Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **5090/22**

Paper 2 Theory **May/June 2024**

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 **16** pages. Any blank pages are indicated.

DC (JP/CB) 329297/3

1 Fig. 1.1 shows two cells from the leaf of a plant observed using a light microscope.

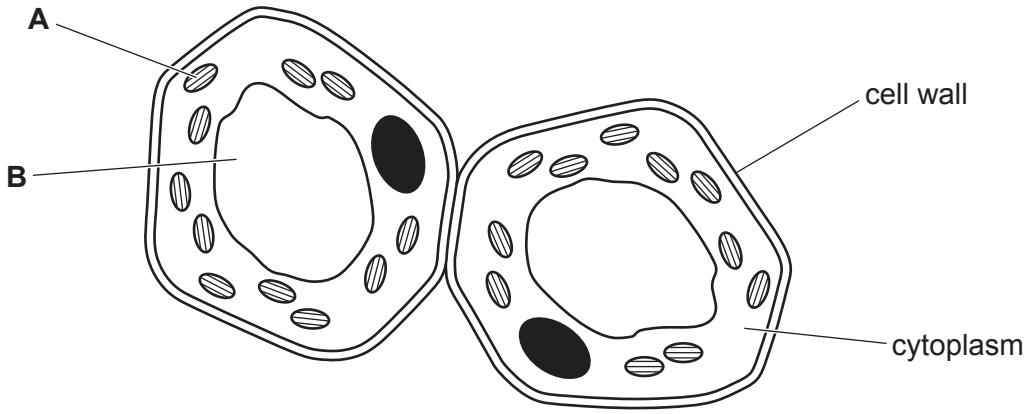

Fig. 1.1

(a) Complete Table 1.1 to identify the structures labelled **A** and **B** and to describe the function of each structure.

Table 1.1

structure	name of structure	description of function
A	.....	....
B	.....	....

[4]

(b) State **one** structure that is **not** visible in Fig. 1.1 but would be visible in the cytoplasm in an electron micrograph of the same two cells.

..... [1]

[Total: 5]

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2 Organisms can be classified into groups using the features they share.

(a) Fish are one of the main groups of vertebrates.

(i) State **three** main features used to classify an organism as a fish.

1 .....

2 .....

3 .....

[3]

(ii) State **two** main groups of vertebrates other than fish.

1 .....

2 .....

[2]

(b) Swordfish are large fish that live in the ocean.

They have a long, bony extension to the skull, called a sword.

Fig. 2.1 is a diagram of a swordfish.

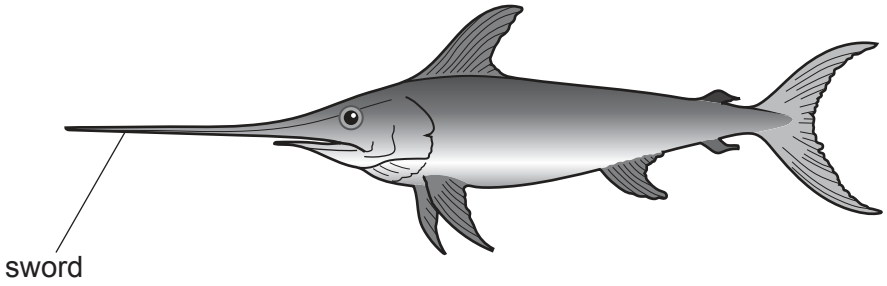

Fig. 2.1

The binomial name of the swordfish is *Xiphias gladius*.

(i) Define the term species.

.....

.....

..... [2]

(ii) State the species name of the organism shown in Fig. 2.1.

..... [1]

(c) Swordfish swim near the surface of the ocean where the water temperature is low.
During evolution, swordfish developed a muscle behind each eye that warms the eyes and the brain to a temperature above that of the ocean.
This feature gives swordfish improved vision.

(i) Name the process that led to the evolution of the muscle behind each eye of the swordfish.

..... [1]

(ii) Suggest reasons why the evolution of this feature has adapted swordfish to survive in the ocean.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 13]

3 **(a)** Complete Table 3.1, using terms from the list below to match each description to a term.

phenotype **dominant** **gene** **genotype**

heterozygous **homozygous** **allele** **recessive**

Table 3.1

description	term
a form of a gene that codes for one of a pair of contrasting features	.....
a form of a gene that always has an effect when it is present	.....
having two different forms of a gene for a particular feature	.....
having two of the same form of a gene for a particular feature	.....
the combination of alleles that an organism has in its chromosomes	.....

[5]

(b) Fig. 3.1 is a diagram of part of a molecule of DNA taken from a bacterial cell.

