

Week 30

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

Topic 21 quiz	2
Exercise sheet 21.1	5
Exercise sheet 21.2	9
Past-paper questions 21.2	13
Exercise sheet 21.3	17
Past-paper questions 21.3	21

IGCSE Biology

Name: _____ Score: _____

1. Microbes are useful in biotechnology because they:
 - ☐ reproduce very fast and are easy to grow
 - ☐ are large animals
 - ☐ never make useful products
 - ☐ cannot be controlled
2. Yeast makes bread rise by producing:
 - ☐ carbon dioxide
 - ☐ oxygen
 - ☐ nitrogen
 - ☐ water only
3. A fermenter is used to:
 - ☐ grow microbes in large amounts under controlled conditions
 - ☐ kill all microbes
 - ☐ store finished medicine
 - ☐ filter water
4. In genetic modification, a useful gene is cut out using:
 - ☐ enzymes
 - ☐ heat only
 - ☐ water
 - ☐ a microscope
5. Genetic modification involves:
 - ☐ inserting a gene from one organism into another
 - ☐ breeding the best parents
 - ☐ cloning by mitosis
 - ☐ removing all genes
6. Which medicines are made using microbes? (Select all that apply.)
 - ☐ antibiotics
 - ☐ insulin

☐ penicillin

☐ sand

Tick every correct option.

7. Which conditions are controlled in a fermenter? (Select all that apply.)

☐ temperature

☐ pH

☐ oxygen supply

☐ the colour of the tank

Tick every correct option.

8. GM crops can be made to be: (Select all that apply.)

☐ pest-resistant

☐ higher-yielding

☐ richer in vitamins

☐ unable to grow

Tick every correct option.

9. Genetic modification raises ethical and environmental concerns as well as offering benefits.

☐ True ☐ False

10. Microbes can produce enzymes used in washing powders.

☐ True ☐ False

IGCSE Biology

1. **reproduce very fast and are easy to grow**

Fast reproduction and easy growth make microbes ideal.

2. **carbon dioxide**

CO₂ from yeast respiration makes dough rise.

3. **grow microbes in large amounts under controlled conditions**

Fermenters culture microbes to make products.

4. **enzymes**

Enzymes cut the gene from the DNA.

5. **inserting a gene from one organism into another**

GM transfers a gene between organisms.

6. **antibiotics; insulin; penicillin**

Antibiotics, penicillin and insulin are made using microbes.

7. **temperature; pH; oxygen supply**

Temperature, pH and oxygen matter; tank colour does not.

8. **pest-resistant; higher-yielding; richer in vitamins**

GM improves crops; it would not make them unable to grow.

9. **True**

Both benefits and concerns must be weighed.

10. **True**

These enzymes work at lower temperatures, saving energy.

21.1 Biotechnology and genetic modification

Name: _____ Class: _____ Date: _____

Total: 6 marks

KEY WORDS bacteria 细菌 • biotechnology 生物技术 • plasmids 质粒 • molecules 分子 • biotechnology and genetic modification 生物技术与基因改造

Objective

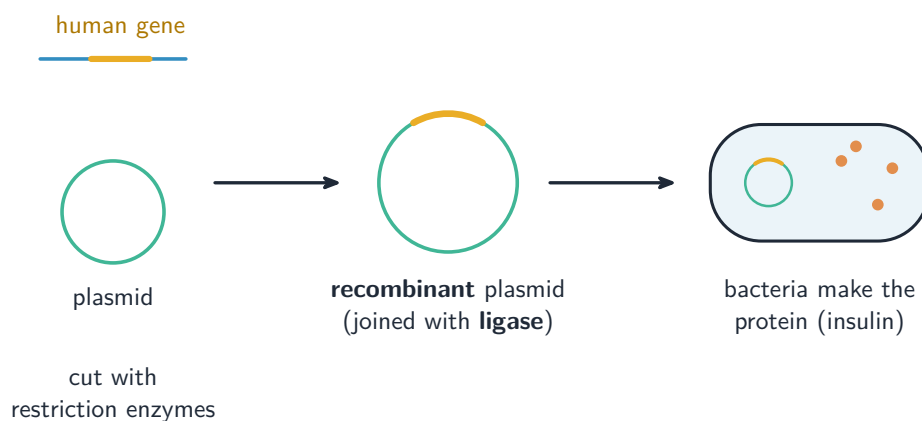
Build the skills to answer exam questions on **biotechnology and genetic modification** 生物技术与基因改造 — what they are, and why **bacteria** 细菌 are useful.

