Cambridge Assessment International Education

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CANDIDATE NAME									
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BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2020**

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 **24** pages. Blank pages are indicated.

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1 Homeostasis is the maintenance of a constant internal environment.

View solution

(a) Human skin is involved in the maintenance of a constant internal body temperature.

(i) Skin is an organ.

State why the skin is an organ.

.....

.....

..... [1]

(ii) State the name of the organ that coordinates the control of body temperature.

..... [1]

Fig. 1.1 shows a diagram of a section through human skin.

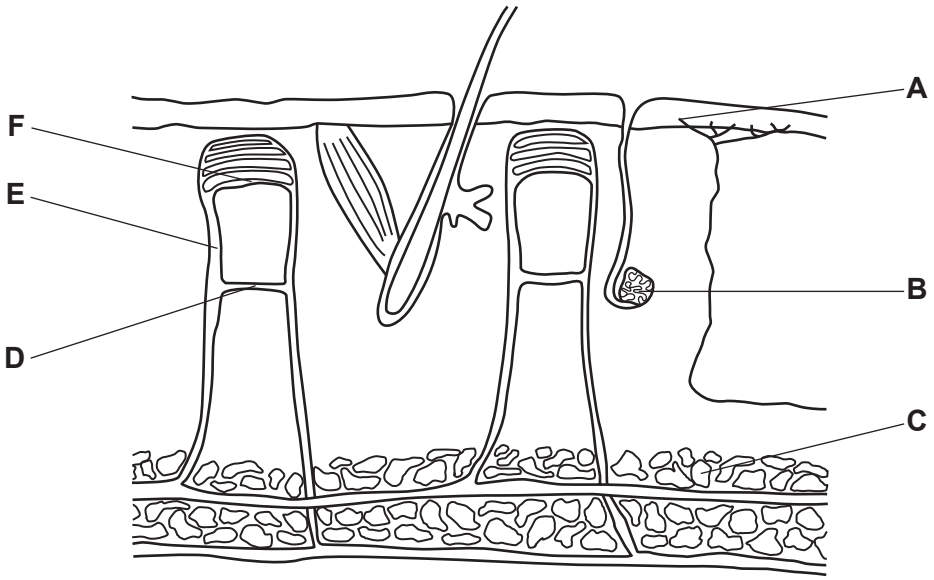

Fig. 1.1

(iii) State the names of structures **A**, **B** and **C** in Fig. 1.1.

A .....

B .....

C .....

[3]

(iv) Structure **D** is a shunt vessel and **E** is an arteriole.

Describe how these blood vessels are involved in maintaining a constant internal body temperature in a cold environment.

.....

.....

.....

.....

.....

.....

..... [3]

(b) Energy is used to maintain body temperature.

View solution

State **three other** uses of energy in humans.

1 .....

2 .....

3 .....

[3]

[Total: 11]

2 Pregnancy can occur after the fusion of a male gamete and a female gamete.

(a) State the name of the ball of cells that implants into the uterus after fertilisation.

View solution

..... [1]

(b) There are many changes that occur in a fetus during pregnancy.

View solution

Compare the development of a fetus in the early stages of pregnancy to its development in the late stages of pregnancy.

.....

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.....

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..... [2]

(c) Describe the functions of amniotic fluid and the amniotic sac.

View solution

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..... [4]

(d) The umbilical artery is found in the umbilical cord. This artery transports blood away from the heart of the fetus.

The umbilical artery is unusual because it transports deoxygenated blood.

View solution

(i) State the name of **one** other artery in the mother that transports deoxygenated blood.

..... [1]

(ii) State **one** excretory product that is transported from the fetus to the placenta.

..... [1]

(iii) State the name of the process that allows substances to move down a concentration gradient across the placenta.

..... [1]

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(e) One of the functions of the placenta is to provide a barrier to toxins and pathogens.

A study was done on donated afterbirths. The afterbirth is a placenta with part of the umbilical cord attached.

The purpose of the study was to find the maximum size of particles that can pass through the placenta and enter the umbilical cord.

