

# Exercise walk-through

Cells as the basic units of living organisms ■ 1.2

eXercise

## You must be able to

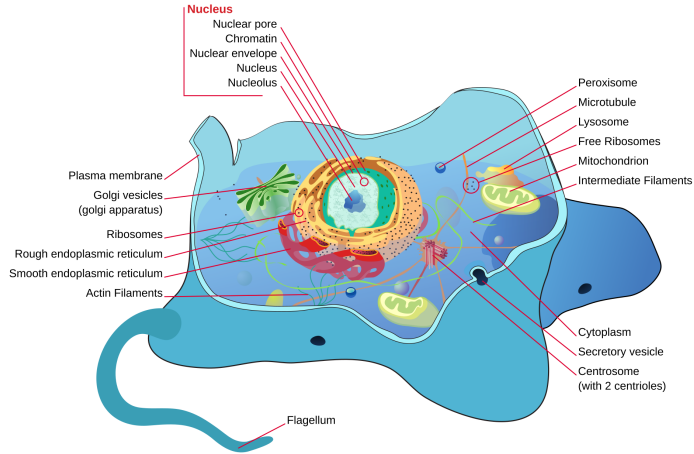
- name organelles from their structure and give their function
- compare a typical plant cell with a typical animal cell
- compare a **prokaryotic cell** with a **eukaryotic cell** 真核细胞
- state that a virus is non-cellular, with a nucleic acid core and a protein **capsid** 衣壳

## Method — Identifying an organelle from its features

Match the clues — shape, membranes, contents — to one organelle, then give its job. Learn to recognise each organelle in the diagram below.

**Example.** *“This organelle is oval, has a folded inner membrane, and contains small circular DNA and 70S ribosomes.”* → It is a **mitochondrion** 线粒体. Its function is **aerobic respiration** 有氧呼吸 — releasing energy as ATP. (The folded inner membrane and own circular DNA are the give-away clues.)

# Method — Identifying an organelle from its features



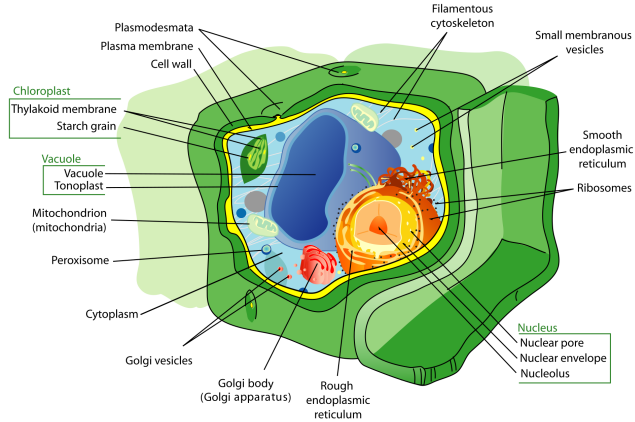
## Method — Answering a “compare” question

“Compare” means give points that mention **both** sides, and include at least one **similarity**.

**Example — plant vs animal cell.** Write paired statements:

- a plant cell has a **cellulose** 纤维素 cell wall; an animal cell has none.
- a plant cell has **chloroplasts** 叶绿体; an animal cell has none.
- a plant cell has one large permanent **vacuole** 液泡; an animal cell has only small, temporary ones.
- **both** have a cell surface membrane, cytoplasm, a nucleus and mitochondria.

# Method — Answering a “compare” question



## Method — Comparing prokaryotic and eukaryotic cells

A **prokaryotic cell** (a bacterium) has no nucleus and no membrane-bound organelles. The key differences examiners reward:

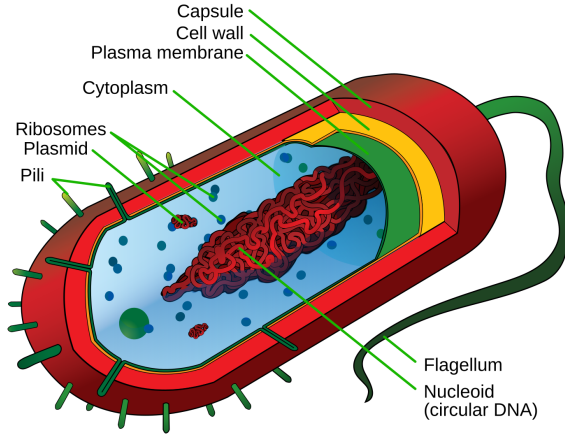
| feature                   | prokaryotic cell                 | eukaryotic cell                   |
|---------------------------|----------------------------------|-----------------------------------|
| nucleus                   | none (DNA free in cytoplasm)     | true nucleus with envelope        |
| DNA                       | circular, no <b>histones</b> 组蛋白 | linear, wound on histones         |
| ribosomes                 | 70S                              | 80S (in the cytoplasm)            |
| membrane-bound organelles | absent                           | present (mitochondria, ER, Golgi) |
| size                      | 1–5 $\mu\text{m}$                | 10–100 $\mu\text{m}$              |

## Method — Comparing prokaryotic and eukaryotic cells

**Both** have a cell surface membrane, cytoplasm, ribosomes and DNA. (A prokaryote also has a wall, but of **peptidoglycan** 肽聚糖, not cellulose.)



