Week 2

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

IGCSE Biology Name: _____ Score: _____

1. Which part of the cell contains DNA and controls the cell?
   - ☐ nucleus
   - ☐ cytoplasm
   - ☐ cell membrane
   - ☐ mitochondria
2. A red blood cell is specialised to carry oxygen. It has:
   - ☐ no nucleus and lots of haemoglobin
   - ☐ a large nucleus
   - ☐ chloroplasts
   - ☐ a tail
3. Magnification is calculated as:
   - ☐ image size ÷ actual size
   - ☐ actual size ÷ image size
   - ☐ image size × actual size
   - ☐ image size + actual size
4. Which part releases energy by respiration?
   - ☐ mitochondria
   - ☐ nucleus
   - ☐ cell wall
   - ☐ vacuole
5. A group of similar cells working together is a:
   - ☐ tissue
   - ☐ organ
   - ☐ organ system
   - ☐ organism
6. An image is 40 mm across and the real object is 0.5 mm. What is the magnification?

   _____

7. Which parts are found ONLY in plant cells? (Select all that apply.)

   ☐ cell wall

   ☐ chloroplasts

   ☐ large vacuole

   ☐ nucleus

   Tick every correct option.

8. A root hair cell's long shape gives it a large surface area for absorbing water.

   ☐ True ☐ False

9. An image is 60 mm and the magnification is ×300. What is the actual size (mm)?

   _____

10. Several different tissues working together form an _____.

    _____

IGCSE Biology

1. **nucleus**

   The nucleus holds DNA and controls the cell.

2. **no nucleus and lots of haemoglobin**

   No nucleus leaves more room for haemoglobin, which carries oxygen.

3. **image size ÷ actual size**

   Magnification = image ÷ actual.

4. **mitochondria**

   Mitochondria are the site of aerobic respiration.

5. **tissue**

   A tissue is a group of similar cells.

6. **80**

   40 ÷ 0.5 = ×80.

7. **cell wall; chloroplasts; large vacuole**

   The nucleus is in both; the cell wall, chloroplasts and large vacuole are plant-only.

8. **True**

   Its structure fits its function of absorption.

9. **0.2**

   Actual = 60 ÷ 300 = 0.2 mm.

10. **organ**

    An organ is made of several tissues.

IGCSE BIOLOGY • EXERCISE SHEET

2.1 Cell structure

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS cells 细胞 • plant 植物 • organ 器官 • cell wall 细胞壁 • organism 生物体

Objective

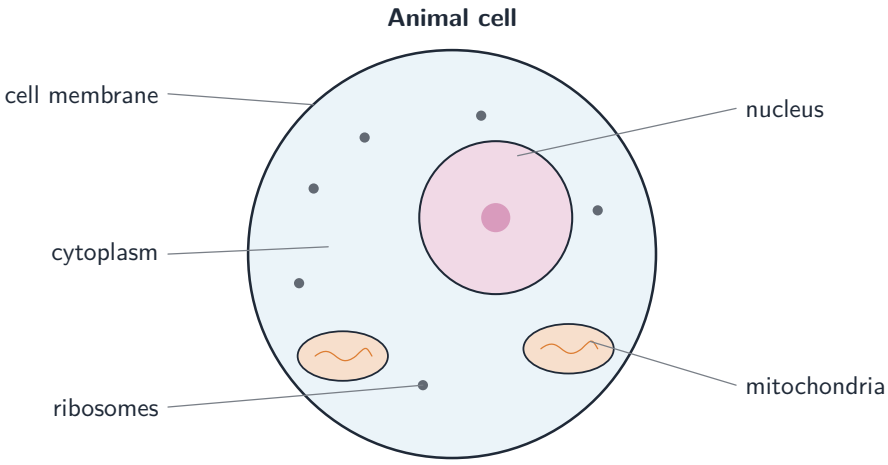
Build the skills to answer exam questions on **cell structure** 细胞结构 — comparing plant, animal and bacterial cells, the function of each structure, and **specialised cells** 特化细胞.

