Oxford Cambridge and RSA

Friday 7 June 2024 – Afternoon

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

J247/02 (Foundation 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

F

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 page 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 **28** 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 Which process in the water cycle involves water moving from clouds to the ground?

A Evaporation

B Precipitation

C Run off

D Transpiration

Your answer ☐ **[1]**

2 Which of these is a **communicable** disease?

A Cirrhosis of the liver

B Coronary heart disease

C Diabetes

D Tuberculosis

Your answer ☐ **[1]**

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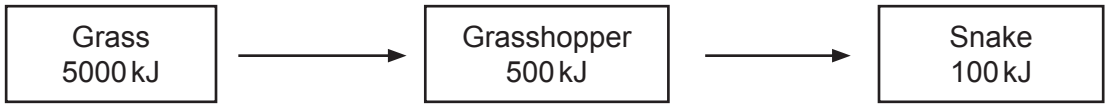
3 The diagram shows a food chain.



How much energy is lost between the producer and primary consumer?

A 400 kJ

B 4400 kJ

C 4500 kJ

D 4900 kJ

Your answer ☐ **[1]**

4 Many plants can reproduce either asexually or sexually.

What is a feature of **sexual** reproduction?

A All the offspring are better adapted to the environment.

B More offspring are produced.

C Reproduction is faster.

D The offspring show variation.

Your answer ☐ **[1]**

5 What is the definition of a **population**?

A All the communities that live in a habitat.

B All the different species living in a habitat.

C All the members of one species that live in a habitat.

D All the organisms that live in a habitat.

Your answer ☐ **[1]**

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6 Cystic fibrosis is caused by a recessive allele (f).

The diagram shows a genetic cross.

		Parent 1	
		F	f
Parent 2	f	Ff	ff
	f	Ff	ff

Which percentage of the offspring have cystic fibrosis?

A 25%

B 50%

C 75%

D 100%

Your answer ☐ **[1]**

7 Scientists use molecular phylogenetics to classify a newly discovered animal.

What features do the scientists use in their classification?

A The number of bones in the limbs

B The sequence of the DNA

C The type of circulatory system

D Where in the cell respiration occurs

Your answer ☐ **[1]**

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8 Using stem cells to treat disease is a new technique in medicine.

What is an **ethical** issue with this process?

A Embryos may be destroyed in the process.

B It is very expensive.

C It needs highly trained doctors.

D Some patients may need repeat treatments.

Your answer ☐ **[1]**

9 Modern dairy cows are produced by selective breeding.

This involves only some of the female cows breeding with male bulls.

What decides which cows breed during selective breeding?

A The bull chooses which cow to mate with.

B The cows best suited to the environment will breed.

C The farmers choose which cows breed.

D Which cows breed is a random process.

Your answer ☐ **[1]**

10 Which sex chromosomes are found in human egg cells?

A All egg cells have one **X** chromosome.

B All egg cells have one **Y** chromosome.

C All egg cells have two **X** chromosomes.

D Egg cells have either an **X** chromosome or a **Y** chromosome.

Your answer ☐ **[1]**

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11 What is the link between HIV and tuberculosis?

A Both HIV and tuberculosis increase the risk of cervical cancer.

B HIV infection increases the risk of getting tuberculosis.

C HIV is the virus that causes tuberculosis.

D Patients with tuberculosis are more likely to be infected with HIV.

Your answer ☐ **[1]**

12 Mendel discovered some of the principles of genetics.

He crossed tall pea plants with short pea plants.

All the offspring were **tall**.

How did Mendel explain this result?

A Offspring are always taller than the parent plant.

B Several genes control the height of the pea plants.

C The height of the pea plants is a mixture of tall and short.

D The instructions for short pea plants are recessive so do not show.

