Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **5090/22**

Paper 2 Theory **October/November 2023**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

DC (LK/CGW) 313685/4
© UCLES 2023

BLANK PAGE

1 Cholera is caused by a type of organism that can be passed from one host to another.

(a) State the term used to describe

(i) a disease-causing organism

..... [1]

(ii) the type of disease in which the disease-causing organism is passed from one host to another.

..... [1]

(b) The disease-causing organism that causes cholera is a bacterium.

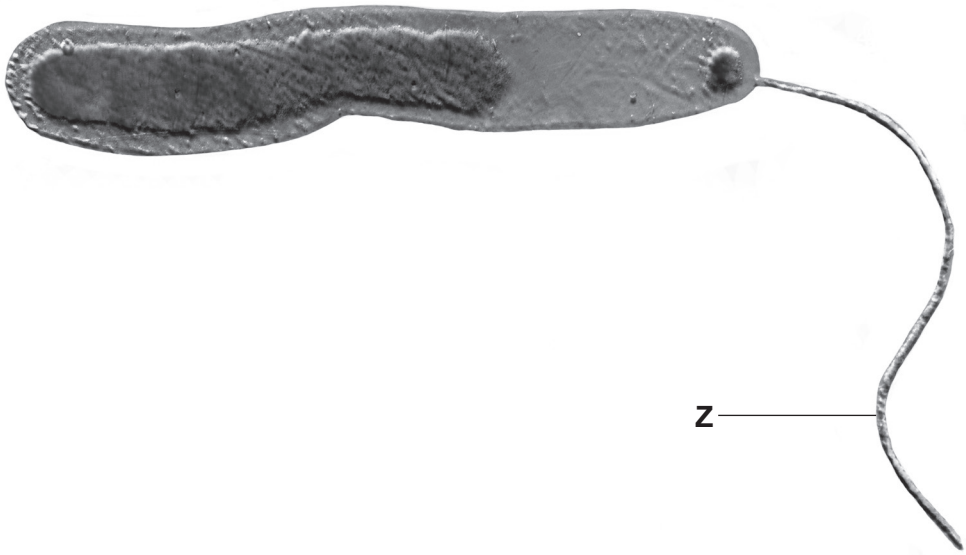
Complete Table 1.1 to list some of the structures present in a bacterial cell and the function of each structure.

Table 1.1

structure	**function**
ribosomes	.....
.....	small rings of DNA that carry genes
.....	controls the passage of substances into and out of the cell
cell wall	.....

[4]

(c) Fig. 1.1 shows a photograph of the bacterium that causes cholera.



magnification ×50 000

Fig. 1.1

(i) The length of the bacterium in the photograph is 100 mm. Use this value to calculate the actual length of the bacterium in micrometres (μm).
Space for working.

..... μm
[2]

(ii) Use your knowledge of a type of specialised human cell to suggest the name of structure **Z** and to state its function.

name .....

function .....

.....
[2]

(iii) The binomial name of this type of bacterium is *Vibrio cholerae*.

State the genus of this type of bacterium and **one** advantage of the binomial system of naming species.

genus .....

advantage .....

.....
[2]

(iv) Explain how the presence of bacteria of this type in a human causes diarrhoea, one of the symptoms of cholera.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 16]

2 Fig. 2.1 shows a reindeer.

Fig. 2.1

Reindeer live in areas of the Arctic where there are no trees.

In some months of the year reindeer eat mostly grasses, ferns and mosses.

Reindeer are eaten by wolves and brown bears.

(a) Construct a food web to show the flow of energy between organisms in this ecosystem.

[4]

(b) In other months of the year reindeer eat an alternative source of food.

This alternative source of food contains a carbohydrate called lichenan.

Reindeer are the only animals that are able to digest lichenan.

(i) List the chemical elements that make up a molecule of lichenan.

..... [1]

(ii) State **one** advantage to reindeer of eating food that contains lichenan.

.....

..... [1]

(iii) Use your knowledge of how cell function is controlled to suggest why other animals are **not** able to digest lichenan.

.....

.....

.....

..... [2]

[Total: 8]

3 Fig. 3.1 shows diagrams that represent the blood flow into and out of three major organs through blood vessels **P** to **U**.

