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GCSE (9–1) Biology A (Gateway Science)

J247/02 Paper 2, B4–B6 and B7 (Foundation Tier)

Monday 11 June 2018 – Morning

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You may use:
- a scientific or graphical calculator
- an HB pencil

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of the booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document consists of **32** pages.

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SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1 Which process in the carbon cycle **takes in** carbon dioxide from the air?

A Combustion

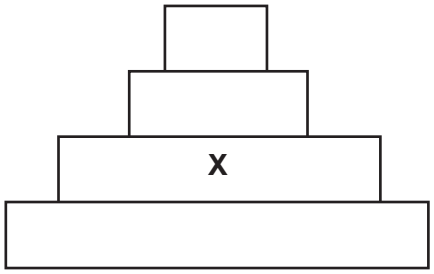
B Decomposition

C Photosynthesis

D Respiration

Your answer ☐ **[1]**

2 The diagram shows a pyramid of biomass.



Which trophic level is **X**?

A Primary consumers

B Producers

C Secondary consumers

D Tertiary consumers

Your answer ☐ **[1]**

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3 There are two main types of reproduction, sexual and asexual.

Which is an **advantage** of sexual reproduction?

A Creates more variation

B Produces larger numbers of offspring

C Produces offspring that are all identical so well adapted

D Only needs one parent

Your answer ☐ **[1]**

4 What did Gregor Mendel discover?

A A theory for how life on Earth started

B How characteristics are inherited in pea plants

C The shape of the DNA molecule

D The theory of natural selection

Your answer ☐ **[1]**

5 Tears and stomach juices are important in the body's response to pathogens.

	Tears	**Stomach juices**
A	Acid	Antibiotics
B	Antibiotics	Antibodies
C	Antibodies	Lysozyme
D	Lysozyme	Acid

Which row of the table correctly describes what substances are found in tears and stomach juices?

Your answer ☐ **[1]**

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6 Which statement describes how vaccines work?

A Cause the body to produce antibodies.

B Cause the release of antigens.

C Contain antiviral drugs.

D Make platelets more active.

Your answer ☐ **[1]**

7 A scientist was studying a population of snails.

He caught 60 snails in the first sample. He marked them and released them.

He caught 50 snails in the second sample. 20 of the snails were marked.

Use this equation: estimated population = $\dfrac{\text{number caught in first sample} \times \text{number caught in second sample}}{\text{number in second sample that are marked}}$

What is the estimated population?

A 150

B 2400

C 3000

D 60 000

Your answer ☐ **[1]**

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8 A gardener releases spiders into a greenhouse. They eat the insects which are eating her plants.

What is this an example of?

A Biological control

B Gene technology

C Homeostasis

D Parasitism

Your answer ☐ **[1]**

9 In selective breeding which organisms breed?

A Humans choose which organisms breed.

B Organisms that are best suited to their environment will breed.

C Random organisms will breed.

D The youngest organisms will breed.

Your answer ☐ **[1]**

10 A scientist is estimating the number of rabbits in a field.

He has eight different estimates, 12, 12, 13, 15, 17, 19, 22 and 26.

Which is the median value for his estimates?

A 8

B 12

C 16

D 17

Your answer ☐ **[1]**

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11 Strains of bacteria are now becoming resistant to antibiotics.

Which process is causing this resistance?

A Genetic modification

B Natural classification

C Natural selection

D Selective breeding

Your answer ☐ **[1]**

12 Plants can be grown in water.

What is the name of this growth method?

A Active transport

B Germination

C Hypothermia

D Hydroponics

Your answer ☐ **[1]**

13 An organism has the genotype TT.

Which term describes this organism?

A Heterozygous dominant

B Heterozygous recessive

C Homozygous dominant

D Homozygous recessive

Your answer ☐ **[1]**

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14 Which process produces gametes?

A Diffusion

B Fertilisation

C Meiosis

D Mitosis

Your answer ☐ **[1]**

15 Which is a **chemical** defence of plants?

A Antimicrobial substances

B Cell walls

C Leaf cuticles

D Thorns

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

16 (a) Characteristics can be examples of continuous or discontinuous variation.

Write the **four** characteristics below in the correct columns of the table.

