AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.2.4

Genetic engineering

Past-paper questions

Tier	**Higher**
Question groups	**24**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

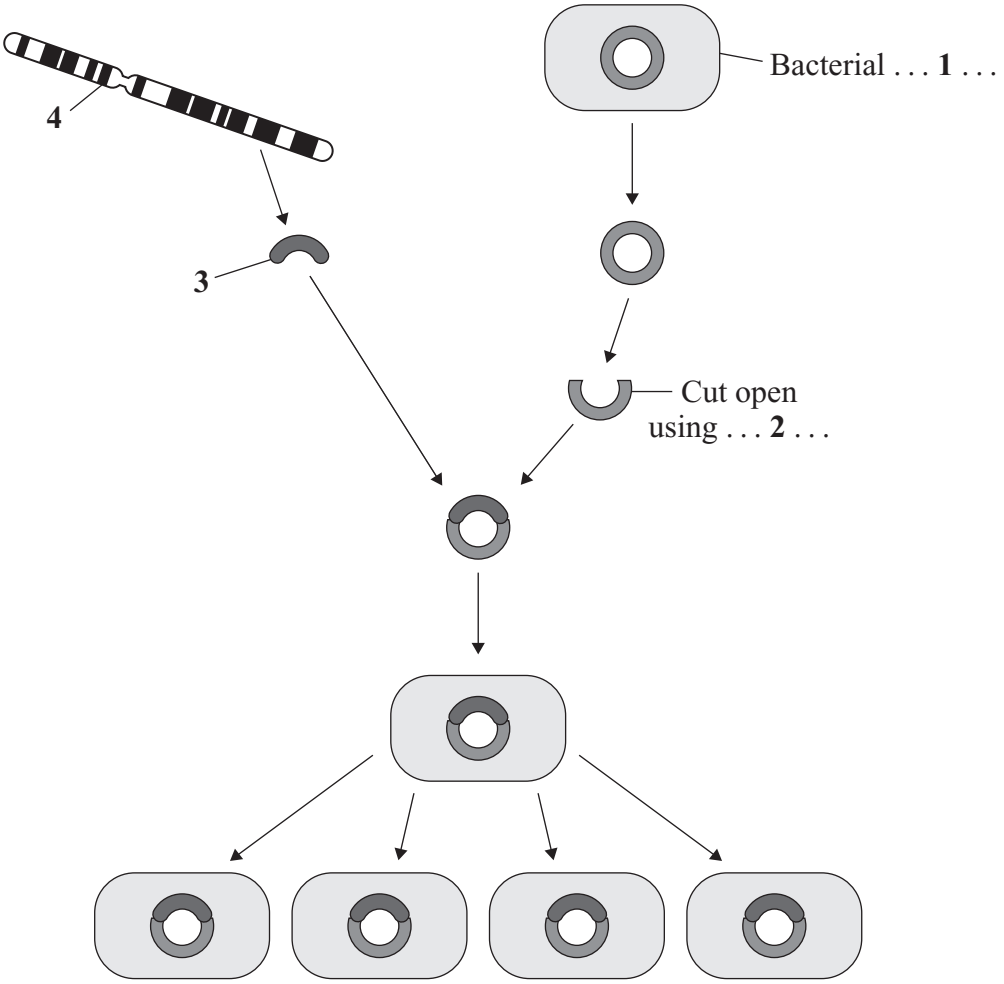
4.6.2.4 Genetic engineering

Question 01

March 2007 | BLY1B | Original Q1 | Legacy

QUESTION ONE

The diagram shows some of the steps involved in genetic engineering.



4.6.2.4 Genetic engineering

Question 01 · continued

Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A cell

B chromosome

C enzyme

D gene

4.6.2.4 Genetic engineering

Question 02

March 2007 | BLY1B | Original Q6 | Legacy

QUESTION SIX

Read the passage.

GM Plants

There is a lot of concern about genetic engineering and its possible effects on the environment.

The practice of producing genetically modified (GM) food plants by adding genes for different characteristics may be a disaster in the making.

Scientists can add genes such as those for herbicide resistance, insecticide production, vitamin A production and other genes to improve growth, to plants that normally lack these characteristics.

There is evidence that some varieties of butterfly are disappearing, possibly due to eating pollen from GM crops.

There are fears that genes may escape from the organisms in which they were placed by cross-breeding, creating 'superweeds' that cannot be killed easily.

The GM crops may themselves also become weeds and spread rapidly through the environment.

Of further concern is the potential danger to humans of eating GM foods. The genes may react in the body and cause long-term effects which are at present unknown.

6A Which technique is used to produce large numbers of identical genetically modified plants?

1 artificial cross-breeding of plants

2 embryo transplants

3 tissue culture

4 transferring wanted genes to developing plant cells

6B Which genetic modification to plants directly benefits human health?

1 herbicide resistance

2 increased growth

3 insecticide resistance

4 vitamin A production

4.6.2.4 Genetic engineering

Question 02 · continued

6C Which concern about GM crops is supported by scientific evidence?

1 Crops will become weeds and spread rapidly through the environment.

2 Herbicides will not be able to kill 'superweeds'.

3 Humans will be harmed by eating GM crops.

4 Some varieties of butterfly will disappear.

6D A scientist wants to find out if a gene for herbicide-resistance can be transferred to weeds from GM crop plants.

How could he investigate this?

1 collect weeds from a number of different environments and study their genes

2 collect weeds from areas where GM crops are grown and spray the weeds with herbicide

3 cross-breed GM herbicide-resistant crop plants with weeds

4 grow the seeds from weeds growing close to GM crops and spray with herbicide

4.6.2.4 Genetic engineering

Question 03

June 2007 | BLY1B | Original Q6 | Legacy

QUESTION SIX

Read the passage.

GM Cotton

The bollworm is an insect that attacks cotton plants.

Scientists have developed genetically modified (GM) cotton plants by inserting a gene into the cotton plants.

The gene enables the cotton plants to produce a poison to kill the bollworm and prevent damage to the cotton crop.

Cotton growers do not need to buy as much pesticide to control the bollworm.

GM cotton seeds are more expensive than ordinary cotton seeds.

However, after seven years of growing the GM cotton, growers are now buying and using as much pesticide as farmers growing non-GM cotton.

6A Which of the following is likely to occur as a result of the bollworm being unable to feed on the cotton plants?

1 Other insects may increase in number.

2 Other insects will not be able to feed on the cotton plants.

3 The bollworm will become resistant to the poison produced by the cotton crop.

4 The predators of the bollworm will begin to eat the cotton plants.

6B The gene that was inserted into the cotton plants allowed the plants to . . .

1 produce more cotton.

2 produce a pesticide.

3 resist all insects.

4 resist pesticides.

4.6.2.4 Genetic engineering

Question 03 · continued

6C After growing GM cotton for three years, the cotton growers were making 30 % more profit than when they grew the non-GM cotton.

This was a result of . . .

1 not having to buy as much pesticide.

2 having a bigger market for their cotton.

3 paying less for the GM seeds.

4 all insect pests having been destroyed.

6D After growing the GM cotton for seven years, the cotton growers were making less money than they did when growing non-GM cotton.

This was most likely because . . .

1 the bollworm had become resistant to the poison produced by the cotton crop.

2 pesticides could not control the bollworm.

3 the GM cotton seeds had become too expensive to buy.

4 there was no market for the GM cotton.

4.6.2.4 Genetic engineering

Question 04

November 2007 | BLY1B | Original Q6 | Legacy

QUESTION SIX

This question is about genetically modified food.

Read the passage.

> In 1996, two supermarkets started to sell genetically modified (GM) tomato puree, a paste made by cooking GM tomatoes.
> It was cheaper than non-GM puree and sold very quickly.
> The GM tomatoes contained a transferred gene which allowed them to keep ripe longer.
> The GM tomatoes were grown in America because the British climate was not suitable.
> Laws prevented uncooked GM tomatoes from being sold in Europe.
> The cans of tomato puree were clearly labelled to show that the GM puree was made from GM tomatoes.
> In 1999, the supermarkets stopped selling the GM tomato puree.

