Oxford Cambridge and RSA

Monday 9 June 2025 – Morning

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

J247/04 (Higher Tier)

Time allowed: 1 hour 45 minutes

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

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

H

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 can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

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 has **32** pages.

ADVICE
- Read each question carefully before you start your answer.

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Section A

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

Write your answer to each question in the box provided.

1 A student is investigating variation by collecting data on shoe sizes.
These are the shoe sizes of six members of their family.

10	5	6	7	8	6

Which of these statements about the data is **correct**?

A The mean shoe size and the modal shoe size are the same.

B The mean shoe size is 6.

C The mean shoe size is larger than the modal shoe size.

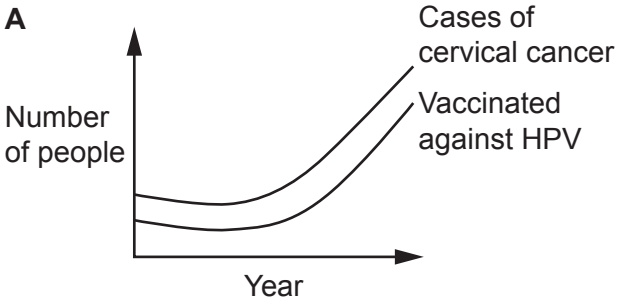
D The modal shoe size is 7.

Your answer ☐ **[1]**

2 People can be vaccinated against HPV.

Which graph shows the correct link between the number of people vaccinated and the number of people with cervical cancer?

A



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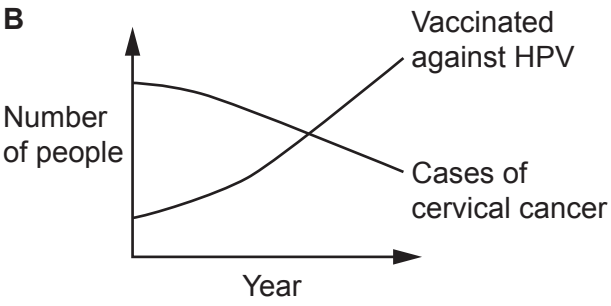

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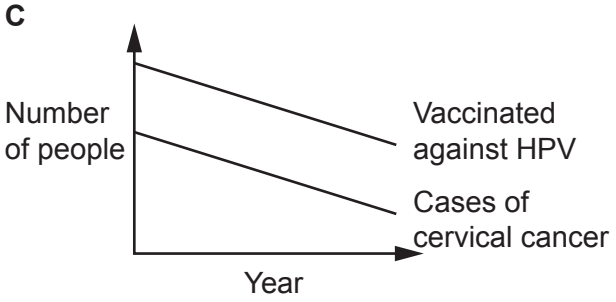

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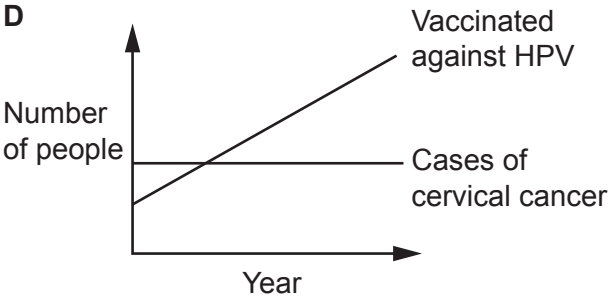

Your answer ☐ **[1]**

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3 What is an adaptation of **white** blood cells?

A They can change shape to squeeze out of blood vessels into tissues.

B They have many ribosomes to produce antibiotics.

C They lack a nucleus so that they can engulf bacteria.

D They produce enzymes to make blood clot.

Your answer ☐ **[1]**

4 What is the **correct** definition of hydroponics?

A A process for growing plants in a mineral solution

B A process in the water cycle

C The movement of sweat out of sweat glands in the skin

D The movement of water in xylem vessels

Your answer ☐ **[1]**

5 An organism has the alleles Aa for a gene.

What do the Aa alleles represent?