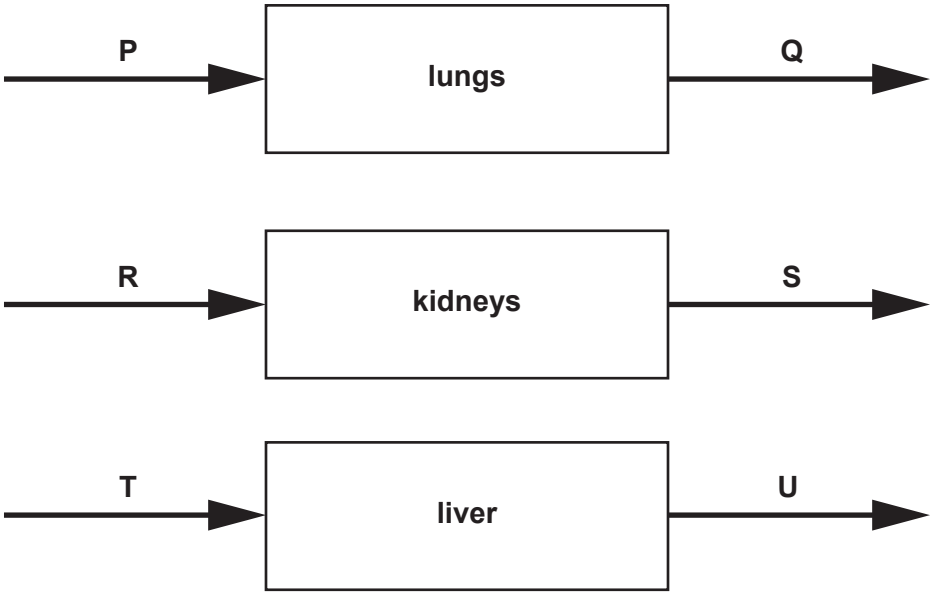


Fig. 3.1

(a) Identify each of the following blood vessels.

Q .....

R .....

U ..... [3]

(b) Compare the structures of blood vessels **Q** and **R**.

.....

.....

.....

.....

.....

..... [3]

(c) Explain each of the following.

(i) Blood in vessel **S** has a lower concentration of urea than blood in vessel **R**.

.....

.....

.....

.....

.....

..... [3]

(ii) Blood in vessel **U** sometimes has a higher concentration of glucose than blood in vessel **T**.

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

4 Fig. 4.1 shows a Siamese fighting fish that lives in fresh water.

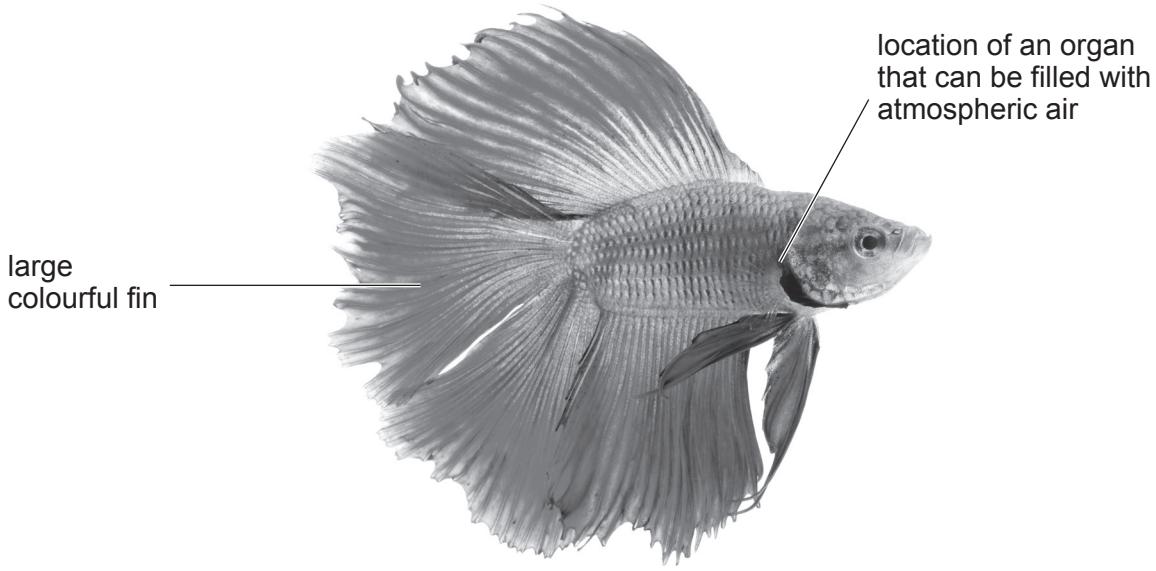


Fig. 4.1

Fig. 4.2 shows the effect of changing pH on the solubility of oxygen in water.

