

Week 1

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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1. Characteristics and classification of living organisms Starter Quiz · 课前小测

IGCSE Biology

Name: _____ Score: _____

1. The mnemonic MRS GREN helps you remember:

- ☐ the seven characteristics of living things
- ☐ the parts of a cell
- ☐ the kingdoms of life
- ☐ the food groups

2. A species is a group of organisms that can:

- ☐ breed to produce fertile offspring
- ☐ live in the same place
- ☐ eat the same food
- ☐ be the same colour

3. Which feature do plant cells have that animal cells do not?

- ☐ a cell wall
- ☐ a nucleus
- ☐ a cell membrane
- ☐ cytoplasm

4. In MRS GREN, the "R" for respiration means:

- ☐ releasing energy from food
- ☐ breathing in air only
- ☐ reproducing
- ☐ removing waste

5. In the binomial system, the first word of the name is the:

- ☐ genus
- ☐ species
- ☐ kingdom
- ☐ phylum

6. Which of these are kingdoms of living things? (Select all that apply.)

- ☐ animals

☐ plants

☐ fungi

☐ rocks

Tick every correct option.

7. Excretion removes waste made by the body's own reactions.

☐ True ☐ False

8. Members of the same species breed to produce _____ offspring.

9. Bacteria are prokaryotes, meaning their cells have no proper nucleus.

☐ True ☐ False

10. Taking in materials for energy, growth and repair is called _____.

IGCSE Biology

1. the seven characteristics of living things

MRS GREN lists the seven life processes.

2. breed to produce fertile offspring

Members of a species breed to give fertile offspring.

3. a cell wall

Plant cells have a cell wall, chloroplasts and a large vacuole.

4. releasing energy from food

Respiration releases energy from food in every living cell.

5. genus

The binomial is genus then species, e.g. Homo sapiens.

6. animals; plants; fungi

Rocks are not living. The kingdoms include animals, plants, fungi, bacteria and protists.

7. True

Egestion removes undigested food; excretion removes metabolic waste.

8. fertile

Fertile offspring can themselves reproduce.

9. True

Bacteria lack a nucleus; the other kingdoms are eukaryotes.

10. nutrition

Nutrition is the N in MRS GREN.

1.1 Characteristics of living organisms

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS organisms 生物体 • characteristics 特征 • excretion 排泄 • respiration 呼吸作用 • growth 生长

Objective

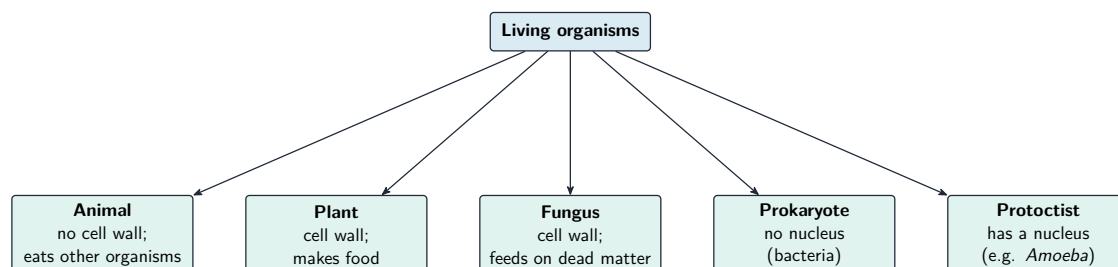
Build the skills to answer exam questions on the **characteristics of living organisms** 生物的特征 — the seven life processes (**MRS GREN**).

You must be able to:

- list the seven characteristics with their exact definitions
- define respiration, excretion, sensitivity and nutrition precisely
- recognise that digestion and breathing are **not** in the list

1 Worked examples

■ MRS GREN



All living organisms carry out the seven life processes

- **Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition.**
- **respiration:** chemical reactions in cells that break down nutrients to release energy.
- **excretion:** removal of the toxic waste products of metabolism (and excess substances).

2 Practice

2.1 State what the letters MRS GREN stand for (any four). [4]

2.2 Define growth. [1]

3 Exam-style questions

3.1 Which is **not** one of the seven characteristics of living organisms? [1]

- **A** respiration
- **B** digestion
- **C** excretion
- **D** sensitivity

3.2 Give the precise definition of: [2]

(a) excretion

(b) sensitivity

3.3 Explain the difference between nutrition and digestion. [2]

Solutions

2.1 any four of: Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition.

2.2 a permanent increase in size and dry mass.

3.1 B. Digestion is part of nutrition, not one of the seven.

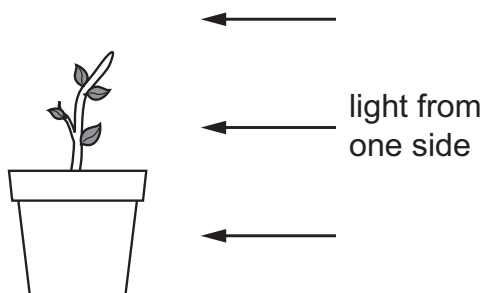
3.2 (a) the removal of the toxic waste products of metabolism (and excess substances).

(b) the ability to detect and respond to changes in the environment.

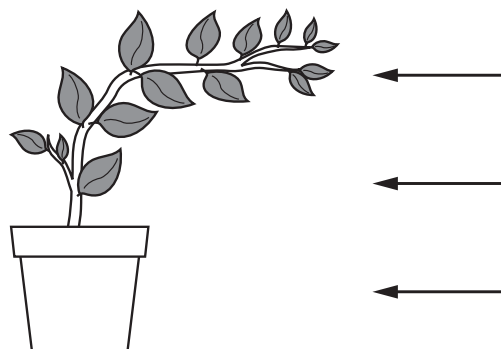
3.3 nutrition is taking in materials for energy, growth and development; digestion is just one part of nutrition (breaking food into small molecules).

- 1 The diagrams show a plant at the start of an experiment, and the same plant two weeks later.

start of the experiment



after two weeks



Which characteristics of living organisms are demonstrated by this experiment?

- A excretion and growth
- B excretion and reproduction
- C growth and sensitivity
- D sensitivity and reproduction

- 1 What is a characteristic of all living organisms?

- A breathing
- B photosynthesis
- C reproduction
- D transpiration

- 1 Which characteristic of living things requires carbon dioxide to diffuse into a leaf?

- A excretion
- B movement
- C nutrition
- D respiration

1 The photograph shows an animal called a margay.



Four processes that occur in the margay are listed.

- excretion
- growth
- digestion
- respiration

How many of the processes that occur in the margay are characteristics of all living organisms?

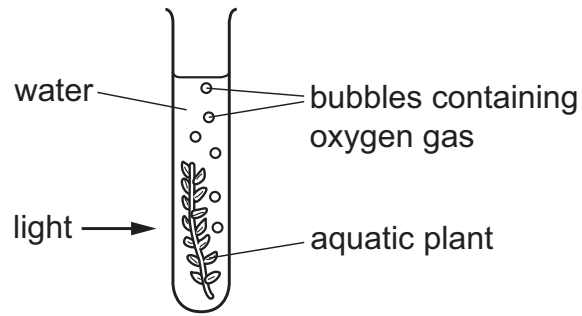
A 1

B 2

C 3

D 4

1 The diagram shows an aquatic plant in light.



What is a characteristic of **all** living things that is demonstrated in the diagram?

