

Answer **all** the questions.

1(a). Plant and animal cells have different structural features.

(i) Name **two** features of plant cells that are not features of animal cells.

1

2

[2]

(ii) Name **one** structure present in animal cells that is not present in plant cells.

[1]

(iii) The cytoskeleton in cells consists of microtubules and microfilaments.

Describe the roles of the cytoskeleton.

[3]

3. Cyanobacteria are photoautotrophs and fossil records confirm their existence 3.5 billion years ago.

Which row describes the structure of cyanobacteria?

	Feature					
	Nucleus	Circular DNA	Mitochondria	Ribosomes	Chloroplast	Cell wall
A	✓		✓		✓	
B			✓		✓	✓
C	✓	✓		✓		
D		✓		✓		✓

Your answer

[1]

4. Three types of microscope are listed below.

Select the row that shows the correct use for each type of microscope.

	Type of microscope and what it is used to observe		
	Light microscope	Transmission electron microscope	Laser scanning confocal microscope
A	an object at a certain depth within a cell	cell surfaces	organelles
B	an object at a certain depth within a cell	cell surfaces	whole cells and tissues
C	whole cells and tissues	organelles	cell surfaces
D	whole cells and tissues	organelles	an object at a certain depth within a cell

Your answer

[1]

5. Fig. 8.1 shows an animal cell.

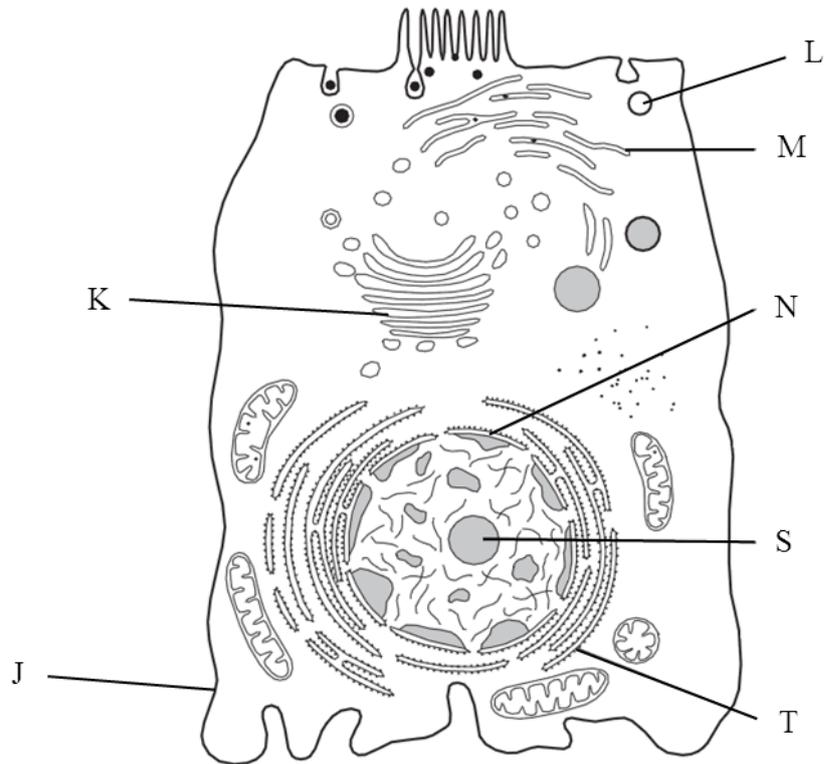


Fig. 8.1

Which option describes the correct sequence of organelles involved during the production and secretion of a protein from this cell?

A S, K, L, J

B T, K, L, J

C T, M, L, J

D S, T, K, L

Your answer

[1]

6. Which of the following statements is / are true?

Statement 1: Microtubules are part of the '9 + 2' formation in bacterial flagella.

Statement 2: Microtubules can be prevented from functioning by a respiratory inhibitor.