You must be able to:

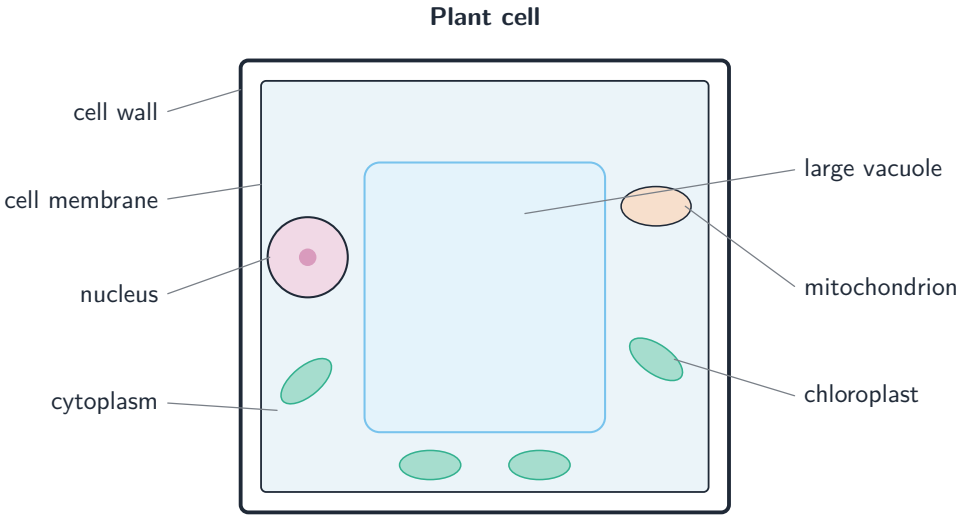
- state which structures are in plant, animal and bacterial cells
- give the function of each structure
- link a specialised cell to its feature, and order the levels of organisation

1 Worked examples

Comparing cells



Animal cell: membrane, cytoplasm, nucleus, mitochondria, ribosomes



A plant cell also has a cell wall, a large vacuole and chloroplasts

- **bacterium:** no nucleus (a loop of DNA), plus plasmids; no mitochondria.
- **levels:** cell → tissue → organ → organ system → organism.

Reading a cell, and calculating its size

Plant against animal. Both have a cell membrane, cytoplasm, a nucleus, mitochondria and ribosomes. Only the plant cell adds a **cell wall** 细胞壁 of cellulose, which gives the fixed shape; a **large permanent vacuole** 液泡 full of cell sap; and **chloroplasts** 叶绿体 containing chlorophyll. A **bacterial cell** 细菌细胞 has a cell wall but no nucleus: its DNA is a single loop, with extra small rings called **plasmids** 质粒, and it has no mitochondria or chloroplasts.

What each structure does. Nucleus: holds the DNA and controls the cell's activities. Cytoplasm: where the reactions happen. Cell membrane: controls what enters and leaves. Mitochondria: aerobic respiration, releasing energy. Ribosomes: protein synthesis. Chloroplast: photosynthesis. Vacuole: stores cell sap and keeps the cell firm.

Specialised cells have a shape that fits the job: a red blood cell has no nucleus, so it carries more haemoglobin; a root hair cell has a long extension, giving a large surface area for absorbing water; a nerve cell is long, to carry impulses a long way; a xylem vessel is a hollow dead tube with no end walls, so water flows freely.

The magnification calculation is asked in almost every paper:

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

Worked example. A cell drawing is 60 mm across and the real cell is 0.03 mm. Find the magnification.

1. Put both lengths in the **same unit**: both are already in mm.

2. magnification $= \dfrac{60}{0.03} = 2000$.
3. Write it as $\times 2000$, with no unit.

Going the other way, actual size $= \dfrac{\text{image size}}{\text{magnification}}$. Remember 1 mm = 1000 μm: converting first is where most marks are lost.

2 Practice

2.1 A student looks at two cells under a microscope. Cell A has a fixed rectangular shape and a large space in the middle; cell B has no fixed shape. Identify which is the plant cell, and name two structures that let you tell. [3]

2.2 State the function of mitochondria. [1]

2.3 State the function of the nucleus and of the cell membrane. [2]

2.4 A drawing of a cell is 45 mm long. The real cell is 0.15 mm long. Calculate the magnification. [2]

2.5 Explain how a root hair cell is adapted to its function. [2]

3 Exam-style questions

3.1 A cell has no nucleus, but has a cell wall, a loop of DNA and plasmids. It is a: [1]

- **A** plant cell
- **B** animal cell
- **C** bacterial cell
- **D** red blood cell

3.2 A red blood cell is a specialised cell.

(a) State its job. [1]

(b) Explain how having no nucleus suits this job. [2]

3.3 Put these in order from smallest to largest: organ, cell, organism, tissue, organ system. [2]

3.4 The diagram in a textbook shows a palisade mesophyll cell from a leaf. The drawing is 80 mm tall and the cell is really 0.10 mm tall.

