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Sports, exercise and health science
Higher level
Paper 2

Tuesday 4 May 2021 (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 magnitude of the impact force, in Newtons (N), at the shoulder during tackling in 35 experienced rugby union players. The researchers looked at the effect of the following variables on the impact force at the shoulder:
- Condition 1: Shoulder pads (with and without)
 - Condition 2: Shoulder (dominant versus non-dominant)
 - Condition 3: Setting (in a laboratory versus on a rugby field)



Table 1 shows the mean maximum impact force in Newtons (and standard deviation) for Conditions 1 and 2.

		Condition 1	
		With shoulder pads	Without shoulder pads
Condition 2	Dominant shoulder	1697 (558) N	1719 (510) N
	Non-dominant shoulder	1573 (560) N	1648 (460) N

- (a) (i) Identify which shoulder has the greatest mean impact force. [1]

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(This question continues on the following page)



(Question 1 continued)

- (ii) Calculate the difference, in Newtons, between mean maximum impact force for dominant and non-dominant shoulders for players wearing pads. [2]

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- (iii) Using the data, discuss the hypothesis that wearing padding could reduce the incidence of injuries to the tackler in rugby union. [2]

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Table 2 shows the mean maximum impact force for trials conducted in the laboratory and on the field (Condition 3).

	Condition 3	
	Laboratory	Field
Force (N)	1717	1997

- (b) Suggest reasons for the lower impact forces recorded in the laboratory setting. [2]

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(Question 1 continued)

(c) Evaluate field and laboratory testing for human performance.

[4]

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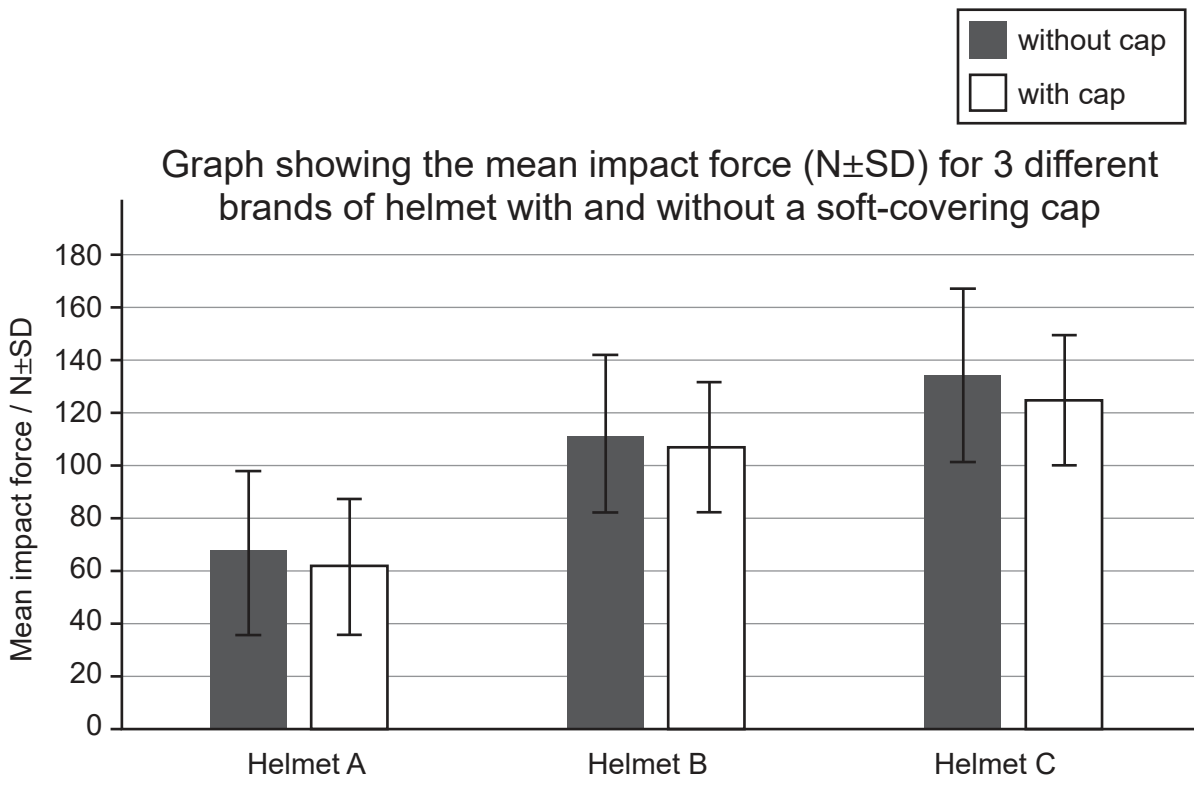
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The possibility of brain injuries is a concern in certain sports. A recent study tested the effect on the impact force (N) of adding a soft-covering cap to a helmet when dropped from a set height. The graph shows the results for three different brands of helmet, A, B, and C.



