

Week 25

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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18. Variation and selection

Starter Quiz · 课前小测

IGCSE Biology

Name: _____ Score: _____

- Which is an example of genetic variation?
 - ☐ blood group
 - ☐ a scar
 - ☐ a learned language
 - ☐ a suntan
- An adaptive feature is one that helps an organism:
 - ☐ survive and reproduce in its environment
 - ☐ grow taller than others
 - ☐ change its DNA at will
 - ☐ live forever
- Antibiotic resistance evolves because:
 - ☐ resistant bacteria survive and multiply while others die
 - ☐ bacteria decide to resist
 - ☐ antibiotics make bacteria stronger
 - ☐ bacteria stop reproducing
- Selective breeding means choosing:
 - ☐ parents with desired features to breed together
 - ☐ random parents
 - ☐ the weakest individuals
 - ☐ never to breed
- Which shows continuous variation?
 - ☐ height
 - ☐ blood group
 - ☐ tongue rolling
 - ☐ eye colour categories
- Which are uses of selective breeding? (Select all that apply.)
 - ☐ cows that produce more milk
 - ☐ crops with higher yield

- ☐ disease-resistant plants
- ☐ wild animals untouched by humans

Tick every correct option.

7. Which create genetic variation? (Select all that apply.)

- ☐ meiosis
- ☐ fertilisation
- ☐ mutations
- ☐ eating well

Tick every correct option.

8. Variation arises randomly; organisms do not choose to adapt.

- ☐ True ☐ False

9. Variation is the raw material that natural selection acts on.

- ☐ True ☐ False

10. Adaptations can be structural, behavioural or functional.

- ☐ True ☐ False

18. Variation and selection

Answers · 答案

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1. blood group

Blood group is determined by genes; the others are environmental.

2. survive and reproduce in its environment

Adaptations improve survival and reproduction.

3. resistant bacteria survive and multiply while others die

Selection favours the already-resistant bacteria.

4. parents with desired features to breed together

Humans pick the parents with the wanted trait.

5. height

Height varies over a continuous range.

6. cows that produce more milk; crops with higher yield; disease-resistant plants

The first three are selective breeding; the last is not.

7. meiosis; fertilisation; mutations

Meiosis, fertilisation and mutations create variation; diet is environmental.

8. True

Mutations are random; selection favours helpful ones.

9. True

Without variation there could be no natural selection.

10. True

All three types help survival.

18.1 Variation

Name: _____ Class: _____ Date: _____

Total: 6 marks

KEY WORDS variation 变异 • continuous 连续 • mutation 突变 • discontinuous 不连续
• continuous variation 连续变异

Objective

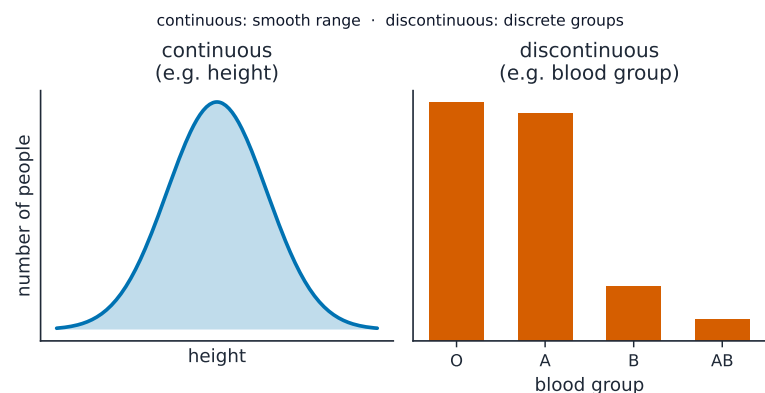
Build the skills to answer exam questions on **variation** 变异 — **continuous** 连续 and **discontinuous** 不连续 variation, and **mutation** 突变.

