

© International Baccalaureate Organization 2021

All rights reserved. No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without the prior written permission from the IB. Additionally, the license tied with this product prohibits use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2021

Tous droits réservés. Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2021

Todos los derechos reservados. No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

Sports, exercise and health science
Standard level
Paper 2

Wednesday 3 November 2021 (morning)

Candidate session number

--	--	--	--	--	--	--	--	--	--

1 hour 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 one question.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.



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]

.....

.....

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

.....

.....

.....

.....

(This question continues on the following page)



(Question 1 continued)

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

[3]

.....

.....

.....

.....

.....

.....

(d) Identify the sport with the smallest standard deviation for eccentric rate of force development.

[1]

.....

.....

(e) Comment on the meaning of the standard deviation with reference to Table 1.

[3]

.....

.....

.....

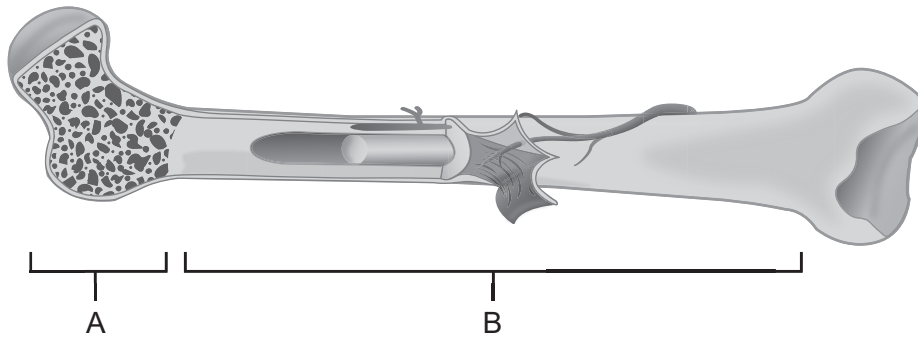
.....

.....

.....



2. The diagram shows a long bone.



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

[2]

A:

.....

B:

.....

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

[1]

.....

.....

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

[1]

.....

.....

(This question continues on the following page)



(Question 2 continued)

(c) Outline **three** functions of cartilage.

[3]

.....

.....

.....

.....

.....

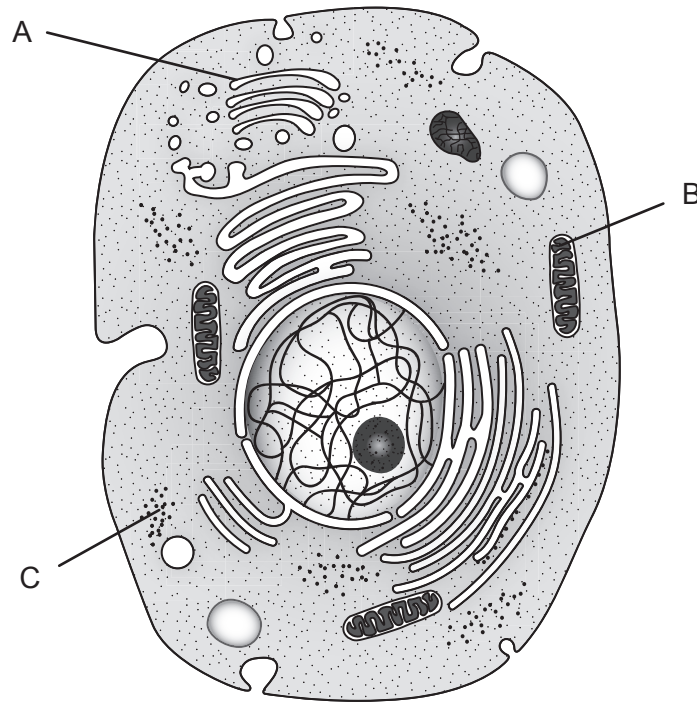
.....



16EP05

Turn over

3. The diagram represents the ultrastructure of a generalized animal cell.



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

[3]

	Name	Annotation
A
B
C

(This question continues on the following page)



(Question 3 continued)

(b) Explain cardiovascular drift and the relevance of hydration during a 50km walk.

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Please **do not** write on this page.

Answers written on this page
will not be marked.



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

[4]

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Outline how maximal oxygen consumption differs between running and arm ergometry.

[2]

.....

.....

.....

.....

.....

.....

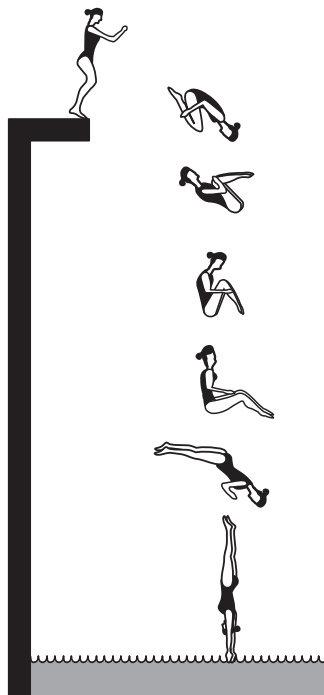


Section B

Answer **one** question. Answers must be written within the answer boxes provided.

- 5. (a) Using examples, describe **two** different types of practice. [4]
- (b) 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]
- (c) Analyse the process of gaseous exchange at the alveoli during exercise. [5]
- (d) Using examples, outline the features of a skilled performer. [6]

- 6. (a) Describe the regulation of heart rate. [4]
- (b) Analyse oxygen deficit. [5]
- (c) Explain the differences in dietary recommendations for a runner during marathon training and a sedentary individual both with healthy body mass index (BMI). [5]
- (d) 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]



7. (a) Carbohydrates are important for muscular contraction during hill walking. Describe the role of insulin on glucose uptake when walking. [4]
- (b) Discuss the structural differences between slow twitch and fast twitch muscle fibre types. [6]
- (c) Analyse how research design and statistical analysis aid the validity of studies conducted by sports scientists. [4]
- (d) Motor skills are classified into various continua. Using examples, outline the motor skills along the interaction continuum. [6]



A large rectangular area containing horizontal dotted lines for writing.



16EP12

A large rectangular area containing 25 horizontal dotted lines for writing.



16EP13

Turn over

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.
2. 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/>.

All other texts, graphics and illustrations © International Baccalaureate Organization 2021



16EP16