 90 minutes before as well as 30 minutes after exercise.

The table summarizes relative energy intake and enjoyability as measured by the Physical Activity Enjoyment Scale (0 = low enjoyability).

<b>Trial</b>	<b>Relative energy intake kJ (SD)</b>	<b>Enjoyability (SD)</b>
Control	2206 (1347)	Not measured
Exercise with placebo	-671 (1521)	87 (17)
Exercise with caffeine	-1638 (1309)	97 (18)

**(This question continues on the following page)**



**(Question 1 continued)**

(d) (i) Identify the trial with the highest enjoyability. [1]

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(ii) Comment how data supports the hypothesis that caffeine decreases relative energy intake (kJ) and improves exercise enjoyability. [1]

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(e) The participants in the study exercised at 65% of the training heart rate range. Outline the use of the Karvonen method. [2]

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(f) Describe the physiological causes of peripheral fatigue during high-intensity activities. [2]

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2. (a) List the chemical elements in a protein molecule. [1]

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(b) Identify the main difference between an essential and a non-essential amino acid. [1]

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(c) A recreational dancer (with a healthy BMI) starts training for a competitive marathon.  
Identify how their recommended macronutrient intake changes. [3]

Macronutrient	Change in recommended intake when marathon training
Carbohydrate	..... .....
Protein	..... .....
Fat	..... .....



3. (a) Outline the reasons that the brain needs glucose. [3]

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(b) Analyse the functions of the **two** principal parts of the diencephalon. [2]

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(c) Predict **two** hormones that may be secreted by the pituitary gland when stimulated by the hypothalamus. [2]

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4. (a) Explain the reasons why adenosine gains and loses a phosphate molecule. [4]

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- (b) Describe the role of calcium ions during the filament sliding of skeletal muscle contraction. [3]

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5. (a) Discuss the mechanism of oxygen exchange between the alveoli and the capillaries. [4]

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- (b) Distinguish how cardiac output and resting heart rate would differ between trained and untrained individuals. [2]

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- (c) Identify **two** cardiovascular adaptations that cause the differences in cardiac output between trained and untrained individuals. [2]

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- (d) Discuss systolic and diastolic blood pressure at rest and during exercise for a trained athlete. [4]

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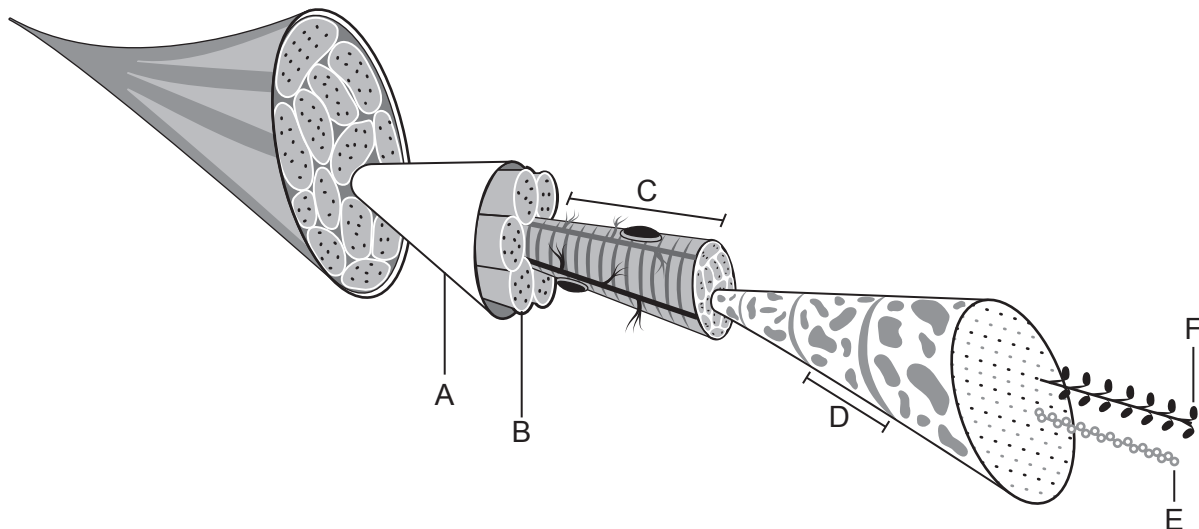
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### Section B

