

2.1.1 The bacterial cell, specialised cells and levels of organisation

Name: _____ Class: _____ Date: _____

Total: 33 marks

KEY WORDS cells 细胞 • organ 器官 • plant 植物 • animal 动物 • cell wall 细胞壁

Objective

Sheet 2.1 covered the structures of a cell and how to calculate a magnification. This sheet is the rest of 2.1: the **bacterial cell** 细菌细胞 and what makes it different, where new cells come from, the six **specialised cells** 特化细胞 the syllabus names, and the ladder from **cell** to **organism** 生物体. Almost every mark here comes from pairing a **feature** with **what it lets the cell do**. This sheet covers syllabus 2.1.

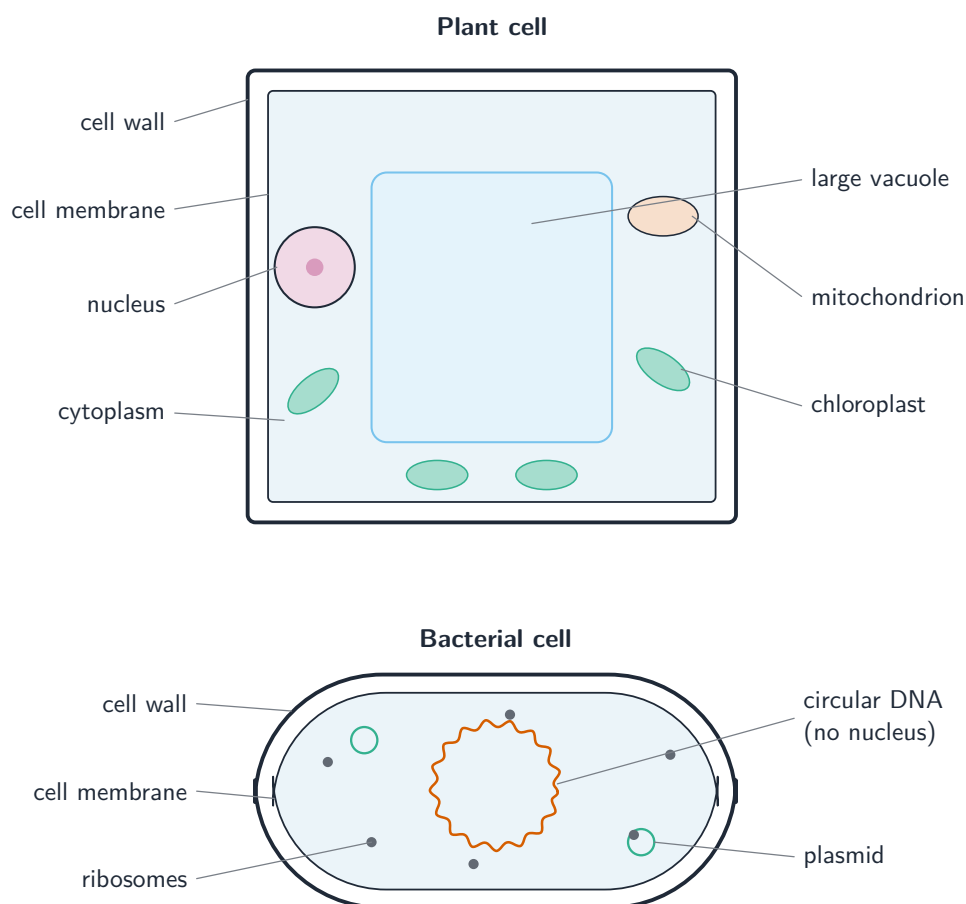
You must be able to:

- describe and compare the structure of a plant cell and an animal cell: **cell wall** 细胞壁, **cell membrane** 细胞膜, **nucleus** 细胞核, **cytoplasm** 细胞质, **chloroplasts** 叶绿体, **ribosomes** 核糖体, **mitochondria** 线粒体 and **vacuoles** 液泡
- describe the structure of a bacterial cell: cell wall, cell membrane, cytoplasm, ribosomes, **circular DNA** 环状 DNA and **plasmids** 质粒
- identify those structures in diagrams and images, and state the function of each
- state that new cells are produced by **division** 分裂 of existing cells
- state the specific functions of the specialised cells: **ciliated cells** 纤毛细胞, **root hair cells** 根毛细胞, **palisade mesophyll cells** 栅栏叶肉细胞, **neurones** 神经元, red blood cells and the **gametes** 配子
- describe the meaning of cell, **tissue** 组织, **organ** 器官, **organ system** 器官系统 and organism

1 Worked examples

Study these first. Each one shows a **method** that a question later on this sheet needs.

