Week 30

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

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

21. Biotechnology and genetic modification

Answers · 答案

IGCSE Biology

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

   Fast reproduction and easy growth make microbes ideal.

2. **carbon dioxide**

   CO_2 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.

IGCSE BIOLOGY • EXERCISE SHEET

21.1 Biotechnology and genetic modification

Name: _____ Class: _____ Date: _____ **Total: 6 marks**

KEY WORDS bacteria 细菌 • plasmids 质粒 • biotechnology 生物技术 • enzymes 酶 • molecules 分子

Objective

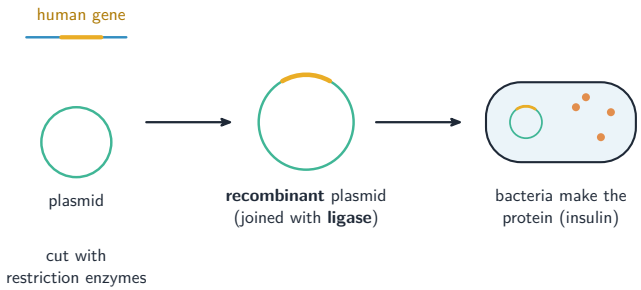
Build the skills to answer exam questions on **biotechnology and genetic modification** 生物技术与基因改造 — what they are, and why **bacteria** 细菌 are useful.

You must be able to:

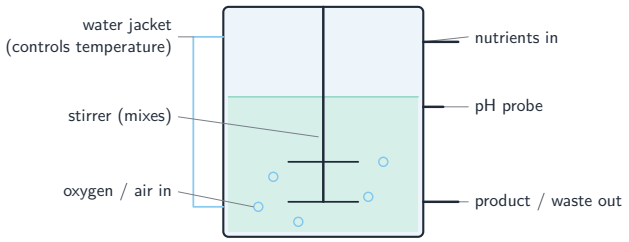
- define biotechnology and genetic modification
- explain why bacteria are used in biotechnology
- recognise the uses of each

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.

IGCSE BIOLOGY • EXERCISE SHEET

21.2 Biotechnology

Name: _____ Class: _____ Date: _____ **Total: 22 marks**

KEY WORDS fermenter 发酵罐 • penicillin 青霉素 • biofuel 生物燃料 • biotechnology 生物技术 • yeast 酵母

Objective

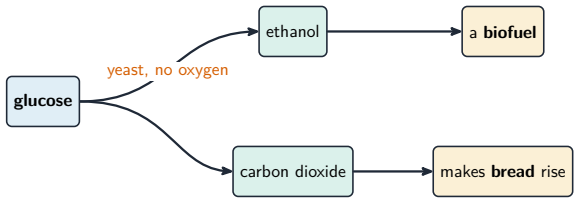
Build the skills to answer exam questions on **biotechnology** 生物技术 — **yeast** 酵母 (biofuel/bread), industrial **enzymes** 酶, and **fermenters** 发酵罐.

You must be able to:

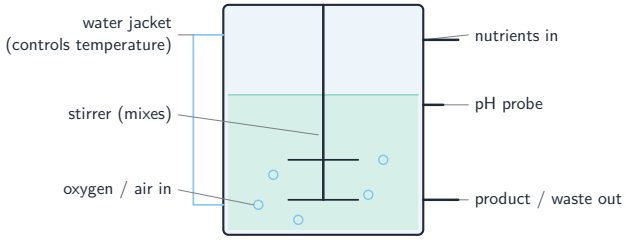
- describe how yeast makes ethanol and carbon dioxide
- give the uses of pectinase, washing-powder enzymes and lactase
- state the conditions controlled in a fermenter

1 Worked examples

Yeast and fermenters



Yeast respires 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]

3.3 Yeast is used to make bread and to make biofuel. Industrial enzymes are used in washing powders and in producing lactose-free milk.

(a) Explain the role of yeast in making bread, and in making biofuel, naming the product that matters in each case. [4]

(b) State **two** reasons why enzymes in washing powder are useful, and explain why such a powder should not be used at very high temperature. [3]

(c) Describe how lactose-free milk is produced using an enzyme. [2]

(d) Name **three** conditions that must be controlled inside a fermenter, and explain why each matters. [6]

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.