- A breathing
- B nutrition
- C photosynthesis
- D respiration

1.2 Concept and uses of classification systems

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS species 物种 • scientific name 学名 • ancestor 祖先 • binomial system 双名法 • base sequence 碱基序

Objective

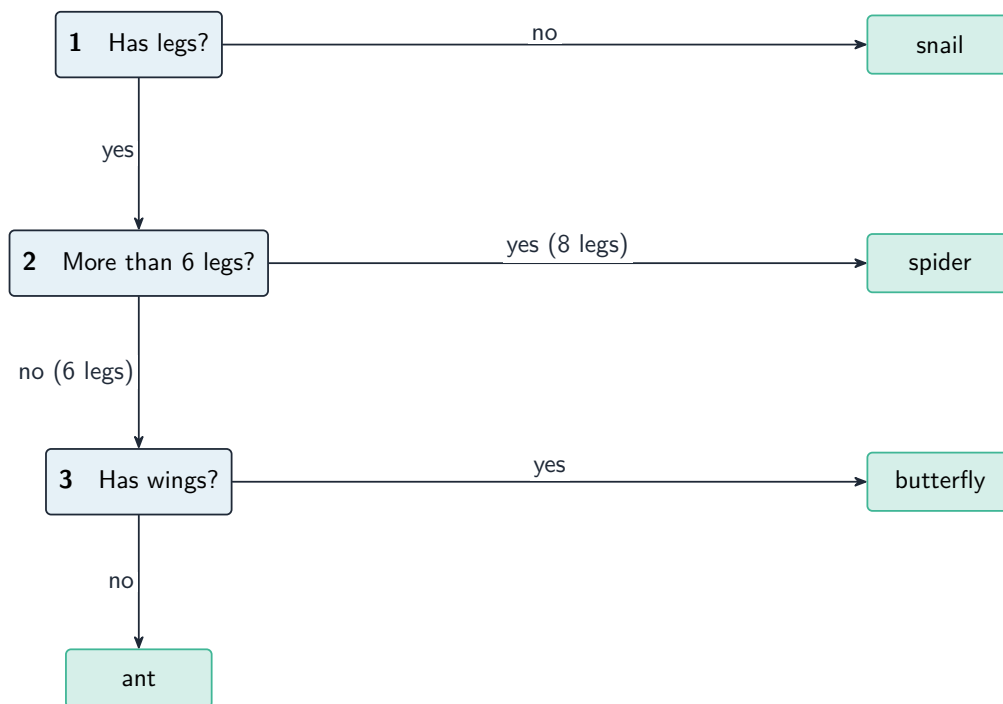
Build the skills to answer exam questions on **classification systems** 分类系统 — **species** 物种, the **binomial system** 双名法, **dichotomous keys** 二歧检索表, and DNA in classification.

You must be able to:

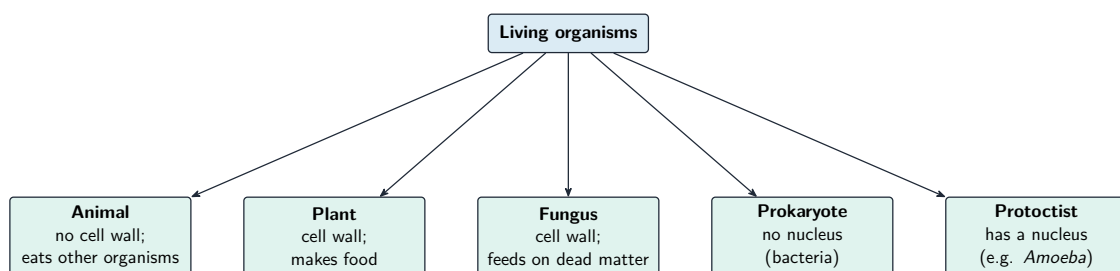
- define a species and use the binomial naming rules
- use and construct a dichotomous key
- explain how DNA base sequences show how closely related organisms are

1 Worked examples

■ Keys and naming



Each step of a key gives two choices until you reach the organism



A key sorts organisms into the five kingdoms

- **species:** a group that can reproduce to make fertile offspring.
- **binomial:** *Genus species* — Genus capital, species lower-case, both italic.
- more similar DNA base sequence → more closely related (more recent ancestor).

2 Practice

2.1 Define a species. [1]

2.2 In the name *Homo sapiens*, state which word is the genus. [1]

3 Exam-style questions

3.1 Two organisms with very similar DNA base sequences are: [1]

- **A** distantly related
 - **B** closely related
 - **C** the same individual
 - **D** not related
-

3.2 A student writes a scientific name as “homo Sapiens”.

(a) State the two mistakes in this name. [2]

(b) State one feature you should use when building a dichotomous key, and one you should avoid. [2]

3.3 Explain how DNA base sequences can be used to find out how closely two species are related. [2]

Solutions

2.1 a group of organisms that can reproduce to make fertile offspring.

2.2 *Homo*.

3.1 B. Similar DNA base sequences mean closely related.

3.2 (a) the genus should have a capital letter (*Homo*); the species should be lower-case (*sapiens*).

(b) use a clear visible feature (e.g. has wings / no wings); avoid a feature that changes, such as size.

3.3 compare the base sequences of the two species; the more similar the sequences, the more closely related they are (they share a more recent ancestor).

2 What can be used to classify organisms?

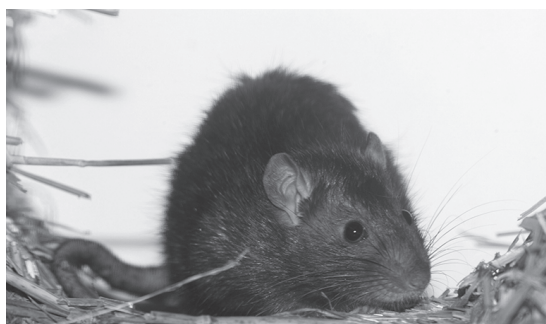
- A the number of bases in DNA
- B the number of different types of bases in DNA
- C the sequence of bases in DNA
- D the sequence of bases in one protein

1 The photographs show two different rats.

Rattus norvegicus



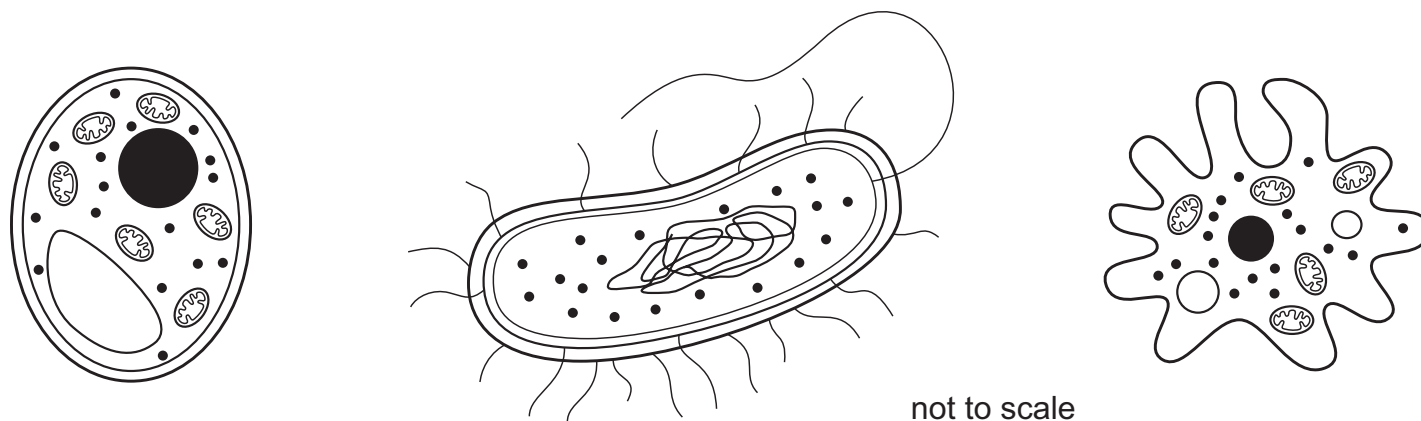
Rattus rattus



Which statement about the rats is correct?

