AQA

GCSE
BIOLOGY

H

Higher Tier   Paper 2H

Monday 11 June 2018   Morning   Time allowed: 1 hour 45 minutes

A

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- There are 100 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

0 1   Many human actions are reflexes.

unconscious, rapid response

0 1.1 ☐   Which two of the following are examples of reflex actions?

[2 marks]

Tick two boxes.

conscious choice

Jumping in the air to catch a ball   ☐

Raising a hand to protect the eyes in bright light   ☐

unconscious   *stimulus*
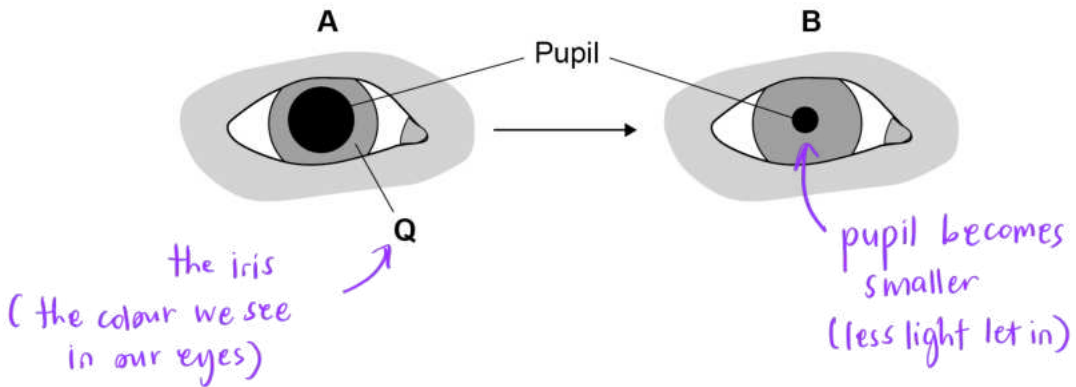
Releasing saliva when food enters the mouth   ☑

Running away from danger   ☐

Withdrawing the hand from a sharp object   ☑

Figure 1 shows how the size of the pupil of the human eye can change by reflex action.

Figure 1

the iris (the colour we see in our eyes)

pupil becomes smaller (less light let in)

0 1.2 ☐   Name one stimulus that would cause the pupil to change in size from A to B, as shown in Figure 1

[1 mark]

Bright light

0 1.3 Structure Q causes the change in size of the pupil.
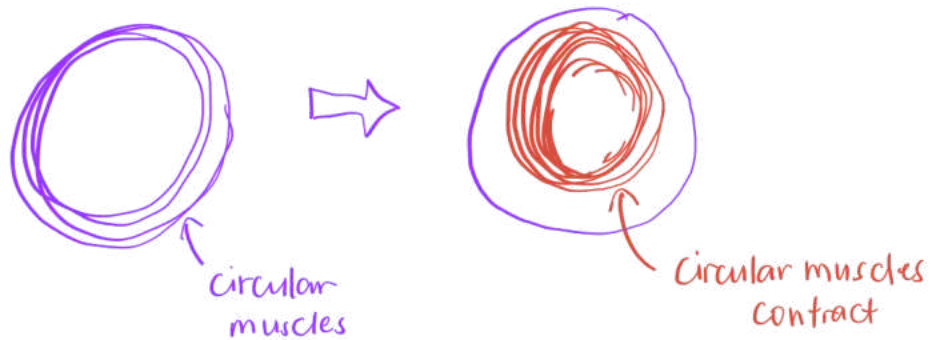
Name structure Q.

[1 mark]

the Iris

0 1.4 Describe how structure Q causes the change in the size of the pupil from A to B.
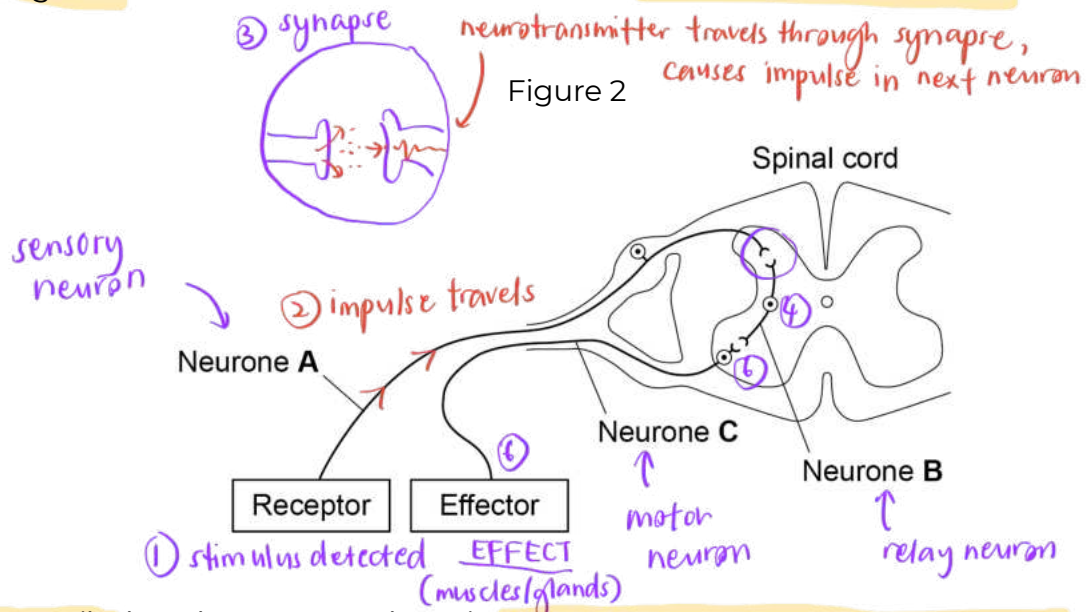
[1 mark]

Muscle contraction

Question 1 continues on the next page

Circular muscles

Circular muscles contract

Turn over ▶

0 1 . 5 Figure 2 shows some structures involved in the coordination of a reflex action.

③ synapse   neurotransmitter travels through synapse, causes impulse in next neuron

Figure 2

Spinal cord

sensory neuron

② impulse travels

Neurone A

Neurone C
motor neuron

Neurone B
relay neuron

Receptor   Effector

① stimulus detected   EFFECT (muscles/glands)

Describe how the structures shown in Figure 2 help to coordinate a reflex action.