You must be able to:

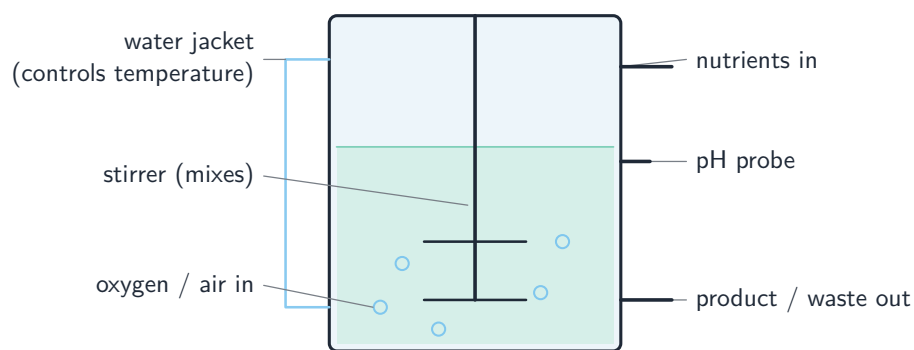
- define biotechnology and genetic modification
- explain why bacteria are used in biotechnology
- recognise the uses of each

1 Worked examples

■ Why bacteria



Biotechnology uses living things (or their enzymes) to make useful products; GM changes an organism's genes



Biotechnology uses fermenters to grow microbes

- **bacteria** are useful: reproduce fast, make complex molecules, contain plasmids, few ethical issues.

2 Practice

2.1 Define biotechnology. [1]

2.2 Define genetic modification. [1]

3 Exam-style questions

3.1 Bacteria are useful in biotechnology because they: [1]

- **A** reproduce slowly
 - **B** reproduce very fast and contain plasmids
 - **C** cannot make molecules
 - **D** have no DNA
-

3.2 Bacteria are widely used in biotechnology.

(a) State two reasons why bacteria are suitable. [2]

(b) State one product made using bacteria. [1]

Solutions

2.1 using living things (or their enzymes) to make useful products.

2.2 changing an organism's genetic material by removing, changing or inserting genes.

3.1 B. Bacteria reproduce fast and contain plasmids.

3.2 (a) any two of: reproduce fast; make complex molecules; contain plasmids; few ethical concerns.

(b) any of: insulin; penicillin; mycoprotein.

21.2 Biotechnology

Name: _____ Class: _____ Date: _____

Total: 7 marks

KEY WORDS fermenter 发酵罐 • biofuel 生物燃料 • penicillin 青霉素 • yeast 酵母 • pectinase 果胶酶

Objective

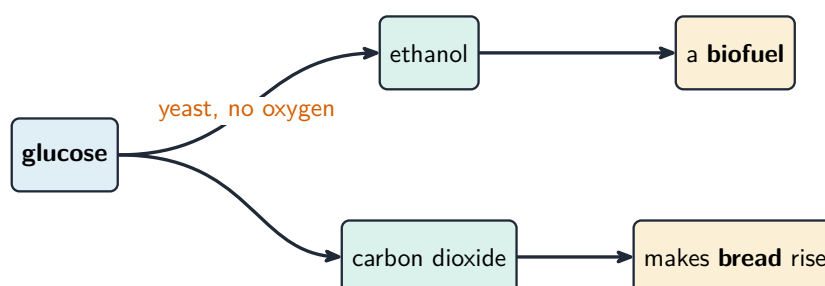
Build the skills to answer exam questions on **biotechnology** 生物技术 — **yeast** 酵母 (biofuel/bread), industrial **enzymes** 酶, and **fermenters** 发酵罐.