(a) Calculate the magnification of the drawing. [2]

(b) The same drawing shows a chloroplast 4 mm across. Calculate the real width of the chloroplast, in micrometres. [3]

(c) Complete the table by naming the structure that carries out each function. [4]

Function	Structure
controls what enters and leaves the cell	
site of aerobic respiration	
absorbs light energy for photosynthesis	
gives the plant cell its fixed shape	

(d) A bacterial cell is examined. Identify two structures present in the palisade cell that the bacterial cell does not have, and name the structure that carries the bacterial cell's genetic material. [3]

(e) Explain how the palisade cell's position and its number of chloroplasts suit its function. [2]

Solutions

2.1 Cell A is the plant cell; any two of: a cell wall, which gives the fixed rectangular shape; a large permanent vacuole, which is the space in the middle; chloroplasts.

2.2 where respiration happens to release energy.

2.3 Nucleus: holds the DNA and controls the cell's activities; cell membrane: controls which substances enter and leave the cell.

2.4 $\dfrac{45}{0.15} = \times 300$.

2.5 It has a long, narrow extension, which gives a large surface area for absorbing water and mineral ions from the soil.

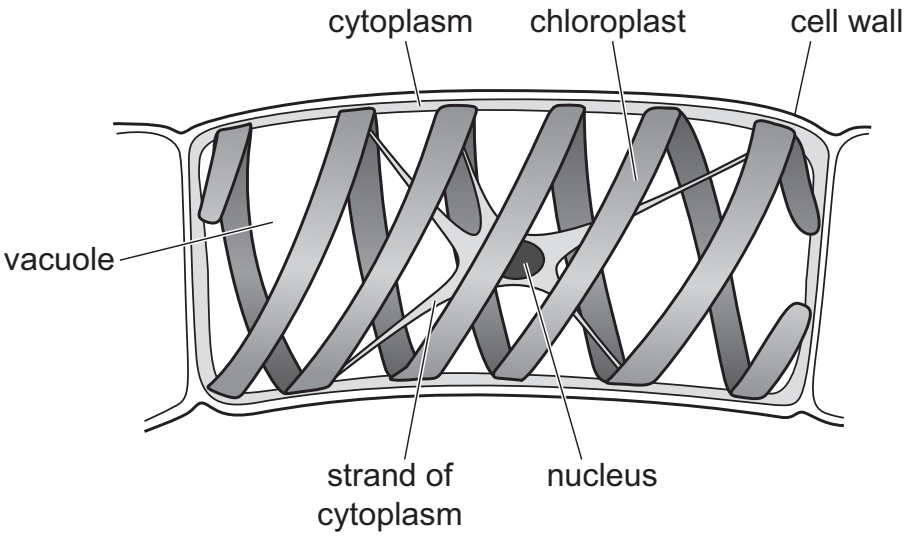
3.1 C. No nucleus + plasmids + a DNA loop → a bacterial cell.

3.2 (a) to transport oxygen.
(b) with no nucleus there is more room for haemoglobin, so it can carry more oxygen.

3.3 cell → tissue → organ → organ system → organism.

3.4 (a) $\dfrac{80}{0.10} = \times 800$.
(b) Actual size $= \dfrac{4}{800} = 0.005$ mm; $0.005 \times 1000 = 5$ μm.
(c) Cell membrane; mitochondrion; chloroplast; cell wall.
(d) Any two of: a nucleus, mitochondria, chloroplasts, a permanent vacuole; the bacterial cell's genetic material is a single loop of DNA, with extra rings called plasmids.
(e) It sits near the top of the leaf, where the light is strongest, and it contains many chloroplasts, so it absorbs as much light as possible for photosynthesis.

3 The diagram shows a single cell from an organism called *Spirogyra*.



Which features does *Spirogyra* share with plant cells?

	cell wall	chloroplast	cytoplasm	nucleus	vacuole
A	yes	yes	yes	yes	yes
B	yes	yes	no	no	yes
C	yes	no	yes	yes	no
D	no	yes	yes	no	yes

4 Which term describes each structure?

	structure		
	brain	liver	neurone
A	organ	organ	cell
B	organ	tissue	cell
C	tissue	organ	tissue
D	tissue	cell	organ

3 A palisade cell and a neurone are observed under a light microscope.

Which cell component is found only in the palisade cell?