Sex **Blood group** **Height** **Eye colour**

Continuous variation	Discontinuous variation

[2]

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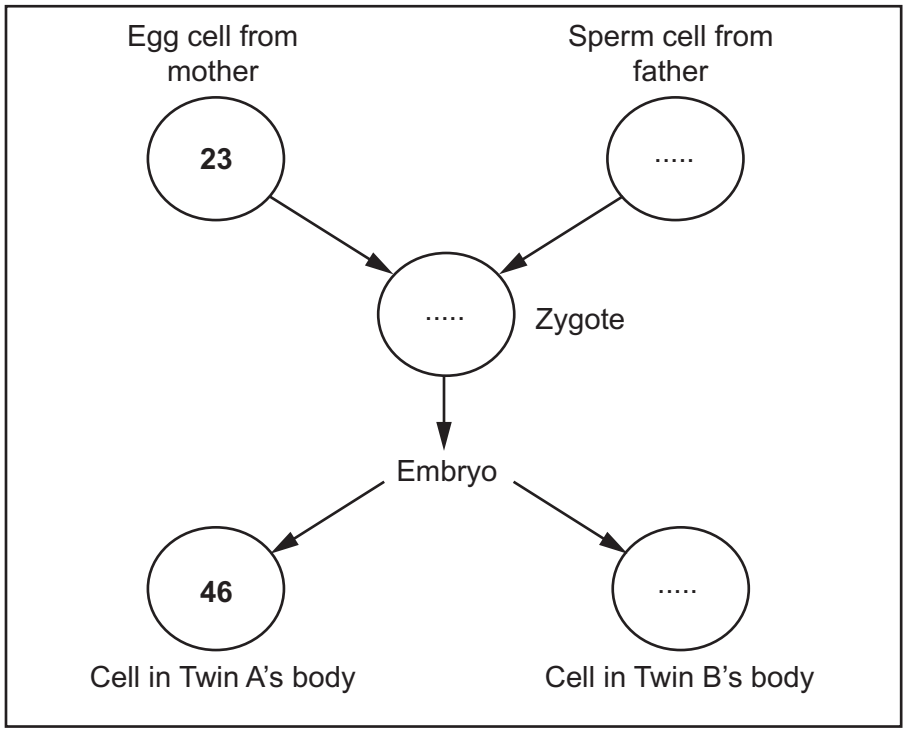
(b) Identical twins occur when an embryo splits into two.

In the diagram below, some of the chromosome numbers in the different cells have been given to you.



Complete the diagram to show the number of chromosomes in:

- The sperm cell
- The zygote
- The cell in Twin B's body.

[3]

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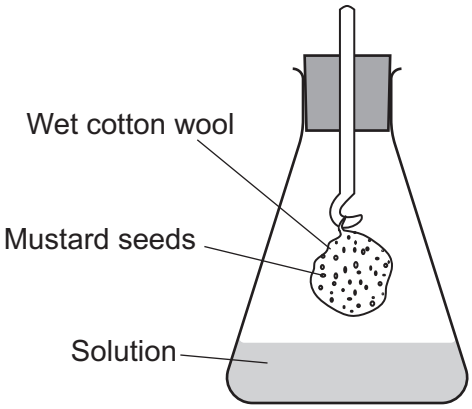
17 A student investigates the effect of acid rain on seed growth.

- She soaks cotton wool in a solution with a pH value of 7.0.
- She puts 20 mustard seeds onto the cotton wool and places it inside a flask.
- She adds the same solution to the flask.
- She then repeats this four times using solutions with different pH values.

One of the flasks is shown in the diagram.



After **8 days** she counts how many of the seeds are growing.

The table shows her results.

pH of solution	Number of the 20 seeds that are growing after 8 days
7.0	17
6.5	18
6.0	16
5.5	6
5.0	2

The student used 20 seeds in each flask.

(a) Write down **one** other factor that the student should have kept the same in this investigation.

..... **[1]**

(b) Describe what this investigation shows about the effect of acid rain on seed growth.

.....

.....

..... **[2]**

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(c) One way to compare the growth of seeds is to use a germination index (**GI**).

Use the formula: $GI = \frac{\text{mean root length} \times \text{number of seeds that are growing}}{\text{number of days}}$

(i) For the seeds at **pH 6.0**, the mean root length was 5 mm.

Calculate the **GI** for these seeds.

Answer = ... **[2]**

(ii) Look at the equation for **GI**.

This is a better way of measuring the effect of acid rain on seed growth than just counting the number of seeds growing.

Explain why.

.....

..... **[1]**

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18 **(a)** The sex chromosomes determine the sex of a baby.

What are the sex chromosomes of a male and of a female?

Male ..... Female ..... **[2]**

(b) The data in the table shows the ratio of males to females in England and Wales.

