

1.2 Cells as the basic units of living organisms

Name: _____ Class: _____ Date: _____

Total: 34 marks

KEY WORDS organelle

• cell surface membrane

• cell wall

• prokaryotic

• prokaryotic cell

Objective

Build the skills to answer exam questions on **cells as the basic units of living organisms** – identifying **organelles**, comparing plant, animal and **prokaryotic** cells, and describing viruses.

You must be able to:

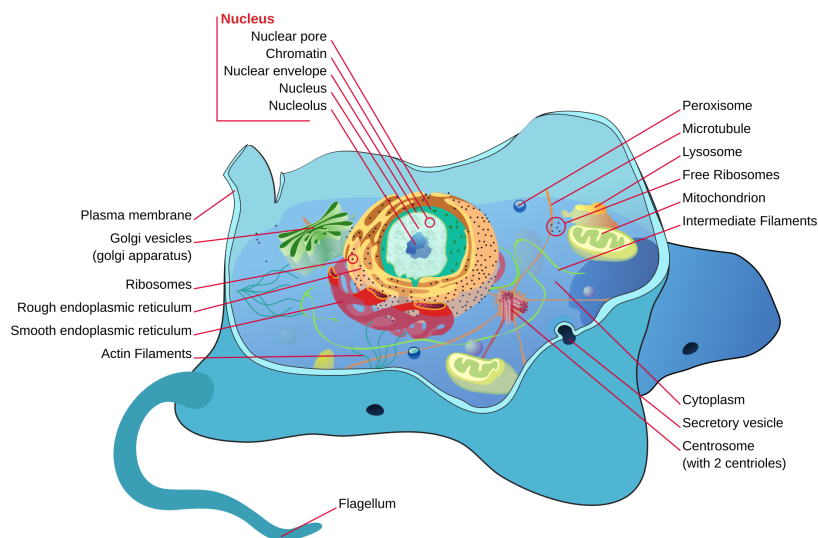
- name organelles from their structure and give their function
- compare a typical plant cell with a typical animal cell
- compare a **prokaryotic cell** with a **eukaryotic cell**
- state that a virus is non-cellular, with a nucleic acid core and a protein **capsid**

1 Key knowledge and worked examples

Study these first. Each shows the **method** for a question type used later.

■ 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.

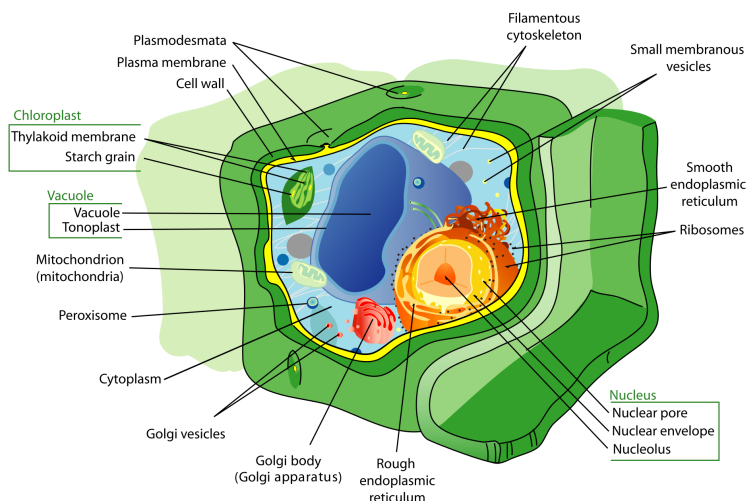


A generalised animal cell – recognise each organelle by its shape and position

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

■ Answering a “compare” question

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



A plant cell – note the features an animal cell does not have

Example – plant vs animal cell. Write paired statements:

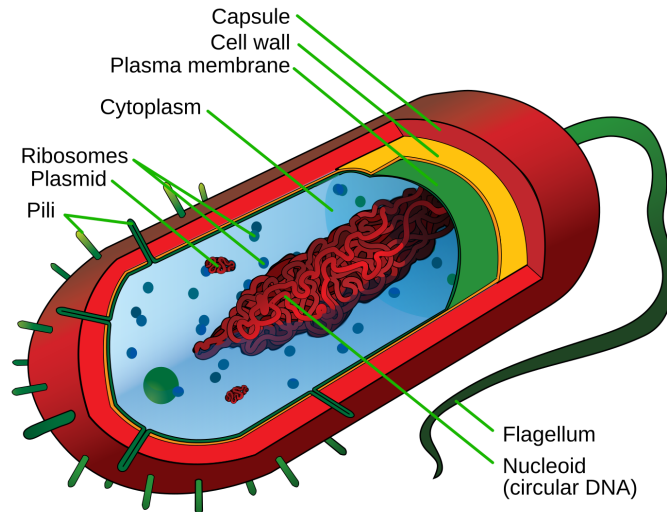
- a plant cell has a **cellulose** cell wall; an animal cell has none.
- a plant cell has **chloroplasts** ; an animal cell has none.
- a plant cell has one large permanent **vacuole** ; an animal cell has only small,

temporary ones.

- **both** have a cell surface membrane, cytoplasm, a nucleus and mitochondria.

■ Comparing prokaryotic and eukaryotic cells

A **prokaryotic cell** (a bacterium) has no nucleus and no membrane-bound organelles.