A cell membrane

B cell wall

C cytoplasm

D nucleus

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

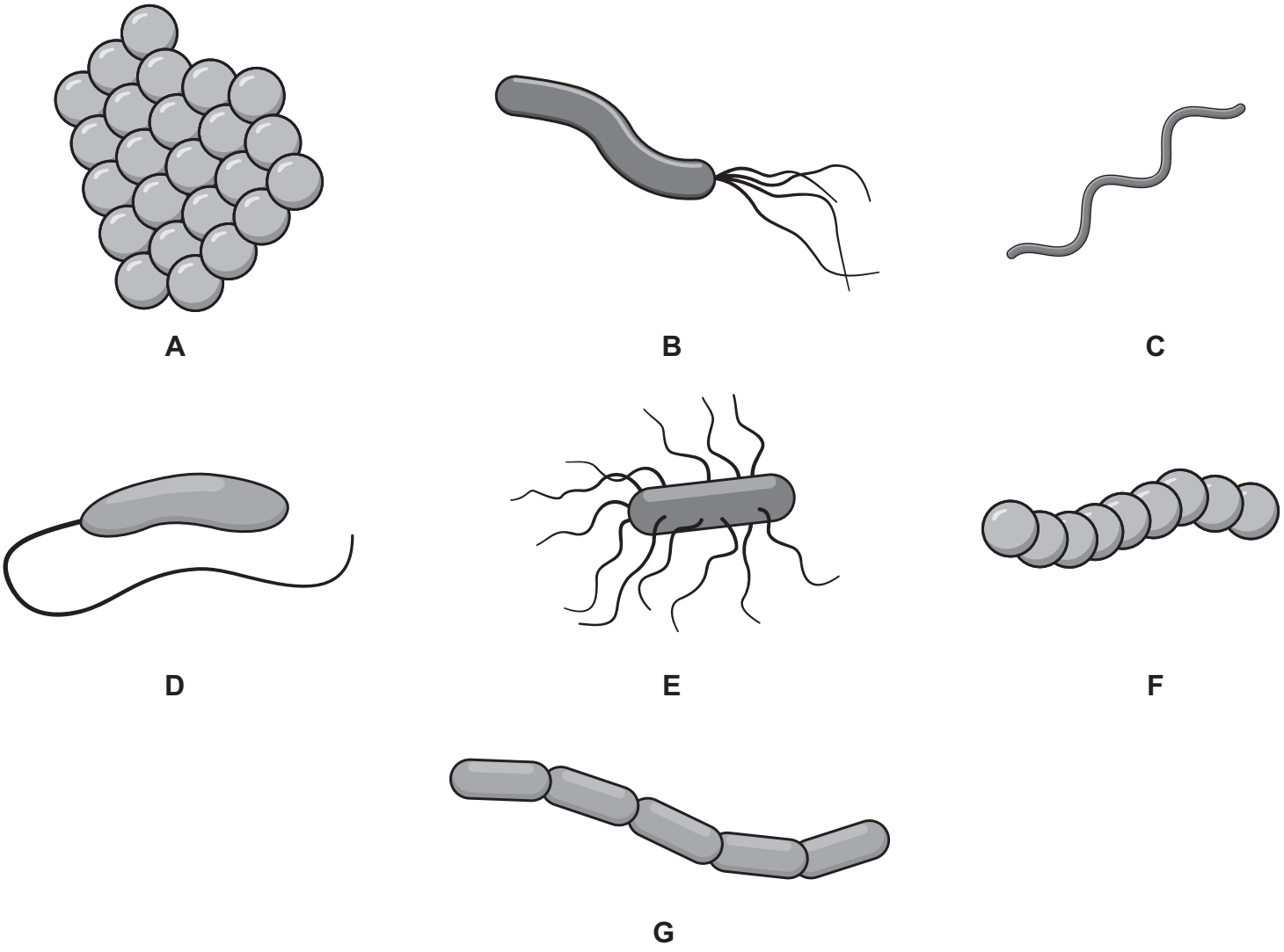


Fig. 1.1

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	*Vibrio cholerae*	
3	(a)	hair-like structures attached at one end only	*Helicobacter pylori*	
	(b)	hair-like structures attached all over	*Salmonella typhi*	
4	(a)	bacteria have a spiral shape	*Treponema pallidum*	
	(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	*Staphylococcus aureus*	
6	(a)	bacteria in the chain are cylindrical in shape	*Streptobacillus moniliformis*	
	(b)	bacteria in the chain are circular in shape	*Streptococcus pyogenes*	**F**

[3]

(b) (i) A cylinder-shaped bacterium has a length of 2 μm and a diameter of 0.5 μm.

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.