Your answer ☐ **[1]**

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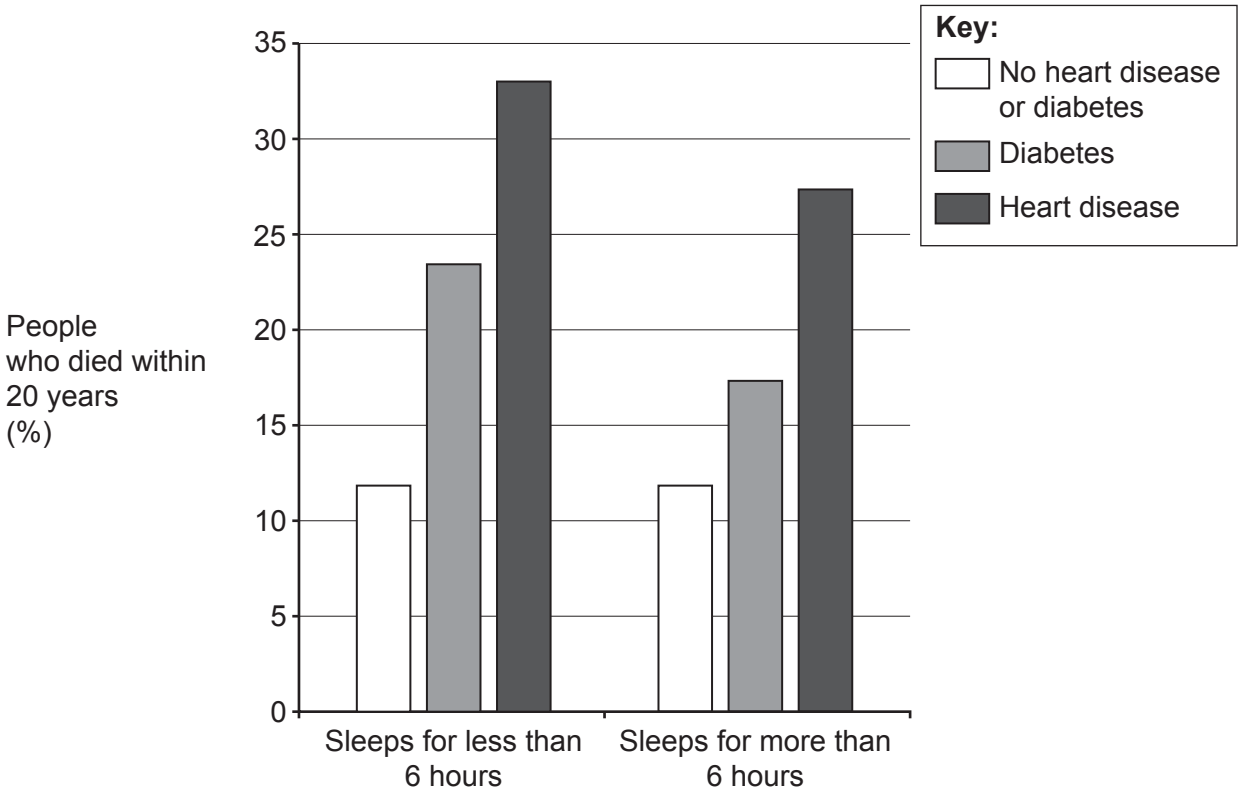
13 Scientists studied groups of people that have diabetes, heart disease or neither condition.

They measured whether these people slept for less or more than 6 hours each night.

The graph shows the percentage in each group that died within 20 years of the study.



What is a conclusion from this graph?

A Diabetes leads to more deaths than heart disease.

B Sleep prevents a person getting heart disease.

C Sleeping more than six hours decreases the risk of death from diabetes and heart disease.

D The number of hours a person sleeps has no effect on how long they live.

Your answer ☐ **[1]**

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14 Which row shows correct abiotic and biotic factors?

	Abiotic	**Biotic**
A	food	light intensity
B	food	predators
C	pH of soil	predators
D	temperature	light intensity

Your answer ☐ **[1]**

15 Which process can make new alleles?

A Evolution

B Mutation

C Selective breeding

D Specialisation

Your answer ☐ **[1]**

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Section B

16 Different cells in the human body are important in defence against disease.

(a) Draw lines to join each **type of cell** to its correct **function**.

Type of cell	Function
Cells in the stomach lining	produce antibodies to kill pathogens
Cells lining the airways	clot the blood to prevent entry of pathogens
Platelets	release mucus to trap pathogens
White blood cells	release acid to kill pathogens

[3]

(b) Vaccinations are used to protect us from diseases.

Complete this sentence about vaccinations.

Vaccinations help the body protect itself because they contain .....

or ..... forms of a pathogen.