[6 marks]

A receptor detects a stimulus such as heat. This generates an impulse which is conducted through neuron A, a sensory neuron. The impulse travels to the spinal cord where it reaches a synapse. Neurotransmitters are released which are absorbed by B, the relay neuron, stimulating an impulse through it. The signal moves through another synapse into the motor neurone, C. The impulse moves through this to the muscle, stimulating contraction. OR to a gland, stimulating release of a chemical.

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

0 2   Many scientists think that global air temperature is related to the concentration of carbon dioxide in the atmosphere.

Figure 3 shows changes in global air temperature and changes in the concentration of carbon dioxide in the atmosphere.

Figure 3 *CO₂ ↑, temp ↓*

overall, both increase

Change in air temperature since 1955 in °C

Concentration of carbon dioxide in the atmosphere in ppm
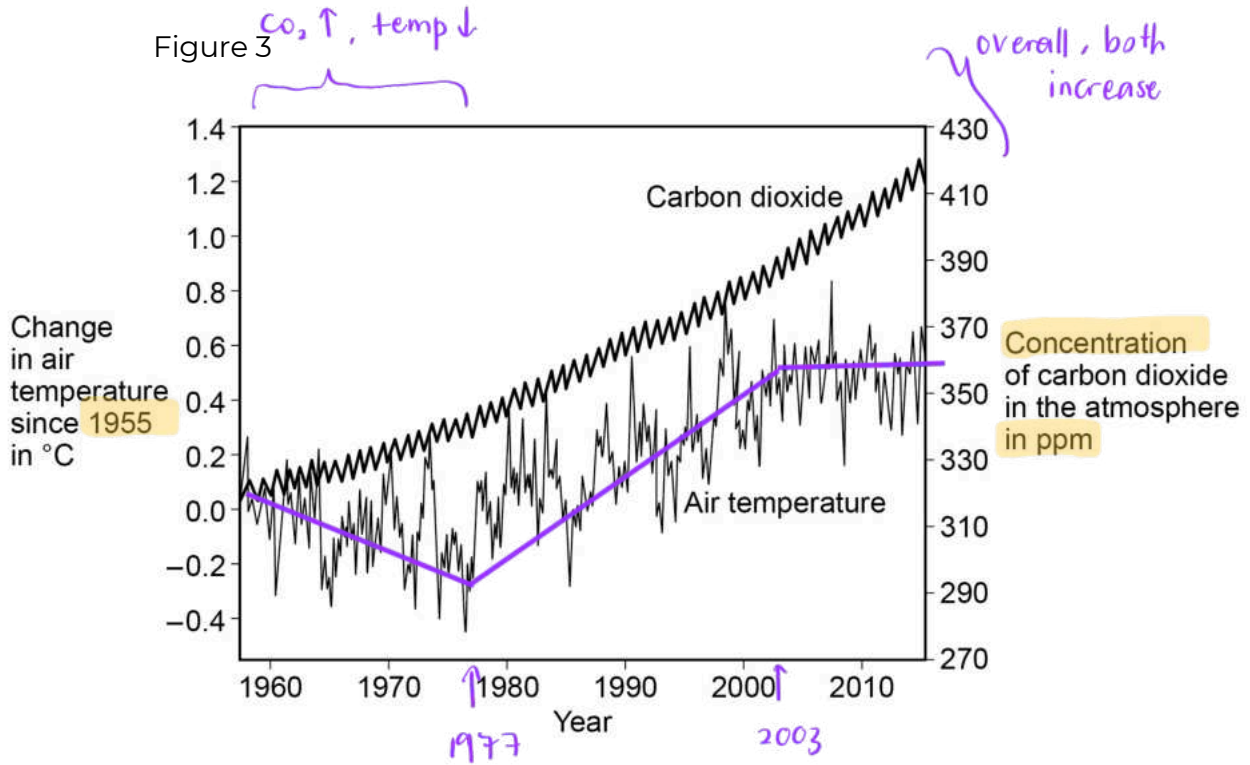
1977   *2003*

0 2 . 1   Complete Table 1.

Use information from Figure 3.

[2 marks]

Choose answers from the box.

You may use each answer once, more than once or not at all.

constant	decreasing	increasing

Table 1

	1960 – 1977	1977 – 2003	2003 – 2015
Trend in carbon dioxide concentration	Increasing	*increasing*	*increasing*
Trend in air temperature	*decreasing*	*increasing*	*constant*

Many scientists think that an increase in carbon dioxide concentration in the atmosphere causes an increase in air temperature.

0 2 . 2   How would an increase in the concentration of carbon dioxide in the atmosphere cause an increase in air temperature?

[1 mark]

Traps heat

OR insulates OR reduces heat loss

0 2 . 3   Evaluate evidence for and against the theory that an increase in the concentration of carbon dioxide in the atmosphere causes an increase in air temperature.

Use data from Figure 3 and your own knowledge.

[4 marks]

The theory could be correct because overall the increase in CO_2 correlates with increasing temperature. ✓ Also, CO_2 traps long wave radiation. ✓ However, between 1960 – 1977, CO_2 concentration rises but temperature falls. ✓ Also, correlation is not the same as causation, and other factors could be at play. ✓

Turn over ▶

In each year, the concentration of carbon dioxide in the atmosphere is higher in the winter than in the summer.

0 2 . 4   Give one human activity that could cause the higher concentration of carbon dioxide in the winter.

[1 mark]

Burning of fossil fuels for heating

0 2 . 5   Give one biological process that could cause the lower concentration of carbon dioxide in the summer.

[1 mark]

Photosynthesis

in summer :   ↑ temperature } → more photosynthesis → ↓ CO_2
             ↑ light intensity

0 2 . 6   Give two possible effects of an increase in global air temperature on living organisms.

