Diploma Programme
Programme du diplôme
Programa del Diploma

# Biology
# Standard level
# Paper 2

Thursday 9 May 2019 (afternoon)

1 hour 15 minutes

Candidate session number

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

**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]**.



2219 – 6011

## Section A

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

**1.** Ebola virus disease (EVD) is the disease in humans and other primates that is caused by the Ebola virus. Fruit bats are the reservoir for the virus and are able to spread the disease without being affected. Humans can become infected by contact with fruit bats or with people infected by the virus, their body fluids or equipment used to treat them.

The table shows data for four African countries that were affected by the 2014–2015 Ebola outbreak.

| Country | Total population / millions | Population density / inhabitants $km^{-2}$ | Number of Ebola cases | Number of deaths | Death rate (as a percentage of Ebola cases) / % |
|---|---|---|---|---|---|
| Liberia | 4.5 | 40 | 10672 | 4808 | 45.1 |
| Sierra Leone | 6.3 | 79 | 13250 | 3949 | 29.8 |
| Guinea | 12.3 | 53 | 3783 | 2512 | 66.4 |
| Mali | 16.3 | 14 | 8 | 6 | 75.0 |

[Source: adapted with permission, from Ebola Situation Report, figure 1, http://apps.who.int/ebola/current-situation/ebola-situation-report-2-march-2016, March 2016, and from Successful treatment of advanced Ebola virus infection with T-705 (favipiravir) in a small animal model, Oestereich, L. *et al*, 2014, under CC BY 3.0]

(a) Identify the country with

(i) the largest number of Ebola cases. [1]

. . . . . .

(ii) the largest number of deaths. [1]

. . . . . .

(b) Analysis of the data suggests that the number of deaths from EVD is not related to the total population size. State **one** piece of evidence from the data that would support this analysis. [1]

. . . . . .

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

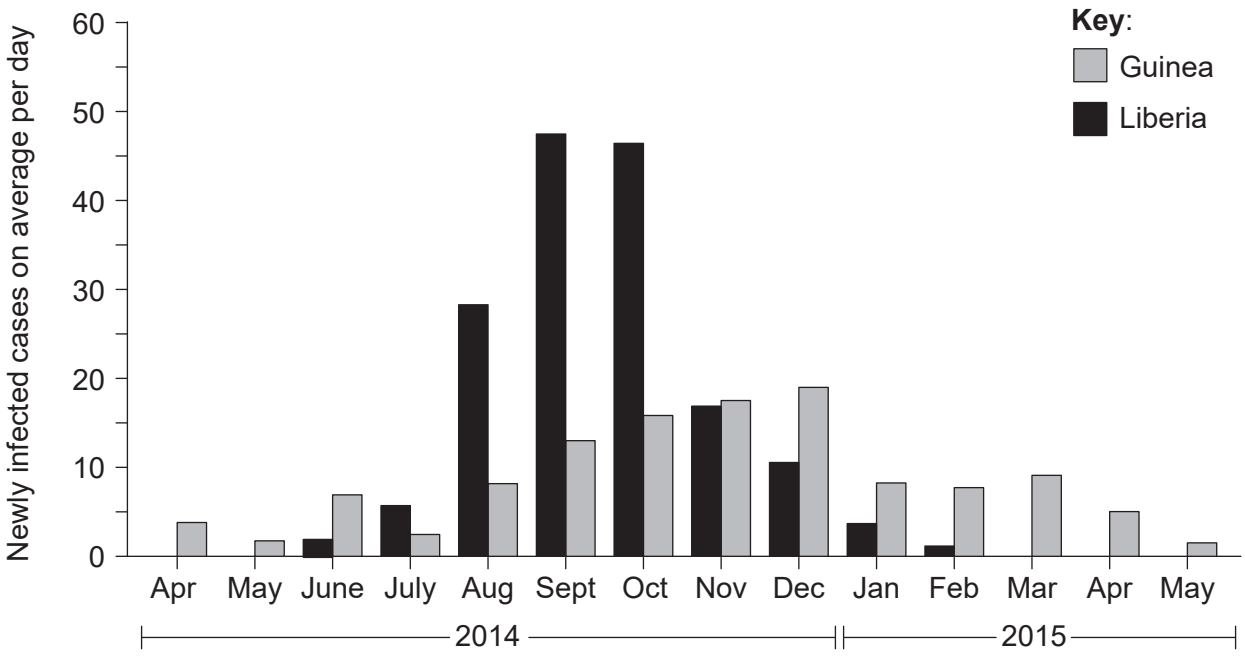
**(Question 1 continued)**

(c) Based on the mode of transmission of the Ebola virus, suggest a possible reason for the relationship between population density and the number of Ebola cases in these four countries. [1]

. . . . . .