6A Why were the GM tomatoes produced in the first place?

1 to produce cheaper puree

2 to produce tastier puree

3 to produce a bigger crop in America

4 to produce larger tomatoes

6B Which of the following is the most likely reason to explain why people stopped buying the GM tomato puree?

1 concern about the effects on the British economy

2 concern about the effect on the environment of growing GM crops

3 European laws prohibiting the sale of GM tomatoes

4 the tomatoes could not be grown in Britain

4.6.2.4 Genetic engineering

Question 04 · continued

6C How are GM tomatoes produced in the first place?

1 producing clones from a mutated plant

2 fusing cells of young tomato plants

3 sexual reproduction of two varieties of tomato plant

4 transferring genes from another species

6D Why were the tins of tomato puree labelled to show that they had been made using GM tomatoes?

1 because the supermarkets were worried about health effects

2 so that the public could choose GM or non-GM puree

3 to inform the public about genetic engineering

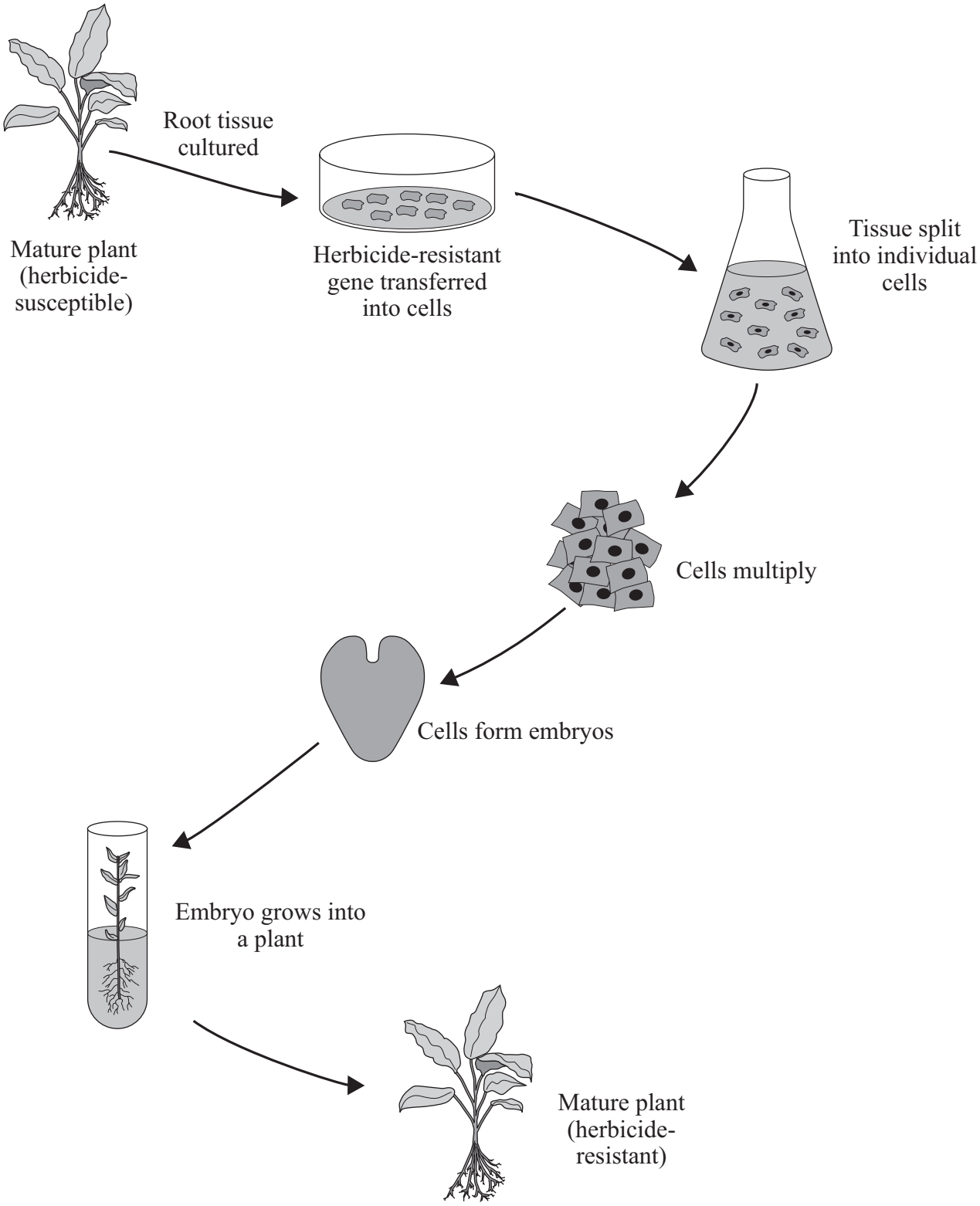
4 to raise public concern over GM crops

4.6.2.4 Genetic engineering

Question 05

January 2008 | BLY1H | Original Q8 | Legacy

8 The diagram shows one method of producing herbicide-resistant crop plants.



4.6.2.4 Genetic engineering

Question 05 · continued

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(a) (i) The herbicide-resistance gene is obtained from a herbicide-resistant plant.

Which structure in a cell carries the genes?

.....

(1 mark)

(ii) How is the herbicide-resistance gene cut out of this structure?

.....

.....

(1 mark)

(b) Apart from having the herbicide-resistance gene, the herbicide-resistant plants are identical to the herbicide-susceptible plants.

Explain why.

.....

.....

.....

.....

(2 marks)

(c) Suggest **one** advantage to a farmer of growing herbicide-resistant crops.

.....

.....

(1 mark)

(d) Many people are opposed to the growing of herbicide-resistant crops produced in this way.

Suggest **one** reason why.

.....

.....

(1 mark)

6

4.6.2.4 Genetic engineering

Question 06

March 2008 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Read the passage:

> The *Agrobacterium tumefaciens* bacterium will accept genes from another organism. The bacterium can then transfer those genes from itself into plants. The plant then grows a lump of cells (a gall) that contain the genes from the bacterium. New plants, containing the genes, can be grown from galls. This technique has been used to transfer genes from a firefly into a tobacco plant, which then glows in the dark.

4A The transfer of genes from the firefly into the bacterium is an example of . . .

1 asexual reproduction.

2 cloning.

3 genetic engineering.

4 transplantation.

4B From which structure in the firefly would scientists cut out the gene that causes glowing?

1 gamete

2 chromosome

3 enzyme

4 cell

4C Cells from the tobacco plants containing the new genes would have to be cloned. This cloning would be carried out using . . .

1 embryo transplantation.

2 adult cell cloning.

3 genetic engineering.

4 tissue culture.

4.6.2.4 Genetic engineering

4D What was the most likely reason for carrying out this experiment?

1 to make tobacco plants grow taller

2 to remove genes from fireflies

3 to see whether genes could be transferred from animals to plants

4 to grow plants from galls

Turn over for the next question

4.6.2.4 Genetic engineering

Question 07

November 2008 | BLY1BP | Original Q6 | Legacy

QUESTION SIX

Read the passage.

> Trials of genetically-modified (GM) maize crops have been carried out.
> A gene, giving resistance to herbicides, was removed from a bacterium and transferred to maize plants.
>
> The trials involved growing fields of the GM maize next to fields of non-GM maize.
>
> The scientists recorded the number and species of organisms in the fields.
> It was found that in the fields with the GM crops there were fewer species, while in the fields without GM crops the number and species of organisms had increased.

6A The gene giving resistance to herbicides would be removed from bacteria by using . . .

1 small scissors.

2 a chromosome from the bacterium.

3 an enzyme.

4 a nucleus.

6B In the trial, the non-GM maize was used . . .

1 so that the number of organisms could be counted easily.

2 because different species of plants and animals were found in the fields where the two types of maize were grown.

3 to make the results accurate.

4 as a control.

6C Many groups of people are opposed to growing GM crops.