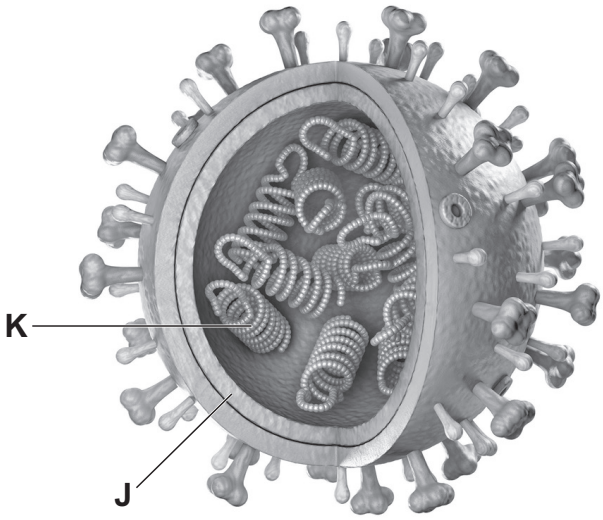


Fig. 1.2

(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]

3 Which structures are found in both plant and animal cells?

A cell walls and cell membranes

B nuclei and cell walls

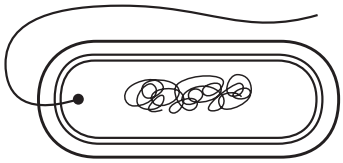
C cytoplasm and chloroplasts

D cell membranes and nuclei

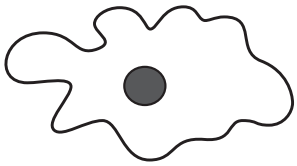
2 The diagrams show four organisms.

Which organism is a prokaryote?

A

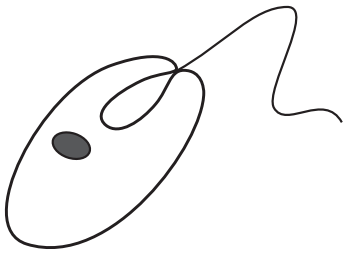


B

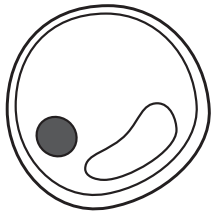


NOT TO SCALE

C



D



5 Fig. 5.1 is a diagram of a plant root hair cell.

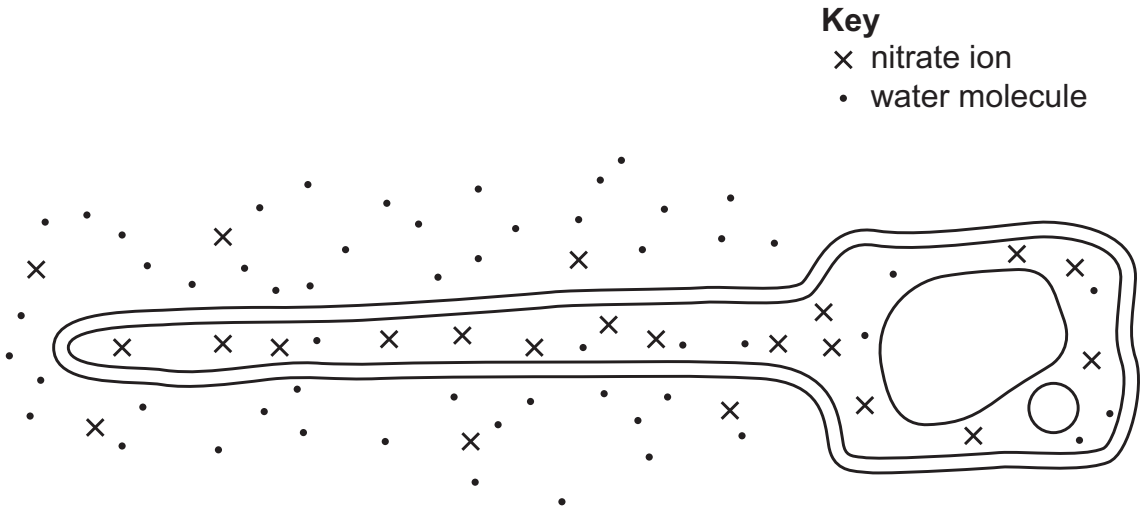


Fig. 5.1

(a) (i) Using the information in Fig. 5.1, explain how nitrate ions are transported into the root hair cell.

.....

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..... [4]

(ii) State **two** ways that nitrogen fixation occurs.

1 .....

2 .....

[1]

(b) State the name of the process that moves water molecules into root hair cells.

..... [1]

(c) Describe differences **and** similarities between the structure of a plant root hair cell and a bacterial cell.