- A The rats belong to the same genus.
- B The rats belong to the same species.
- C The rats can breed together to produce fertile offspring.
- D The rats do **not** share any of the same features.

2 The diagrams show cells of organisms from three different kingdoms.



1

2

3

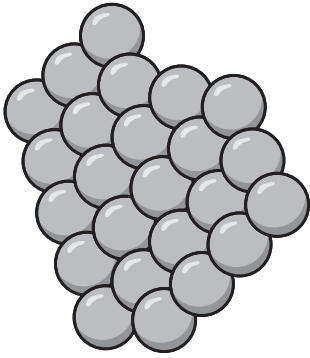
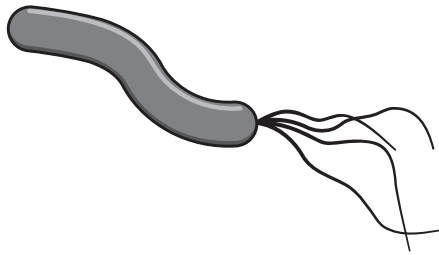
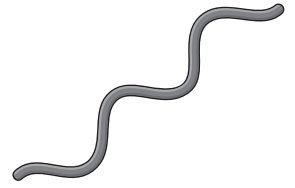
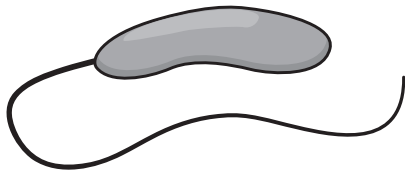
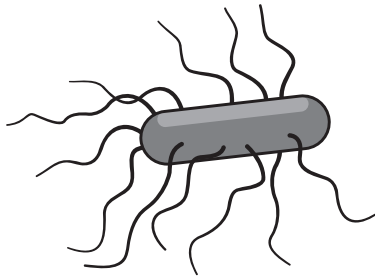
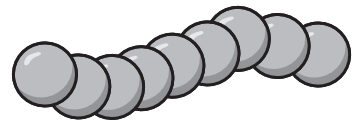
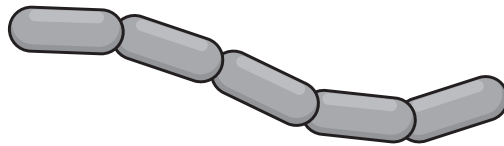
Which row shows the kingdoms for the organism cells labelled 1, 2 and 3?

	cell 1	cell 2	cell 3
A	fungus	protocist	prokaryote
B	fungus	prokaryote	protocist
C	prokaryote	fungus	protocist
D	prokaryote	protocist	fungus

2 What are the two parts of the scientific name of an organism?

- A** genus followed by kingdom
- B** genus followed by species
- C** kingdom followed by genus
- D** kingdom followed by species

1 (a) Fig. 1.1 shows drawings of seven species of bacteria.

**A****B****C****D****E****F****G**

not to scale

Fig. 1.1

Use the key to identify each species of bacteria in Fig. 1.1.

Write the letter of each species (**A** to **G**) in the correct box beside the key.

One has been done for you.

key

1	(a)	hair-like structure or structures visible	go to 2	
	(b)	no hair-like structures visible	go to 4	
2	(a)	more than one hair-like structure	go to 3	
	(b)	one hair-like structure only	<i>Vibrio cholerae</i>	
3	(a)	hair-like structures attached at one end only	<i>Helicobacter pylori</i>	
	(b)	hair-like structures attached all over	<i>Salmonella typhi</i>	
4	(a)	bacteria have a spiral shape	<i>Treponema pallidum</i>	
	(b)	bacteria do not have a spiral shape	go to 5	
5	(a)	bacteria are grouped to form a chain	go to 6	
	(b)	bacteria do not form a chain	<i>Staphylococcus aureus</i>	
6	(a)	bacteria in the chain are cylindrical in shape	<i>Streptobacillus moniliformis</i>	
	(b)	bacteria in the chain are circular in shape	<i>Streptococcus pyogenes</i>	F

[3]

(b) (i) A cylinder-shaped bacterium has a length of $2\mu\text{m}$ and a diameter of $0.5\mu\text{m}$.

Calculate:

- the radius of this bacterium
- the volume of this bacterium.

Include the units in your answers.

Space for working.

radius

volume

[4]

(ii) State the name of the kingdom that bacteria belong to.

..... [1]

(c) Fig. 1.2 is a diagram of a virus.

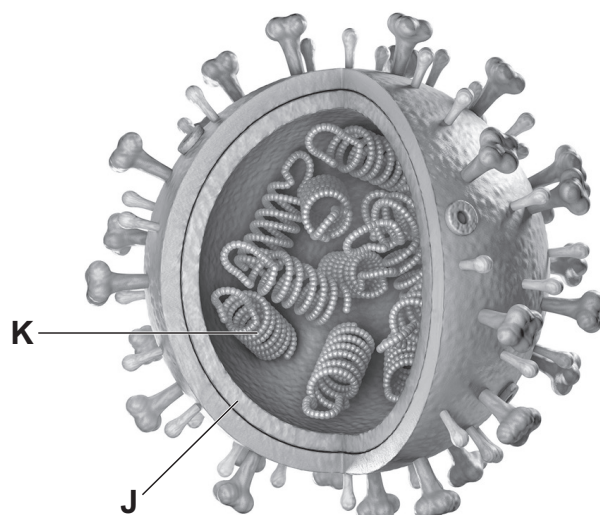


Fig. 1.2

(i) State the name of the parts labelled **J** and **K** in Fig. 1.2.

J

K

[2]

(ii) State **two** structures present in bacteria that are absent in viruses.

1

2

[2]

[Total:12]

1 Scientists use classification systems to study relationships between different groups of organisms.

(a) State the **two** parts of a scientific name used in the binomial system.

..... [1]

(b) Scientists discover a new species. It is multicellular, and has cell walls that are **not** made of cellulose. This new species feeds by releasing digestive enzymes into its surroundings and then absorbing the digested nutrients.

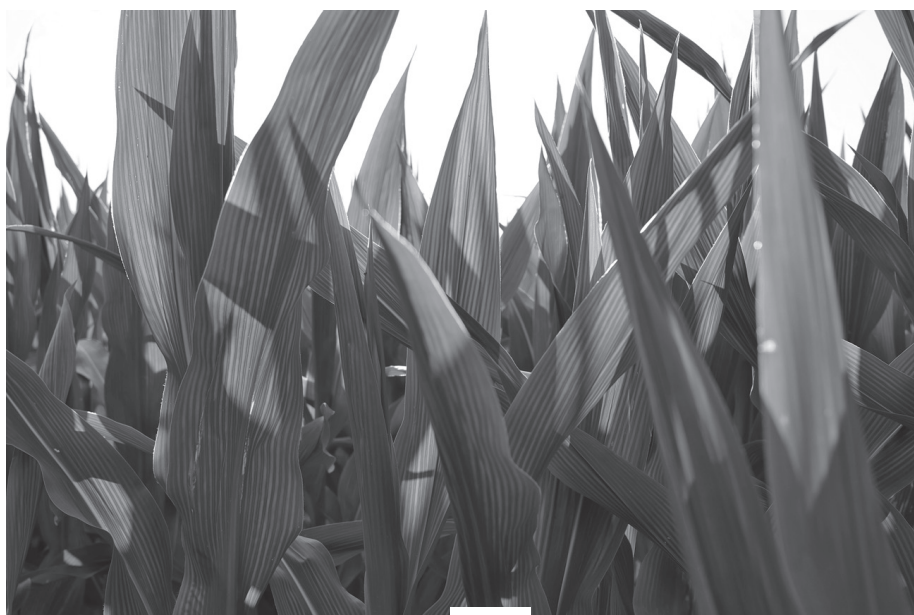
Identify the kingdom that the new species belongs to.

