AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.2.4

Genetic engineering

Past-paper questions

Tier	**Foundation**
Question groups	**18**
Available paper years	**2007–2024**

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

January 2007 | BLY1F | Original Q4 | Legacy

4 (a) Use words from the box to complete the sentences about curing disease.

antibiotics	**antibodies**	**antitoxins**	**painkillers**	**statins**

The substances made by white blood cells to kill pathogens are called ..... .

The substances made by white blood cells to counteract poisons produced by pathogens are called ..... .

Medicines which kill bacteria are called ..... .

(3 marks)

(b) The MMR vaccine protects people against three diseases.

Write down the names of **two** of these diseases.

1 .....

2 .....

(2 marks)

(c) All vaccinations involve some risk.

The table shows the risk of developing harmful effects:

- from the disease if a child is **not** given the MMR vaccine;
- if a child **is** given the MMR vaccine.

Harmful effect	Risk of getting the harmful effect from the disease (if not vaccinated)	Risk of getting the harmful effect from MMR vaccine
Convulsions	1 in 200	1 in 1000
Meningitis	1 in 3000	Less than 1 in 1 000 000
Brain damage	1 in 8000	0

4.6.2.4 Genetic engineering

Question 01 · continued

BLANK

A mother is considering if she should have her child vaccinated with the MMR vaccine.

Use information from the table to persuade the mother that she should have her child vaccinated.

.....

.....

.....

.....

(2 marks)

(d) The vaccine used to protect us from the Hepatitis B virus is produced by genetic engineering.

Yeast cells are used to produce the vaccine.

Use words from the box to complete the sentence.

chromosomes	**drugs**	**enzymes**	**genes**	**hormones**

To produce the vaccine ..... are used to cut out .....

from the Hepatitis B virus which are then inserted into the yeast cells.

(2 marks)

9

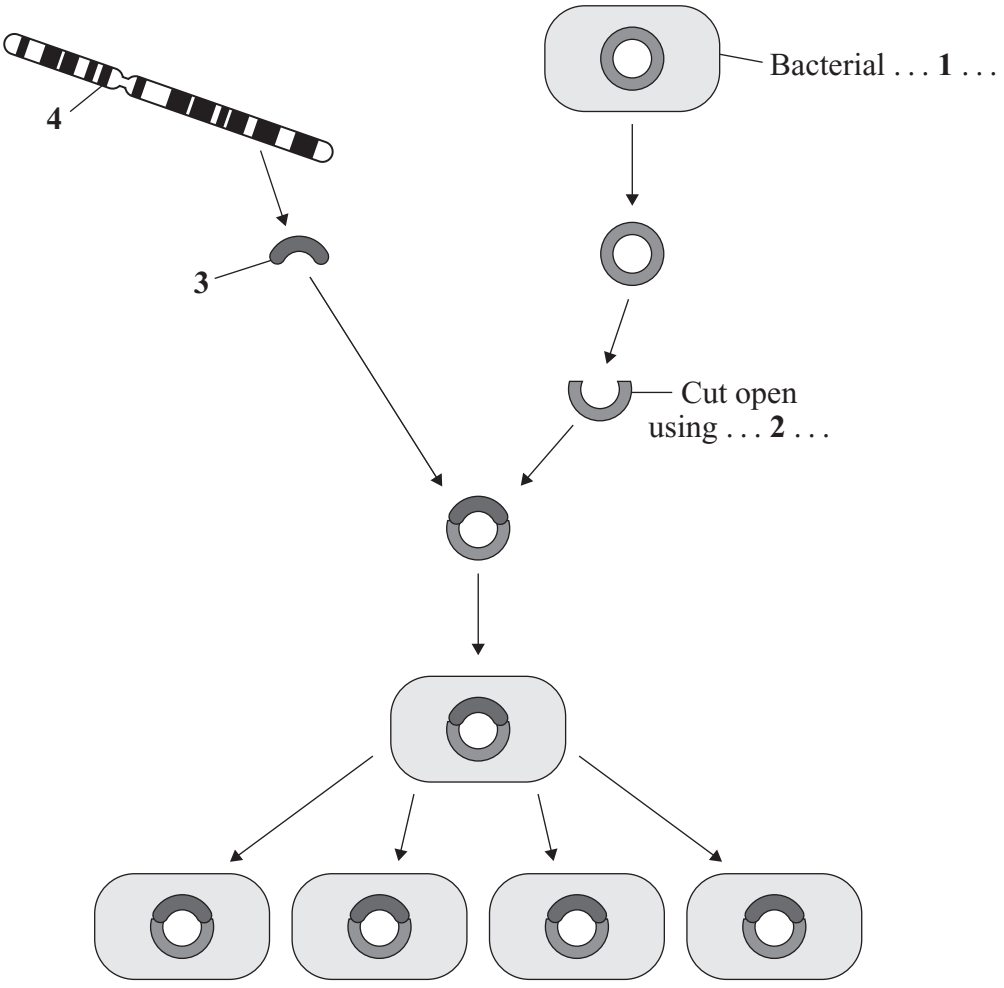
4.6.2.4 Genetic engineering

Question 02

March 2007 | BLY1B | Original Q5 | Legacy

QUESTION FIVE

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



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 03

January 2008 | BLY1F | Original Q5 | Legacy

5 Scientists have produced many different types of GM (genetically modified) food crops.

(a) Use words from the box to complete the sentence about genetic engineering.

clones	**chromosomes**	**embryos**	**genes**

GM crops are produced by cutting ..... out of the

..... of one plant and inserting them into the cells of a crop plant.

(2 marks)

(b) Read the information about GM food crops.

