Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2021**

1 hour 15 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.

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1 **(a)** Complete the sentence about the nervous system.

View solution

The brain and spinal cord form the ..... nervous system and the nerves coming into and out of the spinal cord are part of the ..... nervous system. [1]

(b) Fig. 1.1 shows part of a human eye and three neurones that conduct electrical impulses between the eye and the brain. These neurones are involved in the pupil reflex.

View solution

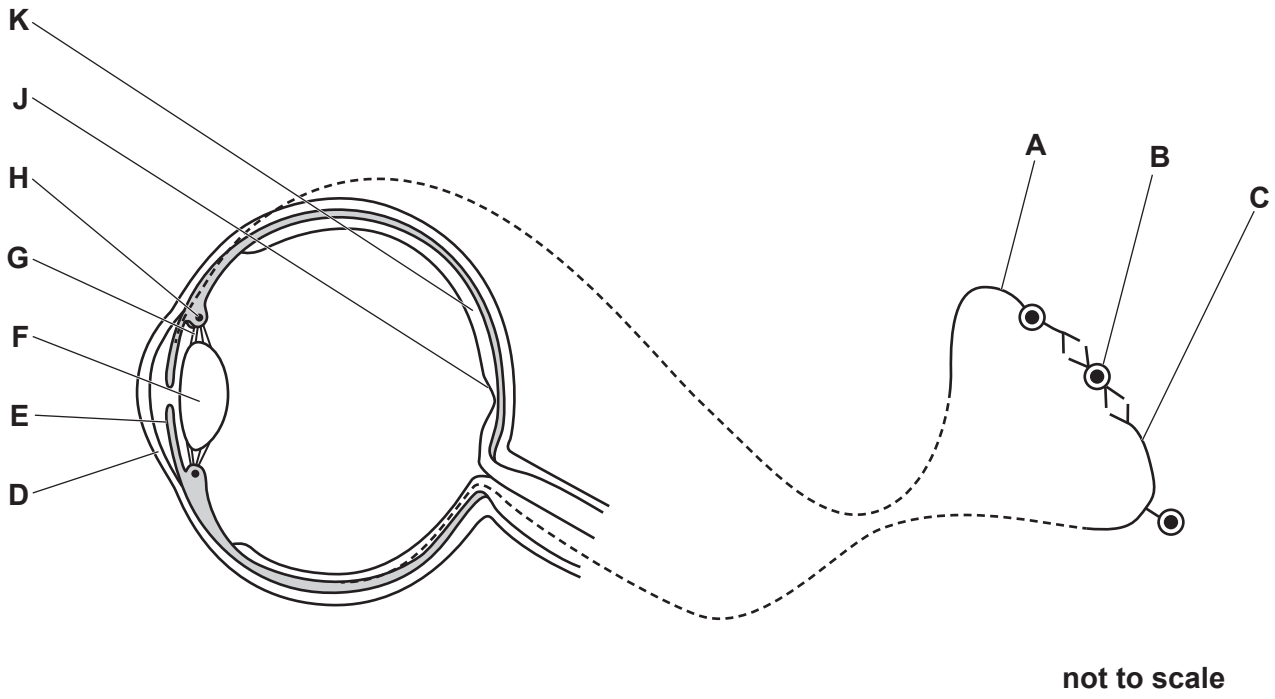

Fig. 1.1

(i) State the type of neurone identified as **A** in Fig. 1.1.

..... [1]

(ii) Table 1.1 shows the names of some parts of the eye, their functions and the letters in Fig. 1.1 that identify the parts of the eye.

Complete Table 1.1.

View solution

Table 1.1

part of the eye	function	letter in Fig. 1.1
suspensory ligament		**G**
	contracts in response to a bright light	
cornea		
	contains a high density of cones for colour vision	

[4]

(c) (i) The eye can adjust how light is refracted through it in order to focus on a near object.

View solution

State **one** process that uses energy when focusing on a near object.

..... [1]

(ii) Mitochondria require oxygen to release energy. Oxygen is transported to cells in the eye by red blood cells.

State the name of the molecule in red blood cells that carries oxygen.

View solution

..... [1]

(iii) Explain how oxygen in the capillaries reaches the cells in the eye.

View solution

.....

.....

.....

.....

..... [2]

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(d) Eyelashes and eyelids are mechanical barriers that help to prevent particles and pathogens entering the eye.

View solution

(i) Give **two** other mechanical barriers that defend the body against pathogens.

1 .....

2 .....

[2]

(ii) State the name of the white blood cells that digest pathogens.