You must be able to:

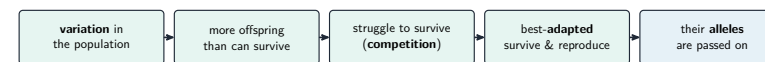
- distinguish continuous and discontinuous variation, with examples
- state the causes of each
- describe mutation as the source of new alleles

1 Worked examples

Two types of variation



Continuous: a smooth range (genes + environment). Discontinuous: separate groups (genes only)



over many generations the population becomes better adapted

Variation is the raw material of natural selection

- **continuous:** e.g. height, mass. **discontinuous:** e.g. blood group.
- **mutation:** a random change in DNA — makes new alleles (the source of all variation). Radiation/chemicals raise the rate.

2 Practice

2.1 Give one example of discontinuous variation. [1]

2.2 State the source of all new alleles. [1]

3 Exam-style questions

3.1 Human height shows continuous variation because it is affected by: [1]

- **A** genes only
- **B** the environment only
- **C** both genes and the environment
- **D** neither

3.2 Mutations are genetic changes.

(a) State what a mutation is. [1]

(b) State two things that increase the rate of mutation. [2]

Solutions

2.1 ABO blood groups (or seed shape).

2.2 mutation.

3.1 C. Height is affected by both genes and the environment.

3.2 (a) a (random) genetic change (in the base sequence of DNA).

(b) ionising radiation (e.g. X-rays); certain chemicals.

Name: _____

IGCSE Biology: **w25 21**

30 What is a source of genetic variation that alters the base sequence of DNA?

- A** gene mutation
- B** mitosis
- C** random fertilisation
- D** random mating

IGCSE Biology: **s25 22**

32 What is a way in which new alleles are formed?

- A** artificial selection
- B** mutation
- C** natural selection
- D** sexual reproduction

IGCSE Biology: **s25 23**

33 Which row describes continuous and discontinuous variation?

	continuous variation	discontinuous variation
A	body mass in animals is an example	caused by genes and the environment
B	caused by genes and the environment	seed shape in peas is an example
C	caused by genes only	ABO blood groups is an example
D	seed colour in peas is an example	caused by genes only

IGCSE Biology: **m25 22**

33 What are sources of genetic variation in populations?

- A** meiosis, mutation, random mating
- B** meiosis, random mating, asexual reproduction
- C** mitosis, mutation, random fertilisation
- D** mitosis, random fertilisation, asexual reproduction

18.2 Adaptive features

Name: _____ Class: _____ Date: _____ **Total: 21 marks**

KEY WORDS adapted 适应 • adaptive feature 适应特征 • xerophytes 旱生植物
• hydrophytes 水生植物 • survive 生存

Objective

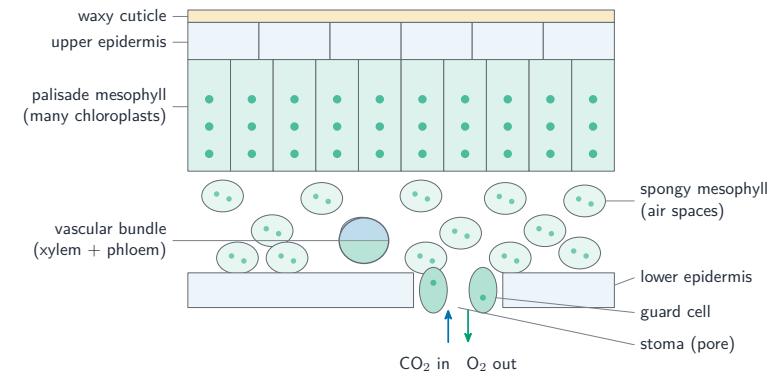
Build the skills to answer exam questions on **adaptive features** 适应特征 — what they are, and the features of **xerophytes** 旱生植物 and **hydrophytes** 水生植物.

You must be able to:

- define an adaptive feature
- describe the adaptive features of a xerophyte (desert plant)
- describe the adaptive features of a hydrophyte (water plant)

1 Worked examples

■ Adaptations



An adaptive feature is an inherited feature that helps an organism survive and reproduce in its environment



over many generations the population becomes better adapted

Adaptive features arise through natural selection

- **xerophyte (desert):** thick waxy cuticle, few small stomata, water storage → reduce water loss.
- **hydrophyte (water):** air spaces to float; stomata on the upper surface.

