

Use of biological resources practice questions

26 questions • 81 marks • mark scheme at the back

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

Name

Total / 81

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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12 Describe and explain the conditions needed in an industrial fermenter for the growth of micro-organisms. **[6 marks]**

[illegible]

13

Biology only

[3 marks]

Fish farmers keep fish of similar size together in separate tanks. Explain why this helps to increase the number of fish that survive.

[illegible]

14

Biology only

[4 marks]

Describe four ways in which a fish farmer can make sure fish grow quickly and stay healthy.

[illegible]

Selective breeding and genetic modification Spec 5.10–5.16

15 Which enzyme is used to join pieces of DNA together? **[1 mark]**

- A. ☐ Amylase
- B. ☐ Ligase
- C. ☐ Protease
- D. ☐ Restriction enzyme

16 A farmer wants to develop a variety of wheat that is resistant to a fungal disease. [2 marks]
Describe how the farmer could use selective breeding to do this.

17 Dairy cattle have been selectively bred to produce more milk. Describe how this was [3 marks]
done and give one disadvantage of selective breeding.

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

19 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

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

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

[illegible]

Cloning

22

Biology only

[1 mark]

In micropropagation, the small pieces of plant tissue that are used to grow new plants are called

- A. ☐ explants
B. ☐ plasmids
C. ☐ vectors
D. ☐ zygotes

23

Biology only

[3 marks]

Describe how micropropagation is used to grow new plants.

[illegible]

24

Biology only

[4 marks]

Describe the stages in the production of a cloned mammal such as Dolly the sheep.

[illegible]

Biology only

A nursery uses micropropagation to produce thousands of orchid plants with attractive flowers. State two advantages of using micropropagation instead of seeds.

[illegible]

Biology only

Some sheep are cloned transgenic animals that produce a human protein in their milk. Explain how these sheep are produced and why cloning is useful.

[illegible]

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. [3] Biology only

- larger fish of the same species eat smaller fish (1)
- this is intraspecific predation (1)
- keeping similar sizes together reduces this, so more fish survive / more fish to harvest (1)

14. [4] Biology only

- maintain water quality / oxygen / temperature / pH (1)
- control disease with medicines / vaccines / clean water (1)
- remove waste products by filtering the water (1)
- feed a balanced diet at the right frequency / amount (1)
- selective breeding of fast-growing fish (1)
- keep predators out / separate species (1)
- Max 4

15. [1]

B B – ligase (1)

16. [2]

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

17. [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)

18. [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)

19. [1]

B B – transfer of genetic material from one species to a different species (1)

20. [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

21. [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

22. [1] Biology only

A A – explants (1)

23. [3] Biology only

- small pieces of tissue (explants) are taken from the parent plant (1)
- aseptic technique / sterilised to prevent contamination by microorganisms (1)
- explants grown in vitro on sterile nutrient agar with nutrients and growth hormones (1)
- cells divide to form plantlets (1)
- Max 3

24. [4] Biology only

- nucleus removed from an unfertilised egg cell (enucleated egg cell) (1)
- diploid nucleus taken from a mature body cell (1)
- diploid nucleus introduced into the enucleated egg cell (1)
- egg cell divides to form an embryo (1)
- embryo implanted into a surrogate mother / uterus (1)
- Max 4

25. [2] Biology only

- plants are genetically identical to the parent / keep the desirable characteristics (1)
- many plants produced quickly / in a small space / all year round (1)
- seeds give offspring that vary, but micropropagated plants are all the same (1)
- Max 2

26. [6] Biology only

Level 3 5-6	A clear, well-ordered explanation of how the transgenic sheep is produced and cloned (human gene, nuclear transfer, surrogate), with a clear reason why cloning is useful. Scientific terms are used accurately.
Level 2 3-4	An explanation covering some of the production stages and at least one reason for cloning, but with gaps or some confusion.
Level 1 1-2	A few simple statements, for example that a human gene is put into a sheep, or that clones are identical. Little explanation.

Indicative content

- a human gene for the protein is inserted into sheep cells, making them transgenic
- a diploid nucleus from a transgenic cell is put into an enucleated egg cell
- the egg divides to form an embryo, implanted into a surrogate mother
- the lamb born is a transgenic clone that makes the human protein, e.g. in milk
- the protein can be collected and purified, and used to treat human conditions, e.g. alpha-1-antitrypsin or clotting factors
- cloning gives many genetically identical animals that all carry the gene and make the protein