You must be able to:

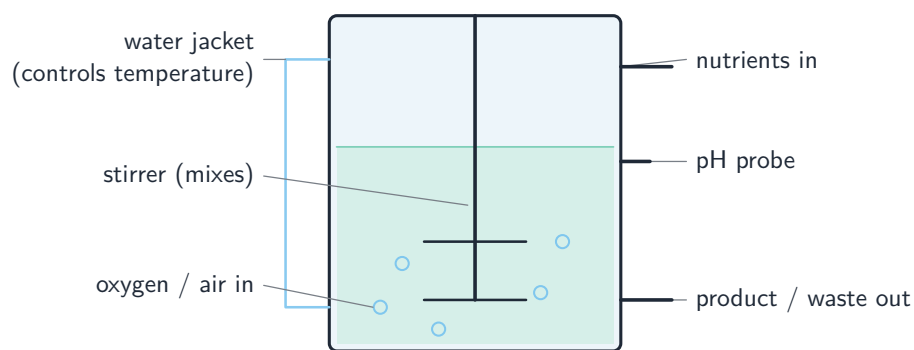
- describe how yeast makes ethanol and carbon dioxide
- give the uses of pectinase, washing-powder enzymes and lactase
- state the conditions controlled in a fermenter

1 Worked examples

■ Yeast and fermenters



Yeast respire anaerobically → ethanol (biofuel) and carbon dioxide (makes bread rise)



A fermenter grows microbes with the conditions controlled — e.g. to make insulin, penicillin, mycoprotein

- **pectinase:** more/clearer fruit juice; **lactase:** lactose-free milk.

2 Practice

2.1 Name the two products yeast makes by anaerobic respiration.

[2]

2.2 State the use of pectinase.

[1]

3 Exam-style questions

3.1 Biological washing powders contain enzymes that: [1]

- **A** make stains
 - **B** digest stains at lower temperatures
 - **C** colour clothes
 - **D** kill bacteria
-

3.2 A fermenter is used to grow microbes.

(a) State two conditions that must be controlled in a fermenter. [2]

(b) Name one useful product made in a fermenter. [1]

Solutions

2.1 ethanol; carbon dioxide.

2.2 it breaks down cell walls to release more (and clearer) fruit juice.

3.1 B. The enzymes digest stains, even at lower temperatures.

3.2 (a) any two of: temperature; pH; oxygen; nutrient supply; waste removal.
(b) any of: insulin; penicillin; mycoprotein.

39 Why is pectinase useful in fruit juice production?

- A** Cloudier juice is produced.
- B** More juice can be extracted from the fruits.
- C** Proteins in the fruit are digested.
- D** Starch is digested to produce more sugar.

40 Which features make bacteria useful in biotechnology?

- 1 They are unaffected by antibiotics.
- 2 They do **not** contain plasmids.
- 3 They make complex molecules.
- 4 They reproduce rapidly.

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

5 Penicillin is an antibiotic.

- (a) (i)** State the type of organism that antibiotics are used to kill.

..... [1]

- (ii)** It is important to try and limit the development of antibiotic resistance.

Describe ways of limiting the development of antibiotic resistance.

.....
.....
.....
.....
..... [2]

- (b)** Penicillin is produced by an organism called *Penicillium chrysogenum*.

Fig. 5.1 is a diagram of *Penicillium chrysogenum*.

