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Friday 7 June 2019 – Afternoon

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

J247/02 Paper 2 (Foundation Tier)

Time allowed: 1 hour 45 minutes

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

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

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- 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.

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.

Write your answer to each question in the box provided.

1 Which of these is an **abiotic** factor that can affect organisms?

A Food availability

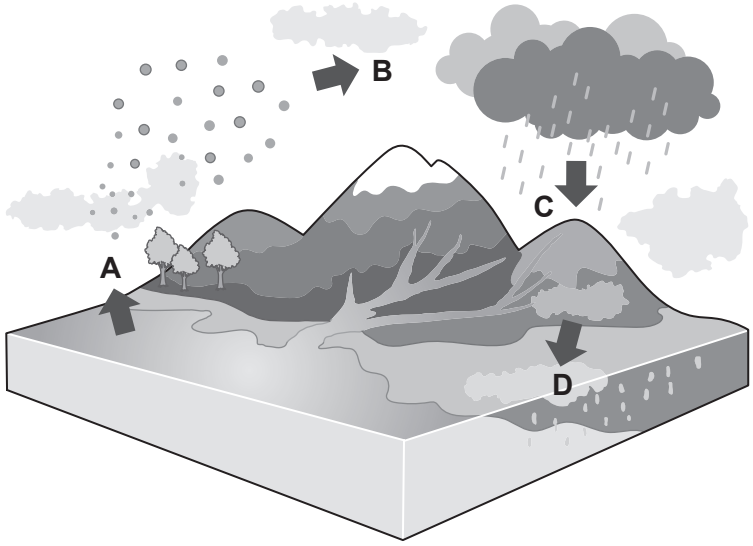
B Light intensity

C Pathogens

D Predators

Your answer ☐ **[1]**

2 The diagram shows the water cycle.



Which label, **A**, **B**, **C** or **D**, represents evaporation?

Your answer ☐ **[1]**

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3 Which combination of gametes will produce a **male** baby?

A A sperm with **XY** chromosomes and an egg with **XX** chromosomes.

B A sperm with one **X** chromosome and an egg with one **Y** chromosome.

C A sperm with one **Y** chromosome and an egg with one **X** chromosome.

D A sperm with **XX** chromosomes and an egg with **XY** chromosomes.

Your answer ☐ **[1]**

4 Why are stem cells useful for repairing damaged tissues?

A They are easily obtained from any organ.

B They are not attacked by pathogens such as bacteria.

C They are haploid.

D They can divide to form different types of cell.

Your answer ☐ **[1]**

5 Which relationship describes an organism living on an animal and harming it?

A Decomposition

B Mutualism

C Parasitism

D Predation

Your answer ☐ **[1]**

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6 Most food chains only have a maximum of five trophic levels.

Explain why.

A Organisms always get larger at higher trophic levels.

B Energy is lost at each trophic level.

C It is more energy efficient to eat meat than plant material.

D The number of organisms feeding always increases at higher trophic levels.

Your answer ☐ **[1]**

7 Which of these is an example of **discontinuous** variation?

A Body weight

B Hand span

C Height

D Sex

Your answer ☐ **[1]**

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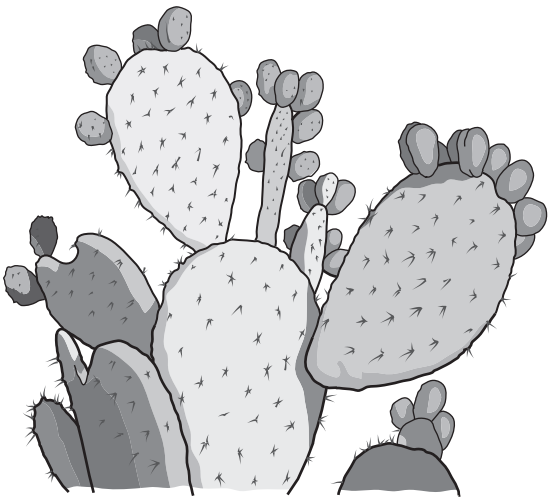
8 The prickly pear is a cactus plant that was introduced into Australia.



