



CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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## 0610/42

May/June 2020

**1 hour 15 minutes**

No additional materials are needed.

- 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.

- 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.

1 Homeostasis is the maintenance of a constant internal environment.

(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.

Because it is made up off group of tissues working together to perform specific functions.

[1]

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

Brain

[1]

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

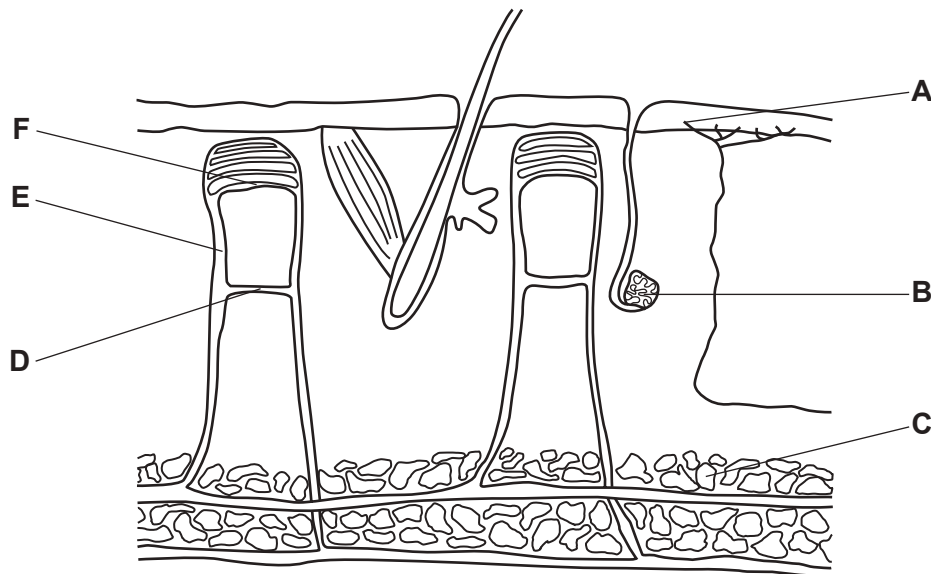


Fig. 1.1

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

A Thermo receptor

B Sweat gland

C Fatty tissue

[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.

During colder temperatures, arterioles (E) vasoconstrict . Shunt vessels (D) dilate which decreases

blood flow towards skin . This reduces heat loss from blood .

[3]

- (b) Energy is used to maintain body temperature.

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

1 Muscle contraction

2 Cell division

3 Active transport

[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.

Embryo ..... [1]

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

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

Growth and development occur in all stages . In early stages, there is increase in complexity whereas  
in the later stages, there is increase in size .

..... [2]

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

a) Maintains temperature

b) Absorbs mechanical shocks

c) Provides support to the fetus

d) Provides a sterile environment for the fetus

e) Allows movement of fetus

f) Allows development of bones and muscles

..... [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.

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

Pulmonary ..... [1]

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

Carbon dioxide ..... [1]

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

Diffusion ..... [1]

- (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  $0.5\mu\text{m}$  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  $0.8\mu\text{m}$ ,  $2.4\mu\text{m}$ ,  $5.0\mu\text{m}$  and  $8.0\mu\text{m}$ .

Their results are shown in Fig. 2.1.