..... [1]

(iii) Conjunctivitis can be caused by pathogens and affects the tissues lining the eyelids and covering the sclera. People with conjunctivitis that is caused by a pathogen can develop active immunity.

Explain why the shape of specific parts of a pathogen is important in the development of active immunity.

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..... [3]

(e) Most insects and some crustaceans have compound eyes.

View solution

State the name of the group that contains insects and crustaceans.

..... [1]

[Total: 17]

2 The classification of giant pandas, *Ailuropoda melanoleuca*, is debated by many scientists.

Fig. 2.1 shows a giant panda eating bamboo plants.



Fig. 2.1

Fig. 2.2 shows a red panda, *Ailurus fulgens*, and a polar bear, *Ursus maritimus*.



red panda eating bamboo plants



polar bear eating fish

Fig. 2.2

(a) State **one** dietary component that is more likely to be found in bamboo plants than in fish.

View solution

..... [1]

(b) **(i)** State **two** features, visible in Fig. 2.1 and Fig. 2.2, that identify the three animals as all belonging to the same vertebrate group.

1 .....

2 .....

[2]

(ii) DNA can also be used to classify species.

Molecular biologists compared the DNA base sequences of eight species from the same vertebrate group. They used the differences to draw a classification diagram.

Fig. 2.3 shows the classification diagram for these eight species. The shorter the horizontal distance from two species to the branching point that they share, the more similar their DNA sequences are and the more closely the two species are related.

The scale on Fig. 2.3 shows the time at which the molecular biologists estimate that each branching point occurred.

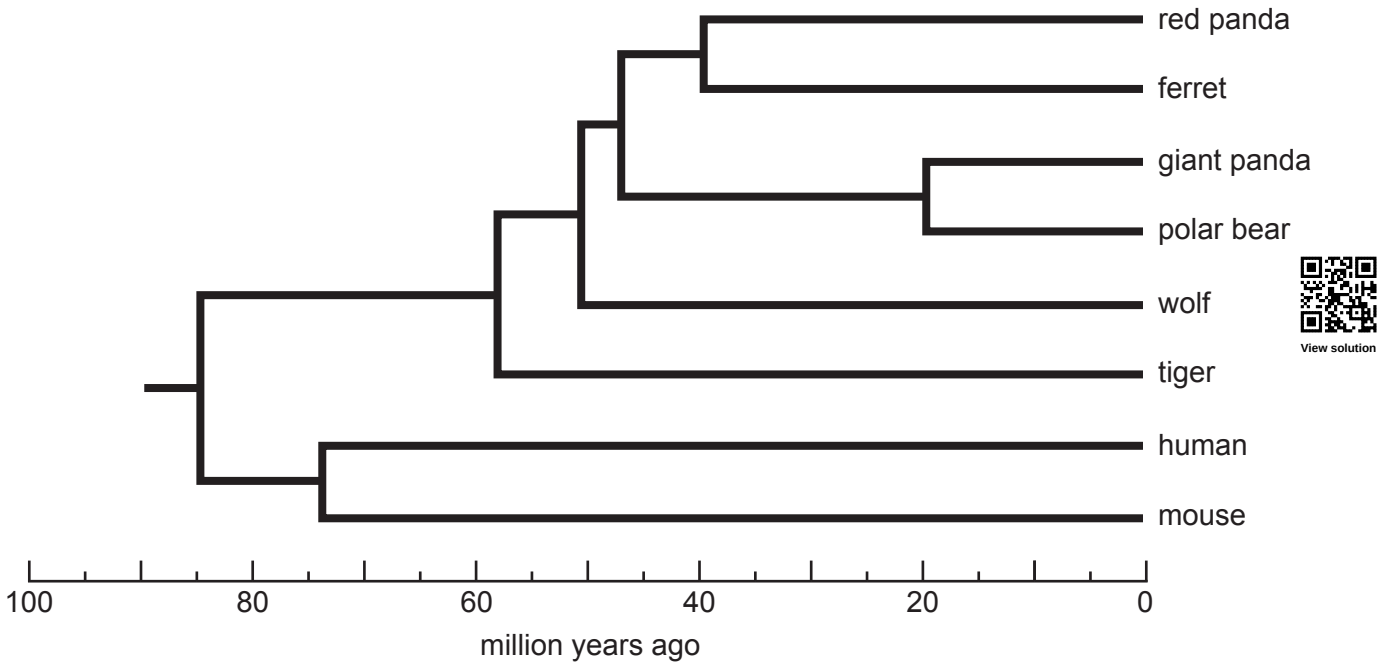

Fig. 2.3

Morphology can also be used to classify species. Some scientists think that morphology suggests that the giant panda is more closely related to the red panda than it is to the polar bear.