..... [1]

(c) Fig. 1.1 shows photographs of two different species, **X** and **Y**.



species **X**



species **Y**

(i) Species **X** and **Y** belong to the plant kingdom.

State **two** structures found in cells from species **X** and **Y** that are **not** found in animal cells.

- 1
- 2 [2]

(ii) Using features visible in Fig. 1.1, identify the group in the plant kingdom that species **X** and **Y** belong to.

Explain your answer.

- species **X**
-
-
-
- species **Y**.....
-
-
-
- [4]

(iii) Understanding evolutionary relationships between crop plants can help scientists and farmers improve agriculture.

Explain how a scientist could determine if different crop plant species share a recent ancestor (are closely related).

-
-
-
-
- [2]

[Total: 10]

2 Part of the base sequence of DNA from four species was determined.

species 1 T C A G G A T T

species 2 T G A G C A A T

species 3 T G A G C A A G

species 4 T G A G G A T T

Which two species are the **least** closely related?

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

- 5 (a) Organisms can be classified by their features and by studying the sequence of bases in their DNA.

Fig. 5.1 is a diagram showing the evolutionary relationships between some different groups of organisms.

Each branch shows the point at which organisms developed new features that classify them as a new group.

The point where the branch starts also indicates a common ancestor shared by the new groups.

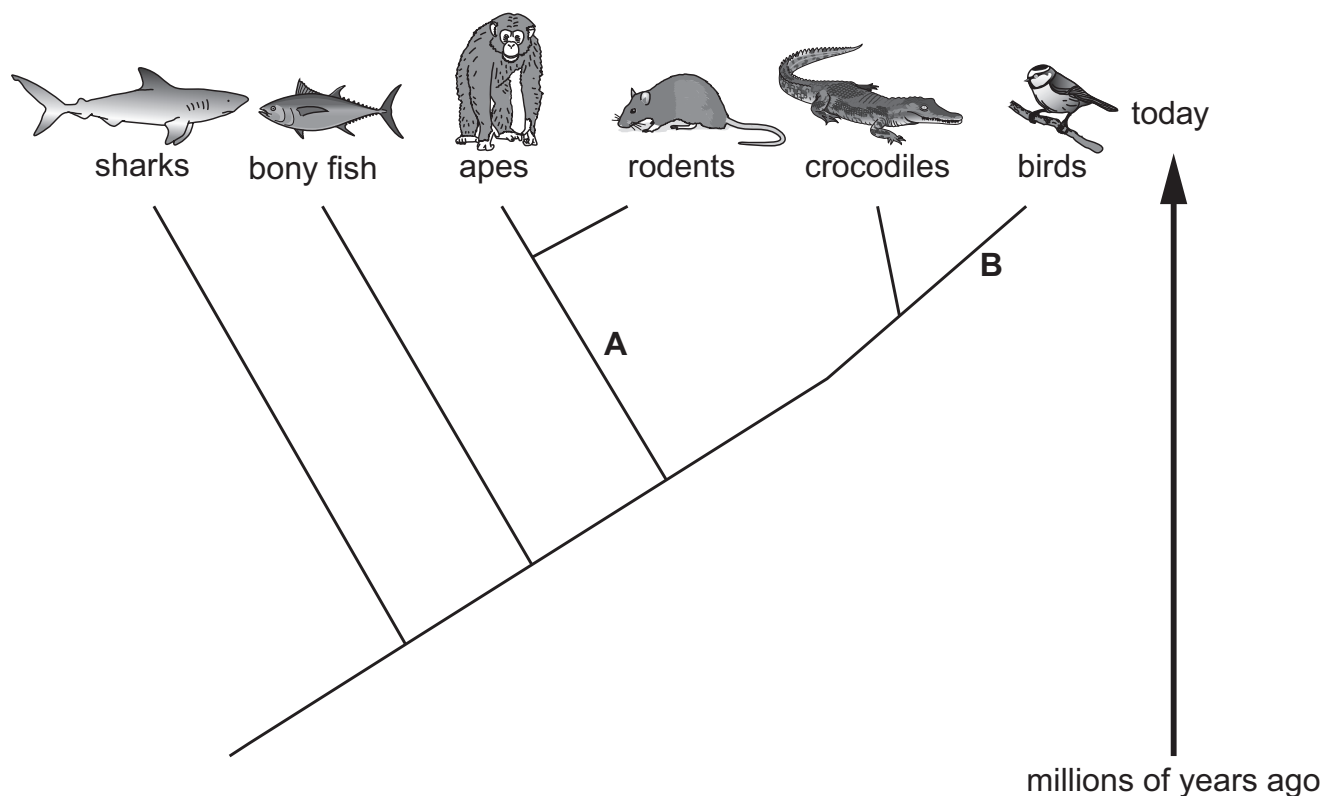


Fig. 5.1

- (i) Suggest which visible features have developed at **A** and **B** in Fig. 5.1.

A

B

[2]

- (ii) Identify the names of the **two** groups that share the most recent common ancestor in Fig. 5.1.

..... and [1]

- (iii) Suggest the groups with the most similar and least similar DNA base sequences to crocodiles in Fig. 5.1.

most similar

least similar

(b) Describe the structure of a DNA molecule.

[4]

(c) Outline how the base sequences in DNA control cell function.

[3]

[Total: 12]

- 1 The relationships of four species of bacteria, P, Q, R and S, were compared.
- Species P and Q have a more recent common ancestor than either species has with species R.

Species S developed recently from species P.

Which species has the **least** similar base sequences in their DNA compared to the other three species of bacteria?

A

P

B

Q

C

R

D

S

1.3 Features of organisms

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS plant 植物 • viruses 病毒 • cell wall 细胞壁 • chloroplasts 叶绿体 • insects 昆虫

Objective

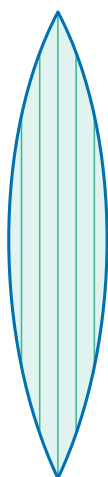
Build the skills to answer exam questions on the **features of organisms** 生物的特征 — the five **kingdoms** 界, the main animal and plant groups, and **viruses** 病毒.

You must be able to:

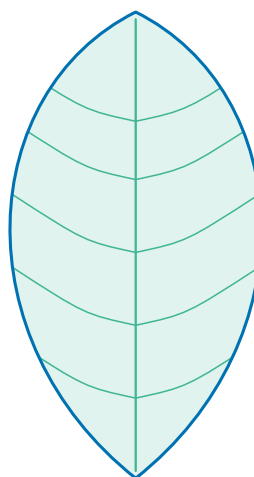
- give the main features of each kingdom
- classify vertebrates and arthropods by their features
- describe monocots/dicots and the structure of a virus

1 Worked examples

■ Plant groups and viruses

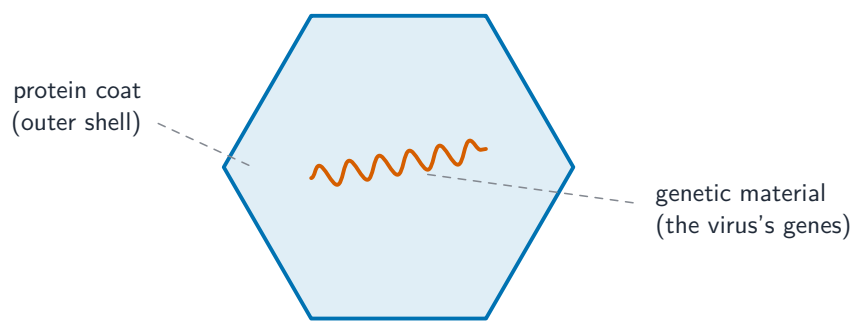


Monocotyledon
parallel veins, 1 cotyledon



Dicotyledon
net (branching) veins, 2 cotyledons

Monocots: one cotyledon, parallel veins. Dicots: two cotyledons, net-like veins



A virus is a protein coat around genetic material — not made of cells

- **insects:** 3 body parts, 3 pairs of legs; **arachnids:** 2 parts, 4 pairs of legs.