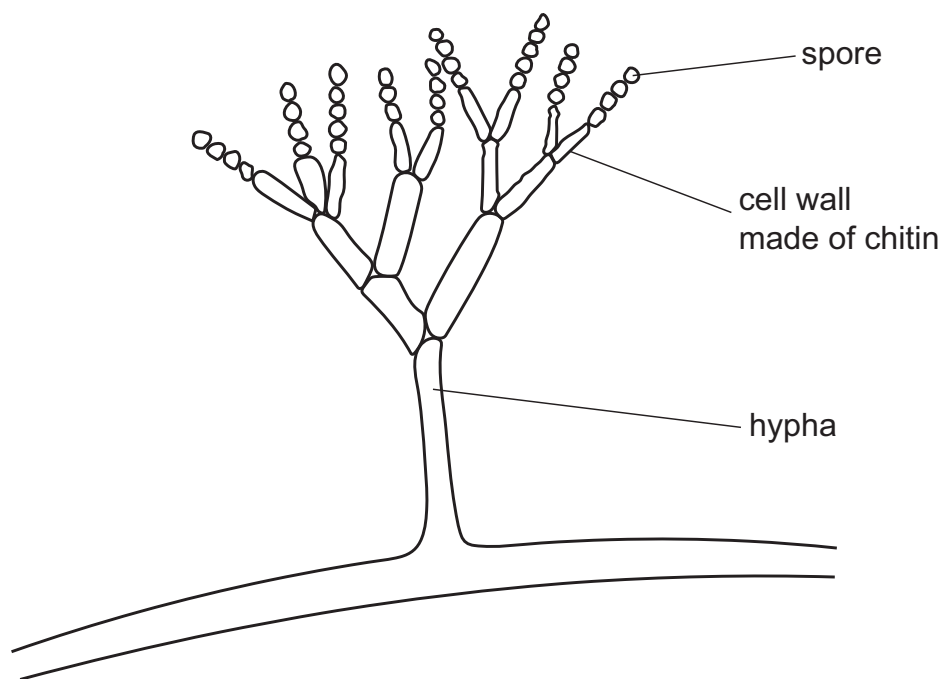


Fig. 5.1

- (i)** State what *Penicillium* in the scientific name of *Penicillium chrysogenum* represents in the binomial system.

..... [1]

- (ii)** Using the information in Fig. 5.1, identify the kingdom that contains *Penicillium chrysogenum*.

..... [1]

(c) Penicillin can be made in a fermenter.

(i) State the name of **one other** product made in a fermenter.

..... [1]

Fig. 5.2 shows a fermenter.