Discuss the evidence for **and** against the giant panda being more closely related to the red panda than it is to the polar bear. Use the information in Fig. 2.1, Fig. 2.2 and Fig. 2.3 in your answer.

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..... [5]

(iii) State one **other** type of evidence that is used to classify species.

..... [1]

[Total: 9]

3 **(a)** Fig. 3.1 shows some of the events that occur in the menstrual cycle.

View solution

A	follicle is fully developed
B	gamete is released into the oviduct
C	lining of the uterus is removed from the body
D	lining of the uterus reaches a maximum thickness
E	lining of the uterus gets thicker

Fig. 3.1

(i) Put the events shown in Fig. 3.1 into the correct sequence.

One has been done for you.

		B		

[1]

(ii) State the name of the hormone that stimulates event **A** to occur.

View solution

..... [1]

(iii) Event **C** means that menstruating females lose blood regularly.

Two females of the same age have different dietary needs because one has started menstruating and the other has **not** started menstruating.

Suggest why the dietary needs of the two females are different.

View solution

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..... [2]

(b) During pregnancy menstruation does not occur.

View solution

Fig. 3.2 shows some of the organs of a pregnant woman, viewed from the side.

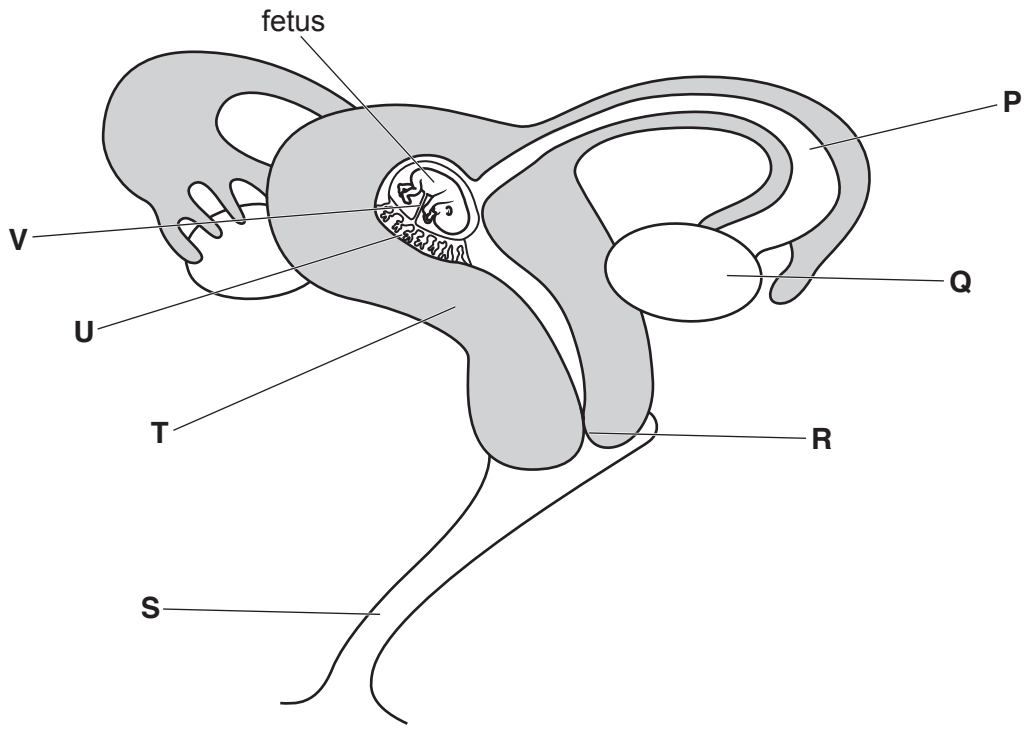

Fig. 3.2

Describe what happens between ovulation and the formation of a fetus.

Use the letters in Fig. 3.2 to support your answer.

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..... [6]

[Total: 10]

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4 **(a)** Climate change is one reason why a plant species could become endangered.

View solution

(i) State **other** reasons why a plant species could become endangered.

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..... [3]

(ii) Describe how human actions are causing climate change.

View solution

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..... [4]

(b) Seed banks are used to conserve endangered plant species.

View solution

Fig. 4.1 shows some of the steps involved in managing a seed bank.

