Topical Past Papers

AS & A Level Biology (9700) Paper 2

[Structured questions based on the AS Level syllabus content]

Exam Series: Feb/Mar 2017 - May/June 2025

Format Type A:
Answers to all questions are provided as an appendix

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Introduction

Each Topical Past Paper Questions Compilation contains a comprehensive collection of hundreds of questions and corresponding answer schemes, presented in worksheet format. The questions are carefully arranged according to their respective chapters and topics, which align with the latest IGCSE or AS/A Level subject content. Here are the key features of these resources:

1. The workbook covers a wide range of topics, which are organized according to the latest syllabus content for Cambridge IGCSE or AS/A Level exams.
2. Each topic includes numerous questions, allowing students to practice and reinforce their understanding of key concepts and skills.
3. The questions are accompanied by detailed answer schemes, which provide clear explanations and guidance for students to improve their performance.
4. The workbook's format is user-friendly, with worksheets that are easy to read and navigate.
5. This workbook is an ideal resource for students who want to familiarize themselves with the types of questions that may appear in their exams and to develop their problem-solving and analytical skills.

Overall, Topical Past Paper Questions Workbooks are a valuable tool for students preparing for IGCSE or AS/A level exams, providing them with the opportunity to practice and refine their knowledge and skills in a structured and comprehensive manner. To provide a clearer description of this book's specifications, here are some key details:

- Title: Cambridge AS & A Level Biology (9700) Paper 2 Topical Past Papers
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Cambridge Assessment International Education (CAIE)
- Subject code: 9700
- Years covered: Feb/Mar 2017 - May/June 2025
- Paper: 2
- Number of pages: 1240
- Number of questions: 365

Contents

Chapter 1

Cell structure

1.1 Cells as the basic units of living organisms

1. 9700_w24_qp_21 Q: 1

(a) Animal cells, plant cells and prokaryotic cells have similarities and differences in their structure.

Table 1.1 lists five organelles found in cells.

Complete Table 1.1 by placing a tick (✓) to show whether the organelle is present in animal cells, plant cells and prokaryotic cells or a cross (✗) if the organelle is absent.

Put a tick (✓) or a cross (✗) in every box.

The first row has been completed for you.

Table 1.1

organelle	cell type		
	animal cells	plant cells	prokaryotic cells
nucleus	✓	✓	✗
large permanent vacuole			
rough endoplasmic reticulum			
Golgi body			
centrioles			

[4]

(b) Fig. 1.1 shows a section through part of an epithelial cell found in the digestive system of an animal.

The cell is specialised for absorption of digested food.

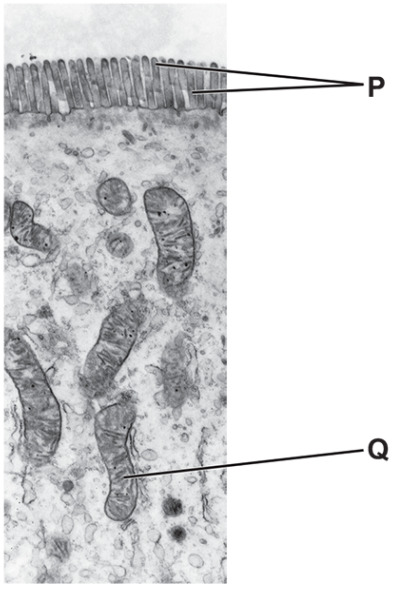

Fig. 1.1

The structures labelled **P** and **Q** in Fig. 1.1 are involved in the absorption of digested food.

(i) Name the structures labelled **P**.

..... [1]

(ii) Explain how the organelle labelled **Q** in Fig. 1.1 is involved in this process.

.....

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..... [2]

[Total: 7]

2. 9700_s21_qp_21 Q: 1

Fig. 1.1 is a transmission electron micrograph of cells from duckweed, *Spirodela oligorrhiza*.

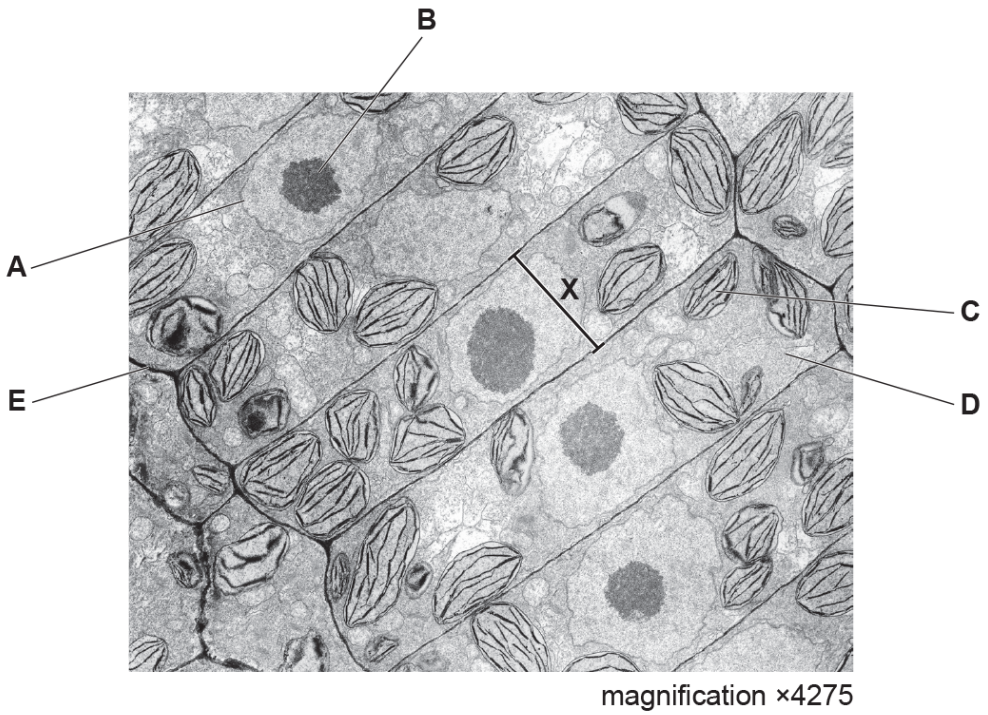

Fig. 1.1

(a) Calculate the actual width of the cell labelled **X**.

Write down the formula you will use to make your calculation.

Show your working and give your answer in micrometres to one decimal place.

formula

..... μm [3]

(b) (i) Table 1.1 lists some biological molecules found in plant cells.

Complete Table 1.1 by choosing **one** letter from Fig. 1.1 that indicates a cell structure where each biological molecule is found.

Table 1.1

biological molecule	letter from Fig. 1.1
DNA	
cellulose	
phospholipid	
histone proteins	

[4]

(ii) State the name of a cell structure, **visible in Fig. 1.1**, where ATP is synthesised.

..... [1]

(iii) Name a cell structure that produces mRNA.

..... [1]

(c) Describe the evidence from Fig. 1.1 that shows that the image is a transmission electron micrograph.

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..... [2]

[Total: 11]

3. 9700_s18_qp_21 Q: 1

Fig. 1.1 is a transmission electron micrograph of a cell from the root of thale cress, *Arabidopsis thaliana*.