A A heterozygous genotype

B A heterozygous phenotype

C A homozygous genotype

D A homozygous phenotype

Your answer ☐ **[1]**

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6 Which of these units of genetic material is **largest**?

A Base

B Chromosome

C Gene

D Genome

Your answer ☐ **[1]**

7 The flow chart shows some developments in our understanding of genetics.

A	The characteristics of two parents are blended so that the offspring has intermediate characteristics.

↓

B	Characteristics are controlled by pairs of factors and one copy of each is passed on to the next generation.

↓

C	Genes are the unit of inheritance and have specific locations on chromosomes.

↓

D	Genes are made of DNA.

Which stage on the flow chart represents the ideas of Mendel?

Your answer ☐ **[1]**

8 Which of these diseases is caused by a bacterium?

A AIDS

B Barley powdery mildew

C Crown gall disease

D Tobacco mosaic disease

Your answer ☐ **[1]**

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9 A muscle cell in a horse has 64 chromosomes.

Which of these statements is **correct**?

A A horse egg cell has 64 chromosomes and is haploid.

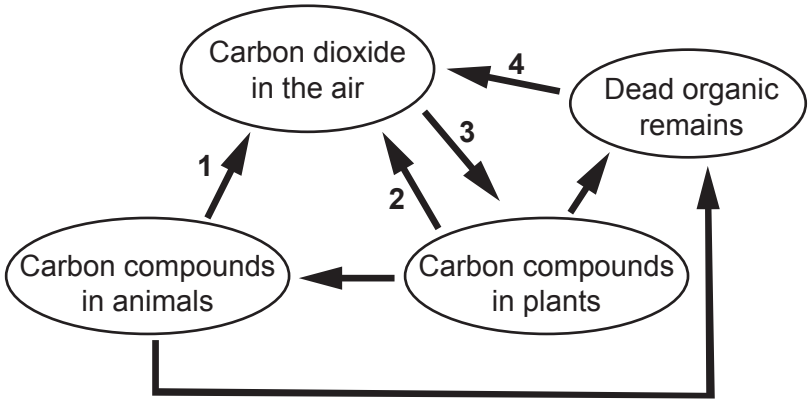
B A horse liver cell has 32 chromosomes and is haploid.

C A horse neurone has 64 chromosomes and is diploid.

D A horse sperm cell has 32 chromosomes and is diploid.

Your answer ☐ **[1]**

10 The diagram shows how carbon is recycled in nature.



Which of the processes **1**, **2**, **3** and **4** may require oxygen?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 1 only

Your answer ☐ **[1]**

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11 Which description is **correct** for human sperm cells?

A They always contain an X chromosome.

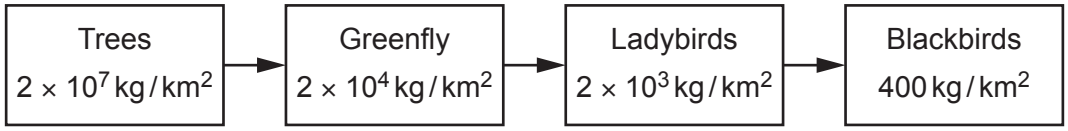
B They always contain a Y chromosome.

C They contain an X and a Y chromosome.

D They contain either an X or a Y chromosome.

Your answer ☐ **[1]**

12 The diagram shows the flow of biomass through a food chain.



What is the combined biomass of all the predators in this food chain?

A 400 kg / km^2

B 2400 kg / km^2

C 22400 kg / km^2

D 20 022 400 kg / km^2

Your answer ☐ **[1]**

13 Clinical testing is used for new medicines.

What is a feature of clinical testing?

A Uses animals

B Uses cell cultures

C Uses computer models

D Uses placebos

Your answer ☐ **[1]**

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14 What is **not** a proven use for monoclonal antibodies?

A Gene therapy

B Pregnancy tests

C Targeting cancer cells

D Testing for cancer

Your answer ☐ **[1]**

15 How may a mutation in non-coding DNA result in a change in phenotype?

A It changes the amino acid sequence of a protein.

B It changes the shape of the active site of a protein.

C It prevents mRNA binding with ribosomes.

D It prevents transcription occurring.

