



QUESTION WORKBOOK

Industrial biotechnology and fermentation

Gene regulation, genomics and biotechnology · Unit B17

OCR A 6.2.1 · Edexcel A 4.14, 8.17 · Edexcel B 6.1 i, 6.1 ii, 6.1 iii, 6.1 v

15 questions · 51 marks

NAVY SCREEN EDITION

Every question in this book has a code beside its number.
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SECTION A · Short, 1 to 2 marks**A1**

IB-Q7

Apart from their rapid growth, state two reasons why industry grows microorganisms rather than farming a plant or an animal for the same product.

[2]

A2

IB-Q15

Name the fungus used to produce mycoprotein, and name the two substances supplied as its main carbon and nitrogen sources during culture.

[2]

SECTION B · Standard, 3 to 5 marks**B1**

IB-Q1

Describe how the conditions inside a stirred-tank fermenter are held at the optimum for the production organism, naming the part of the fermenter responsible in each case.

[4]

B2
IB-Q2

Compare batch fermentation with continuous fermentation, referring to the closed-culture growth curve in your answer.

[4]

B3
IB-Q3

A company cultures a bacterium that secretes a new antibiotic only once the culture stops dividing. It also sells the bacterial biomass itself as animal feed. Suggest which fermentation method suits each product, and suggest why.

[4]

B4
IB-Q4

A local authority proposes to replace part of the meat served in its school meals with mycoprotein. Evaluate this proposal.

[4]

B5

IB-Q8

Describe how mycoprotein is produced from *Fusarium venenatum*, from culture to finished food. [4]

B6

IB-Q9

Describe the four phases of the closed-culture growth curve that a batch fermentation passes through, in order. [4]

B7

IB-Q10

A continuous fermenter has a working volume of 8000 dm^3 and is run at a dilution rate of 0.15 per hour. Calculate the flow rate of fresh medium into the fermenter in dm^3 per hour, and calculate how long it takes for a volume of medium equal to the whole vessel to pass through. [4]

B8
IB-Q11

A small start-up proposes cutting costs by skipping the steam sterilisation of its fermenter medium, relying only on filtering the incoming air. Evaluate this proposal. [4]

B9
IB-Q5

Explain why a fermenter must be run under aseptic conditions, and explain how those conditions are achieved at industrial scale. [3]

B10
IB-Q6

A fermenter is inoculated with 5.0×10^4 bacteria of a strain whose doubling time under these conditions is 20 minutes. Calculate the number of bacteria present after 4 hours of exponential growth. [3]

B11
IB-Q12

Explain why microbial cells intended as human food have their nucleic acid content reduced during processing. [3]

B12

IB-Q13

Compare the generation time of a bacterium such as *Escherichia coli* with that of a fungus and with that of a farm animal such as a cow, and compare the consequence each has for industrial production. [3]

B13

IB-Q14

Explain why the temperature and pH probes in a fermenter are described as providing negative feedback. [3]

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