Which of the following is likely to be the main reason for this opposition?

1 GM crops have only been developed for economic reasons.

2 The effect of eating GM crops on human health is not known.

3 There is no evidence that GM crops have better nutritional value.

4 GM crops are resistant to disease.

4.6.2.4 Genetic engineering

Question 07 · continued

6D Which process would be used to produce large numbers of the new GM maize plants?

1 sexual reproduction

2 the continued transfer of genes to new maize plants

3 asexual reproduction

4 crossing GM maize with non-GM maize

Turn over for the next question

4.6.2.4 Genetic engineering

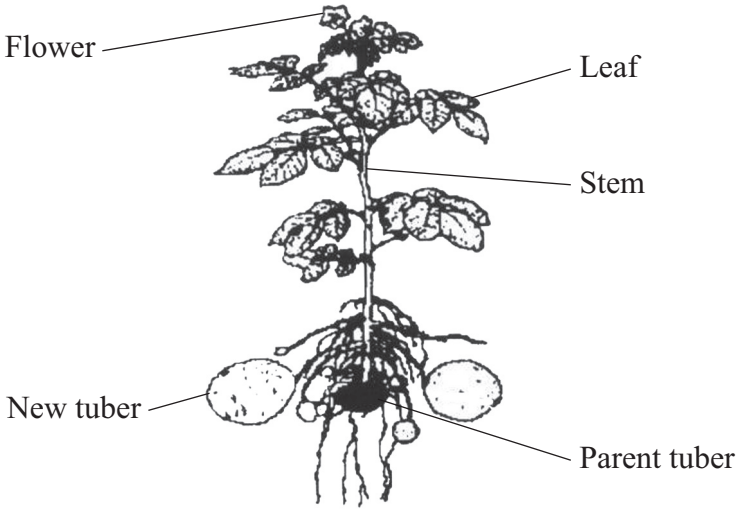
Question 08

March 2009 | BLY1BP | Original Q7 | Legacy

QUESTION SEVEN

There are many varieties of potato plant, producing tubers with different qualities.

Potato plants can reproduce both sexually and asexually.



7A How could new varieties of potato be produced?

1 taking small groups of cells from a new tuber and growing them

2 taking cuttings from the leaf or stem of the plant and growing them

3 allowing gametes from different potato plants to fuse together

4 allowing new tubers to stay in the ground and to grow next year

7B Scientists wish to create a variety of potato which will tolerate drought conditions.
They have identified the gene which gives a cactus species the ability to survive with very little water.

What would be the best way of producing drought-resistant potatoes?

1 breed ordinary potato plants with cactus plants

2 use enzymes to cut out the gene from the cactus and transfer it to potato cells

3 selectively breed cactus plants which, over many generations, are more like potatoes

4 grow potato plants in low water conditions over many generations

4.6.2.4 Genetic engineering

Question 08 · continued

7C Some people believe that using genetic engineering to develop potatoes that are tolerant to drought conditions should **not** be allowed.

One reason for this is because . . .

1 the new variety of potato may be susceptible to the same diseases as cactus plants.

2 the cost of the technology required outweighs the possible profits.

3 the native potato may compete with the new variety.

4 there are ethical concerns about interfering with natural processes.

7D Herbicide-resistant potatoes have also been produced.

The advantage of this is that . . .

1 old potato plants can easily be killed to make way for new crops.

2 it is easy to kill insects which might feed on the crop.

3 the growth of wild flowers is encouraged, maintaining biodiversity.

4 competition from other plants can be reduced.

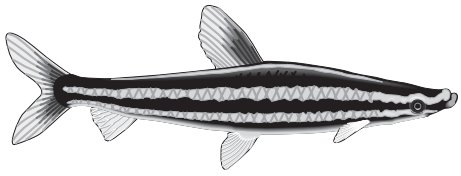
4.6.2.4 Genetic engineering

Question 09

June 2009 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Zebra fish are small freshwater fish that can tolerate a wide range of environmental conditions. Scientists want to use zebra fish as an indicator species for different types of water pollution.



4A Scientists have extracted 'glow' genes from a jellyfish and transferred them into the eggs of a zebra fish.

What term describes this process?

1 cloning

2 genetic engineering

3 tissue culture

4 embryo transplant

4B Genes from jellyfish are transferred into zebra fish eggs by . . .

1 using a small pair of sharp scissors.

2 using enzymes.

3 mixing the gametes of jellyfish and zebra fish.

4 taking cytoplasm from a jellyfish egg and placing it into a zebra fish egg.

4.6.2.4 Genetic engineering

Question 09 · continued

Zebra fish created by this process would glow with different colours, depending on the type of chemical pollution in the water. The table shows how this would work.

Colour	Type of chemical pollution			
	Pesticides	Fertilisers	Acidity	Herbicides
Red	✓			
Green			✓	
Yellow		✓		
Orange				✓

4C Zebra fish would glow green because of . . .

1 an increase in the sulfur dioxide content of the atmosphere.

2 a reduction in the carbon dioxide content of the atmosphere.

3 an increase in the methane content of the atmosphere.

4 an increase in the amount of chemicals used in agriculture.

4D In one river, different zebra fish glow red and orange.

This indicates that the river is polluted by . . .

1 chemicals released from industry.

2 smoke released from power stations.

3 chemicals washed off farmland.

4 sewage leaking from drains.

4.6.2.4 Genetic engineering

Question 10

June 2009 | BLY1H | Original Q6 | Legacy

6 Cattle give out methane.

6 (a) Explain how the methane given out by cattle is affecting the Earth's climate.

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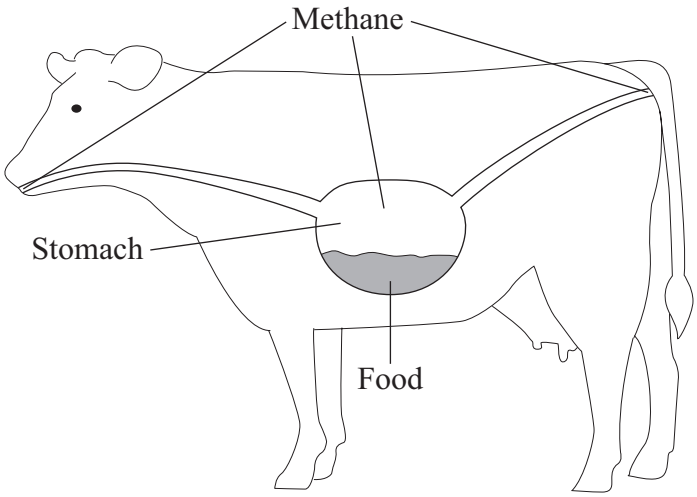
(3 marks)

(Extra space) .....

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6 (b) Scientists are investigating how to reduce methane emissions from cattle.

Most of this methane is emitted by the cows belching.



Scientists have found that less methane is belched if the cows eat high-sugar rye grass.

This rye grass has been produced by genetic engineering.

4.6.2.4 Genetic engineering

Question 10 · continued

for mark

6 (b) (i) Suggest how the high-sugar rye grass might have been produced by genetic engineering.

.....

.....

.....

.....

.....

.....

(3 marks)

(Extra space) .....

.....

6 (b) (ii) Some people might object to the growing of genetically-engineered, high-sugar rye grass for feeding cattle.

Give **two** reasons why.

1 .....

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2 .....

.....