The prickly pear cactus spread across the country.

To control the spread of the prickly pear cactus, a caterpillar was released to eat it.

What is the name of this type of control?

A Biodiversity

B Biological

C Mutualism

D Pesticide

Your answer ☐ **[1]**

9 Which statement about health is true?

A Health is the absence of disease.

B A person who is free from disease must be healthy.

C A person can have a serious disease and be healthy.

D A person can be free from disease and not be in good health.

Your answer ☐ **[1]**

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10 Which of these gives a correct risk factor for the named disease?

	Disease	Risk factor
A	bronchitis	exercise
B	cardiovascular disease	diet rich in saturated fat
C	type 1 diabetes	alcohol
D	cirrhosis of the liver	smoking

Your answer ☐ **[1]**

11 Cystic fibrosis is a genetic condition caused by a recessive allele **(f)**.

Which is the genotype of a person **with** cystic fibrosis?

A Heterozygous and **ff**

B Heterozygous and **Ff**

C Homozygous and **ff**

D Homozygous and **FF**

Your answer ☐ **[1]**

12 Each cell in the eye of a kangaroo has **16** chromosomes.

How many chromosomes are there in one kangaroo **sperm cell**?

A 4

B 8

C 16

D 32

Your answer ☐ **[1]**

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13 What do most vaccines contain?

A Antivirals

B Dead or weakened pathogens

C Specific antibiotics

D White blood cells

Your answer ☐ **[1]**

14 A student estimates the number of snails in a pond. Part of his method involves collecting snails and marking them.

What is the name of the method he is using?

A Aseptic technique

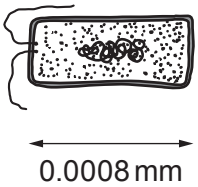
B Capture-recapture

C Percentage increase

D Scaling-up

Your answer ☐ **[1]**

15 Look at the bacterial cell that causes disease in humans.



The human eye can see objects 0.1 mm in size.

What **minimum** magnification will be needed before the eye can see this bacterial cell?

A 12.5×

B 125×

C 1250×

D 12500×

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

16 This question is about selective breeding.

(a) The table shows the main steps in the process of selective breeding.

They are **not** in the correct order.

A	Repeat the process over many generations.
B	Decide which features are wanted.
C	Choose the individuals that have the features that are wanted.
D	Choose the offspring that have the features that are wanted.
E	Allow the individuals to mate.

Write the letters in the boxes below to give the correct order.

Two have been done for you.

	C			**A**

[2]

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(b) Cows are female and are used by farmers to produce milk.

Bulls are male.

Look at the details of different varieties of cows and bulls.

Variety	Milk production	Aggressive
Cow A	thin and watery	no
Cow B	medium yield and creamy	no
Cow C	medium yield and creamy	yes
Bull A	mother produced high yield	yes
Bull B	mother produced high yield	no
Bull C	mother produced low yield	no

A farmer wants to produce cows that produce a high yield of creamy milk.

He does **not** want his animals to be aggressive.

Suggest which cow and bull he should choose to mate with each other.

Explain your answer.

cow ..... × bull .....

explanation .....