Your answer ☐ **[1]**

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Section B

16 Many different bacteria can cause disease.

(a) State the name given to any organism that causes disease.

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

(b) A patient in hospital has a bacterial disease.
A doctor tells the patient:

> ‘Some time ago, bacteria entered your body.
>
> Your body detected chemicals on the surface of the bacteria.
>
> This made your body produce protein molecules to help kill the bacteria.
>
> I will give you a tablet containing a medicine that will also kill the bacteria.
>
> You should not get this disease again because cells in your body will now provide you with immunity.’

(i) The boxes contain descriptions used by the doctor and some biological terms.

Draw **four** lines to connect each **description** to its correct **biological term**.

Description	**Biological term**
chemicals on the surface of the bacteria	antibiotics
proteins produced by the body	antibodies
medicine given by the doctor to kill the bacteria	antigens
cells that provide immunity	antiseptics
	white blood cells

[4]

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(ii) The doctor would change the type of medicine given to the patient if the disease was caused by a virus.

State the change the doctor would make.

Give a reason for your answer.

Change .....

Reason .....

.....

[2]

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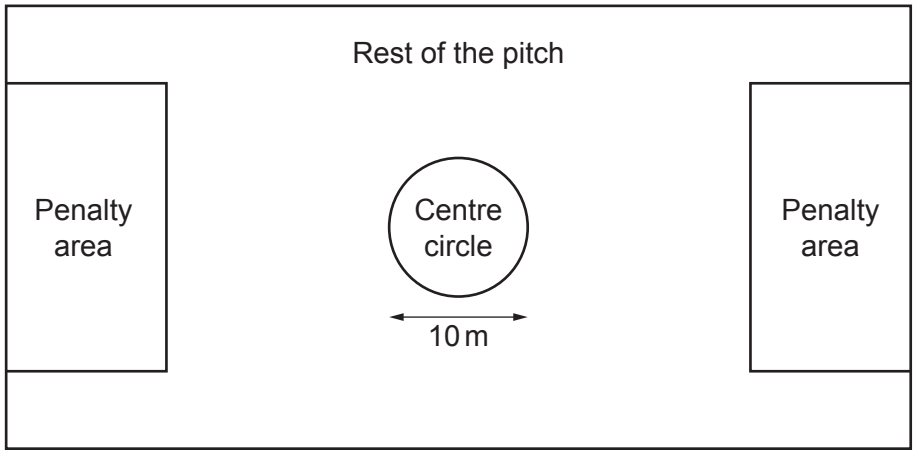
17 Some students investigate the number of dandelion plants growing in three different parts of a football pitch.



(a) The students sample the pitch to find the mean number of dandelion plants per m^2 in each part.

Explain how the students use a quadrat to find the mean number of dandelion plants per m^2 in a part of the pitch.

.....

.....

.....

.....

.....

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

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(b) The table shows some of the students' results.

Part of the pitch	**Area (m^2)**	**Mean number of dandelions per m^2**	**Total number of dandelions**
Both penalty areas	1300	4.0	5200
Centre circle	.....	3.0	.....
Rest of the pitch	5500	2.0	11 000

Calculate the area of the centre circle and the total number of dandelions in the centre circle.

Use the equation: area of a circle = πr^2

Use π = 3.14

Write your answers in the table.

[3]

(c) The students write a conclusion for their experiment.

Complete the students' conclusion.

Use words from the list.

community	**compete**	**differently**	**efficiently**	**equally**
habitat	**mutate**	**population**	**respire**	

The football pitch contains a ..... of different plant species, mainly grass and dandelions.

The part of the pitch that has the most players running on it has the most dandelions.

This is because it is more difficult for plants to grow there.

The dandelions successfully ..... with the grass in these areas.

We can only make this conclusion if abiotic factors affect each area ..... .

[3]

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(d) Describe how the pupils could extend their experiment to show that soil pH was the same in each part of the pitch.

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

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18 Locusts are insects that live in many parts of Africa.

They eat many different types of plants.

One female locust can lay 50 eggs and they take 10 days to hatch.