	Ratio of males to females in England and Wales
At birth	105 males : 100 females
Average over the whole population	98 males : 100 females

(i) What percentage of babies are male at birth?

Answer = ... % **[1]**

(ii) In a hospital 410 babies are born in a week.

Calculate how many of them are likely to be male.

Answer = ... **[1]**

(iii) On average, men do not live as long as women.

How does the data in the table show this?

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..... **[2]**

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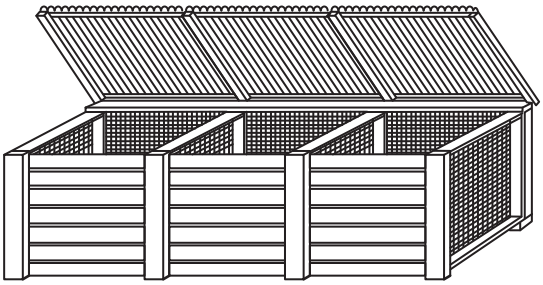
19 A gardener buys a composter to decay plant material as quickly as possible.

The composter has three sections.



Section **A** Section **B** Section **C**

She designs an experiment to see if watering makes the plant material decay faster.

She waters:

- Section **A** once a week
- Section **B** once a month
- Section **C** is not watered.

(a) The gardener wants valid results. Explain **one** factor that the gardener should keep constant.

.....

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..... **[2]**

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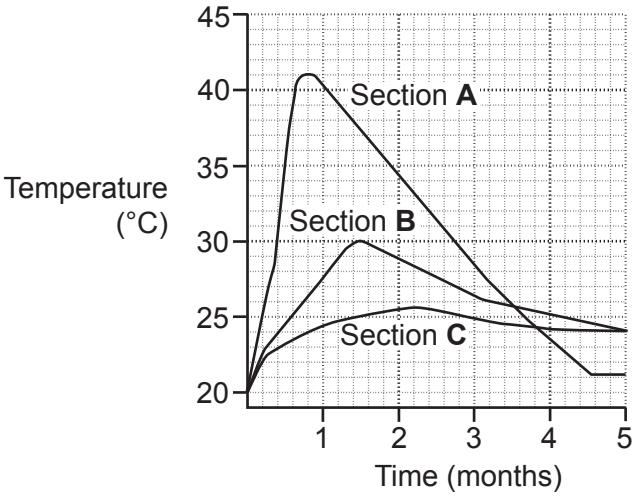
(b) The gardener measures the temperature in each section for five months.

She knows that heat is given off when plant material decays.

The graph shows her results.



(i) Write down **two** differences between the change in temperature in Section **A** and the change in temperature in Section **C**.

1 .....

.....

2 .....

.....

[2]

(ii) The gardener decides that she should water all sections every week.

Explain why she decides this.

.....

..... **[1]**

(c) Each section of the composter has holes in it to let oxygen in.

Explain why this helps the material to decay.

.....

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..... **[2]**

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20 Retinitis pigmentosa is a genetic condition.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

If people have retinitis pigmentosa then the cells in their retina are damaged.

(a) Explain the meaning of these terms.

Mutation .....

.....

Gene .....

.....
[2]

(b) If a person has two alleles for retinitis pigmentosa, they will not be able to see properly.

(i) Why does a person need two affected alleles to have the condition?

.....

..... **[1]**

(ii) Why does the condition affect the ability to see properly?

.....

..... **[1]**

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(c) Two people are heterozygous for retinitis pigmentosa and are expecting a baby.

Complete the genetic diagram to work out the probability that the baby will have the condition.

R is the normal allele and r is the allele for retinitis pigmentosa.

	R	r
R		
r		

Answer = ... **[3]**

(d) **(i)** Scientists want to use stem cells as a treatment for this condition.

Why might stem cells be able to repair the retina?

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..... **[2]**

(ii) Write down **two** reasons why medical treatments are tested on animals first.

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..... **[2]**

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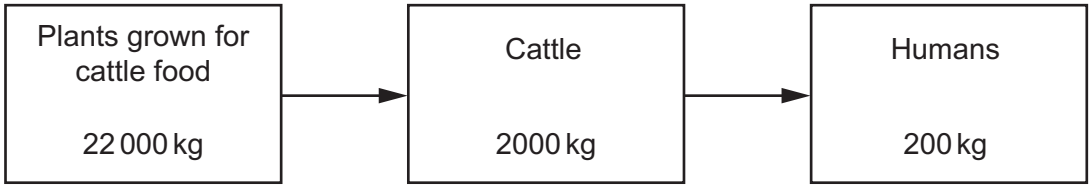
21 The diagram shows the flow of biomass through an agricultural food chain.