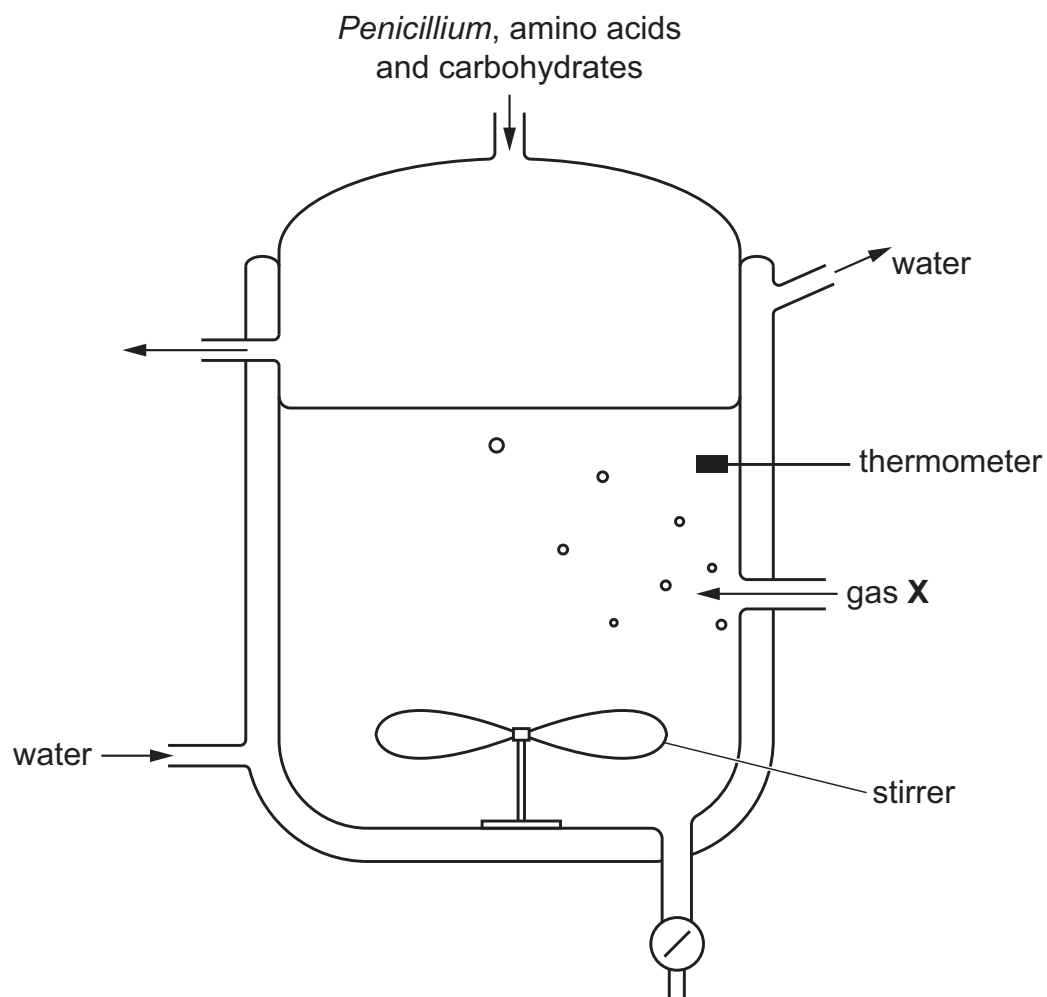


Fig. 5.2

(ii) Gas **X** in Fig. 5.2 is needed for the production of penicillin.

State the name of gas **X**.

..... [1]

- (iii) The concentration of gas **X** is one of the conditions that must be controlled to ensure that penicillin is produced.

State the **other** conditions required to produce penicillin **and** describe how they are controlled in the fermenter.

[5]

- (d)** State the name of the organism that is used in bread-making **and** in biofuel production.

..... [1]

[Total: 13]

21.3 Genetic modification

Name: _____ Class: _____ Date: _____

Total: 7 marks

KEY WORDS resistance 抗性 • genetic modification 基因改造 • restriction enzymes 限制酶 • recombinant plasmid 重组质粒
• ligase 连接酶

Objective

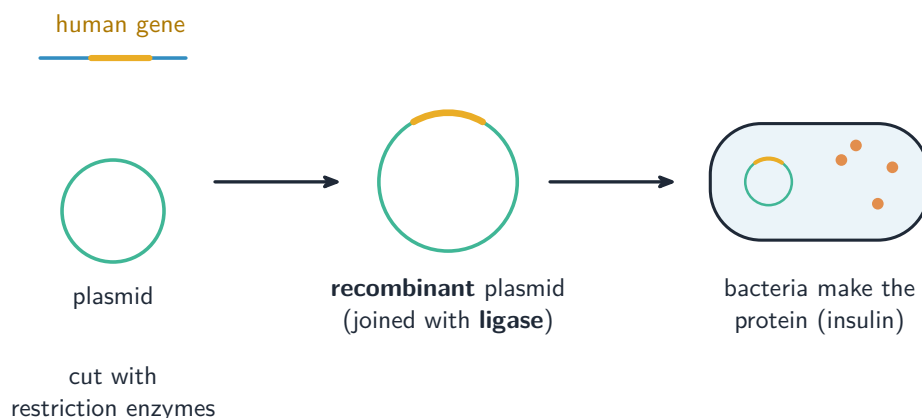
Build the skills to answer exam questions on **genetic modification** 基因改造 — making a human protein in bacteria, and the uses and concerns of GM crops.

You must be able to:

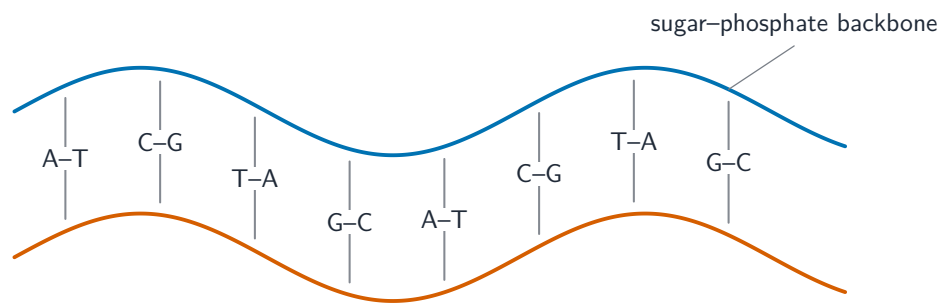
- describe the steps of inserting a human gene into a bacterium
- name the enzymes used (restriction enzymes, ligase)
- give the uses and concerns of genetic modification

1 Worked examples

■ Making insulin in bacteria



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



two strands form a double helix; bases pair A-T and C-G

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]

Solutions

2.1 restriction enzymes.