A prokaryotic cell: circular DNA lies free in the cytoplasm; 70S ribosomes; no nucleus

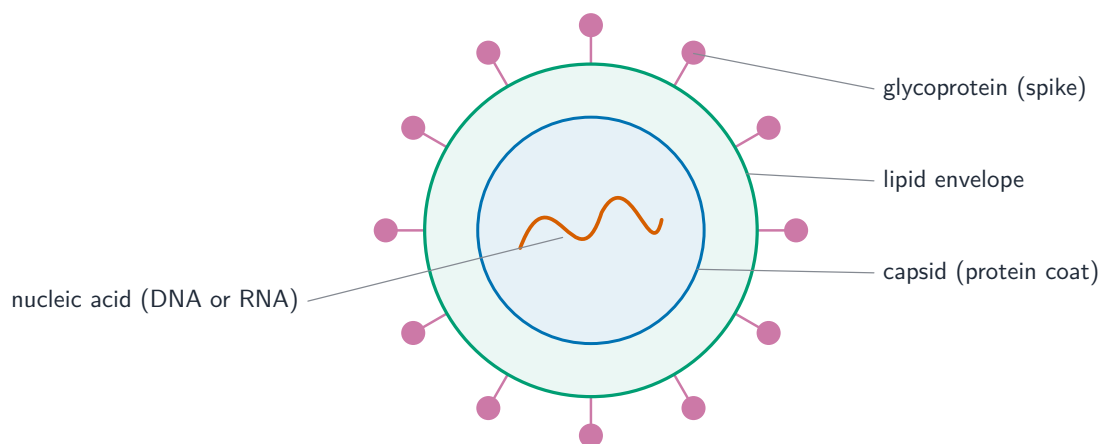
The key differences examiners reward:

feature	prokaryotic cell	eukaryotic cell
nucleus	none (DNA free in cytoplasm)	true nucleus with envelope
DNA	circular, no histones	linear, wound on histones
ribosomes	70S	80S (in the cytoplasm)
membrane-bound organelles	absent	present (mitochondria, ER, Golgi)
size	1–5 μm	10–100 μm

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

■ Viruses are non-cellular

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



A generalised virus: nucleic acid core, protein capsid, and (in some) a lipid envelope

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

2 Practice

2.1 Name the organelle that carries out each function.

[4]

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	

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

[3]

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

[2]

3 Exam-style questions

3.1 Which structures are found in **both** a prokaryotic cell and a eukaryotic cell? [1]

- ☐ **A** cell surface membrane, cytoplasm, ribosomes
B mitochondria, nucleus, ribosomes
C chloroplasts, cell wall, vacuole
D nuclear envelope, Golgi body, lysosomes

3.2 An organelle has a **double membrane** and contains small **circular DNA**. Which organelle could it be? [1]

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

3.3 Which feature is present in a prokaryotic cell but **not** in a eukaryotic cell? [1]

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

3.4 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. [2]

(b) Another organelle has “*sheets of membrane covered with ribosomes*”. Name it and state what it makes. [2]

3.5 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. [3]

3.6 Describe the structure of a virus.

[3]

3.7 An electron micrograph shows a cell containing many mitochondria, an extensive network of rough endoplasmic reticulum, a large Golgi body, numerous vesicles at the cell surface, and no cell wall.

(a) State, with **three** pieces of evidence from the description, whether this is a prokaryotic or a eukaryotic cell. [3]

(b) Suggest the function of this cell, and justify your suggestion using **two** of the organelles named. [3]

(c) Describe the route taken by a protein from the gene that codes for it to the outside of the cell, naming each organelle involved. [4]

(d) State **two** reasons why the mitochondria could not have been seen in this detail with a light microscope. [2]

Solutions

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

2.1

- rough endoplasmic reticulum; Golgi body (Golgi apparatus); chloroplast; lysosome

2.2

- Any three of: cellulose cell wall; chloroplasts; large permanent vacuole (tonoplast); plasmodesmata

2.3

(a)

- 80S

(b)

- 70S

3.1 A

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

3.2 B

- Mitochondria (and chloroplasts) have a double membrane and their own circular DNA

3.3 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

3.4

(a)

- Golgi body / Golgi apparatus; modifies and packages proteins/lipids into vesicles for secretion

(b)

- rough endoplasmic reticulum; makes (and transports) proteins

3.5

- 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. One similarity, e.g. both have a cell surface membrane / cytoplasm / ribosomes / DNA

3.6

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

3.7

(a)

- Eukaryotic. It has membrane-bound organelles – mitochondria and a Golgi body – which prokaryotes lack; it has rough endoplasmic reticulum, again absent in prokaryotes. (The absence of a cell wall additionally suggests an animal cell.)

(b)

- A secretory cell – for example a gland cell producing enzymes or hormones. The extensive rough ER means very high rates of protein synthesis; the many mitochondria supply the ATP for that synthesis and for moving the vesicles

(c)

- The gene is transcribed to mRNA in the **nucleus**; the mRNA is translated by **ribosomes** on the rough ER, and the protein enters the ER lumen; vesicles carry it to the **Golgi body**, where it is modified and packaged; Golgi vesicles then fuse with the **cell surface membrane**, releasing the protein by exocytosis

(d)

- A light microscope resolves only to about 200 nm, limited by the wavelength of light, so internal detail cannot be separated; its maximum useful magnification, about $\times 1500$, is far too low – electrons have a much shorter wavelength and resolve to about 0.5 nm