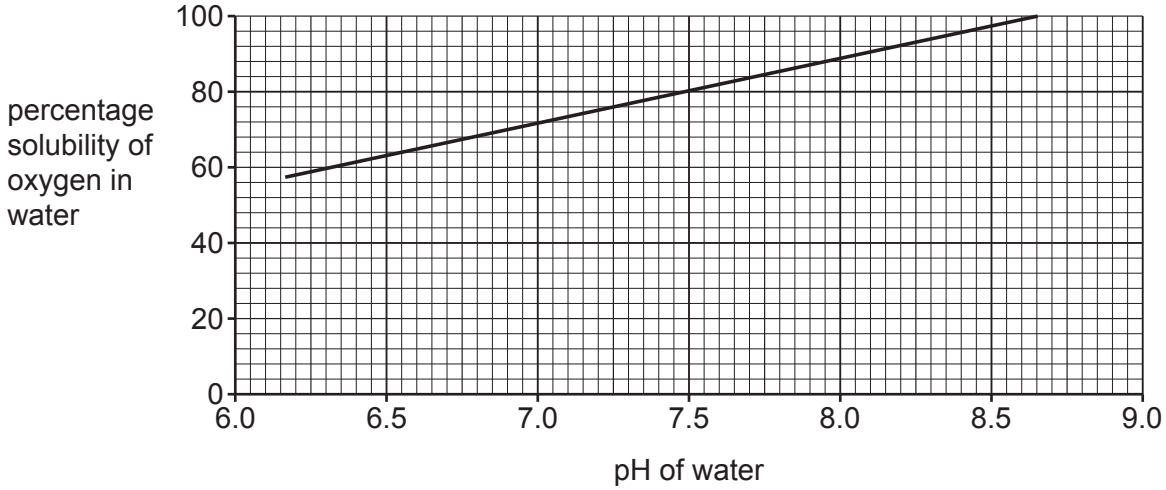


Fig. 4.2

Fig. 4.3 shows the effect of changing temperature on the solubility of oxygen in water.