. . . . . .

The graphs show the progress of the EVD epidemic in Guinea and Liberia for the period April 2014 to May 2015.




[Source: Ebola Situation Report 2 March 2016 and data from *International Journal of Infectious Diseases*, 38, Ligui Wang *et al*, Epidemiological features and trends of Ebola virus disease in West Africa, 52-53., Copyright 2015, with permission from Elsevier]

(d) Based on the data, compare and contrast the progress of the epidemic in Liberia and Guinea. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

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

**(Question 1 continued)**

(e) Suggest **two** possible reasons for the drop in the daily numbers of newly infected cases after October 2014 in Liberia. [2]

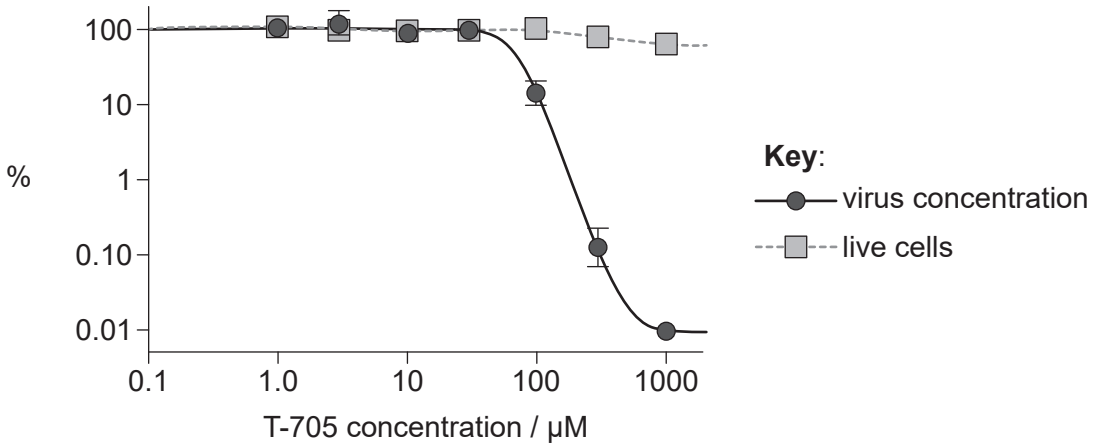
. . . . . .

. . . . . .

. . . . . .

. . . . . .

An antiviral drug, T-705, was tested in order to establish whether it has potential to treat EVD. The graph shows the data from an in vitro trial of T-705 on cells that had been infected with Ebola virus five days previously. Virus concentration and live cells are shown as percentage of the control.




[Source: Oestereich, Lisa & Rieger, Toni & Neumann, Melanie & Bernreuther, Christian & Lehmann, Maria & Krasemann, Susanne & Wurr, Stephanie & Emmerich, Petra & de Lamballerie, Xavier & Ölschläger, Stephan & Günther, Stephan. (2014). Evaluation of Antiviral Efficacy of Ribavirin, Arbidol, and T-705 (Favipiravir) in a Mouse Model for Crimean-Congo Hemorrhagic Fever. *PLoS neglected tropical diseases*. **8**. e2804. 10.1371/journal.pntd.0002804.]

(f) Based on these data, outline the evidence that T-705 has potential to be used as a treatment for EVD. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

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

**(Question 1 continued)**

(g) District administrators combatting the 2014 Ebola epidemic in West Africa were assisted by international organizations such as the World Health Organization, who provided data on the progress of the epidemic. Suggest **one** other way in which international organizations can assist with combatting an epidemic of Ebola. [1]

. . . . . .

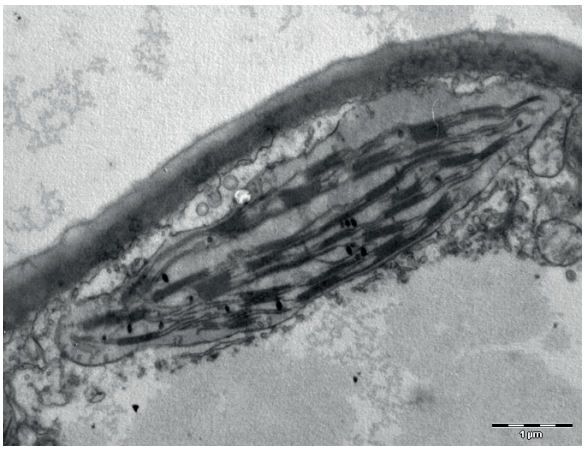
. . . . . .