- Herbicide-resistant GM crops produce higher yields.
- Scientists are uncertain about how eating GM food affects our health.
- Insect-resistant GM crops reduce the total use of pesticides.
- GM crops might breed naturally with wild plants.
- Seeds for GM crops can be bought from only one manufacturer.
- The numbers of bees will fall in areas where GM crops are grown.

Use this information to answer these questions.

(i) Give **two** reasons why some farmers are in favour of growing GM crops.

1 .....

.....

2 .....

.....

(2 marks)

(ii) Give **two** reasons why many people are against the growing of GM crops.

1 .....

.....

2 .....

.....

(2 marks)

6

4.6.2.4 Genetic engineering

Question 04

March 2008 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

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.

9A The transfer of genes from the firefly into the bacterium is an example of . . .

1 asexual reproduction.

2 cloning.

3 genetic engineering.

4 transplantation.

9B From which structure in the firefly would scientists cut out the gene that causes glowing?

1 gamete

2 chromosome

3 enzyme

4 cell

9C 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

9D 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

END OF TEST

4.6.2.4 Genetic engineering

Question 05

January 2009 | BLY1F | Original Q4 | Legacy

4 Animals have adaptations that enable them to survive.

4 (a) The photograph shows an echidna.



© Noeline Kelly/Corbis

The echidna has pointed spines on its back.

Explain how these spines might help the echidna to survive.

.....

.....

.....

.....

.....

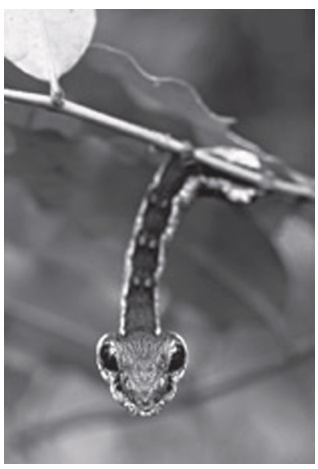
(2 marks)

Question 4 continues on the next page

Question 05 · continued

for mark

4 (b) The photograph shows a caterpillar.



© S.J. Krasemann / Peter Arnold / Still Pictures

Explain how the caterpillar's appearance might help it to survive.

.....

.....

.....

.....

.....

(2 marks)

4.6.2.4 Genetic engineering

Question 05 · continued

for mark

4 (c) Draw a ring around the correct answer to complete each sentence.

4 (c) (i) Evolution can be explained by a theory called

genetic engineering
mutation
natural selection

.

(1 mark)

4 (c) (ii) This theory was suggested by a scientist called Charles

Darwin
Lamarck
Semmelweiss

.

(1 mark)

4 (c) (iii) This scientist said that all living things have evolved from

monkeys
dinosaurs
simple life forms

.

(1 mark)

4 (d) Many religious people oppose the theory of evolution.

Give **one** reason why.

.....

.....

(1 mark)

8

4.6.2.4 Genetic engineering

Question 06

March 2009 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

Insulin is a drug needed by some people suffering from diabetes.

Bacteria can be genetically engineered to produce insulin.

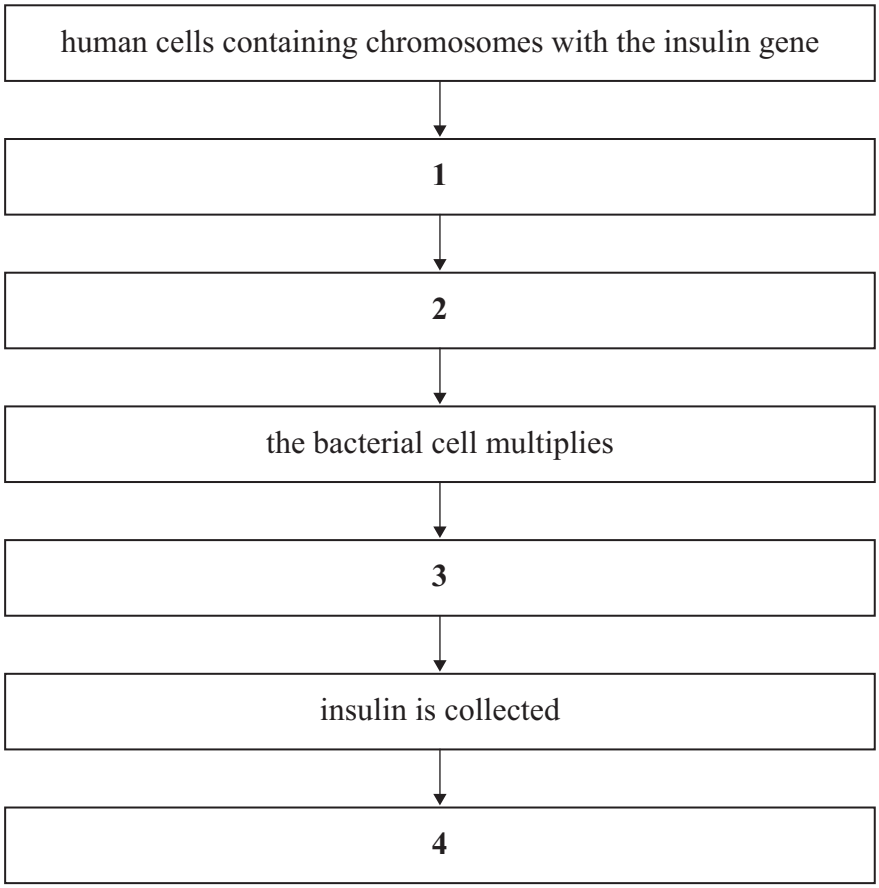
Match statements, **A**, **B**, **C** and **D**, with the labels **1–4** on the flow chart.