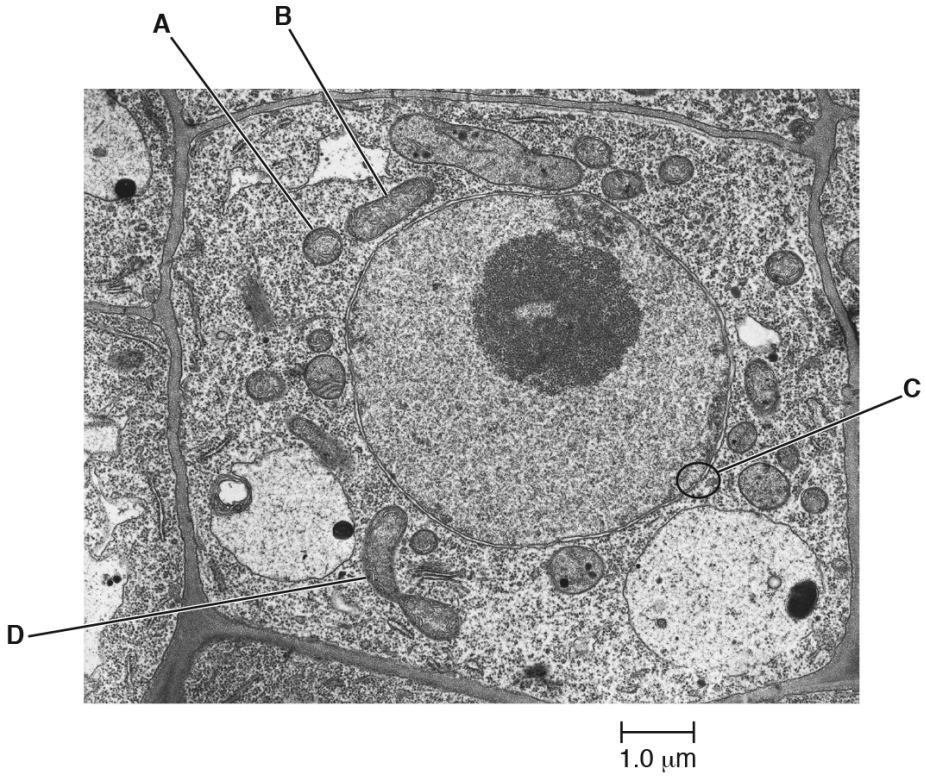

Fig. 1.1

(a) (i) The structures labelled **A** and **B** on Fig. 1.1 are sections of two mitochondria.

Suggest why **A** and **B** are different shapes.

.....

.....

.....[1]

(ii) The structure labelled **D** on Fig. 1.1 is a mitochondrion about to divide.

Explain the importance of the division of mitochondria for the cell shown in Fig. 1.1 **and** for cells in the root tips of thale cress.

.....

.....

.....

.....

.....[2]

(b) Within a cell, substances move between the nucleus and the cytoplasm. The area labelled **C** in Fig. 1.1 shows an area where this communication occurs.

Make a large, labelled drawing of area **C** to show where this communication occurs.

[2]

(c) Outline the functions of the nucleus in non-dividing cells, such as the cell in Fig. 1.1.

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.....[4]

[Total: 9]

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4. 9700_w18_qp_23 Q: 1

(a) Aphids are small insects which feed directly on phloem sap.

The salivary glands of aphids have secretory cells that make and release a variety of proteins that assist in feeding.

Fig. 1.1 is a transmission electron micrograph of a small area of a salivary gland cell of an aphid.

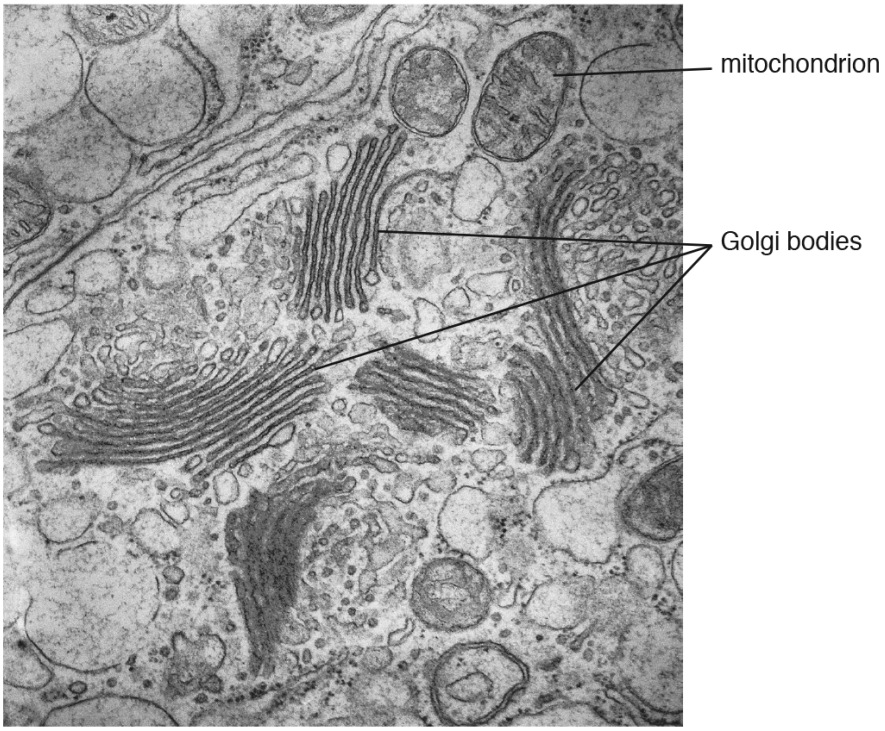

Fig. 1.1

Describe the role of Golgi bodies in secretory cells, such as the salivary gland cells of aphids.

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..... [3]

(b) **(i)** Explain why secretory cells have large numbers of mitochondria.

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..... [2]

(ii) Mitochondria are partly controlled by the nucleus, but can also function independently.

Suggest the features of mitochondria that allow them to function independently of the nucleus.

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..... [2]

(c) Aphids are important vectors of plant viral diseases.

(i) Describe the structure of a typical virus.

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..... [3]

(ii) Suggest how viruses are able to pass from one plant cell to the next without crossing membranes.

.....

.....

..... [1]

[Total: 11]

5. 9700_s17_qp_21 Q: 1

(a) Each of the statements **A** to **D** describes a structure found in eukaryotic cells.

Identify the structure that is described in each statement.

A An organelle that contains 70S ribosomes.

.....

B A thread-like structure composed of DNA and histone proteins.

.....

C The organelle that modifies and packages proteins for secretion.

.....

D The structure that synthesises rRNA and combines it with proteins.

.....

[4]

(b) Prokaryotes and plant cells have cell walls.

Outline the composition of the cell wall of a prokaryote **and** the composition of the cell wall of a plant cell to show how they differ.

.....

.....

.....

.....

.....[2]

[Total: 6]

6. 9700_s17_qp_22 Q: 1

(a) In multicellular organisms, the structure of different cell types is adapted to their function. Within these cells there are a number of different organelles, each with a particular function.

Table 1.1 contains information about the structure and function of five different types of cell. The table also includes, for each type of cell, one example of a cell organelle that is essential for the function to be carried out.

Complete Table 1.1.

Table 1.1

type of cell	function of cell	example of organelle required to carry out function
palisade mesophyll		chloroplast
Leydig	synthesis of steroid hormones	
	production of secretory vesicles for release of antibody	Golgi body
root hair cell	active uptake of mineral ions from the soil	
pancreas acinar	synthesis of enzymes	

[5]

(b) A tissue is a collection of one or more types of cell, specialised to carry out a particular function.

An organ can be considered a structural unit within an organism that:
- consists of more than one type of tissue
- performs a particular function.

The aorta is the main artery of the body.

Explain, with reference to its structure and function, whether the aorta may be described as a tissue or an organ.

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.....[4]

[Total: 9]

7. 9700_w17_qp_23 Q: 1

Fig. 1.1 is a transmission electron micrograph of a part of an animal cell.

