



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 written permission from the IB.

Additionally, the license tied with this product prohibits commercial 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, is not permitted and is subject to the IB's prior written consent via a license. More information on how to request a license can be obtained from <http://www.ibo.org/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

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 de l'IB.

De plus, la licence associée à ce produit interdit toute utilisation commerciale 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, n'est pas autorisée et est soumise au consentement écrit préalable de l'IB par l'intermédiaire d'une licence. Pour plus d'informations sur la procédure à suivre pour demander une licence, rendez-vous à l'adresse <http://www.ibo.org/fr/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

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 que medie la autorización escrita del IB.

Además, la licencia vinculada a este producto prohíbe el uso con fines comerciales 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— no está permitido y estará sujeto al otorgamiento previo de una licencia escrita por parte del IB. En este enlace encontrará más información sobre cómo solicitar una licencia: <http://www.ibo.org/es/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

**Biology**  
**Standard level**  
**Paper 1**

Thursday 9 May 2019 (afternoon)

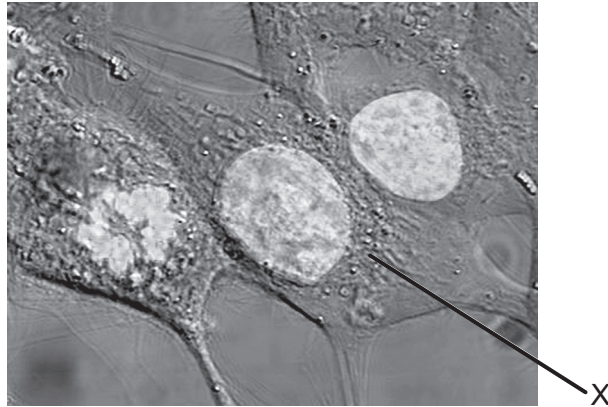
45 minutes

---

**Instructions to candidates**

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[30 marks]**.

1. Which structures are found only in prokaryotic cells?
  - A. Ribosomes
  - B. Pili
  - C. Cell walls
  - D. Flagella
  
2. The magnification of the micrograph is  $2000\times$ .

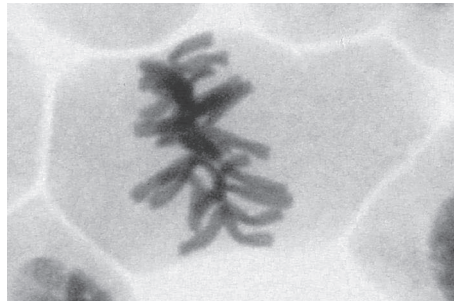


[Source: [https://upload.wikimedia.org/wikipedia/commons/6/6c/HeLa\\_cells\\_stained\\_with\\_Hoechst\\_33258.jpg](https://upload.wikimedia.org/wikipedia/commons/6/6c/HeLa_cells_stained_with_Hoechst_33258.jpg) by TenOfAllTrades.]

What is the maximum diameter of the nucleus in the cell labelled X?

- A.  $10\ \mu\text{m}$
- B.  $10\ \text{nm}$
- C.  $20\ \mu\text{m}$
- D.  $20\ \text{nm}$

3. The image shows a micrograph of a cell.



[Source: © 2014, [https://commons.wikimedia.org/wiki/File:Mitosis\\_\(261\\_13\)\\_Pressed;\\_root\\_meristem\\_of\\_onion\\_\(cells\\_in\\_prophase,\\_metaphase,\\_anaphase,\\_telophase\).jpg](https://commons.wikimedia.org/wiki/File:Mitosis_(261_13)_Pressed;_root_meristem_of_onion_(cells_in_prophase,_metaphase,_anaphase,_telophase).jpg) by Doc. RNDr. Josef Reischig, CSc.]

What explains the appearance of the cell in the micrograph?