A insulin is produced by genetically engineered bacteria

B diabetics inject insulin to control diabetes

C the insulin gene is 'cut out' using enzymes

D the insulin gene is transferred into a bacterium



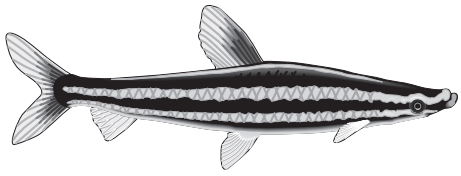
4.6.2.4 Genetic engineering

Question 07

June 2009 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

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.



9A 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

9B 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.

Question 07 · 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				✓

9C 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.

9D 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.

END OF TEST

4.6.2.4 Genetic engineering

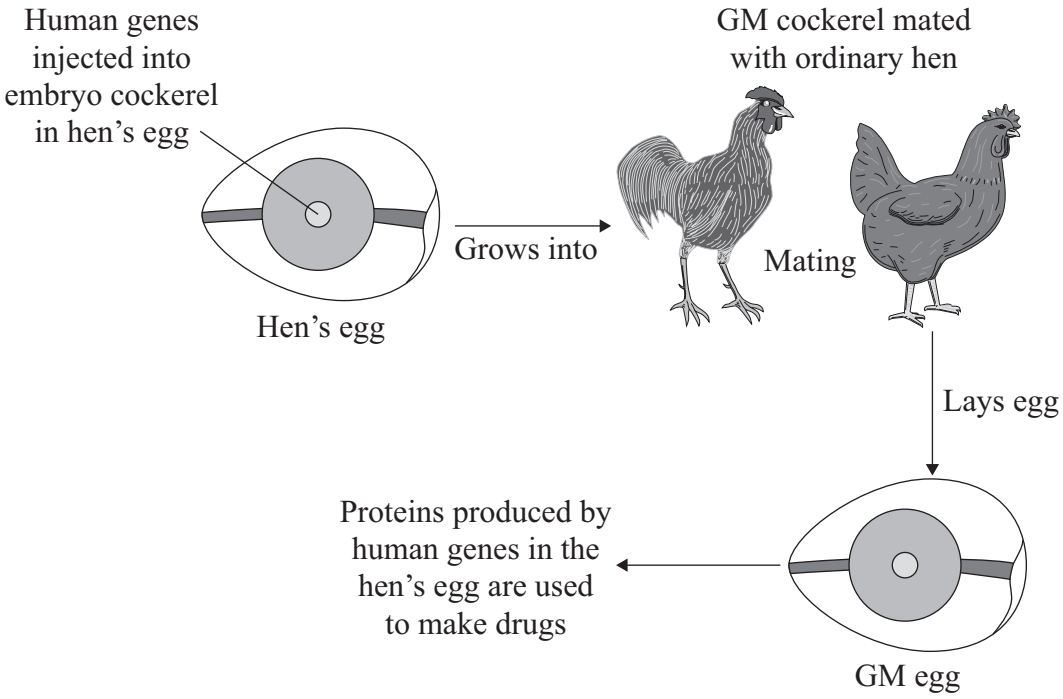
Question 08

January 2010 | BLY1F | Original Q4 | Legacy

4 Scientists have discovered how to produce genetically modified (GM) hens' eggs.

Some proteins produced in GM eggs can be used as drugs to treat humans.

The diagram shows how this is done.



4 (a) Which type of reproduction is involved when the cockerel mates with the hen?

Tick (✓) **one** box.

Asexual ☐

Cloning ☐

Sexual ☐

(1 mark)

4 (b) From which part of a human are the genes cut?

Tick (✓) **one** box.

Chromosome ☐

Embryo ☐

Gland ☐

(1 mark)

4.6.2.4 Genetic engineering

Question 08 · continued

for mark

4 (c) Read the information about genetically modified animals.

- GM animals might escape and breed with wild animals.
- Genetic modification can produce fast-growing animals for food.
- Genetic modification can be used to clone animals in danger of extinction.
- Using GM animals can reduce the number of animals used in medical research.
- Animals have the right to be free from genetic modification.

Use **only** this information to answer these questions.

4 (c) (i) Give **two** reasons why many people are in favour of genetically modified animals.

1 .....

.....

2 .....

.....

(2 marks)

4 (c) (ii) Give **two** reasons why many people are against genetically modified animals.

1 .....

.....

2 .....

.....

(2 marks)

6

4.6.2.4 Genetic engineering

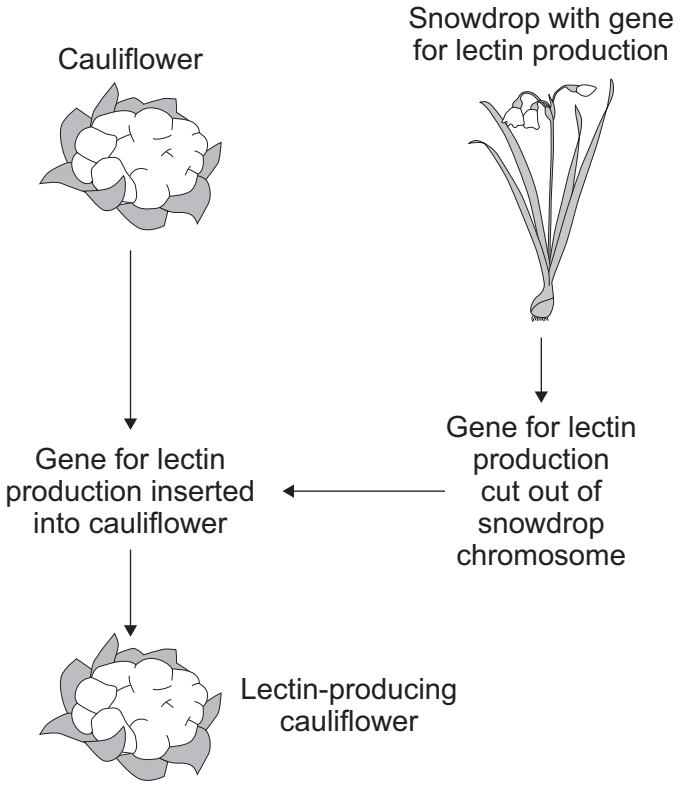
Question 09

June 2010 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

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.