2 Practice

2.1 Define an adaptive feature. [1]

2.2 State one adaptive feature of a desert plant. [1]

3 Exam-style questions

3.1 A thick waxy cuticle helps a desert plant by: [1]

- **A** increasing water loss
- **B** reducing water loss
- **C** trapping more light
- **D** attracting insects

3.2 Xerophytes live where water is scarce.

(a) Describe two adaptive features that reduce water loss, and how each helps. [4]

3.3 Marram grass grows on dry sand dunes. Water lily grows with its roots in mud and its leaves floating on the surface.

(a) State what is meant by an *adaptive feature*. [2]

(b) Describe **three** adaptive features of a xerophyte such as marram grass, and explain how each reduces water loss. [6]

(c) Describe **two** adaptive features of a hydrophyte such as water lily, and explain each. [4]

(d) Explain why a xerophyte would not survive if planted in a pond. [2]

Solutions

2.1 an inherited feature that helps an organism survive and reproduce in its environment.

2.2 any of: thick waxy cuticle; few/small stomata; water storage.

3.1 B. A thick waxy cuticle reduces water loss.

3.2 (a) a thick waxy cuticle reduces evaporation from the leaf surface; few/small stomata reduce water lost by transpiration.

3.3 (a) An adaptive feature is an inherited characteristic that makes an organism better suited to its environment, so it is more likely to survive and reproduce there.

(b) A **thick waxy cuticle** — water cannot evaporate through wax, so loss from the leaf surface is very low. **Rolled leaves with stomata on the inside** — this traps a pocket of humid air next to the stomata, so the concentration gradient for water vapour is small and less diffuses out. **Hairs around the stomata (or sunken stomata)** — they trap still, humid air and shelter the pores from the wind, again reducing the gradient. (Also accept: long roots reaching deep water; a small surface area to volume ratio.)

(c) **Large air spaces in the leaves and stems** — these hold the leaf up at the surface so it reaches the light, and store oxygen for the roots in airless mud. **Stomata on the upper surface only** — the lower surface is in contact with water, so gases can only be exchanged from above.

(d) Its features are all for saving water, which is not scarce in a pond; its roots are not adapted to airless waterlogged mud, so they would not get enough oxygen for respiration and would die.

34 What are features of hydrophytes which have leaves that float?

- A long root system
- B many stomata on upper surface of leaves
- C hairy leaves
- D small air spaces in the spongy mesophyll