Statement 3: Microtubules are involved in moving chromosomes from the equator to the poles of the cell during mitosis.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

7. The concept of molecules with complementary shapes can be used to explain many processes in living things.

Lupus is an autoimmune disease. Lupus occurs when nuclear proteins are exposed and the immune system makes antibodies against these proteins. As a result the proteins clump together. These clumps stick to surfaces such as the blood vessel walls and cause fatigue, joint pain and skin rashes.

(i) What is meant by the term *autoimmune disease*?

[2]

(ii) Suggest why antibodies specific to nuclear proteins are not normally made.

[1]

8. Which of the following statements describes an organelle which is **not** membrane bound?

- A contains cristae
- B modifies and packages proteins
- C contains digestive enzymes
- D is made of rRNA and protein

Your answer

[1]

- 9(a). A small, permanent pond is the habitat for a climax community of producers (aquatic plants and algae) and consumers (bacteria, protoctista, worms, snails, arthropods and small vertebrates like newts and fish).

Why might ecologists call this a 'climax community'?

----- [1]

- (b). The protoctist *Paramecium caudatum* is usually between 200 and 300 μm in length. An accurate measurement would help in the correct identification of a specimen from this pond.

What laboratory equipment would you select to make an accurate measurement of the length of *Paramecium caudatum*?

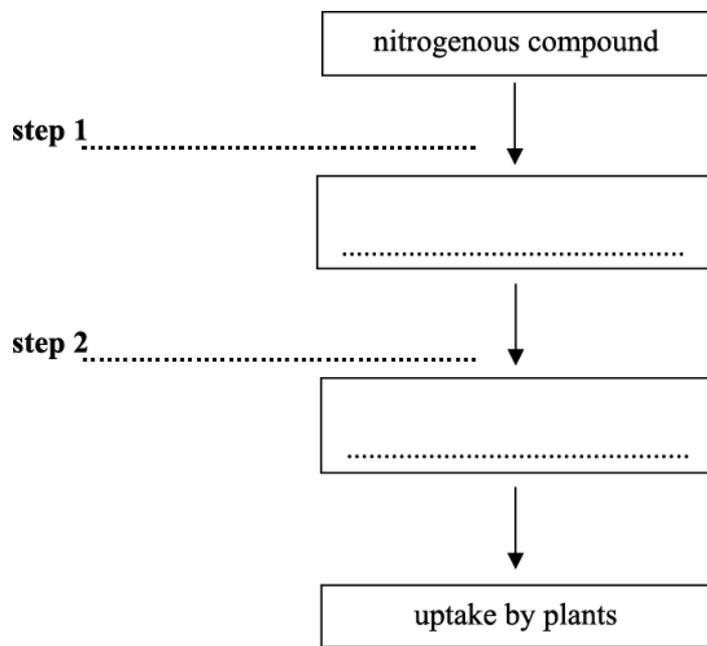
----- [2]

- (c). An animal fell into the pond. It drowned and decayed. Within a year the biological compounds in its body had been completely recycled.

- (i) What nitrogenous excretory molecule from the decomposers would pass to the next stage of the nitrogen cycle?

----- [1]

- (ii) Complete the flow chart to show what happens to this nitrogenous compound, and name the groups of bacteria involved at steps 1 and 2, as it is converted to a form that plants can take up and use.



[4]

10. A range of microscopes are available for scientific research. Each type of microscope has a different use.

Select the row that shows the correct uses for all the types of microscope.

	Type of microscope and what it is used to observe			
	Light microscope	Transmission electron microscope	Scanning electron microscope	Laser scanning confocal microscope
A	an object at a certain depth within a cell	organelles	cell surfaces	whole cells and tissues
B	cell surfaces	an object at a certain depth within a cell	whole cells and tissues	organelles
C	whole cells and tissues	organelles	cell surfaces	an object at a certain depth within a cell
D	organelles	an object at a certain depth within a cell	whole cells and tissues	cell surfaces

Your answer

[1]

11. Haemoglobin is found in erythrocytes. Unlike other vertebrates, the mature erythrocytes of mammals lack nuclei and other membrane-bound organelles.