9A The gene for lectin production is cut from the snowdrop chromosome using . . .

1 lectin.

2 a herbicide.

3 an enzyme.

4 an electric shock.

9B 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 09 · continued

9C 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.

9D 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.

END OF TEST

4.6.2.4 Genetic engineering

Question 10

November 2010 | BLY1BP | Original Q8 | Legacy

QUESTION EIGHT

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

8A What is *genetic engineering*?

1 asexual reproduction

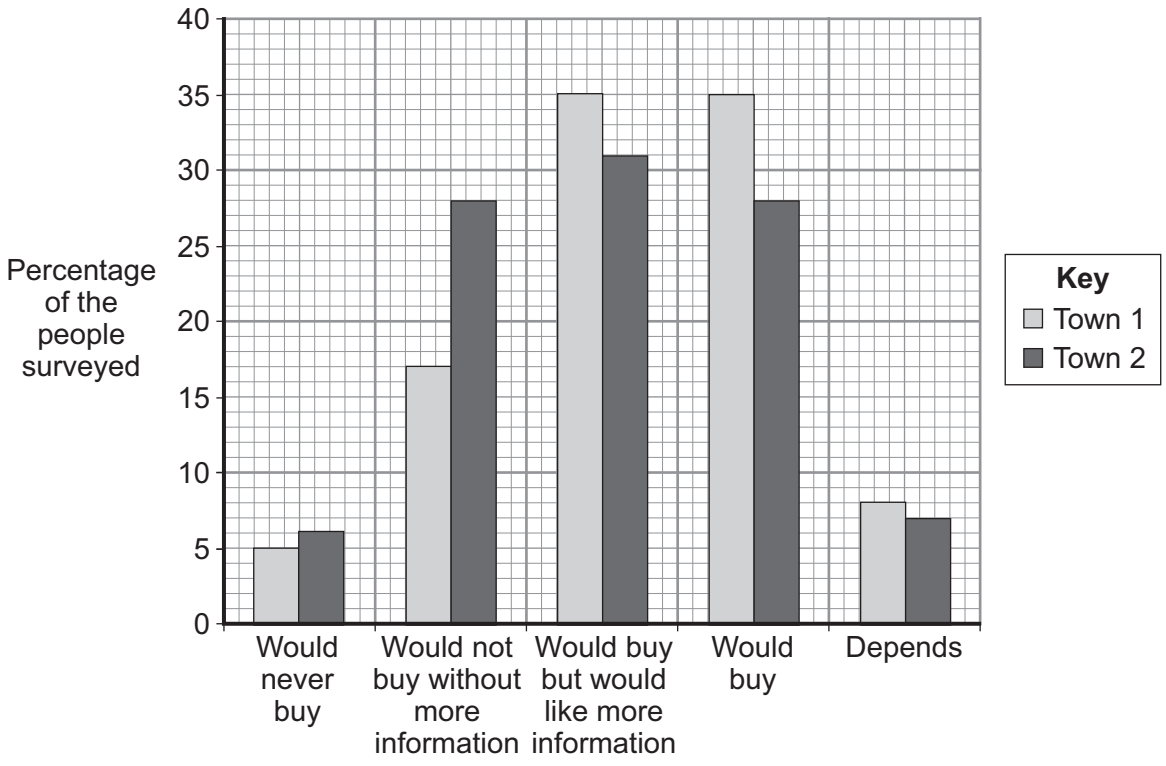
2 transferring new genes to organisms

3 causing mutations in organisms

4 developing disease resistant bacteria

8B **Graph 1** shows what people in **Town 1** and **Town 2** think about GM labelled foods.

