

Biotechnology and genetic modification practice questions

14 questions • 42 marks • mark scheme at the back

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Name

Total / 42

Biotechnology **Spec 21.1, 21.2**

- 1** Bacteria are widely used in biotechnology and genetic modification. State two features of bacteria that make them useful. **[2 marks]**

- 2** **Supplement** **[2 marks]**
Apart from their rapid reproduction and their ability to make complex molecules, bacteria are useful in genetic modification for other reasons. Explain two of these other reasons.

- 3** Ethanol can be produced by yeast for use as a biofuel. Describe the role of anaerobic respiration in yeast in this process. **[3 marks]**

4 Bakers add yeast to dough and leave it in a warm place before baking. Describe and explain what happens to the dough, and to the substances made by the yeast, during bread-making. [4 marks]

5 Pectinase is added to crushed fruit when making fruit juice. What is the effect of pectinase? [1 mark]

- A. ☐ It kills bacteria in the juice
- B. ☐ It breaks down cell walls so more juice is released
- C. ☐ It makes the juice sweeter by making glucose
- D. ☐ It stops the fruit from rotting

6 A student investigates how well a biological washing powder removes egg white stains from cloth at different temperatures. (a) Name the type of enzyme in the powder that breaks down the egg white stain. [1] (b) State two variables the student should keep the same. [2] (c) Suggest what the student should measure. [1] (d) The stain was not removed at 80 °C. Explain why. [2] [6 marks]

7 Supplement Some people cannot digest lactose. Explain how lactase is used to produce lactose-free milk. [3 marks]

8

Supplement

[5 marks]

Fermenters are used to make penicillin on a large scale. (a) Name the type of organism that makes penicillin, and one other product made in fermenters. [2] (b) Describe and explain how the temperature and the oxygen concentration are controlled in a fermenter. [3]

Genetic modification

Spec 21.3

9

Define the term genetic modification.

[2 marks]

10

Which is an example of genetic modification?

[1 mark]

- A. ☐ Crossing two different varieties of wheat
- B. ☐ Inserting a human gene into bacteria so they make insulin
- C. ☐ Treating diabetes with insulin injections
- D. ☐ Growing yeast in a fermenter

11

Outline three ways in which genes have been inserted into crop plants to improve them.

[3 marks]

12

Supplement

[5 marks]

Bacteria can be genetically modified to make human insulin. Outline the process, starting from the human insulin gene.

13

Supplement

[1 mark]

Which enzyme is used to join a human gene into a bacterial plasmid?

- A. ☐ Restriction enzyme
- B. ☐ DNA ligase
- C. ☐ Amylase
- D. ☐ Protease

14

Supplement

[4 marks]

Maize can be genetically modified to be resistant to insect pests. Discuss the advantages and disadvantages of growing this GM maize.

Mark scheme

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

1. [2]

- rapid reproduction rate / reproduce quickly (1)
- (able to) make complex molecules (1) allow named example e.g. proteins

2. [2] **Supplement**

- few ethical concerns over their manipulation / growth (1)
- have plasmids (1)
- (plasmid) can have a gene inserted / can carry the gene into the bacterium (1)
- Max 2

3. [3]

- yeast respire without oxygen / anaerobically (1) ignore 'ferments' alone
- breaks down sugar / glucose (1)
- to produce ethanol / alcohol (and carbon dioxide) (1)
- ethanol is separated and used as a fuel (1)
- Max 3

4. [4]

- yeast respire anaerobically (1)
- producing carbon dioxide (1)
- bubbles of gas trapped in the dough make it rise (1) reject ethanol makes the dough rise
- gas bubbles expand when baked (1)
- ethanol / alcohol is also produced and evaporates during baking (1)
- Max 4

5. [1]

B B (1)

6. [6]

- (a) protease (1) reject lipase / amylase
- (b) size / type of cloth (1)
- amount / volume of egg white stain (1)
- volume of water / solution (1)
- mass / concentration of washing powder (1)
- pH / amount of stirring (1)
- Max 2 for (b)
- (c) time taken for the stain to disappear (1) allow how much stain is left after a fixed time
- (d) enzyme / protease is denatured (1)
- active site changes shape, so protein / substrate no longer fits (1)

7. [3] Supplement

- lactase is an enzyme added to milk (1)
- it breaks down lactose (1)
- into glucose and galactose (both needed) (1)
- so people who are lactose intolerant can drink / digest it (1)
- Max 3

8. [5] Supplement

- (a) fungus / *Penicillium* (1)
- insulin / mycoprotein (1)
- (b) temperature kept at the optimum using a water jacket / cooling water (1)
- heat released by respiration is removed / temperature monitored by a probe (1)
- so enzymes work fast and are not denatured (1)
- sterile air is pumped / bubbled in (1)
- stirrer spreads oxygen through the culture (1)
- oxygen for aerobic respiration, releasing energy for growth (1)
- Max 3 for (b)

9. [2]

- changing the genetic material of an organism (1)
- by removing, changing or inserting individual genes (1)

10. [1]

B B (1)

11. [3]

- gene for resistance to herbicides (1)
- gene for resistance to insect pests (1)
- gene to improve nutritional quality (1) allow golden rice / more vitamin A

12. [5] Supplement

- gene cut out of human DNA using restriction enzymes (1)
- leaving sticky ends (1)
- plasmid cut with the same restriction enzyme, giving complementary sticky ends (1)
- gene joined into plasmid using DNA ligase, forming a recombinant plasmid (1) reject ligase cuts
- recombinant plasmid inserted into bacteria (1)
- bacteria multiply (1)
- bacteria express the gene / make insulin (1)
- Max 5

13. [1] Supplement

B B (1)

14. [4] Supplement

- advantage: higher yield as fewer plants are damaged by insects (1)
- advantage: less insecticide needed, saving money / less harm to other insects (1)
- disadvantage: gene could spread to wild plants (1)
- disadvantage: may harm non-pest insects / reduce biodiversity (1)
- disadvantage: insect pests may become resistant (1)
- disadvantage: seeds expensive / long-term effects on health not known (1)
- Max 4; Max 3 if only advantages or only disadvantages