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

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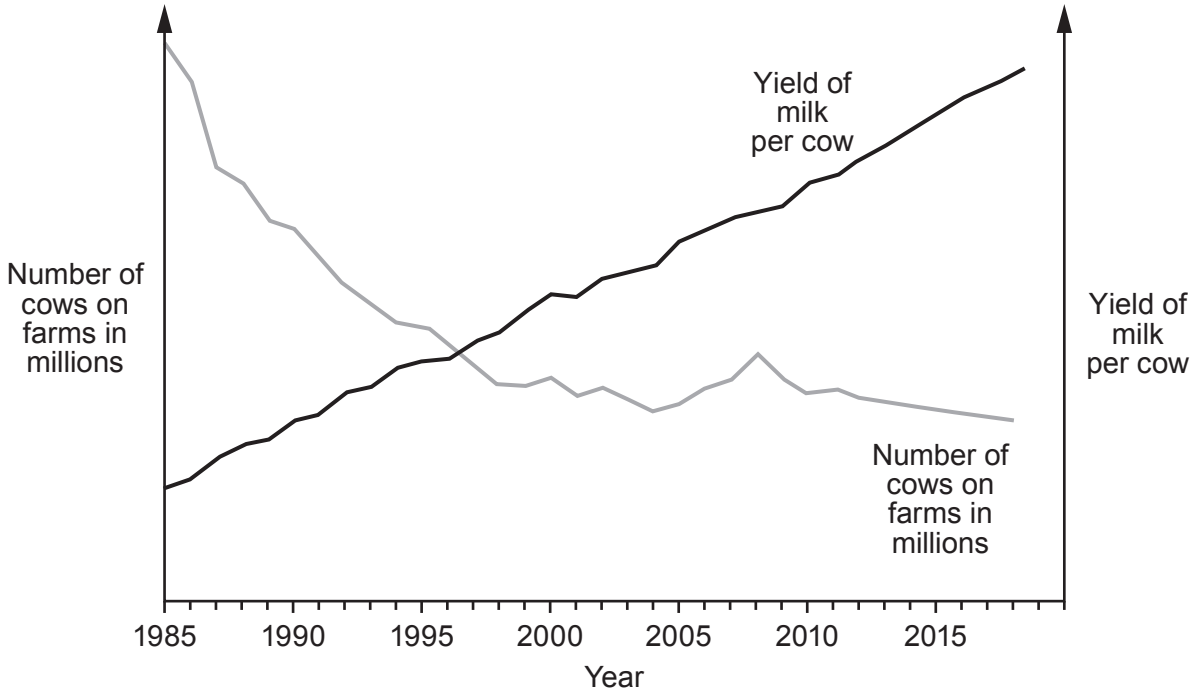
(c) The graph shows the number of cows and the yield of milk per cow on farms in the USA since 1985.



(i) Describe the relationship between number of cows and yield of milk shown in the graph.

.....

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

(ii) Suggest **two** reasons for the relationship shown in the graph.

1 .....

.....

2 .....

.....

[2]

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17 Over the whole world the demand for food to feed humans is increasing.

(a) Describe why is there an increasing demand for food.

.....

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

(b) Genetic modification (GM) is one method that humans are using to try and produce more food.

(i) What is genetic modification?

.....

.....

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

(ii) Scientists can use GM to alter the features of crops.

One feature is crop yield.

Suggest **two other** features of crops they could change.

1 .....

2 .....

[2]

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(iii) In a recent survey **200** people were asked about GM crops.

The people surveyed were shown six statements. Three were negative statements and three were positive statements.

They were asked to choose **one** statement they agreed with.

These are the results.

	Statement	**Number of people choosing statement**
Negative	GM crops are not safe enough to use.	42
	Growing GM crops does more harm than good.	32
	Growing GM crops tampers with nature.	22
Positive	Growing GM crops can prevent people being hungry.	35
	Eating GM crops has very little risk to consumers.	35
	Growing GM crops can make food more nutritious.	34

Calculate the percentage of people in the survey that have a **negative** opinion of genetic modification.

Percentage = ... % **[2]**

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18 Some people get very painful headaches called migraines. Scientists think that these are caused by a protein in the brain called CGRP. Levels of the CGRP protein are higher in the brains of people who get migraines.

Doctors are trying to find a treatment to prevent migraines. They have produced an antibody against the CGRP protein.

(a) Complete these sentences to describe how **antibodies** are made in the body.

Use words from the list.

Each word can be used once, more than once, or not at all.

antibiotics **antigens** **antivirals**

platelets **red blood cells** **white blood cells**

Foreign cells have chemical groups on their surface called ..... .

These chemical groups are detected by ..... which then produce antibodies.

[2]

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(b) The doctors test the antibody treatment on migraine patients.

The patients are divided into two groups:

- One group is given an injection of the antibody.
- The second group receives an injection of a placebo which does not contain the antibody.

They record the mean number of days each patient had migraines before and after treatment.

The table shows their results.