[2 marks]

1 Greater yield of some plants

2 Migration to cooler areas

OR loss of habitat
OR extinction

11

Turn over for the next question

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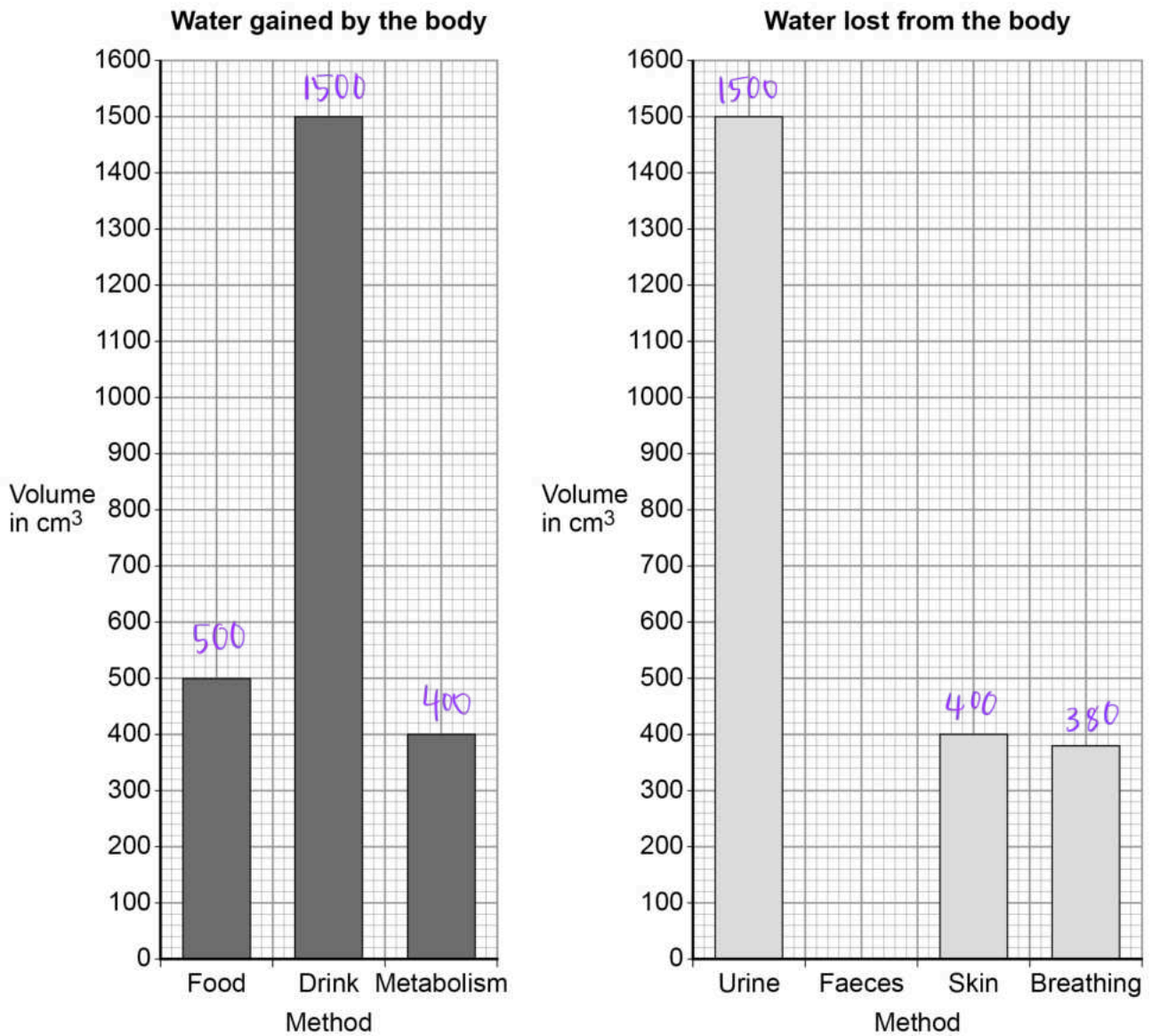ANSWER IN THE SPACES PROVIDED

Turn over ▶

0 3   It is important to maintain water balance in the body.

Figure 4 shows how much water a person gained and lost by different methods in one day.

Figure 4

Water gained by the body

Volume in cm³

- Food: 500
- Drink: 1500
- Metabolism: 400

Method

Water lost from the body

Volume in cm³

- Urine: 1500
- Faeces:
- Skin: 400
- Breathing: 380

Method

When water is balanced, the volume of water taken in by the body is equal to the volume of water lost from the body.

| 0 | 3 .| 1 | | Calculate the volume of water the person lost in one day in faeces.

Use information from Figure 4.

[2 marks]

$2400 - 2200 = 120$ ✓

cm3

Volume lost in faeces = _____ 120 ✓

| 0 | 3 .| 2 | | Figure 4 shows that one method of gaining water is by metabolism.

Which metabolic process produces water?

[1 mark]

Tick one box.

Breakdown of protein to amino acids ⎱ these
  ⎰ actually
Changing glycogen into glucose   require
            water
Digestion of fat

Respiration of glucose ✓

$glucose + O_2 \longrightarrow CO_2 + H_2O$

Question 3 continues on the next page

Turn over ▶

The next day, the person ran a 10-kilometre race.

The volume of water lost from the body through the skin and by breathing increased.

| 0 | 3 . 3 | Explain why more water was lost through the skin during the race.

[2 marks]

sweat gland

More sweating to cool the body

OR ~ running produces heat

need to maintain body temperature

evaporation of water cools the student (running creates lots of heat)

| 0 | 3 . 4 | Explain why more water was lost by breathing during the race.

[3 marks]

During the race, more energy was needed for muscle contraction. ✓
Therefore, more aerobic respiration is required. ✓ This uses oxygen, so
faster breathing rate is necessary to take in more oxygen. ✓

running → muscle contraction → more energy → more respiration
→ more oxygen → greater breathing rate