[2]

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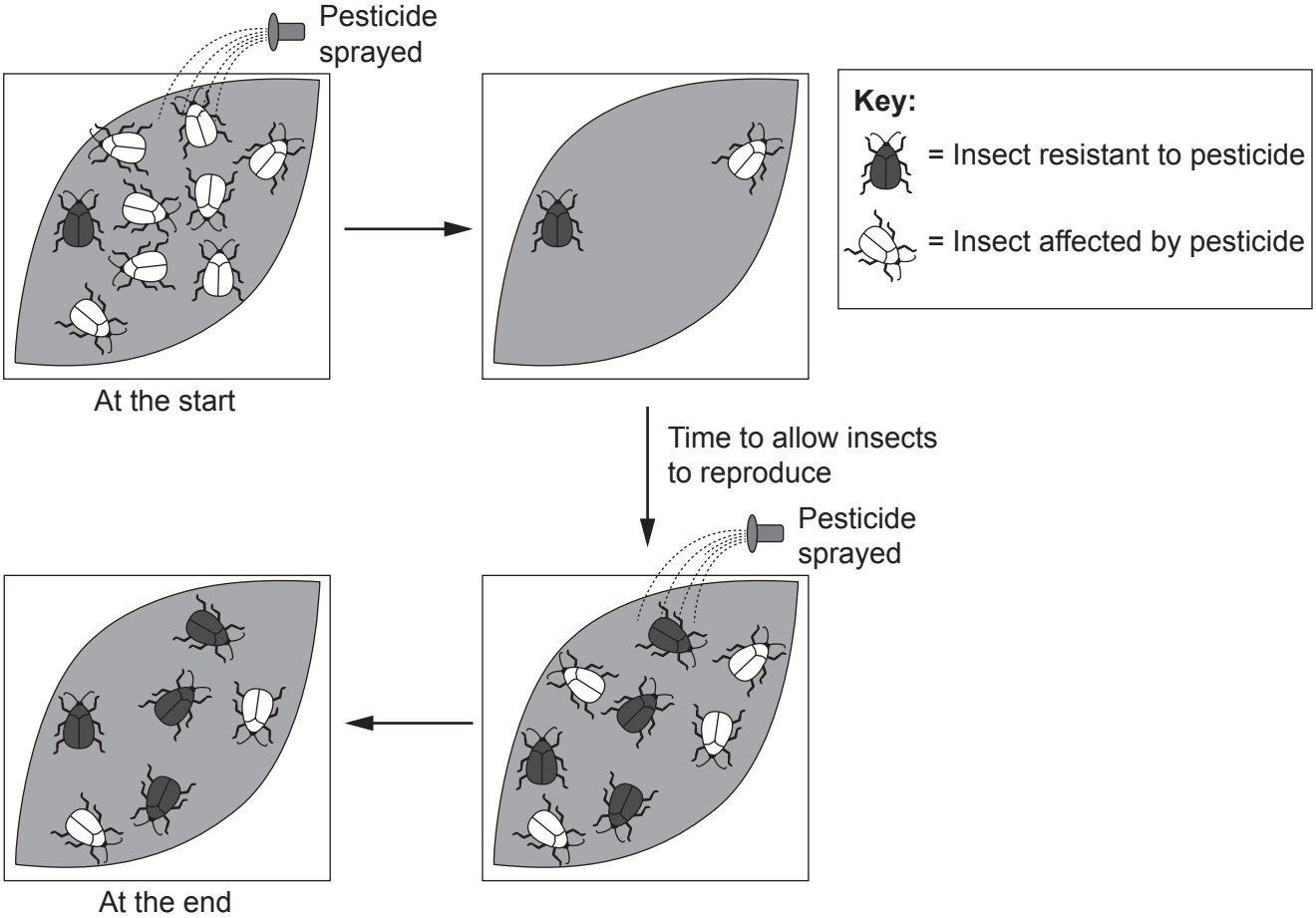
17 A scientist investigates the effects of pesticide on a population of insects.

At the start, the population contained:

- one insect resistant to the pesticide,
- eight insects affected by the pesticide.

They sprayed the insecticide twice, with a time gap between the sprayings.

The diagram shows their results.