Graph 1



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 %

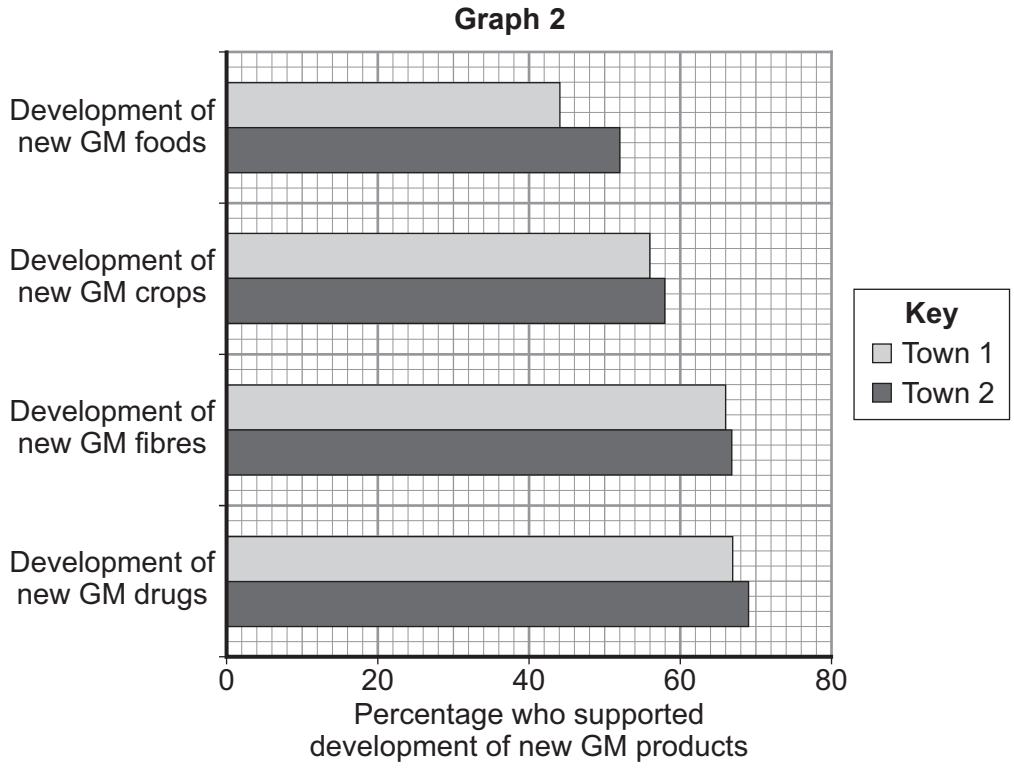
3 35 %

4 66 %

4.6.2.4 Genetic engineering

Question 10 · continued

8C **Graph 2** shows the amount of support among people in the two towns for the development of new GM products.



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.

8D 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 11

January 2011 | BLY1F | Original Q4 | Legacy

4 We can now produce organisms with the characteristics we want the organisms to have.

List A gives the names of four ways of producing organisms.

List B gives information about the ways of producing organisms.

Draw **one** line from each way of producing organisms in **List A** to the correct information in **List B**.

List A **Ways of producing organisms**	**List B** **Information**
	Taking part of the stem from a plant, then putting this part of the stem in wet soil in a plant pot.
Embryo transplantation	
	Growing groups of cells from a plant on special jelly.
Genetic engineering	
	Transferring genes from one organism to a different organism.
Taking cuttings	
	Growing plants from seeds in a garden.
Tissue culture	
	Separating groups of cells from a very young developing animal then putting the groups of cells into host mothers.

(4 marks)

4

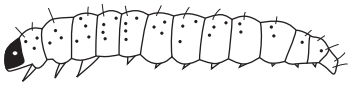
4.6.2.4 Genetic engineering

Question 12

March 2011 | BLY1BP | Original Q9 | Legacy

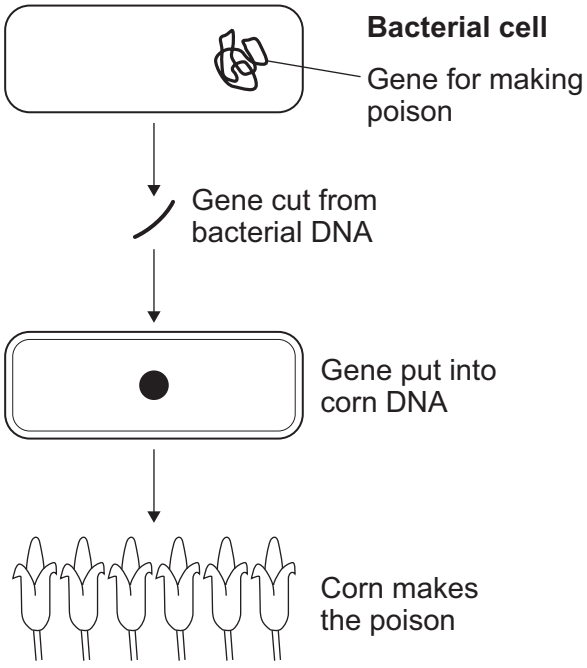
QUESTION NINE

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.



9A 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 12 · continued

9B 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.

9C 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.

9D 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.

END OF TEST

4.6.2.4 Genetic engineering

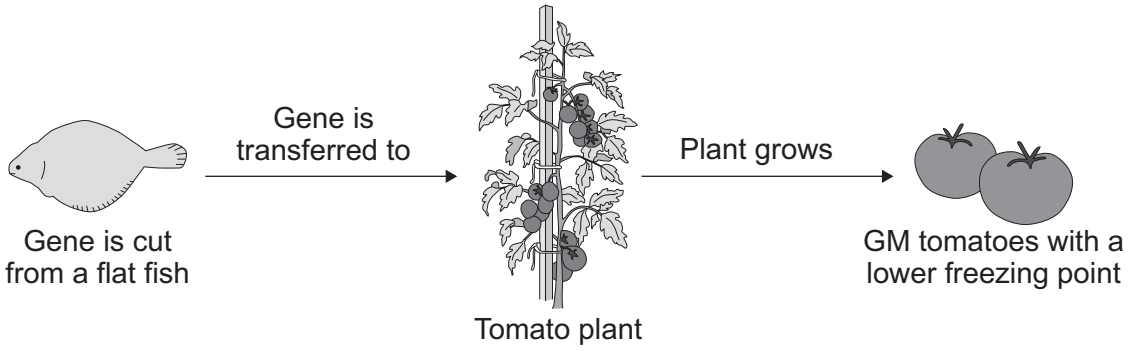
Question 13

June 2011 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

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.



9A The scientists removed the gene from the flat fish by using . . .

1 hormones.

2 enzymes.

3 very small scissors.

4 a very fine pipette.

9B 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 13 · continued

9C 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.

9D 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.

