IGCSE BIOLOGY • EXERCISE SHEET

21.3 Genetic modification

Name: _____ Class: _____ Date: _____ **Total: 7 marks**

Objective

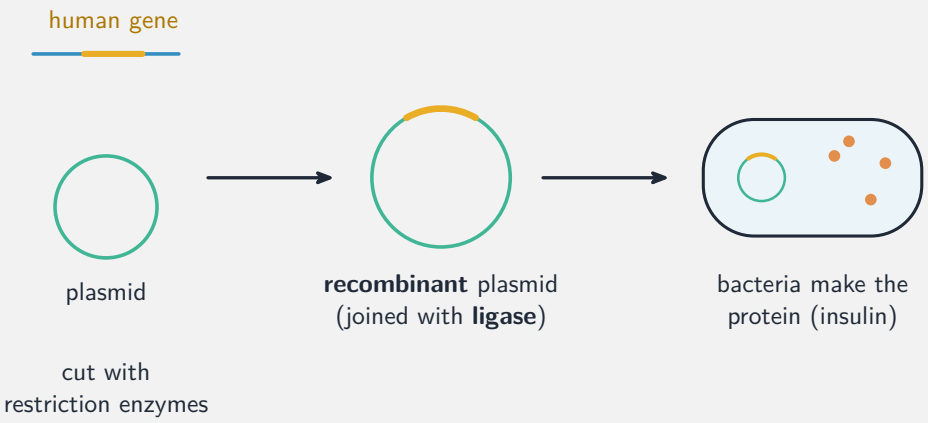
Build the skills to answer exam questions on **genetic modification** 基因改造—making a human protein in bacteria, and the uses and concerns of GM crops.

You must be able to:

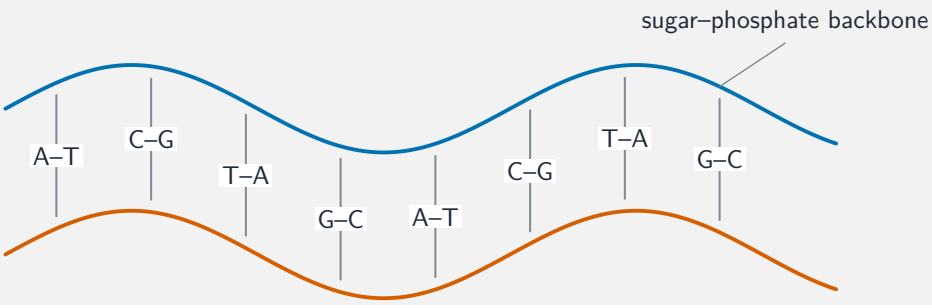
- describe the steps of inserting a human gene into a bacterium
- name the enzymes used (restriction enzymes, ligase)
- give the uses and concerns of genetic modification

1 Worked examples

Making insulin in bacteria



Cut the gene with restriction enzymes (sticky ends) → join into a plasmid with ligase → bacteria express it



Genetic modification edits the DNA double helix

- **uses:** human proteins (insulin); herbicide/pest resistance; better nutrition in crops.

2 Practice

2.1 Name the enzymes used to cut a gene out of DNA. [1]

2.2 Name the enzyme that joins the gene into a plasmid. [1]

3 Exam-style questions

3.1 A plasmid carrying an inserted human gene is called a: [1]

- **A** recombinant plasmid
- **B** restriction enzyme
- **C** ribosome
- **D** chromosome

3.2 Human insulin can be made by genetically modified bacteria.

(a) Describe how the human gene is inserted into a bacterium. [3]

(b) State one concern people have about GM crops. [1]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **21.3 Genetic modification** past-paper sheet in the Library, or try these in **Practice mode**:

- 0610/21 N25 —Q40 (genetic modification)
- 0610/23 N25 —Q40 (GM / insulin)

Solutions

2.1 restriction enzymes.

2.2 (DNA) ligase.

3.1 A. A plasmid with an inserted gene is a recombinant plasmid.

3.2 (a) cut the human gene out with restriction enzymes, leaving sticky ends; cut a plasmid with the same enzyme and join the gene in with ligase; put the recombinant plasmid into a bacterium, which expresses the gene.
(b) any of: concerns about health; effects on wild species; the cost of GM seeds.