Q1. (June 2018)

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

A Antimicrobial substances

B Cell walls

C Leaf cuticles

D Thorns

Your answer ☐ **[1]**

Q2. (June 2018)

9 Which is an advantage of growing crop plants by hydroponics?

A The plants can be grown where there is poor soil.

B The plants can support themselves more securely.

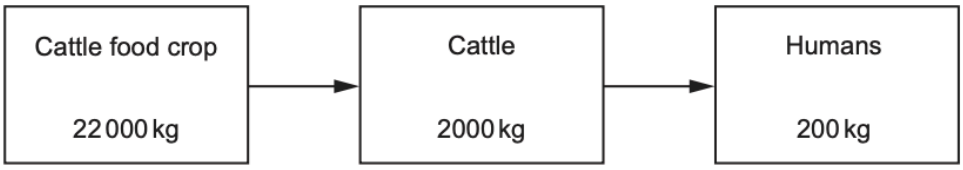
C The plants do not require minerals.

D The plants require less sunlight.

Your answer ☐ **[1]**

Q3. (June 2018)

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



(a) (i) Calculate the percentage efficiency of transfer of biomass between the cattle food crop and humans.

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

(ii) Write down **two** ways that biomass is lost from the food chain.

1 .....

2 .....

[2]

(b)* High levels of light intensity can damage plants. To prevent damage, plants have a protection mechanism.

When light intensity levels get **too high**, the protection mechanism switches on. This stops the plant absorbing too much light.

When the light intensity drops to safe levels, the protection mechanism switches off **slowly**.

Explain why this mechanism would **reduce** the biomass available to humans.

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

(c) Switching off the protection mechanism described in part **(b)** involves the plant making a **protein**.

Scientists have put extra copies of the gene for this protein into the plants. This makes the plant make more mRNA molecules.

(i) Explain why making more mRNA will switch off the mechanism faster.

.....

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

(ii) Scientists have found that the genetically modified plants make 20% more biomass.

Use the agricultural food chain on page 21 to calculate the increase in biomass this would provide for humans.

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

(iii) Inserting extra copies of a plant's gene into a plant is a type of genetic modification (GM).

Another example of GM involves inserting a bacterial gene into a plant which makes the plant produce an insecticide.

People are more likely to support genetic modification involving extra copies of the plant gene, rather than inserting the bacterial gene.

Suggest reasons why.

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.....

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

Q4. (June 2019)

18 Two farmers grow barley in their fields.

They both have a problem with barley powdery mildew infecting their crops.

(a) Powdery mildew is caused by a fungus.

Describe how fungal infections can spread and how they enter plant leaves.

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

(b) The farmers want to prevent their crops from getting powdery mildew.

(i) Explain how burning plants after the barley has been harvested can protect the crops.

.....

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

(ii) Explain how growing barley in the fields one year, then wheat the next year can protect the crops.

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

(c) The farmers test two different fungicides.

They each grow barley in one of their fields. Each farmer sprays a different fungicide on their field. They then compare the crop yield in the two different fields.

How could you improve the farmers' experiment?

Explain your answer.

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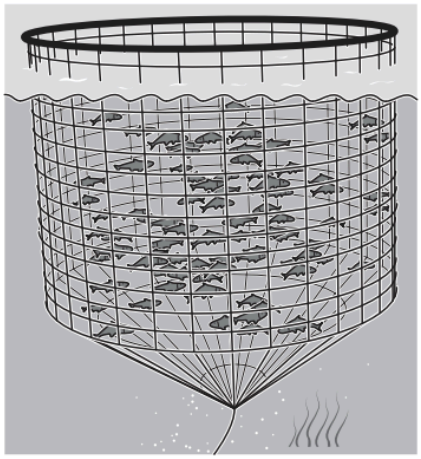
..... **[2]**

Q5. (June 2023)

23 The demand for food in the world is growing. One possible solution to this is the use of aquaculture.

This involves farming fish, such as salmon, in large cages in lakes or the sea as shown in the diagram.
However, growing salmon in cages allows parasites on their body to spread easily from fish to fish.