8

Turn over for the next question

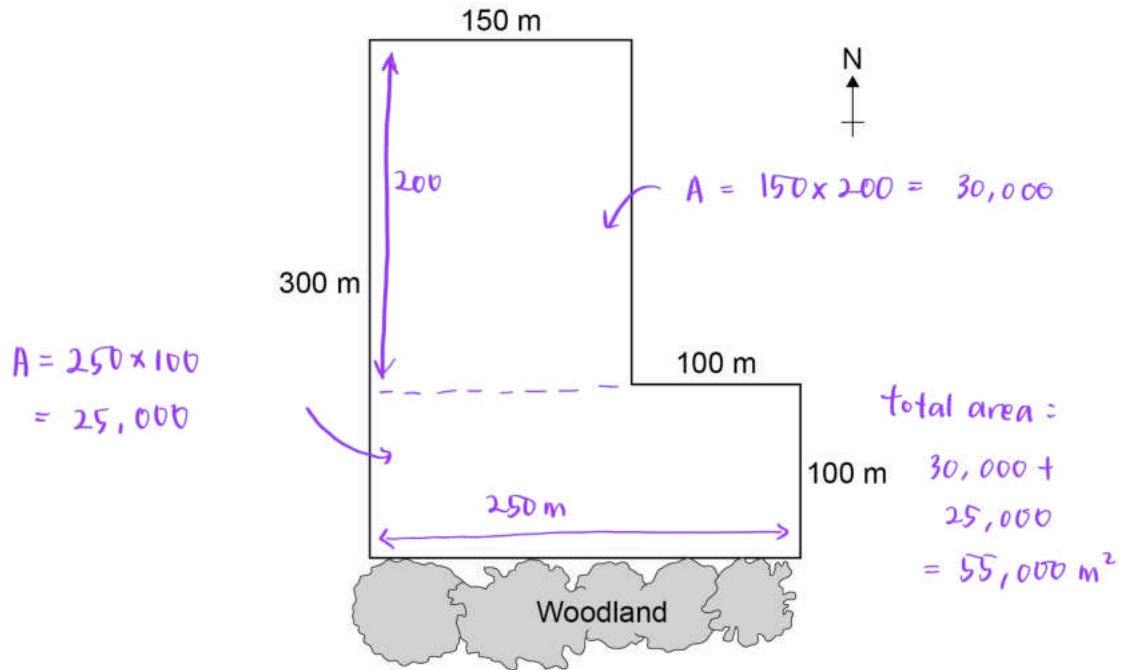DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ►

13

0	4

Some students investigated the size of a population of dandelion plants in a field.

Figure 5 shows the field.

Figure 5

200

$A = 150 \times 200 = 30,000$

300 m

$A = 250 \times 100$
$= 25,000$

100 m

total area :

100 m
$30,000 +$
$25,000$
$= 55,000 \, m^2$

250 m

Woodland

The students:

• placed a 1 m x 1 m square quadrat at 10 random positions in the field
• counted the number of dandelion plants in each quadrat.

Table 2 shows the students' results.

mean $= \dfrac{6+9+5+8+10+2+1+8+11}{10}$

Table 2

$= \dfrac{60}{10}$

Process for question 4.2 :

① Find mean of dandelions

② Find area field

③ Multiply

④ Convert to standard form

$= 6$

Quadrat number	Number of dandelion plants
1	6
2	9
3	5
4	8
5	0
6	10
7	2
8	1
9	8
10	11

0 4 1 Why did the students place the quadrats at random positions?

[1 mark]

To make the study representative of the whole field
OR to avoid bias OR because there is an uneven dandelion distribution

0 4 2 Estimate the total number of dandelion plants in the field.

Calculate your answer using information from Figure 5 and Table 2.

Give your answer in standard form.

[5 marks]

mean dandelions per m^2 = 6

total area = 55,000 m^2

total dandelions = 55,000 × 6 = 330,000

= 3.3×10^5

Total number of dandelion plants = 3.3×10^5

Question 4 continues on the next page

Turn over ▶

Quadrats 5, 7 and 8 were each placed less than 10 metres from the woodland.

These quadrats contained low numbers of dandelion plants.

The students made the hypothesis:

'Light intensity affects the number of dandelion plants that grow in an area.'

| 0 | 4 | 3 |

Plan an investigation to test this hypothesis.

[6 marks]

Identify two areas, one light and the other dark ✓. At each, divide the area into coordinates. Use a random number generator function on your calculator to generate 20 coordinates for each place. At each of these, place a 1m² quadrat and count the number of dandelions. Measure also the light intensity ✓ at each. Record these and compare the data at the different intensities (✓)

make choice of quadrat location quantitative so can be random

0 4 4 | Light is an environmental factor that affects the growth of dandelion plants.

Give two other environmental factors that affect the growth of dandelion plants.

[2 marks]

1   Water

2   Temperature

growth → requires photosynthesis → this needs correct tempearture, ions/minerals and water

Turn over for the next question

OR-soil — very important

14

Turn over ▶

0 5   Cell division is needed for growth and for reproduction.

0 5 1   Table 3 contains three statements about cell division.

Complete Table 3.

Tick one box for each statement.

[2 marks]

*produces 4
genetically different cells*

Table 3

*produces two genetically
identical daughter cells*

Statement	Statement is true for		
	Mitosis only	Meiosis only	Both mitosis and meiosis
All cells produced are genetically identical	✓		
In humans, at the end of cell division each cell contains 23 chromosomes		✓	
Involves DNA replication			✓

*normal body (somatic)
cells have 46 chromosomes*

⇩

*gametes from meiosis
have 23*

Bluebell plants grow in woodlands in the UK.

• Bluebells can reproduce sexually by producing seeds.

• Bluebells can also reproduce asexually by making new bulbs.

0 5 . 2 One advantage of asexual reproduction for bluebells is that only one parent is needed.

Suggest two other advantages of asexual reproduction for bluebells.

[2 marks]

1   Many offspring produced

2   Takes less time (no need for fertilisation of gametes or pollination)

OR more energy efficient / allows colonisation of local area etc.

0 5 . 3 Explain why sexual reproduction is an advantage for bluebells.

[4 marks]

uses meiosis to produce gametes
⇩
this introduces variation
⇩
some individuals better adapted to survive

Sexual reproduction results in genetic variation in offspring, so some individuals will be better adapted to survive. Seeds may disperse long distances, allowing colonisation of new areas. Also, many offspring so higher probability some will survive ✓

Turn over ►

8

0 6   Some students investigated geotropism in the roots of bean seedlings.

Figure 6 shows the apparatus used.