IGCSE Biology: w25 23

34 Which term is used to describe a characteristic that helps an organism to survive and reproduce in its environment?

- A adaptive feature
- B competition
- C observable feature
- D phenotype

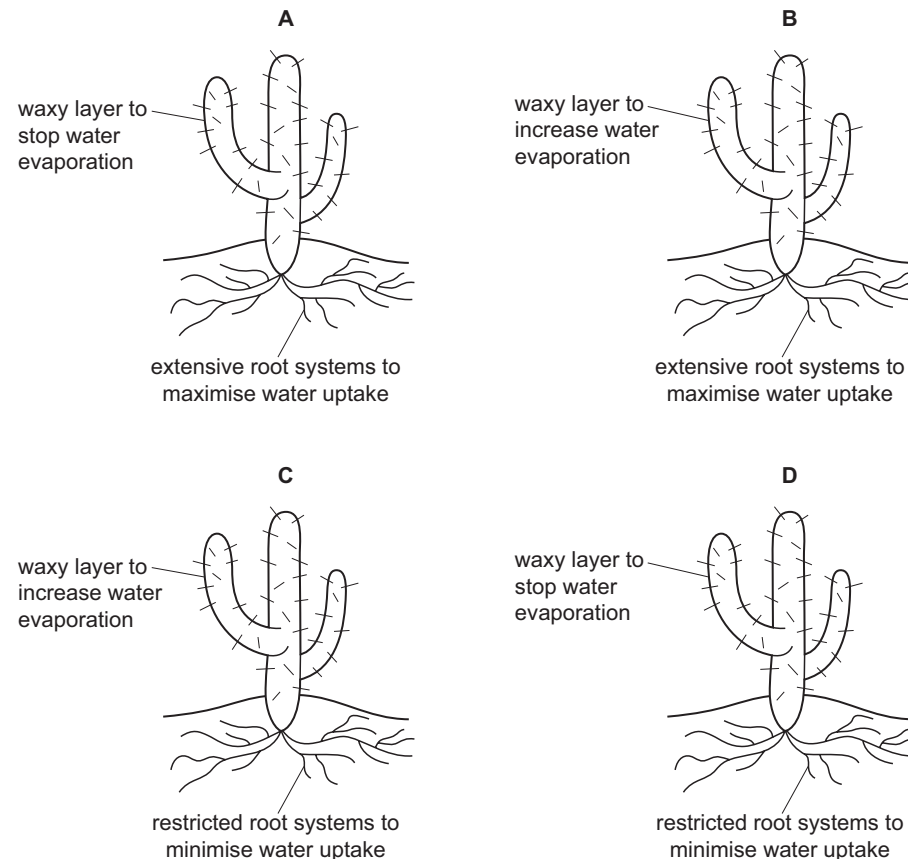
IGCSE Biology: s25 21

32 The table shows some features of leaves.

Which leaf is adapted to survive in hot, dry habitats?

	number of stomata	thickness of waxy cuticle	surface area of leaf
A	many	thick	small
B	many	thin	large
C	few	thick	small
D	few	thin	large

34 Which diagram of a xerophyte is labelled correctly?



IGCSE Biology: s25 23

34 Which statements describe an adaptive feature in an organism?

- 1 It helps an organism to survive and reproduce in its environment.
- 2 It always shows continuous variation.
- 3 It is inherited.

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only

4 Xerophytes are plants that show adaptive features for dry habitats.

(a) Complete the sentence to define the term adaptive feature.

An adaptive feature is an feature that helps an organism to and in its environment.

[2]

(b) Marram grass is a xerophytic plant.

Fig. 4.1 is a photomicrograph of a cross-section of a marram grass leaf.

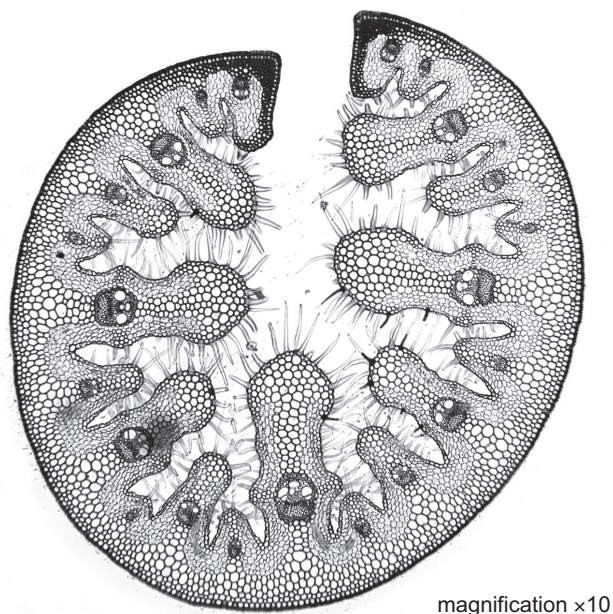


Fig. 4.1

Using Fig. 4.1, describe the visible features that identify this as a xerophyte leaf.

.....

 [2]

(c) (i) The mean cell wall thickness of an epidermal cell from one species of xerophyte is $1.276\mu\text{m}$.

Convert $1.276\mu\text{m}$ to mm.

..... mm [1]

(ii) State the name of the carbohydrate molecule used to build cell walls in xerophytes.

..... [1]

(iii) Suggest **one** way the stem of a xerophyte is adapted for dry habitats.

.....

 [1]

(d) Fig. 4.2 is a diagram showing the root systems of two different species of xerophyte.