The researchers inserted beads with a diameter of 0.5 μm into blood vessels in the placenta. Three hours later they recorded the percentage of beads found in the blood in the placenta and in the umbilical cord.

They then repeated the tests using beads with diameters of 0.8 μm, 2.4 μm, 5.0 μm and 8.0 μm.

Their results are shown in Fig. 2.1.

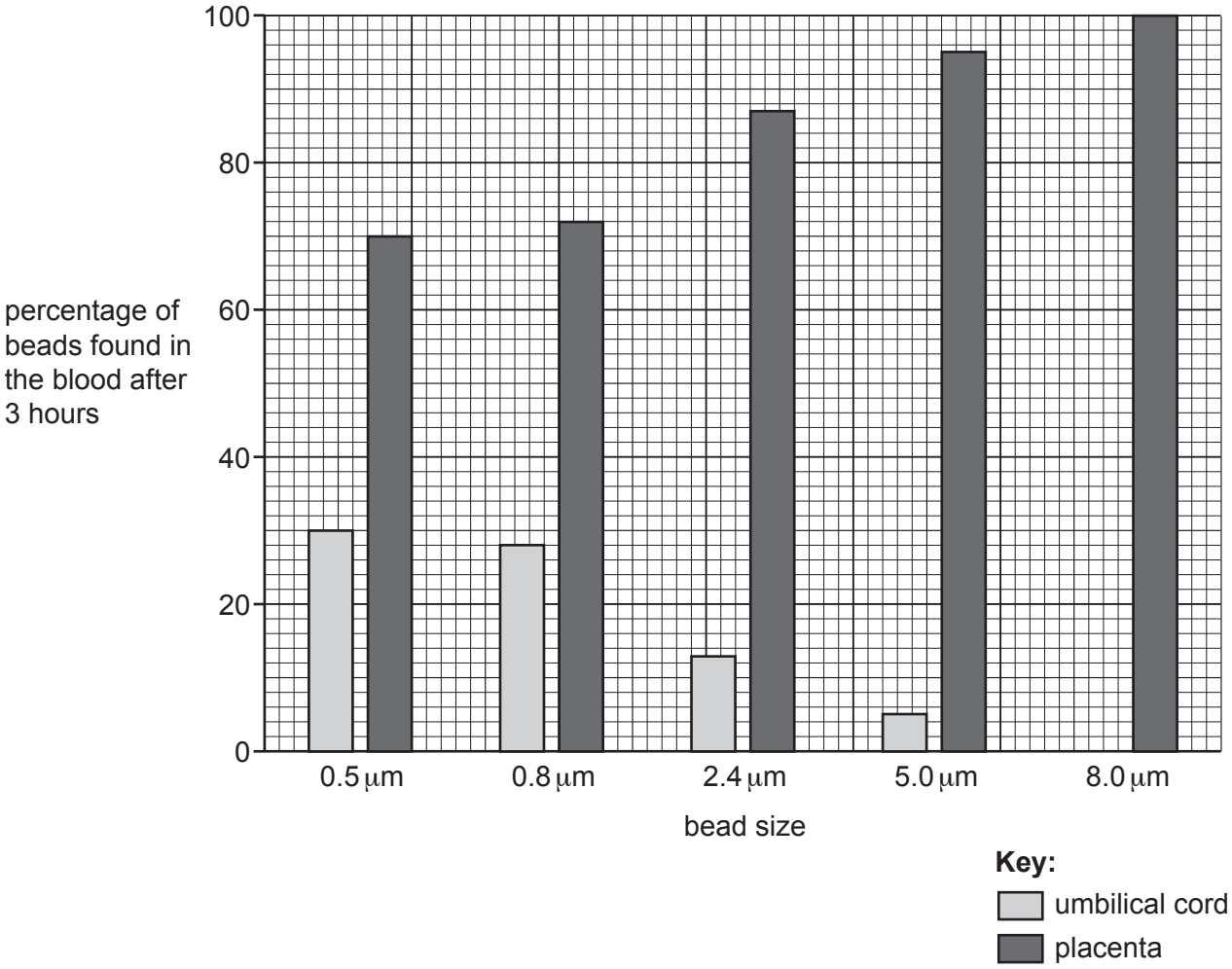

Fig. 2.1

(i) Convert the diameter of the 5.0 μm beads into millimetres (mm).