A large group of locusts is called a swarm and contains one thousand million locusts.

A swarm can fly 80 km in a day.

(a) Give the number of locusts in a swarm in standard form.

Number of locusts = ... **[1]**

(b) Some students want to find out how long it would take a swarm of locusts to eat all the grass in a field.

This is the method they use:

- Keep one locust in a cage in their laboratory.
- Give the locust grass to eat.
- Measure the mass of grass that the locust eats in one hour.
- Find the mass of grass in the whole field.

These are the students' results:

Mass of grass eaten by one locust in one hour = 0.001 kg
Mass of grass in a field = 5 000 kg

(i) Calculate how long it would take for a swarm of locusts to eat all the grass in the field.

Time taken = ...hours **[3]**

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(ii) Suggest **one** way that the students could improve their method to get a more accurate estimate of the time.

.....

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

(c) Explain why locusts are a major risk to food security in Africa.

Use information from all of question 18.

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

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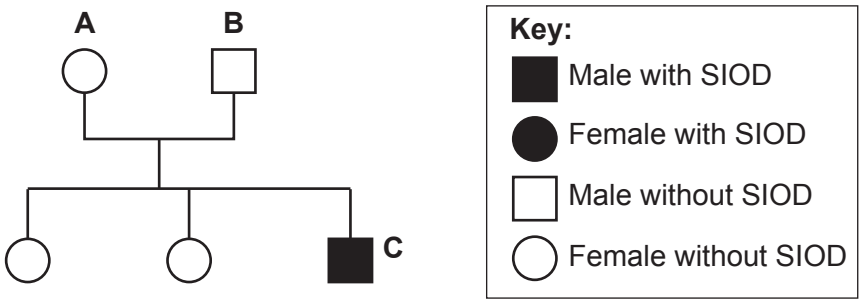
19 SIOD is an inherited genetic disorder.

The diagram shows a family tree with a person who has SIOD.



(a) SIOD is caused by a recessive allele.

Explain how you can tell from the family tree that the allele for SIOD is recessive.

.....

.....

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

(b) The parents **A** and **B** are expecting another child.

Predict the probability that this child will have SIOD.

Complete the genetic diagram to explain your answer using **D** for the dominant allele and **d** for the allele for SIOD.

		Parent **A**	
Parent **B**			

Probability = ... **[3]**

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(c) One of the symptoms of SIOD is kidney failure.

People with the disorder often need a kidney transplant.

(i) After receiving a kidney transplant from a donor, a person needs to take drugs to reduce the activity of their immune system.

Explain why it is necessary to reduce the activity of their immune system after a transplant.

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

(ii) Give a possible disadvantage of having to take drugs to reduce the activity of the immune system.

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

(iii) The first person to receive stem cell treatment for SIOD was in 2023.

This person received stem cells from a donor.

These stem cells reached the bone marrow and produced large numbers of white blood cells.

Explain why stem cells can produce large numbers of white blood cells.

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

(iv) Six months later, the person received a kidney transplant from the same donor.

Why would this person **not** need to take drugs to reduce the activity of their immune system?

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

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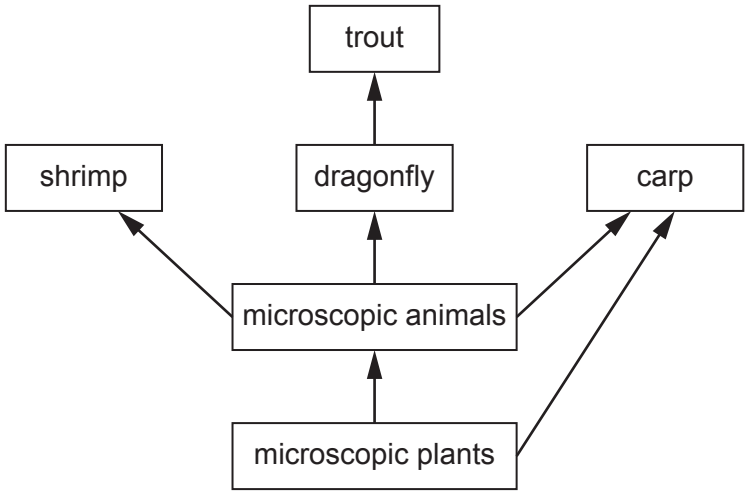
20 The diagram shows a food web from a lake in North America.