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(2 marks)

8

4.6.2.4 Genetic engineering

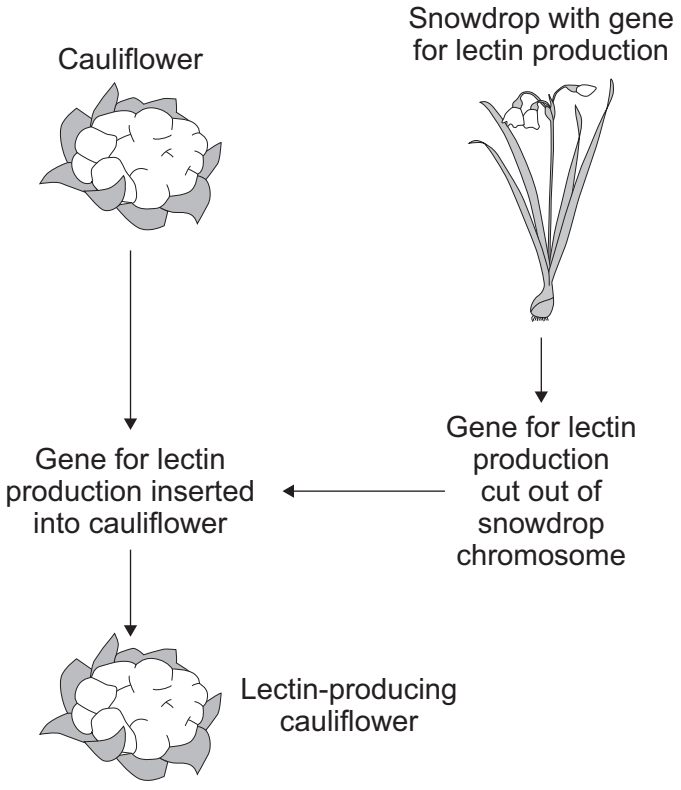
Question 11

June 2010 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Up to 40 % of cauliflower crops may be eaten by insects.
Snowdrops can survive attacks by insects because they produce a substance called lectin.
Lectin interferes with the insect's digestive system.

The diagram shows one method of introducing the gene for lectin production into cauliflowers.



4A The gene for lectin production is cut from the snowdrop chromosome using . . .

1 lectin.

2 a herbicide.

3 an enzyme.

4 an electric shock.

4B The technique used to transfer the gene from the snowdrop to the cauliflower is called . . .

1 biodiversity.

2 embryo transplant.

3 cloning.

4 genetic engineering.

4.6.2.4 Genetic engineering

Question 11 · continued

4C What is the main benefit to the environment of farmers growing lectin-producing cauliflowers?

1 More snowdrops will survive.

2 Less pesticide will be used.

3 Insects will eat something else.

4 Less fertiliser will be needed.

4D An ethical concern about this technique is that . . .

1 it will make farmers richer.

2 it will increase biodiversity.

3 it is interfering with nature.

4 it is sustainable.

Turn over for the next question

4.6.2.4 Genetic engineering

Question 12

November 2010 | BLY1BP | Original Q3 | Legacy

QUESTION THREE

Some foods are produced from genetically modified (GM) crops. Genetic engineering produces GM plants.

3A What is *genetic engineering*?

1 asexual reproduction

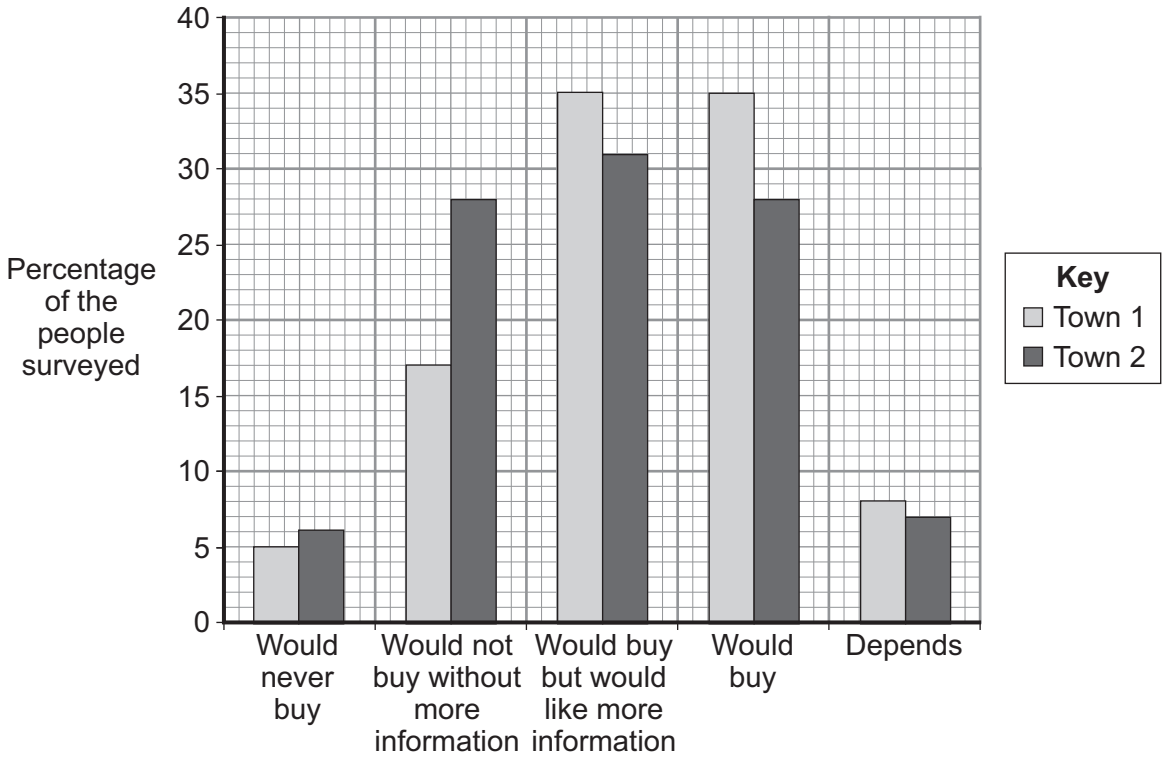
2 transferring new genes to organisms

3 causing mutations in organisms

4 developing disease resistant bacteria

3B **Graph 1** shows what people in **Town 1** and **Town 2** think about GM labelled foods.

Graph 1



Question 12 · continued

In **graph 1**, what percentage of the people surveyed in **Town 1** would buy GM foods, but would like more information about them?

1 28 %

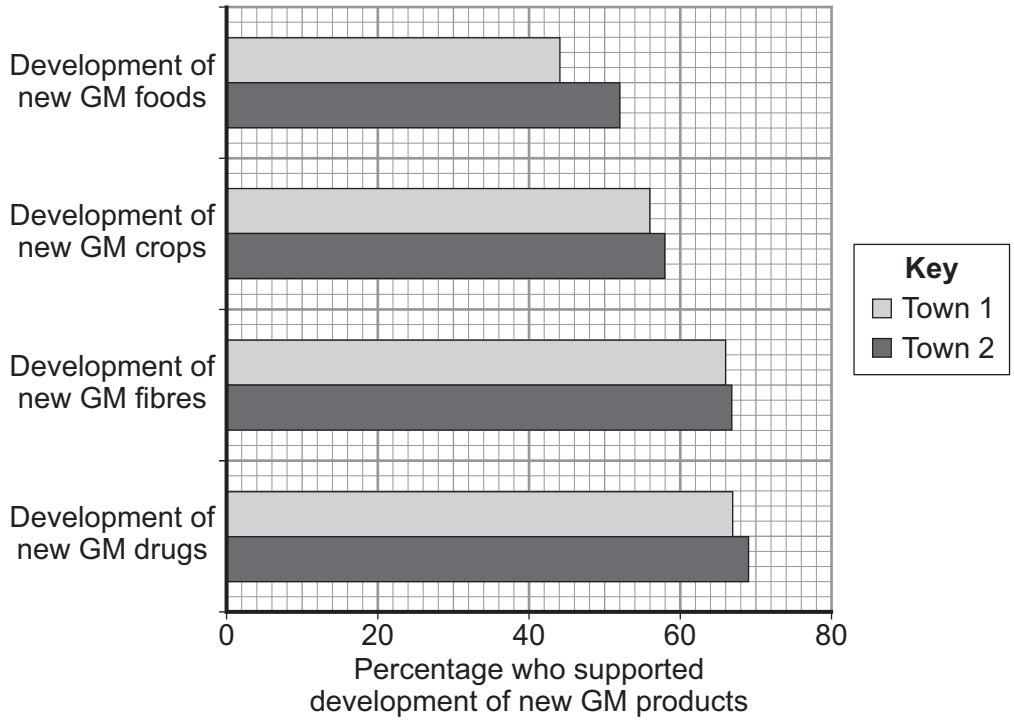
2 31 %

3 35 %

4 66 %

3C **Graph 2** shows the amount of support among people in the two towns for the development of new GM products.