(a) Small fish called wrasse are often kept in the cage with the salmon.
The wrasse act as a biological control mechanism. This results in an increased growth rate of the salmon.

Suggest how putting wrasse in the cage results in an increased growth rate of the salmon.

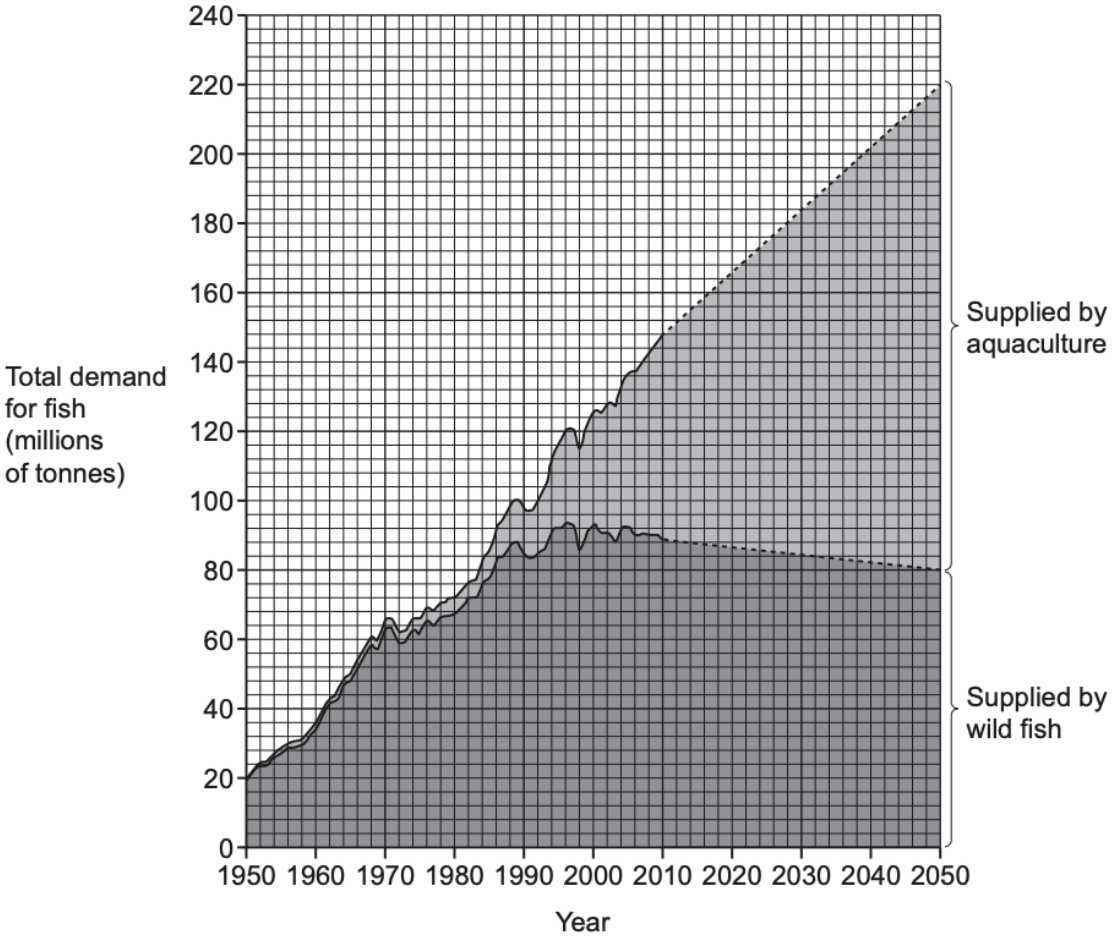
.....

.....

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

(b) Many people in the world eat fish as their main source of protein.
Fish eaten by people can be caught directly from the sea (wild fish) or grown using aquaculture.

The graph shows how the world's total demand for fish has changed since 1950 and how it is expected to change up to 2050. It also shows how the total demand is met by the supply of wild fish and fish from aquaculture.



Describe the patterns in past and predicted fish use shown by the graph.

Include data.