(a) Explain why carp are described as feeding at **two** different trophic levels.

Use details from the food web.

.....

.....

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

(b) Carp are large fish that have been introduced into America from Asia.

Their numbers in lakes have increased and they are becoming pests.

Suggest a reason why the population of a species often increases rapidly after they are introduced into a new area.

.....

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

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(c) Carp feed at the bottom of lakes and this stirs up mud into the water.

The mud contains minerals but makes the water cloudy.

Explain **two** different effects that this could have on the microscopic plants living in the lake.

1 .....

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.....

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2 .....

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[4]

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(d)* Carp embryos develop into male or female fish depending on the level of female hormone they produce.

If carp embryos produce high levels of the female hormone, oestrogen, they will become females.

Scientists are trying to reduce the numbers of carp in lakes by using genetic engineering.

This is their plan:

- introduce a gene into some early carp embryos that will stop the production of oestrogen
- release the genetically modified carp into the lakes.

Describe how the gene could be introduced into carp cells and explain how the scientists' plan could decrease the number of carp in the lake.

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

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21 People can have their DNA tested.

The table shows five different types of DNA test and the purpose of each test.

Type of DNA test	Purpose of test
A	identifying which part of the world a person's ancestors came from
B	identifying the best drug to treat a genetic disorder
C	identifying genes that might increase the chance of developing a disease
D	identifying any recessive alleles that are not being expressed
E	finding DNA that has come from a cancerous tumour

(a) Which type of test, **A**, **B**, **C**, **D** or **E**, is identifying risk factors?

.....

[1]

(b) Which type of test, **A**, **B**, **C**, **D** or **E**, will **not** affect the person being tested but might be useful if they are planning to have children?

.....

[1]

(c) Test **E** can test for a cancerous tumour.

Describe how cancerous tumours form.

.....

.....

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

(d) Deciding whether to take test **C** can be a difficult decision for some people.

Suggest **one** possible reason why.

.....

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

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22 Farmers sometimes give their farm animals antibiotics even if the animals only have harmless bacteria living in their body.

This is to increase the growth rate of the animals.

(a) Suggest why harmless bacteria living in the digestive system of animals could **decrease** the growth rate of the animals.

.....

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

(b) Scientists have been studying the bacteria found in different farm animals.

They took samples from different farm animals and tested them to see if bacteria in the samples were killed by different antibiotics.

(i) Describe how bacteria can be tested in the laboratory to see if they are killed by an antibiotic.

.....