Graph 2



Graph 2 shows that . . .

1 more people in **Town 1** than in **Town 2** support the development of new GM foods.

2 more people in **Town 2** than in **Town 1** support the development of new GM crops.

3 the same number of people in **Town 1** and in **Town 2** support the development of new GM foods.

4 more people in **Town 1** than in **Town 2** support the development of new GM drugs.

3D Some people in England have protested against GM crops being grown and GM foods being sold in shops.

The most likely reason for the protests is that . . .

1 scientists have increased crop yields.

2 people think that GM crops will damage farmland.

3 farmers do not want to grow crops which are resistant to insect attack.

4 people think that GM foods may be a risk to human health.

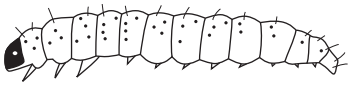
4.6.2.4 Genetic engineering

Question 13

March 2011 | BLY1BP | Original Q4 | Legacy

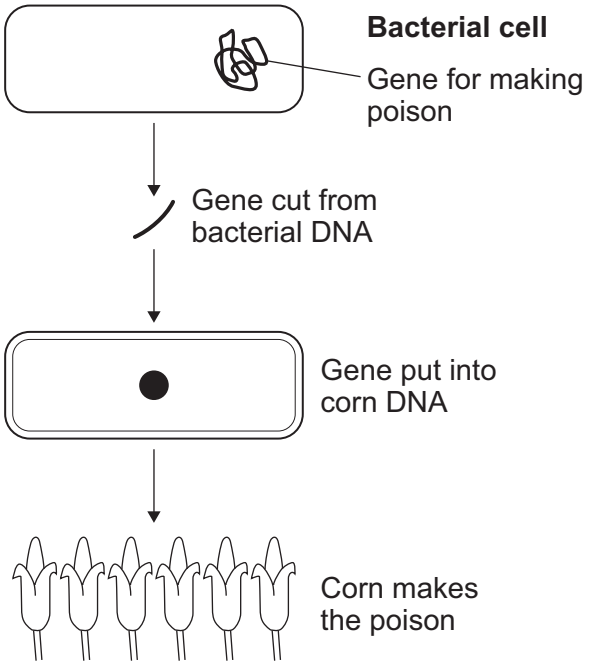
QUESTION FOUR

The drawing shows a European corn borer. European corn borers eat and destroy corn stems.



It is possible to produce corn plants that produce a poison which kills the corn borer if it eats any part of the plant.

The gene for making the poison is cut from the genetic material of a bacterial cell. The gene is then inserted into the cells of a corn plant. The corn plant then produces the poison.



4A Transferring genes from one organism to another is called . . .

1 cloning.

2 evolution.

3 genetic engineering.

4 tissue culture.

4.6.2.4 Genetic engineering

Question 13 · continued

4B One economic benefit of producing this type of corn is that . . .

1 more people will want to buy this type of corn.

2 there will be fewer pests.

3 the farmer will need to use less fertiliser.

4 the farmer will produce more corn.

4C An environmental concern about growing this type of corn is that . . .

1 more chemicals will have to be used on the land.

2 it is against some people's religious beliefs.

3 the bacterial gene may get transferred to wild plant species.

4 this type of corn will be much more expensive.

4D Scientists think that this type of corn is not harmful for people to eat.

This is very difficult to prove because . . .

1 people will not volunteer to be part of a trial.

2 the human diet contains a wide variety of foods.

3 scientists are not allowed to carry out experiments on humans.

4 animals that eat this corn appear to be healthy.

4.6.2.4 Genetic engineering

Question 14

March 2011 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

Read the information about rice growing.

- Rice growing can contribute to global warming.
- Most rice is grown in wetland areas, where other crops cannot grow.
- Methane is produced by bacteria which live in soil water that has very little oxygen in it.
- Rice can be grown on drier land, but yields are reduced.
- Other crops are more profitable in these drier areas.
- Allowing the soil to dry out for a short time increases the amount of oxygen in the soil and increases rice yields.

9A In wetland areas, rice is a very important crop for people's diet and for the economy of these areas.

For people who live in these wetland areas, the best way of reducing methane in the atmosphere is . . .

1 to invest money in new drainage systems.

2 to stop producing rice in wetland areas.

3 to grow more rice in drier areas.

4 to grow other crops in wetland areas.

9B Over its growing period, a rice crop will . . .

1 reduce the amount of carbon dioxide in the atmosphere.

2 reduce the amount of oxygen in the atmosphere.

3 reduce the amount of methane in the atmosphere.

4 have no effect on the composition of the atmosphere.

9C Some varieties of rice plant cause 30 % less methane to be released into the atmosphere. However, these rice plants produce less rice.

Which of the following might produce a high yielding rice plant **and** release less methane?

1 cloning

2 embryo transplantation

3 sexual reproduction

4 tissue culture

4.6.2.4 Genetic engineering

Question 14 · continued

9D A new strain of rice has been genetically modified to produce extra vitamins.

The final decision whether to allow this strain of rice to be grown on a large scale should be taken by . . .

1 farmers.

2 industrialists.

3 politicians.

4 scientists.

END OF TEST

4.6.2.4 Genetic engineering

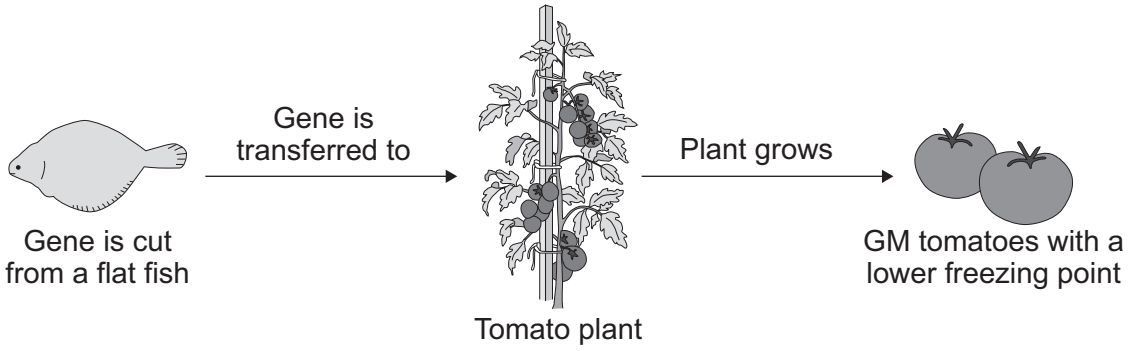
Question 15

June 2011 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Scientists have produced genetically modified (GM) tomatoes. The GM tomatoes freeze at a lower temperature than non-GM tomatoes. GM tomatoes are less likely to be damaged in storage.

The diagram shows how the scientists produced the GM tomatoes by genetic engineering.



4A The scientists removed the gene from the flat fish by using . . .

1 hormones.

2 enzymes.

3 very small scissors.

4 a very fine pipette.

4B The scientists wanted to produce large numbers of plants identical to the new tomato plants quickly.

Which would be the best way of doing this?

1 reproducing the new embryo plant sexually

2 splitting embryos from the new tomato plant

3 growing seeds from the new tomato plant

4 culturing groups of cells from the new tomato plant

4.6.2.4 Genetic engineering

Question 15 · continued

4C One ethical reason for allowing the GM crops to be grown is that . . .

1 scientists know that there are no health risks from eating GM crops.

2 GM companies will make large profits from the sale of GM plants.

3 the high yield from some GM crops could feed starving people.

4 GM crops are not a risk to the environment.

4D Some people object to GM crops because GM crops . . .