Figure 6

Apparatus A
Stationary

Apparatus B
Rotating slowly
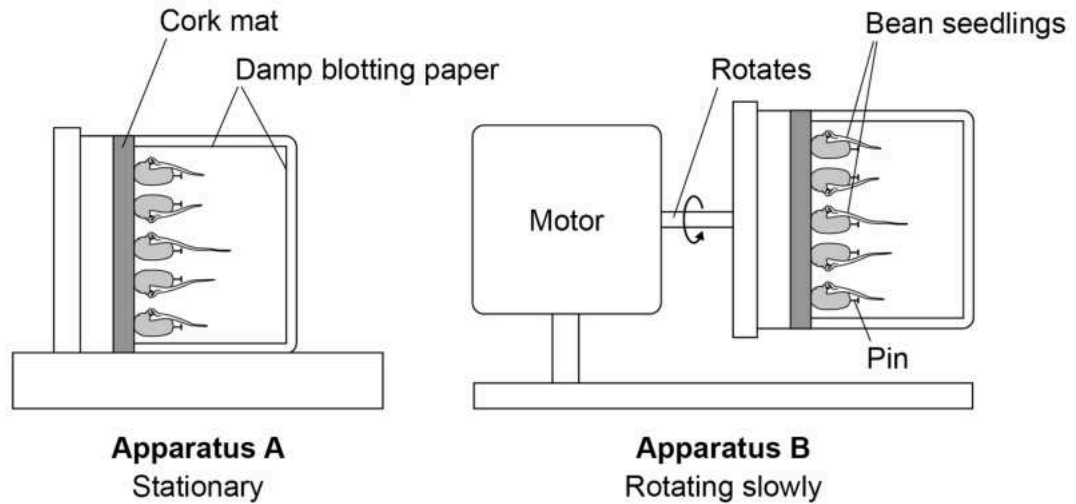
This is the method used.

1. Measure the length of the root of each of 10 bean seedlings.

2. Pin 5 seedlings to the cork mat in apparatus A.

3. Pin 5 seedlings to the cork mat in apparatus B.

4. Leave A and B in a dark cupboard for 2 days.

5. After the 2 days:
     • make a drawing to show the appearance of each seedling
• measure the length of the root of each seedling.

0 6 . 1   Why did the students surround the seedlings with damp blotting paper?

[1 mark]

Tick one box.

affects water not light

To prevent light affecting the direction of root growth   ✗   ☐

To prevent photosynthesis taking place in the roots   ✗   ☐

To prevent the growth of mould on the roots   ☐

To prevent water affecting the direction of root growth   ☑

Apparatus B is a control.

Apparatus B rotates slowly.

0 6 2 How does apparatus B act as a control?

[1 mark]

Gravity acts evenly on all sides

Table 4 shows the students' results.

Table 4

if excluded, then mean = 13.75

	Apparatus A					Apparatus B				
Seedling number	1	2	3	4	5	1	2	3	4	5
Length at start in mm	35	41	32	33	39	30	33	29	28	31
Length after 2 days in mm	49	57	43	45	54	45	45	44	29	44
Length change in mm	14	16	11	12	15	15	12	15	1	13
Mean length change in mm	14					11				

higher change with A

anomaly – has been included in mean

0 6 . 3 One student stated:

'The mean length change for the seedlings in apparatus B is not valid.'

Suggest the reason for the student's statement.

[1 mark]

The anomaly of seedling 4 has been included

0 6 . 4 Suggest one improvement the students could make to obtain a more valid mean length change for the seedlings in apparatus B.

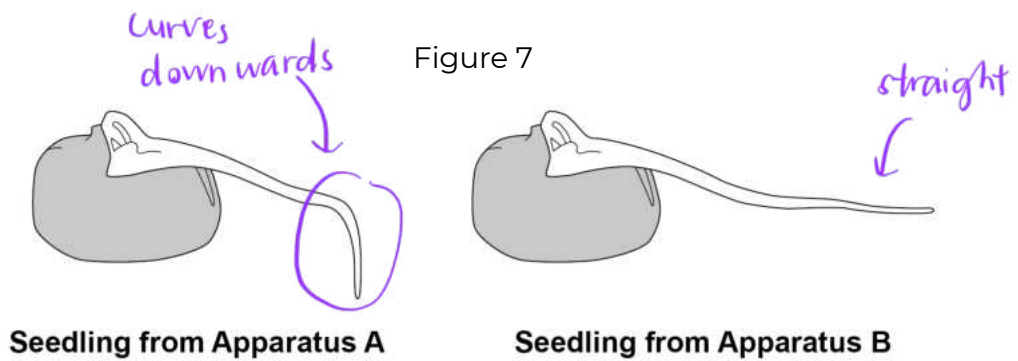[1 mark]

Recalculate mean with seedlings 1, 2, 3 and 5

OR repeat experiment and calculate new mean

Turn over ▶

0 6 5   Figure 7 shows the students' drawings of two seedlings at the end of the 2 days.

Curves
down wards

Figure 7

straight

Seedling from Apparatus A   **Seedling from Apparatus B**

A plant hormone is made in the root tip.

The hormone diffuses from the tip into the tissues of the root.

Explain how the hormone causes the appearance of the seedlings in Figure 7 to be different.

You should refer to both seedlings in your answer.

[3 marks]

There is more auxin at the bottom of the root in A, but even distribution throughout the root in B. Therefore there is reduced cell elongation at the bottom cells of the root in B, causing the root to bend

OR top grows faster than bottom

0 6 6 In horticulture plant hormones are used for controlling plant growth.

Draw one line from each plant hormone to the correct use of that hormone.

[3 marks]

Plant hormone Use of hormone

To reduce the time taken
for tomatoes to ripen

Auxin

To slow down the growth of
plant stems

Ethene

To promote seed
germination

Gibberellin

To stimulate root growth
in plant cuttings

*produced by bananas,
they make fruit around them ripens.*
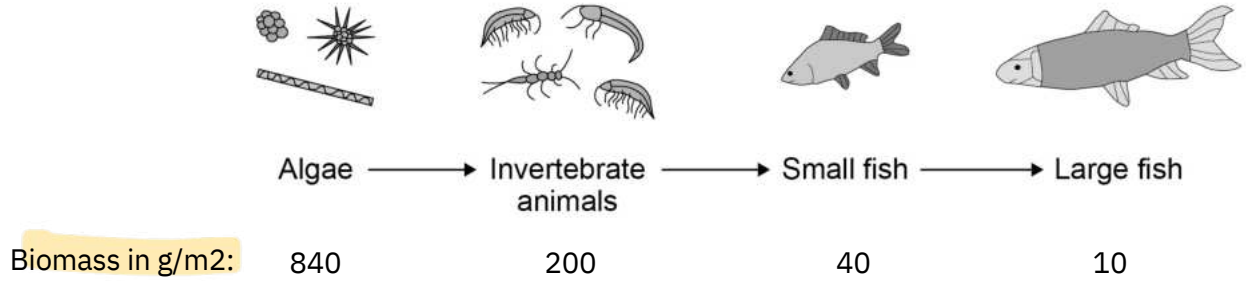
10

Turn over for the next question

0 7   Figure 8 shows:

• a food chain for organisms in a river

• the biomass of the organisms at each trophic level.