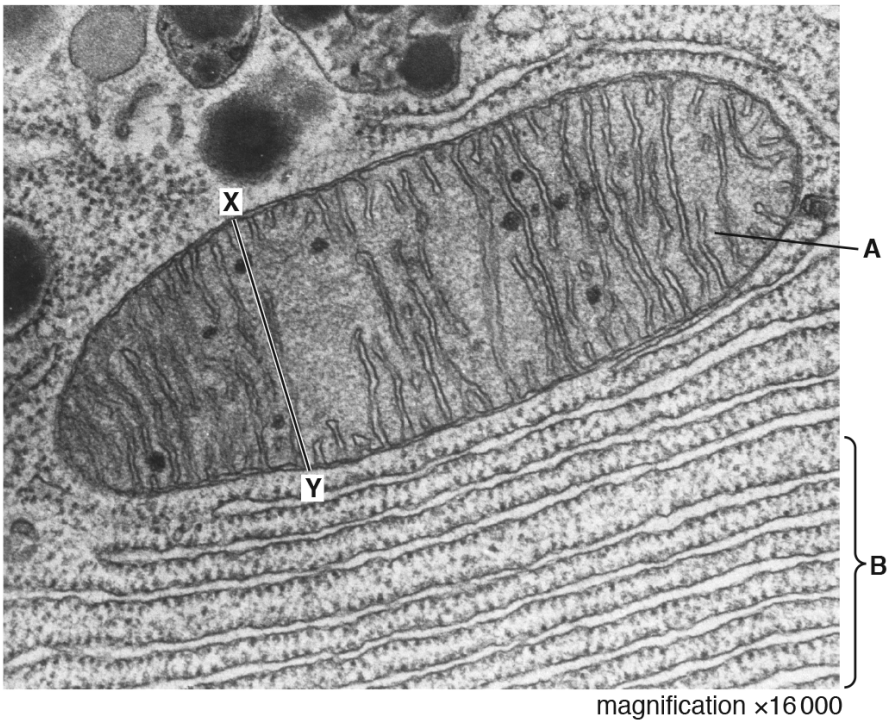

Fig. 1.1

(a) Calculate the actual width of the organelle labelled **A**, as shown by line **X**–**Y**.

State the formula that you will use and show your working.

Give your answer in μm and to one decimal place.

formula

..... μm [3]

(b) **(i)** Name the organelle **A** and state its role in cells.

name .....

role .....

.....

.....[2]

(ii) Name the cell structure labelled **B** and state **one** reason for your answer.

name .....

reason .....

.....

.....[2]

[Total: 7]

Chapter 2

Biological molecules

2.1 Carbohydrates and lipids

8. 9700_s25_qp_21 Q: 2

In mammals, the small intestine is the main site of absorption of the products of digestion.

Fig. 2.1 is a transmission electron micrograph of a longitudinal section (L.S.) of part of an epithelial cell from the small intestine of a mammal.

Fig. 2.2 is a transmission electron micrograph of a horizontal section made at the position indicated by the two arrows in Fig. 2.1.

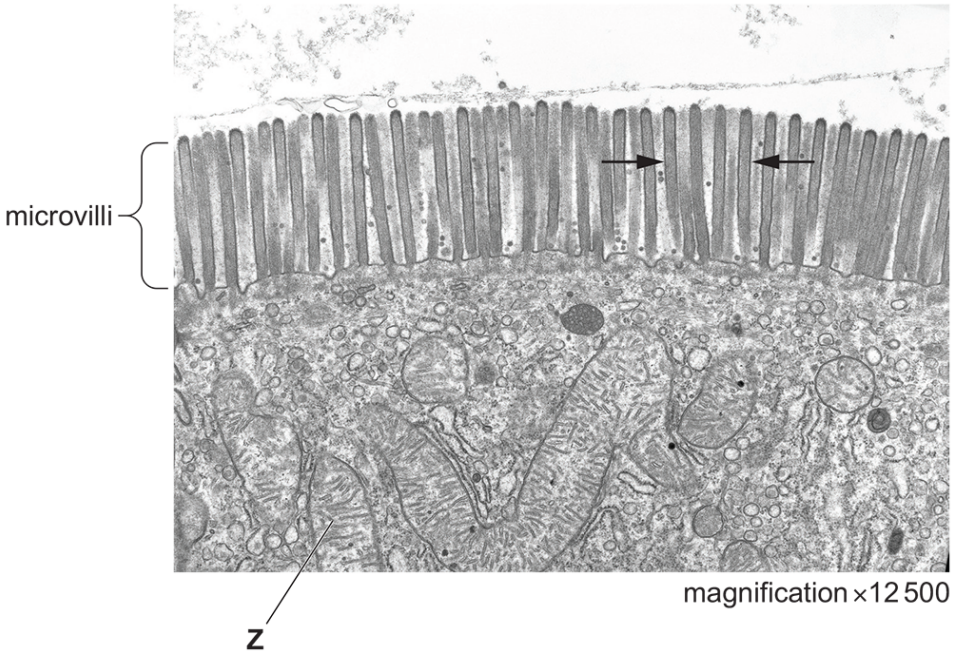

Fig. 2.1

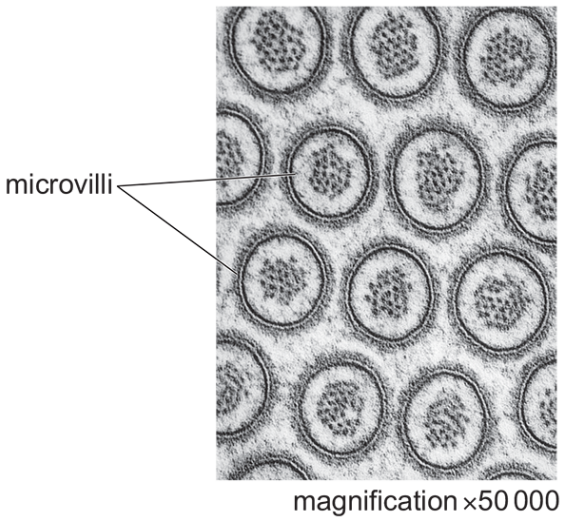

Fig. 2.2

(a) Microvilli and cilia are cell structures.

Describe how the structure of cilia differs from the structure of the microvilli visible in Fig. 2.1 and Fig. 2.2.

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.....

..... [2]

(b) A scientist measured the length and the diameter of some of the microvilli shown in Fig. 2.1 to estimate the total surface area of microvilli on the surface of the epithelial cell.

The scientist assumed that each microvillus was cylindrical in shape.

Suggest **one** other measurement needed to estimate the total surface area of the microvilli of the epithelial cell.

.....

.....

..... [1]

(c) Identify the organelle labelled **Z** in Fig. 2.1 **and** explain why there is a large number of these organelles in the epithelial cells of the small intestine.

organelle .....

explanation .....

.....

.....

..... [2]

(d) Bacteria are found attached to epithelial cells in the intestines of mammals.

Describe how the organisation and distribution of DNA in epithelial cells differs from the organisation and distribution of DNA in bacterial cells.

.....

.....

.....

..... [2]

[Total: 7]

9. 9700_s23_qp_21 Q: 2

Glycogen and cellulose are polymers.

Fig. 2.1 shows small, representative regions of a glycogen molecule and a cellulose molecule.