View solution

Space for working.

..... mm [1]

(ii) One million beads with a diameter of 2.4 μm were injected into the placenta.

View solution

Calculate the number of these beads in the umbilical cord after 3 hours.

Space for working.

..... beads
[2]

(iii) Table 2.1 shows a range of substances and their diameters.

View solution

Table 2.1

toxins and pathogens	diameter / μm
nicotine	2.0×10^{-2}
drug **X**	3.0×10^{-2}
rubella virus	5.0×10^{-2}
Vibrio cholerae	8.0×10^{-1}
Trypanosoma brucei	1.8×10^{1}

State the names of **all** the toxins and pathogens listed in Table 2.1 that could pass through the placenta and enter the umbilical cord.

Use the data in Fig. 2.1 to make your choice.

.....

.....

..... [1]

(f) Fig. 2.2 shows the junction between two neurones with drug **X** absent and two neurones with drug **X** present, immediately after a painful stimulus.

View solution

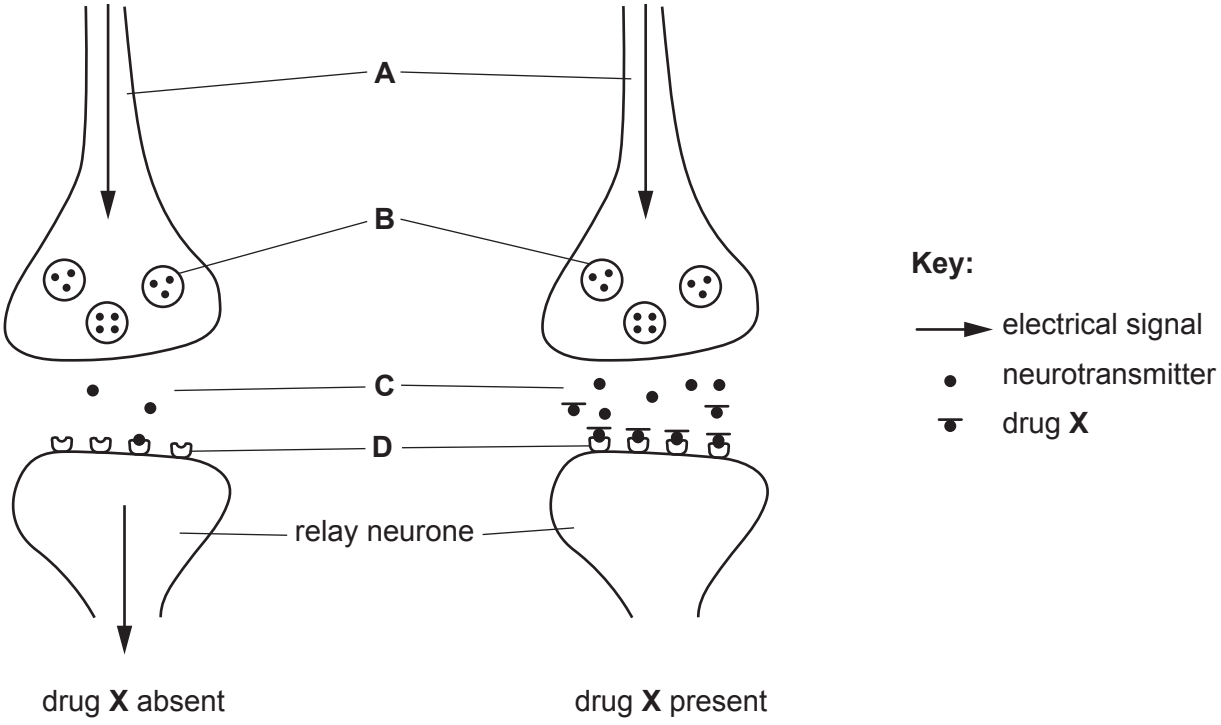

Fig. 2.2

(i) State the names of **A**, **B**, **C** and **D** in Fig. 2.2.