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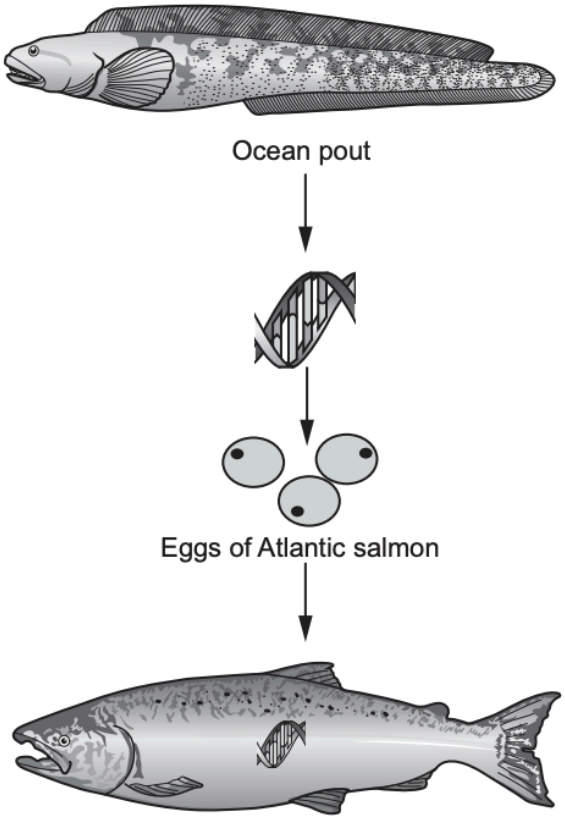
..... **[3]**

(c) Scientists are trying to increase the mass of Atlantic salmon produced by aquaculture using genetic engineering and a fish called ocean pout.

The growth of fish is controlled by growth hormone.
Atlantic salmon only grow for part of the year but ocean pout grow throughout the year.

The diagram shows how scientists are producing genetically engineered Atlantic salmon.



(i) What is the name of the enzyme used to cut out the gene from the DNA of the ocean pout?

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

(ii) What is the name of the enzyme used to join the gene from the ocean pout into the DNA of the Atlantic salmon?

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

(iii) Explain how the addition of the gene from ocean pout can cause the Atlantic salmon to grow faster.

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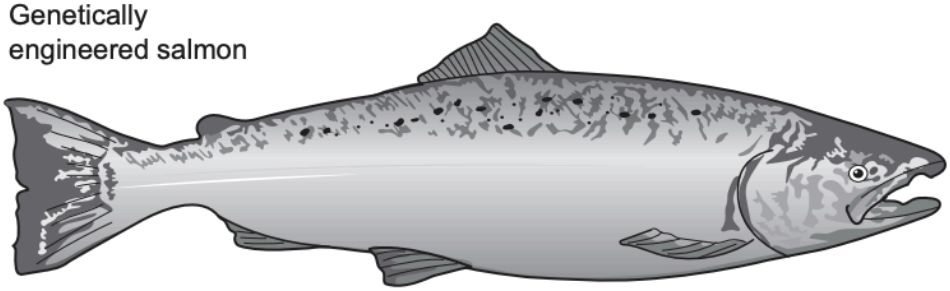
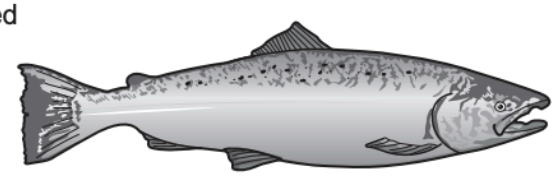
..... **[2]**

(iv) This diagram shows a genetically engineered salmon and a non-engineered salmon of the same age. The drawings are to the same scale.

Genetically engineered salmon



Non-engineered salmon



Use a ruler to measure the length of each salmon.