(i) Explain **one** advantage and **one** disadvantage of the lack of nuclei and other membranebound organelles to mammalian erythrocytes.

Advantage -----

Disadvantage -----

[2]

(ii) Viruses do not use erythrocytes as host cells, whereas the malarial pathogen *Plasmodium* spends part of its life cycle inside erythrocytes.

Suggest why.

[2]

(iii) Explain why erythrocytes do **not** make use of any of the oxygen that they are transporting.

[2]

12. *Amoeba proteus* is a single-celled organism that lives in freshwater habitats. Fig. 1.1 is a drawing of *A. proteus*.

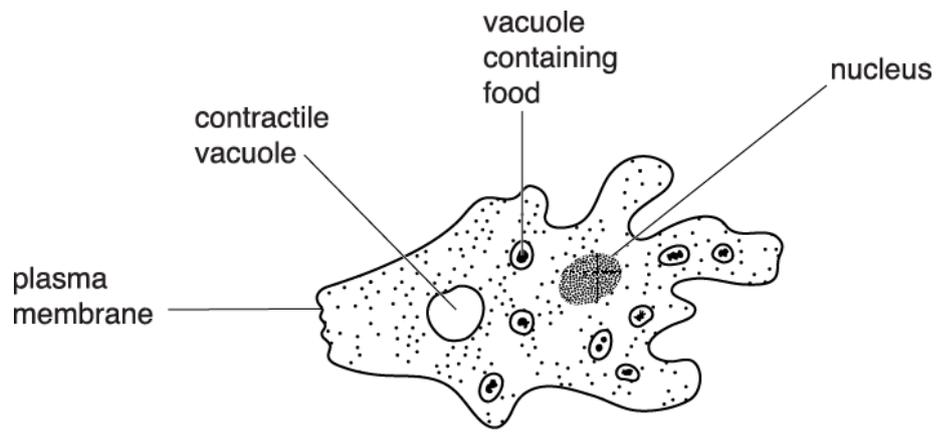


Fig. 1.1

State **one** feature shown in Fig. 1.1 that would **not** be present in a prokaryotic cell.

----- [1]

13(a). Table 3.1 lists the **maximum** magnification and resolution of three different types of microscope.

Microscope	Magnification	Resolution (nm)
X	× 1500	200
Y	× 100 000	20
Z	× 500 000	1

Table 3.1

Which microscope, **X**, **Y** or **Z**, is a **transmission** electron microscope?

[1]

(b). Fig. 3.1(a) and Fig. 3.1(b) below show root hairs on the surface of roots. The two images were taken using different types of microscope.

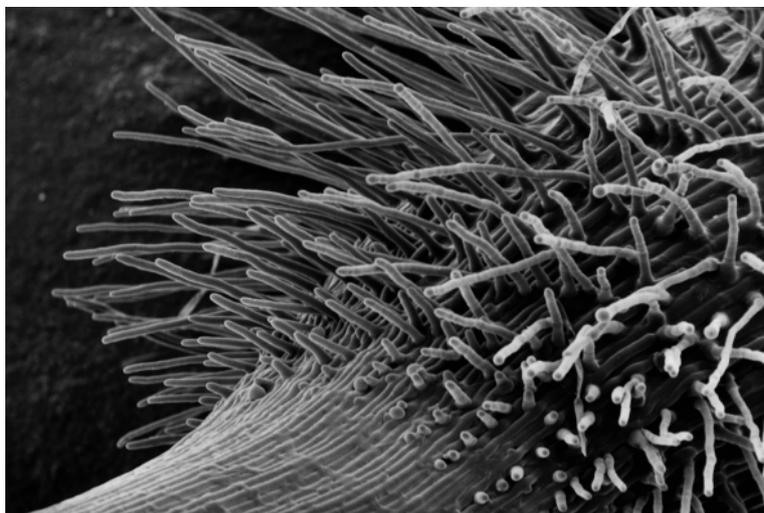


Fig. 3.1(a)



Fig. 3.1(b)

One of the images was taken using a scanning electron microscope.