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.....

..... [5]

[Total: 11]

3 Which structures are found in both plant cells and bacterial cells?

	cell membrane	cell wall	plasmid	ribosomes
A	yes	yes	yes	no
B	no	yes	yes	yes
C	yes	no	yes	yes
D	yes	yes	no	yes

IGCSE BIOLOGY • EXERCISE SHEET

2.2 Size of specimens

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS magnification 放大倍数 • specimen 标本 • size of specimens 标本大小 • cells 细胞 • tissue 组织

Objective

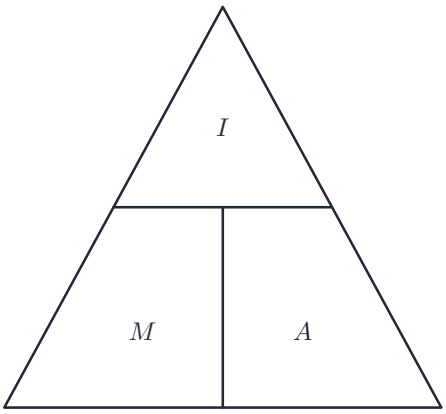
Build the skills to answer exam questions on the **size of specimens** 标本大小 — the **magnification** 放大倍数 formula and converting units.

You must be able to:

- use magnification = image size ÷ actual size (and rearrange it)
- convert between mm and μm
- give magnification as a number with no unit

1 Worked examples

■ Magnification

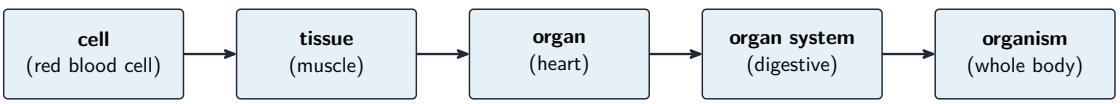


I = image size
M = magnification
A = actual size

$$M = \frac{I}{A}$$

cover a letter to get its formula

Cover the quantity you want: magnification = image ÷ actual; actual = image ÷ magnification



Cells make tissues, organs and organ systems

Image 5.00 mm at ×250: actual $= \dfrac{5.00}{250} = 0.02$ mm $= 20$ μm.

Units: 1 mm = 1000 μm. Always use the same unit before dividing.

2 Practice

2.1 Write the formula for magnification. [1]

2.2 Convert 0.05 mm into μm. [1]

3 Exam-style questions

3.1 Magnification has the unit: [1]

- **A** mm
- **B** μm
- **C** no unit
- **D** cm

3.2 A cell has an actual size of 40 μm. It is drawn 20 mm wide.

(a) Convert the actual size to mm. [1]

(b) Calculate the magnification of the drawing. [2]

3.3 A structure is shown at $\times$400 and its image size is 8.0 mm. Calculate its actual size in μm. [3]

Solutions

2.1 magnification $= \dfrac{\text{image size}}{\text{actual size}}$.

2.2 $0.05 \times 1000 = 50$ μm.

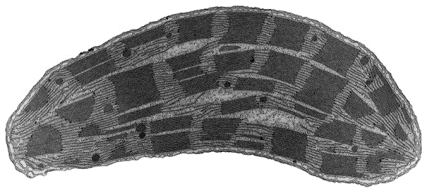
3.1 **C**. Magnification is just a number — no unit.

3.2 (a) 40 μm $= 0.04$ mm.

(b) magnification $= \dfrac{20}{0.04} = 500$.

3.3 actual $= \dfrac{\text{image}}{\text{magnification}} = \dfrac{8.0}{400} = 0.02$ mm; $= 20$ μm.

4 The diagram shows an image of a chloroplast. The image is 5 cm long.



The actual length of the chloroplast is 5 μm.

What is the magnification of the image?

A ×10 **B** ×1000 **C** ×10 000 **D** ×100 000

4 In a human, the diameter of the aorta as it leaves the heart is 36 mm.

The thickness of the wall of the aorta at this point is 9 mm.

What is the diameter of the lumen of the aorta at this point?