(a) **(i)** Calculate how much biomass is lost between the plants and humans.

Answer = ... kg **[1]**

(ii) One way biomass is lost from the food chain is by insects eating the leaves of plants.

Write down **one** other way that biomass is lost from the food chain.

..... **[1]**

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(b) The plants grown for cattle food often have their leaves eaten by insects.

Scientists have produced genetically modified (GM) plants that make insecticide in their leaves.

(i)* Explain why these GM plants would make more biomass available to humans.

In your answer use the diagram of the agricultural food chain and ideas about photosynthesis.

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..... **[6]**

(ii) Suggest **two** reasons why some people are against this type of genetic engineering.

1 .....

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2 .....

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[2]

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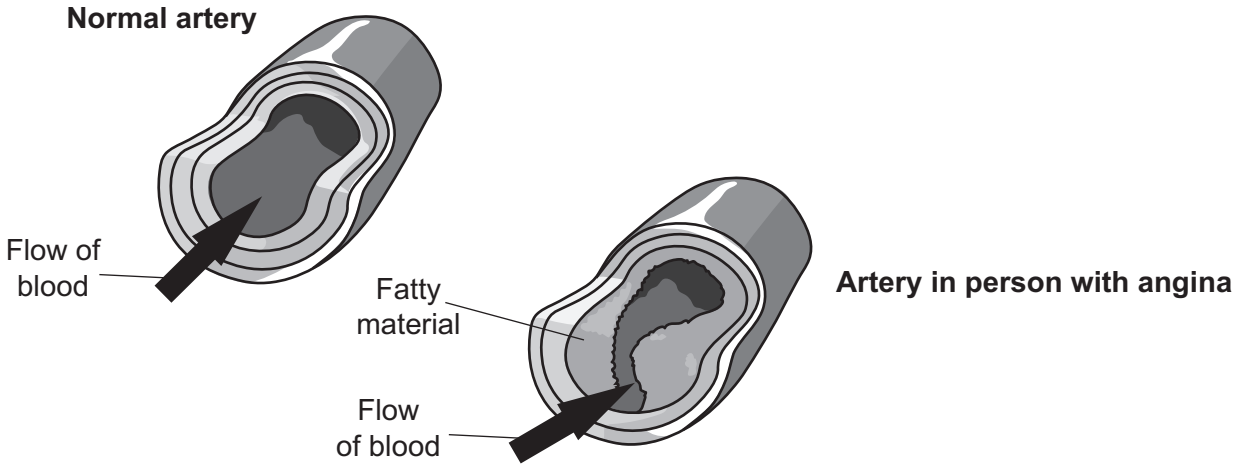
22 Angina is caused by a problem in the arteries that supply the heart muscle.

Fatty material (cholesterol) builds up in these arteries.



(a) In angina the heart muscle starts to carry out anaerobic respiration.

Explain why this happens.

Use the information in the diagram and your biological knowledge.

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..... **[3]**

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(b) Angina is often the first sign of a disease called coronary heart disease (CHD).

The table is used to estimate the risk of getting CHD. The more points a person scores, then the higher the risk of getting CHD.

Risk factor	**Number of points**		
	1	**2**	**3**
Age in years	<20	21–30	31–40
Blood cholesterol level	Low	Medium	High
Number of cigarettes smoked per day	0	1–10	11–20
Mass	Below average	Average	Above average
Number of parents with coronary heart disease (CHD)	0	1	2

(i) How many points are scored by smoking 20 cigarettes a day?

..... **[1]**

(ii) What is the effect of age on the chance of getting CHD?

.....

..... **[1]**

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(iii) Here is some information about two people.

Person A	**Person B**
25 years old	19 years old
Non-smoker	Smokes 20 cigarettes a day
Low blood cholesterol level	Low blood cholesterol level
Average mass	Below average mass
One parent with CHD	No parents with CHD

Use the table to work out whether Person A or Person B is most likely to develop CHD.

Show how you worked out your answer.