1 could be made resistant to insect attack.

2 could have a longer shelf-life.

3 could be made resistant to weedkillers.

4 could transfer genes to wild plants.

Turn over for the next question

4.6.2.4 Genetic engineering

Question 16

November 2011 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Scientists use genetic engineering to produce genetically modified (GM) plants.

4A Which row in the table shows the correct order of sizes of structures involved in genetic engineering?

	Largest → Smallest						
1	chromosome	→	cell	→	gene	→	nucleus
2	nucleus	→	cell	→	chromosome	→	gene
3	cell	→	gene	→	nucleus	→	chromosome
4	cell	→	nucleus	→	chromosome	→	gene

Seeds from crops of oil-seed rape are used to produce biofuels.

Farmers spray their fields with herbicide before planting a crop of oil-seed rape.

GM oil-seed rape was developed to be resistant to the herbicide.

4B The GM oil-seed rape has most probably been developed by . . .

1 spraying herbicide on oil-seed rape plants over several generations.

2 taking cuttings from other species that are resistant to herbicides.

3 transferring genes from other species into oil-seed rape plants.

4 producing mutations in non-GM varieties of oil-seed rape.

4C In trials of the GM crop, four field trials were set up.

Which trial will produce the **smallest** yield of oil-seed rape crop?

1 spraying with herbicide before planting non-GM crops

2 spraying with herbicide during growth of a non-GM crop

3 spraying with herbicide before planting a GM crop

4 spraying with herbicide during growth of a GM crop

4.6.2.4 Genetic engineering

Question 16 · continued

4D The main concern about planting a GM oil-seed rape crop is that the gene for herbicide resistance might spread to . . .

1 wild plants.

2 other oil-seed rape crops.

3 insects.

4 humans.

Turn over for the next question

4.6.2.4 Genetic engineering

Question 17

June 2012 | BL1HP | Original Q6 | Legacy

6 The picture shows a zebra fish.



Illustration © Emily S. Damstra

Zebra fish are small freshwater fish that usually have black and silver stripes.
Zebra fish can tolerate a wide range of environmental conditions.

6 (a) Scientists have genetically modified zebra fish to act as pollution indicators.
The genetically modified zebra fish have a gene transferred from a jellyfish.
The gene allows the stripes of the zebra fish to change colour.

Describe how the scientists produced the genetically modified zebra fish.

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(3 marks)

6 (b) Some scientists are worried about the production of genetically modified zebra fish.

Suggest reasons why.

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(2 marks)

5

4.6.2.4 Genetic engineering

Question 18

June 2014 | BL1HP | Original Q8 | Legacy

8 Read the information.

> Insects can be both useful and harmful to crop plants.
> Insects such as bees pollinate the flowers of some crop plants. Pollination is needed for successful sexual reproduction of crop plants.
> Some insects eat crops and other insects eat the insects that eat crops.
>
> Corn borers are insects that eat maize plants.
> A toxin produced by the bacterium *Bacillus thuringiensis* kills insects.
> Scientists grow *Bacillus thuringiensis* in large containers. The toxin is collected from the containers and is sprayed over maize crops to kill corn borers.
>
> A company has developed genetically modified (GM) maize plants. GM maize plants contain a gene from *Bacillus thuringiensis*. This gene changes the GM maize plants so that they produce the toxin.

8 (a) Describe how scientists can transfer the gene from *Bacillus thuringiensis* to maize plants.

[3 marks]

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4.6.2.4 Genetic engineering

Question 18 · continued

8 (b) Would you advise farmers to grow GM maize plants?

Justify your answer by giving advantages and disadvantages of growing GM maize plants.

Use the information from the box and your own knowledge to help you.

[4 marks]

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7

4.6.2.4 Genetic engineering

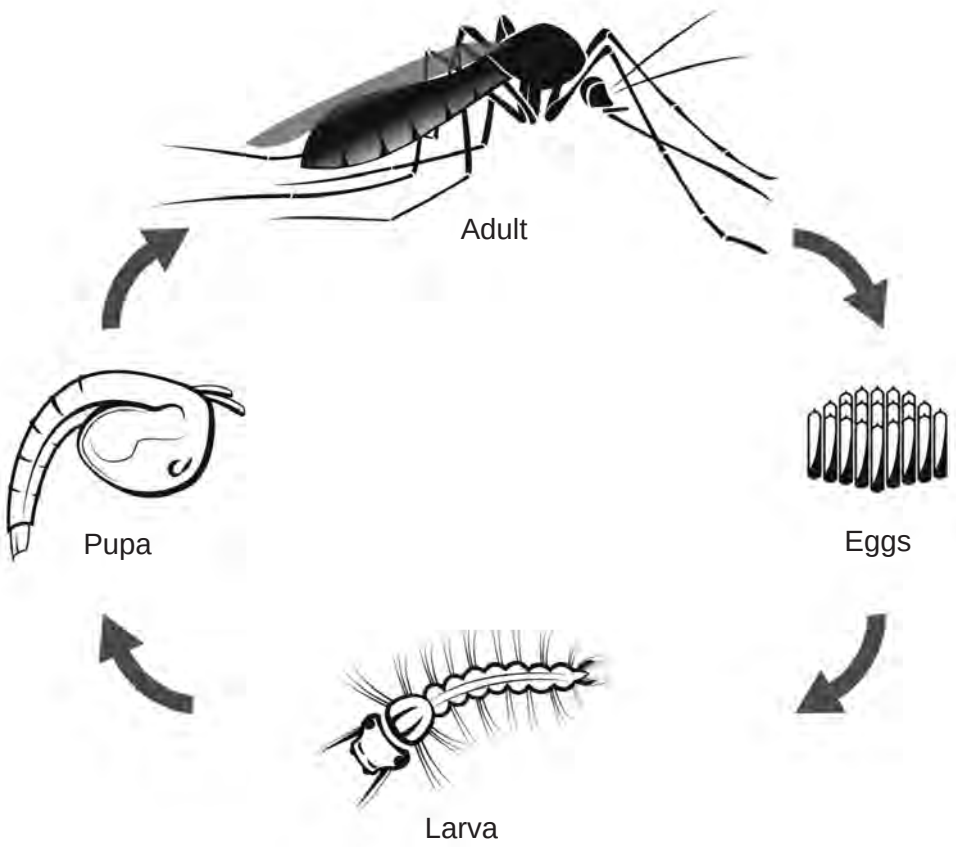
Question 19

June 2016 | BL1HP | Original Q6 | Legacy

6 Malaria is a disease caused by a microorganism carried by mosquitoes.
The microorganism is transferred to humans when adult female mosquitoes feed on human blood.

Figure 5 shows the life cycle of a mosquito.

Figure 5



The World Health Organisation estimates that 3×10^8 people are infected with malaria every year.

Scientists estimate that malaria kills 2×10^6 people every year.

The people who are infected with malaria but do not die, may be seriously ill and need health care for the rest of their lives.

6 (a) Based on the estimated figures, what percentage of people infected with malaria die from the disease?

[2 marks]

4.6.2.4 Genetic engineering

Question 19 · continued

6 (b) An internet article states:

1 Mosquito larvae are at the start of the food chain for some fish.
2 Adult mosquitoes provide food for bats and birds.
3 Mosquitoes are also important in plant reproduction because they feed from flowers of crop plants.

6 (b) (i) The first sentence in the article is **not** correct.

Explain why.

[2 marks]

6 (b) (ii) A company plans to produce genetically modified (GM) adult male mosquitoes. The GM mosquitoes will carry a gene from bacteria. The gene causes the death of offspring before they become adults.

Male mosquitoes do **not** feed on blood.
Scientists are considering releasing millions of adult male GM mosquitoes into the wild.

Do you think scientists should release millions of male GM mosquitoes into the wild?

In your answer you should give advantages and disadvantages of releasing GM mosquitoes into the wild.

[4 marks]

Question 6 continues on the next page

4.6.2.4 Genetic engineering

Question 19 · continued

6 (b) (iii) Describe the process for creating a GM mosquito.