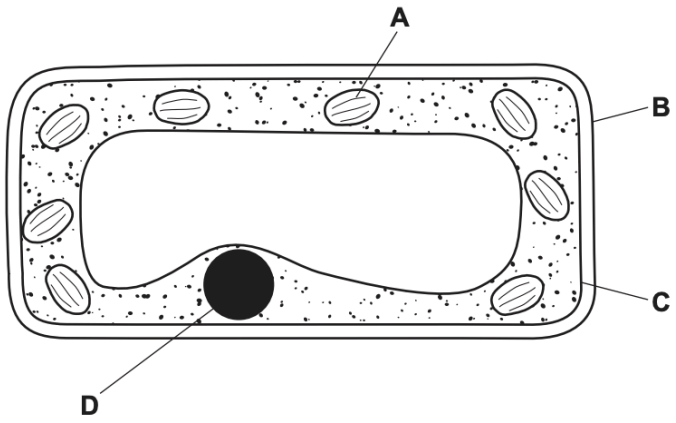
Calculate the percentage increase in length caused by genetic engineering using your measurements.

Give your answer to **2** significant figures.

Percentage increase in length = ... % **[3]**

Q6. (June 2024)

5 The diagram shows a labelled plant cell.



Which part of the plant cell gives **physical** protection against disease?

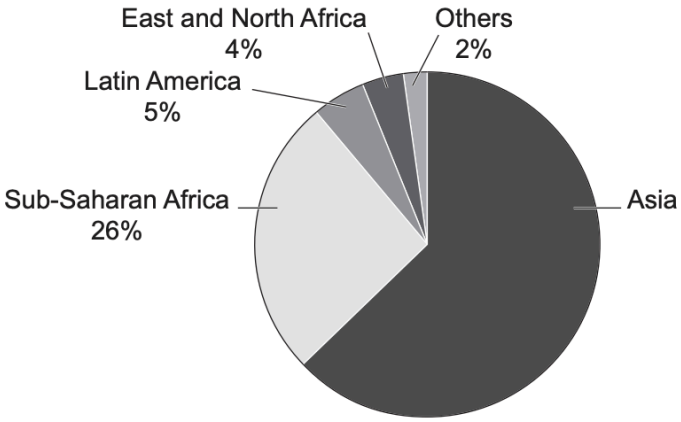
Your answer ☐ **[1]**

Q7. (June 2024)

11 Lack of food security can lead to people being undernourished.

1×10^9 people in the world are undernourished.

The pie chart shows the percentage of undernourished people found in different parts of the world.



How many people are undernourished in Asia?

A 1.75×10^8

B 6.3×10^8

C 1.75×10^9

D 63×10^9

Your answer ☐ **[1]**

Q8. (June 2025)

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]**

Q9. (June 2025)

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]**

(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]**

Q10. (June 2025)

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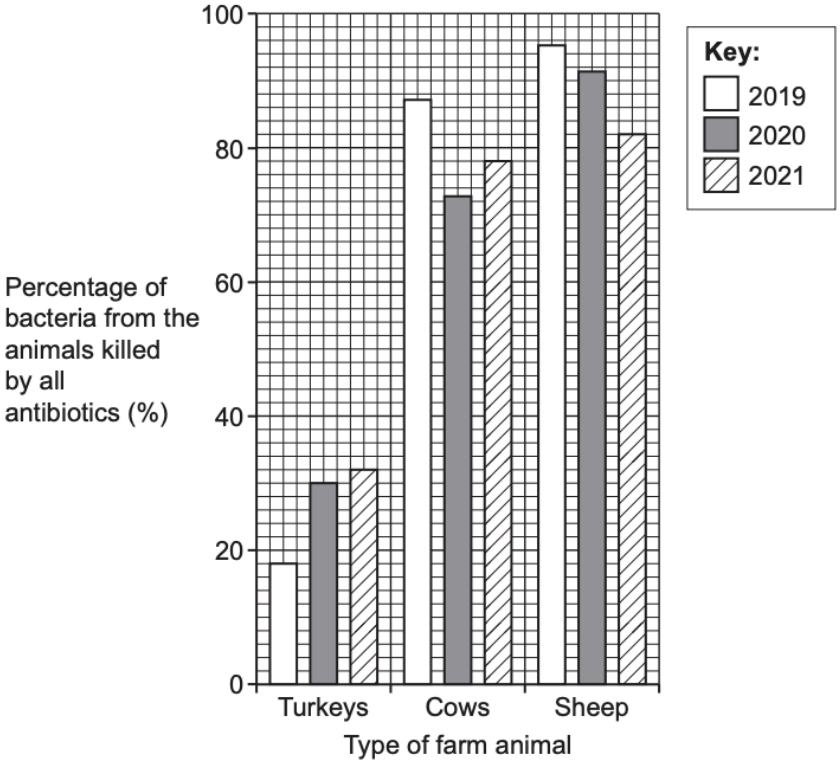
..... **[3]**

