Cells as the Basic Units of Living Organisms (1.2): Cambridge (CIE) A Level Biology 9700 Exam Questions by Topic

22 questions · 53 marks · about 64 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · Paper 2 · May/June 2025 (22) · Q1(a) · 3 marks

1 Root hair cells are specialised plant cells located in the outer layer of young roots of plants. Root hair cells have an essential role in the uptake of water and dissolved mineral ions from the soil solution.

The transport of water across the root to reach the central xylem tissue can occur by the symplast pathway or apoplast pathway.

(a) Fig. 1.1 is a diagram of a photomicrograph of a root hair cell.

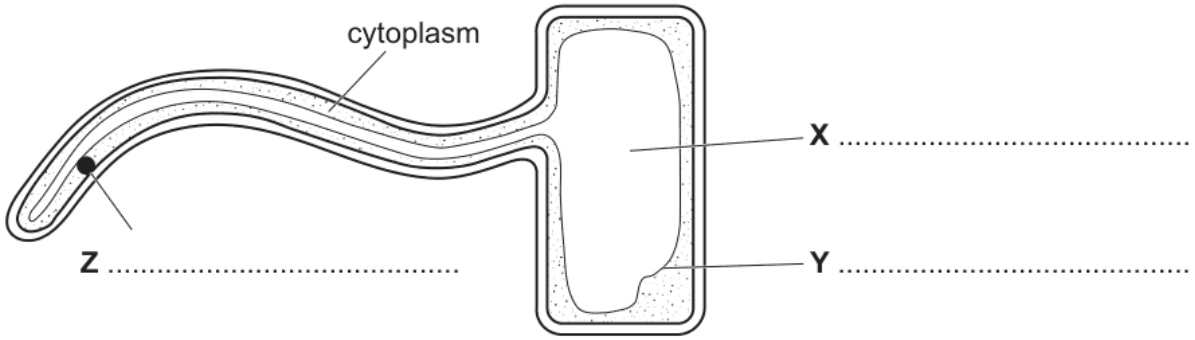


Fig. 1.1

On Fig. 1.1, name cell structures **X**, **Y** and **Z**.

[3]

Question 2 · Paper 2 · May/June 2024 (22) · Q2(a)(i) · 3 marks

2 Alveolar macrophages are cells of the immune system that remain in the alveolar region of the gas exchange system. The macrophages protect against infection caused by pathogens that have been inhaled.

(a) Alveolar macrophages have the same cell structures as typical animal cells.

(i) Complete Table 2.1 to **name** the cell structures that match the functions stated.

Do **not** use abbreviations.

Table 2.1

cell structure	function
.....	manufactures ribosomal subunits from proteins and ribosomal RNA
.....	synthesises triglycerides and other lipids
pair of	organise microtubules of the cell cytoskeleton

[3]

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(ii) Fig. 2.1 is a diagram of an alveolar macrophage showing:

- some of the cell structures that would be visible using an electron microscope
- a newly formed phagocytic vacuole (phagosome) containing two cells of *Mycobacterium tuberculosis*.

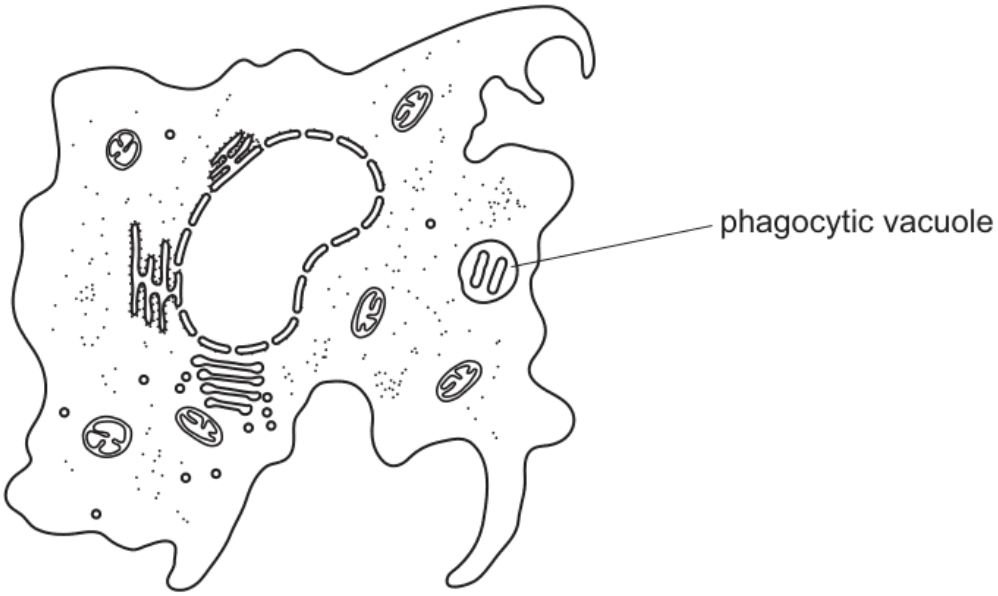


Fig. 2.1

The cell structures with the functions described in Table 2.1 are **not** shown in Fig. 2.1.