(a) Complete the table using the information in the diagram.

	Number of insects resistant to pesticide	Number of insects affected by pesticide	Ratio of insects resistant to pesticide : insects affected by pesticide
At the start	1	8	1 : 8
At the end			

[2]

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(b) Which process does the scientist's investigation demonstrate?

Tick (✓) **one** box.

Genetic engineering ☐

Natural selection ☐

Selective breeding ☐

[1]

(c) Explain why the results of this investigation are important for farmers.

.....

.....

.....

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

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18 Diseases in plants are caused by different types of pathogens.

(a) Which type of pathogen causes each of these diseases?

Use words from the list.

Bacteria	**Fungi**	**Protists**	**Virus**

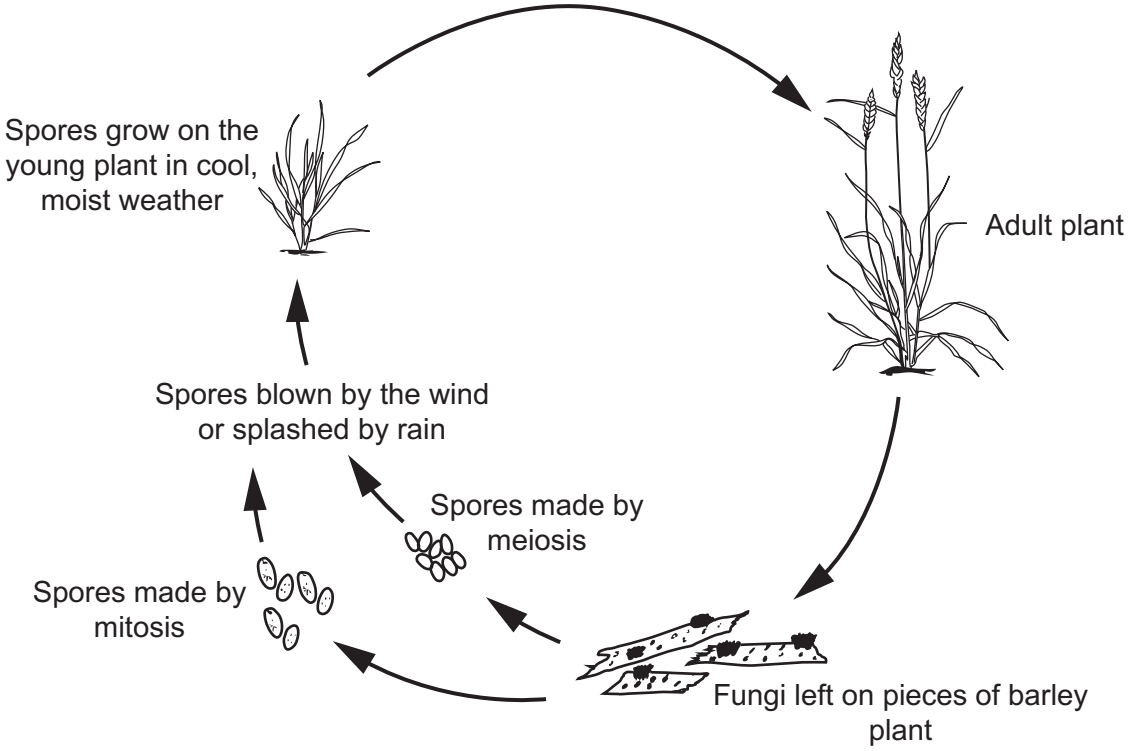
Tobacco mosaic disease: .....

Crown gall disease: .....

[2]

(b) Barley plants are infected by a fungus that causes powdery mildew.

The diagram shows the life cycle of the fungus.



(i) Rainy weather in the spring causes **more** barley plants to be infected with powdery mildew.

Suggest **two** reasons why. Use the diagram.

1 .....

.....

2 .....

.....

[2]

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(ii) The fungus reproduces using spores.

Which type of reproduction uses meiosis to make spores?

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

(iii) Farmers make sure that they clear all the dead barley plants from their fields in the autumn.

Explain why.

.....

.....

.....

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

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19 Spinal muscular atrophy (SMA) is a genetic disease.

(a) 700 000 babies are born each year in the UK.