A .....

B .....

C .....

D .....

[4]

(ii) Describe **and** explain how drug **X** affects the function of the relay neurone shown in Fig. 2.2.

.....

.....

.....

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.....

.....

..... [3]

(g) Drug **X** can be injected into the body. This is one way that HIV can be transmitted.

View solution

Describe **two** other ways that HIV can be transmitted.

1 .....

.....

2 .....

.....

[2]

[Total: 23]

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3 Cheetahs, *Acinonyx jubatus*, are carnivores found in the dry grasslands and woodlands of southern Africa. Cheetahs hunt for food during the day. They eat deer and antelope.

The cheetah is the fastest mammal on land but can only run at high speed (sprint) over a short distance. Its hunting strategy is to creep up on prey and then sprint to catch them.

Fig. 3.1 is a photograph of a cheetah in its natural habitat.



Fig. 3.1

(a) Suggest how these adaptive features enable cheetahs to survive in their natural environment.

fur colouring .....

.....

.....

streamlined body shape .....

.....

.....

[2]

View solution

(b) The king cheetah is a rare variety of *A. jubatus* that has inherited striped fur markings.

View solution

Fig. 3.2 shows a cheetah with spots and a king cheetah.



cheetah with spots



king cheetah

Fig. 3.2

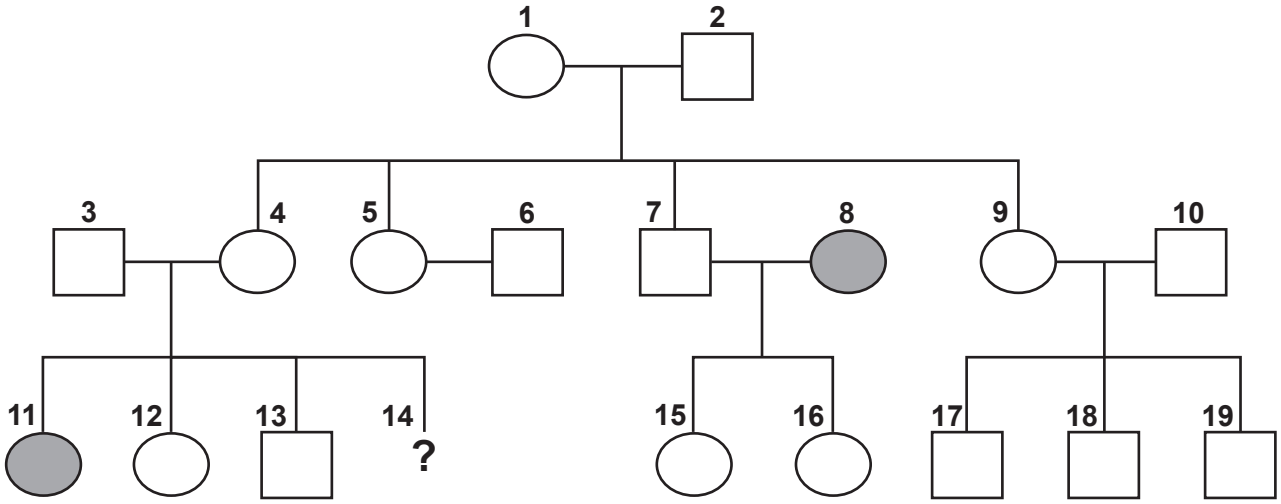
(i) Define the term *inheritance*.

.....

.....

..... [1]

Fig. 3.3 shows a pedigree diagram of a population of cheetahs.



Key:

female king cheetah

female cheetah with spots

male king cheetah

male cheetah with spots

Fig. 3.3

(ii) Deduce the genotype of cheetah **11**.