A 1800 m **B** 2700 μm **C** 18 000 μm **D** 27 000 μm

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

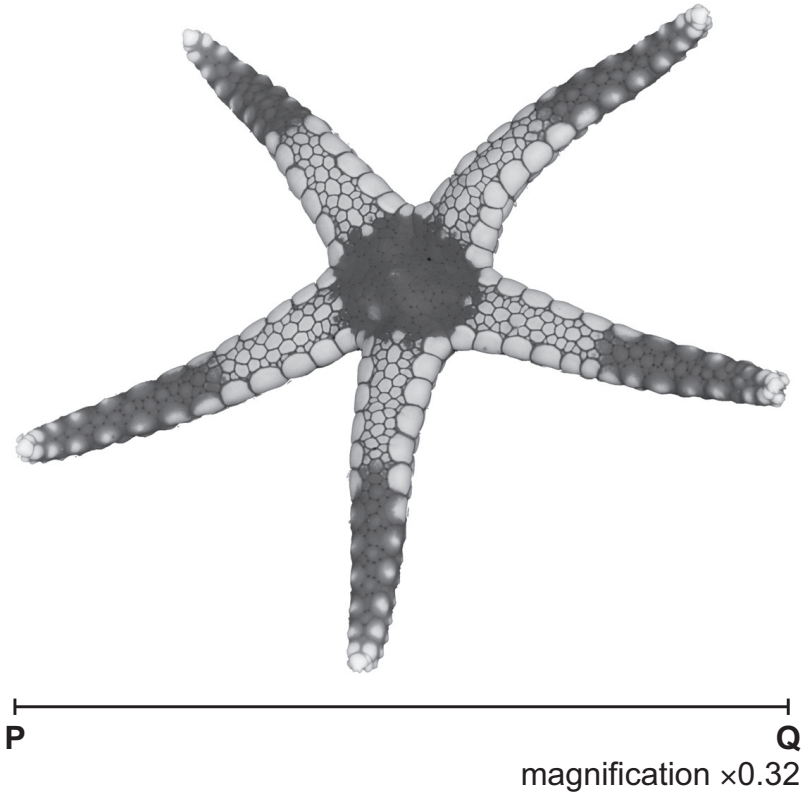


Fig. 3.1

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

[4]

(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.

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

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

Space for working.

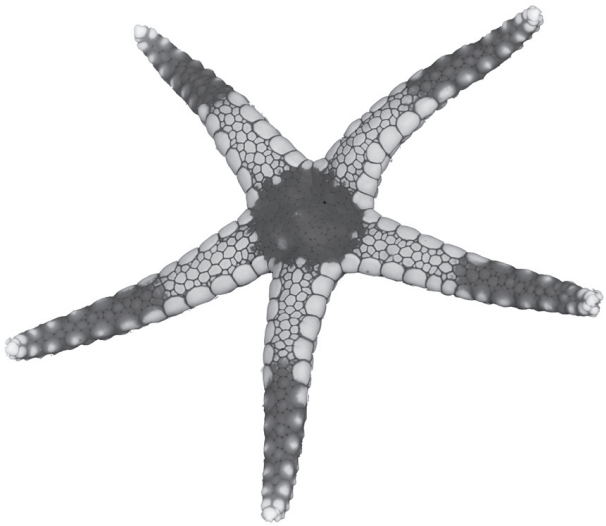
..... mm
[3]

(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 m^2 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 .....

.....