END OF TEST

4.6.2.4 Genetic engineering

Question 14

November 2011 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

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

9A 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.

9B 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.

9C 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 14 · continued

9D 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.

END OF TEST

4.6.2.4 Genetic engineering

Question 15

June 2012 | BL1FP | Original Q6 | Legacy

6 Insecticides are chemicals which kill insects.
Insecticides may be sprayed onto crops to increase crop yield.

6 (a) Killing insects on crops increases crop yield.

Suggest why.

.....

.....

(1 mark)

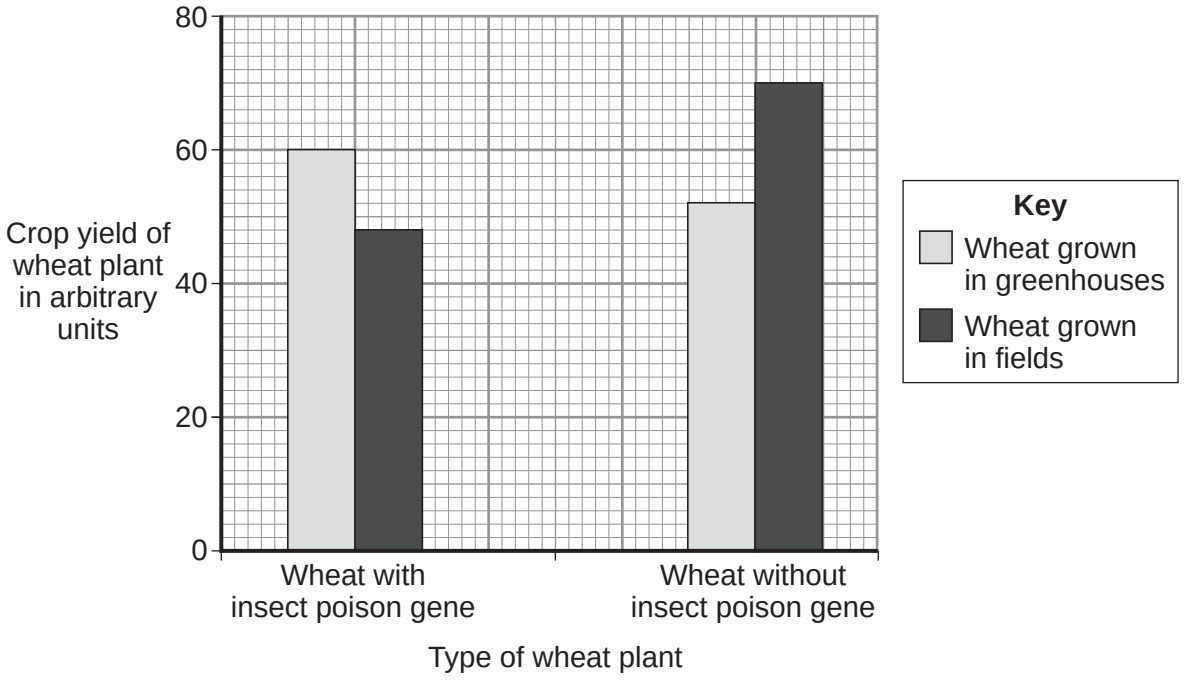
6 (b) A microorganism contains a gene which causes the production of an insect poison.

Scientists transferred the gene for production of the insect poison into wheat plants.
This makes genetically modified (GM) wheat.

The scientists:

- grew wheat plants with the insect poison gene in fields and in greenhouses
- grew wheat plants without the insect poison gene in fields and in greenhouses
- measured the crop yield of the wheat plants.

The bar chart shows the results.



6 (b) (i) What was the yield of the wheat with the insect poison gene grown in greenhouses?

..... arbitrary units
(1 mark)

4.6.2.4 Genetic engineering

Question 15 · continued

6 (b) (ii) The yield from wheat without the insect poison gene grown in greenhouses was different from the yield you gave in **(b)(i)**.

Describe this difference in yield.

.....

.....

.....

.....

(2 marks)

6 (b) (iii) Look again at the bar chart.

What advice would you give to a farmer about the type of wheat to grow in fields?

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

6 (c) Some people are concerned about the use of GM crops.

Why?

.....

.....

.....

.....

.....

(2 marks)

8

4.6.2.4 Genetic engineering

Question 16

June 2013 | BL1FP | Original Q6 | Legacy

6 The photographs show two breeds of cow.

Friesian cow



Jersey cow



In parts **(a)** and **(b)** draw a ring around the correct answer to complete each sentence.

6 (a) Cows produce their young (calves) by

asexual reproduction.
cloning.
sexual reproduction.

(1 mark)

6 (b) Cows and their calves have many similar characteristics.

6 (b) (i) The information for characteristics is carried by

clones.
embryos.
genes.

(1 mark)

6 (b) (ii) The information for characteristics is passed to the next generation in cells

called

body cells.
gametes.
neurones.

(1 mark)

4.6.2.4 Genetic engineering

Question 16 · continued

6 (c) Friesian and Jersey cows can both be used for meat or to produce milk.

The information shows features of Friesian and Jersey cows.

Friesian cows	Jersey cows
Body mass up to 600 kg	Body mass up to 400 kg
Milk contains 3.4% protein	Milk contains 3.8% protein
Can be milked for 325 days after giving birth	Can be milked for 250 days after giving birth
Produce no milk for 55 days before having a calf	Produce no milk for 45 days before having a calf
Produce > 30 litres of milk per day	Produce < 30 litres of milk per day

Use **only** the information above to answer these questions.

In your answers you must make comparisons between the two breeds of cow.

6 (c) (i) Give **two** advantages of a farmer keeping Friesian cows and **not** Jersey cows.