Treatment	Mean number of migraine days per patient **before treatment**	Mean number of migraine days per patient **after treatment**	Percentage decrease in migraine days per patient
antibody injection	9.1	4.4	51.6
placebo	9.1	6.4	29.7

(i) The placebo group does **not** receive the antibody.

Suggest why this group is included in the study.

.....

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

(ii) The total number of **migraine days** for the patients on the placebo **after treatment** was 480.

The mean number of migraine days per patient after treatment was 6.4.

Calculate the number of patients in the placebo group.

Number of patients = ... **[2]**

(c) Explain why it is important that a second group of doctors should repeat this test.

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

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19 A salt marsh is a large, muddy area of land where a river joins the sea.

(a) When the tide comes in, the salt marsh gets covered with seawater.

Suggest **one** reason why salt marshes are difficult places for plants to grow.

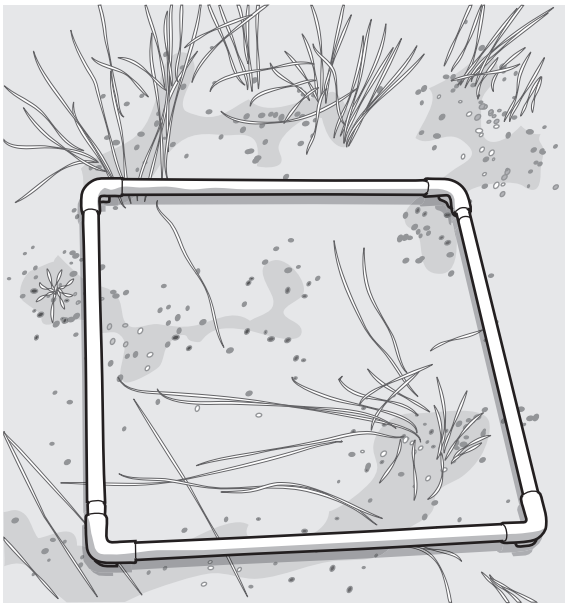
.....

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

(b) Student **A** and student **B** study the plants growing on a salt marsh.

They both sample the plants present by laying out two tape measures at right angles across the salt marsh.

They then place a square frame on the ground in different places and count the number of plants in the square, as shown below.



What is the name of the square frame that they use to sample the plants?

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

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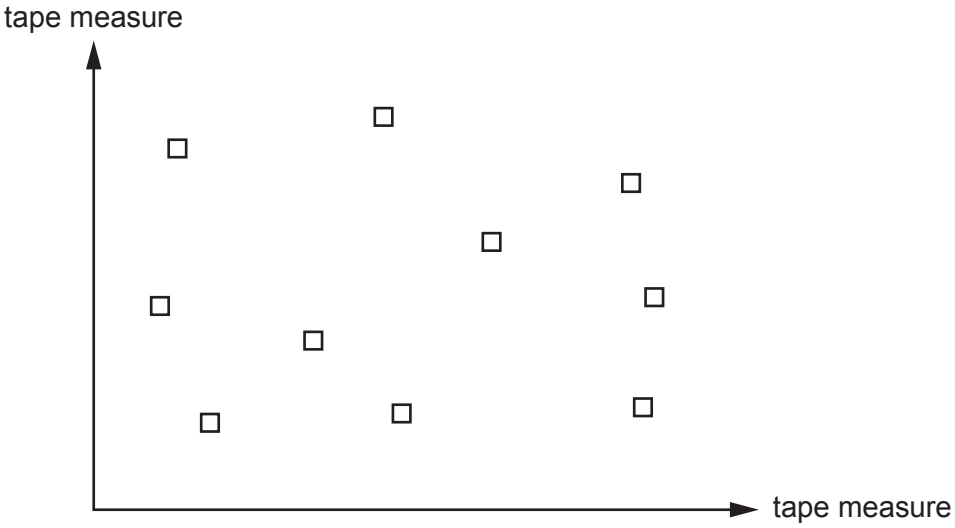
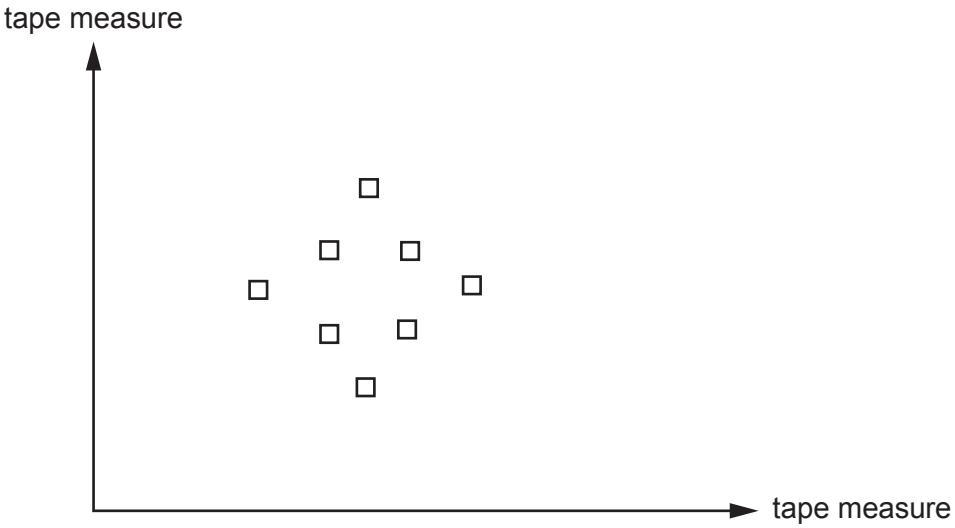
(c) The diagrams show the position of each student's samples across the salt marsh. Each small square in the diagrams represents one sample.