[3 marks]

11

4.6.2.4 Genetic engineering

Question 20

June 2016 | BL3HP | Original Q9 | Legacy

9 **Figure 8** shows some information about 'stem cell burgers'.

Figure 8

The first laboratory burger has now been cooked

In July 2013 the first burger grown from cow stem cells was cooked.

Muscle stem cells from cows were grown into strands of beef in a laboratory. About 20 000 strands of beef were then made into a burger. The burger can be cooked and eaten by humans. This type of meat is called cultured meat.

The cultured meat is exactly the same as normal cow muscle tissue and the cells are not genetically modified.

9 (a) (i) Some scientists think using cultured meat instead of traditionally-produced meat will help reduce global warming.

Suggest **two** reasons why using cultured meat may slow down the rate of global warming.

[2 marks]

1 _____

_____

2 _____

_____

9 (a) (ii) Suggest **two** other possible advantages of producing cultured meat instead of farmed meat.

Do **not** refer to cost in your answer.

[2 marks]

1 _____

_____

2 _____

_____

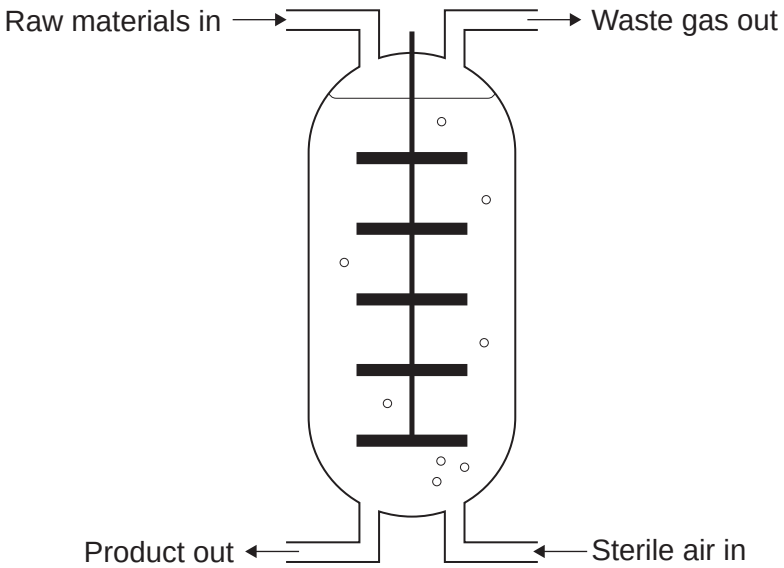
4.6.2.4 Genetic engineering

Question 20 · continued

9 (b) Mycoprotein is one type of food that is mass-produced.

Figure 9 shows a fermenter used to produce mycoprotein.

Figure 9



Describe how mycoprotein is produced.

[4 marks]

8

4.6.2.4 Genetic engineering

Question 21

June 2019 | 8461/2H | Original Q7

0 7 Ragwort is a weed that grows on farmland.

Ragwort is poisonous to horses.

0 7 . 1 Plan an investigation to estimate the size of a population of ragwort growing in a rectangular field on a farm.

[4 marks]

Question 7 continues on the next page

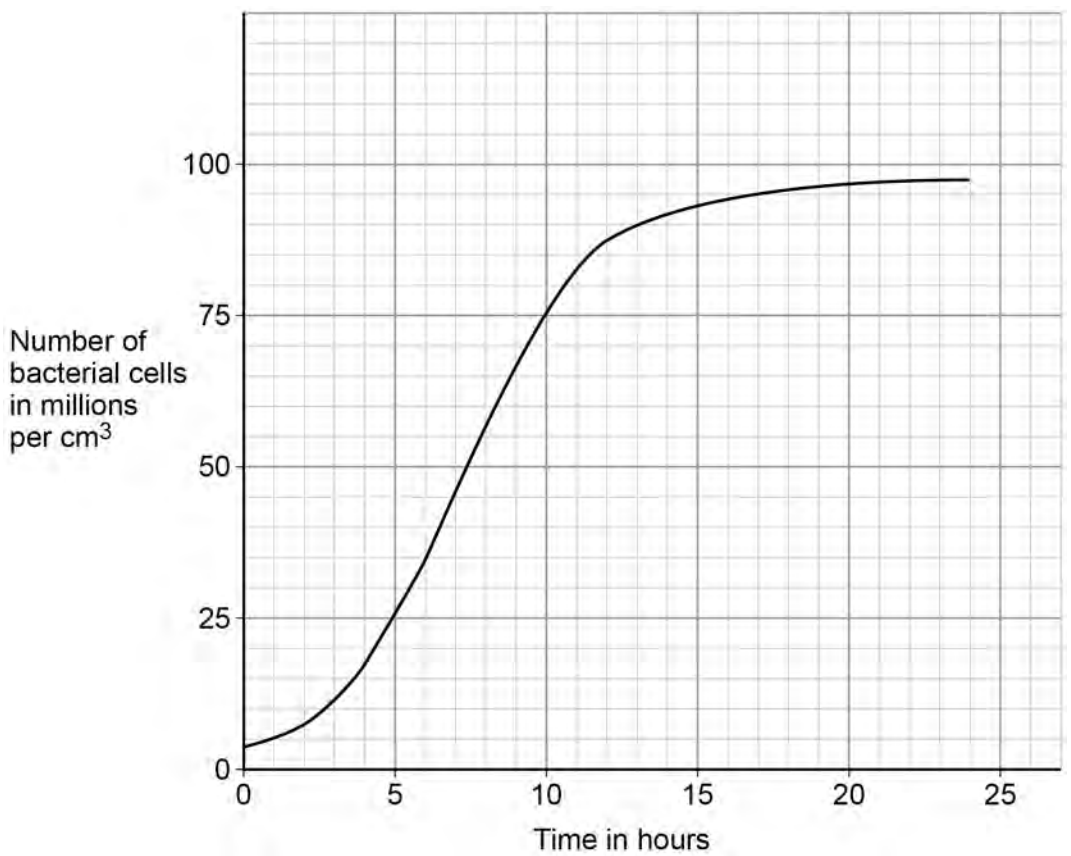
Question 21 · continued

The herbicide glyphosate will kill ragwort and other weeds.

Scientists use bacteria for the genetic engineering of crop plants to make the crops resistant to glyphosate.

Figure 8 shows the growth of a culture of the bacteria in a solution of nutrients at 25 °C

Figure 8



0 7 . 2 Why did the rate of reproduction increase between 2 hours and 7 hours?

[1 mark]

4.6.2.4 Genetic engineering

Question 21 · continued

0 7 . 3 After 12 hours, the rate of reproduction decreased.

Suggest **three** ways the scientists could maintain a high rate of reproduction in the bacterial culture.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 7 . 4 The rate of reproduction of the bacteria is fastest at 7 hours.

How many times faster is the rate of reproduction at 7 hours than the rate at 12 hours?

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

Rate at 7 hours is _____ times faster.

Question 7 continues on the next page

4.6.2.4 Genetic engineering

Question 21 · continued

0 7 . 5 Scientists transferred a gene for resistance to the herbicide glyphosate into the bacteria.

The genetically-modified (GM) bacteria can then transfer the glyphosate-resistance gene to a crop plant.

Explain the advantage of making crop plants resistant to glyphosate.

