

Selective breeding and genetic modification: practice questions

7 questions • 20 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 / 20

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

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

2 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.

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

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

Mark scheme

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

1. [1]

B B – ligase (1)

2. [2]

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

3. [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)

4. [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)

5. [1]

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

6. [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

7. [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