Diploma Programme
Programme du diplôme
Programa del Diploma

Sports, exercise and health science
Higher level
Paper 2

Wednesday 3 November 2021 (morning)

Candidate session number

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]**.

8821 – 6602

Section A

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

1. A study investigated the effect of three different sports on force–time variables during a vertical jump performed by elite athletes. The variables measured were time during the eccentric phase (when the quadriceps lengthen to prepare for the jump), total jump time (eccentric and concentric phases), eccentric rate of force development, and jump height.

Table 1: Mean and standard deviation (SD) for the force–time variable data

	Eccentric time (ms)	**Total jump time (ms)**	**Eccentric rate of force development (kN s^{-1})**	**Jump height (cm)**
Basketball	260 (7)	494 (9)	3.37 (0.12)	46.8 (12.7)
Football	199 (5)	485 (10)	4.53 (0.16)	50.1 (15.9)
Baseball	241 (8)	495 (2)	5.41 (0.10)	45.7 (11.8)

(a) Identify the sport with the greatest mean jump height. [1]

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(b) Calculate the difference between mean eccentric rate of force development for baseball and basketball. [2]

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(Question 1 continued)

(c) Using the data from Table 1, analyse the differences in force–time variables for basketball, football and baseball players. [3]

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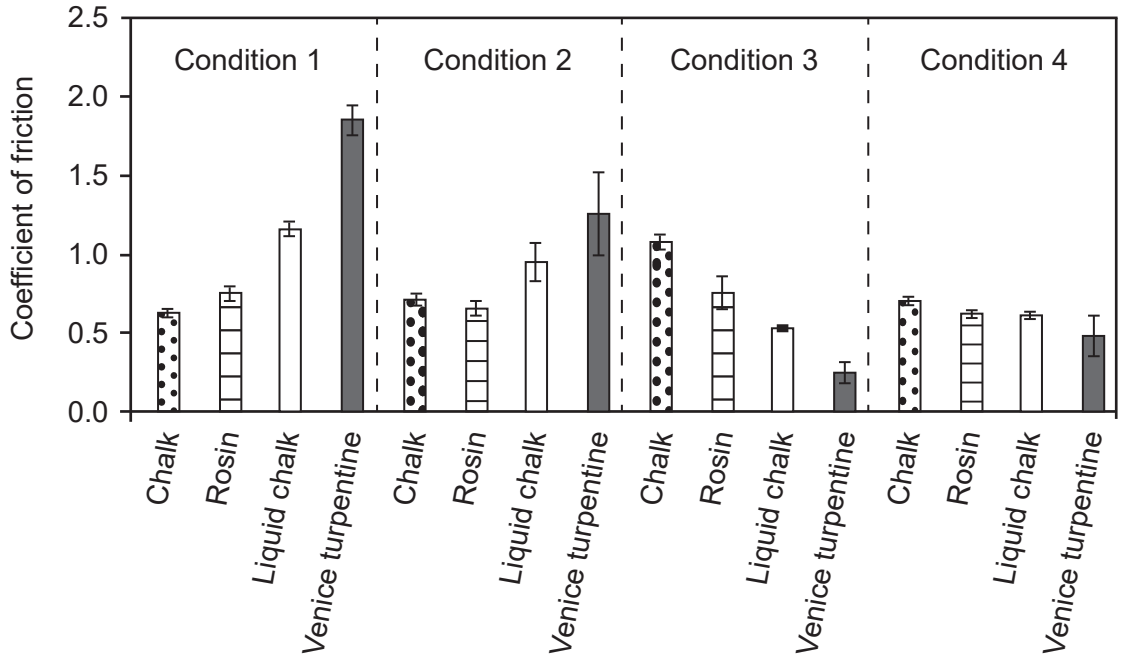
2. A separate study examined the performance of four grip-enhancing agents (chalk, rosin, liquid chalk, Venice turpentine) used in sports like weightlifting and climbing. Grip effectiveness was measured in four different conditions:

- Condition 1: Dry fingers, dry surface (control)
- Condition 2: Damp fingers, dry surface
- Condition 3: Wet fingers, dry surface
- Condition 4: Dry fingers, wet surface

Figure 1: Coefficient of friction for the grip-enhancing agents in the four conditions



Note: error bars indicate standard deviation

(a) Identify the grip-enhancing agent with the greatest coefficient of friction in Condition 3. [1]

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(This question continues on the following page)

(Question 2 continued)

(b) Using the data in Figure 1, analyse the influence of Venice turpentine on grip. [3]

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(c) Comment on the meaning of the standard deviation, with reference to the data in Figure 1. [3]

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(d) Describe the effect of different materials on the coefficient of friction. [2]

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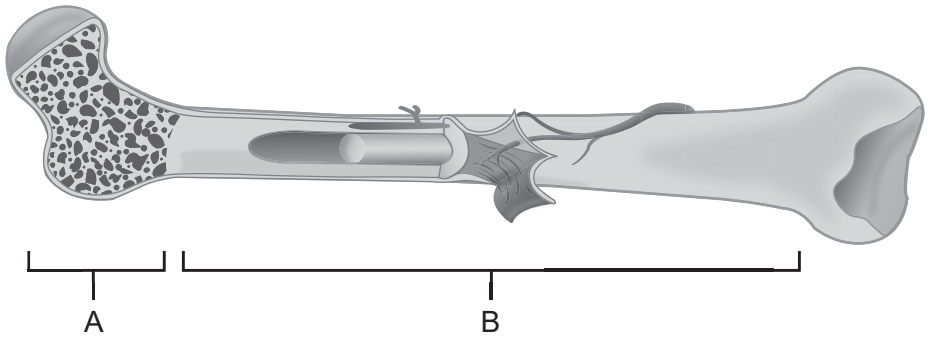
3. The diagram shows a long bone.