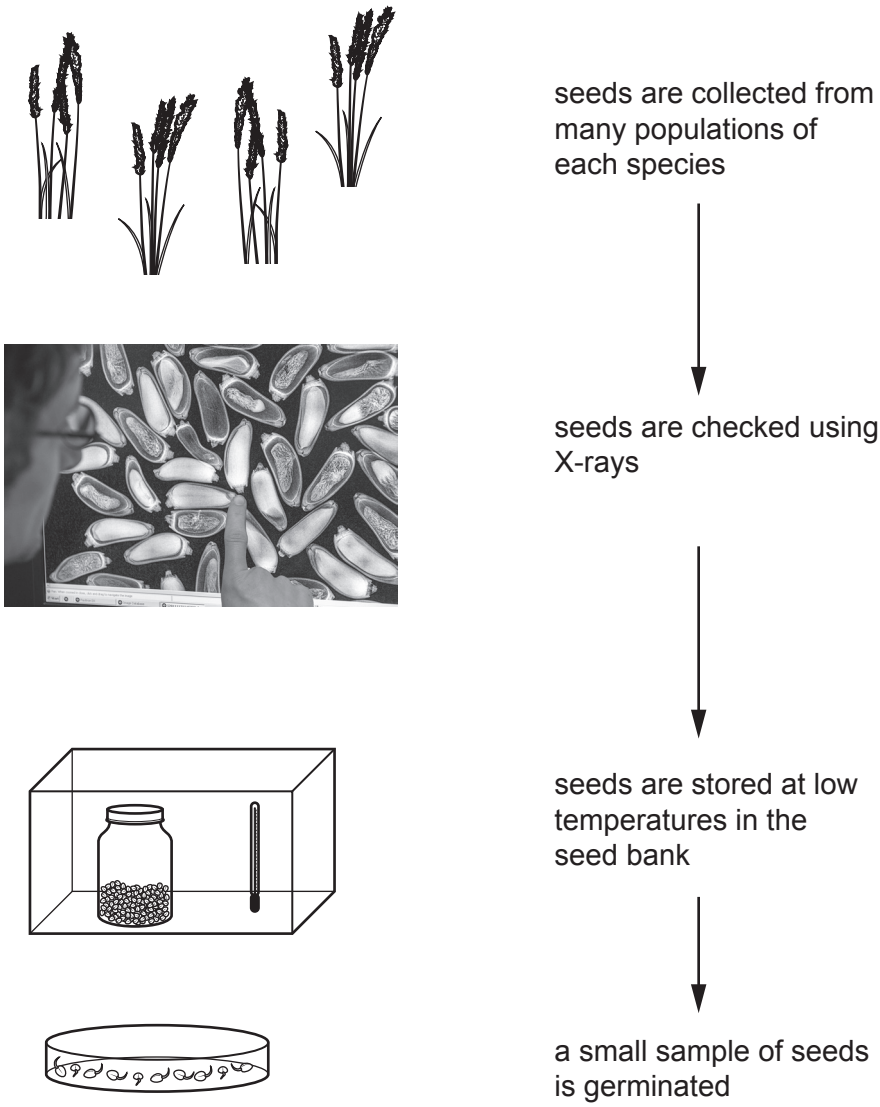

Fig. 4.1

(i) Explain why seeds from one species are collected from many populations to store in a seed bank.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Seeds are X-rayed before they are stored to check that they contain an embryo.

View solution

State **one** possible consequence of using ionising radiation on seeds.

.....

..... [1]

(iii) Seeds stored at low temperatures have very low respiration rates.

View solution

Explain why.

.....

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.....

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..... [2]

(c) One purpose of seed banks is to reintroduce plant species into their natural environment.

A survey was done to find out why some reintroduction programmes are not successful.

Fig. 4.2 shows the results of the survey.