2 Practice

2.1 State the main feature that distinguishes a vertebrate from an arthropod. [1]

2.2 State the two parts that make up a virus. [2]

3 Exam-style questions

3.1 Which feature places an organism in the plant kingdom? [1]

- **A** no cell wall
- **B** cells contain chloroplasts and can photosynthesise
- **C** single-celled with no nucleus
- **D** feeds on other organisms

3.2 An animal has three pairs of legs, a body in three parts and one pair of antennae.

(a) Name the arthropod group it belongs to. [1]

(b) State two features of a mammal. [2]

3.3 Explain why many scientists do not classify viruses as living organisms. [2]

Solutions

2.1 a vertebrate has a backbone; an arthropod does not (it has an exoskeleton).

2.2 a protein coat; genetic material inside.

3.1 B. Plants have cell walls and chloroplasts and photosynthesise.

3.2 (a) insects.

(b) any two of: have fur/hair; feed young on milk;.

3.3 a virus is not made of cells and cannot carry out the life processes on its own; it can only reproduce inside a living host cell.

- 4 Fig. 4.1 is a photograph of a bee on a flower. One of the bee's legs is covered with pollen.



Fig. 4.1

- (a) (i) State **three** features of flowers that attract pollinating insects such as bees.

1

2

3 [3]

- (ii) State **one** way that pollen grains are adapted for pollination by bees.

.....

.....

..... [1]

- (b) Describe **two** ways the structure of a monocotyledonous plant differs from the structure of a dicotyledonous plant.

1

.....

2

..... [2]

(c) Fig. 4.2 is a diagram of a cross-section of an insect-pollinated flower.

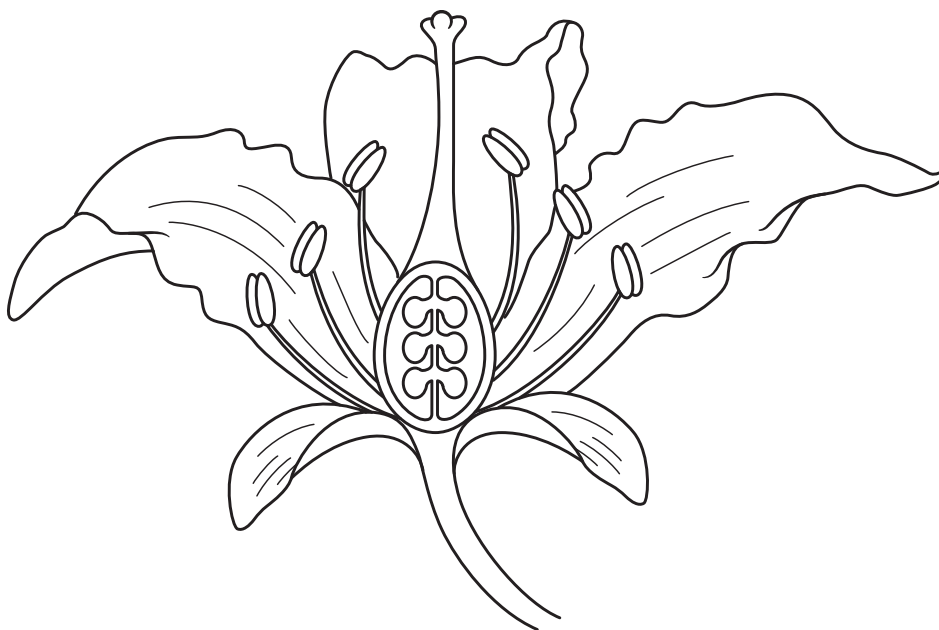


Fig. 4.2

On Fig. 4.2, name and draw label lines to:

- the structure that supports an anther
- a structure that protects the flower bud
- an ovule.

[3]

(d) Describe sexual reproduction in a flower, from the release of pollen to the formation of a zygote.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(e) Sexual reproduction also occurs in humans.

(i) State the name of the male gamete in a human.

..... [1]

(ii) State where gametes are formed in the human male reproductive system.

..... [1]

(iii) Human male gametes are haploid.

State the name of the process that produces haploid male gametes.

..... [1]

(iv) Describe the function of the prostate gland in the male reproductive system.

.....
.....
..... [1]

[Total: 18]

2 (a) Dicotyledons and monocotyledons belong to the plant kingdom.

(i) State **two** main features of plants.

1

2 [2]

(ii) State the names of **two** other kingdoms.

1

2 [2]

(b) Fig. 2.1 is a diagram of a cross-section of a monocotyledonous stem.

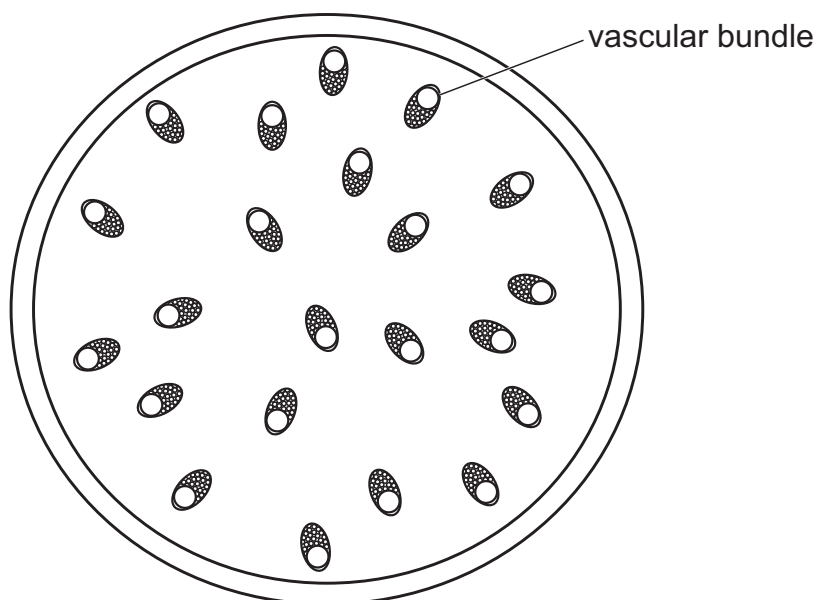


Fig. 2.1

Describe how the distribution of vascular bundles in a dicotyledonous stem would differ from the monocotyledonous stem shown in Fig. 2.1.

.....

.....

..... [1]

(c) Fig. 2.2 is an incomplete drawing of a cross-section of a dicotyledonous root.

Complete Fig. 2.2 by:

- sketching the distribution of phloem and xylem
- labelling the phloem, xylem and a root hair.