- Three kinds of cell, side by side



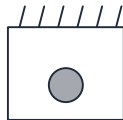
structure	plant	animal	bacteria	function
cell wall	✓ (cellulose)	×	✓	supports the cell and stops it bursting
cell membrane	✓	✓	✓	controls what enters and leaves
nucleus	✓	✓	×	contains the genetic material; controls the cell
cytoplasm	✓	✓	✓	where most chemical reactions happen
chloroplasts	✓	×	×	contain chlorophyll; where photosynthesis happens
large permanent vacuole	✓	×	×	filled with cell sap; keeps the cell firm
mitochondria	✓	✓	×	where aerobic respiration 有氧呼吸 happens
ribosomes	✓	✓	✓	where proteins are made
circular DNA	×	×	✓	the bacterium's genetic material, loose in the cytoplasm
plasmids	×	×	✓	small extra rings of DNA, carrying a few genes

- A bacterium has **no nucleus**, **no mitochondria**, **no chloroplasts** and **no vacuole**. Its genetic material is a **loop of DNA** in the cytoplasm, plus **plasmids**.

■ Where new cells come from

All new cells are produced by the division of existing cells. That one sentence answers a surprising number of questions: how an organism grows, how a wound heals, how a bacterial population increases.

■ The six specialised cells



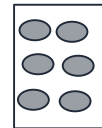
ciliated cell

cilia beat and sweep mucus along the trachea and bronchi



root hair cell

a long **hair** gives a large surface area, to absorb water and mineral ions



palisade mesophyll cell

packed with **chloroplasts**, and tall, so it absorbs as much light as possible



neurone

very **long**, so one cell carries an electrical impulse a long way



red blood cell

no nucleus and a dented disc shape, so it carries more oxygen



egg cell and sperm cell

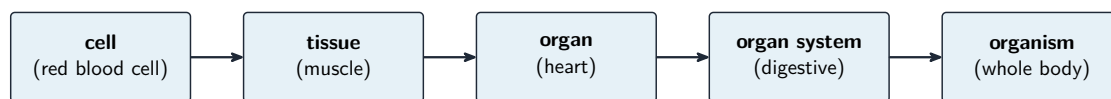
the egg carries **food stores**; the sperm has a **flagellum** and swims

A mark is never given for naming the cell. It is given for the **feature** and for **what that feature lets the cell do**.

A **specialised cell** has a structure that suits one particular job. Answer in two halves every time – **the feature**, then **what it lets the cell do**:

cell	feature	so that it can
ciliated cell	cilia on its surface	sweep mucus along the trachea and bronchi
root hair cell	a long, thin hair	absorb water and mineral ions over a large surface area
palisade mesophyll cell	packed with chloroplasts , and tall	absorb as much light as possible for photosynthesis
neurone	very long , with fine branches	carry an electrical impulse a long way in one cell
red blood cell	no nucleus , dented disc shape	hold more haemoglobin, so it carries more oxygen
egg cell / sperm cell	food stores / a flagellum and mitochondria	feed the embryo / swim to the egg cell

■ Cell to organism



level	meaning	example
cell	the basic unit of all living things	a palisade mesophyll cell
tissue	a group of cells of similar structure working together to do one job	palisade tissue in a leaf; muscle tissue
organ	several tissues working together to do one job	a leaf; the heart; the stomach
organ system	several organs working together	the transport system of a plant; the digestive system
organism	a complete living thing	a maize plant; a human

- A leaf is an **organ**, not a tissue, because it contains **more than one tissue** – palisade tissue, xylem, phloem and epidermis – all working together for photosynthesis.