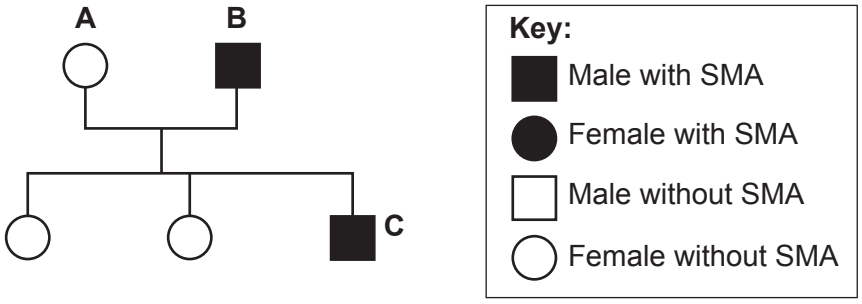
35 of these babies are born with SMA.

Calculate the percentage of babies that have SMA.

Percentage of babies with SMA = ... % **[2]**

(b) The diagram shows a family tree which contains some people with SMA.

SMA is caused by a recessive allele.



(i) Use the key to give the phenotype of person **A**.

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

(ii) Which term describes the genotype of person **B**?

Tick (✓) **one** box.

Heterozygous ☐

Homozygous dominant ☐

Homozygous recessive ☐

[1]

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(iii) People that have SMA cannot produce a protein that is needed for their motor neurones to function.

Explain why person **C** has difficulty moving their legs.

.....

.....

.....

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

(c) Researchers have developed a treatment for SMA.

This involves using a virus to insert a replacement gene into the nucleus of motor neurone cells.

(i) Why is the gene inserted into the **nucleus** of the motor neurone?

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

(ii) Researchers tested this treatment on animals first.

Suggest **one** reason why they did this.

.....

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

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20 Mistletoe is a green plant that can often be seen growing high in a tree in winter.

Mistletoe can make its own food but very slowly.

Therefore, it needs to take some food from the tree that it grows on. The tree does not benefit.

(a) Which term describes the mistletoe's relationship with the tree?

Put a (ring) around the correct option.

mutualistic partner **parasite** **predator** **prey**

[1]

(b) Complete these sentences about how the mistletoe feeds.

Use words from the list.

chlorophyll	**leaf**	**phloem**	**photosynthesis**
respiration	**starch**	**sunlight**	**xylem**

Mistletoe can make some food by ..... .

This is because it contains the green chemical ..... which traps energy from ..... .

The energy is used by the mistletoe to make sugars.

The mistletoe also gets some sugars from the ..... tissue of the tree.

[4]

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21 The number of elephants living in Africa is decreasing. They are often killed by hunters.

The table shows estimates for the number of elephants in Africa.

Year	**1979**	**1989**	**2015**
Number of elephants	1.3 million	600 000	400 000

(a)
(i) Calculate how many times more elephants there were in 1979 compared to in 2015.

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

(ii) Suggest **two** reasons why it is difficult for scientists to give an accurate estimate for the number of elephants living in Africa.

1 .....

.....

2 .....

.....
[2]

(b) Elephants are very important for ecotourism in southern Africa.

Explain how ecotourism benefits the elephants and the local people.

Elephants benefit from ecotourism because .....

.....

.....

Local people benefit from ecotourism because .....

.....

.....
[2]

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22 Microorganisms are found in milk.

These microorganisms make enzymes that can cause milk to decompose.

(a) State the name of **one** type of microorganism that can cause milk to decompose.

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

(b) Some students design an investigation to see how fast a sample of milk decomposes.

This is the method the students use:

- Pour 20 cm^3 of milk into a beaker.
- Keep the beaker at 25 °C.
- Measure the pH of the milk at different times over 72 hours.

(i) Suggest **one** piece of apparatus the students could use to keep the beaker of milk at a constant temperature.

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

(ii) When milk decomposes, sugars in the milk are turned into lactic acid.

To show how fast the milk decomposes, the students measure the time it takes for the pH to change.

Which term describes the time it takes for the pH to change?

Tick (✓) **one** box.