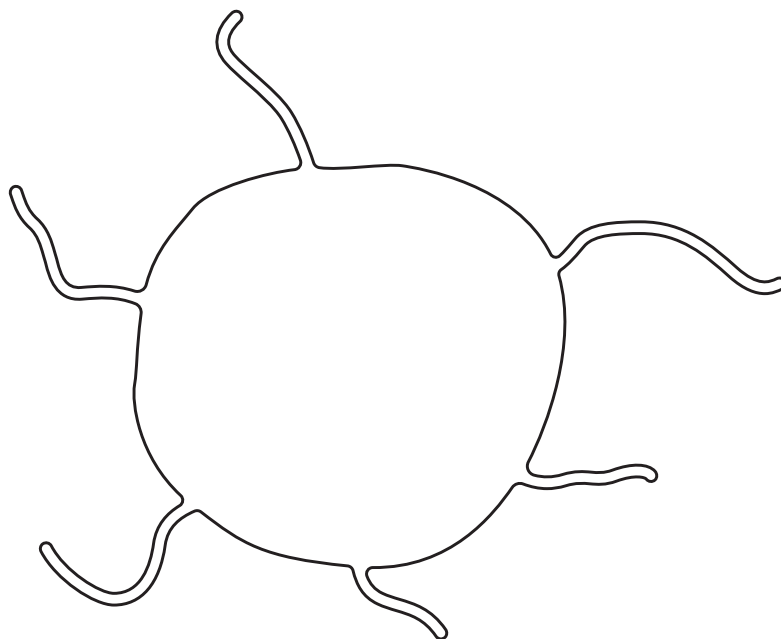


Fig. 2.2

[3]

(d) State **two** functions of xylem.

1

2

[2]

(e) A farmer investigated the effect of girdling on the mass of apple fruit produced by apple trees.

The farmer removed a 3 mm strip of bark and phloem tissue from the branches that produce the fruit, as shown in Fig. 2.3.

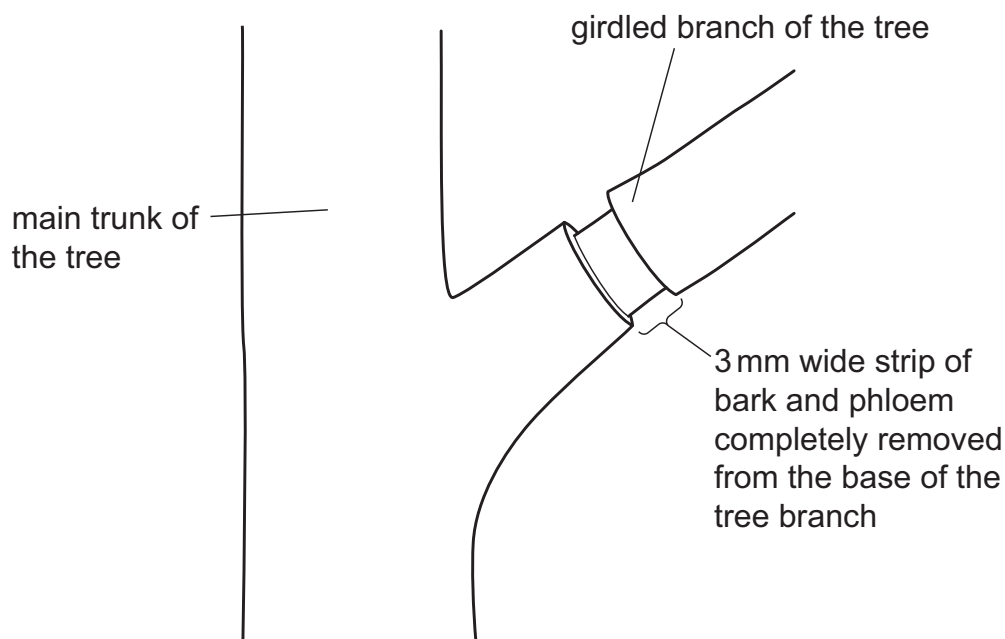


Fig. 2.3

The farmer girdled nine apple trees and left nine apple trees ungirdled.

The mass of ten fruits from the girdled trees and the mass of ten fruits from the ungirdled trees were compared.

Table 2.1 shows the results.

Table 2.1

treatment of trees	mass of ten fruits/g
girdled	1796
ungirdled	958

Describe the results shown in Table 2.1 **and** suggest an explanation for them.

..... [5]

(f) Apples are used to make apple juice.

State **one** enzyme used in fruit juice production.

..... [1]

[Total: 16]

- 3 (a) Fig. 3.1 is a photograph of a necklace starfish, *Fromia monilis*.

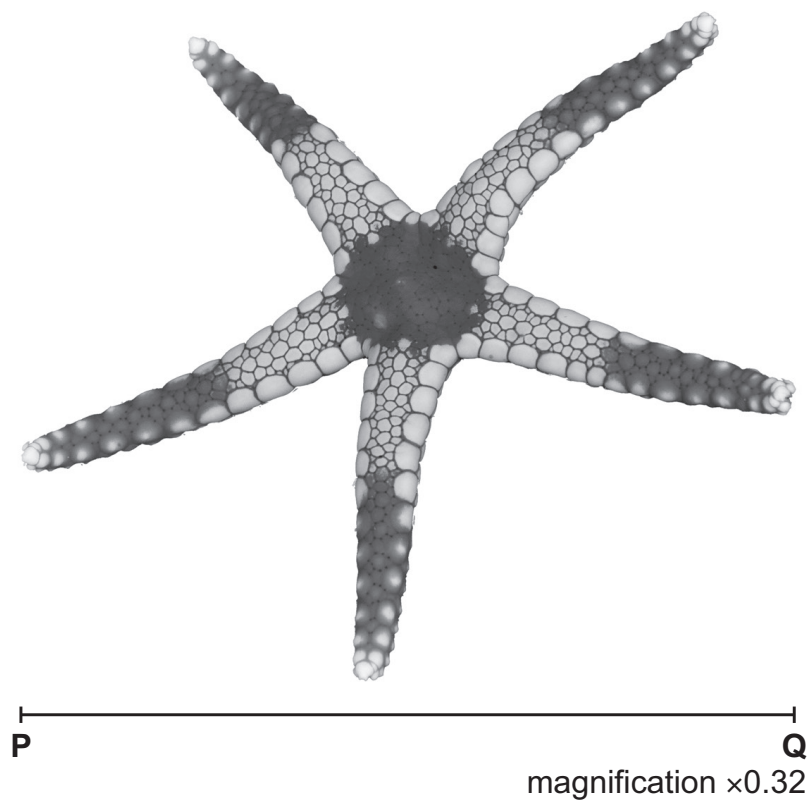


Fig. 3.1

- (i) Draw a large diagram of the necklace starfish shown in Fig. 3.1.

(ii) Line **PQ** in Fig. 3.1 represents the diameter of the necklace starfish.

Measure the length of line **PQ** in Fig. 3.1.

length of line **PQ** mm

Calculate the actual diameter of the necklace starfish using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line PQ in Fig. 3.1}}{\text{actual diameter of the necklace starfish}}$$

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

Space for working.

..... mm
[3]

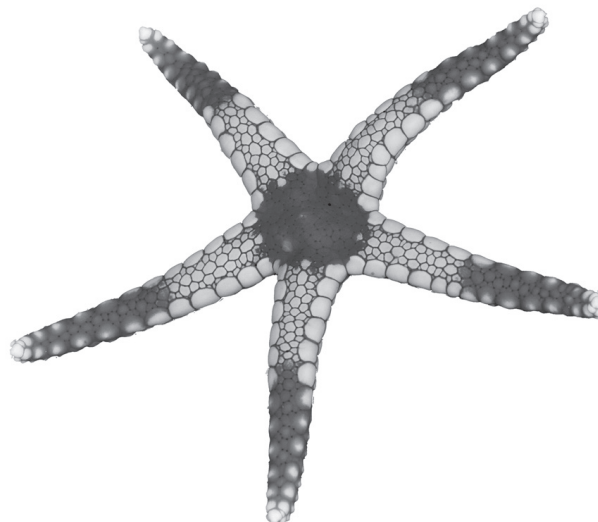
- (iii) Fig. 3.2 is a photograph of a spiny starfish, *Marthasterias glacialis*. Fig. 3.3 is a photograph of a necklace starfish.