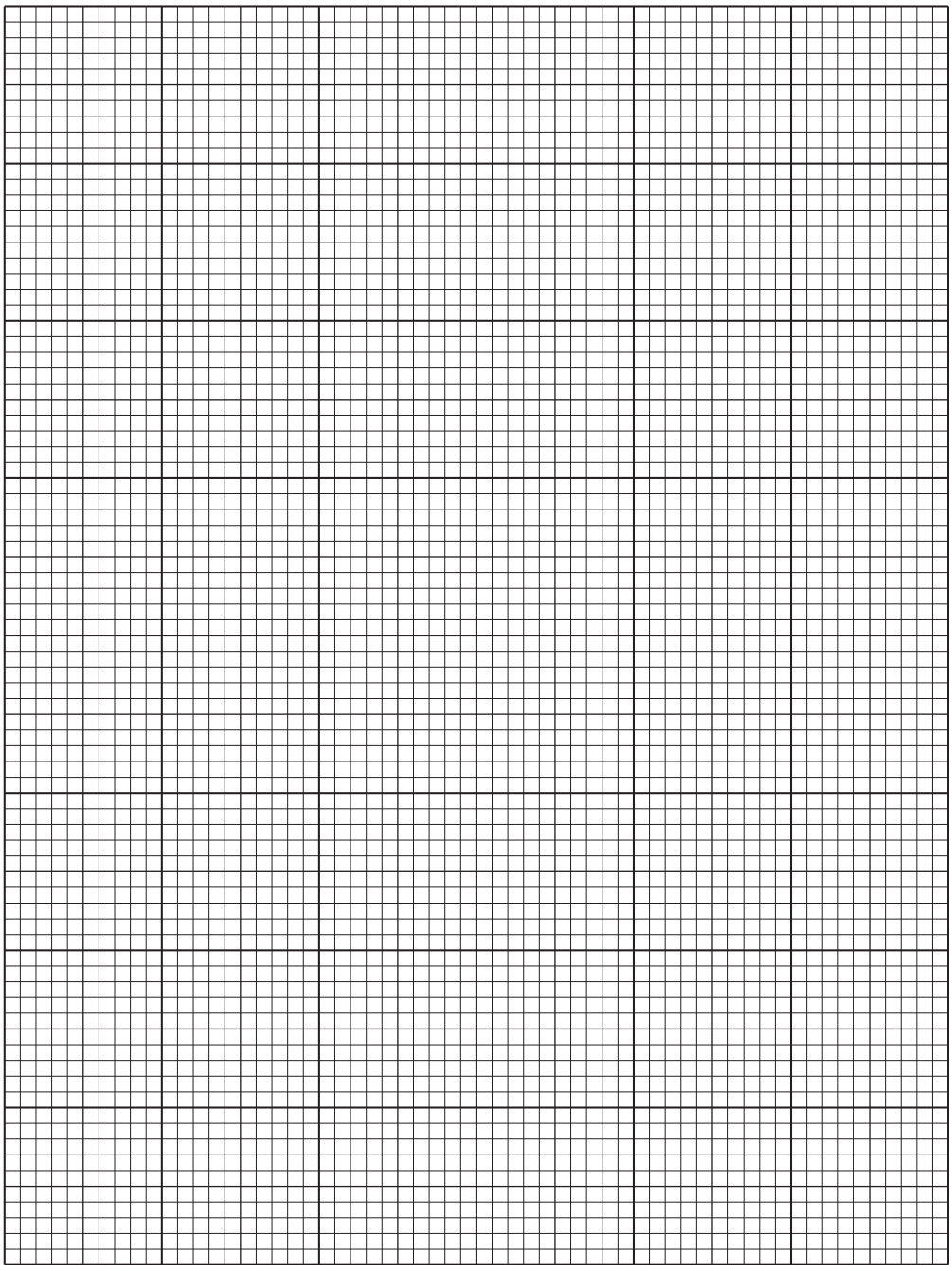
[2]

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.



[4]

(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.

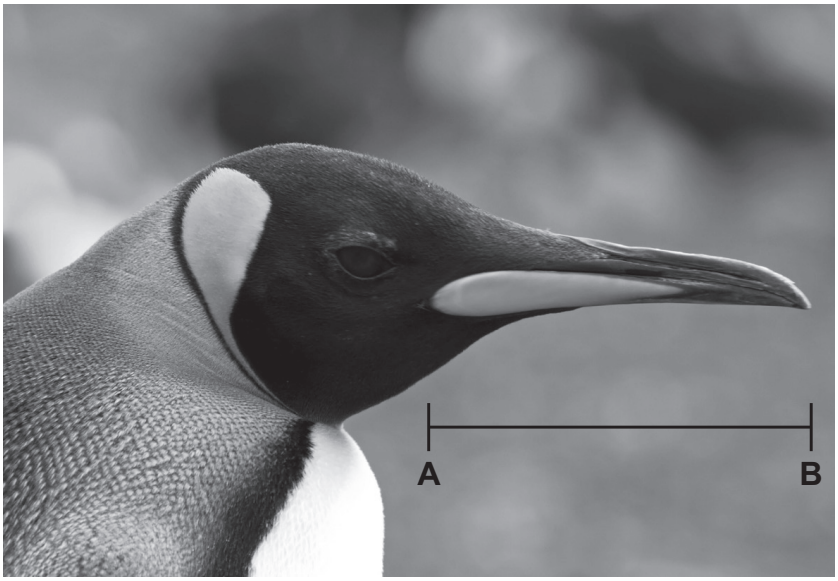
Space for working.

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 ×0.42

Fig. 3.1

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

[4]

(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.

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.....

.....

..... [6]

[Total: 15]

5 A student measured the length of a structure using a microscope.

The magnification used was ×250.

The image size of the structure was 5.00 mm.

What was the actual length of the structure?

A 1.25×10^{3} mm

B 1.25×10^{3} μm

C 2.00×10^{1} μm

D 2.00×10^{-5} μm

4 A cell is 65 μm across.

What is this measurement in mm?

A 0.00065 mm **B** 0.0065 mm **C** 0.065 mm **D** 0.65 mm