Control variable ☐

Dependent variable ☐

Independent variable ☐

[1]

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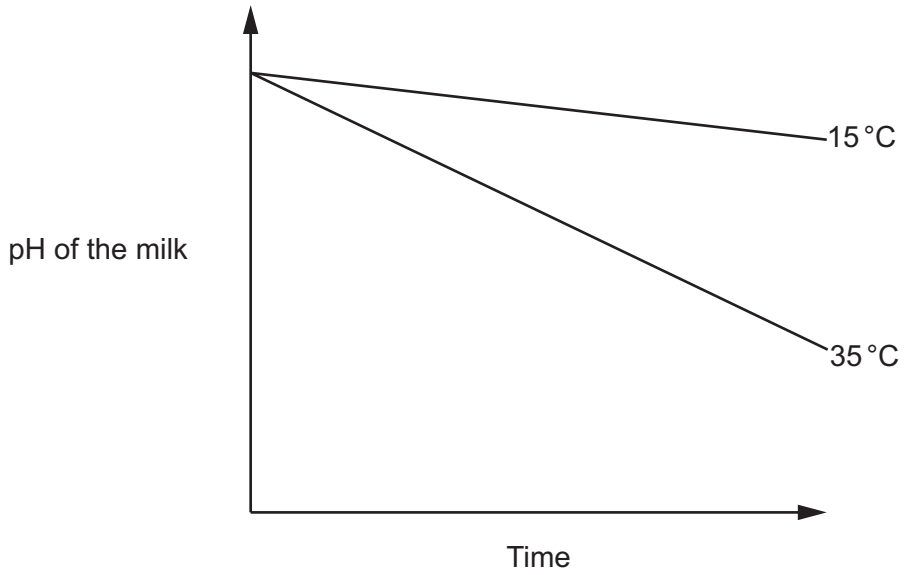
(c) The students repeated the experiment at two other temperatures.

The table shows the results.

	pH of milk				
Temperature (°C)	**At the start**	**After 12 hours**	**After 24 hours**	**After 48 hours**	**After 72 hours**
15	6.5	6.4	6.3	6.1	5.8
25	6.5	6.3	6.2	5.9	5.5
35	6.5	6.3	6.1	5.5	4.9

(i) The graph shows the pattern of the students' results for 15 °C and 35 °C.

Draw a line on the graph to show the pattern at 25 °C.



[1]

(ii) Complete the sentences to explain the difference between the students' results at 15 °C and 35 °C.

Milk decomposes ..... at 35 °C.

Increasing the temperature increases the ..... of the molecules.

This causes more frequent ..... between enzymes and the

..... molecules.

[4]

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(iii) The students want to find the temperature at which the enzymes from the microorganisms change shape and stop functioning (denature).

How could they extend their experiment to find this out?

Tick (✓) **two** boxes.

- [ ] Repeat at higher temperatures.
- [ ] Repeat at lower temperatures.
- [ ] Repeat at more temperatures between 15 °C and 35 °C.
- [ ] Identify the lowest pH reached.
- [ ] Identify the temperature where pH decreases the most.
- [ ] Identify the temperature where pH does not decrease.

[2]

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23 In some countries people do not have food security.

This means they do not have enough food to eat.

(a) Hydroponics can be used to try and grow more food.

What is hydroponics?

Tick (✓) **one** box.

- [ ] Growing crops with fertiliser
- [ ] Growing crops with pesticides
- [ ] Growing crops with their roots in water
- [ ] Growing crops without water

[1]