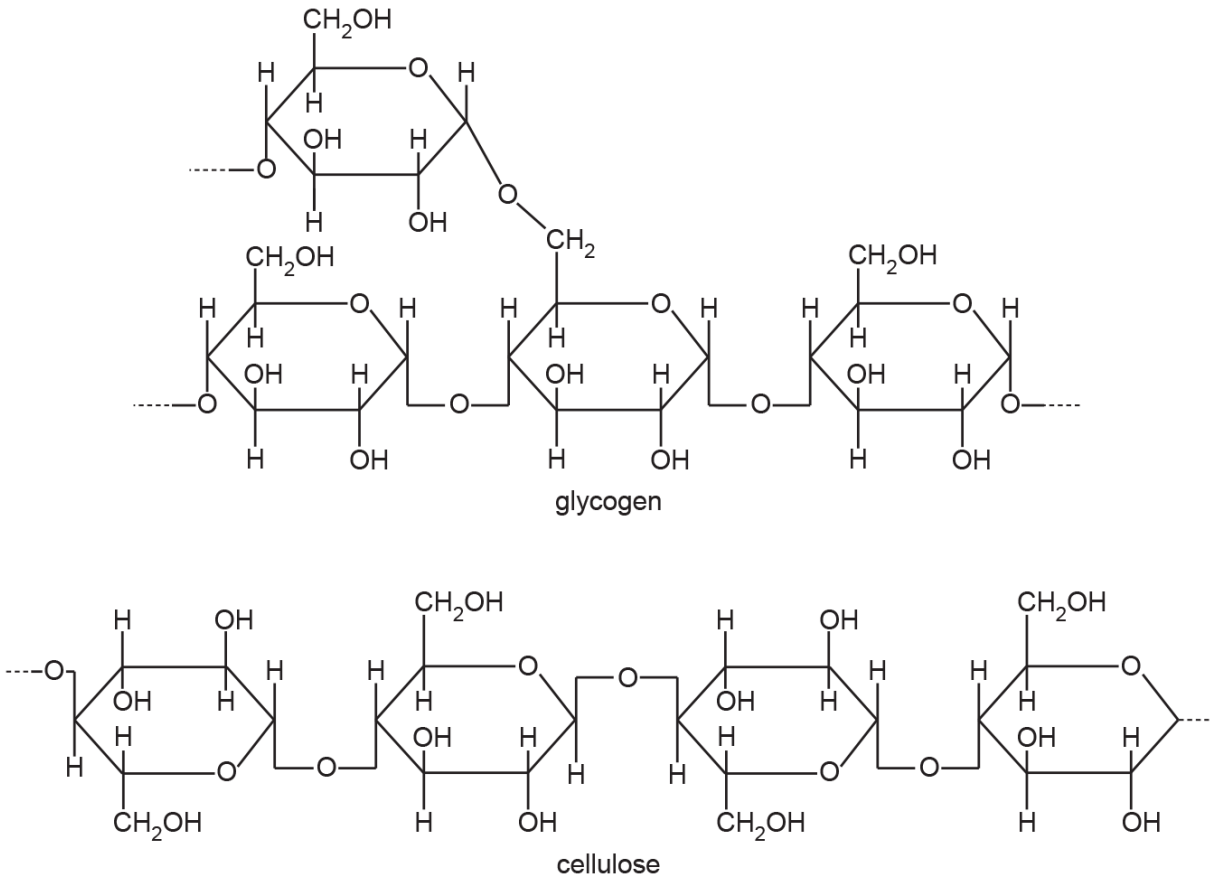

Fig. 2.1

(a) Describe **three** ways, **visible in Fig. 2.1**, in which the molecule of glycogen differs from the molecule of cellulose.

1 .....

.....

2 .....

.....

3 .....

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[3]

(b) Glycogen is found in the form of granules in mammalian liver and muscle cells. Fig. 2.2 is a diagram of part of a molecule of glycogen isolated from a glycogen granule.

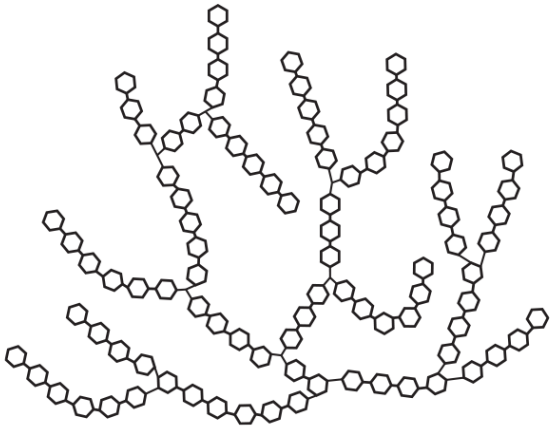

Fig. 2.2

Explain how the structure of glycogen is related to its function in cells.

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..... [3]

(c) Explain how the arrangement of cellulose molecules in plant cell walls is related to their function.

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.....

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..... [3]

[Total: 9]

10. 9700_s22_qp_21 Q: 4

Adipocytes are cells found in adipose tissue in mammals. These cells absorb glycerol and fatty acids to make triglycerides for long-term storage.

Fig. 4.1a shows a glycerol molecule and three fatty acids. Fig. 4.1b shows the triglyceride molecule formed from these components.

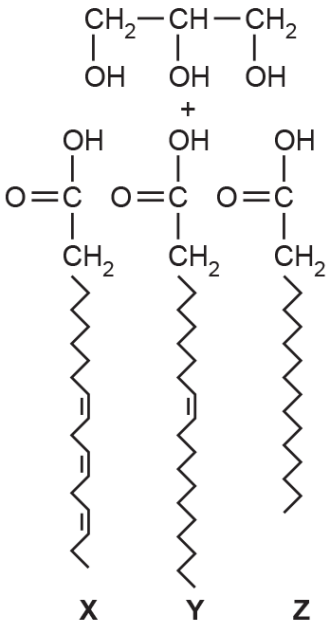

Fig. 4.1a

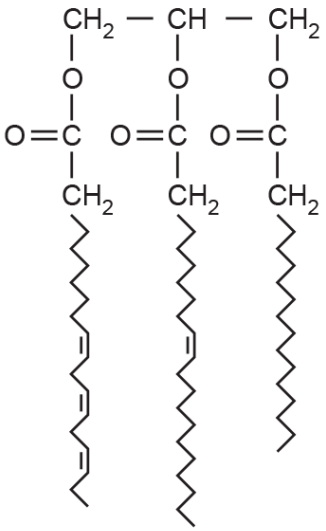

Fig. 4.1b

(a) (i) State the name of the bonds that form between glycerol and fatty acids.

..... [1]

(ii) When a bond forms between glycerol and a fatty acid, water is a product of the reaction.

State the name given to this type of reaction.

..... [1]

(iii) Describe the differences between the fatty acids, **X**, **Y** and **Z**, shown in Fig. 4.1a.

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.....

.....

..... [3]

(b) **(i)** State reasons why triglycerides are described as hydrophobic.

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.....

..... [2]

(ii) Explain why triglycerides are **not** suitable as a component of cell surface membranes.

.....

.....

.....

.....

..... [2]

[Total: 9]

11. 9700_w21_qp_21 Q: 1

(a) Fig. 1.1 is a transmission electron micrograph of cells from the leaf of a plant.

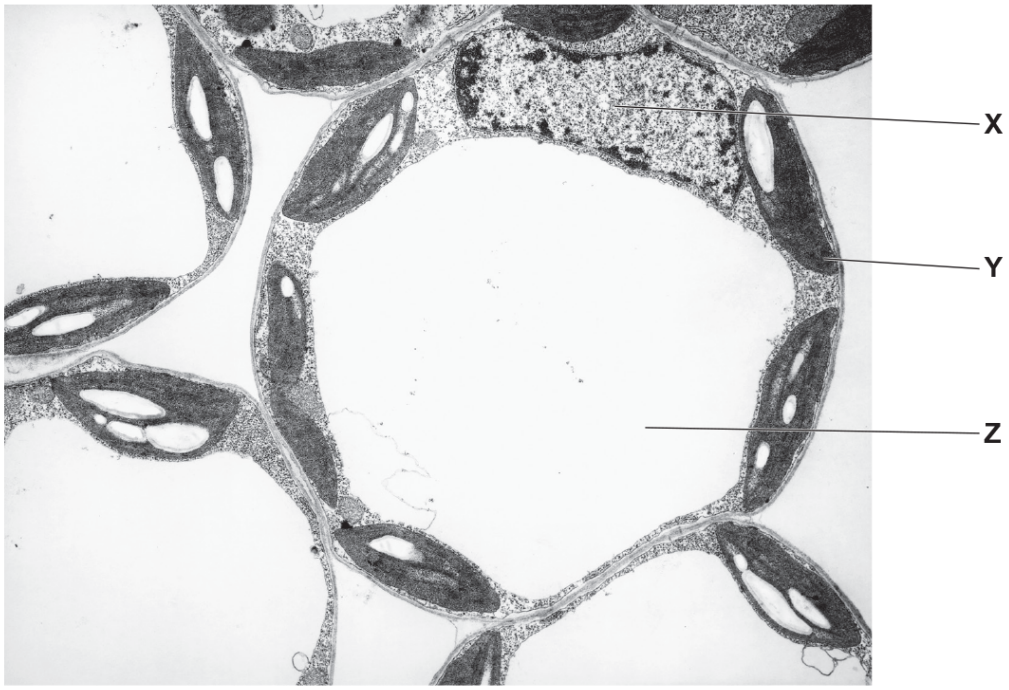

Fig. 1.1

(i) Name the cell structures **X**, **Y**, and **Z**.