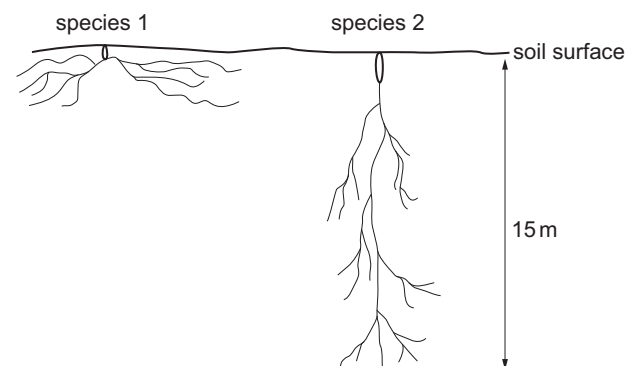


Fig. 4.2

Describe the **two** root systems shown in Fig. 4.2 and suggest how each one is an adaptation for living in a dry environment.

.....

 [3]

18.3 Selection

Name: _____ Class: _____ Date: _____

Total: 7 marks

KEY WORDS antibiotic 抗生素 • bacteria 细菌 • resistant 耐药 • selection 选择
• natural selection 自然选择

Objective

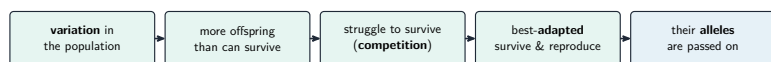
Build the skills to answer exam questions on **selection** 选择 — **natural selection** 自然选择, antibiotic resistance, and **selective breeding** 选择育种.

You must be able to:

- describe the steps of natural selection
- explain antibiotic resistance as natural selection
- describe selective breeding and contrast it with natural selection

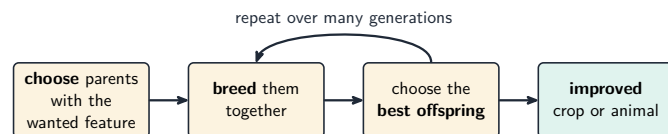
1 Worked examples

■ Natural and artificial selection



over many generations the population becomes better adapted

Variation → too many offspring → struggle/competition → best-adapted survive and reproduce → pass on alleles



humans choose which breed (not the environment)

Selective breeding: humans choose which organisms breed, over many generations

- key difference: the **environment** selects (natural) vs **humans** select (artificial).

2 Practice

2.1 State what is meant by natural selection. [1]

2.2 State who or what “selects” in selective breeding. [1]

3 Exam-style questions

3.1 In natural selection, the individuals most likely to survive and reproduce are those that are: [1]

- A the largest
- B best adapted to the environment
- C chosen by humans
- D identical to each other

3.2 Some bacteria become resistant to an antibiotic.

(a) Explain how antibiotic resistance spreads, using natural selection. [3]

(b) State the main difference between natural selection and selective breeding. [1]

Solutions

2.1 the process by which the best-adapted organisms survive, reproduce and pass on their alleles.

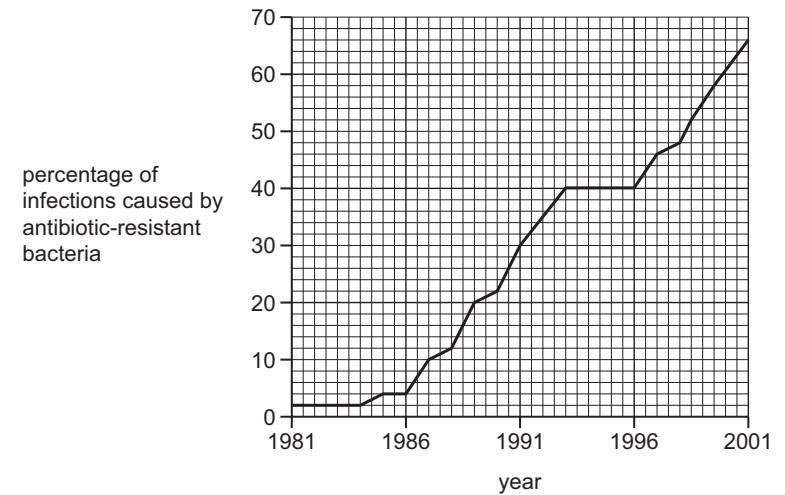
2.2 humans.