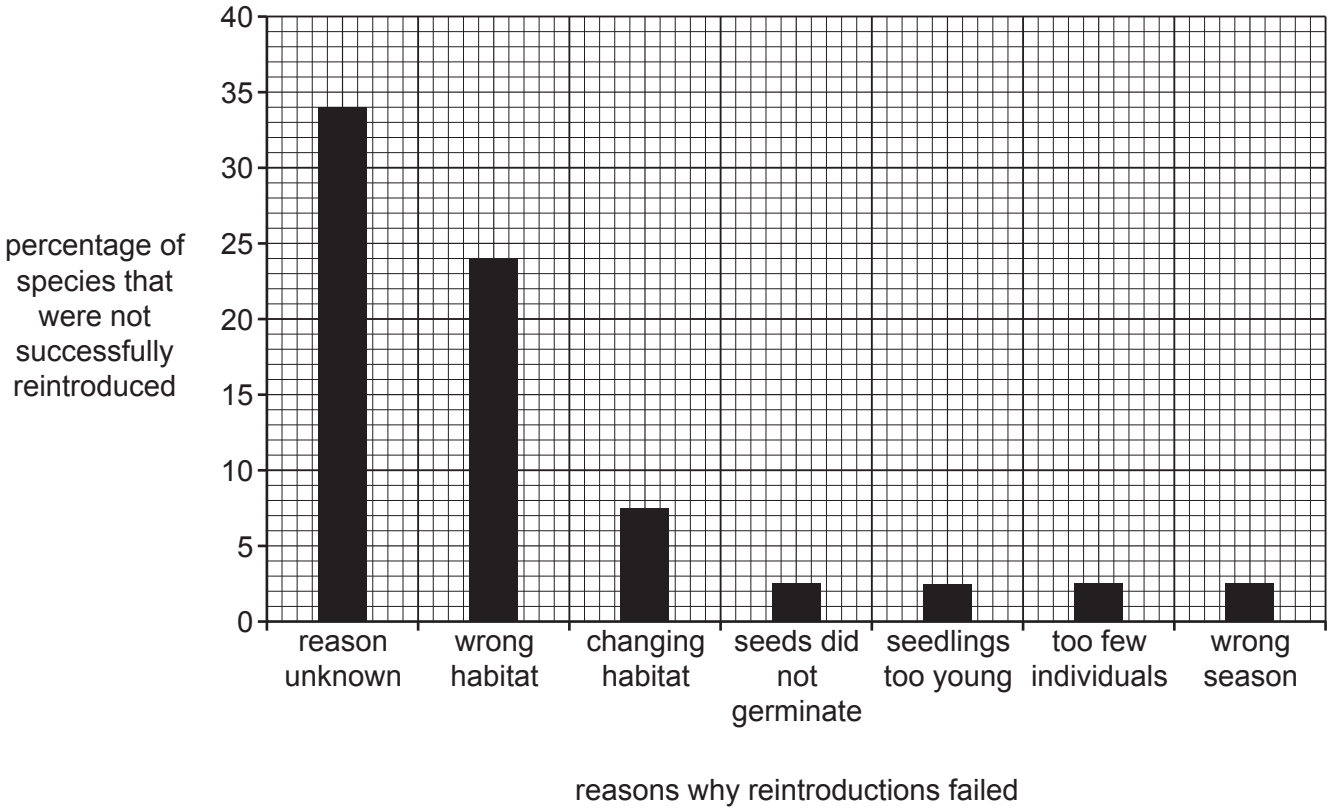

Fig. 4.2

(i) Some of the seeds in the reintroduction programmes did not germinate.

View solution

State the conditions that are necessary for seeds to germinate.

.....

.....

.....

..... [3]

(ii) Some reintroduction programmes failed because the seedlings were too young. Young seedlings only have a few small roots.

View solution

Explain why it would be important to reintroduce plants with many large roots.

.....

.....

.....

.....

.....

.....

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.....

..... [4]

(iii) The low number of individuals also caused some reintroduction programmes to fail.

State the name of the phase in a population growth curve where the number of individuals is very low.

..... [1]

[Total: 21]