X .....

Y .....

Z .....

[3]

(ii) State **two** ways in which the structure of an animal cell differs from plant cells such as those shown in Fig. 1.1.

1 .....

.....

2 .....

.....

[2]

(b) (i) Cell structure **Y** in Fig. 1.1 contains a large starch granule (grain).

Name the chemical reagent used to test for starch **and** state the colour change that will be seen if starch is present.

reagent .....

colour change ..... [2]

(ii) Starch granules contain amylose and amylopectin.

Describe the similarities **and** differences between the structure of amylose and the structure of amylopectin.

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.....

.....

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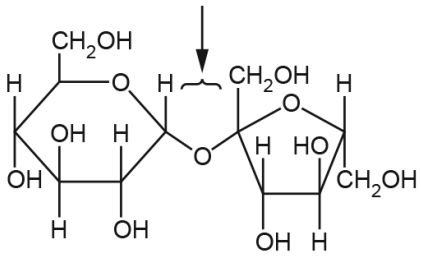
..... [4]

[Total: 11]

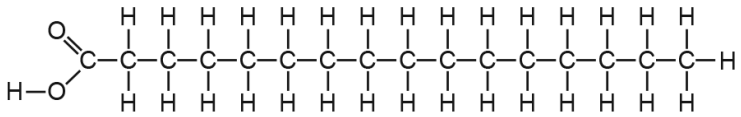
12. 9700_s20_qp_21 Q: 1

Fig. 1.1 shows five biological molecules.

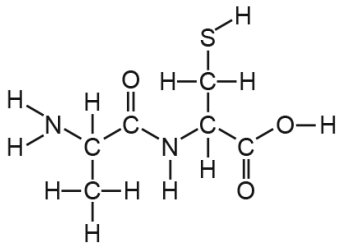
A



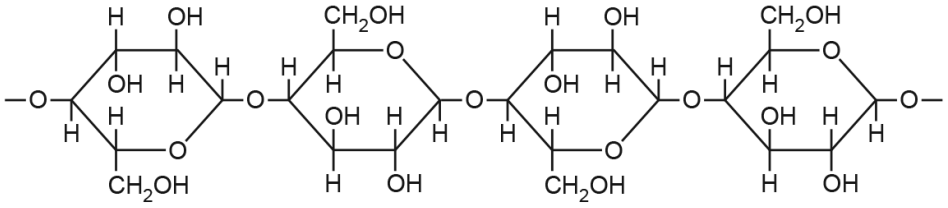
B



C



D



E

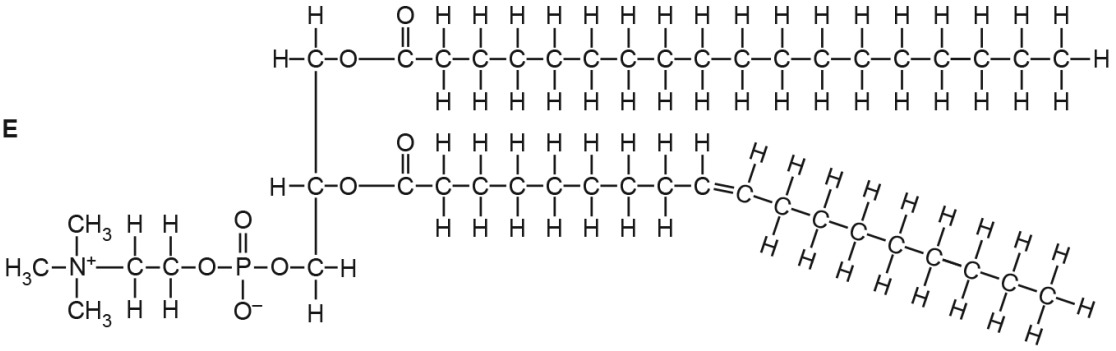


Fig. 1.1

(a) State the name of the bond in molecule **A** indicated by the arrow.

..... [1]

(b) Molecule **B** is described as a saturated fatty acid.

State why molecule **B** is described as a saturated fatty acid.

.....

..... [1]

(c) Molecule **D** is a polymer.

State the name of the monomer that is used to synthesise this polymer.

..... [1]

(d) State the letter of the molecule that could be formed during the hydrolysis of a polypeptide.

..... [1]

(e) State the letter of the molecule that forms part of the cell surface membranes of eukaryotic cells.

..... [1]

(f) Molecule **A** and molecule **C** dissolve in water. Molecule **B** does **not** dissolve in water.

Explain why molecule **A** and molecule **C** dissolve in water, but molecule **B** does **not** dissolve in water.

.....

.....

..... [1]

[Total: 6]

2.2 Proteins

13. 9700_w18_qp_23 Q: 2

(a) Proteins are macromolecules composed of many amino acids.

(i) Two amino acids are represented in the diagram in Fig. 2.1.

Complete the diagram to show how the two amino acids react together to form a dipeptide.

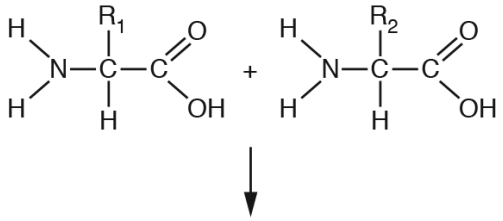


Fig. 2.1

[3]

(ii) State what is represented by R_1 and R_2 in Fig. 2.1.

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..... [2]

(b) Amylose and cellulose are polysaccharides.

Fig. 2.2 shows the structure of part of a cellulose molecule.

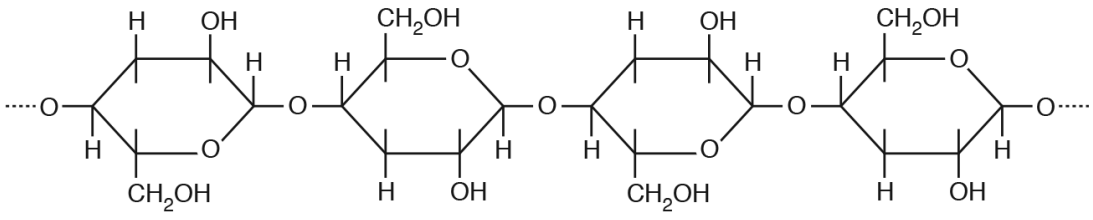

Fig. 2.2

With reference to Fig. 2.2, state how the **structure** of a cellulose molecule differs from the **structure** of an amylose molecule.

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..... [2]

(c) Cellulose is the main component of plant cell walls.

Explain why cellulose is suitable as a component of plant cell walls.

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..... [4]

[Total: 11]

2.3 Water

14. 9700_s21_qp_21 Q: 2

Fig. 2.1 shows three molecules of water.