Helmet A-B: $p > 0.05$
Helmet A-C: $p > 0.05$
Helmet B-C: $p > 0.05$

(This question continues on the following page)



20EP04

(Question 1 continued)

(d) Identify the brand of helmet that demonstrated the lowest mean impact force. [1]

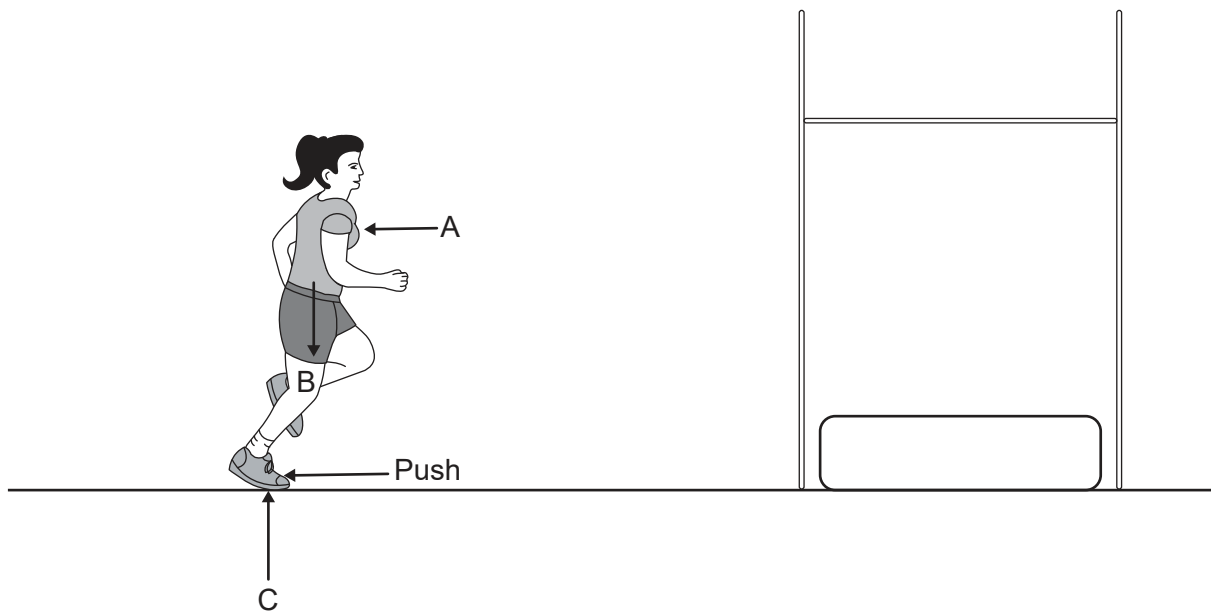
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(e) Deduce the effect of having a soft-covering cap on the impact force of the different helmets. [2]

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2. The diagram shows the forces acting on a high jumper.



(a) State the forces labelled A, B, C.

[3]

A:

B:

C:

(b) Outline friction.

[1]

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(c) Using sporting examples, discuss how an athlete can increase and decrease frictional forces to enhance their performance.

[3]

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3. (a) Outline **two** environmental constraints that can enhance a person's learning of a new skill.

[2]

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(b) Using examples, explain how a coach may apply a constraints-led approach to improve player motivation.

[3]

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(c) Identify possible performance indicators in a frequency table for a sport of your choice.

[3]

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4. (a) Describe the functions of the main blood vessels connecting the heart and the lungs. [3]

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(b) Explain the mechanics of inhalation in the lungs during exercise. [4]

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5. (a) List **two** mechanisms that the body uses in response to an infection. [2]