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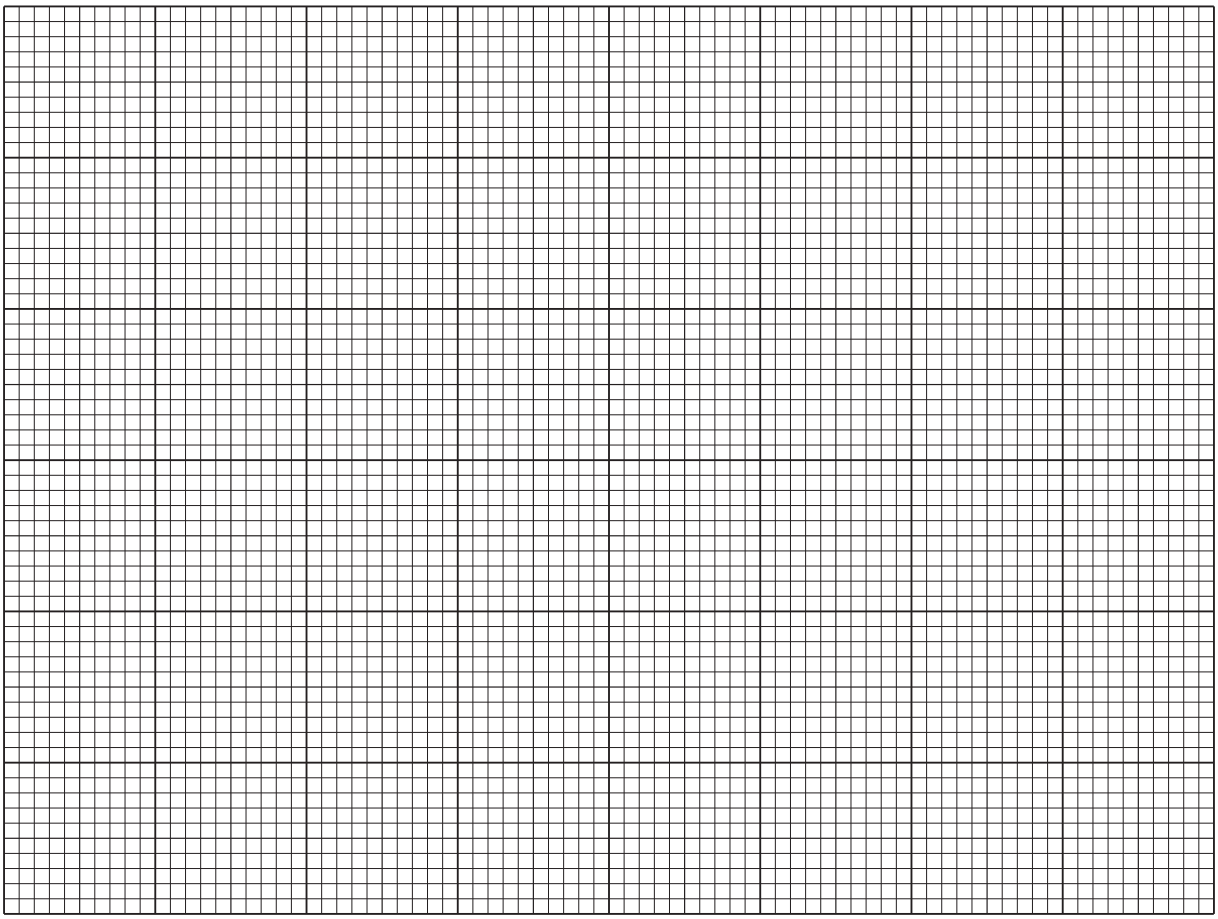
(b) The table shows the percentage of people that do **not** get enough food in four different countries.

Country	**Percentage of people who do not get enough food (%)**
Haiti	48
Pakistan	12
Sri Lanka	8
USA	3

Draw a bar chart to show the percentage of people that do **not** get enough food in each of the countries in the table.



[3]

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(c)* The table shows some information about food security in Haiti and USA.

	Total population (million)	Percentage of people who do not get enough food (%)	Number of people who do not get enough food (million)
Haiti	11.5	48	5.5
USA	331.9	3	10.0

Write about food security.

In your answer:

- explain biological reasons for why people may be short of food,
- compare the information in the table about food security in Haiti and USA.

.....

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.....

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

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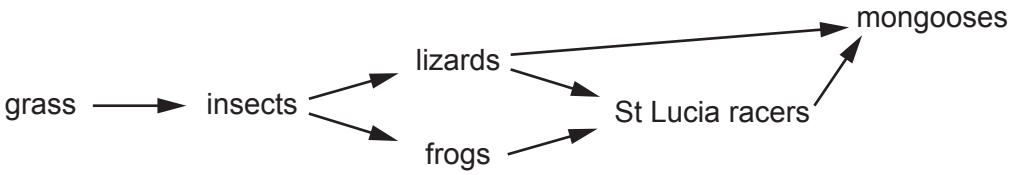
24 The St Lucia racer is the rarest snake in the world.