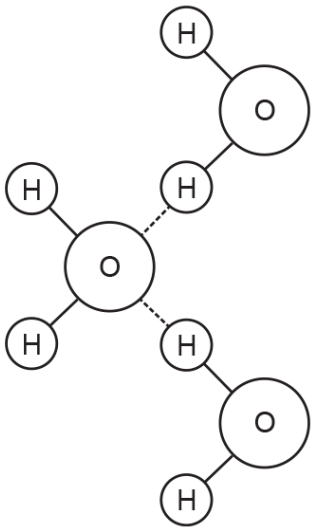

Fig. 2.1

(a) Describe the hydrogen bonding that occurs between the water molecules shown in Fig. 2.1.

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.....

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.....

..... [3]

(b) The human enzyme, salivary amylase, is composed of one polypeptide. Fig. 2.2 represents the structure of a molecule of salivary amylase.

Fig. 2.2

(i) Explain the role of hydrogen bonding in maintaining the secondary structure of proteins, such as salivary amylase.

.....

.....

..... [1]

(ii) Explain the role of hydrogen bonding in maintaining the tertiary structure of proteins such as salivary amylase.

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..... [2]

(c) Outline the importance of water as a solvent in **plants**.

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..... [3]

[Total: 9]

15. 9700_w18_qp_21 Q: 3

(a) Fig. 3.1 is a transmission electron micrograph showing two adjacent cells in a leaf.

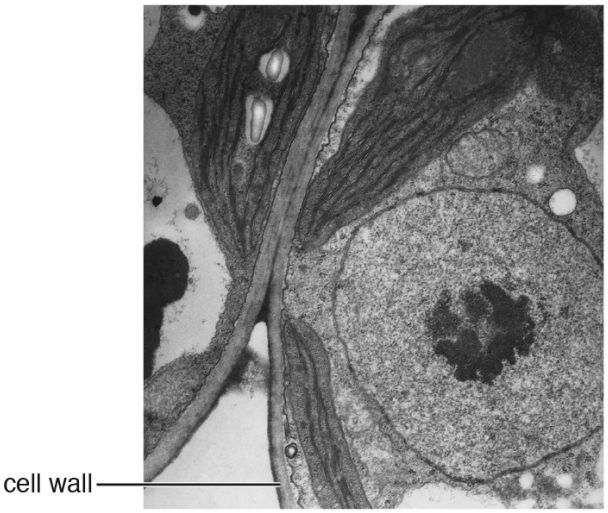

Fig. 3.1

(i) Cellulose is the main polysaccharide in cell walls of plants.

Describe the structure of cellulose.

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.....

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.....

.....

..... [3]

(ii) State **one** feature **visible** in Fig. 3.1, other than the cell wall, that identifies the cells as plant cells.

..... [1]

(iii) Outline the role of ATP in a leaf cell.

.....

.....

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..... [3]

Water is a main component of plant cells.

(b) Fig. 3.2 shows two water molecules linked by a hydrogen bond.

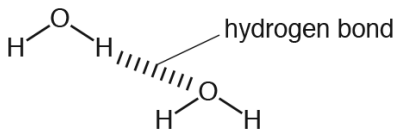

Fig. 3.2

Explain how hydrogen bonding occurs between water molecules.

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..... [2]

(c) Suggest why water is an excellent solvent for ions.

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..... [2]

[Total: 11]

Appendix A

Answers

1. 9700_w24_ms_21 Q: 1

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th rowspan="2">organelle</th><th colspan="3">cell type</th></tr>
<tr><th>animal cells</th><th>plant cells</th><th>prokaryotic cells</th></tr>
<tr><td>nucleus</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>large permanent vacuole</td><td>×</td><td>✓</td><td>× ;</td></tr>
<tr><td>rough endoplasmic reticulum</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>Golgi body</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>centrioles</td><td>✓</td><td>×</td><td>× ;</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>(b)(i)</td><td>microvilli ;</td><td>1</td></tr>
<tr><td>(b)(ii)</td><td>site of aerobic respiration, so
produces / provides, ATP ;
A provides energy
R produces energy

use of ATP in context of absorption of digested food
for, active transport / (idea of) absorption against a concentration gradient
or
endocytosis / pinocytosis; A bulk transport into cell(s) ;</td><td>2</td></tr>
</table>

2. 9700_s21_ms_21 Q: 1

Question	Answer	Marks
(a)	actual width = image width ÷ magnification ; **A** A = I ÷ M M = I ÷ A I = A × M or magnification triangle working = width divided by 4275 ; e.g. 16 000 ÷ 4275 17 000 ÷ 4275 18 000 ÷ 4275 19 000 ÷ 4275 ; 3.7 (μm) 4.0 (μm) 4.2 (μm) 4.4 (μm) ; **R** answer if given to more than 1 dp or whole number	**3**
(b)(i)	DNA – **A** / **B** / **C** ; cellulose – **E** ; phospholipid – **A** / **C** ; histone proteins – **A** / **B** ;	**4**
(b)(ii)	chloroplast / mitochondrion ;	**1**
(b)(iii)	nucleus ; **A** chloroplast / mitochondrion **R** nucleolus	**1**

Question	Answer	Marks
(c)	*any two from* **1** (section at) high resolution ; **A** suggestion of a correct value of resolution for a TEM **2** any named structure visible in Fig. 1.1 that can, only be seen in a TEM / not be seen in a photomicrograph ; e.g. internal structure of chloroplasts / thylakoid(s) / grana e.g. internal structure of mitochondria / cristae **3** high magnification / higher magnification (magnification > 1000 / higher than with light microscope) ; *in context of higher than light microscope* **4** (very) thin ; **5** 2D / no surface contours / no surface features / AW ; **A** not 3D	**2**

3. 9700_s18_ms_21 Q: 1

(a)(i)	*answers must be comparative* *one from:* *idea that* the sections are orientated differently / cut in different planes / cut at different angles / AW ; **A** is a cross section / AW, and **B** is a longitudinal section / AW mitochondria show a variety of, sizes / shapes ; mitochondria, are flexible / change shape ; **A** and **B** are of, different ages / stages of development ;	**1**
(a)(ii)	*two from:* replace, old / worn out / damaged, mitochondria ; require more mitochondria as cells, enlarge / grow ; more mitochondria are needed, for new cells / when cell divides ; **A** so numbers remain the same in the new cells / after cell division **A** *idea that* mitochondria are shared out (between daughter cells) (mitochondria) provide (most), energy / ATP ; **I** cell needs (much) energy without stating mitochondria provide energy **R** energy production **I** uses of energy	**2**
(b)	*two from:* nuclear envelope shown as two membranes with closed ends and a gap ; label to nuclear pore ;	**2**
(c)	*four from:* 1 contains / AW, chromosomes / chromatin / DNA / genes / genetic material / inherited material / genetic information ; 2 (coded) information for synthesis of, polypeptides / proteins ; **A** controls protein synthesis 3 ref. to sequence(s) of bases (in DNA) ; 4 transcription (of genes) / production of mRNA ; 5 contains nucleolus ; 6 manufacture of ribosomal sub-units ; **A** makes ribosomes 7 *idea that* DNA is protected from degradation / enzymes / AW ; 8 AVP ; e.g. responds to signals that control, gene expression / AW post-transcription modification / modifies mRNA / any example repairs DNA **I** controls cell's activities **I** sends mRNA to cytoplasm / mRNA travels through nuclear pores	**4**