- A. The cell is dying.
  - B. The DNA is replicating.
  - C. The cell is in metaphase.
  - D. The cell is in telophase.
4. Which processes are involved in the development of cancer?
- I. Mutations occur in oncogenes.
  - II. Oncogenes prevent cancer.
  - III. Oncogenes affect cell cycle regulatory proteins.
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

5. The table shows concentrations of potassium ions and sodium ions inside and outside human cells.

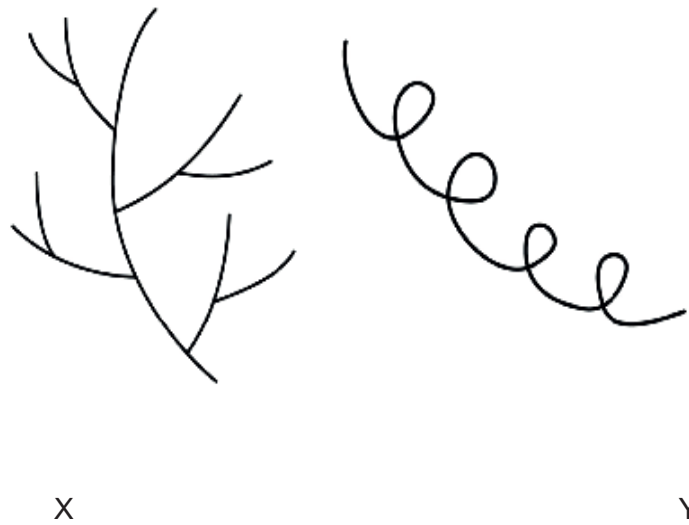
Ions	Concentration of ions / $10^{-3} \text{ mol dm}^{-3}$	
	Intracellular	Extracellular
Potassium ions	135	4
Sodium ions	10	145

[Source: © International Baccalaureate Organization 2019]

What explains these concentrations?

- A. Potassium ions diffuse in and sodium ions diffuse out.
  - B. Sodium ions diffuse in and potassium ions diffuse out.
  - C. Active transport pumps sodium ions in and potassium ions out.
  - D. Active transport pumps sodium ions out and potassium ions in.
6. Where do hydrogen bonds form?
- A. Between the slight negative charge of hydrogen and slight positive charge of oxygen within a water molecule
  - B. Between the slight positive charge of hydrogen and slight negative charge of oxygen within a water molecule
  - C. Between the slight positive charge of hydrogen and slight negative charge of oxygen in different water molecules
  - D. Between the slight negative charge of hydrogen and slight positive charge of oxygen in different water molecules

7. The diagram shows two polysaccharides, formed from condensation of many glucose molecules.



[Source: © International Baccalaureate Organization 2019]

What are the names of X and Y?

	<b>X</b>	<b>Y</b>
A.	glycogen	amylose
B.	amylopectin	amylase
C.	amylase	glycogen
D.	amylose	amylopectin

8. Which statement correctly describes genome and proteome?
- Only the genome but not the proteome can be analysed using gel electrophoresis.
  - The genome and the proteome are the same in all tissues in an organism.
  - In cells of different tissues, the genome is the same while the proteome varies.
  - Only mutations in the proteome but not in the genome cause any variability.

9. The base sequences of a short section of DNA are shown, together with mRNA that has been transcribed from it and one of the tRNA anticodons that could be used to translate the mRNA.

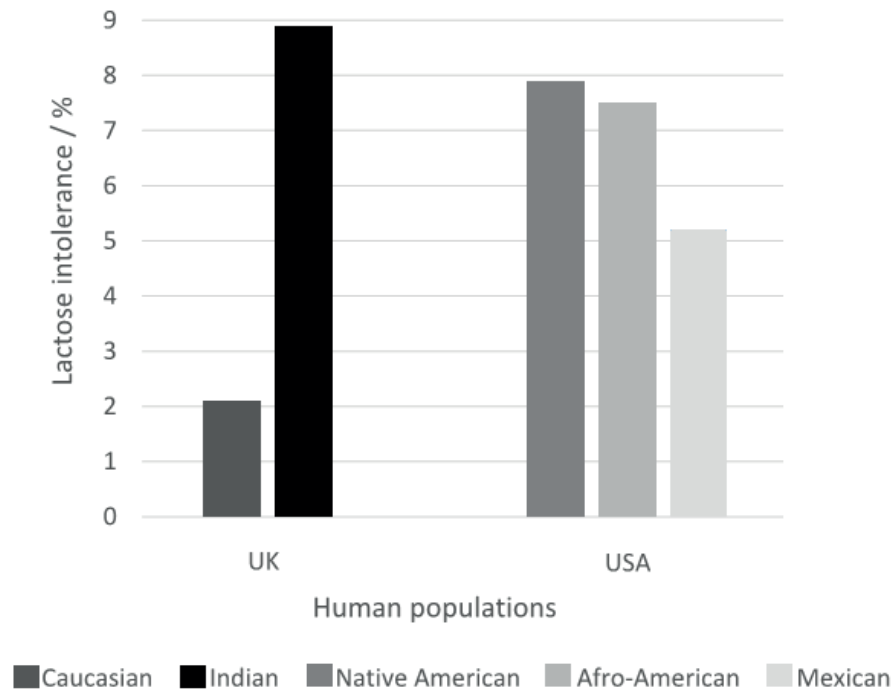
**DNA strand 1** A-C-G-G-C-A-T-T-A-G-C-T-A      **tRNA anticodon** U-U-A