View solution

..... [1]

(iii) Predict the probability of cheetah **14** being a king cheetah.

View solution

..... [1]

(iv) Describe how a breeder could determine the genotype of cheetah **17**.

View solution

.....

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..... [2]

(v) When the king cheetah was first discovered it was thought that it was a new species.

View solution

Pedigree diagrams of cheetahs proved it was not a new species.

Suggest **one** type of evidence, other than pedigree diagrams, that can be used to determine how closely related organisms are.

.....

.....

..... [1]

(c) Cheetahs are at risk of becoming endangered.

View solution

(i) Suggest why the cheetah is at risk of becoming endangered.

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..... [3]

(ii) Describe how species like the cheetah can be conserved.

View solution

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..... [3]

[Total: 14]

4 Some crop farmers use herbicides on their fields.

Fig. 4.1 shows a farmer spraying a rice crop with herbicides.



Fig. 4.1

View solution

(a) Herbicides kill weeds.

Explain why farmers use herbicides.

.....

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..... [2]

(b) Fields of crop plants were sprayed with two herbicides. A farmer measured the concentration of the two herbicides, **A** and **B**, in a lake near the fields.

View solution

The water in the lake was sampled at intervals for two weeks.

Fig. 4.2 shows the results.

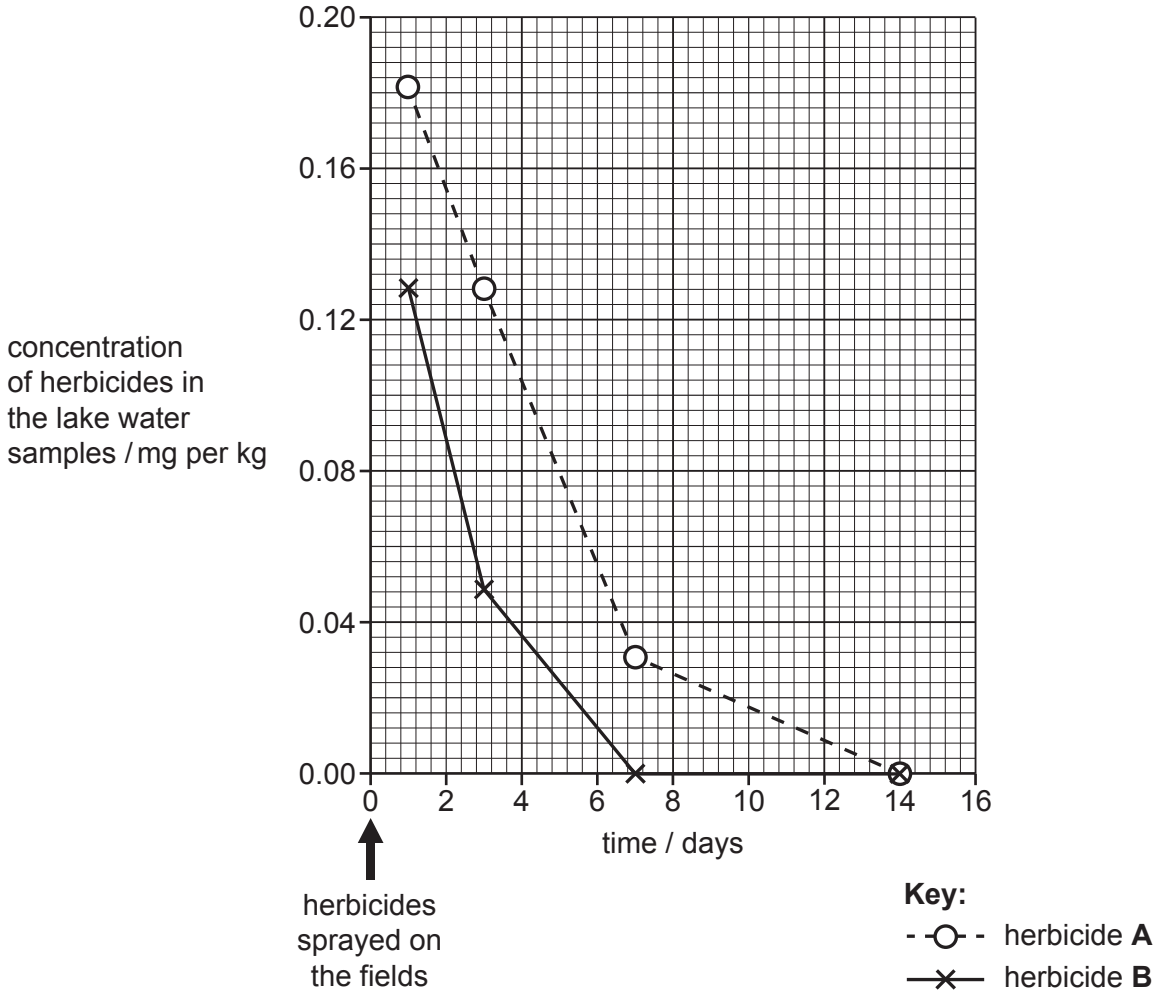

Fig. 4.2

(i) Compare the concentrations of herbicide **A** and herbicide **B** in the lake.