4. 9700_w18_ms_23 Q: 1

(a)	*any three from* **1** modification / process / described, of, proteins / polypeptides ; **2** further detail of modification ; *examples of modification* folding of polypeptides / protein folding assembly of polypeptides to form quaternary structure addition of (named) prosthetic group addition of sugars / addition of carbohydrate / glycosylation cutting of polypeptides removal of, methionine / first amino acid making proteins functional **3** packaging into vesicles / formation of Golgi vesicles / formation of secretory vesicles ; **A** 'budding off' / 'breaking off' / transport proteins in Golgi vesicles **4** formation of (primary) lysosomes ; **5** AVP ; e.g. modification of lipids synthesis of, phospholipids / glycolipids synthesis of cell wall polysaccharides	**3**
(b)(i)	(mitochondria) provide / make / produce, ATP ; **A** needs a lot of, ATP / energy **R** 'produce / make, energy' (ATP / energy required for) protein synthesis / movement of (secretory / Golgi) vesicles / exocytosis ;	**2**
1(b)(ii)	*any two from* **1** mitochondria have (circular) DNA ; **2** mitochondria, have / make, (70S) ribosomes (for, protein synthesis / translation) ; **R** if 80S ribosomes **3** mitochondria can divide ; **R** by mitosis **4** AVP ; **5** AVP ; e.g. (mitochondrial / mt) DNA codes for (some mitochondrial) proteins mRNA transcribed from mtDNA mitochondria produce their own tRNA can replicate DNA **I** mitochondria have a double membrane	**2**
(c)(i)	*any three from* protein coat / capsid ; **A** protein layer **R** 'cell wall of protein' nucleic acid (core) ; **R** if 'in a nucleus' DNA or RNA ; acellular / non-cellular / 'not a cell' ; size – *accept within range* 15 nm to 1000 nm ; AVP ; e.g. (protein coat made of) capsomeres surrounded by, membrane / envelope / (phospho)lipid bilayer **I** antigens / enzymes	**3**
(c)(ii)	*any one from* (viruses) pass through plasmodesmata ; **A** 'cytoplasmic strands, through cell walls / between cells' via symplast pathway ;	**1**

5. 9700_s17_ms_21 Q: 1

(a)	**A** chloroplast / mitochondrion ; **B** chromosome(s) / chromatid / chromatin ; **C** Golgi (body / apparatus / complex) ; **D** nucleolus ;	**4**
(b)	*max 1 if only written about prokaryote wall or only about plant wall* **1** prokaryote cell wall has, peptidoglycan / murein ; **2** plant cell wall has, cellulose / polymer of β glucose ; **I** lignin **3** AVP ; e.g. prokaryote wall is made of chains crossed linked by, peptides / amino acids hydrogen bonds between cellulose molecules (within microfibrils) in plant cell wall **A** cellulose chains other components such as pectins / hemicelluloses in plant cell walls	**max 2**

6. 9700_s17_ms_22 Q: 1

(a) *one mark per blank box* — **5**

type of cell	function of cell	example of organelle required to carry out function
palisade mesophyll	photosynthesis ; **A** (absorb light to) synthesise, organic compounds / glucose / starch (from inorganic compounds)	chloroplast
Leydig	synthesis of steroid hormones	smooth endoplasmic reticulum ; **A** SER / smooth ER
plasma cell ; **A** B-cell / white blood cell / leucocyte / (B-) lymphocyte / agranulocyte **R** T lymphocyte / granulocyte / phagocyte / macrophage / neutrophil	production of secretory vesicles containing antibody	Golgi body
root hair cell	active uptake of nitrates	mitochondrion ; **A** cell surface / plasma, membrane **A** cell membrane
pancreas acinar	synthesis of enzymes	rough endoplasmic reticulum ; **A** RER / rough ER **A** ribosomes **A** mitochondrion

(b) **max 4**

I functions of individual tissues
if all cell types named as single cell, allow max 1 for named tissue types

(organ because more than one tissue type)
three named tissue types ; ; ;

endothelium	**A** squamous epithelium **A** endothelial cells **A** epithelial cells
smooth muscle	**A** smooth muscle cells
connective tissue	
elastic tissue	**A** elastic fibres **R** elastin / elastic muscle
fibrous tissue	**A** collagen **A** collagen fibres
nervous tissue	**A** nerve cells
blood	**A** blood cells *only in context of vasa vasorum*

general function
transports / carries / AW, blood ; **A** delivers **R** pumps blood **I** provides

detail ; e.g. to tissues / to body cells / to body / away from heart / AW
R to lungs
(blood) is oxygenated / contains oxygen

Total: **9**

7. 9700_w17_ms_23 Q: 1

(a)	actual length = image length / magnification ; **A** A = I / M M = I / A I = A × M or magnification triangle 2.5 (μm) ;; *for 40 mm **X–Y** length* **A** 2.6 (*for 40/41 mm*) **A** 2.4 (*for 38/39 mm*) *max 1 for* *incorrect or no answer but correct calculation e.g. 40 000 ÷ 16 000* *correct answer but to more than one decimal place* *correct measurement and correct calculation but incorrect conversion*	3
(b)(i)	mitochondrion ; **A** mitochondria *max 1 for function* produces / makes / synthesises / provides / AW, ATP **or** releases / provides / supplies, energy **or** aerobic respiration ; AVP ; e.g. part of the urea cycle β-oxidation of fat oxidative phosphorylation	2
(b)(ii)	rough endoplasmic reticulum ; **A** rough ER **I** RER ribosomes are attached ; *accept mp2 if organelle identified as endoplasmic reticulum/RER*	2

8. 9700_s25_ms_21 Q: 2

Question	Answer	Marks
(a)	*any **two** from:* *cilia* (composed of) microtubules / not composed of microfilaments / not composed of actin (fibres) ; **R** if microvilli have microtubules 9+2, arrangement / pattern / structure (in horizontal section) ; AVP ; e.g. *ref. to* component proteins – e.g. tubulin / dynein (cilia) extend from / attach to, a basal body / basal body at base **R** centrioles	2
(b)	number of microvilli (over the surface of the cell) ; **I** amount / quantity	1
(c)	mitochondrion ; synthesises / makes / produces / provides, ATP for, active transport / active uptake / endocytosis / exocytosis ; **I** absorption **A** provides energy *if no ATP* **A** any other suitable function of an epithelial cell in the small intestine e.g. synthesis of, enzymes / carrier proteins / mucus **or** movement of organelles within cell	2
(d)	*no ora for this question* *organisation for one mark* linear, chromosome / DNA **A** straight **or** DNA associated with, histones / histone proteins / basic proteins ; **A** *ref. to* chromatin *distribution for one mark* DNA, contained in nucleus / surrounded by nuclear envelope / surrounded by nuclear membranes ; **A** *ref. to* DNA in nucleolus	2

9. 9700_s23_ms_21 Q: 2

Question	Answer	Marks
(a)	*if only one molecule described, statement of difference must be in context of glycogen* *any **three** from:* *glycogen* branched (v cellulose unbranched) ; monomer is / made of, alpha- / α-, glucose (v cellulose monomer is β-glucose) ; (1,4- and) 1, 6-. glycosidic bond(s) (v cellulose 1,4-glycosidic bond(s)) ; alternate, monomers / glucose residues / 1,4-(glycosidic) bonds, are not, rotated 180° / inverted / flipped / AW ; **ora**	**3**
(b)	*any **three** from:* **1** glycogen is a store of, energy / glucose ; **R** produces energy **2** *idea that* many, branching points / 'ends' / terminals, for easy / faster, addition / release, of glucose ; **3** compact so stores much, glucose / energy (in cells / small space) ; **4** insoluble ; **5** does not, lower / change, water potential (of cell) ; **A** no osmotic effect **6** AVP ; e.g. prevents loss of glucose from cell (chemically) inactive so does not take part in cell metabolism / AW	**3**

Question	Answer	Marks
(c)	*any **three** from:* **1** unbranched (polymer) / straight chain / linear ; **2** cellulose molecules are arranged in parallel ; **3** *idea that* large number of -OH groups (projecting in all directions) ; **4** allows, hydrogen bonds / H-bonds, to form with water **or** makes molecule hydrophilic ; **5** many hydrogen bonds between cellulose molecules / AW ; **6** cellulose molecules form microfibrils ; **I** 'fibrils' / fibres **7** hydrogen bonds give high tensile strength to microfibrils **A** cellulose fibres / cell wall **or** hydrogen bonds help cell walls to resist, turgor pressure / AW ;	**3**