**2.** (a) Identify which electron micrograph shows a mitochondrion, providing **one** observation to support your choice. [1]

A

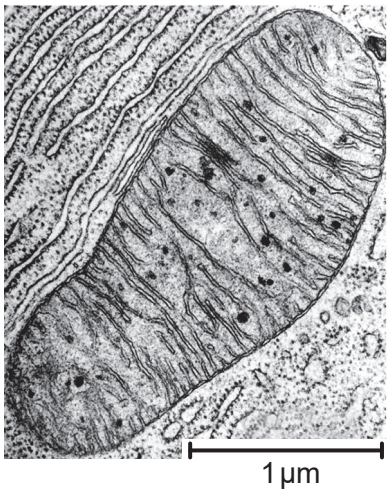

[Source: Pradana Aumars, https://commons.wikimedia.org/wiki/Category:Bacteria#/media/File:Bacteria_cell_division.jpg]

B



[Source: and3k and caper437/ https://bs.wikipedia.org/wiki/Datoteka:Chloroplast_in_leaf_of_Anemone_sp_TEM_12000x.png]

C




[Source: republished with permission of McGraw-Hill Education, from *Harrison's Principles of Internal Medicine*,J L Jameson *et al.*, 16th edition, 2004; permission conveyed through Copyright Clearance Center, Inc]

. . . . . .

. . . . . .

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

**(Question 2 continued)**

(b) Discuss the evidence for the theory that mitochondria may have evolved from free-living prokaryotes by endosymbiosis. [3]

. . . . . .

. . . . . .

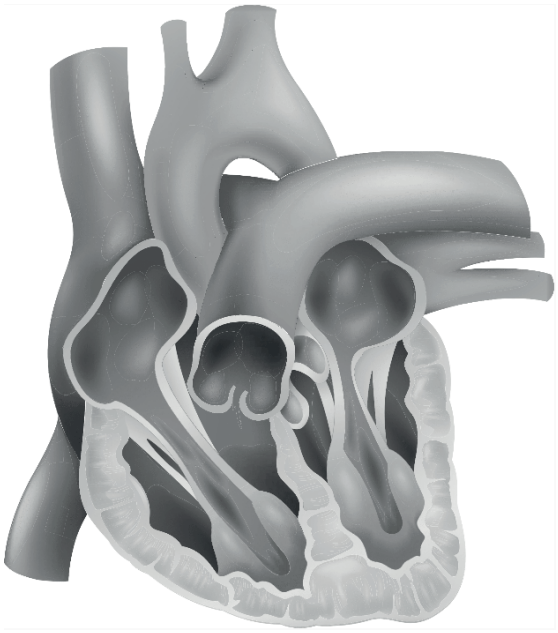
. . . . . .

. . . . . .

. . . . . .

. . . . . .

**3.** (a) The diagram shows the human heart.



[Source: BlueRingMedia/Shutterstock]

On the diagram, label

(i) the aorta. [1]

(ii) the right atrium. [1]

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

**(Question 3 continued)**

(b) Explain how valves control the flow of blood through the heart. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

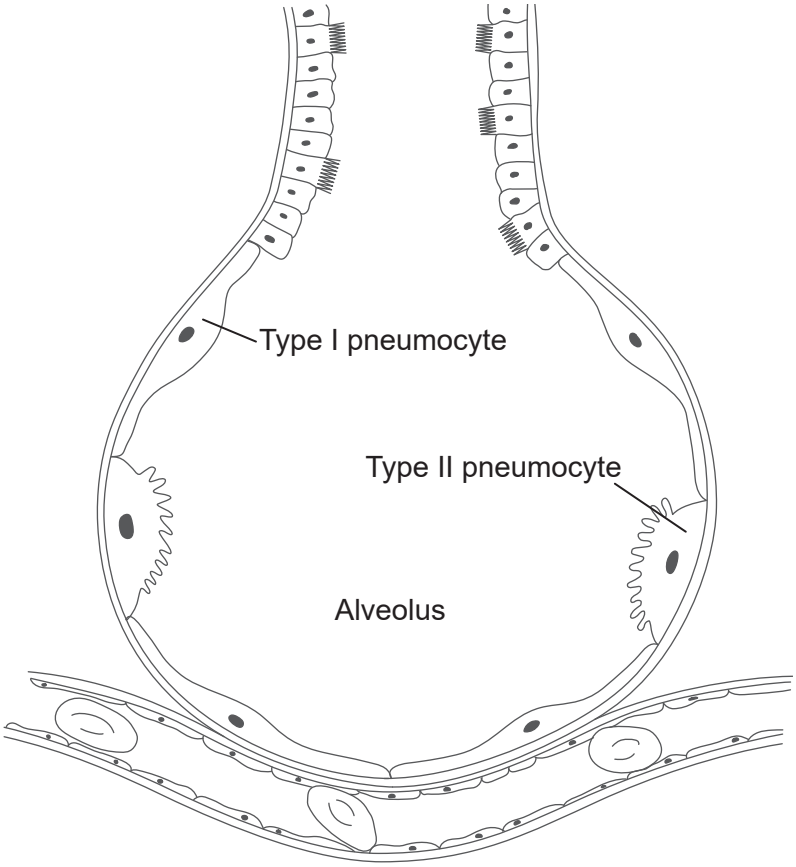
(c) Outline the causes and consequences of blood clot formation in coronary arteries. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(d) Outline the role of lymphocytes in defence against disease. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