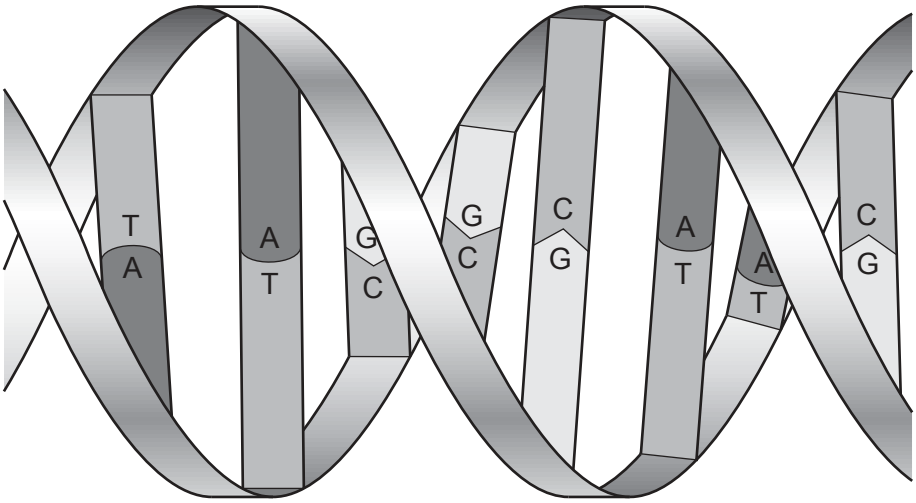

Fig. 3.1

(i) State the term which describes the shape of the DNA molecule.

..... [1]

(ii) Most of the DNA in bacterial cells is found in one large loop in the cytoplasm.

Name another structure in bacterial cells which contains DNA.

..... [1]

(iii) State the name of the **type** of molecule that is represented by the letters A, T, G and C in Fig. 3.1.

..... [1]

(iv) Outline the importance of the sequence of A, T, G and C in DNA.

.....

.....

.....

..... [2]

[Total: 10]