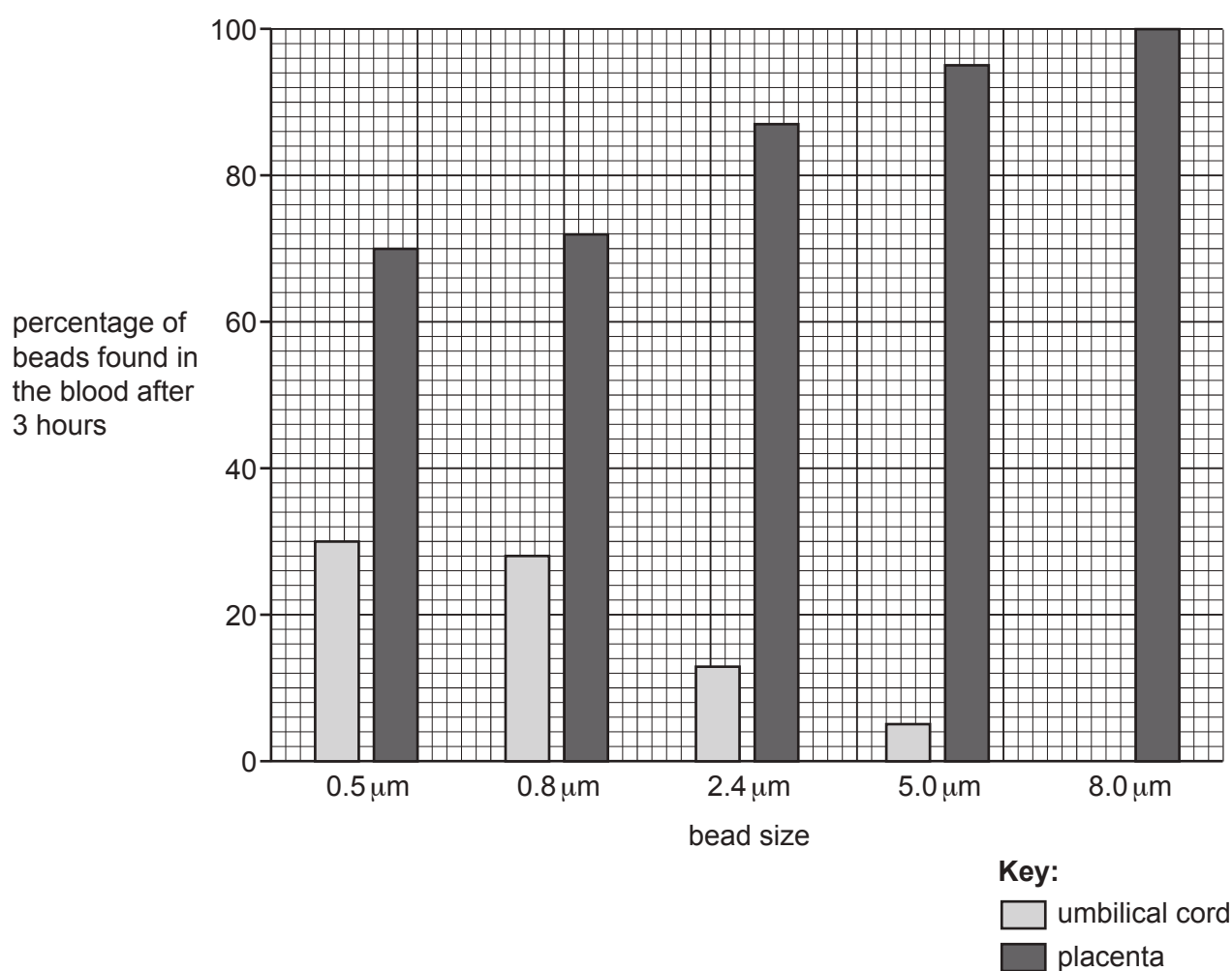


Fig. 2.1

- (i) Convert the diameter of the  $5.0\text{ }\mu\text{m}$  beads into millimetres (mm).

Space for working.

$$\begin{aligned} 1 \text{ micrometer} &= 0.001 \text{ mm} \\ &= 5.0 \times 0.001 = 0.005 \text{ mm} \end{aligned}$$

0.005  
..... mm [1]

- (ii) One million beads with a diameter of  $2.4\text{ }\mu\text{m}$  were injected into the placenta.

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

Space for working.

130 000  
..... beads [2]

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

**Table 2.1**

toxins and pathogens	diameter/ $\mu\text{m}$
nicotine	$2.0 \times 10^{-2}$
drug X	$3.0 \times 10^{-2}$
rubella virus	$5.0 \times 10^{-2}$
<i>Vibrio cholerae</i>	$8.0 \times 10^{-1}$
<i>Trypanosoma brucei</i>	$1.8 \times 10^1$

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.

Nicotine , drug X , rubella virus .

.....  
.....  
..... [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.