Identify which image, **Fig. 3.1(a)** or **Fig. 3.1(b)**, was taken using a scanning electron microscope.

Justify your choice.

[2]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	<p>cellulose / cell, wall ;</p> <p>chloroplast(s) ; starch grain(s) / amyloplast(s) ; large / permanent, vacuole ;</p> <p>tonoplast ; plasmodesma(ta) ;</p>	2 max	<p>Mark the first answer on each prompt line. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT wall unqualified, DO NOT CREDIT if incorrect compound e.g peptidoglycan / chitin</p> <p>IGNORE plastid IGNORE vacuole alone – must be qualified as large or permanent</p> <p>Examiner's Comments</p> <p>Candidates were asked to name two characteristics of plant cells that were not found in animal cells. The most common responses were 'chloroplasts' and 'cell wall'. A number of candidates need to be more specific in their responses to such questions, as 'vacuole' was not sufficient to gain a mark at this level. Examiners were looking for the more specific response of a large or permanent vacuole.</p>
		ii	<p>centriole / glycogen granule ;</p>	1	<p>Mark the first answer. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT lysosomes, cilia, flagella</p> <p>Examiner's Comments</p> <p>Candidates needed to name one structure present in animal cells that was not found in plant cells. Many candidates gave a correct response. 'Centrioles' was the most common such response, closely followed by cilia / flagella. The mark scheme allowed 'lysosomes' even though this is a feature that is still being debated - plant cells certainly have small vacuoles that contain lytic enzymes, but they are not always called lysosomes in plants.</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
	<p>iii</p> <p>1 (whole) cell, support / stability / scaffolding / maintain shape ;</p> <p>2 movement of, cilia / flagella / undulipodia OR use of cilia / flagellum / undulipodium to move cell ;</p> <p>3 changing shape of cell / cytokinesis / pseudopodia / phagocytosis / endocytosis / exocytosis / muscle contraction ;</p> <p>4 (named) organelles, moved / held in place ;</p> <p>5 movement of, chromosomes / chromatids / (m)RNA ;</p>	<p>3 max</p>	<p>IGNORE 'movement of, cell / membrane' unqualified</p> <p>IGNORE strength / structure / rigid</p> <p>IGNORE make up cilia / flagella</p> <p>ACCEPT descriptions</p> <p>ACCEPT movement of vesicle IGNORE movement of substances / materials</p> <p>ACCEPT formation of spindle / centrioles</p> <p>Examiner's Comments</p> <p>Candidates were asked to describe the roles of the cytoskeleton. Most candidates were able to give some correct responses. Many stated that the cytoskeleton was involved with transporting vesicles or organelles around the cell. Some candidates need however to be more specific, as transporting 'substances' around the cell was not accepted. Movement of cilia or flagella and provision of support for the cell were also commonly stated.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
b		<p>1 nucleus, contains gene (for protein) / site of transcription / produces mRNA ;</p> <p>2 ribosomes / rough endoplasmic reticulum / RER, site of, protein synthesis / translation ;</p> <p>3 vesicles for transport (of protein) ;</p> <p>4 Golgi (apparatus / body), processes / modifies / (re)packages, proteins ;</p> <p>5 (vesicles) fuse to, cell surface / plasma, membrane ;</p>	4 max	<p>Max 4 marks for content Look for name of organelle and its function / role ACCEPT enzyme / protease for protein MAX 3 if answer refers to insulin or incorrect protein</p> <p>ACCEPT DNA / genetic material / genetic information for 'gene' IGNORE 'mRNA leaves nucleus'</p> <p>ACCEPT description of assembling a <i>chain</i> of amino acids</p> <p>mp3 can be awarded either for transport between ER and Golgi or between Golgi and Plasma membrane</p> <p>E.G. tertiary folding / quaternary structure / carbohydrate added / converted to glycoprotein / placed in vesicles IGNORE ref to RER</p> <p>IGNORE binds / attach / joins IGNORE exocytosis IGNORE ref to vesicles leaving cell ACCEPT merges with / becomes part of</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			QWC ;	1	<p>Any two technical terms from the list below used