

GCSE Biology

Worksheet: Role of biotechnology

TIME 30 min	TOTAL 27 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Role of biotechnology

NAME

CLASS

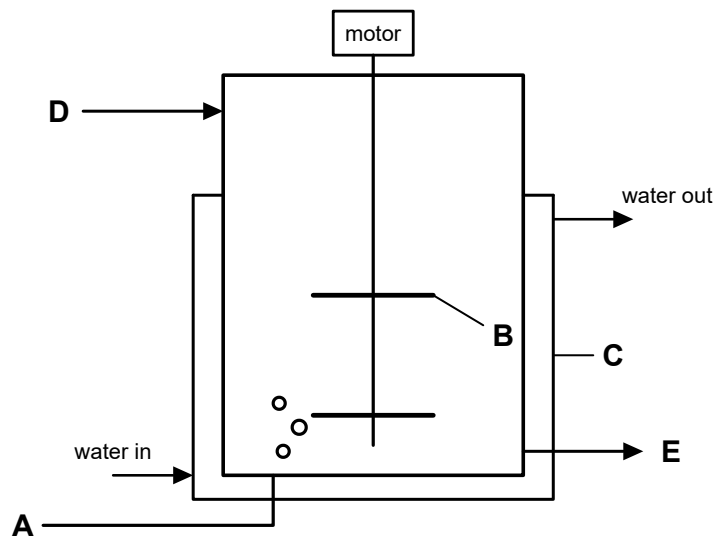
DATE

- 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

Figure 1 shows a fermenter used to grow the fungus that is used to make mycoprotein.

Figure 1



0 1 . 1

Table 1

Function	Letter
Adds sterile air, which provides oxygen for aerobic respiration	
Mixes the contents so that the fungus is evenly spread	
Keeps the temperature at the optimum for the fungus	
Adds glucose syrup, which the fungus uses as food	

Table 1 lists four functions of parts of the fermenter. Write the letter from Figure 1 for the part that carries out each function.

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[4 marks]

0 1 . 2

The fungus is grown in aerobic conditions.
What does **aerobic** mean?

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.....

[1 mark]

0 2

Modern biotechnology techniques allow large quantities of microorganisms to be grown for food.

0 2 . 1

Mycoprotein is made from a microorganism.
What type of microorganism is used?

Tick (✓) **one** box.

A bacterium

☐

A fungus

☐

A protist

☐

A virus

☐

[1 mark]

0 2 . 2

Name the microorganism used to make mycoprotein.

.....

.....

.....

[1 mark]

0 2 . 3

Why is mycoprotein suitable for vegetarians?

.....

.....

[1 mark]

0 2 . 4

Name **one** genetically modified crop that provides food with improved nutritional value.

.....

.....

.....

.....

[1 mark]

0 3

Table 2 compares the nutrients in 100 g of mycoprotein and in 100 g of beef mince.

Table 2

Nutrient	Mycoprotein	Beef mince
Protein in g	11	20
Fat in g	2.9	15
Fibre in g	6	0
Cholesterol in mg	0	60

0 3 . 1

Calculate the mass of mycoprotein that contains the same mass of protein as 100 g of beef mince.
Give your answer to the nearest gram.

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.....

.....

Mass = g

[2 marks]

0 3 . 2

Suggest **two** health advantages of eating mycoprotein instead of beef mince.

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.....

.....

[2 marks]

0 3 . 3

Explain why mycoprotein is suitable for vegetarians.

.....

.....

[1 mark]

0 3 . 4

Describe how mycoprotein is produced.

.....

.....

.....

.....

[2 marks]

0 4

The fungus *Fusarium* is grown continuously in a large fermenter that contains 100 m³ of culture. Every hour, 10% of the culture is removed and replaced with fresh glucose syrup. Each cubic metre of the culture that is removed contains 15 kg of fungus.

0 4 . 1

Calculate the volume of culture removed from the fermenter each hour.

.....

.....

.....

Volume = m³

[1 mark]

0 4 . 2

Calculate the mass of fungus harvested from the fermenter in one day.

.....

.....

.....

.....

Mass of fungus = kg

[2 marks]

0 4 . 3

Suggest **two** advantages of removing a small part of the culture every hour, rather than letting the fungus grow for several days and then harvesting all of it at once.