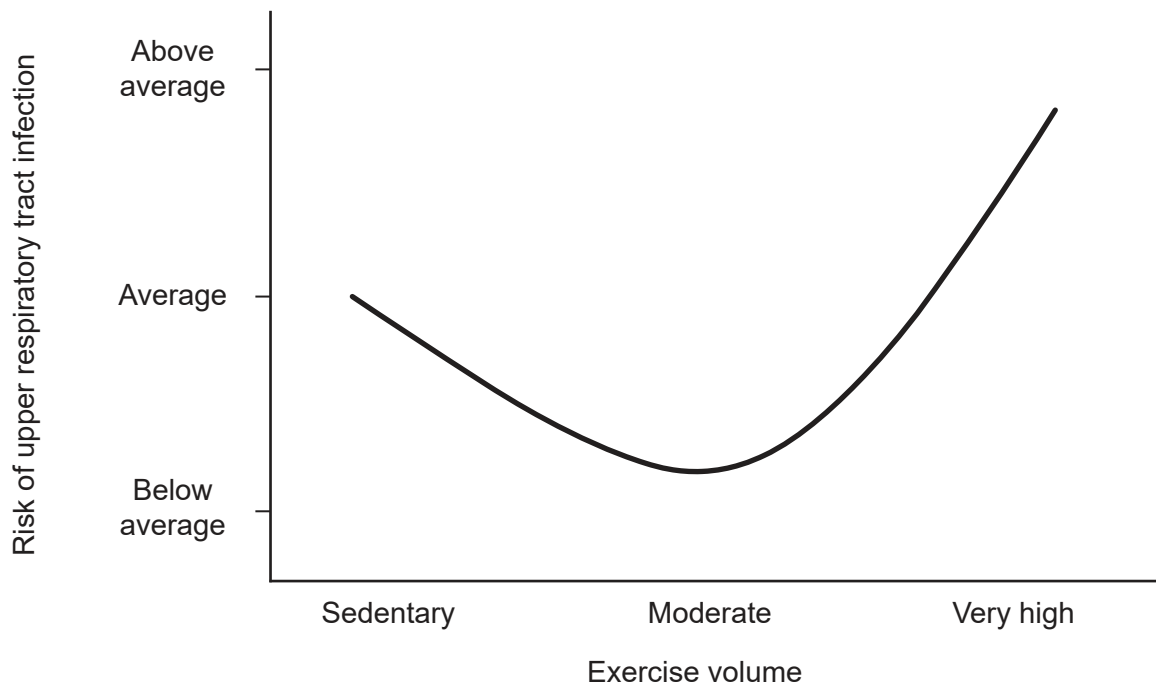
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(b) Discuss the relationship shown in the following graph. [2]



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6. (a) A student's study found a strong correlation between grip strength and $VO_2\text{max}$. Outline why the student should treat their results with caution.

[2]

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- (b) Explain how the following study design elements can be applied in an experimental method:

- (i) control group

[2]

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- (ii) placebo.

[2]

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7. (a) Identify a fitness test that can be used for the following components of fitness:

(i) flexibility

[1]

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(ii) muscular endurance.

[1]

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(b) Describe how an athlete uses the principle of overload to improve their muscular strength through resistance training.

[2]

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Section B

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

8. (a) Outline features of the three different types of muscle found in the body. [6]
- (b) Analyse the structure of slow-twitch and fast-twitch muscle fibres. [6]
- (c) The skin is the largest organ of the body. Outline **four** functions of the skin that maintain health. [4]
- (d) Using a sporting example, discuss how the frontal and temporal lobes of the cerebrum assist an athlete's performance. [4]
9. (a) (i) List **two** structures of the ventilatory system. [2]
- (ii) Describe the function of the conducting airways in maintaining a healthy state. [2]
- (b) Explain the variability in VO_2 max in each of the following groups:
- (i) trained and untrained [2]
- (ii) young and old [2]
- (iii) male and female [2]
- (c) Describe the source and role of insulin and glucagon in the body. [6]
- (d) With reference to specific hormones, discuss the relationship between the hypothalamus and the pituitary gland. [4]
10. (a) Outline **six** structures in an animal cell. [6]
- (b) Discuss the relative contributions of the three energy systems for a runner during a 100m sprint and a 10 000m race. [6]
- (c) Discuss the oxygen debt process which occurs during recovery after a 10 000m race. [4]
- (d) Using sporting examples, distinguish between peripheral and central fatigue. [4]



11. (a) Using examples, outline the following types of skill.
- (i) perceptual [2]
 - (ii) motor [2]
 - (iii) perceptual motor [2]
- (b) Discuss specific areas in which a novice golfer may differ from a professional golfer when putting the ball towards the hole. [6]



- (c) Outline the role of genes in influencing sports performance. [4]
- (d) Evaluate the use of genetic screening for sports, exercise and health. [4]



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20EP15

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20EP16

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20EP17

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20EP18

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20EP19

References:

1. [Rugby player training] Steve Haag/Gallo Images/Getty Images.
- 1.(a) [Table 1] Reprinted from *Journal of Science and Medicine in Sport*, [e-journal] 14, Usman, J., Mcintosh, A. S., Fréchède, B., 2011. An investigation of shoulder forces in active shoulder tackles in rugby union football. pp.547-552. with permission from Elsevier. Available at: [https://www.jsams.org/article/S1440-2440\(11\)00106-X/pdf](https://www.jsams.org/article/S1440-2440(11)00106-X/pdf) [accessed 05 September 2019].
- 1.(b) [Table 2] Reprinted from *Journal of Science and Medicine in Sport*, [e-journal] 14, Usman, J., Mcintosh, A. S., Fréchède, B., 2011. An investigation of shoulder forces in active shoulder tackles in rugby union football. pp.547-552. with permission from Elsevier. Available at: [https://www.jsams.org/article/S1440-2440\(11\)00106-X/pdf](https://www.jsams.org/article/S1440-2440(11)00106-X/pdf) [accessed 05 September 2019].
- 1.(c) Breedlove KM, et al. The Ability of an Aftermarket Helmet Add-On Device to Reduce Impact-Force Acceleration During Drop Tests. *J Athl Train*. 2017;52(9):802-808.
5. Roy Stevenson.

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