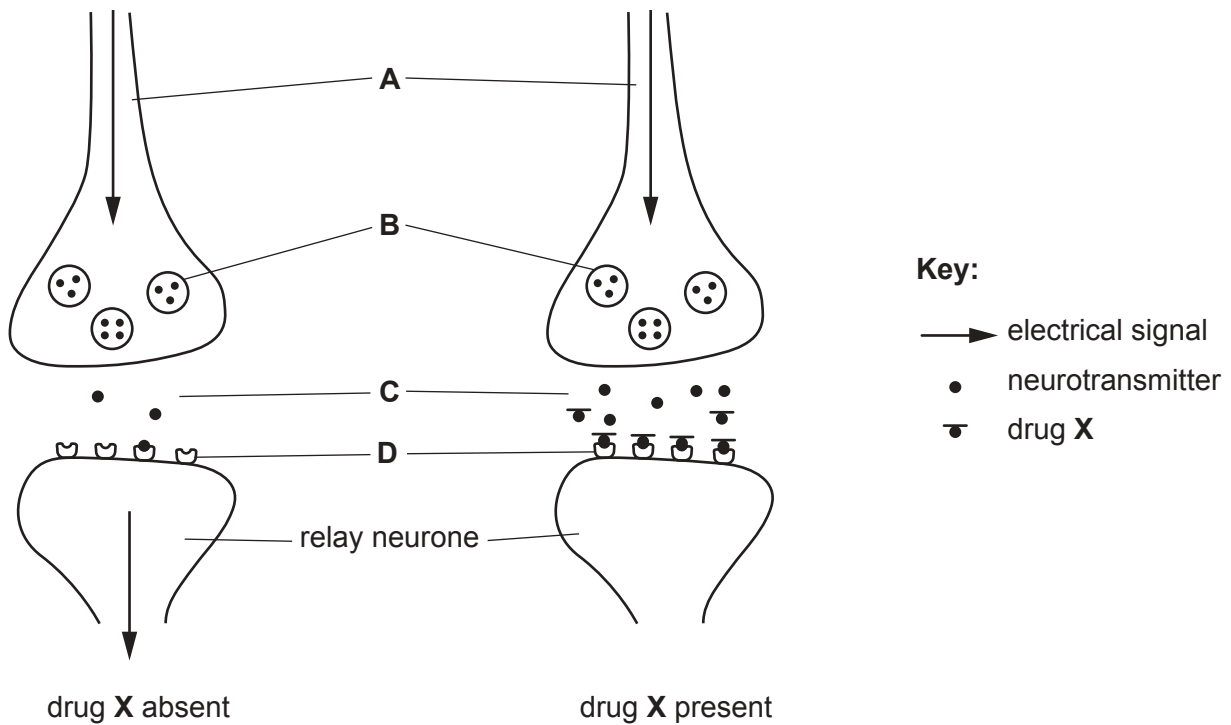


Fig. 2.2

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

**A** Sensory neuron

**B** Vesicle

**C** Synapse

**D** Receptor molecules.

[4]

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

Drug X blocks receptors molecules which prevent neurotransmitters from binding to receptor molecules. Drug X is similar in shape to neurotransmitter receptor hence, it stops impulse being transmitted in relay neuron . So less pain is felt with drug X .

[3]



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

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

1 Blood transfusion .....

.....

2 Breast feeding .....

.....

[2]

[Total: 23]

- 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 Camouflaged so that not seen by prey when stalking .

.....

.....

streamlined body shape Improved ability to run fast .

.....

.....

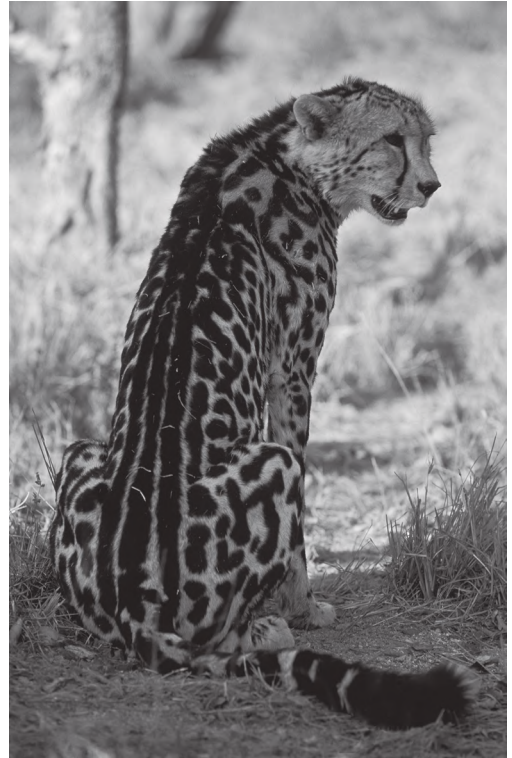
[2]

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

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*.