Complete Fig. 2.1 by drawing **and** labelling the cell structures described in Table 2.1. [2]

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4 In the immune system, a plasma cell develops from an activated B-lymphocyte. Mature plasma cells synthesise and secrete antibody molecules.

(a) Fig. 4.1 is a diagram of a transmission electron micrograph of a plasma cell.

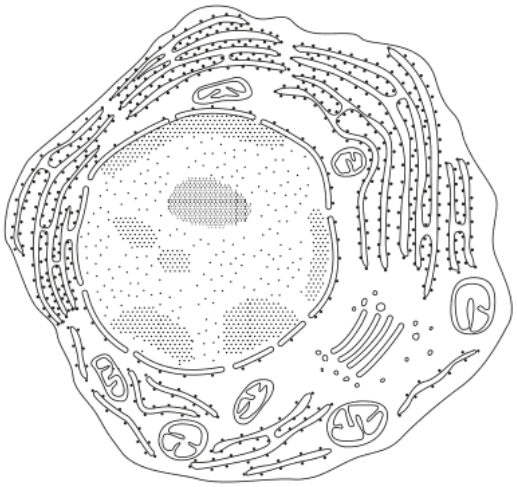


Fig. 4.1

The plasma cell can be seen in greater detail using an electron microscope compared with using a light microscope.

(i) Describe the **extra** detail of the nucleus that can be seen using an electron microscope.

.....

.....

.....

.....

.....

.....

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Question 5 · Paper 2 · October/November 2018 (22) · Q6(a) · 3 marks

6 As a red blood cell matures, cell organelles are lost from the cell. This provides more space for the haemoglobin molecules that have been synthesised.

(a) The red blood cell has a short lifespan due to the loss of the nucleus and other organelles.

State **one** function performed by each of the organelles listed, before they are lost from the developing red blood cell.

rough endoplasmic reticulum

.....

Golgi body

.....

centrioles

.....

[3]

Question 6 · information from earlier in the question

4 *Trypanosoma brucei* is a unicellular organism that causes the infectious disease known as sleeping sickness. Insects known as tsetse flies pass on the organism from infected people to uninfected people when male and female tsetse flies feed on human blood.

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(a) Fig. 4.1 is a transmission electron micrograph of the form of *T. brucei* found in human blood.

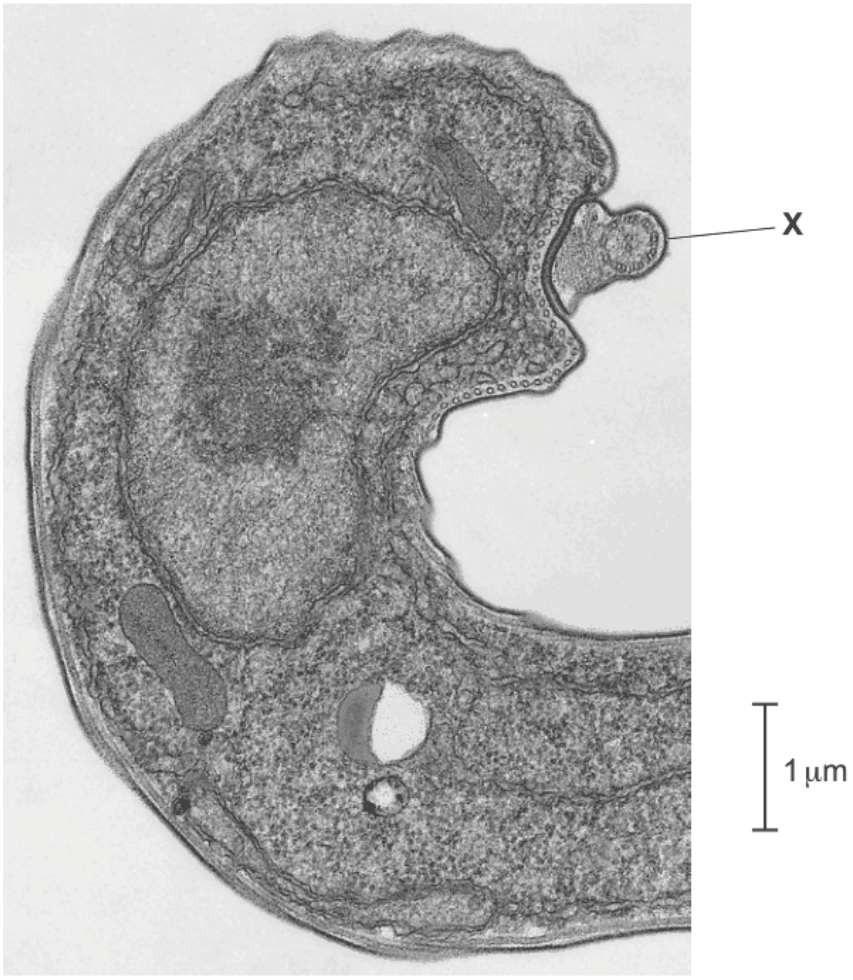


Fig. 4.1

Question 6 · Paper 2 · May/June 2023 (22) · Q4(a)(ii) · 2 marks

(ii) With reference to Fig. 4.1, explain how the structure labelled **X** provides evidence that *T. brucei* is motile (able to move).