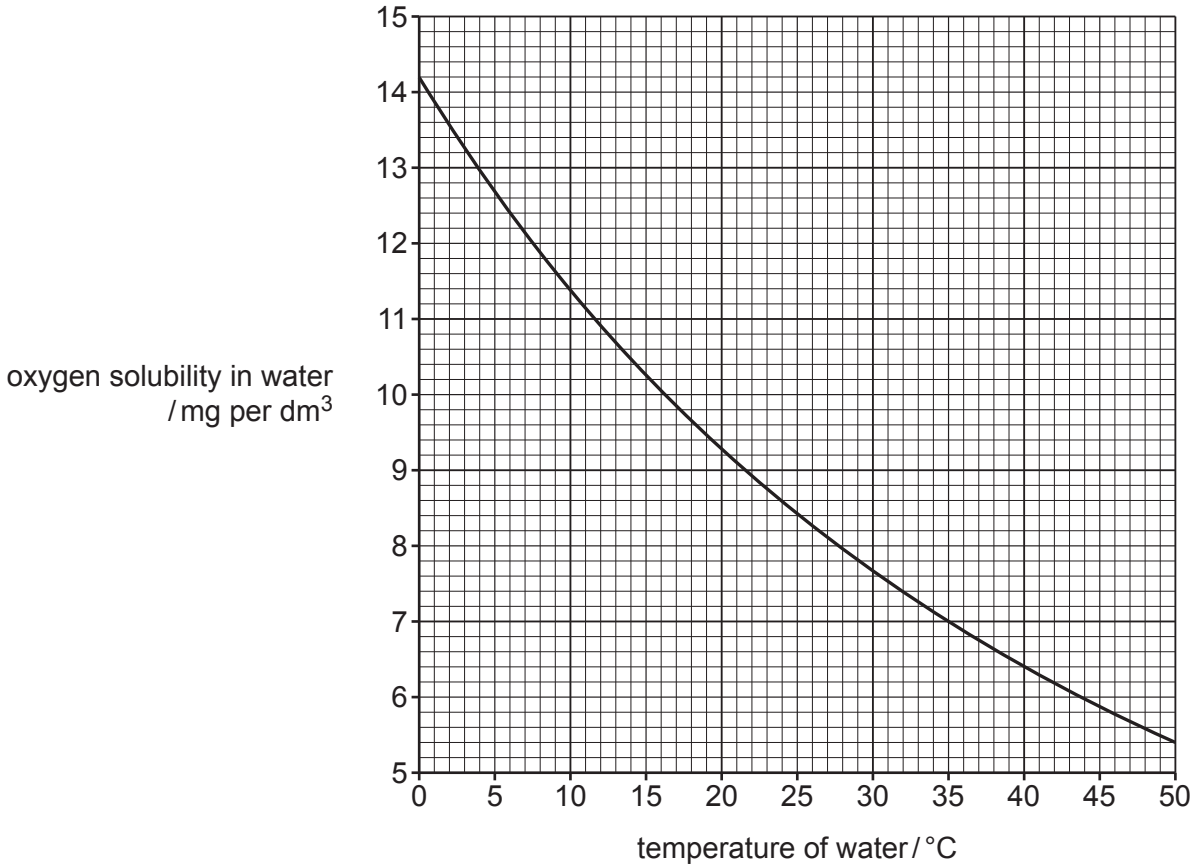


Fig. 4.3

(a) Siamese fighting fish live in shallow water that can range in pH from 6.9 to 8.2 and in temperature from 15 °C to 40 °C.

(i) Use the information in Fig. 4.2 and Fig. 4.3 to explain how the conditions in which these fish live may be challenging.

.....

.....

.....

.....

.....

..... [3]

(ii) All fish have gills that provide a gas exchange surface in water.

Siamese fighting fish also have an organ that has similar features to those of a human lung. These fish swim to the surface of water to take air from the atmosphere into this organ.

Explain the advantage to Siamese fighting fish of also having this organ.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Siamese fighting fish have 42 chromosomes in each diploid cell.

State each of the following.

(i) the named structure in each diploid cell that contains the chromosomes

..... [1]

(ii) the type of nuclear division that produces gametes

..... [1]

(iii) the number of chromosomes in each gamete of the Siamese fighting fish.

..... [1]

(c) The dramatic shape and colour of Siamese fighting fish are produced by selective breeding.

Suggest how the process of selective breeding in Siamese fighting fish can be used to produce these desirable features.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 15]

5 A student investigates the use of an enzyme in fruit juice production.

The student carries out the following steps:

- cuts one apple into small pieces
- puts the same number of pieces into each of three beakers, **A**, **B** and **C**
- adds 2 cm^3 of a dilute enzyme solution to the apple in beakers **A** and **B**
- adds 2 cm^3 of distilled water to the apple in beaker **C**
- places each beaker in a water-bath at a constant temperature for 30 minutes
- filters the juice from each beaker into a separate measuring cylinder and records the volume of juice collected in each measuring cylinder.

(a) **(i)** Identify the enzyme that the student should add to the apple in beakers **A** and **B**.

..... [1]

(ii) Outline the reason why the student set up beaker **C**.

.....

..... [1]

(b) The results of the student's investigation are shown in Table 5.1.

Table 5.1

beaker	temperature of water-bath / °C	volume of juice collected / cm^3
A	45	20
B	90	5
C	45	5

Use your knowledge of enzyme action to explain these results.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(c) Bacteria can be genetically modified to produce enzymes for use in biotechnology.

State **two** reasons why bacteria are suitable for this purpose.

1 .....