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

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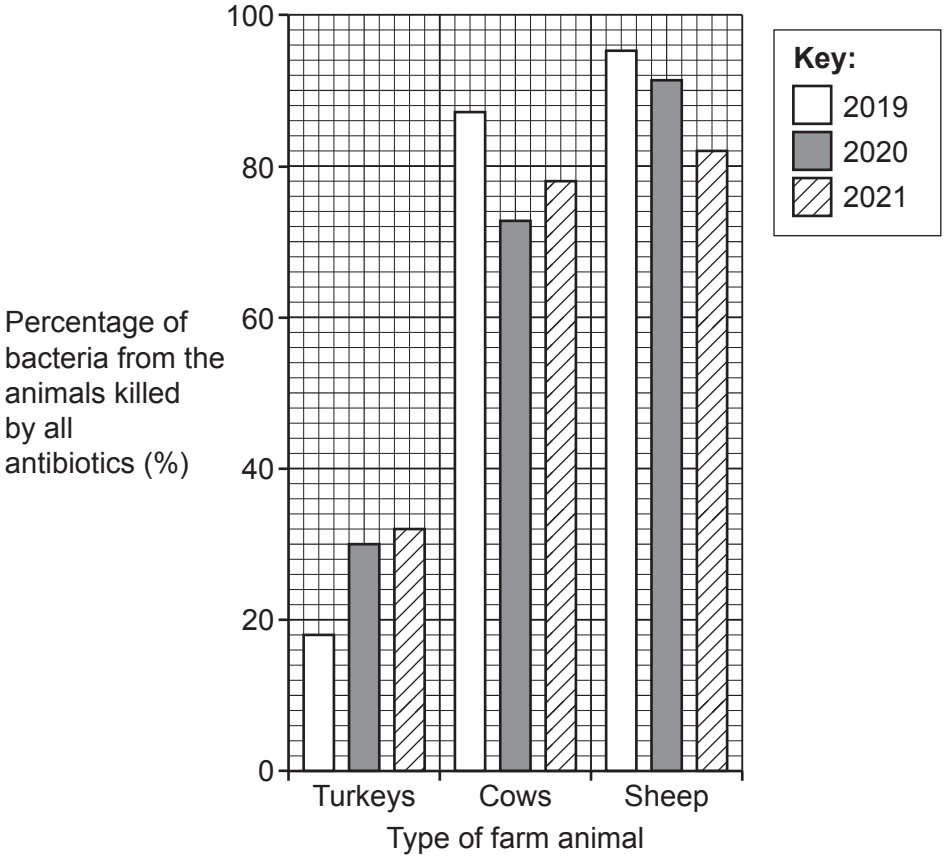
(ii) The scientists' tests were done in 2019, 2020 and 2021 on three types of farm animals.

The bar chart shows the percentage of bacteria from the animals that were killed by all the antibiotics that they tested.



Scientists think that the use of antibiotics in farm animals might be increasing the number of populations of bacteria that are resistant to antibiotics.

Farmers have agreed to reduce the use of antibiotics.

Discuss if the figures in the bar chart support the idea that farmers are reducing the use of antibiotics.

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

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(c) A student writes three sentences about how antibiotic resistance might occur:

1. ‘Bacteria mutate when the DNA in their nucleus changes.’
2. ‘Antibiotics cause these mutations to occur.’
3. ‘These mutations can produce an allele that makes the bacteria immune to antibiotics.’

Identify the mistake the student has made in each sentence.

Sentence 1 .....

.....

Sentence 2 .....

.....

Sentence 3 .....

.....

[3]

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23 A bacterium causes a disease in cucumber plants called bacterial wilt.

Here are some details of the disease:

- Bacteria causing the disease are found on beetles.
- The beetles feed on cucumber plants.
- Inside the plant, the bacteria produce a sticky substance in the xylem vessels.
- The leaves of the plants then wilt and die.

(a) Explain how a beetle feeding on a cucumber plant causes the leaves of the plant to wilt from this disease.

.....

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

(b) Spraying the surface of the plant with chemicals that kill bacteria does **not** prevent the disease spreading.

Suggest a reason why.

.....

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

(c) Scientists are trying to find a different way of killing the bacteria.

They plan to use another organism to kill the bacteria.

(i) What is the name of this type of control method?

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

(ii) The organism that the scientists plan to use is a virus.

The virus produces an enzyme that breaks down the bacterial cell wall.

Explain why this may cause the bacteria to swell up and burst.

.....

.....

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

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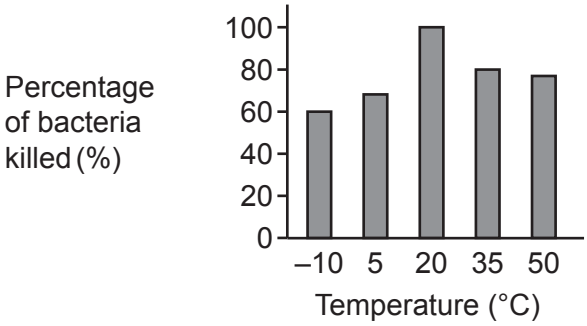
(iii) The scientists added the virus to the bacteria and measured how effective it was at killing the bacteria. They did this at different temperatures.

Their results are shown in the graph.



The scientists concluded that the virus could be used to treat bacterial wilt throughout the year.

Use the graph to explain why the scientists made this conclusion.

.....

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

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

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