2 Practice

Now use the methods above.

2.1 State **three** structures found in a plant cell but not in an animal cell. [3]

2.2 State **two** structures found in a bacterial cell that are found in neither a plant nor an animal cell, and **one** structure a bacterial cell does not have. [3]

2.3 Explain how a neurone is adapted to its function. [2]

2.4 Explain how an egg cell is adapted to its function. [2]

2.5 State where all new cells come from. [1]

2.6 Describe what is meant by a tissue and by an organ, and give one example of each. [4]

3 Exam-style questions

3.1 Which structure is found in a plant cell **and** in a bacterial cell, but **not** in an animal cell? [1]

A	B
C	D

A a chloroplast

B a cell wall

C a nucleus

D a ribosome

3.2 The table lists three specialised cells and their functions.

cell	function
ciliated cell	moving mucus in the trachea
palisade mesophyll cell	photosynthesis
sperm cell	reproduction

For **each** cell, state one feature that adapts it to its function, and explain how that feature helps. [6]

3.3 A leaf and a heart are both organs.

(a) Describe what is meant by a tissue, an organ and an organ system. [3]

(b) Name one tissue found in a leaf, and state its function. [2]

(c) Explain why a leaf is described as an organ rather than as a tissue. [2]

(d) A bacterial cell has no nucleus. State where its genetic material is found, and name the other structure in a bacterium that carries genes. [2]

(e) A cut in the skin heals over several days. Use your knowledge of where new cells come from to explain how this happens. [2]

Solutions

Each answer shows the steps, then the **result**.

2.1

- a **cell wall**
- **chloroplasts**
- a **large permanent vacuole**

2.2

- found only in the bacterium: **circular DNA** and **plasmids**
- a bacterium has **no nucleus** – also acceptable: no mitochondria, no chloroplasts, no large permanent vacuole

2.3

- a neurone is very **long**, and has fine branches at its ends
- so a single cell can carry an **electrical impulse** a long way, for example from the foot to the spinal cord

2.4

- the egg cell contains **food stores** in its cytoplasm
- which feed the **embryo** until it implants and the placenta can supply it
- also acceptable: the **jelly coat**, which changes after one sperm enters so that no second sperm can get in

2.5

- from the **division of existing cells**

2.6

- a **tissue** is a group of cells of similar structure working together to do one job
- for example **muscle tissue**, or **palisade tissue** in a leaf
- an **organ** is several tissues working together to do one job
- for example the **heart**, the **stomach** or a **leaf**

3.1 B

- a **cell wall** is present in plant cells and bacterial cells, and absent from animal cells
- **A** is in plant cells only; **C** is in plant and animal cells but not bacteria; **D** is in all three

3.2

- **ciliated cell**: it has **cilia** on its surface, which beat and sweep the mucus, with its trapped particles, along the trachea
- **palisade mesophyll cell**: it is packed with **chloroplasts** and is tall, so it absorbs as much light as possible for photosynthesis

- **sperm cell:** it has a **flagellum**, which beats so the sperm can swim to the egg cell; the **acrosome** and the **mitochondria** are equally acceptable, each with its own reason

3.3

(a)

- a **tissue** is a group of cells of similar structure working together to do one job
- an **organ** is several tissues working together to do one job
- an **organ system** is several organs working together

(b)

- any one of: **palisade tissue, xylem, phloem, epidermis**
- with its function: palisade tissue carries out photosynthesis; xylem carries water; phloem carries sucrose; the epidermis covers and protects the leaf

(c)

- a leaf contains **more than one tissue** – palisade tissue, xylem, phloem and epidermis
- a tissue is only **one** kind of cell working together, so a structure built from several tissues is an organ

(d)

- its genetic material is a **loop of DNA**, loose in the **cytoplasm**
- genes are also carried on **plasmids**

(e)

- all new cells are produced by the **division of existing cells**
- the cells at the edge of the cut divide, producing new cells that fill the gap and close the wound