The magnifications of the photographs are **not** the same.



spiny starfish

Fig. 3.2



necklace starfish

Fig. 3.3

State **two** ways the spiny starfish in Fig. 3.2 differs from the necklace starfish in Fig. 3.3, and **one** way it is similar.

Do **not** include references to size in your answer.

difference 1

.....

difference 2

.....

similarity 1

.....

[3]

(b) Seven-armed starfish live in the sea.

Scientists investigated the distribution of seven-armed starfish, *Luidia ciliaris*, in one region.

- Photographs of 20 m² areas of seabed were taken at different depths.
- The depth of the water in each area was measured when the water was at its highest level (high tide).
- The numbers of seven-armed starfish in each photograph were counted.
- All photographs were taken on the same day in July.

(i) State **two** ways that the method used by the scientists ensured that the numbers of seven-armed starfish counted at different depths could be compared.

- 1
-
- 2
-

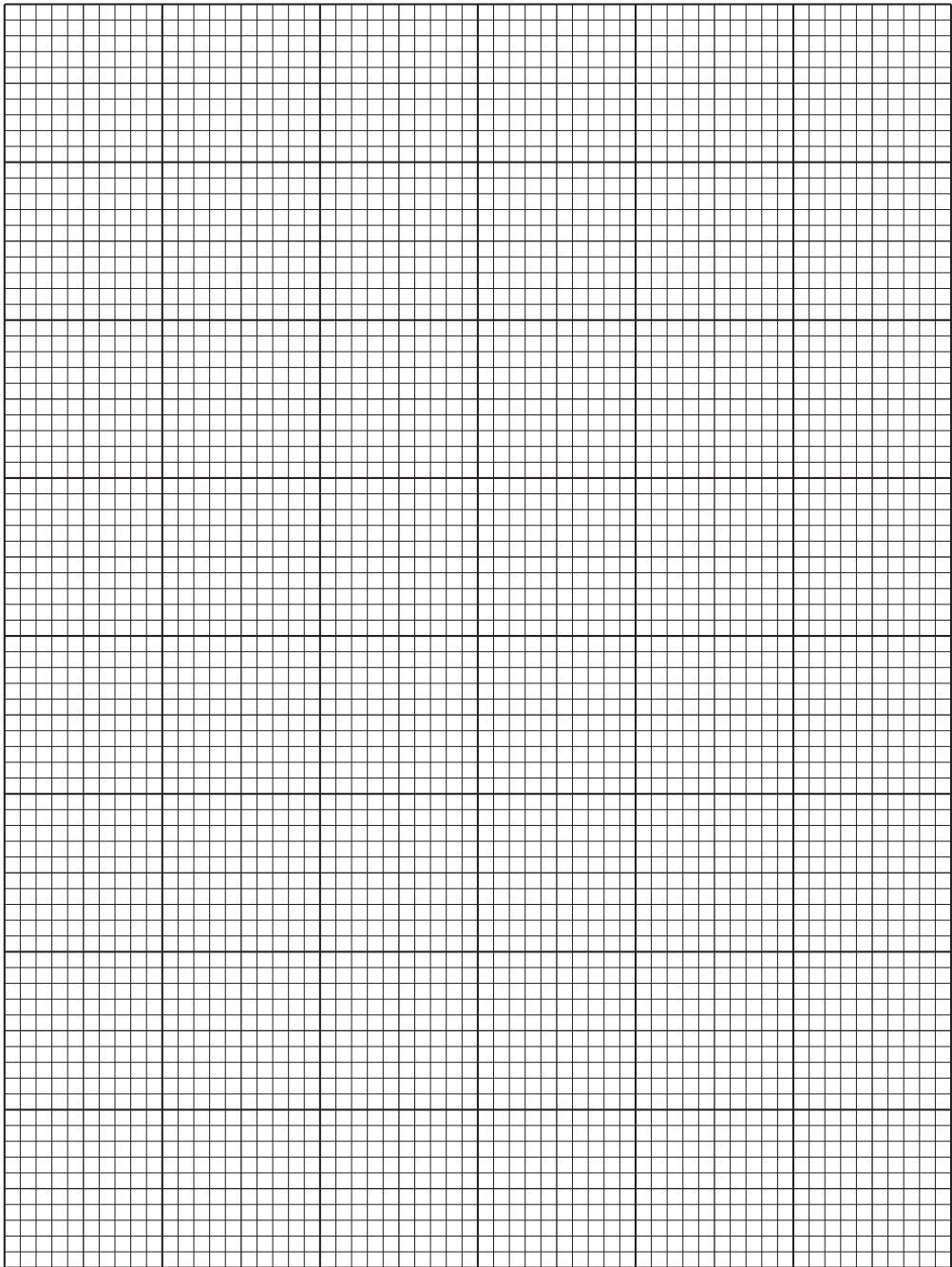
[2]

The results of the investigation are shown in Table 3.1.

Table 3.1

depth / m	number of seven-armed starfish counted
0.0–9.9	337
10.0–19.9	1486
20.0–29.9	1243
30.0–39.9	241
40.0–49.9	121

(ii) Plot a histogram on the grid of the data in Table 3.1.



(iii) State the depth range in Table 3.1 at which most seven-armed starfish were found.

.....m [1]

(iv) Using the information in Table 3.1, calculate the total number of seven-armed starfish that were photographed at all depths, and use this value to calculate the percentage of starfish that were photographed in the 0.0–9.9 m range.

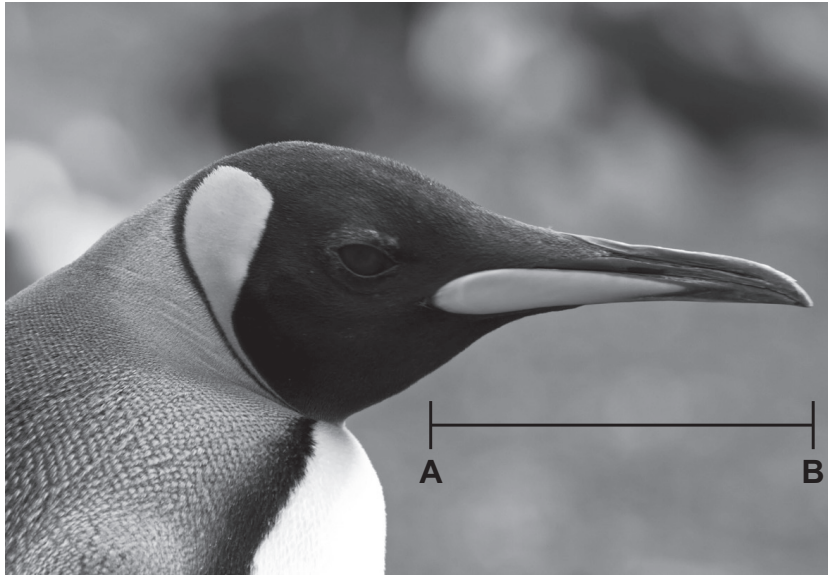
Express the percentage as a whole number.

Space for working.

total number of seven-armed starfish photographed
percentage of seven-armed starfish photographed at 0.0–9.9 m%
[3]

[Total: 20]

- 3 (a) Fig. 3.1 is a photograph of the head of a king penguin.



magnification $\times 0.42$

Fig. 3.1

- (i) Make a large drawing of the head of the king penguin shown in Fig. 3.1.