**DNA strand 2** T-G-C-C-G-T-A-A-T-C-G-A-T      **mRNA** U-G-C-C-G-U-A-A-U-C-G-A-U

Which strand of DNA is transcribed and to which codon in the mRNA would the tRNA anticodon bind during translation?

	<b>DNA strand transcribed</b>	<b>mRNA codon that tRNA anticodon binds to</b>
A.	DNA strand 1	second
B.	DNA strand 2	second
C.	DNA strand 1	third
D.	DNA strand 2	third

10. Lactose intolerance occurs when the enzyme, lactase, that digests lactose is not produced after infancy in humans. The incidence of lactose intolerance varies in different racial groups. The graph shows the distribution of lactose intolerance in different human populations.



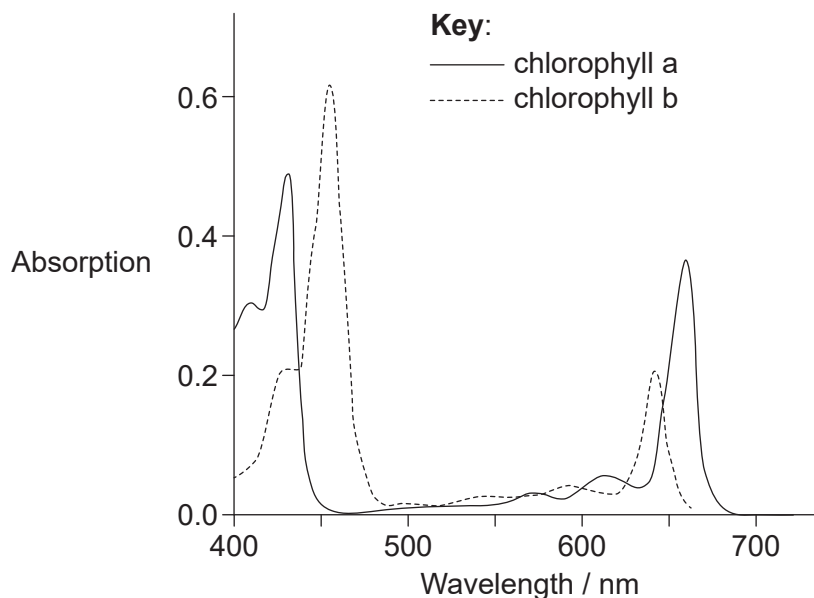
[Source: © International Baccalaureate Organization 2019]

What can be hypothesized from the graph?

- A. Native American people produce most lactase after infancy.
- B. Most Indian people do not produce lactase after infancy.
- C. Lactase is not produced after infancy in most Caucasian people.
- D. One quarter of Afro-Caribbean people will probably experience digestive problems when drinking milk.



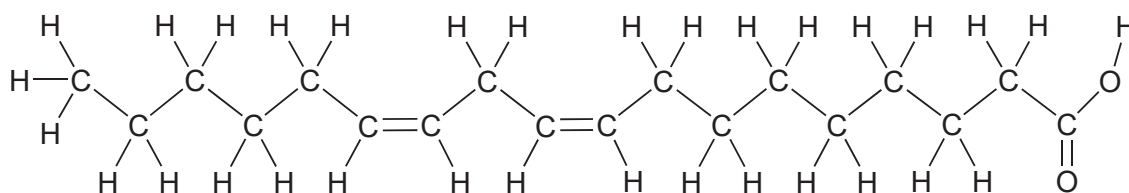
11. The graph shows the absorption spectra of chlorophyll a and chlorophyll b.