**4.** The diagram shows the structure of an alveolus and an adjacent capillary.




[Source: © International Baccalaureate Organization 2019]

(a) Outline the functions of type I and type II pneumocytes. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) Explain how gases are exchanged between the air in the alveolus and the blood in the capillaries. [3]

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

**5.** The table gives common names and binomial names for some mammals.

| Common name | Binomial name |
|---|---|
| Golden bamboo lemur | *Hapalemur aureus* |
| Golden jackal | *Canis aureus* |
| Grey wolf | *Canis lupus* |
| Red fox | *Vulpes vulpes* |

(a) State **one** feature that characterizes these species as mammals. [1]

. . . . . .

(b) Identify the **two** species most closely related. [1]

1. . . . . .

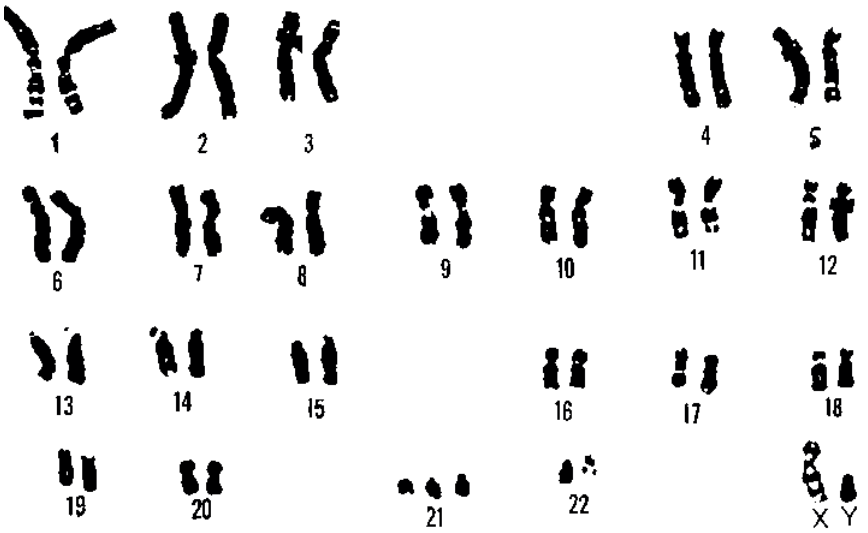
2. . . . . .

(c) Identify **two** species from the list that are classified in different genera. [1]

1. . . . . .

2. . . . . .

**6.** The image shows the chromosomes from a body cell of an adult human.




[Source: http://www.ornl.gov/sci/techresources/Human_Genome/graphics/slides/elsikaryotype.shtml, U.S. Department of Energy Human Genome Program.]

(a) Identify, with a reason, the sex of this individual. [1]

. . . . . .

. . . . . .

(b) Identify the chromosome that is affected by a trisomy in this individual, naming the condition that this trisomy gives rise to. [1]

Chromosome number: . . . . . .

Name of condition: . . . . . .

## Section B

Answer **one** question. Up to one additional mark is available for the construction of your answer. Answers must be written within the answer boxes provided.

**7.** (a) Outline the stages in the production of mRNA by transcription. [4]

(b) Describe the functions of proteins in cell membranes. [4]

(c) Explain how natural selection can lead to speciation. [7]

**8.** (a) Describe how detritivores obtain nutrition and the effects they have in ecosystems. [4]

(b) Outline the role of amylase in digestion in humans. [4]

(c) Explain how plants capture and use light in photosynthesis. [7]