Use the information in Fig. 4.2 to support your answer.

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..... [3]

(ii) Suggest how herbicides damage ecosystems in a lake.

View solution

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..... [4]

(c) Herbicide **A** is a synthetic plant hormone called 2,4-D that selectively kills dicotyledonous plants only.

(i) State **two** features that distinguish leaves of dicotyledonous plants from leaves of monocotyledonous plants.

1 .....

2 .....

[2]

(ii) State the name of a natural plant hormone that stimulates cell elongation.

..... [1]

(iii) Herbicide **B** is a chemical that prevents the uptake of magnesium ions.

View solution

Suggest how herbicide **B** kills plants.

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..... [3]

[Total: 15]

5 The Galápagos Islands are a group of small islands in the Pacific Ocean.

In 1839 Charles Darwin published a book that described differences in a family of birds called finches.

Each species of Galápagos finch had:

- a different diet
- a different beak shape, as shown in Fig. 5.1.

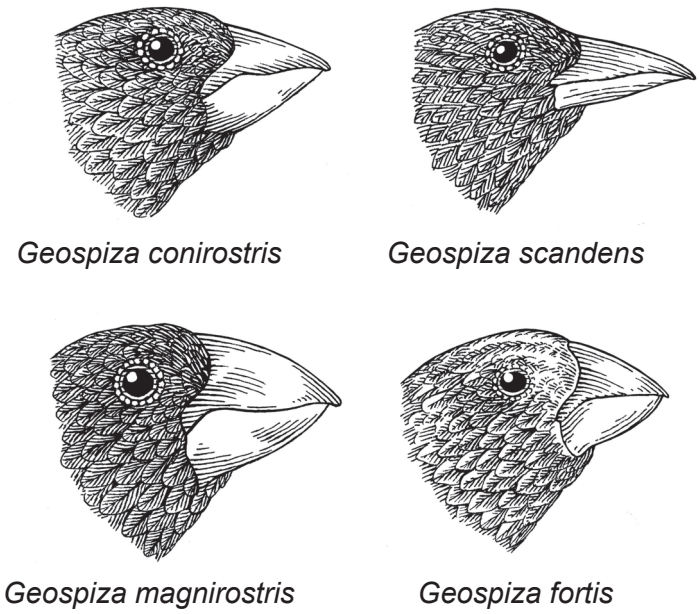

Fig. 5.1

(a) State the genus name for the Galápagos finches shown in Fig. 5.1.

..... [1]

View solution

(b) Galápagos finches share a common ancestor.

View solution

Suggest how Galápagos finches have evolved different shaped beaks.

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..... [5]

[Total: 6]

6 **(a)** Fig. 6.1 is a diagram showing some parts of a plant. The circle shows a magnified cross-section of part of the stem.