Student **A**'s sampling



Student **B**'s sampling

(i) The whole salt marsh has an area of 2500 m^2.

Each square frame has an area of 0.25 m^2.

Calculate the percentage of the whole salt marsh that was sampled by student **A**.

Percentage = ... % **[3]**

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(ii) Look at the two students' sampling shown in the diagrams.

Explain which student is likely to get the most accurate estimate for the number of plants in the salt marsh.

student .....

explanation .....

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.....

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

(iii) Their teacher said that they should take care as there may be harmful bacteria in the salt marsh.

State **two** things that the students could do to reduce the risk of infection from the harmful bacteria.

1 .....

.....

2 .....

.....
[2]

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(d)* In some salt marshes large sand banks have been built. These stop tides from entering the salt marsh. The level of soil on the salt marsh builds up and the marsh turns into dry land.

Local farmers want to turn salt marshes into dry land and other people want to leave it as a salt marsh.

Explain why. Use ideas about land use and biodiversity in your answer.

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

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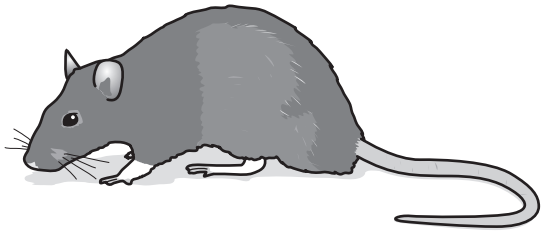
20 Rats are a major pest in many areas of the world. They can reduce food security and spread diseases.



(a) Warfarin is a chemical that is used as a rat poison. It stops platelets working in the blood.

Describe the function of platelets in the blood.

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

(b) Some rats are resistant to warfarin. When fed with large amounts of warfarin the rats do not die.

Scientists found that the resistance is due to the dominant allele **R**.

Two resistant rats (**Rr**) mate.

Complete this genetic diagram to find the ratio of resistant rats to non-resistant rats that would be expected to be produced.

		Rr	
		.....	.....
Rr	R	.....	.....
	r	.....	.....

Ratio = ...

[3]

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(c) After several years, the percentage of resistant rats in the population had increased.

Use Darwin's theory of natural selection to explain this observation.

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

(d) Scientists are now trying to find another poison to use on rats.

They have introduced a chemical called phosphine. This blocks the action of mitochondria in rat cells.

Explain why this might kill rats.

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

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21 Animals and plants can get different types of diseases.