3.1 B. The best-adapted individuals are most likely to survive and reproduce.

3.2 (a) a few bacteria carry a resistant allele (by mutation); the antibiotic kills the non-resistant ones, so the resistant survive; they reproduce and pass on the resistance allele, so the population becomes resistant.

(b) in natural selection the environment selects; in selective breeding humans select.

22 The graph shows the change in the percentage of infections caused by antibiotic-resistant bacteria in one country.



Which statements could explain the change in the percentage of infections caused by antibiotic-resistant bacteria?

- 1 The use of antibiotics has resulted in natural selection for resistant bacteria.
- 2 The use of antibiotics has caused a decrease in viral diseases.
- 3 The use of antibiotics when **not** essential increased the percentage of antibiotic-resistant infections.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

2 Chickens are birds that are bred by farmers to produce eggs and meat. Modern farmed chickens are very different from the red junglefowl that is their wild ancestor.

Table 2.1 describes some of the characteristics of red junglefowl and farmed chickens.

Table 2.1

type of bird	mean body mass/g	mean number of eggs per year	mean mass of pectoral muscle/g	mean age at maturity/days
red junglefowl	775	12	91	142
chicken	4090	160	437	59

(a) (i) Using Table 2.1, calculate the percentage change in the mean body mass from the red junglefowl to the chicken.

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

Space for working.

..... % [3]

(ii) Suggest reasons why farmers have selectively bred chickens to reach maturity faster than red junglefowl.

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..... [2]

(iii) Describe how a farmer could breed chickens with a larger body mass.

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(b) Chicken faeces can be used as a fertiliser.

Chicken faeces spread on agricultural land near lakes can act as a pollutant, and cause the destruction of the freshwater habitat.

Explain how the use of chicken faeces near freshwater lakes can lead to habitat destruction.

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..... [6]

(c) Chicken waste contains a substance that is similar to urea.

Explain how urea is made in humans.

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..... [3]

33 Which row correctly describes a type of selection?

	type of selection	humans involved	example
A	artificial	no	production of farmed animals that produce lots of milk
B	artificial	yes	production of bacteria that are resistant to antibiotics
C	natural	yes	production of insulin through genetic modification of bacteria
D	natural	no	production of wild animals with long necks to reach tree leaves as a food source

27 *Clostridium difficile* is a species of bacterium that is resistant to many antibiotics.

From 2002 to 2006, the number of people in one country infected with *Clostridium difficile* increased from 1300 to 6200 people.

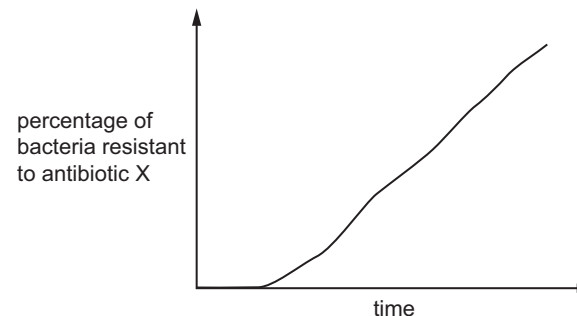
What was the percentage increase in the number of people infected with *Clostridium difficile* from 2002 to 2006 to the nearest whole number?

- A** 21% **B** 27% **C** 79% **D** 377%

33 How does artificial selection differ from natural selection?

- A** Artificial selection changes the characteristics of living things.
B Artificial selection is based on genetic variation.
C Artificial selection does **not** involve competition for resources.
D Artificial selection occurs over many generations.

35 The graph shows the change in the percentage of bacteria resistant to antibiotic X.



What causes the change shown in the graph?

- A** artificial selection
B natural selection
C meiosis
D random fertilisation