View solution

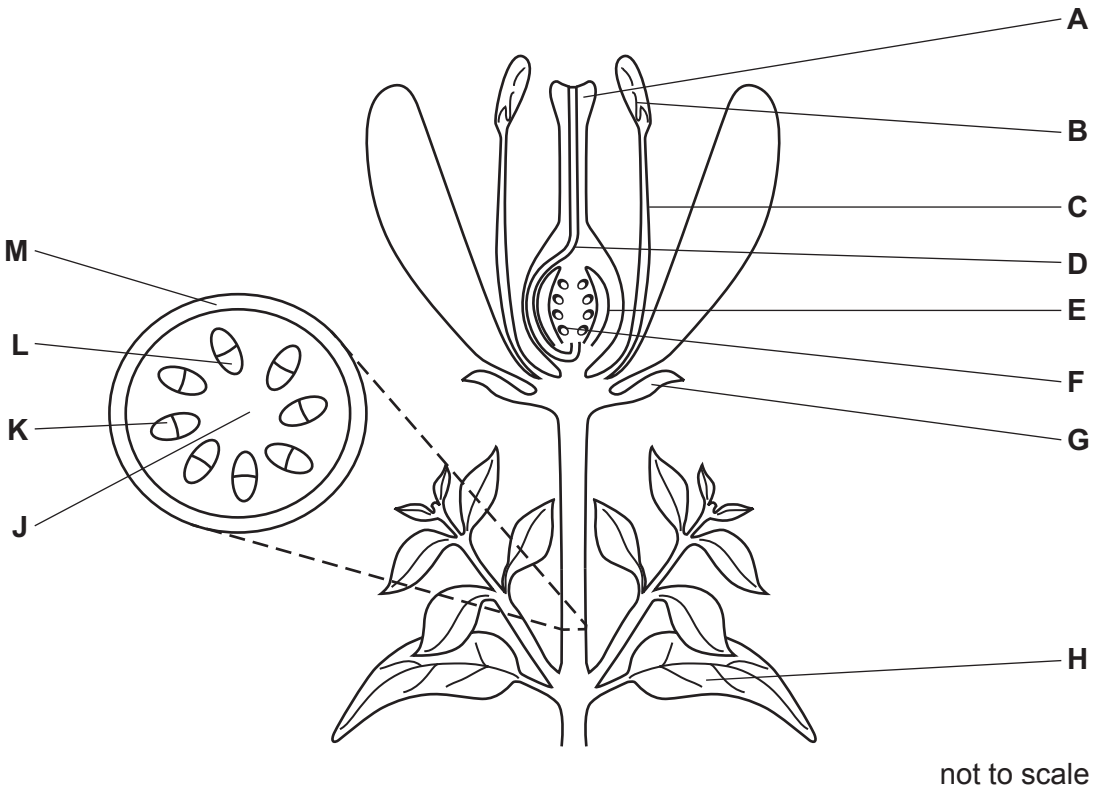

Fig. 6.1

(i) Table 6.1 contains statements about the functions of some of the structures in Fig. 6.1.

Complete the table by:

- stating the name of the structure
- identifying the letter that labels that structure.

Table 6.1

function	name of structure	letter from Fig. 6.1
provides support to the stem		
protects flower bud		
produces glucose		
produces pollen		
delivers male nuclei to the site of fertilisation		

[5]

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(ii) State **one** letter from Fig. 6.1 that identifies a structure that contains a **haploid** nucleus.

..... [1]

(iii) State the name of the process that describes the transport of sucrose in a plant.

..... [1]

(iv) State **one** letter from Fig. 6.1 that is a structure that is an example of a source for sucrose transport.

..... [1]

(b) In addition to sucrose, amino acids are also transported in plants.

View solution

(i) State the name of a mineral ion that becomes part of an amino acid.

..... [1]

(ii) State the name of the structures inside cells that assemble amino acids into proteins.

..... [1]

(iii) State the name of the group of molecules that are made of proteins and act as catalysts.

..... [1]

[Total: 11]

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