.....

.....

.....

.....

.....

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Question 7 · Paper 4 (A level) · May/June 2024 (43) · Q8(c) · 2 marks

(c) Old or damaged mitochondria reduce the ability of a cell to carry out aerobic respiration and produce the ATP needed for the metabolic processes of the cell.

Suggest what occurs to these mitochondria to allow the cell to maintain the same overall rate of respiration and ATP production.

.....

.....

.....

.....

Question 8 · information from earlier in the question

3 The liver receives blood from the hepatic artery and from the hepatic portal vein. The hepatic portal vein transports blood from the digestive system.

Hepatocytes are the main cell type of the liver. They have a wide range of functions, including:

- the synthesis of triglycerides and plasma proteins
- detoxifying waste
- energy storage.

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(c) Fig. 3.2 is a transmission electron micrograph of part of a hepatocyte showing some cell structures.

The peroxisome shown in Fig. 3.2 is a spherical organelle bound by a single membrane. It carries out a variety of enzyme-catalysed metabolic reactions, including detoxification. Some of these reactions require oxygen.

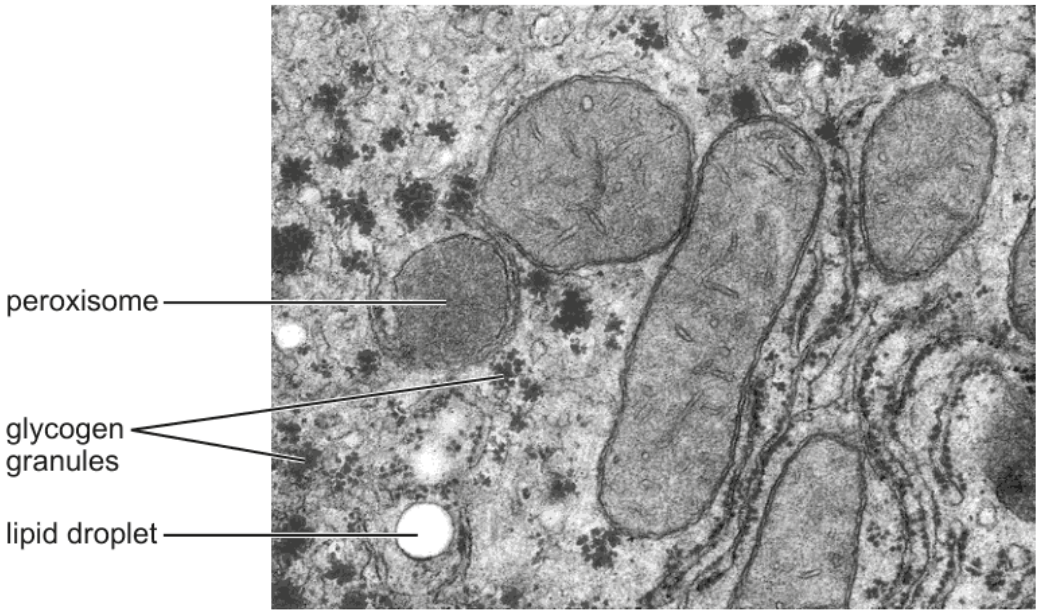


Fig. 3.2

(i) Describe the evidence **visible** in Fig. 3.2, apart from the presence of a peroxisome, that indicates some of the functions of a hepatocyte.

Add labels to Fig. 3.2 to identify the location of any cell structures, if not already labelled, that are part of your evidence.

.....

.....

.....

.....

.....

.....

.....

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Question 9 · Paper 2 · October/November 2023 (22) · Q3(c)(ii) · 1 mark

(ii) The mitochondria in Fig. 3.2 are larger than the peroxisome.

State **one other** difference, **visible** in Fig. 3.2, between a peroxisome and a mitochondrion.

.....

.....

.....

Question 10 · Paper 2 · October/November 2022 (21) · Q1(a)(i) · 2 marks

1 (a) Fig. 1.1 is a transmission electron micrograph showing a section of a human liver cell.



Fig. 1.1

(i) Name organelles **A** and **B** shown in Fig. 1.1.

A .....

B .....

[2]

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Question 11 · information from earlier in the question

1 **(a)** Fig. 1.1 is a photomicrograph of a region of eukaryotic tissue. Some of the cells are in stages of mitosis.