[Source: adapted from F. P. Zscheile and C. L. Comar, 'Influence of Preparative Procedure on the Purity of Chlorophyll Components as Shown by Absorption Spectra.' *Int. J. Plant Sciences*, Volume 102, Number 3, Mar., 1941, pp. 463–481. Used with the kind permission of University of Chicago Press.]

What can be concluded from the graph?

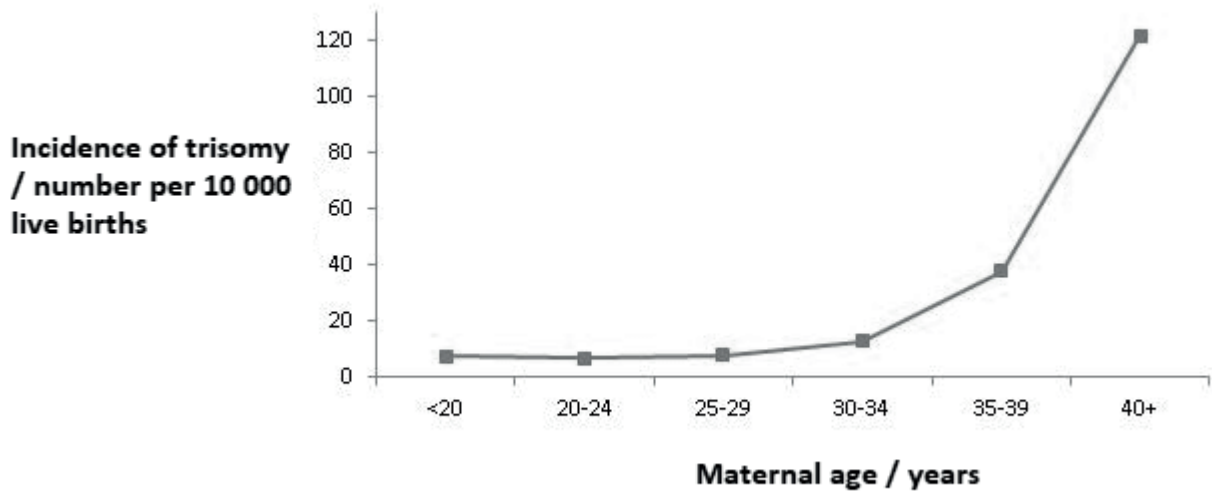
- A. Both chlorophyll a and chlorophyll b absorb a large amount of green light
  - B. Chlorophyll b absorbs red light more efficiently than blue light
  - C. Other pigments must absorb light between blue and red in the spectrum
  - D. Chlorophyll a and chlorophyll b have different absorption peaks
12. The diagram shows a type of fatty acid.



What type of fatty acid is shown?

- A. Trans unsaturated
- B. Cis unsaturated
- C. Trans saturated
- D. Cis saturated

13. The graph shows the incidence of trisomy resulting from non-disjunction in pregnancies at different maternal ages.

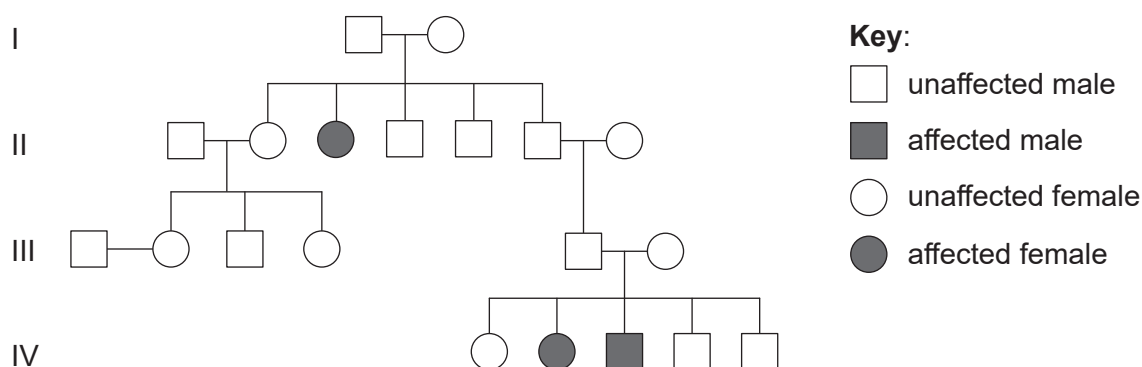


[Source: Center for Disease Control]

What can be inferred from the graph?