2.2 (DNA) ligase.

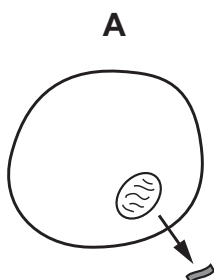
3.1 A. A plasmid with an inserted gene is a recombinant plasmid.

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.

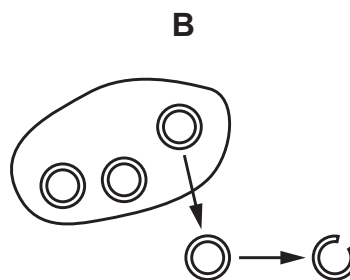
(b) any of: concerns about health; effects on wild species; the cost of GM seeds.

40 The diagrams show the stages in the production of human insulin.

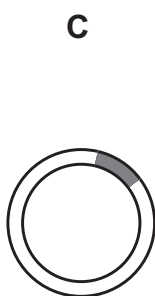
Which stage uses the enzyme DNA ligase?



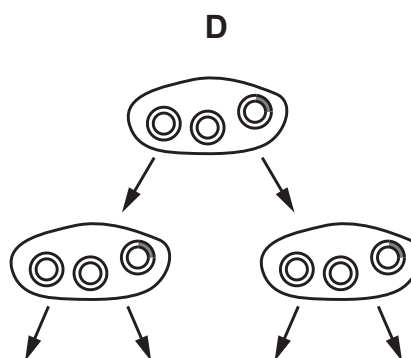
The gene for insulin is identified and removed from a human cell.



A plasmid is removed from a bacterium and cut open.



The gene for insulin is inserted into the plasmid.



The plasmid is inserted into a bacterium that reproduces, and insulin is produced.

40 Human insulin can be produced in large quantities by genetically modified bacteria.

Four of the steps in the processes of genetic modification and insulin production are listed.

- 1 Insulin is removed from the bacterial culture.
- 2 An enzyme is used to cut out the insulin gene from a human chromosome.
- 3 The insulin gene is placed into the plasmid of a bacterium.
- 4 Bacteria with the insulin gene reproduce very rapidly.

What is the order of these steps?

- A** 1 → 2 → 3 → 4
- B** 2 → 3 → 4 → 1
- C** 3 → 2 → 4 → 1
- D** 4 → 1 → 2 → 3

40 Some of the processes involved in the production of insulin by genetic modification are listed.

- 1 cutting of bacterial plasmid DNA with restriction enzymes
- 2 expression in bacteria of the human gene to make insulin
- 3 insertion of recombinant plasmids into bacteria
- 4 multiplication of bacteria containing recombinant plasmids

In which order do these processes occur?

- A** 1 → 3 → 4 → 2
- B** 2 → 1 → 3 → 4
- C** 3 → 1 → 2 → 4
- D** 4 → 1 → 3 → 2

40 Some processes involved in the production of human insulin by genetic modification are listed.

- 1 insertion of the human insulin gene DNA into a cut bacterial plasmid
- 2 bacteria containing recombinant plasmids multiply and make human insulin
- 3 human insulin gene DNA is isolated using restriction enzymes
- 4 recombinant plasmids are inserted into bacteria

What is the sequence of these processes in genetic modification?

- A** 1 → 3 → 2 → 4
- B** 1 → 4 → 3 → 2
- C** 3 → 1 → 4 → 2
- D** 3 → 2 → 1 → 4

3 Scientists developed genetically modified (GM) maize.

Fig. 3.1 shows the mass of GM maize grown in one country from 2000 to 2015.