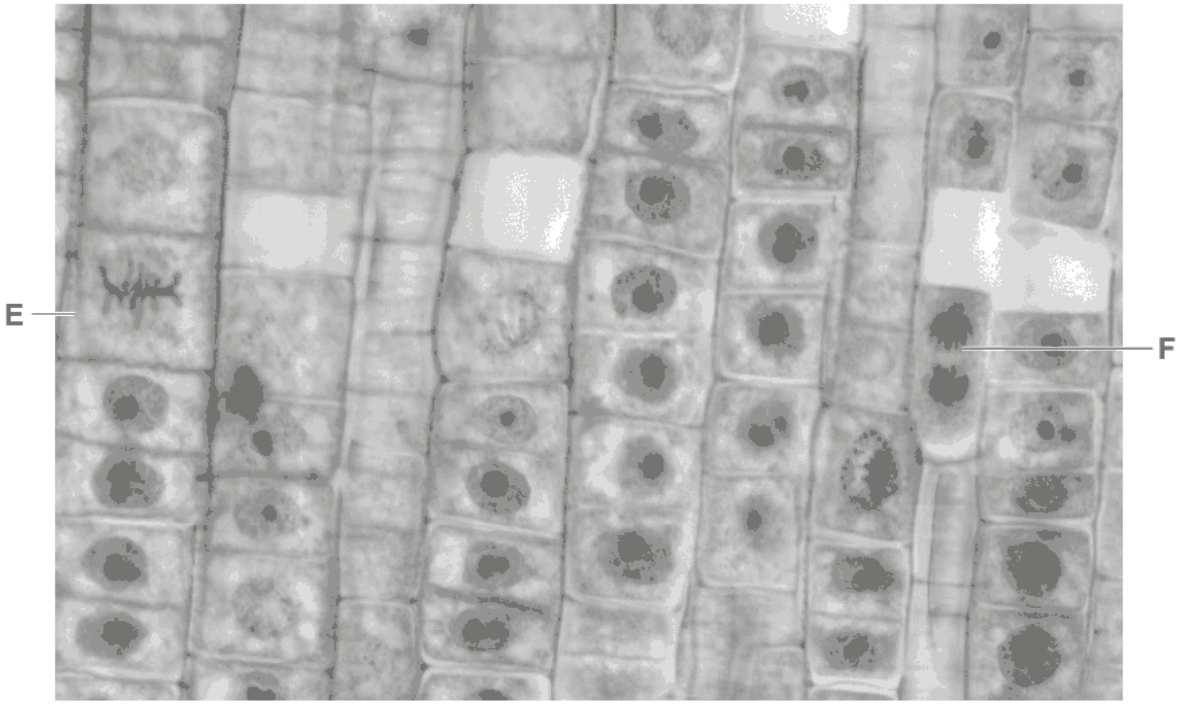


Fig. 1.1

Question 11 · Paper 2 · May/June 2021 (22) · Q1(a)(iii) · 1 mark

(iii) State, with a reason, whether Fig. 1.1 shows a region of animal or plant tissue.

.....

.....

Question 12 · Paper 2 · October/November 2019 (22) · Q1(d) · 5 marks

(d) Draw a diagram in the space provided to show the structure of a typical plant cell.

Label your diagram with the name of any structures that are found **only** in plant cells.

Do **not** label any structures that are also found in animal cells.

Question 13 · information from earlier in the question

(a) A stroke is caused when a small blood clot, often forming in the left atrium, is carried by the blood to the brain where it blocks a small artery and leads to brain damage.

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Question 13 · Paper 2 · February/March 2022 (22) · Q5(a)(ii) · 1 mark

(ii) Explain why blocking a small artery in the brain leads to brain damage.

.....

.....

Question 14 · Paper 2 · February/March 2024 (22) · Q5(b) · 1 mark

(b) The passage contains a description of the main features of prokaryotic cells. There is **one** factual error in the passage.

Prokaryotic cells are unicellular and generally between 1 μm and 5 μm in diameter. Prokaryotes do **not** have organelles surrounded by double membranes. They do have cell surface membranes, 70S ribosomes and a cellulose cell wall. The DNA of a prokaryotic cell is circular and is found free in the cytoplasm rather than enclosed in a nuclear envelope.

Identify **and** correct the factual error in the passage.

.....

Question 15 · Paper 2 · February/March 2022 (22) · Q4(c) · 2 marks

(c) Bacteria are unicellular prokaryotic cells with a diameter of 1–5 μm.

State **two other** structural features that would identify a cell as prokaryotic.

1 .....

2 .....

[2]

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Question 16 · Paper 2 · May/June 2019 (22) · Q4(a) · 4 marks

4 The bacterium *Vibrio cholerae* is the causative organism of the infectious disease cholera.

V. cholerae has structural features typical of all bacterial cells. It also has a flagellum for movement.

(a) Fig. 4.1 is an outline drawing of *V. cholerae*.

Complete Fig. 4.1 by drawing **and** labelling the structures found in *V. cholerae*.