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..... **[3]**

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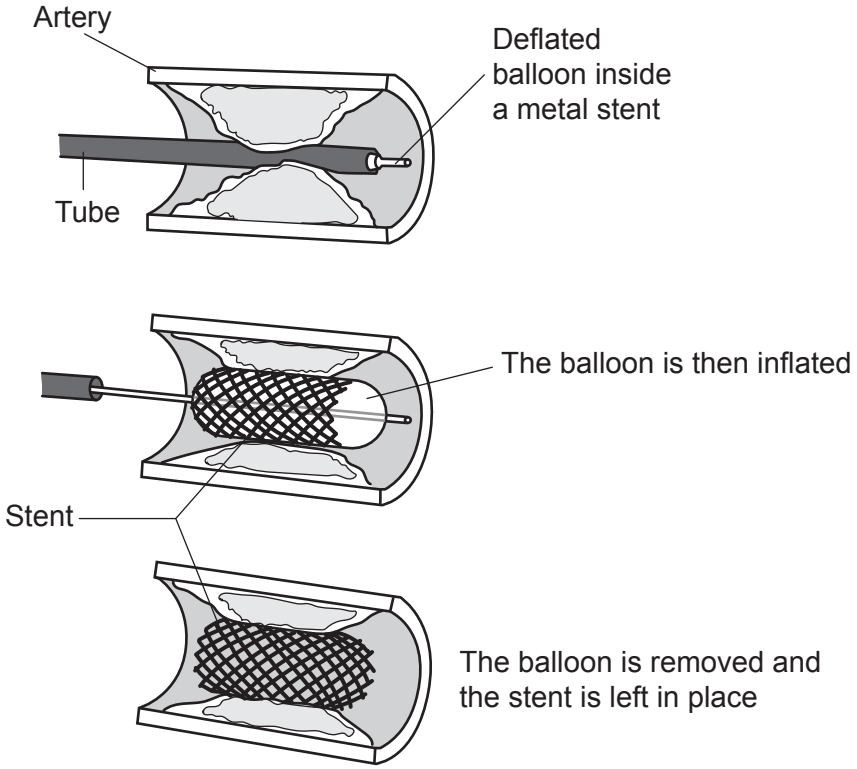
(c) There are several treatments for coronary heart disease (CHD).

One of these is an operation.

In this operation, doctors insert a metal grid called a stent into the artery.



(i) Look at the diagram.

Why does using a stent help treat CHD?

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..... **[2]**

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(ii) Taking a drug called statins is a treatment for CHD.

The drug is taken every day and lowers the level of cholesterol in a person's blood.

Suggest one **advantage** and one **disadvantage** of taking statins.

Advantage .....

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Disadvantage .....

.....

[2]

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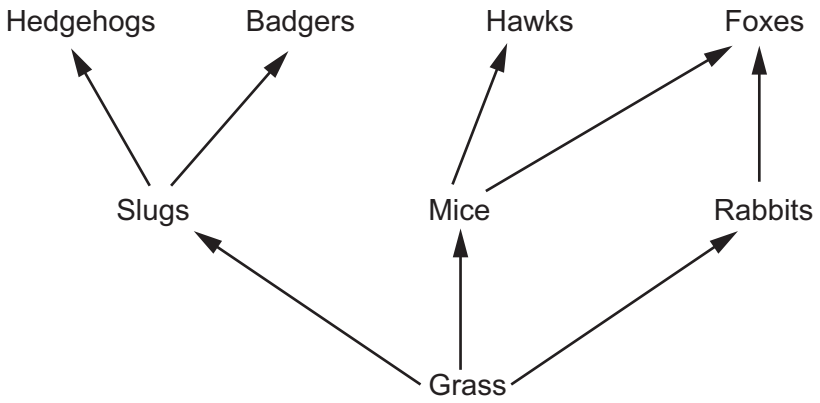
23 The diagram shows part of a food web from a grassland.