(ii) The length of line **AB** represents the length of the penguin's beak.

Measure the length of line **AB** in Fig. 3.1.

length of line **AB** mm

Use your measurement and the formula to calculate the actual length of the penguin's beak.

$$\text{magnification} = \frac{\text{length of line } \mathbf{AB} \text{ in Fig. 3.1}}{\text{actual length of the penguin's beak}}$$

Give your answer to **one** decimal place.

Space for working.

..... mm
[3]

(b) Fig. 3.2 shows the heads of a gentoo penguin and a black-footed penguin.



gentoo



black-footed

not to scale

Fig. 3.2

Other than size, state **two** ways the gentoo penguin differs from the black-footed penguin in Fig. 3.2.

1

.....

2

.....

[2]

- (c)** Penguins are covered in feathers. The feathers reduce heat loss by insulating the birds from the cold.

A beaker of hot water can be used to represent a penguin.

Plan an investigation to determine the effect of the thickness of an insulating material on heat loss in a beaker of hot water.

[6]

[Total: 15]

- 2** Which set of features is characteristic only of birds?

- A** hair and wings
- B** hard-shelled eggs and feathers
- C** scales and soft-shelled eggs
- D** wings and soft-shelled eggs

3 A single-celled organism has chloroplasts, a cell wall and a nucleus.

Which kingdom is this organism placed in?

- A** fungus
- B** plant
- C** prokaryote
- D** protocist

- 4 Fig. 4.1 is a photograph of a water lily, *Nymphaea alba*, in a lake.



Fig. 4.1

Fig. 4.2 is a photomicrograph of a cross-section of part of a water lily leaf.

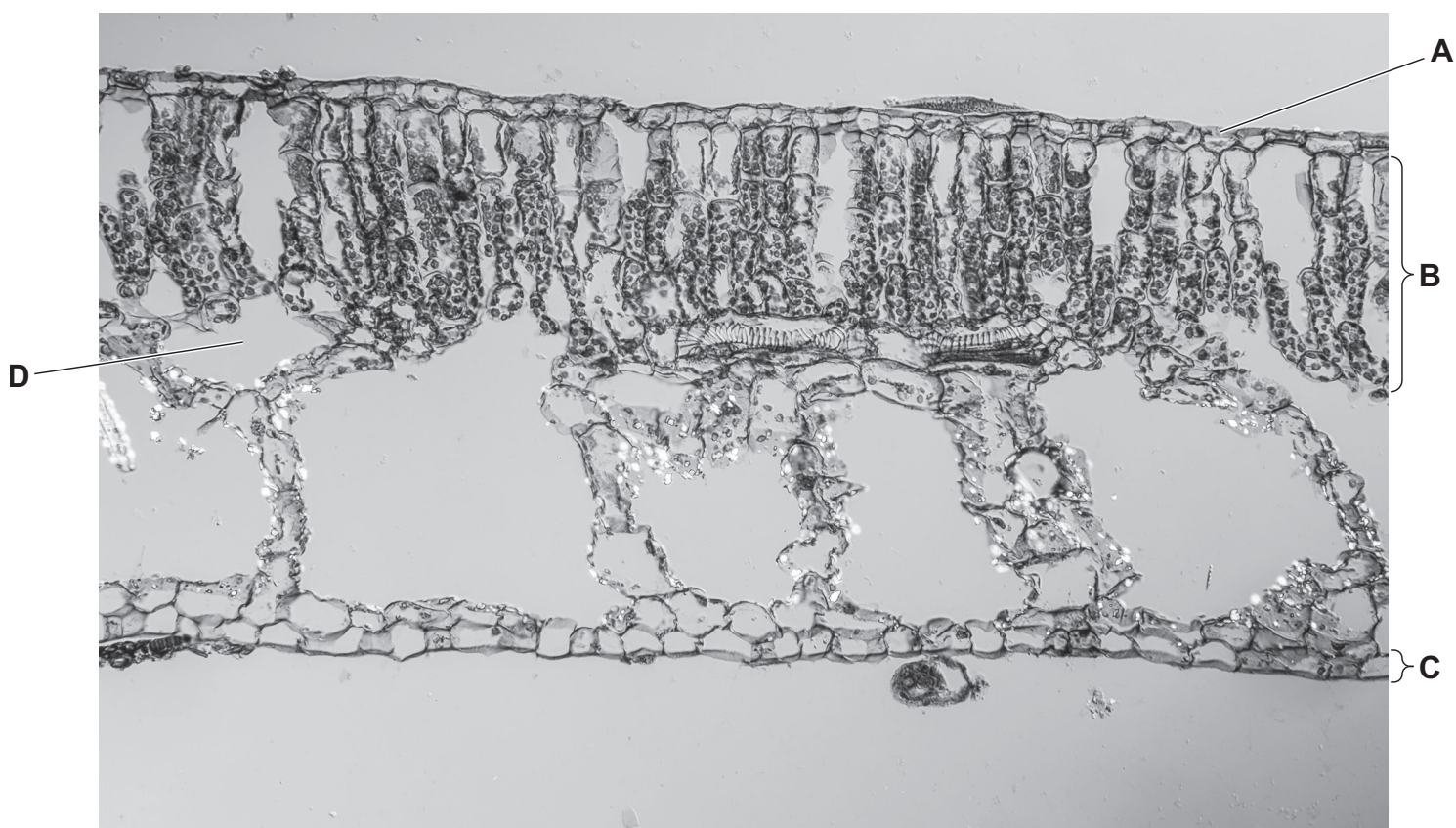


Fig. 4.2

- (a) (i) Identify tissue **B** and tissue **C** labelled in Fig. 4.2.

B

C

[2]

(ii) Describe **two** functions in water lilies of the area labelled **D** in Fig. 4.2.

1

.....

2

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[2]

(iii) A green pigment is found in tissue **B** in Fig. 4.2.

Describe the function of this pigment.

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[2]

(iv) Water lilies have a very thin cuticle compared to a plant growing on land.

Explain how this is an adaptation for water lilies.

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[2]

(b) Table 4.1 shows the stomatal density and habitat of two different hydrophytes.

Table 4.1

type of plant	habitat	stomatal density on upper leaf surface / stomata per mm ²	stomatal density on lower leaf surface / stomata per mm ²
pondweed	under the water	0	0
water lily	leaves on the surface of the water	573	0

(i) Convert the stomatal density of the upper leaf surface of the water lily to stomata per cm².

..... stomata per cm² [1]

(ii) Using the data in Table 4.1, explain the stomatal density found in the two different hydrophytes.

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..... [4]

- (c) Fig. 4.3 is a photograph of rice, *Oryza sativa*, a monocotyledonous crop plant grown in flooded fields in waterlogged soils.



Fig. 4.3

- (i) Identify a characteristic visible in Fig. 4.3 that can be used to classify rice as a monocotyledonous plant.

(ii) Waterlogged soil contains very low concentrations of oxygen.

Suggest how this limits the amount of proteins a plant can make.

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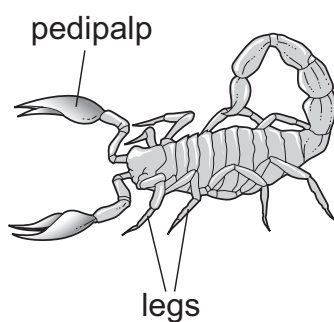
.....

.....

..... [3]

[Total: 17]

2 The diagram shows an arthropod.



To which group does it belong?

- A arachnids
- B crustaceans
- C insects
- D myriapods