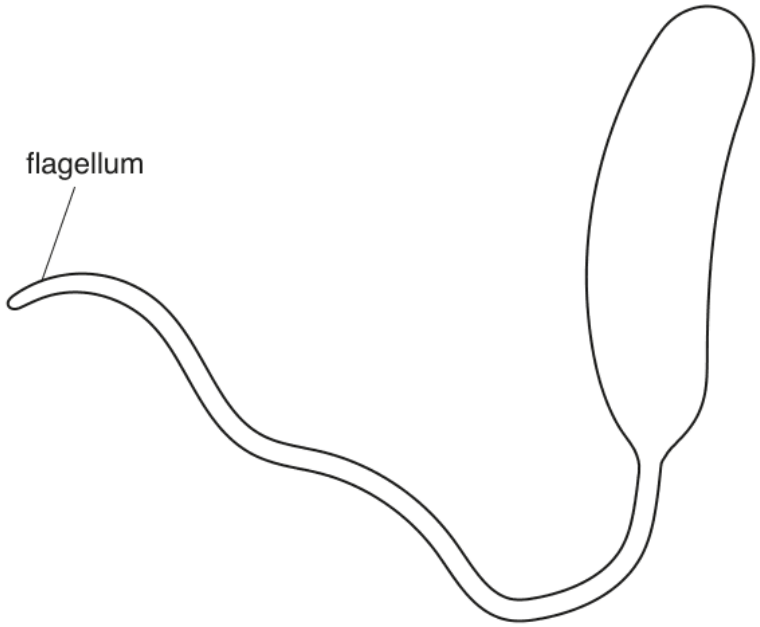


Fig. 4.1

Question 17 · information from earlier in the question

4 *Trypanosoma brucei* is a unicellular organism that causes the infectious disease known as sleeping sickness. Insects known as tsetse flies pass on the organism from infected people to uninfected people when male and female tsetse flies feed on human blood.

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(a) Fig. 4.1 is a transmission electron micrograph of the form of *T. brucei* found in human blood.

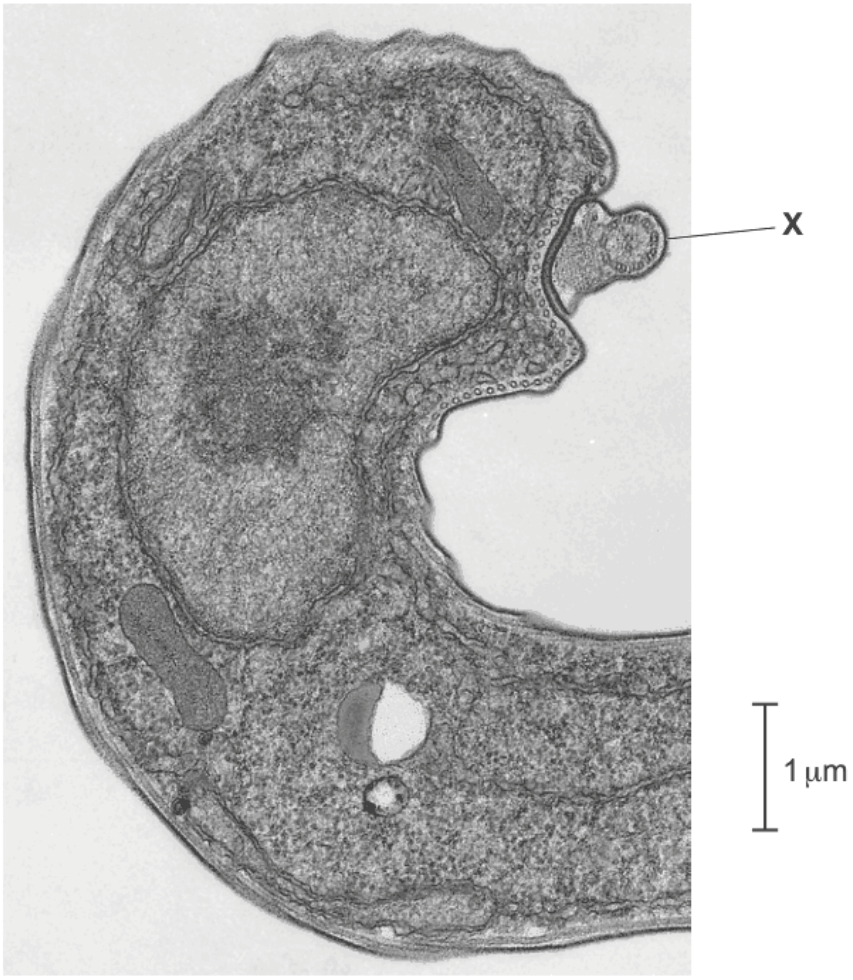


Fig. 4.1

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Question 17 · Paper 2 · May/June 2023 (22) · Q4(a)(iii) · 3 marks

(iii) With reference to Fig. 4.1, explain whether *T. brucei* is a eukaryote or prokaryote.

.....

.....

.....

.....

.....

.....

.....

.....

Question 18 · Paper 2 · February/March 2023 (22) · Q1(a) · 2 marks

1 (a) Table 1.1 lists cell structures that can be found in eukaryotic cells or prokaryotic cells. Some of these cell structures can be found in both types of cell.

Complete the table using a tick (✓) to show that the cell structure can be present in a particular type of cell and a cross (✗) to show that the cell structure **cannot** be present.

Put a tick or a cross in every box.

The top row has been completed for you.

Table 1.1

cell structure	eukaryotic cells	prokaryotic cells
nucleus	✓	✗
Golgi body		
circular DNA		
70S ribosome		

[2]

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Question 19 · Paper 2 · May/June 2022 (23) · Q2(a) · 3 marks

2 Bacterial cells are prokaryotic. The cells of plants are described as eukaryotic.

(a) Complete the passage comparing a bacterial cell with a plant cell.

