

GCSE Combined Science: Trilogy

Worksheet: Genetic engineering

TIME 25 min	TOTAL 24 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Genetic engineering

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Genetic engineering is used in agriculture and in medicine.

0 1 . 1

What is genetic engineering?

Tick (✓) **one** box.

Breeding organisms with desired characteristics over many generations

☐

Growing new plants from small groups of cells

☐

Modifying the genome of an organism by introducing a gene from another organism

☐

Producing identical copies of an adult animal

☐

[1 mark]

0 1 . 2

Bacteria have been genetically engineered to produce a substance used to treat diabetes.

Name this substance.

.....

.....

.....

[1 mark]

0 1 . 3

Which **two** characteristics have crop plants been genetically engineered to have?

Tick (✓) **two** boxes.

Ability to grow without light

☐

Ability to grow without water

☐

Resistance to herbicides

☐

Resistance to insect attack

☐

Ability to make their own mineral ions

☐

[2 marks]

0 1 . 4

What name is given to crops whose genes have been modified by genetic engineering?

[1 mark]

0 2

Genetic engineering is used in agriculture and in medicine.

0 2 . 1

Complete the sentences using words from the box. Each word may be used once or not at all.

bacteria chromosome enzyme gene genome insulin

Genetic engineering involves modifying the of an organism by introducing a from another organism, to give a desired characteristic. For example, have been genetically engineered to produce human to treat diabetes.

[4 marks]

0 2 . 2

Which characteristic have crop plants been genetically engineered to have?

Tick (✓) **one** box.

Lower yields

☐

Resistance to insect attack

☐

Slower growth

☐

Smaller fruits

☐

[1 mark]

0 3

A type of salmon has been genetically engineered with a growth-hormone gene from another species of fish. The genetically modified (GM) salmon reach the size at which they are sold in about 18 months, compared with about 36 months for ordinary farmed salmon.

0 3 . 1

Calculate the percentage decrease in the time taken to reach the size at which the salmon are sold.

.....

.....

.....

.....

Percentage decrease = %

[2 marks]

0 3 . 2

Suggest **one** advantage to a fish farmer of growing the GM salmon.

.....

.....

[1 mark]

0 3 . 3

GM salmon are only allowed to be farmed in tanks on land, not in cages in the sea.

Suggest why.

.....

.....

.....

.....

[2 marks]

0 4

In genetic engineering, a plasmid 5000 base pairs long was cut open at one site. A human gene 1800 base pairs long was inserted at the cut, and the plasmid was closed into a circle again.

0 4 . 1

Calculate the length of the new plasmid.

.....

.....

.....

Length = base pairs

[1 mark]

0 4 . 2

Calculate the percentage of the new plasmid that is made up of the inserted gene.

Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage = %

[2 marks]

0 5

Some maize plants have been genetically engineered to produce a protein that kills insects that eat them. Scientists compared these GM plants with non-GM maize grown in the same area. Table 1 shows the results.

Table 1

Type of maize	Mean yield in tonnes per hectare	Mean mass of insecticide sprayed in kg per hectare
non-GM	8.2	1.5
GM (insect-resistant)	9.4	0.3

0 5 . 1

Calculate the percentage increase in yield for the GM maize compared with the non-GM maize.

Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage increase = %

[2 marks]

0 5 . 2

Explain why the GM maize had a higher yield and needed less insecticide.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Give **two** concerns that some people have about growing GM crops.

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Genetic engineering · 24 marks

Question 1 (5 marks)

01.1 [1 mark]

Correct: Modifying the genome of an organism by introducing a gene from another organism

01.2 [1 mark]

Answer: (Human) insulin

- (human) insulin (1)
-

01.3 [2 marks]

Correct: Resistance to herbicides; Resistance to insect attack

01.4 [1 mark]

Answer: Genetically modified (GM) crops

- genetically modified / GM (crops) (1)
-
-

Question 2 (5 marks)

02.1 [4 marks]

Answer: genome; gene; bacteria; insulin

- genome (1)
 - gene (1)
 - bacteria (1)
 - insulin (1)
-

02.2 [1 mark]

Correct: Resistance to insect attack

Question 3 (5 marks)

03.1 [2 marks]

Answer: 50%

- $(36 - 18) \div 36 \times 100$ (1)
- 50 (%) (1)

Notes: Correct answer with no working scores 2 marks.

03.2 [1 mark]

Answer: More fish can be produced each year from the same tanks

- more fish can be produced in a year / the fish can be sold sooner / less food and space is needed per fish sold (1)
-

03.3 [2 marks]

Answer: To stop the GM salmon escaping into the sea, where they could breed with wild salmon and pass on the gene, or compete with wild fish

- to stop GM salmon escaping into the wild (1)
 - where they could breed with wild salmon and pass on the gene / compete with wild fish for food, affecting wild populations (1)
-

Question 4 (3 marks)

04.1 [1 mark]

Answer: 6800 base pairs

- $5000 + 1800 = 6800$ (1)
-

04.2 [2 marks]

Answer: 26.5%

- $1800 \div 6800 \times 100$ (1)
- 26.5 (%) (1)

Notes: Correct answer with no working scores 2 marks. An answer not given to 3 significant figures scores 1 mark. 36.0% (dividing by the original plasmid length) scores 1 mark. Allow ECF from the previous part.

Question 5 (6 marks)

05.1 [2 marks]

Answer: 14.6%

- $(9.4 - 8.2) \div 8.2 \times 100$ (1)
- 14.6 (%) (1)

Notes: Correct answer with no working scores 2 marks. 14.63 or 15 (not given to 3 significant figures) scores 1 mark.

05.2 [2 marks]

Answer: Insects that eat the GM maize are killed, so less of the crop is damaged and farmers do not need to spray as much insecticide

- insects feeding on the plants are killed so less damage to the crop (1)
- (so) less insecticide needs to be sprayed (1)

05.3 [2 marks]

Answer: Effects on populations of wild flowers and insects; the effects of eating GM crops on human health have not been fully explored; genes could spread to wild plants

- effect on populations of wild flowers / insects (1)
- effects of eating GM crops on human health have not been fully explored (1)
- genes may spread to wild plants / other crops (e.g. by pollen) (1)

Any 2 of the points above.