4 Fig. 4.1 is a simplified diagram of a nephron.

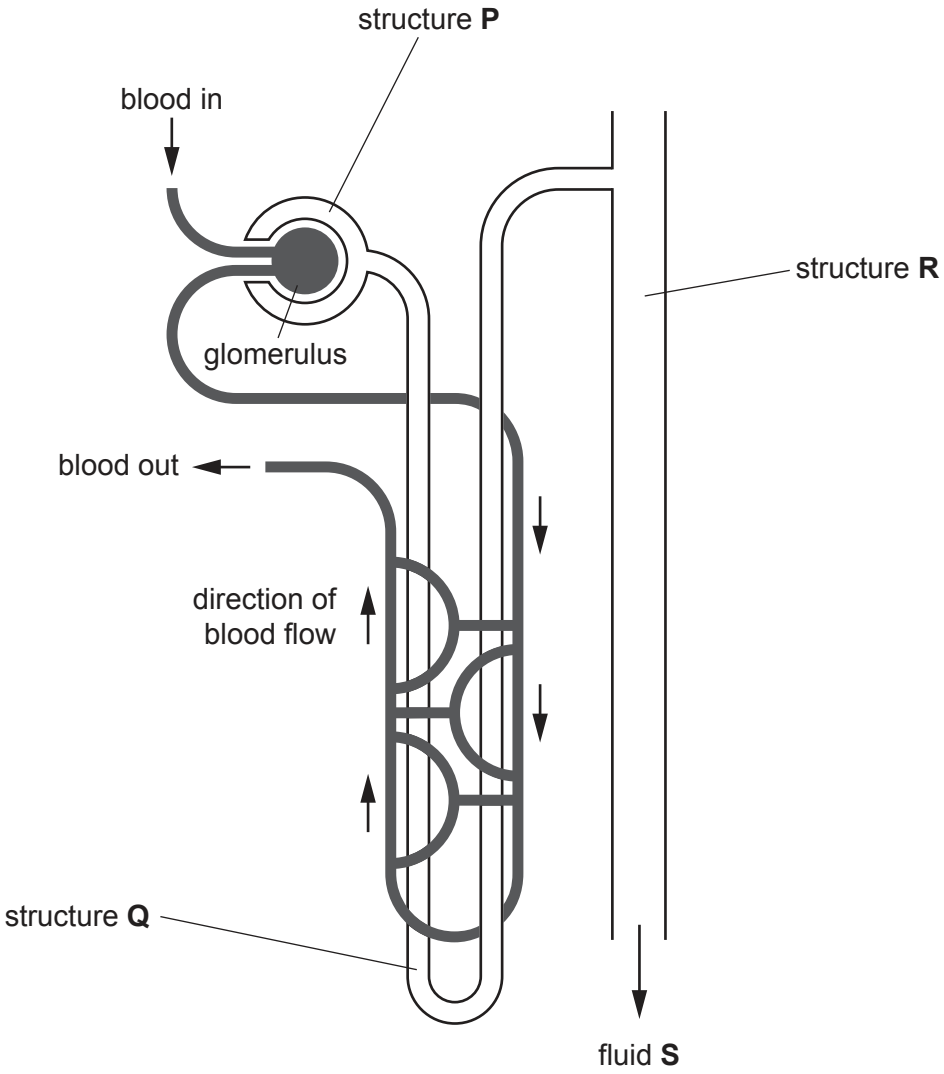

Fig. 4.1

(a) (i) Identify each of the structures labelled **P**, **Q** and **R** in Fig. 4.1.

P .....

Q .....

R .....

[3]

(ii) Name the organ which contains many nephrons.

..... [1]

(iii) Name the organ that stores fluid **S** before it is released from the body.

..... [1]

(b) Table 4.1 shows the composition of a sample of fluid **S** from a healthy person.

The person that provided the sample of fluid **S** eats a balanced diet.

Table 4.1

component	concentration / arbitrary units
glucose	0.00
protein	0.00
ions	1.50
urea	2.00

(i) State why it is important that urea is removed from the blood in fluid **S**.

..... [1]

(ii) Use your knowledge of the function of a nephron to explain the concentration of each of the following components of fluid **S**.

glucose

.....

.....

.....

.....

protein

.....

.....

.....

[5]

(iii) Explain what would happen to the concentration of ions in fluid **S** if the person drank a large volume of water several hours before the sample was collected.

.....

.....

.....

..... [3]

[Total: 14]

5 Fig. 5.1 is a diagram of a pineapple growing on a pineapple plant.

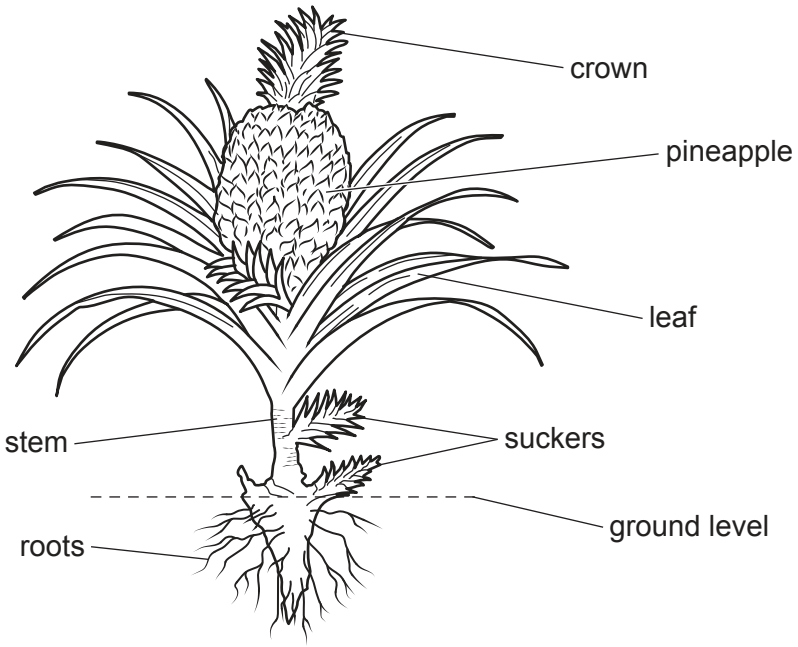

Fig. 5.1

(a) Pineapple plants can be grown on farms by removing the suckers from a parent plant and planting these in the ground to form new plants.

(i) State the type of reproduction used to grow pineapple plants in this way.

..... [1]

(ii) State **two** advantages and **two** disadvantages of producing pineapple plants in this way.

advantages

1 .....

.....

2 .....

.....

disadvantages

1 .....

.....

2 .....

.....

[4]

(iii) Pineapples are an important crop in Hawaii, USA. They were introduced to Hawaii from South America.

Birds called hummingbirds pollinate pineapple flowers. If pollinated, pineapple fruits develop and they contain hard, inedible seeds. If **not** pollinated, pineapple fruits develop without seeds.

Hummingbirds are **not** found in Hawaii.