A bacterial cell and a plant cell have a cell wall, but the main component of the bacterial cell wall is ..... and not cellulose. The same organelle is used for protein synthesis in both cell types, but a bacterial cell only has smaller, 70S, ... A bacterial cell does not have a large ..... surrounded by a tonoplast.

[3]

Question 20 · Paper 2 · October/November 2022 (22) · Q2(a) · 2 marks

2 Human cytomegalovirus (HCMV) is a common virus affecting humans. In people with a fully functioning immune system, infection by HCMV usually causes no, or only mild, symptoms.

Fig. 2.1**A** is a diagram of a section through HCMV. In Fig. 2.1**B**, only the outer part of HCMV is sectioned.

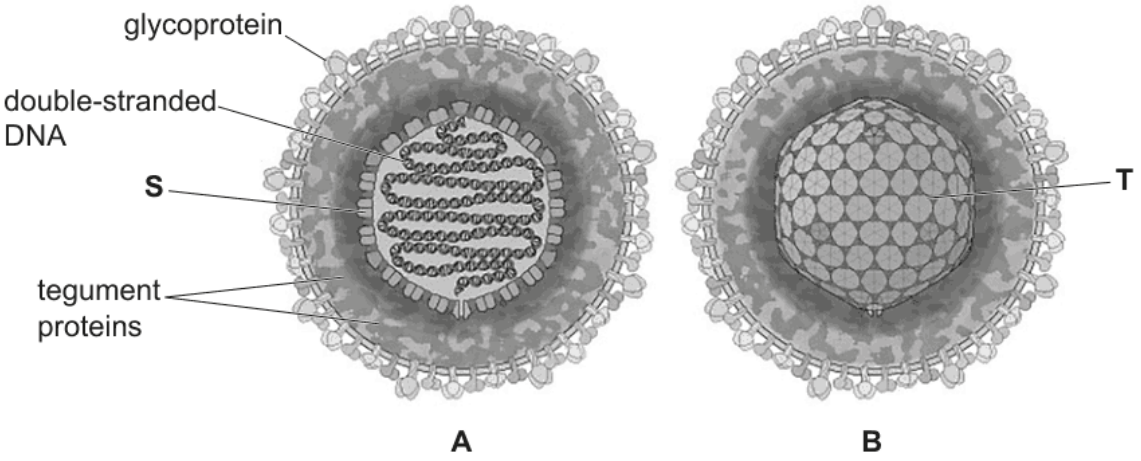


Fig. 2.1

The viral DNA shown in Fig. 2.1 contains genes that code for proteins important in viral replication and viral structure, including viral DNA polymerase and proteins known as tegument proteins.

Viruses can only replicate in host cells as they need to use processes and contents of the host cell. Complete viral particles that are released from the host cell are known as virions.

(a) Structure **S** in Fig. 2.1**A** is a subunit of structure **T** in Fig. 2.1**B**.

Name the chemical compound used to make structure **S and** name structure **T**.

S .....

T .....

[2]

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Question 21 · Paper 2 · October/November 2022 (22) · Q2(d) · 2 marks

(d) The virus in Fig. 2.1 is drawn as a spherical shape. Structure **T** is always the same shape. However, electron micrographs show that HCMV virions are not all the same shape.

Suggest how HCMV virions can be of different shapes.

.....

.....

.....

.....

Question 22 · Paper 2 · February/March 2019 (22) · Q6(d)(i) · 3 marks

(d) A virus named *Pandoravirus salinus* was discovered in 2013 by French scientists.

The virus was so large that the scientists initially thought that *P. salinus* was a bacterium.

P. salinus was confirmed to be a virus after further research.

(i) List **three** key features of viruses.

1 .....

2 .....

3 .....

[3]

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Mark schemes

Question 1 · Paper 2 · May/June 2025 (22) · Q1(a) · 3 marks

1(a)	**X** = (large / permanent) vacuole ; **Y** = tonoplast ; **A** vacuolar membrane **Z** = nucleus ;	**3**

Question 2 · Paper 2 · May/June 2024 (22) · Q2(a)(i) · 3 marks

2(a)(i) — *one mark each correct row* — **3**

cell structure	function
nucleolus ;	manufactures ribosomal subunits from proteins and ribosomal RNA
smooth endoplasmic reticulum ; **R** endoplastic	synthesises triglycerides and other lipids
pair of centrioles ; **R** centrosomes	organise microtubules of the cell cytoskeleton

Question 3 · Paper 2 · May/June 2024 (22) · Q2(a)(ii) · 2 marks

2(a)(ii) — **2**

structures should be labelled and drawn with enough detail not to be mistaken for another structure

all three correct = 2 marks
one or two correct = 1 mark
all three structures correctly drawn but no labels = 1 mark

- roughly spherical organelle within the nucleus labelled as nucleolus
- minimum of one single membrane-bound tubular sac labelled as, smooth endoplasmic reticulum / smooth ER / SER
  R if dots (ribosomes) drawn and resembles RER
- two, short lines or cylinders, not parallel to each other labelled as (pair of) centrioles
  R if inside the nucleus

