

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

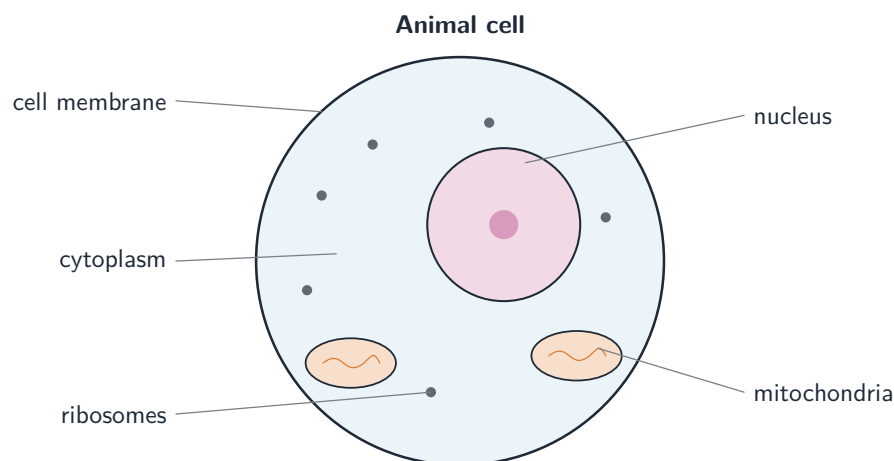
Build the skills to answer exam questions on **cell structure** 细胞结构 — comparing plant, animal and bacterial cells, the function of each structure, and **specialised cells** 特化细胞.

You must be able to:

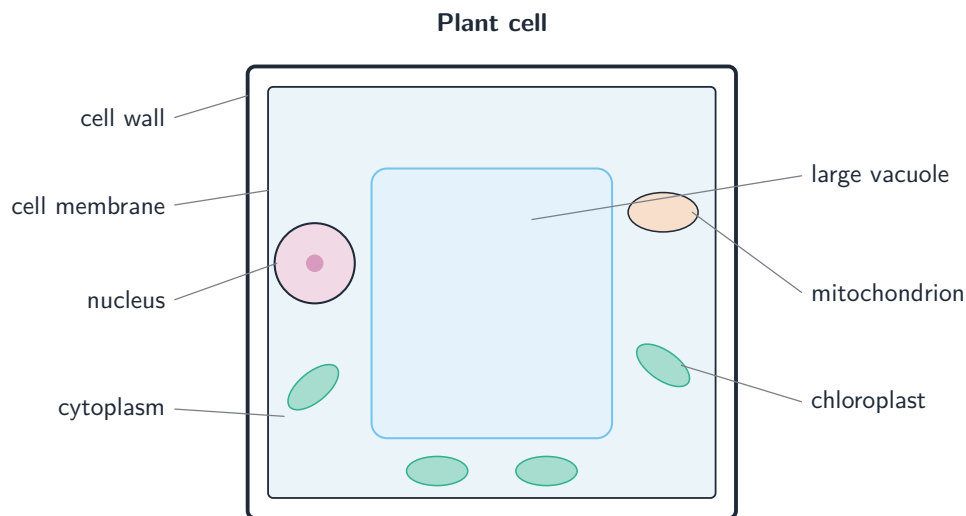
- state which structures are in plant, animal and bacterial cells
- give the function of each structure
- link a specialised cell to its feature, and order the levels of organisation

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

Going the other way, $\text{actual size} = \frac{\text{image size}}{\text{magnification}}$. Remember $1 \text{ mm} = 1000 \mu\text{m}$:
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	B
C	D

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]