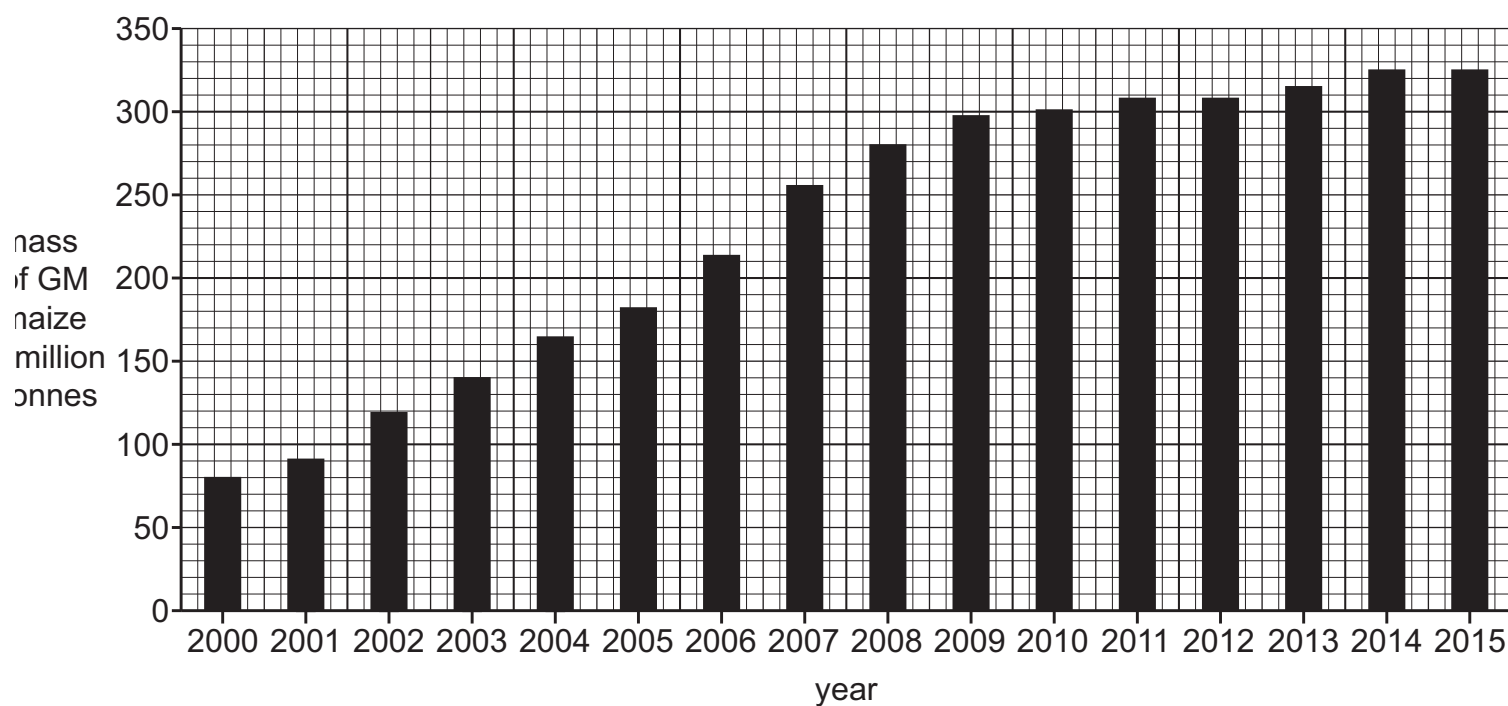


Fig. 3.1

(a) Calculate the percentage increase in the mass of GM maize grown between 2000 and 2015.

Give your answer to **two** significant figures.

Space for working.

..... % [3]

(b) To develop GM maize, a gene for producing a natural insecticide was taken from a bacterium and transferred into maize plant cells.

(i) Genes are found at specific positions on a biological molecule.

State the name of this biological molecule.

..... [1]

(ii) Scientists who develop GM crop plants breed them for many generations before allowing farmers to grow the crop plants.

Suggest why scientists breed the GM crop plants for many generations.

.....
.....
.....
.....
..... [2]

(iii) Human proteins can also be made using bacteria that have been genetically modified.

Describe how a gene can be transferred from one organism to another using genetic modification.

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..... [6]

(c) Some people are worried that GM crops could pollinate wild plants.

(i) Suggest how pollination between GM crops and wild plants could be prevented.

.....

.....

..... [1]

(ii) State **two** advantages of GM crops **other than** insect resistance.

1

2 [2]

[Total: 15]

40 The diagram shows a bacterial cell.

Which cell structure makes bacteria useful in genetic modification?