View solution

5 Fig. 5.1 shows some of the stages in the reproduction of the bacterium *Escherichia coli*.

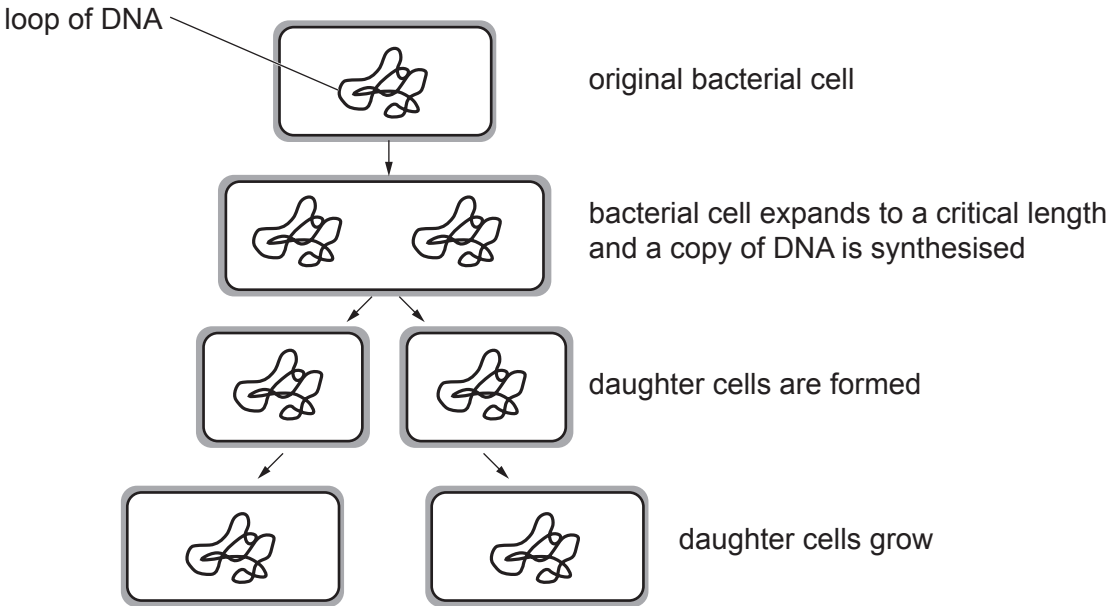

Fig. 5.1

View solution

(a) Complete the sentences about the cells in Fig. 5.1.

The DNA is in the form of a double ..... . The DNA is copied so that the number of loops of DNA after cell division is ..... in each daughter cell. The daughter cells are genetically ..... to the original cell.

[3]

(b) Students used a microscope and time-lapse photography to observe *E. coli* cells reproducing.

They used the series of photographs to identify which cells were dividing.

They measured the lengths of the dividing cells and put their data into two groups:

- cell lengths immediately before cell division
- cell lengths immediately after cell division.

Fig. 5.2 shows their results.

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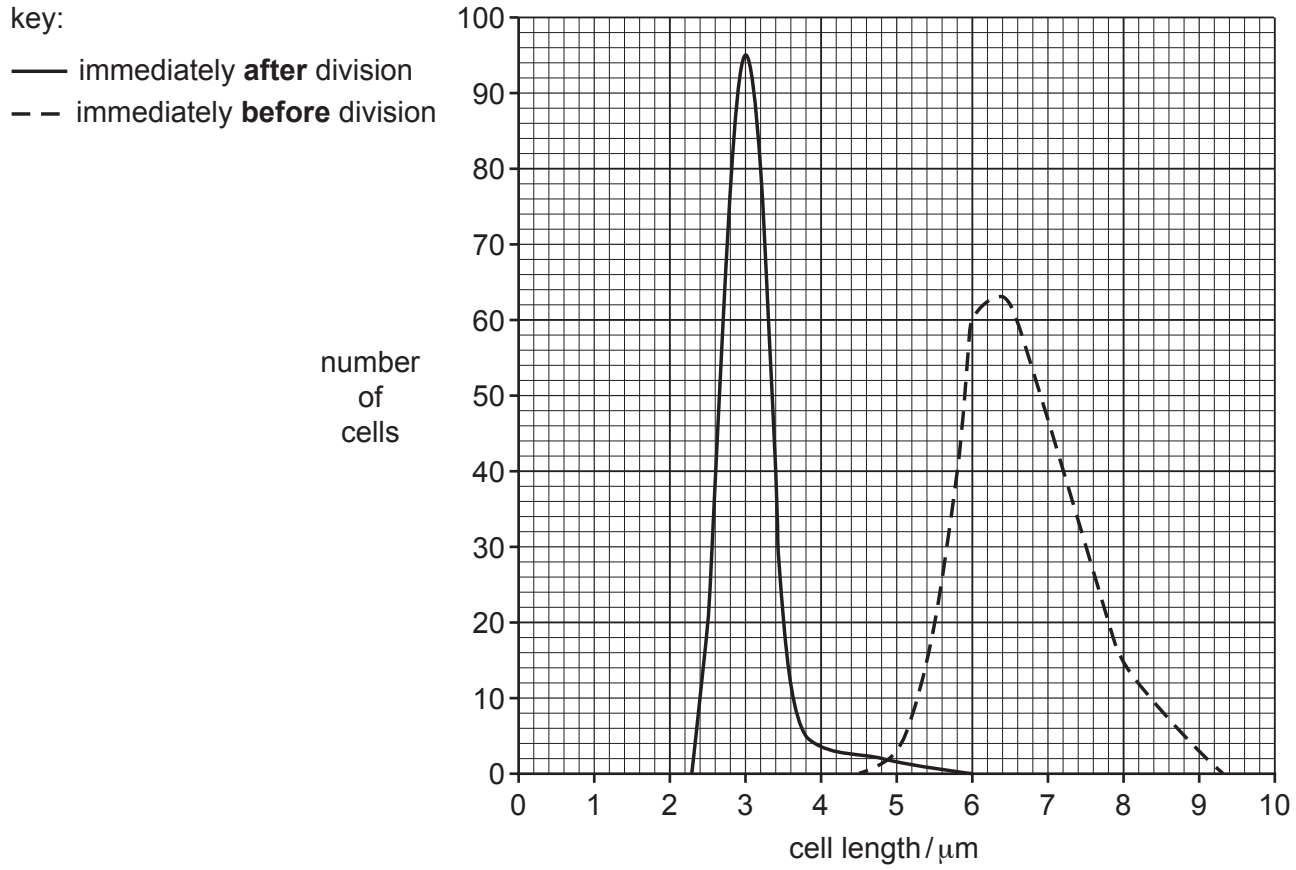