(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]**

(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]

Q11. (June 2025)

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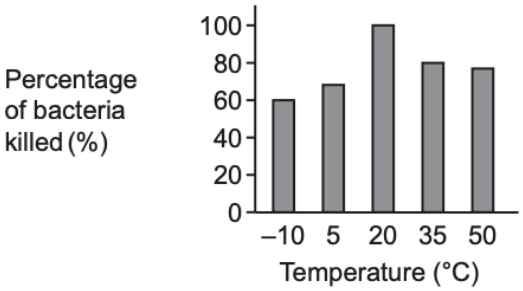
..... **[2]**

(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]**

Q12. (Nov 2020)

1 Which of these is an **advantage** of using hydroponics for crop production?

A Fertilisers are not required for crop growth.

B The crops can be grown in areas where the soil is poor.

C The crop plants do not need extra support.

D The crops will not be eaten by pests.

Your answer ☐ **[1]**

Q13. (Nov 2021)

18 This question is about plant diseases.

(a) Plant diseases can be caused by bacteria, fungi or viruses.

Complete the table by choosing words from this list to identify the **cause** of each of the diseases.

You can use each word once, more than once, or not at all.

bacterium **fungus** **virus**

Name of disease	Cause
Barley mildew	.....
Crown gall disease	.....
Tobacco mosaic disease	.....

[3]

(b) Tomatoes are an important food crop. They can be infected by a number of different pathogens.

It is important that farmers can identify which pathogen is infecting their tomatoes as soon as possible.

Give **two** reasons to explain why.

1 .....

.....

2 .....

.....

[2]

(c) Tomatoes can be infected by two types of disease called early blight and late blight.

The type of disease can currently be identified by taking sections of leaves and examining them using a microscope.

Scientists are developing a new method of identifying these two diseases. They scan a leaf with light for 10 seconds and measure the wavelengths of light that are reflected.

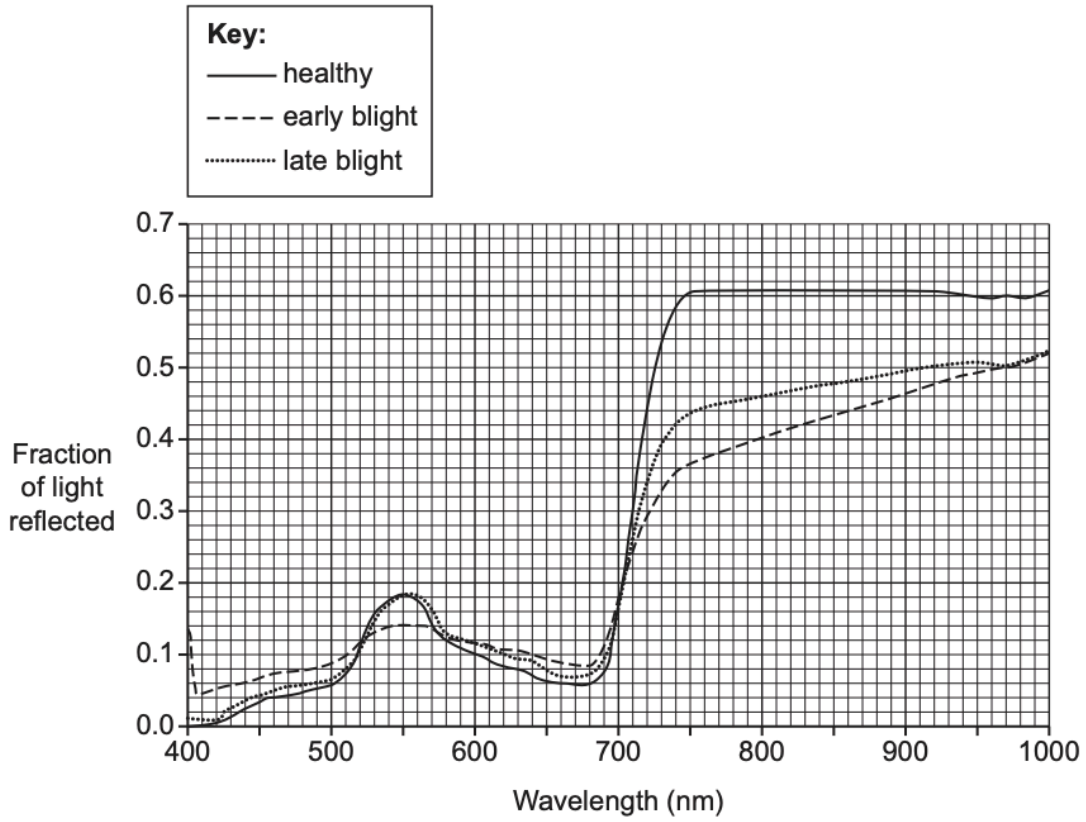
(i) Give **one** reason why the new method may be an improvement on the current method.