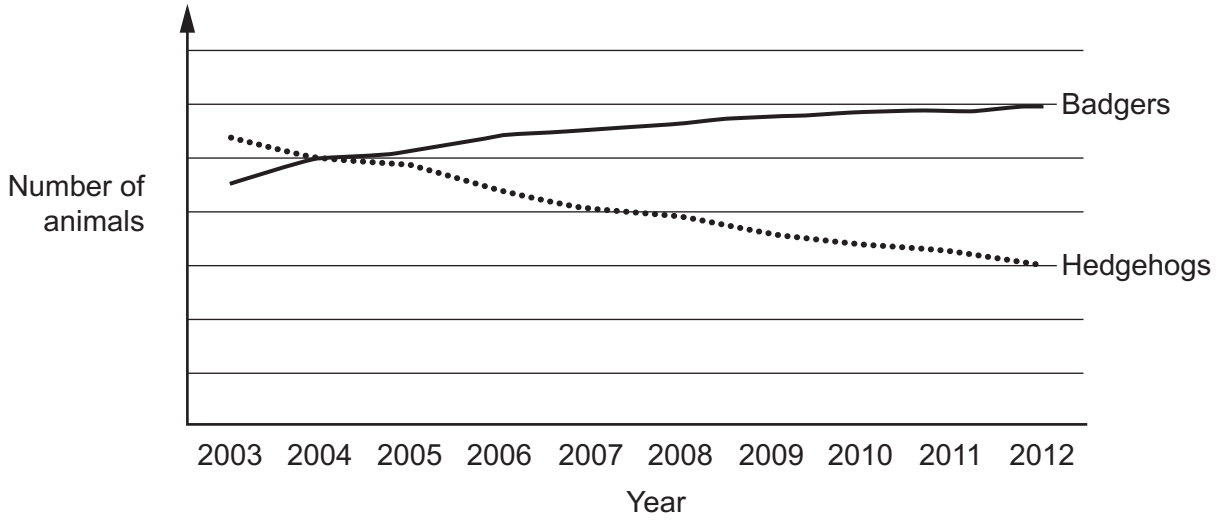
(a) How many secondary consumers are shown in this food web?

..... **[1]**

(b) A survey was set up to see if the number of badgers and hedgehogs has changed in the UK.

The number of badgers and hedgehogs were counted in different areas each year from 2003 to 2012.

The graph shows the results.



Use the food web to suggest an explanation for the change in the number of hedgehogs shown in the graph.

.....

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..... **[2]**

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(c) Hedgehogs are covered in small spines.

When they are frightened they often roll up into a ball and keep still.

(i) In country areas, where badgers live, this is an advantage to the hedgehogs.

In cities, where there are many roads, this is a disadvantage.

Explain these two conclusions.

.....

.....

..... **[2]**

(ii) Scientists have noticed that a new type of hedgehog is increasing in numbers in cities.

These hedgehogs do not roll up. They run away when frightened. The scientists think that genes control this behaviour.

Explain how this type of hedgehog may become more common in cities.

Use ideas about natural selection.

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..... **[4]**

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24 A student investigates plants growing underneath a tree.

He lays out a tape measure on the ground, starting at the tree. He then places a quadrat on the ground.

He measures the percentage of the ground in the quadrat that is covered by plants. He repeats this every metre away from the tree.

The table shows his results.

Distance from the tree (m)	Percentage of ground covered by plants (%)
1	10
2	15
3	18
4	22
5	50
6	58
7	62
8	64

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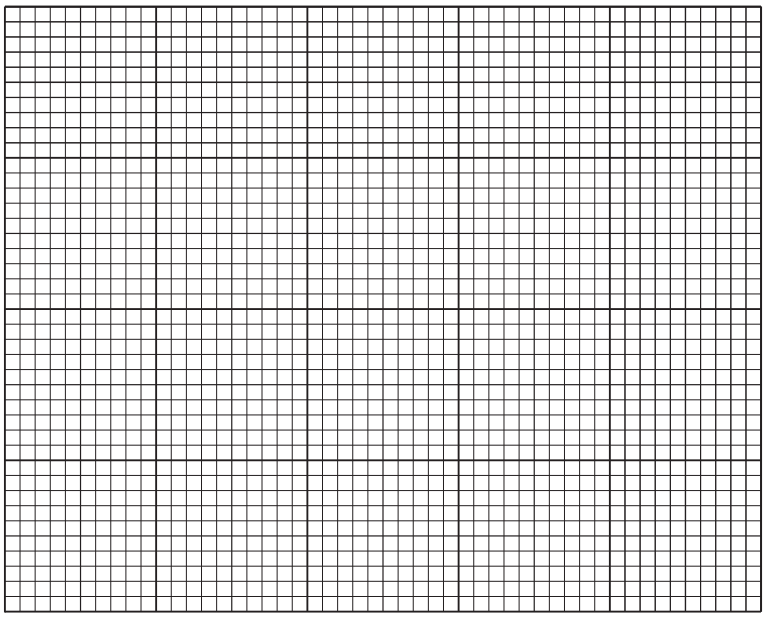
(a) Plot a graph of the student's results and draw a line of best fit.



[5]

(b) The student thinks that shade from the tree is affecting the plants.

Explain how the student's results show this.

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..... **[4]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

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