Figure 8

Algae ⟶ Invertebrate animals ⟶ Small fish ⟶ Large fish

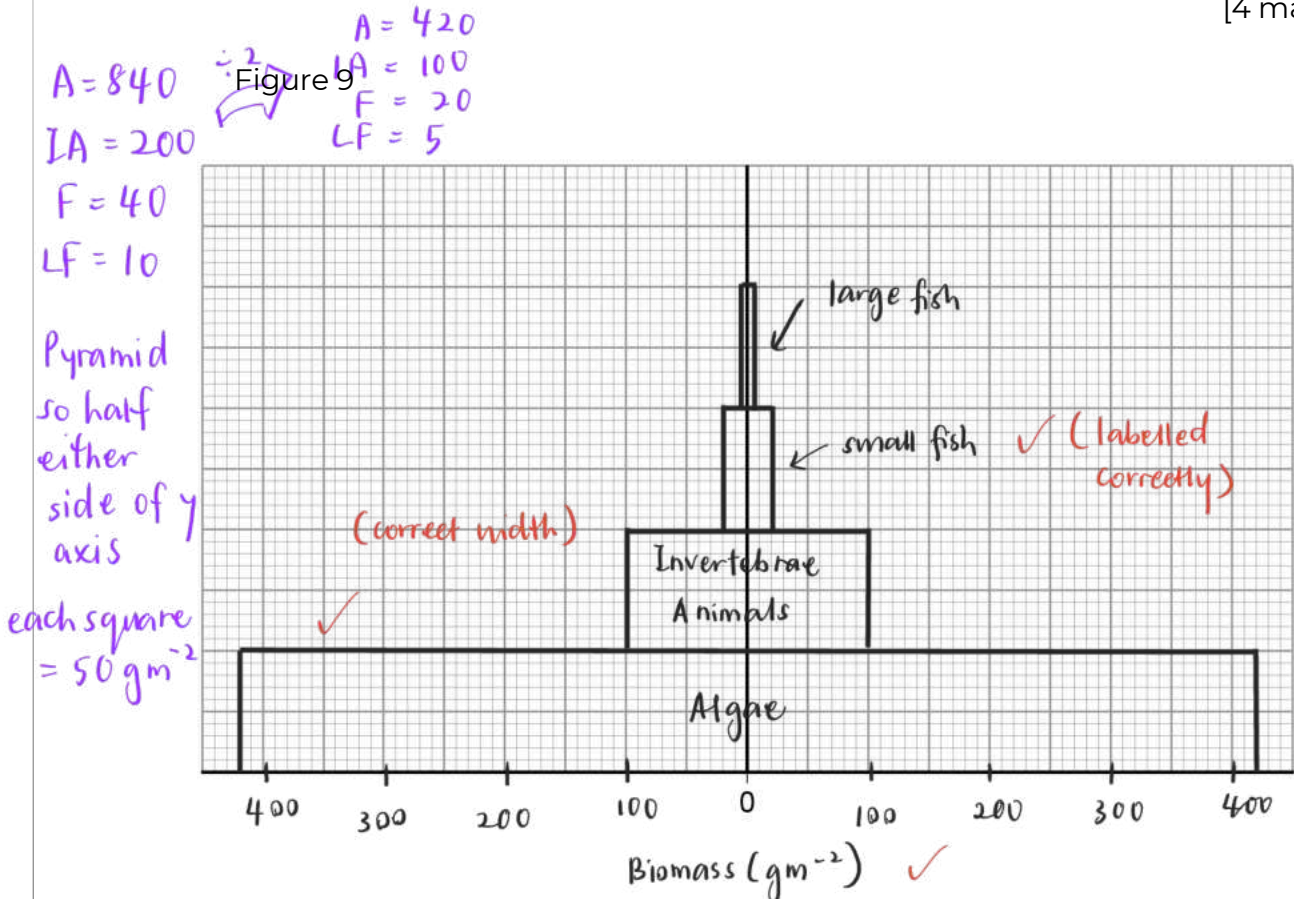Biomass in g/m2:   840   200   40   10

0 7.1   Draw a pyramid of biomass for the food chain in Figure 8 on Figure 9

You should:

• use a suitable scale

• label the x-axis

• label each trophic level.

[4 marks]

A = 420
A = 100
F = 20
LF = 5

A = 840
IA = 200
F = 40
LF = 10

Figure 9

Pyramid so half either side of y axis

each square = 50 gm⁻²

large fish

small fish   ✓ (labelled correctly)

(correct width)

Invertebrate Animals

Algae

400 300 200 100 0 100 200 300 400

Biomass (gm⁻²) ✓

24

IB/G/Jun18/8461/2H

(handwritten: 840) *(handwritten: 10)*

0 7 2 Calculate the percentage of the biomass lost between the algae and the large fish.

Give your answer to 2 significant figures.

[3 marks]

(handwritten working:)

$\%\ lost = \dfrac{initial - final}{initial} \times 100$

$\dfrac{840 - 10}{840} \times 100 = 98.8095\ \% \checkmark$

↑ round up

$= 99\ \%$

Percentage loss = _____ 99 % ✓

0 7 3 Give one way that biomass is lost between trophic levels.

[1 mark]

Respiration

OR through gases

Question 7 continues on the next page

Turn over ▶

0 7 . 4 A large amount of untreated sewage entered the river. Many fish died.

Untreated sewage contains organic matter and bacteria.

Explain why many fish died.

[5 marks]

Bacteria decay organic matter by digestion. They respire aerobically, lowering the oxygen concentration of the river water. Fish have less oxygen, hence reduced energy supply so they die.