2 .....
[2]

[Total: 9]

6 Fig. 6.1 is a cross-section of a plant leaf.

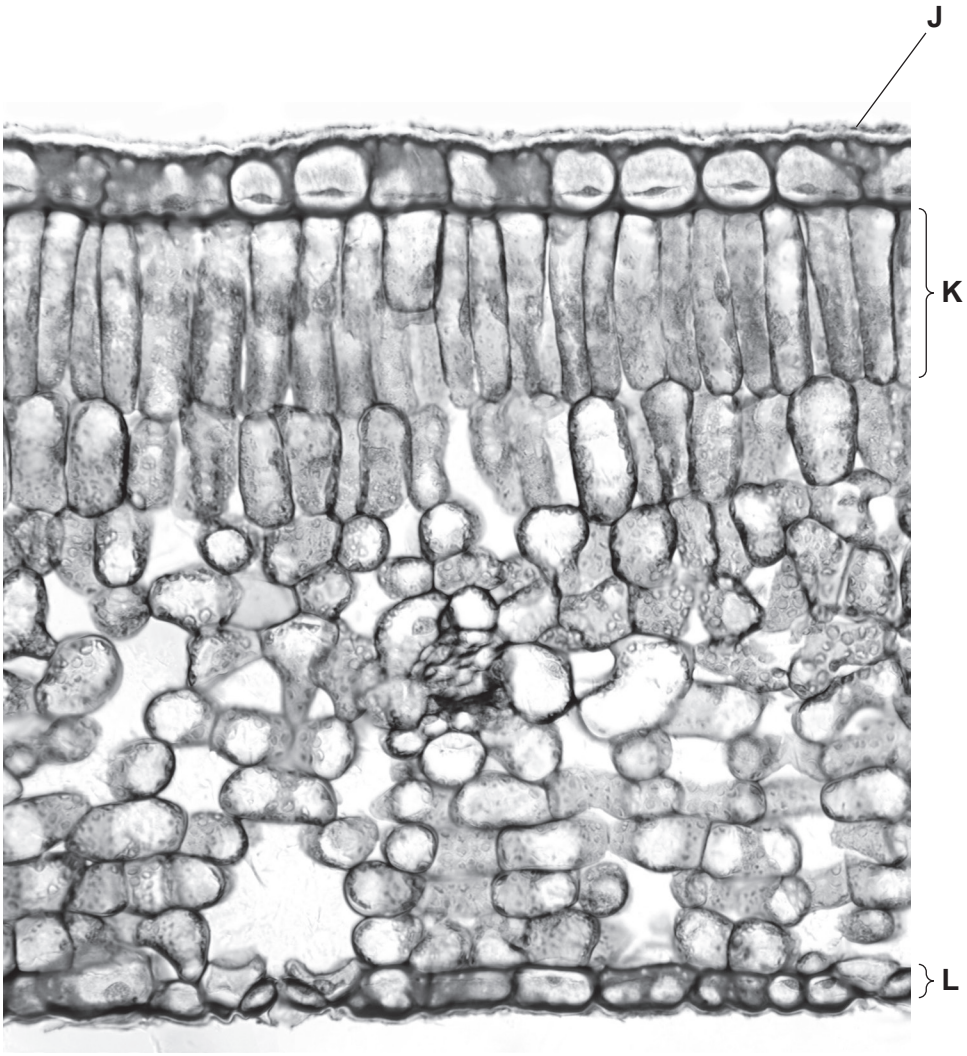


Fig. 6.1

(a) Identify each of **J**, **K** and **L** and explain the importance of each in the process of photosynthesis.

J .....

.....

.....

.....

K .....

.....

.....

.....

L .....

.....

.....

.....
[6]

(b) Name and describe the function of **one** tissue found in the vascular bundle of a leaf.

.....

.....

.....

.....

.....

..... [4]

[Total: 10]

7 Mangrove trees grow in forests that form an important coastal ecosystem.

Mangrove forests have a high biodiversity, with many different animal species found in them.

(a) Describe what is meant by each of the following terms.

(i) ecosystem

.....

.....

.....

..... [2]

(ii) biodiversity

.....

..... [1]

(iii) species

.....

.....

.....

..... [2]

(b) Like many forests around the world, mangrove forests are vulnerable to the effects of human activity.

Explain how forests can be conserved as a sustainable resource.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 10]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2023