(a) Look at the list of four diseases.

AIDS

Type 2 diabetes

Crown gall disease

Barley powdery mildew

Write each disease in the correct column of this table.

Communicable disease			**Non-communicable disease**
Caused by a bacterium	**Caused by a fungus**	**Caused by a virus**	

[3]

(b) Sinusitis is an infection that can be caused by bacteria or viruses.

Sinusitis causes a runny nose and bad headaches.

(i) Doctors only give antibiotics to patients with these symptoms if they are sure their illness is caused by bacteria.

Write down **two** reasons why.

1 .....

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2 .....

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[2]

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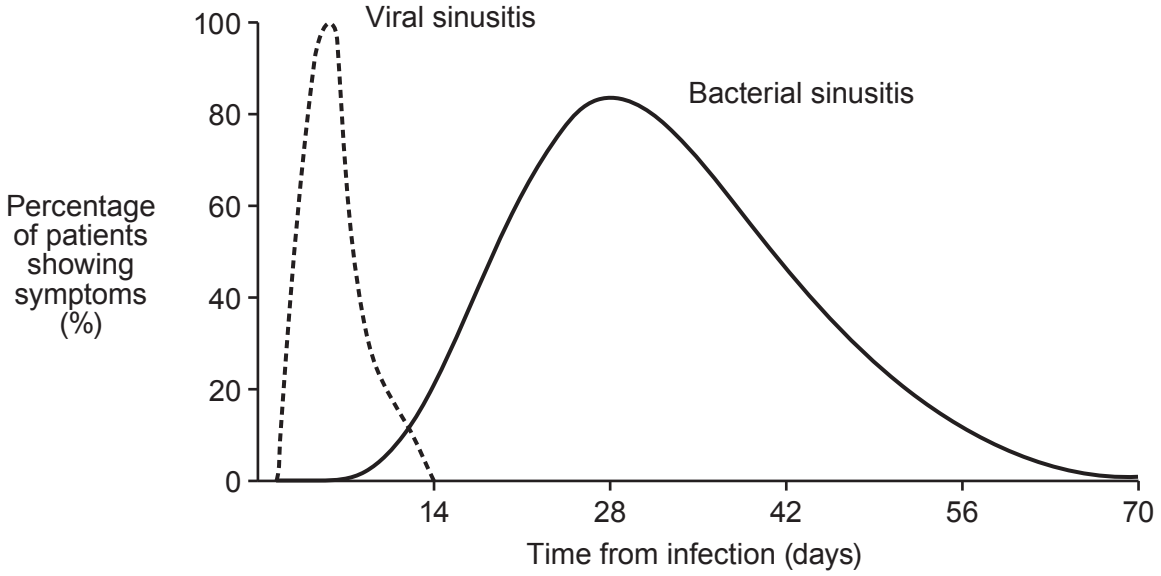
(ii) Look at the graph. It shows the length of time that patients show symptoms of sinusitis.



Doctors usually wait 14 days after infection before giving patients antibiotics for sinusitis.

Use the graph to explain why.