3.3 (a) In bread, the yeast respires anaerobically and produces **carbon dioxide**; the bubbles of gas are trapped in the dough and make it rise. In biofuel, the same anaerobic respiration is used for the **ethanol**; the ethanol is distilled off and burned as fuel.
(b) They break down stains that water alone cannot remove — protease digests protein stains such as blood, and lipase digests fatty stains. At very high temperature the enzymes are **denatured**: the shape of the active site changes so the substrate no longer fits, and they stop working.
(c) The enzyme **lactase** is added to the milk, or the milk is passed over lactase immobilised on beads; the lactase breaks the lactose down into glucose and galactose, which lactose-intolerant people can digest.
(d) **Temperature** — a water jacket keeps it at the optimum; too low and the reaction is slow, too high and the enzymes denature. **pH** — monitored and corrected, because enzymes work only over a narrow pH range and are denatured outside it. **Oxygen supply** — sterile air is bubbled through and a paddle stirs, so the organisms can respire aerobically and grow quickly, and the contents stay evenly mixed. (Also accept nutrient supply, or sterility to keep unwanted microorganisms out.)

Name: IGCSE Biology: **w25 21**

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.

IGCSE Biology: **s25 22**

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.

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..... [2]

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

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

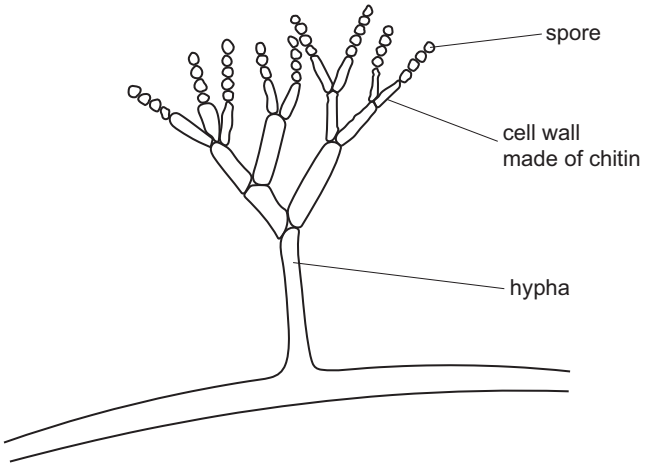

Fig. 5.1

(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.

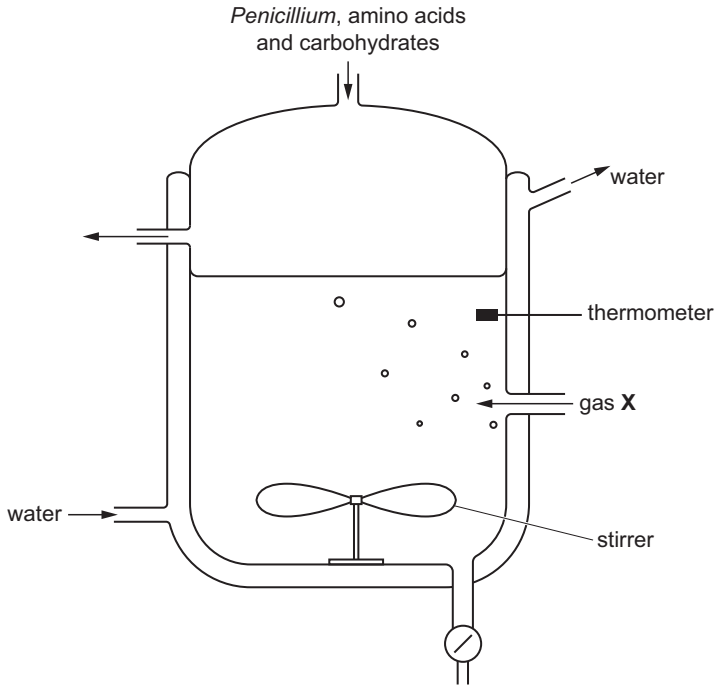

Fig. 5.2

(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.