## Method — Comparing prokaryotic and eukaryotic cells

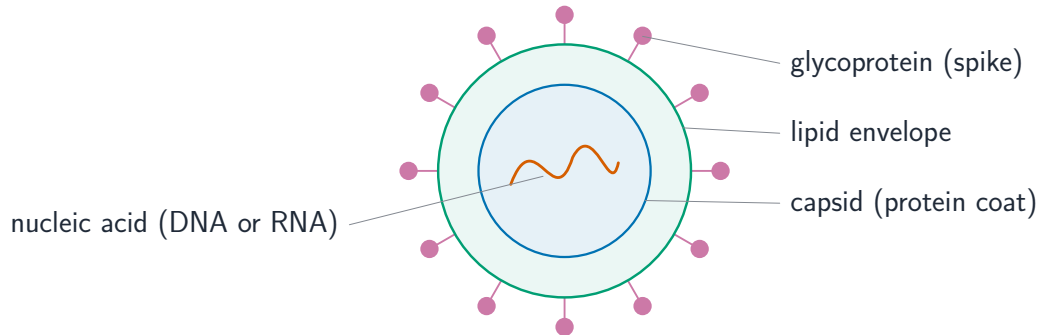


## Method — Viruses are non-cellular

A virus is **not** a cell. It has only a **nucleic acid 核酸** core (DNA *or* RNA) inside a protein **capsid**; some also have an outer phospholipid **envelope 包膜**.

It has no cytoplasm, no organelles and no ribosomes, so it cannot release energy or make proteins on its own.

## Method — Viruses are non-cellular



## Practice 2.1 ■ 4 marks

Name the organelle that carries out each function.

| function                                            | organelle |
|-----------------------------------------------------|-----------|
| makes and transports proteins (has ribosomes on it) |           |
| packs and modifies proteins into vesicles           |           |
| site of photosynthesis                              |           |
| breaks down old organelles and waste                |           |

## Solution 2.1

### Worked steps

rough endoplasmic reticulum; Golgi body (Golgi apparatus); chloroplast; lysosome  
**B1** each.

## Practice 2.2 ■ 3 marks

State **three** structures found in a plant cell that are **not** found in a typical animal cell.

## Solution 2.2

Method: Answering a “compare” question

### Worked steps

Any three of: cellulose cell wall; chloroplasts; large permanent vacuole (tonoplast); plasmodesmata **B1** *each, max 3.*

## Practice 2.3 ■ 2 marks

Give the size (S value) of the ribosomes found in (a) the cytoplasm of a eukaryotic cell, and (b) a prokaryotic cell.



## Solution 2.3

Method: Comparing prokaryotic and eukaryotic cells

### Worked steps

(a) 80S; (b) 70S **B1** *each*.

## Exam-style 3.1 ■ 1 mark

Which structures are found in **both** a prokaryotic cell and a eukaryotic cell?

**A** cell surface membrane, cytoplasm, ribosomes

**B** mitochondria, nucleus, ribosomes

**C** chloroplasts, cell wall, vacuole

**D** nuclear envelope, Golgi body, lysosomes

## Solution 3.1

Method: Comparing prokaryotic and eukaryotic cells

**A** cell surface membrane, cytoplasm, ribosomes



**B** mitochondria, nucleus, ribosomes

**C** chloroplasts, cell wall, vacuole

**D** nuclear envelope, Golgi body, lysosomes

### Worked steps

**A.** A cell surface membrane, cytoplasm and ribosomes occur in all cells; the others are eukaryote-only.

## Exam-style 3.2 ■ 1 mark

An organelle has a **double membrane** and contains small **circular DNA**. Which organelle could it be?

- A lysosome
- B mitochondrion
- C ribosome
- D smooth endoplasmic reticulum

## Solution 3.2

Method: Identifying an organelle from its features

- A lysosome
- B mitochondrion**
- C ribosome
- D smooth endoplasmic reticulum



### Worked steps

**B.** Mitochondria (and chloroplasts) have a double membrane and their own circular DNA.

## Exam-style 3.3 ■ 1 mark

Which feature is present in a prokaryotic cell but **not** in a eukaryotic cell?

- A** 70S ribosomes only
- B** a cell surface membrane
- C** a Golgi body
- D** linear DNA wound on histones

## Solution 3.3

Method: Comparing prokaryotic and eukaryotic cells

**A** 70S ribosomes only



**B** a cell surface membrane

**C** a Golgi body

**D** linear DNA wound on histones

### Worked steps

**A.** Prokaryotes have only 70S ribosomes; the cell surface membrane is in both, and a Golgi body and histone-wound linear DNA are eukaryote features.

## Exam-style 3.4 ■ 2 marks

A student views an electron micrograph of an animal cell.

(a) One organelle is described as “*a stack of flat membrane sacs near the nucleus*”.

Name this organelle and state its function.

(b) Another organelle has “*sheets of membrane covered with ribosomes*”. Name it and state what it makes.



## Solution 3.4

Method: Identifying an organelle from its features

### Worked steps

- (a) Golgi body / Golgi apparatus **A1**; modifies and packages proteins/lipids into vesicles for secretion **A1**.
- (b) rough endoplasmic reticulum **A1**; makes (and transports) proteins **A1**.

## Exam-style 3.5 ■ 3 marks

The diagram of the prokaryotic cell above shows several features. Compare the structure of a prokaryotic cell with that of a eukaryotic cell. Give **two** differences and **one** similarity.

## Solution 3.5

### Worked steps

Two differences, e.g. prokaryote has no nucleus while eukaryote has a true nucleus; prokaryote has 70S ribosomes while eukaryote has 80S; prokaryote has no membrane-bound organelles while eukaryote does **M1** **M1** — *each a paired point*. One similarity, e.g. both have a cell surface membrane / cytoplasm / ribosomes / DNA **A1**.

## Exam-style 3.6 ■ 3 marks

Describe the structure of a virus.

## Solution 3.6

Method: Viruses are non-cellular

### Worked steps

A nucleic acid core, either DNA or RNA (B1); surrounded by a protein coat called a capsid (B1); some have an outer phospholipid envelope / it is non-cellular with no organelles (B1) *max 3*.