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

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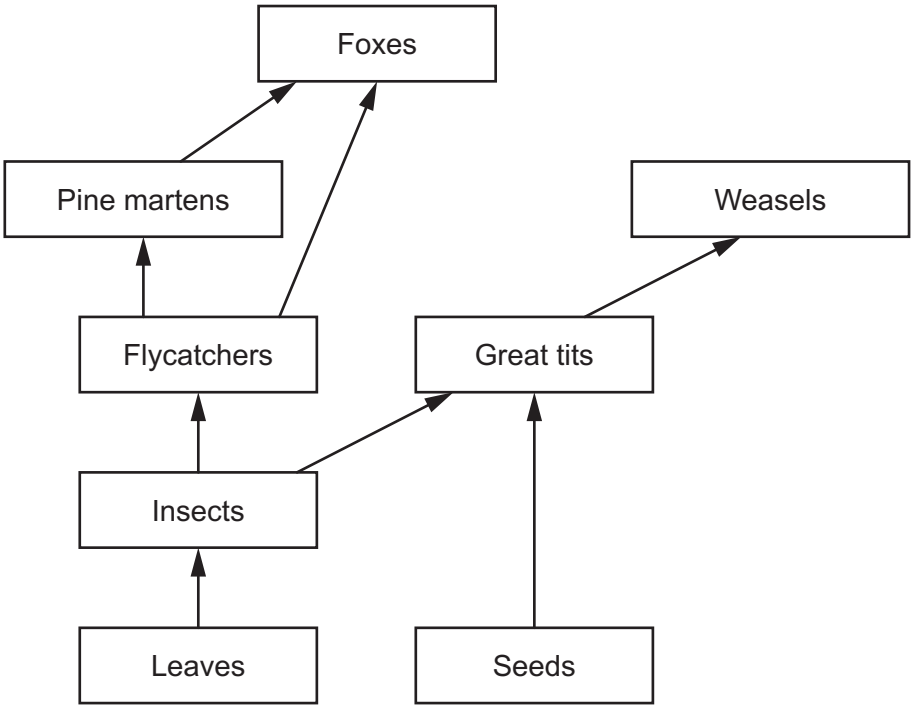
22 The diagram shows part of a food web from a woodland.



(a) **(i)** Great tits are described as both primary consumers and secondary consumers.

Explain why.

.....

.....

.....

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

(ii) Foxes are described as both predators and competitors of pine martens.

Explain why.

.....

.....

.....

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

(iii) Which organism in the food web occupies the second trophic level?

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

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(b) Great tits and flycatchers are both birds.

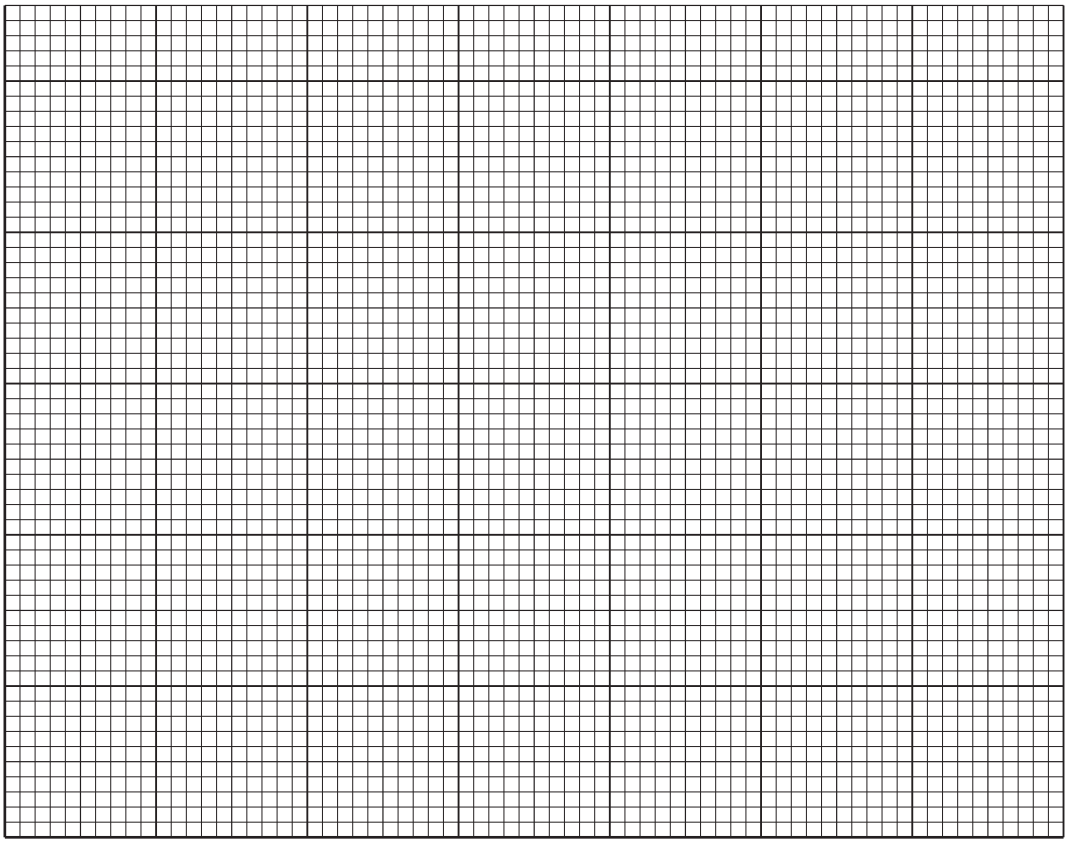
In a conservation project, scientists have built boxes for the birds to nest in. The scientists fixed the boxes on trees at different heights.