13

Turn over for the next question

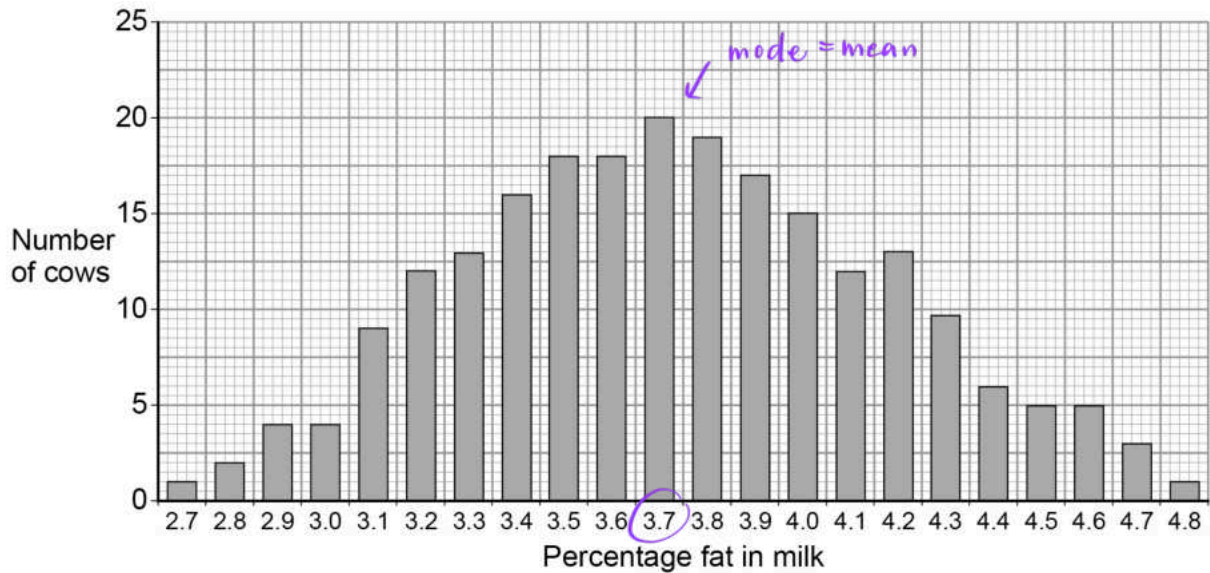DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

* 2 7 *

0 8 Scientists want to breed cows that produce milk with a low concentration of fat.

Figure 10 shows information about the milk in one group of cows.

The cows were all the same type.

Figure 10

mode = mean

most frequent value = highest bar

0 8 . 1 In Figure 10 the mean percentage of fat in the milk is equal to the modal value.

Give the mean percentage of fat in the milk of these cows.

[1 mark]

Mean percentage = _____ 3.7 %

F
↑

0 8 . 2 A student suggested:

'The percentage of fat in milk is controlled by one dominant allele and one recessive allele.' ↘ f

How many different phenotypes would this produce?

Tick one box.

[1 mark]

genotypes
FF = phenotype 1
Ff = phenotype 1
ff = phenotype 2

2 3 22 46 [ ] [✓] [ ] [ ] [ ] [ ] [ ] [ ]

0 8 3   Give the evidence from Figure 10 which shows the percentage of fat in the milk is controlled by several genes.

larger range of phenotypes

[1 mark]

Large range of values

OR not only 2 values OR in between values

0 8 4   One of the genes codes for an enzyme used in fat metabolism.

A mutation in this gene causes a reduction in milk fat.   *fat production*

The mutation changes one amino acid in the enzyme molecule.

Explain how a change in one amino acid in an enzyme molecule could stop the enzyme working.

[3 marks]

mutation

active site no longer complementary

A different protein is produced with an altered active site. Substrate does not bind so no enzyme substrate complex formed.

Question 8 continues on the next page
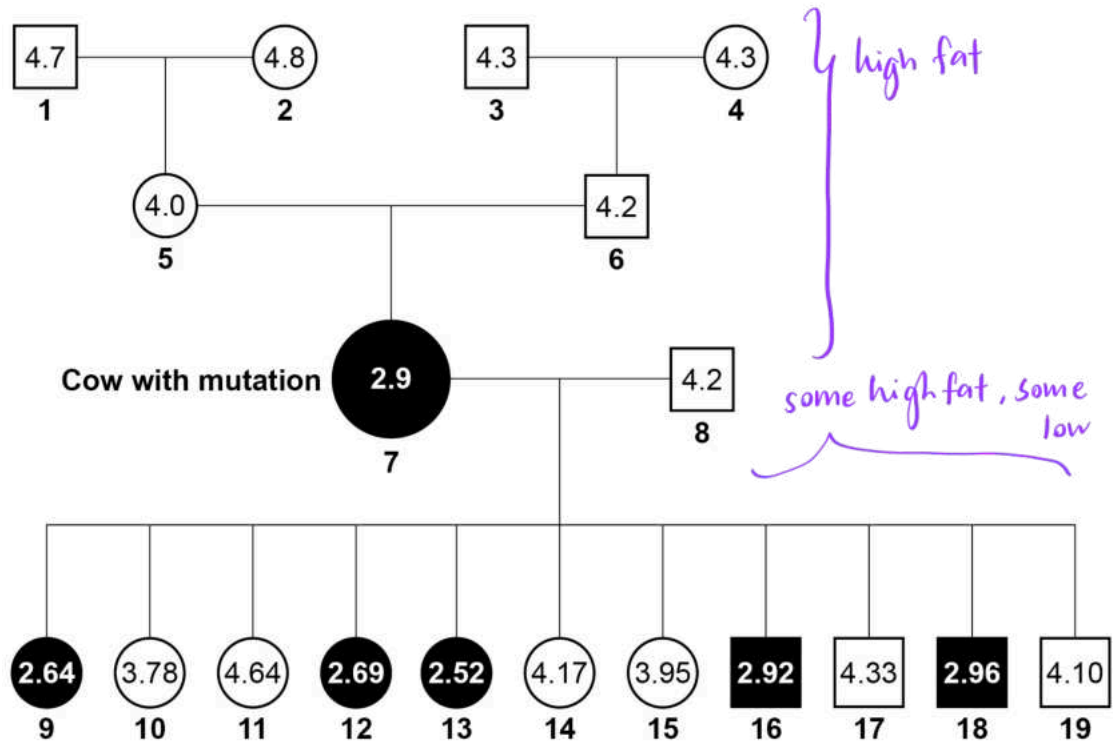
Turn over ▶

IB/G/Jun18/8461/2H

The scientists found one cow with a mutation.

The cow's milk contained only 2.9% fat.

Figure 11 shows the percentage of fat in the milk of cattle related to the cow with the mutation.

The values for male cattle are the mean values of their female offspring.