Question 4 · Paper 2 · October/November 2020 (22) · Q4(a)(i) · 3 marks

4(a)(i) — **3**

*any **three** from:*
I heterochromatin / euchromatin
envelope / two membranes / double membrane / inner and outer membrane ;
nuclear pores ; **A** pores in nuclear envelope *for two marks*
(outer surface of) outer membrane with ribosomes ;
ref. to (outer nuclear) membrane continuous with RER ; **R** inner membrane

AVP ; e.g. perinuclear space **A** intermembranous space
pore complexes

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Question 5 · Paper 2 · October/November 2018 (22) · Q6(a) · 3 marks

6(a)	*rough endoplasmic reticulum* protein / polypeptide / named protein, synthesis / transport / modification ; **A** post-translational modification / examples *named protein e.g. haemoglobin, carbonic anhydrase, membrane proteins* *Golgi body* modification / processing, of, proteins / lipids **A** post-translational modification / examples / makes proteins functional **or** packaging (molecules) into vesicles **or** formation of, Golgi / secretory, vesicles **or** forms (primary) lysosomes ; *centrioles* formation of, spindle fibres / spindle **or** microtubule organisation ;	**3**

Question 6 · Paper 2 · May/June 2023 (22) · Q4(a)(ii) · 2 marks

4(a)(ii)	*any **two** from:* suggestion for structure as a flagellum ; **R** microvillus **A** cilium / undulipodium presence of microtubules ; presence of 9 + 2 (microtubule) arrangement / pattern, (in cross section) ; AVP ; e.g. *ref. to* location on outer part of cell (so can move) / AW circular cross section suggests tubular structure (hence flagellum) / AW e.g. looks cylindrical	**2**

Question 7 · Paper 4 (A level) · May/June 2024 (43) · Q8(c) · 2 marks

8(c)	1 degraded / broken down by, lysosomes / hydrolytic enzymes ; 2 components of breakdown / AW, used to produce new mitochondria ;	**2**

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Question 8 · Paper 2 · October/November 2023 (22) · Q3(c)(i) · 3 marks

3(c)(i)	*any **three** from:* **I** Golgi body / lysosome / vesicle *mp1 and mp2 complete term needed either in the text or labelled* 1 smooth endoplasmic reticulum labelled on Fig. 3.2 and detail **;** e.g. for, lipid / triglyceride / cholesterol, synthesis tubular appearance / no ribosomes 2 rough endoplasmic reticulum labelled on Fig. 3.2 and detail **;** e.g. for protein, synthesis / AW **A** for enzyme synthesis flattened (sac) appearance ribosomes **A** ribosome(s) labelled and for (plasma) protein synthesis 3 mitochondrion labelled on Fig. 3.2 and detail **;** e.g. many mitochondria for (aerobic) respiration produce ATP / provide energy, (for hepatocyte reactions) **R** generate / make, energy double membrane / presence of cristae *allow if one mitochondrion is correctly labelled and one of the 'circular' mitochondria has a different label e.g lysosome* 4 presence of glycogen granule(s) as, energy / glucose, store **; A** releases / provides, glucose 5 presence of lipid droplet(s), as energy store **;** **A** provides fatty acids **A** provides components for cholesterol synthesis *penalise once (from mp1, 2, or 3) if diagram not labelled but structures named correctly and correct detail given*

Question 9 · Paper 2 · October/November 2023 (22) · Q3(c)(ii) · 1 mark

3(c)(ii)	*any **one** from:* **I** *ref. to* staining or size mitochondrion, bound by / has, double membrane / two membranes **; I** peroxisome has (only) one membrane peroxisome no cristae / mitochondrion has cristae **; R** cisternae peroxisome spherical shape and mitochondria, different shapes / AW **; I** if only peroxisome shape stated **A** circular *for spherical* **A** description e.g. 'sausage' shape	**1**

Question 10 · Paper 2 · October/November 2022 (21) · Q1(a)(i) · 2 marks

1(a)(i)	**A** mitochondrion **;** **B** rough endoplasmic reticulum **; A** ribosome / 80S ribosome	**2**

Question 11 · Paper 2 · May/June 2021 (22) · Q1(a)(iii) · 1 mark

1(a)(iii)	**must state 'plant' to gain mark** **I** vacuoles / large permanent vacuole / vague ref. to shape *any one from* cell walls present**;** uniform / regular, shape of cells **;** no, cleavage furrow / pinching in of cytoplasm (in cells at cytokinesis) **;** cell plate present (in late telophase / cytokinesis, stages) **;**	**1**

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Question 12 · Paper 2 · October/November 2019 (22) · Q1(d) · 5 marks

1(d)	*drawing max 2:* regular shaped cell and cell wall drawn in ; central vacuole drawn ; *labels:* *max 2 if animal structures also labelled* *max 1 for labels if incorrect non-cellular structure included* *e.g. vascular bundle / stoma* large / permanent, vacuole ; **A** central vacuole **A** vacuole *if clearly drawn as large* tonoplast ; **R** *if drawn as double membrane* (cellulose) cell wall ; **R** chitin / murein plasmodesma(ta) ; chloroplast ; **A** granum / thylakoid *i.e. chloroplast not labelled but internal structures correctly labelled* **A** if drawn with a single or double membrane starch, grain / granule ; **A** amyloplast	**5**