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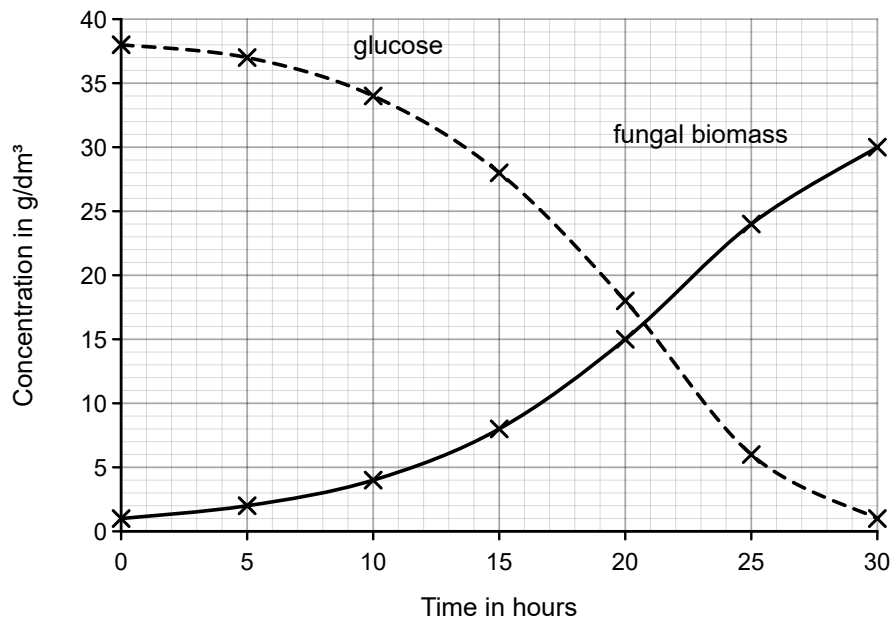
[2 marks]

.....

0 5

Figure 2 shows the concentration of fungal biomass and the concentration of glucose in a fermenter over 30 hours.

Figure 2



0 5 . 1

Calculate the mean rate of increase in fungal biomass between 10 hours and 20 hours.
Give the unit.

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.....

.....

.....

Mean rate =

[2 marks]

0 5 . 2

Explain why the concentration of glucose decreased.

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.....

.....

.....

[2 marks]

0 5 . 3

Suggest why the increase in fungal biomass slowed down after 25 hours.

.....

.....

[1 mark]

0 5 . 4

In some factories, fresh glucose syrup is added all the time, and some of the culture is removed.

Suggest **one** advantage of this.

.....

.....

[1 mark]

END OF QUESTIONS

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

Mark scheme

GCSE Biology · Worksheet: Role of biotechnology · 27 marks

Question 1 (5 marks)

01.1 [4 marks]

Answer: A; B; C; D

- adds sterile air: A (1)
 - mixes the contents: B (1)
 - keeps the temperature constant: C (1)
 - adds glucose syrup: D (1)
-

01.2 [1 mark]

- with oxygen / oxygen is present (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: A fungus

02.2 [1 mark]

Answer: *Fusarium*

- *Fusarium* (1)
-

02.3 [1 mark]

- it is a protein-rich food that does not come from animals (it is made from a fungus) (1)
-

02.4 [1 mark]

Answer: Golden rice

- golden rice (1)
-

Question 3 (7 marks)

03.1 [2 marks]

Answer: 182 g

- $20 \div 11 \times 100$ (1)
- 182 (g) (1)

Notes: An answer of 181.8 (not given to the nearest gram) scores 1 mark.

03.2 [2 marks]

- it contains less fat, so there is less risk of obesity (1)
- it contains no cholesterol / less fat, so there is less risk of coronary heart disease (1)
- it contains more fibre, which helps digestion (1)

Any 2 of the points above.

03.3 [1 mark]

- it is made from a fungus, not from animals (1)
-

03.4 [2 marks]

- the fungus *Fusarium* is grown on glucose syrup (1)
- in aerobic conditions in a fermenter (1)
- the fungal biomass is harvested and purified (1)

Any 2 of the points above.

Question 4 (5 marks)

04.1 [1 mark]

Answer: 10 m^3

- $100 \times 0.1 = 10 \text{ (m}^3\text{)} (1)$

04.2 [2 marks]

Answer: 3600 kg

- mass removed each hour = $10 \times 15 = 150 \text{ kg} (1)$
- $150 \times 24 = 3600 \text{ (kg)} (1)$

Notes: Allow ECF from the previous part.

04.3 [2 marks]

- the fungus is harvested all the time, so production does not stop (1)
- fresh glucose syrup is added all the time, so the fungus does not run out of food and keeps growing quickly (1)
- waste products are removed, so they do not build up and slow the growth of the fungus (1)
- the fermenter does not need to be emptied, cleaned, sterilised and restarted as often, which saves time and money (1)

Any 2 of the points above.

Question 5 (6 marks)

05.1 [2 marks]

Answer: 1.1 g/dm^3 per hour

- $(15 - 4) \div 10 = 1.1$ (1)
- g/dm^3 per hour (1)

Notes: The unit mark is independent: allow g per dm^3 per hour or $\text{g/dm}^3/\text{h}$.

05.2 [2 marks]

- the fungus used glucose in respiration, to release energy (1)
- and to make new biomass, e.g. proteins and cell walls, for growth (1)

05.3 [1 mark]

- the glucose was running out, so it limited growth (1)

05.4 [1 mark]

- the fungus keeps growing quickly because the glucose never runs out (1)
- mycoprotein can be harvested all the time, so more is produced (1)

Any 1 of the points above.