Figure 11

Key

● Female with low-fat milk

■ Male whose female offspring have low-fat milk

○ Female with high-fat milk

□ Male whose female offspring have high-fat milk

`0 8 5` Animal 8 is homozygous.

The mutation in animal 7 produced a dominant allele for making low-fat milk.

Give evidence from Figure 11 that animal 7 is heterozygous.

[1 mark]

Produces some offspring with high fat milk.

`0 8 6` Animals 7 and 8 produced 11 offspring. These offspring were produced by in vitro fertilisation (IVF).

The embryos from IVF were transferred into 11 other cows.

produce one calf per mating season (usually)

Suggest why IVF and embryo transfer were used rather than allowing animals 7 and 8 to mate naturally.

[1 mark]

Allows more offspring to be produced at the same time.

`0 8 7` Draw a Punnett square diagram to show a cross between animals 7 and 8.

Identify which offspring produce low-fat milk and which offspring produce high-fat milk.

[4 marks]

hetero (females)   homo Recessive (male)

Use the following symbols:

D = dominant allele for making low-fat milk

d = recessive allele for making high-fat milk

male

female		d	d
	D	Dd (low fat)	Dd (low fat)
	d	dd (high fat)	dd (high fat)

Turn over ▶

0 8 . 8 The scientists want to produce a type of cattle that makes large volumes of low-fat milk.

The scientists will selectively breed some of the animals shown in Figure 11.

Describe how the scientists would do this.

[4 marks]

Find the female with the highest yield and lowest fat and the male who's offspring have the same characteristics. Cross these individuals. Select the best offspring for both characteristics from each generation and repeat for several generations.

16

0 9   Figure 12 shows a ring-tailed lemur.

Figure 12

Table 5 shows part of the classification of the ring-tailed lemur.

Table 5

(Delicious)
King
Prawn
Curry
OR
Fat
Greasy
Sausage

Classification group	Name
Kingdom	*Animalia*
Phylum	*Chordata*
Class	*Mammalia*
Order	*Primates*
Family ~~Genus~~	*Lemuroidea*
	Lemur
Species	*catta*

0 9 . 1   Complete Table 5 to give the names of the missing classification groups.

[2 marks]

0 9 . 2   Give the binomial name of the ring-tailed lemur.

Use information from Table 5.

Genus species

[1 mark]

Lemur catta

Turn over ▶

Lemurs are only found on the island of Madagascar.
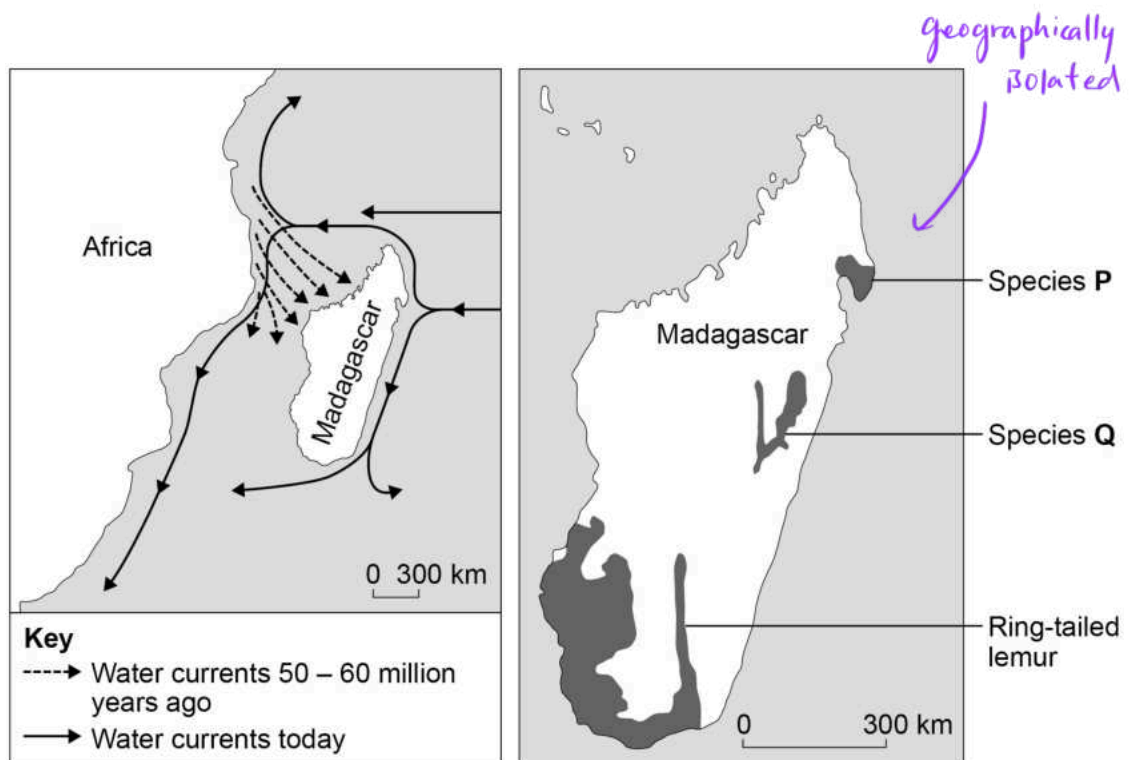
Madagascar is off the coast of Africa.

Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.
Today there are many species of lemur living on Madagascar.

Figure 13 shows information about water currents.

Figure 14 shows the distribution of three species of lemur on Madagascar.

Figure 13 Figure 14

Africa

Madagascar

Key

----▸ Water currents 50 – 60 million years ago
——▸ Water currents today

0 300 km

geographically isolated

Madagascar

Species **P**

Species **Q**

Ring-tailed lemur

0   300 km

0 9 . 3   Suggest how ancestors of modern lemurs reached Madagascar.

[1 mark]

Carried by favourable currents on masses of vegetation

speciation

0 9 4   <mark>Describe</mark> how the <mark>ancestors</mark> of <mark>modern lemurs</mark> may have <u>evolved into the species</u> shown in Figure 14.

[5 marks]

Different populations become isolated from one another. There was variation between the habitats of different populations. There was substantial genetic variation within lemur populations. These individuals that are better adapted survive to reproduce and pass on favourable alleles to offspring. Eventually, individuals of one population cannot produce fertile offspring with another. They are now separate species.

9

END OF QUESTIONS

There are no questions printed on this page

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