The snake lives on the island of St Lucia. The diagram shows a food web from St Lucia.



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

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

(b) Mongooses are described as both **predators** and **competitors** of St Lucia racers.

Explain why.

.....

.....

.....

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

(c) Biomass is lost as it passes through this food web.

Put a ring around **two** ways that biomass is lost from this food web.

egestion **growth** **photosynthesis** **respiration**

[1]

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(d) Mongooses were introduced into St Lucia by farmers to control pests in their fields.

(i) Which term describes this type of pest control?

Tick (✓) **one** box.

Abiotic control ☐

Biological control ☐

Chemical control ☐

Genetic control ☐

[1]

(ii) The mongooses soon spread throughout St Lucia.

- Female mongooses can breed 3 times each year and produce 3 babies each time.
- The St Lucia racer lays about 5 eggs each year.

Explain why the mongooses almost made the snake extinct.

.....

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

(e) By 1973 the St Lucia racers were thought to be extinct but a small number were found on a small island off the coast of St Lucia.

There was a plan to build a bridge to allow tourists to visit the island.

(i) Suggest why these snakes have survived on the island.

.....

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

(ii) Suggest why scientists are against the plan to build the bridge.

.....

.....

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

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25 Antibiotics and antiseptics are both used to kill bacteria.

(a) Which is a correct statement about antiseptics and antibiotics?

Tick (✓) **one** box.

Antibiotics are not used inside the body, but antiseptics are. ☐

Antibiotics are used inside the body, but antiseptics are not. ☐

Antibiotics are used on living tissue and antiseptics on non-living tissue. ☐

Antibiotics are used on non-living tissue and antiseptics on living tissue. ☐

[1]

(b) Disinfectants also kill bacteria.

Some students do an experiment to see how well four different disinfectants (**A**, **B**, **C** and **D**) kill bacteria.

This is the method they use:

- Mix 2 cm^3 of each disinfectant solution with liquid nutrient agar.
- Pour each of the mixtures into separate Petri dishes and allow to set.
- Spread bacteria on the surface of the agar.
- Put each Petri dish in an incubator.

(i) Describe how the students should spread bacteria on the surface of the agar.

.....

.....

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

(ii) The students' teacher told them **not** to seal the lid on the Petri dishes all the way round with tape.

Explain why.

.....

.....

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

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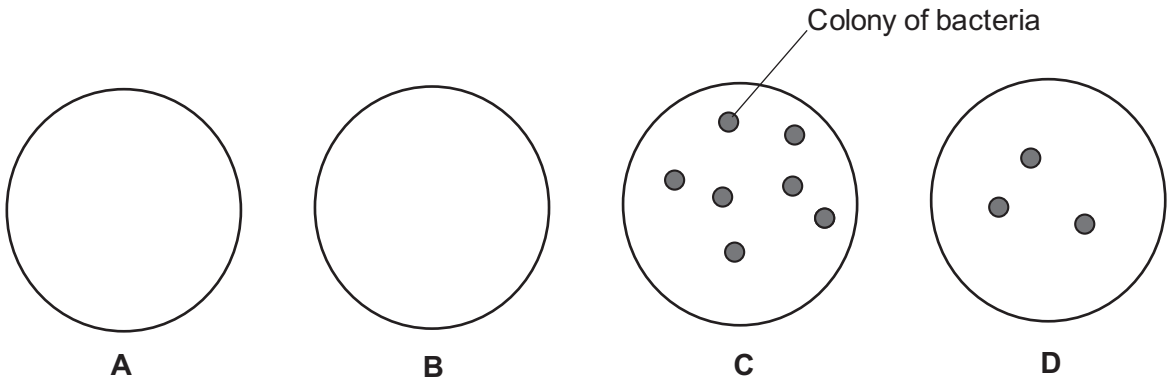
(c) The diagrams show the Petri dishes after 3 days.



(i) Explain **two** conclusions the students can make about disinfectants **B**, **C** and **D** from these results.

1 .....

.....

2 .....

.....

[2]

(ii) One of the students said that disinfectant **A** is equally effective at killing bacteria as disinfectant **B**.

Explain how the students could improve their experiment to test if that is true.

.....

.....

.....

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

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

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

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