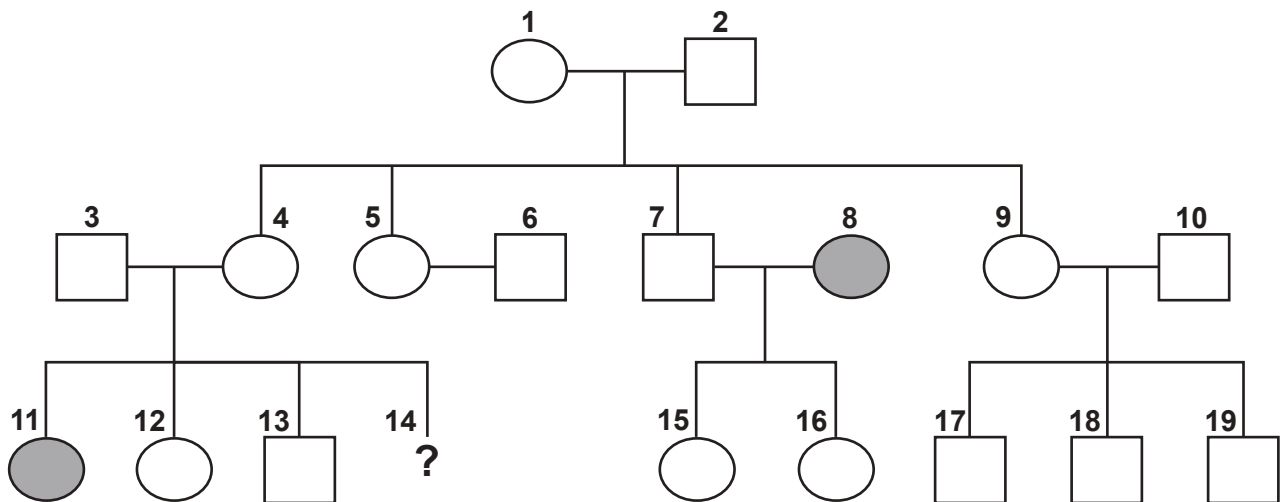
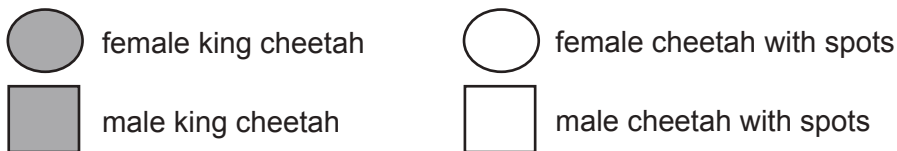
Transmission of genetic information from generation to generation.

.....

.....

..... [1]

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

**Key:****Fig. 3.3**

- (ii) Deduce the genotype of cheetah 11.

cc ..... [1]

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

0.25 / 25% /  $\frac{1}{4}$  ..... [1]

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

By performing a test cross or by breeding with homozygous recessive a breeder can determine the genotype of cheetah 17

..... [2]

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

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.

Morphological or anatomical evidence .

.....

.....

..... [1]

- (c) Cheetahs are at risk of becoming endangered.

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

a) Hunting

.....

b) Lack of food

.....

c) Loss of natural habitat

.....

d) Pollution

.....

e) Climate change

.....

f) Outbreak of diseases

.....

..... [3]

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

a) Captive breeding programmes

.....

b) Local co-operation

.....

c) Awareness of farmers and land users

.....

d) Conservation of national parks

.....

e) Legal monitoring of numbers

.....

f) Public pressure against hunting

.....

..... [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**

- (a) Herbicides kill weeds.

Explain why farmers use herbicides.

To increase crop yield and to reduce competition with weeds .

.....

.....

.....

.....

..... [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.

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

Fig. 4.2 shows the results.

