

Use of biological resources practice questions

19 questions · 58 marks · mark scheme at the back

For Edexcel International GCSE Science (Double Award) 4SD0.

Name

Total / 58

Food production: crop plants Spec 5.1-5.4

1 Which change in a glasshouse is most likely to increase the rate of photosynthesis if carbon dioxide is the limiting factor? [1 mark]

- A. ☐ Increasing the carbon dioxide concentration
- B. ☐ Decreasing the temperature
- C. ☐ Shading the glass to reduce the light
- D. ☐ Adding more oxygen

2 State two ways in which a polythene tunnel can increase the yield of a crop. [2 marks]

3 Explain how adding fertiliser to the soil can increase the yield of a crop. [3 marks]

4 Farmers can use a pesticide or biological control to reduce the number of aphids on a crop. Give two advantages and two disadvantages of using a pesticide instead of biological control. [4 marks]

- 5** The table shows the mean mass of tomatoes grown on one plant in a glasshouse with and without extra carbon dioxide. Calculate the percentage increase in mass with extra carbon dioxide. **[3 marks]**

Mean mass of tomatoes per plant (practice data)	
Carbon dioxide	Mass of tomatoes per plant in kg
Normal air	4.0
Extra carbon dioxide	5.0

Answer =

- 6** A farmer wants to grow a large crop of lettuces. Describe and explain how the farmer could use a glasshouse and other methods to increase the yield. **[6 marks]**

Food production: micro-organisms and fish farming Spec 5.5–5.9B

- 7** Which gas, made by yeast, causes bread dough to rise? [1 mark]

A. ☐ Oxygen

B. ☐ Carbon dioxide

C. ☐ Ethanol

D. ☐ Nitrogen

8 Describe the role of *Lactobacillus* in the production of yoghurt.

[3 marks]

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9 A student investigated the effect of temperature on the rate of anaerobic respiration in yeast. She mixed yeast with sugar solution, added a layer of oil, and collected the gas in a syringe in a water bath. (a) Explain why a layer of oil was added. (b) State two variables she should control.

[4 marks]

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10 In the investigation at 30 °C, 12 bubbles of gas were counted in 3 minutes. Calculate the mean number of bubbles produced per minute.

[2 marks]

Answer =

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11 An industrial fermenter has a water jacket and stirring paddles. Explain the purpose of each of these features.

[3 marks]

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16 Describe how a gene can be removed from human DNA and inserted into a bacterial plasmid. **[4 marks]**

17 What does the term transgenic mean? **[1 mark]**

- A. ☐ An organism grown in a fermenter
- B. ☐ The transfer of genetic material from one species to a different species
- C. ☐ An organism produced by selective breeding
- D. ☐ An organism with two copies of every chromosome

18 Maize plants have been genetically modified to contain a gene from the bacterium *Bacillus thuringiensis* (Bt). The gene codes for a toxin that kills insect pests. Explain how this could improve food production. **[3 marks]**

19 Describe how large amounts of human insulin can be made using genetically modified bacteria grown in a fermenter. **[6 marks]**

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

A A (1)

2. [2]

- traps heat / keeps plants warm so faster growth (1)
- protects from pests / wind / frost / heavy rain (1)
- allow lets the growing season be extended (1)
- Max 2

3. [3]

- fertilisers contain mineral ions / nitrates (1)
- nitrate is used to make protein (1)
- so plants grow faster / bigger, giving a higher yield (1)
- ignore plant food

4. [4]

- advantage: kills pests quickly / more effective (1)
- advantage: easy to apply over a large area (1)
- disadvantage: kills non-target organisms / harmless insects (1)
- disadvantage: pests may become resistant / may build up in food chains / pollute water (1)
- allow other correct points

5. [3]

- increase = $5.0 - 4.0 = 1.0$ kg (1)
- $(1.0 \div 4.0) \times 100$ (1)
- 25% (1)
- correct answer with no working gains 3 marks
- reject $(1.0 \div 5.0) \times 100 = 20\%$

6. [6]

Level 3 5-6	Detailed description and explanation of at least three methods, linking each to a clear reason for increased yield, with correct use of terms such as photosynthesis, limiting factor, mineral ions and pests.
Level 2 3-4	Describes at least two methods and gives some explanation of how they increase yield, with some use of scientific terms.
Level 1 1-2	Identifies one or two methods with little or no explanation.