- A. The incidence of three copies of a chromosome increases directly in proportion with the age of the mother.
- B. The incidence of three sets of chromosomes increases from age 20.
- C. The incidence of three copies of a chromosome increases the most from age 35.
- D. The incidence of three sets of chromosomes increases the most from age 30.

14. The pedigree chart shows a family affected by cystic fibrosis.

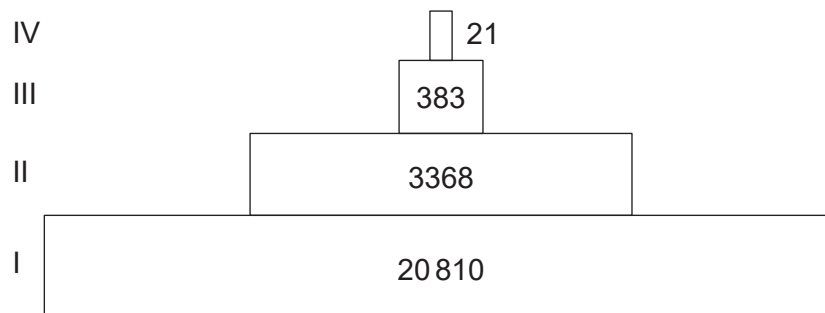


[Source: © International Baccalaureate Organization 2019]

What is the genotype of the affected boy's father?

- A. AA only
- B. Either AA or Aa
- C. Aa only
- D. aa only
15. The children in a family have blood groups A, B and O. What are the genotypes of their parents?
- A.  $I^A I^A$  and  $I^B i$
- B.  $I^A i$  and  $I^B i$
- C.  $I^A I^B$  and  $ii$
- D.  $I^A I^B$  and  $I^B i$
16. Genetically modified maize, called Bt maize, is thought to be affecting the monarch butterfly (*Danaus plexippus*) in the USA. What is the reason for this?
- A. The monarch butterfly feeds on maize nectar, which contains Bt toxin.
- B. The monarch caterpillar feeds on maize leaves, which contain Bt toxin.
- C. Bt toxin kills the plants that the monarch caterpillar usually eats.
- D. Bt toxin is in maize pollen, which blows on to plants that the monarch caterpillar eats.

17. In an ecosystem, in the transfer of carbon from producers to consumers, what is carbon transferred as?
- I. Carbon dioxide
  - II. Protein
  - III. Hydrogencarbonate ions
- A. I only
  - B. II only
  - C. I and II only
  - D. I and III only
18. The Silver Springs feed into the Silver River in Florida. The diagram shows a pyramid of energy for the Silver Springs ecosystem. The units are  $\text{kJ m}^{-2} \text{y}^{-1}$ .



[Source: © International Baccalaureate Organization 2019]

What do level I and level III represent in the pyramid of energy?

	I	III
A.	sunlight	secondary consumer
B.	producer	tertiary consumer
C.	producer	secondary consumer
D.	primary consumer	tertiary consumer