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..... [5]

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

..... [1]

[Total: 13]

IGCSE BIOLOGY • EXERCISE SHEET

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

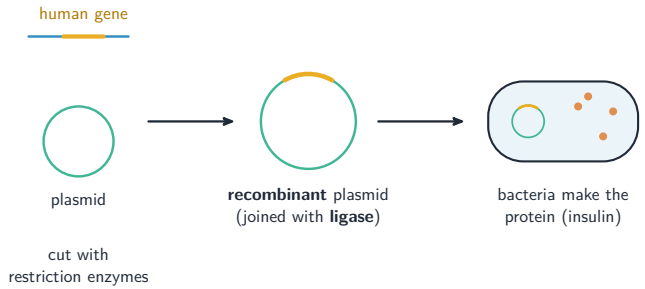
Build the skills to answer exam questions on **genetic modification** 基因改造 — making a human protein in bacteria, and the uses and concerns of GM crops.

You must be able to:

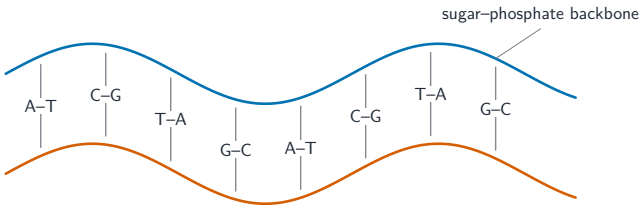
- describe the steps of inserting a human gene into a bacterium
- name the enzymes used (restriction enzymes, ligase)
- give the uses and concerns of genetic modification

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.

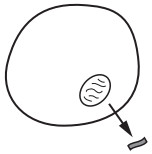
3.1 **A**. A plasmid with an inserted gene is a recombinant plasmid.

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.

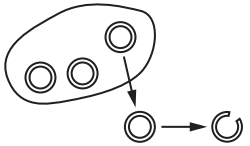
Which stage uses the enzyme DNA ligase?

A



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

B

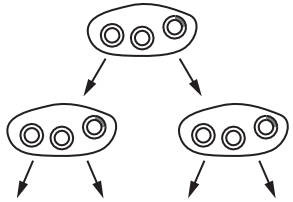


A plasmid is removed from a bacterium and cut open.

C

The gene for insulin is inserted into the plasmid.

D



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 $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

B $2 \rightarrow 3 \rightarrow 4 \rightarrow 1$

C $3 \rightarrow 2 \rightarrow 4 \rightarrow 1$

D $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$

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 $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$

B $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$

C $3 \rightarrow 1 \rightarrow 2 \rightarrow 4$

D $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

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 $1 \rightarrow 3 \rightarrow 2 \rightarrow 4$

B $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

C $3 \rightarrow 1 \rightarrow 4 \rightarrow 2$

D $3 \rightarrow 2 \rightarrow 1 \rightarrow 4$

3 Scientists developed genetically modified (GM) maize.

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

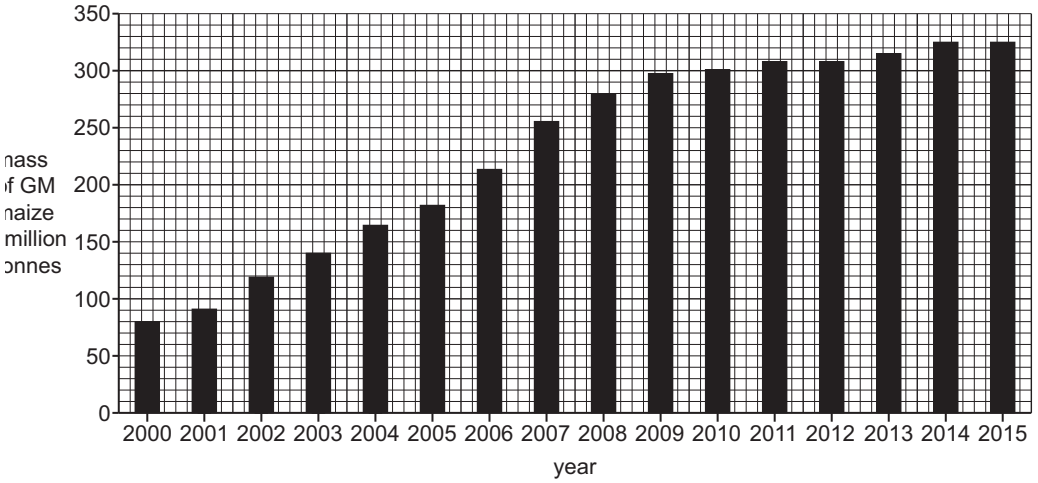


Fig. 3.1

(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.

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..... [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?