Question 13 · Paper 2 · February/March 2022 (22) · Q5(a)(ii) · 1 mark

5(a)(ii)	lack of, glucose / oxygen, to (some) brain cells (so cells cannot respire) ;	**1**

Question 14 · Paper 2 · February/March 2024 (22) · Q5(b) · 1 mark

5(b)	prokaryotic cell walls are, made of peptidoglycan / made of murein / not made of cellulose ;	**1**

Question 15 · Paper 2 · February/March 2022 (22) · Q4(c) · 2 marks

4(c)	*any **two** from:* peptidoglycan cell wall ; circular DNA ; naked DNA / DNA without histones ; 70S ribosomes ; DNA not enclosed by nuclear envelope ; **A** no (true) nucleus absence of, (double) membrane-bound organelles / named example of (double) membrane-bound organelle ; AVP ;	**2**

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Question 16 · Paper 2 · May/June 2019 (22) · Q4(a) · 4 marks

4(a)	*max 3* if any membrane-bound organelles drawn inside cell e.g. nucleus, Golgi body, mitochondrion, lysosome, ER, a large vacuole BUT **I** vesicle / small vacuoles **I** detail of cell wall / cell surface membrane around flagellar area *four from:* cell wall **;** *must add another line to diagram* **R** cellulose cell wall cell (surface) membrane **; A** plasma membrane *label line to the inside of cell wall* **I** if outer line labelled as cell membrane DNA **;** **A** bacterial chromosome / nucleoid *as label* *allow one or two circular molecules* (*circle, loop, ball of string, tangled)* **R** *if obviously linear* **R** if label includes, histones / histone proteins / chromatin **R** if nuclear, envelope / membrane, shown **R** if nucleolus shown or labelled ribosomes **;** **R** 80S ribosomes *shown as, dots / small spheres* cytoplasm / cytosol **;** plasmid **;** *smaller than DNA, circular* AVP **;** e.g. 70S / smaller / 17–20 nm, *for ribosome* murein / peptidoglycan (for cell wall – allow even if cell wall label not added) pilus /pili *drawn as external hair-like structure(s)* basal granule *at base of flagellum* capsule drawn to outside *(some do have a capsule)*	**4**

Question 17 · Paper 2 · May/June 2023 (22) · Q4(a)(iii) · 3 marks

4(a)(iii)	*any **three** from:* *eukaryote because presence of* (true) nucleus / nuclear envelope / nuclear membranes **;** mitochondrion **;** *if mp1 **and** 2 not gained, allow* double membrane-bound structures nucleolus **;** chromatin **;** (**X**) has 9+2 pattern of microtubules **; A** *ref. to* cytoskeleton / microtubules **X** / AW, covered by cell (surface) membrane **;** endoplasmic reticulum **;** **I** rough / smooth **I** ER / SER / RER **A** Golgi body *not prokaryote because* absence of cell wall **;** **I** does not have peptidoglycan cell wall (size) greater than 5 μm **;** **A** larger than (typical) prokaryote / bacterial cell **A** valid calculated size using scale bar *if stated as a prokaryote, read whole response and if all ideas refer correctly to eukaryotic structures, allow max 1*	**3**

Question 18 · Paper 2 · February/March 2023 (22) · Q1(a) · 2 marks

1(a)

cell structure	eukaryotic cells	prokaryotic cells
nucleus	✓	×
Golgi body	✓	×
circular DNA	✓	✓
70S ribosome	✓	✓

one mark for each correct column **; ;**

2

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Question 19 · Paper 2 · May/June 2022 (23) · Q2(a) · 3 marks

2(a)	peptidoglycan / murein ; ribosomes ; (permanent / large) vacuole ;	3

Question 20 · Paper 2 · October/November 2022 (22) · Q2(a) · 2 marks

2(a)	**S** = protein ; **A** amino acid **R** protein coat **I** capsomere **T** = capsid ; **A** protein coat **R** capsomere	2

Question 21 · Paper 2 · October/November 2022 (22) · Q2(d) · 2 marks

2(d)	presence of (viral), envelope / (outer) membrane / phospholipid bilayer ;	2
	ref. fluid / flexible ;	
	ref. to preparation (for electron microscopy) ; e.g. distortion / squashed / artefact **I** ref. to use of the microscope e.g. electron beam affects	
	AVP ; e.g. *suggestion of* variation in tegument protein, number / arrangement / organisation / AW	

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Question 22 · Paper 2 · February/March 2019 (22) · Q6(d)(i) · 3 marks

6(d)(i)	non-cellular / acellular / not made of cells ; protein coat / capsid ; nucleic acid core / DNA or RNA ; AVP ; ; ; e.g. only replicate inside host cells ref. to no characteristics of living organisms (sensitivity, growth, etc.) ref. to size, e.g. most are smaller than bacteria ref. to capsomeres	**3**

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