[3 marks]

15

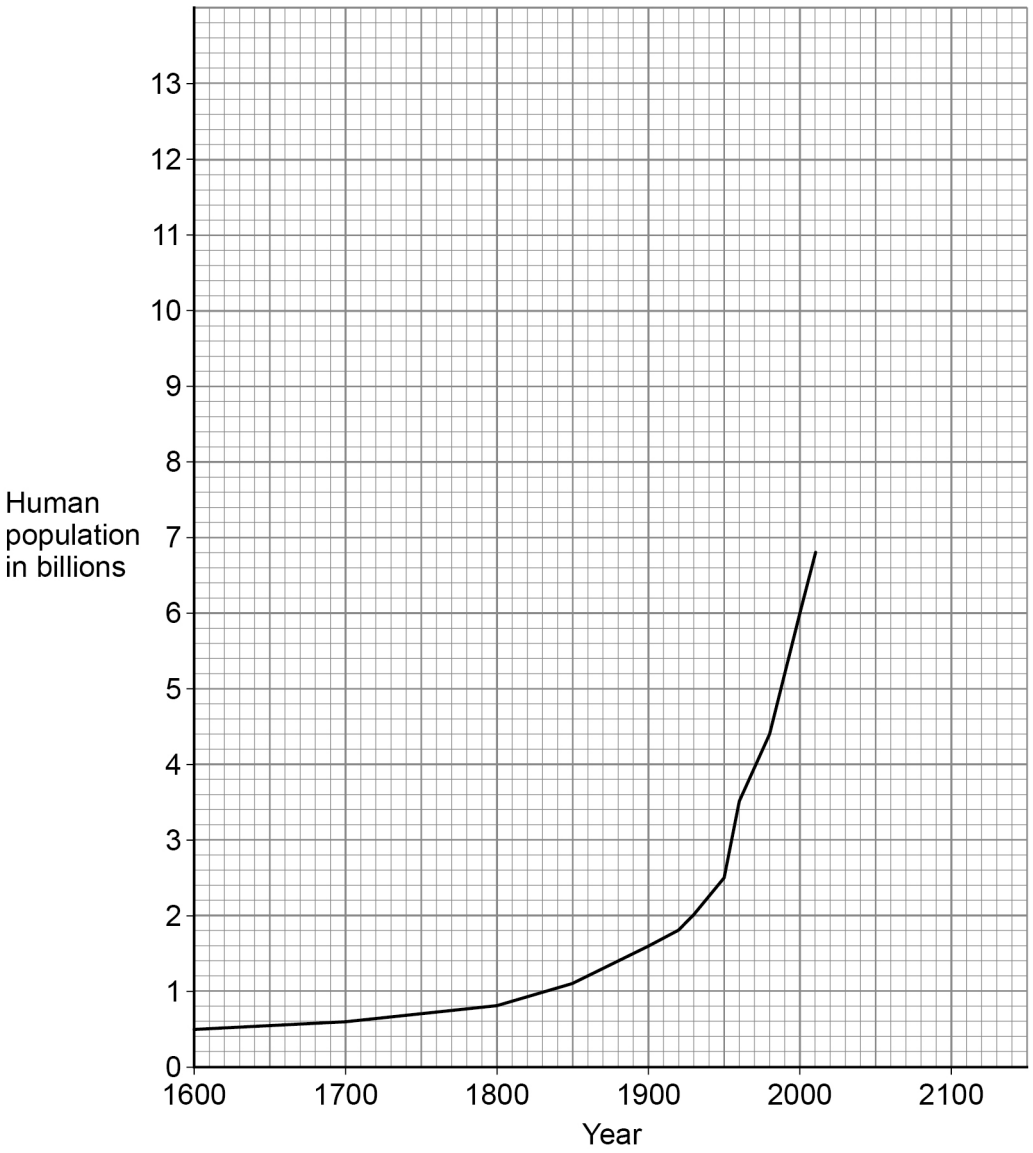
4.6.2.4 Genetic engineering

Question 22

November 2020 | 8461/2H | Original Q2

0 2 **Figure 2** shows the human population from 1600 to 2010.

Figure 2



In 1900 the human population was 1.6 billion.

0 2 . 1 Calculate how many times greater the human population was in the year 2000 compared with the year 1900.

[2 marks]

Number of times greater = _____

4.6.2.4 Genetic engineering

Question 22 · continued

0 2 . 2 In 1950 the human population was 2.5 billion.

Calculate the mean annual increase in the human population between 1900 and 1950.

[2 marks]

Mean annual increase = _____ billion per year

0 2 . 3 Predict the human population in 2050 if the current rate of population increase continues.

You should draw an extrapolation line on **Figure 2**.

[2 marks]

Predicted human population = _____

0 2 . 4 The increasing human population has caused a decline in fish stocks.

Describe how fishing quotas can help to return fish stocks to a sustainable level.

[2 marks]

Question 2 continues on the next page

4.6.2.4 Genetic engineering

Question 22 · continued

0 2 . 5 Farming techniques have changed in recent years.

Describe:

- why more land is being used for farming
- how increased farming has decreased biodiversity.

[6 marks]

4.6.2.4 Genetic engineering

Question 22 · continued

0 2 . 6 Genetic modification of crop plants can help meet the demands of the increasing human population.

Golden rice is a genetically modified (GM) crop.

What is the advantage of golden rice compared with non-GM rice?

[1 mark]

Tick (✓) **one** box.

Golden rice contains protein-rich mycoprotein ☐

Golden rice has improved nutritional value ☐

Golden rice produces human insulin ☐

0 2 . 7 Suggest **one** reason why some people are concerned about the use of golden rice.

[1 mark]

_____

_____

16

4.6.2.4 Genetic engineering

Question 23

June 2024 | 8461/2H | Original Q9

0 9 Glyphosate is a herbicide used in agriculture.

Soya bean plants have been genetically modified (GM) to be resistant to glyphosate.

A farmer can increase the yield of soya beans by:

- growing GM soya bean plants
- spraying glyphosate on the field.

0 9 . 1 Explain how the use of GM soya bean plants **and** glyphosate can increase the yield of soya beans.

[6 marks]

4.6.2.4 Genetic engineering

Question 23 · continued

0 9 . 2 Suggest **two** reasons why some people are concerned about the use of GM soya bean plants.

Do **not** refer to ethical concerns or religion in your answer.

[2 marks]

1 _____

_____

2 _____

_____

8

4.6.2.4 Genetic engineering

Question 24

June 2025 | 8461/2H | Original Q4

0 4 Human growth hormone (hGH) is made by the pituitary gland.

0 4 . 1 Name **one other** hormone made by the pituitary gland.

[1 mark]

0 4 . 2 hGH is a protein.

A child with a deficiency of hGH can be given injections of hGH.

What would happen to the hGH if it was given as a tablet that was swallowed?

[1 mark]

Question 4 continues on the next page

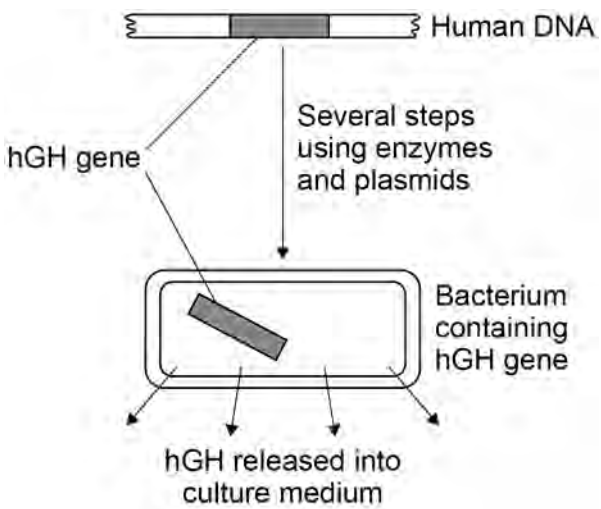
4.6.2.4 Genetic engineering

Question 24 · continued

Scientists can use genetic engineering to make hGH.

Figure 4 shows a summary of the process.

Figure 4



0 4 . 3 Describe how scientists can transfer the gene for hGH from human cells to bacterial cells.

Use information from **Figure 4**.

[4 marks]

Extra space

4.6.2.4 Genetic engineering

Question 24 · continued

0 4 . 4 Growth hormone (GH) can be extracted from the urine of farm animals.

It is better to use hGH made by genetic engineering than to use GH from the urine of farm animals.

Suggest **two** reasons why.

Do **not** refer to ethical reasons or religious beliefs in your answer

[2 marks]

1 _____

_____

2 _____

_____

8

Turn over for the next question