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

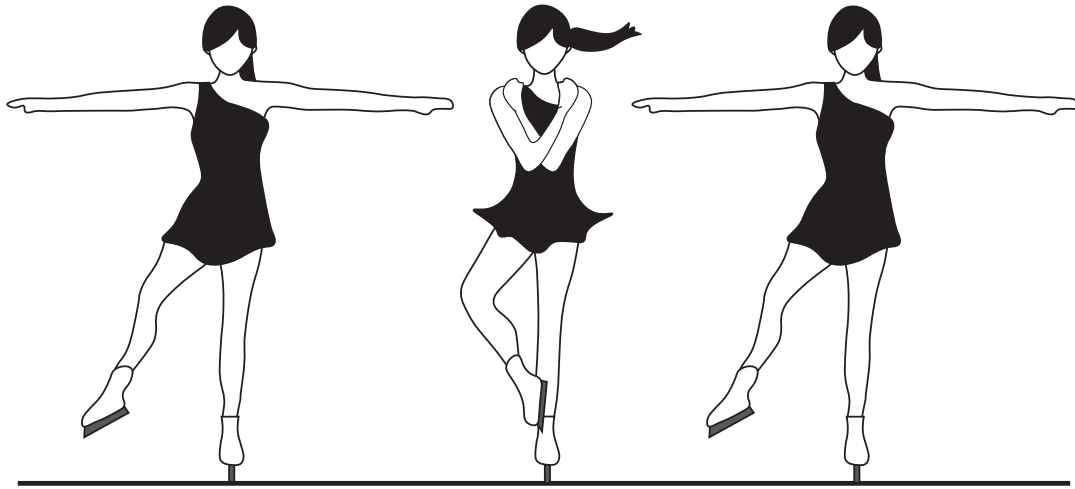
- 6. (a) Describe Newton's laws and how they apply in football (soccer). [5]
- (b) Outline the ethical and health implications of genetic screening. [4]
- (c) Discuss how heat contributes to cardiovascular drift during a football (soccer) game. [6]
- (d) Explain how exercise and training can affect an athlete's susceptibility to infection. [5]
  
- 7. (a) Outline how a coach uses key principles of training to maximize athletic development. [6]
- (b) Describe the role of hormones and the basic mechanism of their release. [4]
- (c) Using an example from a team sport, evaluate the application of psychological refractory period (PRP). [5]
- (d) Discuss methods that minimize and maximize friction. [5]
  
- 8. (a) Annotate the structure of skeletal muscle. Write your answers in the answer pages following, not on the diagram. [6]



- (b) Outline the relationship between genes and human characteristics. [4]
- (c) Analyse how different methods can improve memory. [5]
- (d) Explain recovery from fatigue after exercise. [5]



9. (a) Outline how a figure skater uses the law of conservation of angular momentum to perform a pirouette. [6]



- (b) Using examples, outline how **two** types of drag can be reduced during performance. [4]
- (c) Discuss the relationship between selective attention and memory. [5]
- (d) Explain how a flow chart system can be used for match analysis in a team invasion game. [5]









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**References:**

1. Balsalobre-Fernández, C., et al, 2015. The validity and reliability of an iPhone app for measuring vertical jump performance. *Journal of Sports Sciences*, 33(15), pp. 1574–9. Source adapted.
- Schubert, M., et al., 2014. Caffeine consumption around an exercise bout: effects on energy expenditure, energy intake, and exercise enjoyment. *Journal of Applied Physiology*, 117(7), pp. 745–754. Source adapted.
8. (a) <https://nl.dreamstime.com/stock-illustratie-structuur-van-skeletachtige-spier-image71569200>.

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