(a) Label structures **A** and **B** in the diagram. [2]

A: . . . . . .

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B: . . . . . .

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(b) (i) State the location of the femur in relation to the tibia using anatomical terminology. [1]

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(ii) State the location of the sternum in relation to the vertebral column using anatomical terminology. [1]

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(Question 3 continued)

(c) Outline **three** functions of cartilage. [3]

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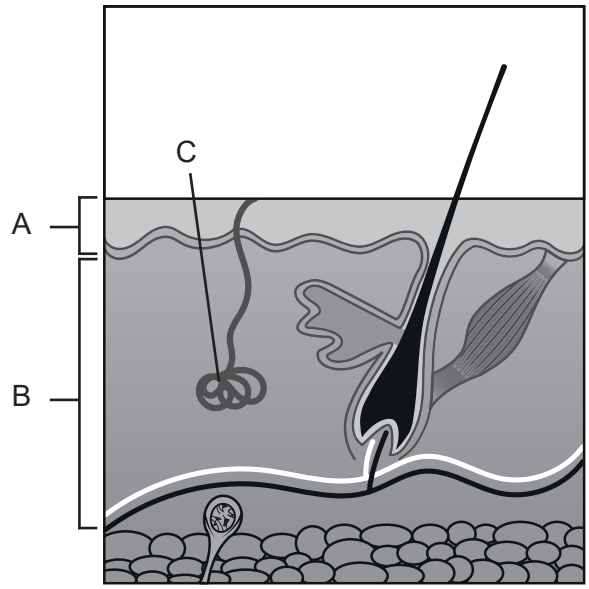
4. The diagram represents skin.



(a) Annotate structures **A**, **B** and **C** in the diagram. [3]

	Name	Annotation
A	. . . . .	. . . . .
B	. . . . .	. . . . .
C	. . . . .	. . . . .

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(Question 4 continued)

(b) Describe how skin allows for homeostasis. [4]

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(c) Explain cardiovascular drift and the relevance of hydration during a 50 km walk. [4]

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5. Analyse how the dominant energy system contributes to adenosine triphosphate (ATP) production during an indoor 60 m sprint. [3]

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6. (a) Discuss the variability of maximal oxygen consumption relative to age for trained and untrained individuals. [4]

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(b) Outline how maximal oxygen consumption differs between running and arm ergometry. [2]

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7. (a) Define the term *learning.* [1]

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(b) Explain factors that a coach can change to increase the rate of learning in a youth soccer academy for children under the age of 11. [3]

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(c) Using examples, describe **two** different types of practice. [4]

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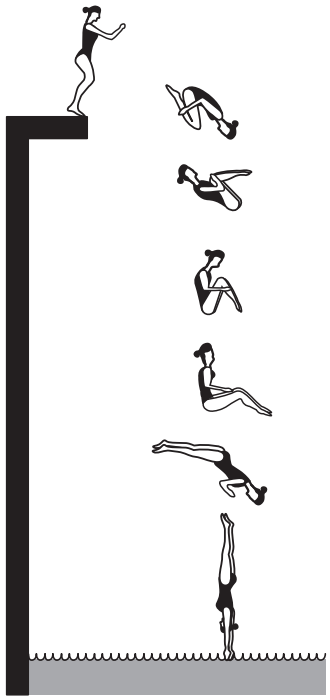
Section B

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

8. (a) The diagram shows a person performing a somersault dive from a 10 m platform.



Outline how they use the law of conservation of angular momentum to perform a somersault dive. [6]

(b) Identify the use of a digital technology that will improve each of the following:

(i) officiating

(ii) sports performance

(iii) and health. [3]

(c) Discuss the benefits for a coach of using information technologies when training a young tennis player. [6]

(d) Periodization can be used to optimize an athlete's performance. Explain how a coach uses the **other** key principles of training to maximize athletic development. [5]

9. (a) Identify **three** reasons why athletes who overtrain may be more susceptible to infection. [3]

(b) Explain the differences in dietary recommendations for a runner during marathon training and a sedentary individual both with healthy body mass index (BMI). [5]

(c) Explain how the hypothalamus regulates the pituitary gland. [6]

(d) Outline the nervous control and mechanics of inspiration during exercise. [6]

10. (a) Analyse oxygen deficit. [5]

(b) Discuss the structural differences between slow twitch and fast twitch muscle fibre types. [6]

(c) Identify **three** strategies for minimizing risk from infection among athletes in an Olympic Village. [3]

(d) Outline **three** methods used to monitor exercise intensity. [6]

11. (a) Using examples, outline the features of a skilled performer. [6]

(b) Using examples, identify types of drag that can be decreased through practice. [3]

(c) Discuss the relative contribution of genetic factors **and** environmental factors on a tennis player's performance. [6]

(d) Explain the causes of peripheral fatigue in a long-distance road cyclist. [5]

References:

1. Laffaye, G., et al., 2014. Countermovement jump height: gender and sport-specific differences in the force-time variables. *Journal of Strength and Conditioning Research*, 28(4), pp. 1096–1105. Source adapted.

Figure 1. Carré, M. J., Tomlinson, S. E., Collins, J. W. and Lewis, R., 2012. An assessment of the performance of grip-enhancing agents used in sports applications. *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology*, 226(7), pp. 616–625. Copyright © 2012 by SAGE Publications. Reprinted by Permission of SAGE Publications. Source adapted.

3. OpenStax College – Anatomy & Physiology, Connexions Web site. http://cnx.org/content/col11496/1.6/, Jun 19, 2013. Attribution 3.0 Unported (CC BY 3.0) https://creativecommons.org/licenses/by/3.0/.