Suggest why it is illegal to introduce hummingbirds into Hawaii.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Pineapples contain a mixture of protease enzymes called bromelain.

(i) When bromelain is added to its substrate, a product is formed.

Complete the word equation to show the substrate and product.

..... ⟶ .....

(substrate) (product)

[2]

(ii) The effect of changing pH on the activity of the enzymes found in bromelain was investigated. The results of this investigation are shown in Fig. 5.2.

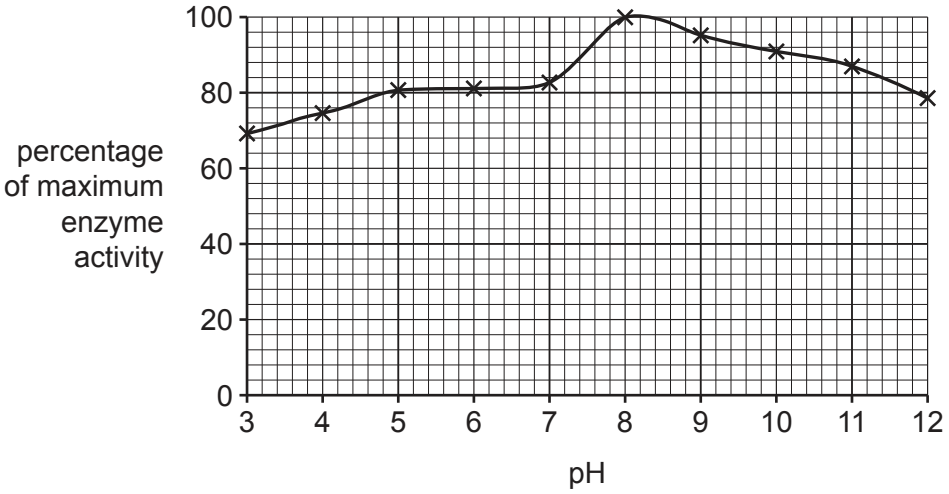

Fig. 5.2

To assist digestion, some people swallow bromelain in the form of a powder with their food.

Use the information in Fig. 5.2 and your knowledge of the human digestive system to discuss the effectiveness of using bromelain in this way.

.....

.....

.....

.....

.....

.....

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..... [4]

[Total: 15]

6 Flowering plants are sometimes grown in soil to provide cut flowers that can then be displayed.

(a) A gardener watered flowering plants with a fertiliser solution containing dissolved chemicals.

Table 6.1 shows the information printed on the label of the container of fertiliser powder used to prepare this fertiliser solution.

Table 6.1

chemical component	mass / g per 100 g fertiliser powder
nitrates	4.0
phosphates	4.0
sulfur	1.0
magnesium	0.5

(i) To prepare the fertiliser solution, the gardener dissolved 20 g of the fertiliser powder in 10 dm^3 of water.

Calculate the total mass of sulfur in the fertiliser solution prepared by the gardener.

Space for working.

..... [2]

(ii) Explain which chemical component of the fertiliser solution is the most important to plants for:

making the leaves of the plants green in colour

.....

.....

the production of enzymes by cells in the leaves of the plants.

.....

.....

[4]

(iii) The chemical components of the fertiliser solution are absorbed by the root hair cells of the plants and are then transported to the leaves.

Complete the words below to name the three main tissues in the pathway taken by the chemical components of the fertiliser solution from the root hair cells to the leaves.

The first letter of each word has been completed for you.

C .....

↓

X .....

↓

M ..... [3]

(b) When flowers from the plants are cut and used for display, the leaves are removed before each stem is placed in water.

A solution containing sucrose is often added to this water.

Sucrose is **not** needed in fertiliser solution used to water plants growing in soil.

Explain the benefit of providing sucrose to cut flowers.

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

7 Plastics are produced in very large amounts by industrial processes around the world.

These plastics can enter ecosystems as pollution.

(a) The total mass of plastics produced globally in the year 2020 was 367 million tonnes.

It is estimated that 3% of all plastics produced globally each year enters the ocean as plastic pollution.

Calculate the total mass of plastic pollution that is estimated to have entered the ocean during the year 2020.

Space for working.

..... [2]

(b) **(i)** Some packaging is made from biodegradable carbohydrates.

Microorganisms break down larger carbohydrate molecules into smaller molecules.

Identify this process and name **one** type of microorganism that is involved.

.....

.....

..... [2]

(ii) Most plastics that enter ecosystems as pollution are non-biodegradable.

Describe the harmful effects of non-biodegradable plastics on both aquatic and terrestrial ecosystems.

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..... [7]

[Total: 11]