Indicative content

- glasshouse traps heat; higher temperature raises the rate of photosynthesis (enzyme activity) up to the optimum
- added carbon dioxide increases photosynthesis if limiting, so more glucose for growth
- extra light lengthens photosynthesis time
- protection from wind, frost and pests reduces crop loss
- fertiliser supplies nitrates for protein, so faster growth
- pesticide or biological control reduces damage by pests, so less crop is eaten
- a limiting factor must be dealt with first, or extra of another factor has no effect

7. [1]

B B (1)

8. [3]

- the bacteria respire / break down lactose (milk sugar) (1)
- to make lactic acid (1)
- which lowers the pH / makes the milk proteins clump so milk thickens (1)
- allow gives a sour taste

9. [4]

- (a) oil stops oxygen entering the solution (1)
- so the yeast can only respire anaerobically (1)
- (b) any two from: volume of sugar solution / concentration of sugar / type of sugar / mass of yeast / time for collecting gas (1)(1)
- allow depth / volume of oil
- reject temperature (independent variable)

10. [2]

- $12 \div 3$ (1)
- 4 bubbles per minute (1)

11. [3]

- water jacket: cools the fermenter / keeps the temperature at the optimum (1)
- because respiration releases heat / heat would denature enzymes (1)
- paddles mix the contents so nutrients and oxygen are evenly distributed (1)

12. [6]

Level 3 5-6	Describes and explains at least four conditions, with a clear reason for each linked to growth or enzyme activity, and accurate use of terms such as aseptic, optimum, oxygenation and agitation.
Level 2 3-4	Describes at least three conditions with some explanation of why they are needed.
Level 1 1-2	Names one or two conditions with little or no explanation.

Indicative content

- aseptic precautions: sterilise equipment and nutrients to stop contamination by other microbes that compete or spoil the product
- nutrients such as glucose and nitrogen sources for growth
- optimum temperature, controlled with a cooling jacket, for fastest enzyme activity
- optimum pH, monitored with probes and controlled by adding acid or alkali, to avoid denaturing enzymes
- oxygenation: sterile air supplied for aerobic respiration, giving more energy for growth
- agitation: stirring so nutrients, oxygen and heat are evenly spread

13. [1]**B B** – ligase (1)**14. [2]**

- choose / breed together wheat plants that show the most resistance (1)
- select resistant offspring and breed them together, repeated over many generations (1)

15. [3]

- choose cows (and bulls) with a high milk yield and breed them together (1)
- select offspring with a high milk yield and breed them again, over many generations (1)
- disadvantage: reduced genetic variation / (inbreeding) more harmful inherited conditions / all affected by one disease (1)

16. [4]

- restriction enzyme cuts the gene out of the DNA (1)
- the same restriction enzyme cuts open the plasmid, leaving matching sticky ends (1)
- gene and plasmid are mixed so the sticky ends join (1)
- ligase joins the DNA / seals the gap to make a recombinant plasmid (1)

17. [1]**B B** – transfer of genetic material from one species to a different species (1)**18. [3]**

- the plants make the toxin / are insect resistant (1)
- fewer insect pests damage the crop / less crop lost (1)
- so yield is higher / more food produced (1)
- allow less insecticide needed, so lower costs (1)
- Max 3

19. [6]

Level 3 5-6	A clear, logical account that includes the genetic engineering stages (enzymes, plasmid, insertion into bacteria) and the use of the fermenter with suitable conditions, ending with extraction of insulin. Correct scientific terms are used throughout.
Level 2 3-4	A mostly correct account with some of the genetic engineering stages and some mention of the fermenter, but with gaps in detail or order.
Level 1 1-2	A few simple, relevant statements, for example that a human gene is put into bacteria that make insulin. Little detail or sequence.

Indicative content

- restriction enzyme cuts the human insulin gene out of human DNA
- the same restriction enzyme cuts open a bacterial plasmid, giving matching sticky ends
- ligase joins the gene into the plasmid to make a recombinant plasmid (the plasmid is the vector)
- the recombinant plasmid is inserted into bacteria
- bacteria are grown in a fermenter with aseptic precautions, nutrients, optimum temperature and pH, oxygen and agitation
- bacteria divide rapidly to give large numbers and make human insulin
- insulin is extracted and purified