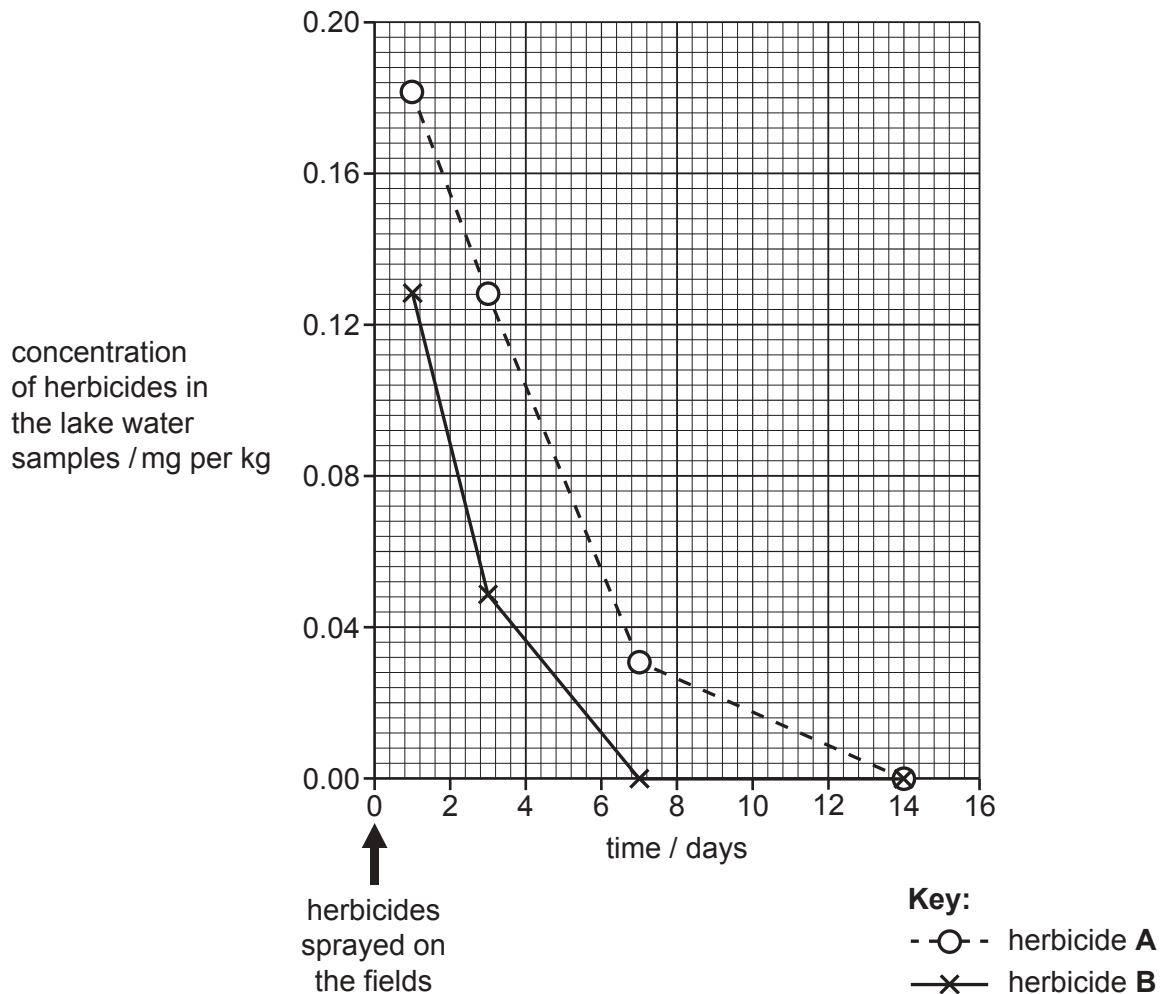


Fig. 4.2

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

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

From the above graph that concentration of both herbicides decreased with time .

A has higher concentration than B throughout whereas B reached zero concentration before A.

For instance, on seventh day concentration B herbicides reached zero whereas concentration of A herbicides reached 0.03 mg per kg .

[3]



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

Herbicide kill aquatic plants . This leads to decrease in the number of producers which ultimately causes scarcity food for herbivores . Death of flora and fauna reduces biodiversity of the lake.

As the aquatic plants die , lack of roots causes erosion and flooding. Herbicides also bioaccumulate at a faster rate in the organisms of the lake . This causes destruction of keystone species of the lake ecosystem .

[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.

## Broad leaves

2 petiole

[2]

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

## Auxin

[1]

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

Suggest how herbicide **B** kills plants.

Lack of magnesium ions prevents the synthesis of chlorophyll hence plants cannot trap sunlight  
.....  
for photosynthesis .

[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.