.....

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

(ii) The diagram shows the results of scanning three different tomato leaves.

One leaf has early blight, one has late blight and the other is healthy.



The scientists think that they only need to shine light of one wavelength at the leaf to decide if it is healthy or which disease it has.

Suggest a wavelength that the scientists could use.

Explain your answer.

Wavelength .....

Explanation .....

.....

.....

[2]

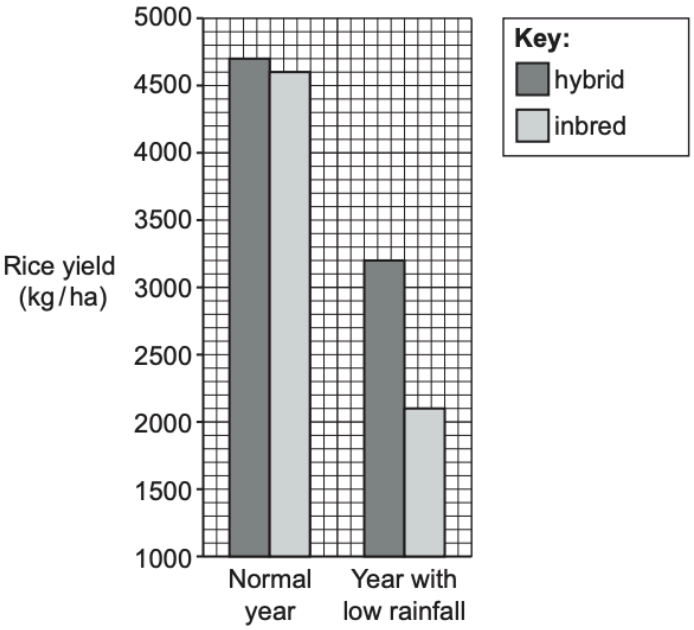
Q14. (Nov 2021)

22 In China, many people rely on rice for their main food supply.

For many years people have grown the same varieties of rice (inbred rice).

New varieties of rice are now available. They are called hybrid rice.

The graph shows the yield of inbred rice and hybrid rice in a normal year and in a year with low rainfall.



(a) When there was low rainfall, the yield of the inbred rice dropped from 4600 kg/ha to 2100 kg/ha. That is a 54% decrease.

Calculate the **percentage decrease** of the hybrid rice when there is low rainfall.

Give your answer to **2** significant figures.

Percentage decrease = ... **[2]**

(b) Explain why hybrid rice may be important if global warming causes changes in the climate in China.

.....

.....

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

(c) Hybrid rice is produced by breeding inbred rice with other types of rice found growing in the wild.

Explain why seedbanks might be useful if the climate changes in the future.

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