1 .....

.....

2 .....

.....

(2 marks)

6 (c) (ii) Give **two** advantages of a farmer keeping Jersey cows and **not** Friesian cows.

1 .....

.....

2 .....

.....

(2 marks)

Question 6 continues on the next page

4.6.2.4 Genetic engineering

Question 16 · continued

6 (d) Cow's milk is different from human milk. Cow's milk should **not** be given to young human babies.

Scientists in China have *genetically engineered* cows to produce human milk. Milk from these cows can be fed to young human babies.

6 (d) (i) What is *genetic engineering*?

Tick (✓) **one** box.

Genes from one organism are transferred to a different organism ☐

Cells are separated from an embryo and are transferred to host mothers ☐

The nucleus from a body cell is transferred to an egg cell ☐

(1 mark)

6 (d) (ii) Some people are worried about using milk from genetically engineered cows, to feed human babies.

Give **one** reason why.

.....

.....

(1 mark)

9

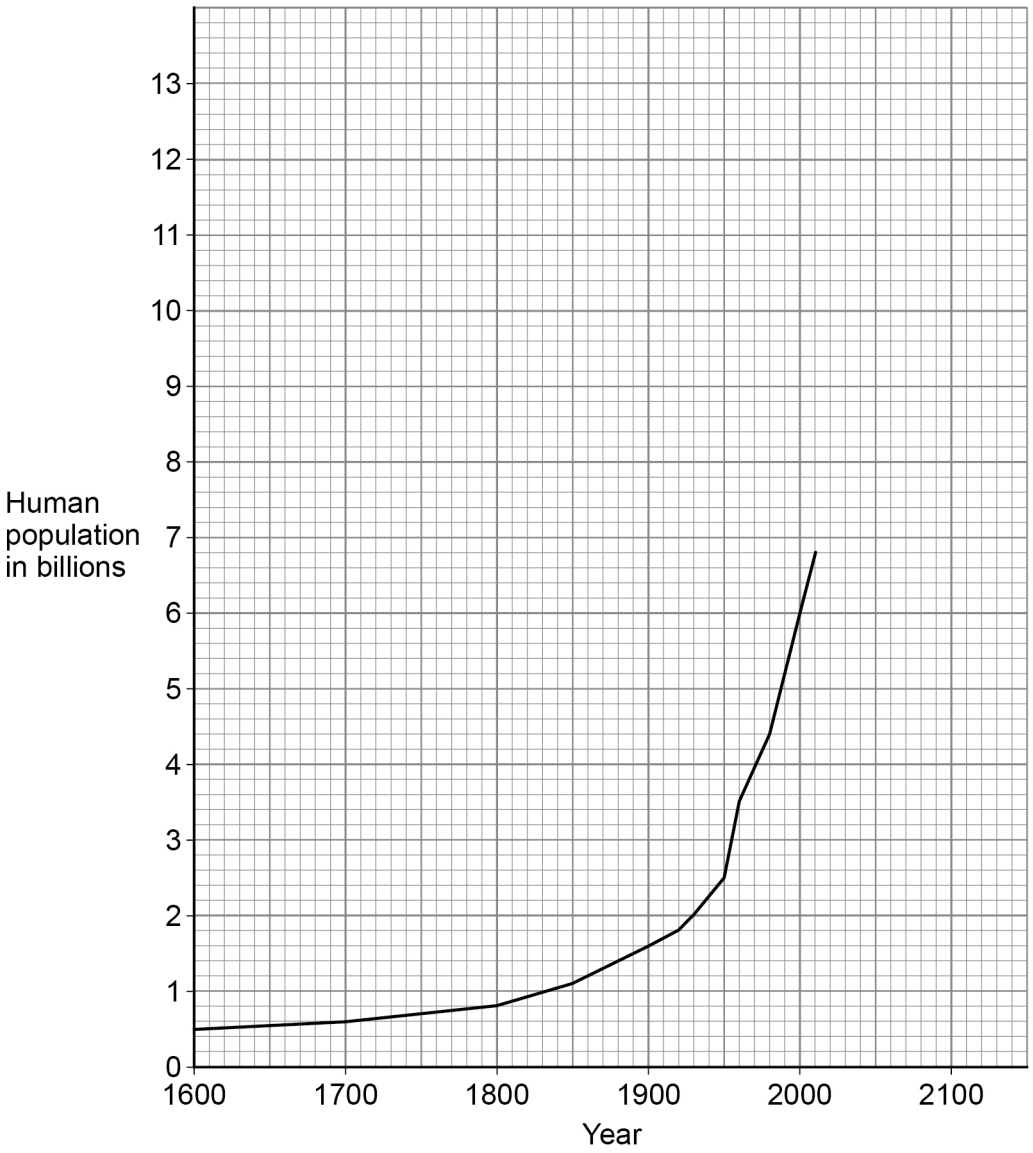
4.6.2.4 Genetic engineering

Question 17

November 2020 | 8461/2F | Original Q9

0 9 **Figure 12** shows the human population from 1600 to 2010.

Figure 12



In 1900 the human population was 1.6 billion.

0 9 . 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 17 · continued

0 9 . 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 9 . 3 Predict the human population in 2050 if the current rate of population increase continues.

You should draw an extrapolation line on **Figure 12**.

[2 marks]

Predicted human population = _____

0 9 . 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 9 continues on the next page

4.6.2.4 Genetic engineering

Question 17 · continued

0 9 . 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 17 · continued

November 2020 | 8461/2F | Original Q9

0 9 . 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 9 . 7 Suggest **one** reason why some people are concerned about the use of golden rice.