appropriately and spelled correctly :</p> <p>ribosomes rough endoplasmic reticulum (NOT RER for QWC) transcription (and derivatives) translation (and derivatives) golgi vesicles plasma membrane / cell surface membrane</p> <p>Examiner's Comments</p> <p>Candidates were asked to outline how organelles work together to secrete a specific protein. Most candidates gave excellent responses that were well organised and clearly worded. The QWC mark was usually awarded. In certain areas candidates need to be more specific with their wording of responses. For example, they should describe the secretory vesicle as 'fusing to the cell surface membrane' rather than 'binding to the membrane'. Binding does not necessarily suggest that the vesicle membrane becomes a part of the cell surface membrane and that the contents of the vesicle are released through the membrane.</p>
			Total	11	
2			ultrastructure ;	1	<p>Mark the first answer for each question part. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Examiner's Comments</p> <p>The term ultrastructure was not so well known and common errors were to write 'organelles' or cytoskeleton'.</p>
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3			D	1	
			Total	1	
4			D	1	
			Total	1	
5			B	1	
			Total	1	
6			C	1	
			Total	1	
7		i	abnormal immune response (1) against tissues normally in the body (1)	2	
		ii	nuclear proteins normally, hidden in nucleus / not exposed to tissue fluids (1)	1	
			Total	3	
8			D	1	
			Total	1	
9	a		(pond community is) final / stable / not subject to further succession	1	IGNORE 'permanent', it is in the rubric.
	b		light microscope (1) graticule (1)	2	
	c	i	urea / uric acid	1	ALLOW ammonia, ammonium (ions).
		ii	Nitrosomonas (1) nitrite (1) Nitrobacter (1) nitrate (1)	4	
			Total	8	
10			C	1	
			Total	1	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
11	<p align="center">i</p> <p><i>advantages</i></p> <p>A1 more space for / can contain more / can carry more, haemoglobin / oxygen <input type="checkbox"/></p> <p>A2 can squeeze through capillaries easily <input type="checkbox"/></p> <p><i>disadvantages</i></p> <p>D1 limited life span / cannot divide / cannot reproduce / cannot undergo mitosis <input type="checkbox"/></p> <p>D2 no, protein synthesis / repair <input type="checkbox"/></p> <p>D3 no respiration, in / by, mitochondria</p> <p>or</p> <p>no mitochondria for respiration</p> <p>or</p> <p>limited respiration / no aerobic respiration / only anaerobic respiration <input type="checkbox"/></p>	max 2	<p>Mark first answer only for advantage and disadvantage.</p> <p>A1 DO NOT CREDIT in context of larger surface area ACCEPT 'Hb' for haemoglobin</p> <p>D1 max time of 120 days / 4 months</p> <p>D3 DO NOT CREDIT 'no mitochondria so no respiration' (as some respiration will still take place)</p> <p>ACCEPT 'ATP release' or 'energy provided' instead of 'respiration' e.g. no energy being provided from mitochondria ATP is not released by mitochondria</p> <p>DO NOT CREDIT ref to producing / creating, energy</p> <p>Examiner's Comments</p> <p>Most candidates stated that lack of a nucleus left more space for oxygen/haemoglobin but a significant number referred wrongly to an increase in surface area. The short life span of erythrocyte was commonly stated as a disadvantage but very few candidates realised their inability to carry out protein synthesis. Many candidates simply re-stated that erythrocytes had no membrane-bound organelles or a nucleus without any further qualification. A common misunderstanding was that the erythrocyte would be unable to respire, failing to realise that anaerobic respiration does still take place. A significant number said that erythrocytes would be unable to defend themselves from infection without a nucleus, or could not control cell activities</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
			or what entered or left the cell.