Fig. 5.2

(i) Use the information in Fig. 5.2 to state the most frequent cell length of the *E. coli* cells immediately **after** cell division.

Give your answer in **millimetres**.

View solution

..... mm
[2]

(ii) Some students concluded that the cells must be at least 6 μm in length before cell division can occur.

Describe the evidence **against** the students' conclusion. Use the information in Fig. 5.2 to support your answer.

.....

.....

.....

.....

..... [2]

(c) Bacteria are useful in genetic engineering because they contain plasmids.

View solution

(i) Describe how a plasmid is cut so that a new gene can be inserted into the plasmid.

.....

.....

..... [2]

(ii) List **two** reasons, other than the presence of plasmids, that make bacteria and single-celled fungi useful to biotechnology industries.

1 .....

2 .....
[2]

[Total: 11]

View solution

6 **(a)** Some students set up the apparatus shown in Fig. 6.1 to compare transpiration in two sets of leaves.

View solution

Set **A** was kept in a transparent bag and set **B** was left in the open air.

All other conditions were kept constant.

The mass of the leaves in each set was measured at the start of the investigation and after five hours.

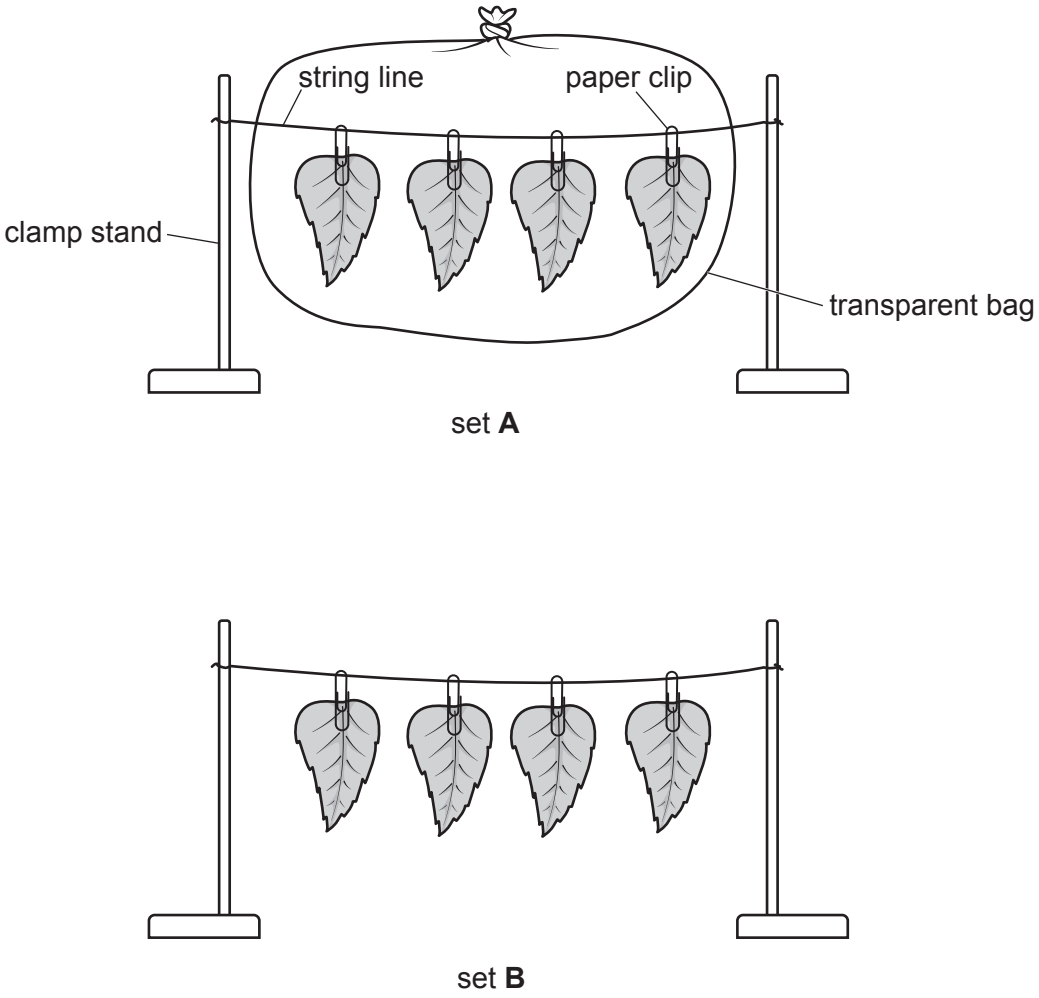

Fig. 6.1

(i) Predict the results for this investigation.

Explain the reason for your prediction.