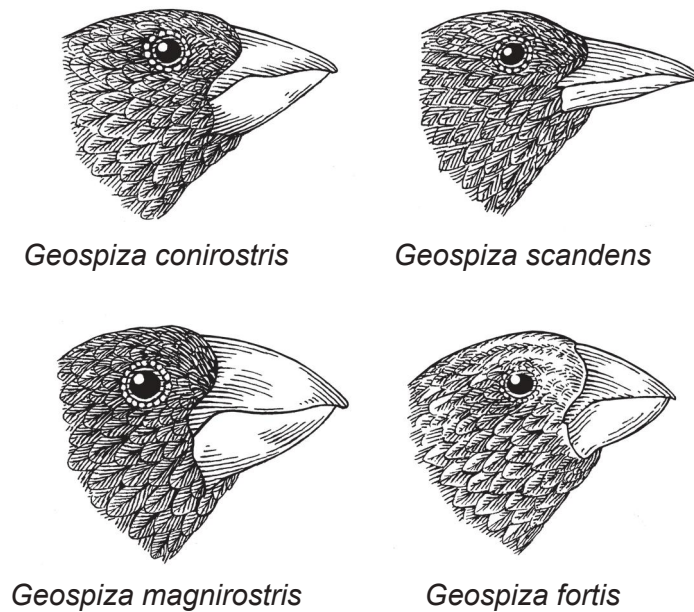


Fig. 5.1

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

Geospiza ..... [1]

- (b) Galápagos finches share a common ancestor.

Suggest how Galápagos finches have evolved different shaped beaks.

By continuous natural selection and sexual reproduction variation in the shapes of beaks .

Mutations in the gene during cell division can also lead to such variations . Birds which where physically  
fit with unique big shape where more likely to food and survive . The birds that survived , reproduced  
and passed on there alleles to future generations . This continued over many generations which led to  
evolution of beak shapes .

[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.

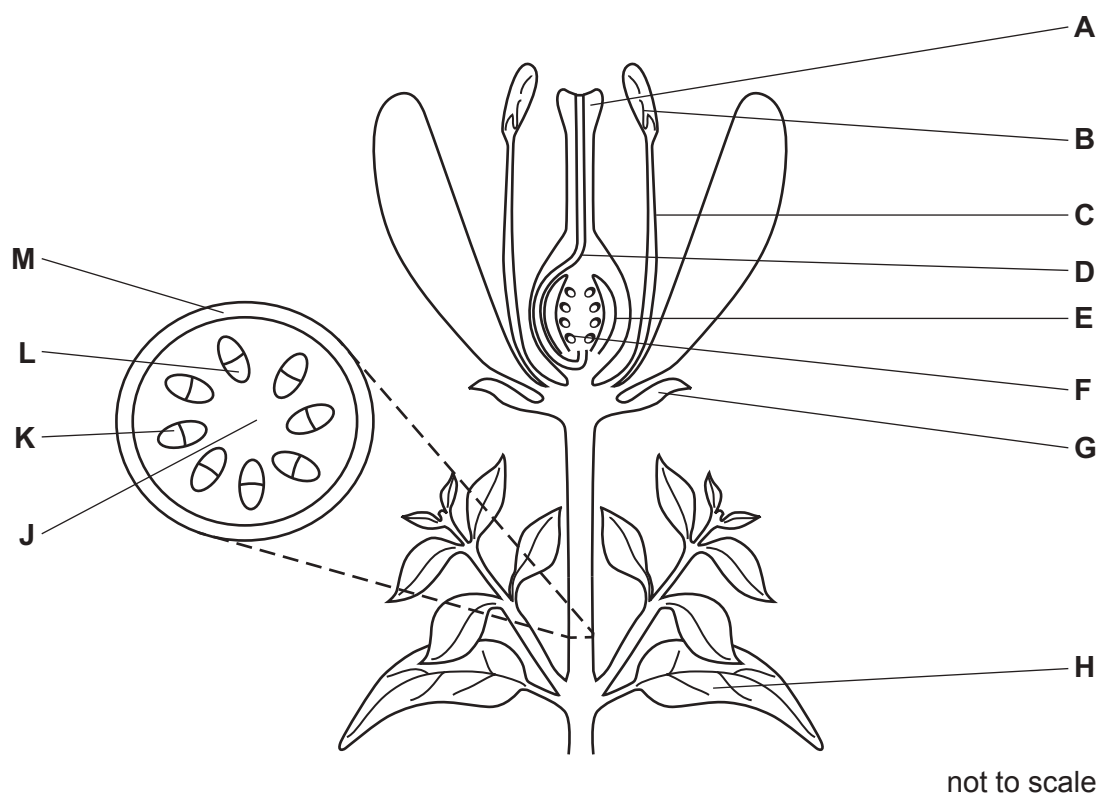


Fig. 6.1

- (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	xylem	L
protects flower bud	sepal	G
produces glucose	leaf	H
produces pollen	anther	B
delivers male nuclei to the site of fertilisation	pollen tube	D

[5]

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

D ..... [1]

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

Translocation ..... [1]

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

H ..... [1]

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

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

Nitrate ions ..... [1]

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

Ribosomes ..... [1]

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

Enzymes ..... [1]

[Total: 11]