[1 mark]

_____

_____

16

4.6.2.4 Genetic engineering

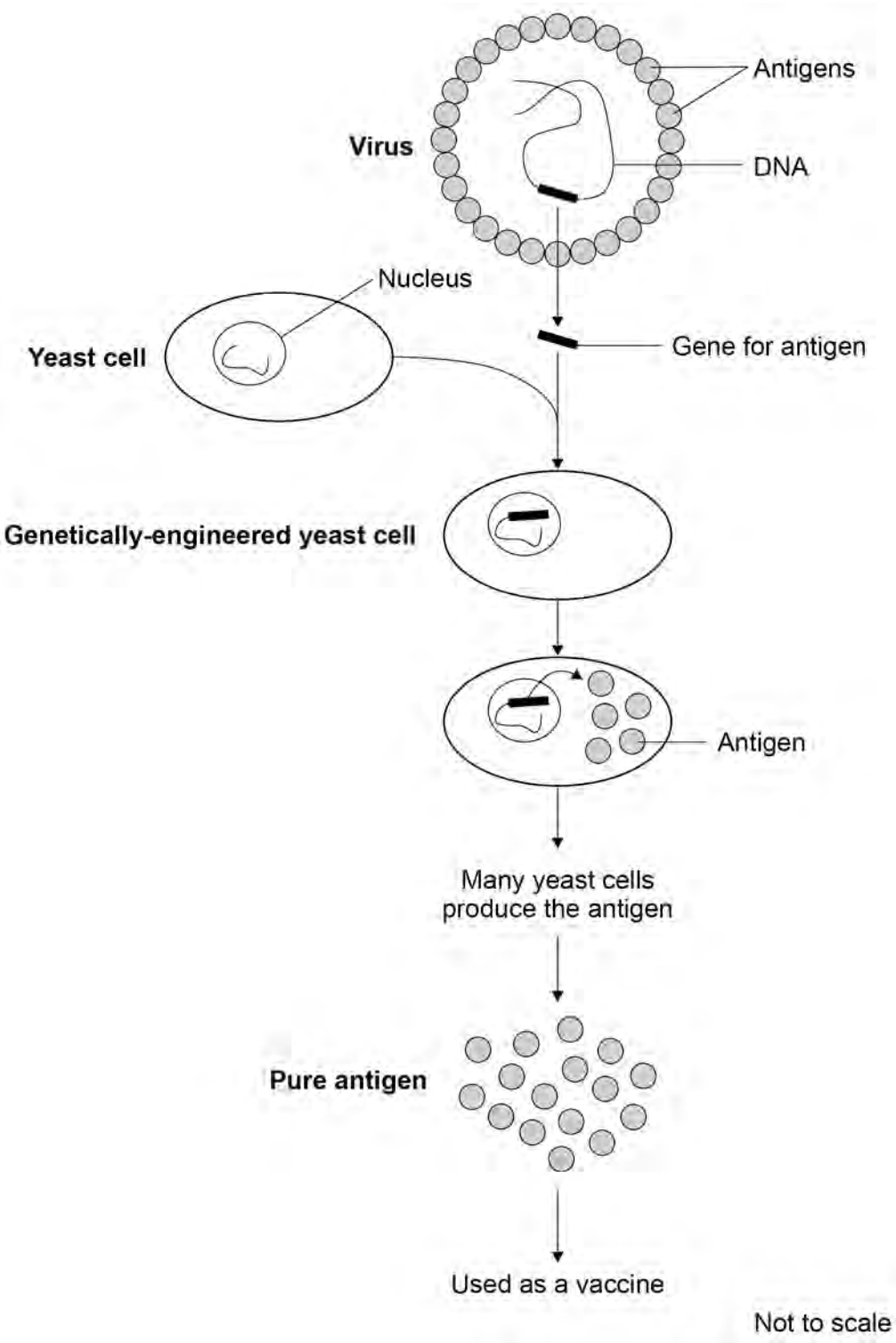
Question 18

June 2024 | 8461/2F | Original Q3

0 3 Genetic engineering can be used for making many useful products.

Figure 3 shows how a vaccine against a virus can be made by genetic engineering.

Figure 3



4.6.2.4 Genetic engineering

Question 18 · continued

Use information from **Figure 3** to answer questions **03.1** and **03.2**.

0 3 . 1 Which part of the virus is put into the yeast cell?

[1 mark]

0 3 . 2 Which part of the virus is made by the yeast cell?

[1 mark]

0 3 . 3 A long time ago, vaccines were made in a different way.

The virus was heated to stop it reproducing.

The vaccine contained whole viruses.

Why might the vaccine containing heat-treated viruses be dangerous?

[1 mark]

Tick (✓) **one** box.

- The viruses may be inactive. ☐
- The viruses may cause an infection. ☐
- The viruses will not mutate. ☐

Question 3 continues on the next page

4.6.2.4 Genetic engineering

Question 18 · continued

Genetic engineering can also be used in agriculture.

Weeds are a problem for farmers because the weeds compete with crop plants.

0 3 . 4 Give **three** factors that the weeds and crop plants compete for.

[3 marks]

1 _____

2 _____

3 _____

Glyphosate is a weed killer used in agriculture.

Genetically modified (GM) maize is a food crop that is resistant to glyphosate weed killer.

Farmers can spray glyphosate on a field to kill the weeds where the GM maize is growing.

0 3 . 5 Suggest **one** advantage of using glyphosate on fields where GM maize is growing.

[1 mark]

_____

_____

0 3 . 6 Suggest **one** problem of using glyphosate on fields where GM maize is growing.

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

[1 mark]

_____

_____

8