prediction .....

.....

explanation .....

.....

.....

[3]

(ii) Explain how transpiration occurred in the leaves shown in Fig. 6.1.

.....

.....

.....

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.....

.....

..... [3]

(iii) The students needed two additional pieces of apparatus to take measurements so that they could calculate the rate of transpiration from their results.

State the **two** additional pieces of apparatus the students needed to take the measurements.

1 .....

2 .....

[2]

(b) Fig. 6.2 shows the positions of the different tissues in part of a dicotyledonous leaf.

View solution

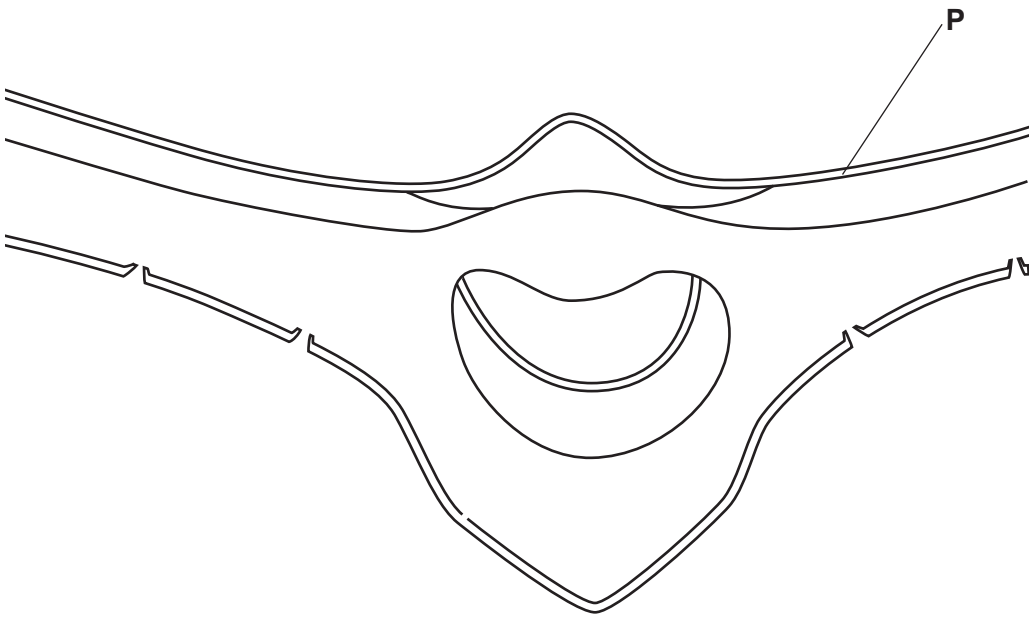

Fig. 6.2

Identify the tissues described in Table 6.1 by:

- drawing label lines with the corresponding letter on Fig. 6.2 **and**
- stating the name of each tissue in Table 6.1.

The label, line and name of the tissue for letter **P** has been completed for you on Fig. 6.2 and in Table 6.1.

Table 6.1

letter	description	name of the tissue
P	a protective transparent layer that allows light to reach the inner tissues	upper epidermis
Q	conducts water from the stem	
R	contains many interconnected air spaces	
S	transports sucrose and amino acids	
T	traps the most light energy to synthesise carbohydrates	

[4]

[Total: 12]

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