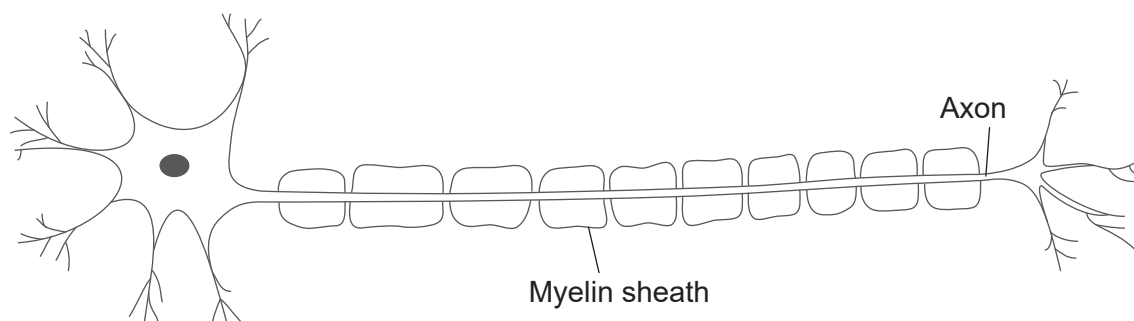
19. Which is **not** essential in a viable mesocosm?
- A. Light source
  - B. Autotroph
  - C. Saprotroph
  - D. Herbivore
20. What is required for natural selection to occur?
- I. Acquired characteristics
  - II. Advantageous characteristics
  - III. Genetic variation
- A. I only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
21. If seeds of an unknown species of plant are discovered, what assumption can be made about the species?
- A. Its male gametes are contained within pollen.
  - B. Its seeds are contained within fruits.
  - C. It is in the domain archaea.
  - D. It is in the phylum angiospermophyta.
22. Which phyla have bilateral symmetry?
- A. annelida, arthropoda, platyhelmintha
  - B. porifera, arthropoda, platyhelmintha
  - C. cnidaria, porifera, mollusca
  - D. porifera, annelida, mollusca

23. Which is the hierarchy of taxa in order of decreasing numbers of species?
- A. domain, phylum, order, family
  - B. phylum, order, family, class
  - C. domain, phylum, order, class
  - D. phylum, class, family, order
24. What is an advantage of capillary walls being one cell thick in the systemic circulation?
- A. To allow carbon dioxide to diffuse into tissues
  - B. To allow oxygen to diffuse out of tissues
  - C. To allow glucose to diffuse into tissues
  - D. To allow urea to diffuse into tissues
25. What causes the atrioventricular valves to close during a heartbeat?
- A. Pressure in the atria is higher than in the ventricles.
  - B. Pressure in the atria is lower than in the ventricles.
  - C. Pressure in the arteries is higher than in the ventricles.
  - D. Pressure in the arteries is lower than in the ventricles.
26. In premature babies born earlier than the 30<sup>th</sup> week of pregnancy, type II pneumocytes are usually not fully developed, so they do not carry out their function normally. What is a possible consequence of this?
- A. The number of alveoli reduces.
  - B. The size of the alveoli increases.
  - C. Capillary networks do not develop fully and oxygen is not absorbed.
  - D. Surface tension between alveoli does not decrease and the alveoli stick together.

27. What is the reason for antibiotics not damaging human cells?

- A. The dose is too small to be harmful.
- B. The dose is taken for only a short time.
- C. Antibiotics occur naturally in humans.
- D. Human metabolism is different from bacterial metabolism.

28. The diagram shows a motor neuron.

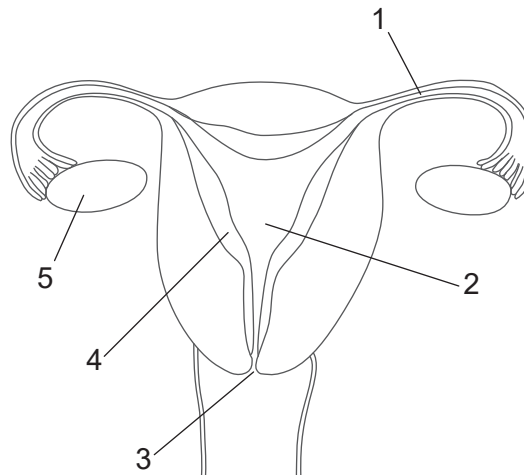


[Source: © International Baccalaureate Organization 2019]

What are the biochemical nature and function of the myelin sheath?

- A. The myelin sheath is mainly protein which allows growth of the axon.
  - B. The myelin sheath is mainly protein which acts as membrane carriers.
  - C. The myelin sheath is mainly lipid which allows saltatory conduction.
  - D. The myelin sheath is mainly lipid which provides an energy source.
29. Which hormone is part of a negative feedback control system and acts on cells in the hypothalamus?
- A. Insulin
  - B. Glucagon
  - C. Melatonin
  - D. Leptin

30. The diagram shows the human female reproductive system.



[Source: © International Baccalaureate Organization 2019]

Which labels indicate where fertilization occurs and where luteinizing hormone (LH) acts?

	Where fertilization occurs	Where LH acts
A.	1	3
B.	2	5
C.	3	4
D.	1	5

---