The table shows how many birds of each type used the boxes for nesting.

	Number of bird boxes used	
Height of bird box above the ground (m)	**By great tits**	**By flycatchers**
1	1	6
2	7	5
4	10	6

(i) Draw a **bar chart** on the graph paper to show the scientists' results.

The results for great tits and flycatchers should be on the same axis.



[4]

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(ii) The food web shows:

- Weasels feed on great tits
- Pine martens feed on flycatchers.

Weasels live on the ground but pine martens live in trees.

How can this be used to explain the results of the scientists' investigation?

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

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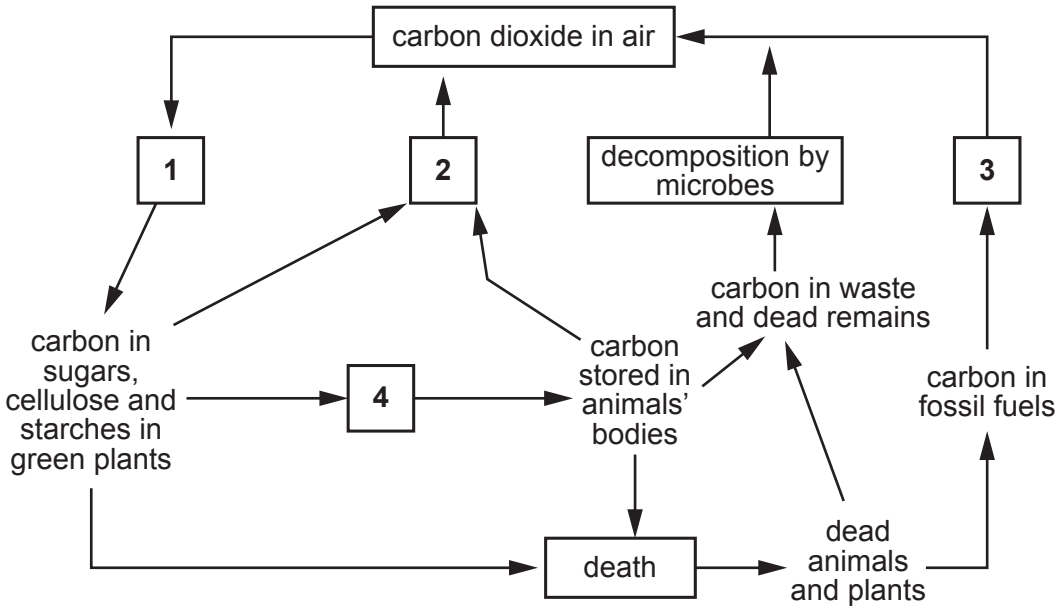
23 **(a)** The diagram shows the carbon cycle.



Boxes **1–4** represent different processes in the carbon cycle.

Draw lines to link boxes 1–4 to the correct name for the process in the carbon cycle.

1	**Combustion**
2	**Eating**
3	**Photosynthesis**
4	**Respiration**

[2]

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(b) Scientists investigated if crops can be grown on the planet Mars.

They used a soil that was similar to the soil found on Mars. The soil contained some minerals but no living organisms.

(i) The scientists managed to grow crops in the soil. However on Mars, the minerals in the soil would soon run out.

Explain why.

.....

.....

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

(ii) Living organisms could be added to the soil but there is no air on Mars. The plants would need to be grown in an enclosed structure.

At first, air would need to be added, but after a while the organisms in the soil and the plants would supply each other with the gases they need.

Explain how this would happen.

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

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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