	<p>ii</p> <p><i>virus</i></p> <p>virus is unable to / cannot, replicate / reproduce, on its own / outside a host cell or virus requires host cell, machinery / DNA / RER / ribosomes, for protein synthesis or virus does not contain, RER / ribosomes, for protein synthesis □</p> <p>-----</p> <p><i>Plasmodium</i></p> <p><i>idea that Plasmodium is using the host cell to hide from the immune system</i> or for <i>Plasmodium</i> to complete its life cycle or for <i>Plasmodium</i> to use as a source of food (for, growth / reproduction) □</p>	2	<p>IGNORE ref to the erythrocyte not having membrane-bound organelles without ref to the need of the virus to use them inside the cell</p> <p>Must be a clear statement ACCEPT needs / has to use, host cell to, replicate / reproduce</p> <p>ACCEPT 'malarial pathogen' for <i>Plasmodium</i> IGNORE eukaryotic / prototist IGNORE it has its own, DNA / nucleus / protein synthesis apparatus</p> <p>IGNORE ref to just, part / stage, of life cycle</p> <p>IGNORE ref to organelles</p> <p>Examiner's Comments</p> <p>This was a challenging question for many, and several failed to specify which organism they were talking about. Candidates often understood that viruses couldn't use erythrocytes for reproduction but failed to make the link that viruses must use the host cell to replicate. Candidates restated the question describing that part of the Plasmodium life cycle took place in the red blood cell but failed to realise it did not complete its life cycle. Commonly, candidates said that the Plasmodium used the erythrocyte for transport and as a source of oxygen. Many candidates spoke of Plasmodium using the erythrocyte</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					because it is injected directly into the blood by the mosquito. Only the most able candidates described how Plasmodium could evade the immune response within the red blood cell.
		iii	<p>1 oxygen is bound to haemoglobin (while being transported) <input type="checkbox"/></p> <p>2 lack mitochondria <input type="checkbox"/></p> <p>3 (therefore) no aerobic respiration <input type="checkbox"/></p> <p>4 (moved by mass flow so) doesn't need, energy / ATP, to move or needs less, energy / ATP (for metabolic processes) <input type="checkbox"/></p>	2	<p>1 ACCEPT 'it' for 'oxygen' ACCEPT 'Hb' for haemoglobin</p> <p>3 ACCEPT only respire anaerobically IGNORE ref to energy</p> <p>4 DO NOT CREDIT 'does not need, energy / ATP' unqualified DO NOT CREDIT 'makes / produces, energy'</p> <p>Examiner's Comments</p> <p>Most candidates scored 1 mark for lack of mitochondria although some candidates just referred to no organelles or no organelles for respiration. Very few candidates made the connection with aerobic respiration and the majority of candidates believed that erythrocytes could not respire at all and just had a completely passive role. Many candidates referred to the pointless nature of using the oxygen that they are supposed to be carrying to other tissues, more of a philosophical attitude than biological one.</p>
			Total	6	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
12		<u>nucleus</u> ; (contractile / food) vacuole;	max 1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Examiner's Comments</p> <p>Well answered and nearly all candidates gave a correct response as 'nucleus' or 'food vacuole'. Some candidates obviously relied on memorised differences between Eukaryotes and Prokaryotes and provided answers such as 'different sized ribosomes'. When a question states 'shown in Fig. 1.1', candidates should understand that they must refer to the figure rather than rely on memory.</p>
		Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
13	a		Z;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Examiner's Comments</p> <p>Most students recognised that microscope Z was the transmission electron microscope.</p>
	b		<p>Fig. 3.1(a) (no mark)</p> <p>shows surface view; 3D / three dimensional; better <u>resolution</u> (than b);</p>	max 2	<p>Please place a green blob on paper</p> <p>Do not allow mp 2 if fig 3.1 b selected Do not allow mp 3 if fig 3.1 b selected Must be comparative comment</p> <p>Examiner's Comments</p> <p>Most students recognised that Fig. 3.1(a) was the image from a scanning electron microscope and were able to justify their choice successfully. The most common response was that the image was three dimensional, but many candidates also stated that it was a surface view. Fewer candidates stated that the resolution was higher than in Fig. 3.1(b).</p>
			Total	3	