10. 9700_s22_ms_21 Q: 4

Question	Answer	Marks
(a)(i)	ester ;	1
(a)(ii)	condensation ;	1
(a)(iii)	1 (hydrocarbon chains of) different lengths / **Y** is longest / **Z** is shortest ; **A** correct numbers of carbon atoms in each fatty acid (**X** 18, **Y** 20 and **Z** 16) *if no ref. to different lengths* 2 **Z** saturated, **X** and **Y** unsaturated ; **A** only Z is saturated 3 **X** polyunsaturated, **Y** monounsaturated ; 4 **X** 3, **Y** 1, **Z** 0 double (C=C) bonds ; **only Z** only has single / C-C) bonds **or** (for whole molecule) **X** 4 double bonds , **Y** 2 double bonds, **Z** 1 double bond ;	3
(b)(i)	*any **two** from:* 1 (hydrocarbon / fatty acid tails, are) non-polar / have no polar groups / not charged ; **A** equal sharing of electrons in molecule 2 not soluble / insoluble, (in water) ; 3 cannot form hydrogen bonds with water ; **I** repel water	2
(b)(ii)	*any **two** from:* 1 no, hydrophilic / polar / phosphate, head / part, to, interact with / AW, water ; **I** triglycerides are hydrophobic 2 cannot form hydrogen bonds with water ; **I** repel water 3 cannot form a bilayer ; in water triglycerides, form micelles / form spheres / ball shaped / form globules / do not form thin films / AW ;	2

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11. 9700_w21_ms_21 Q: 1

Question	Answer	Marks
(a)(i)	**X** nucleus ; **Y** chloroplast ; **Z** vacuole ;	3
(a)(ii)	*any **two** from:* no, large / permanent, vacuole / (temporary) small vacuoles ; *this is in context of large permanent vacuole* no, chloroplast / chloroplasts ; no cell wall ; no plasmodesmata ; glycogen granules **or** no, starch, granules / grains ; nucleus, (more) central / AW ; **A** nucleus not at, periphery / edge, of cell centrioles (present) ; AVP ; e.g. fewer Golgi bodies	2
(b)(i)	iodine solution ; **A** iodine in potassium iodide solution / I in KI solution (change in colour from) orange / brown, to, blue / black / purple ;	2

Question	Answer	Marks
(b)(ii)	*any **four** from:* *similarities to max 3* polymers / polysaccharides / described ; composed of α-glucose ; (monomers joined by) glycosidic bonds ; contain 1–4 (glycosidic) bonds / linkages ; **A** glucosidic *differences to max 3* amylose molecules are unbranched / amylopectin molecules are branched ; amylopectin molecules contain 1–6 (glycosidic) bonds ; amylose helical ; amylose is a smaller molecule ; amylopectin is more compact ;	**4**

12. 9700_s20_ms_21 Q: 1

(a)	glycosidic ;	**1**
(b)	*any one from:* no double, bond / bonds, in hydrocarbon chain ; each carbon (atom) in the hydrocarbon chain is bonded to two hydrogen atoms ; there is, a full complement / maximum number, of hydrogen atoms on the hydrocarbon chain ; **A** aliphatic chain *for hydrocarbon chain* **A** hydrogens *for hydrogen atoms*	**1**
(c)	β-glucose / beta-glucose ; **R** B-glucose	**1**
(d)	**C** ;	**1**
(e)	**E** ;	**1**
(f)	*any one from:* **A** and **C** are, polar / hydrophilic ; **A** has many, OH / hydroxyl groups **B** is, non-polar / hydrophobic ; **A** has, only one OH / no groups, that interact with water	**1**

13. 9700_w18_ms_23 Q: 2

(a)(i)	water shown formed from –OH and –H ; **A** H_2O formed without indicating where from peptide bond shown correctly between C of carboxylic acid and N of amino group ; complete dipeptide drawn ; **A** hydrogen 'up or down'	**3**
(a)(ii)	R group / side chain / variable group / residual group / functional group ; indicate, different amino acids / type of amino acid ; **A** specific to each amino acid **A** the two amino acids are different **A** two examples of R groups, e.g. –H and $–CH_3$ both amino acids have different R groups = 2 marks	**2**
(b)	*any two from* straight chain / linear, v helix / helical ; **I** coil(ed) **R** branched / branching β-glucose, not α-glucose ; **A** β-1:4 glycosidic bond v α-1:4 glycosidic bond (β-)glucose / monomers / residues, are arranged, rotated 180° to each other / AW ; AVP ; e.g. more hydrogen bonds	**2**
(c)	*any four from* **1** (molecules) form fibrils and fibres ; **2** hydrogen bonding between (cellulose) molecules ; **3** (cellulose molecule) is straight / linear ; **4** (straight chain allows) molecules lie parallel to each other ; *mp4 dependent on mp3* **5** gives strength (to cell wall) to, prevent cell bursting / withstand (turgor) pressure / AW ; **R** if only in context of a cellulose molecule **6** *ref.* to fibres at angles / criss-cross / AW ; **7** *idea of* many gaps, in wall / between fibres, allowing passage of water / named) substances / making cell wall permeable ; **I** plasmodesmata **R** partially / AW, permeable **8** AVP ; e.g. cellulose is insoluble many –OH groups (for hydrogen bonding)	**4**

14. 9700_s21_ms_21 Q: 2

Question	Answer	Marks
(a)	*any three from* **1** (diagram shows) hydrogen bond is a weak bond ; **2** each oxygen (atom) forms two hydrogen bonds / each hydrogen (atom) forms one hydrogen bond ; **3** (attraction) between oxygen (atom) of one water molecule and hydrogen (atom) of another (forms a hydrogen bond) ; **R** cohesion / adhesion – *if used for attraction* **4** water is dipolar ; **5** detail ; e.g. electrons not shared equally between oxygen and hydrogen **A** oxygen is more electronegative (than hydrogen) **A** *ref. to* (two) lone pair(s) (of electrons) on oxygen **A** uneven distribution of, electrons / charge e.g. oxygen has, small / slight, negative charge / δ^-, **and**, hydrogen has, small / slight, positive charge / δ^+ *only needs to state 'small' once*	**3**

Question	Answer	Marks
(b)(i)	*idea that* (H-bonds) maintain / AW, (shape / structure, form of) α-helices / β-pleated sheets ; **A** allows formation of, α-helices / β-pleated sheets **R** if bonds are between R groups	1
(b)(ii)	*any two from* 1 *idea that* hydrogen bonds help to, stabilise / AW, further folding of, amylase / polypeptide / protein ; 2 between, R groups with amine and carboxyl groups ; **A** between R groups with -NH and, -CO / -OH 3 *idea that* may be between amino acids far apart in primary structure ; 4 *either* helps to maintain / form / AW, globular shape / 3D shape / structure (of amylase / polypeptide / protein) ***or*** maintains / forms / AW, (specific) shape / structure, of, active site / binding site ;	2
(c)	*any three from* 1 dissolves / AW, ions / minerals / salts, and (named) polar molecules ; **A** 'assimilates' as polar **I** substances / nutrients 2 transports, solute(s) / named solutes / dissolved substance, in, xylem / phloem / xylem and phloem ; 3 storage of, solutes / named solutes, in vacuoles ; 4 metabolic / chemical / cellular, reactions occur in water ; 5 dissolves, carbon dioxide / oxygen, with ref to, respiration / photosynthesis;	3

15. 9700_w18_ms_21 Q: 3

(a)(i)	*any three from* (polymer / polysaccharide of) β-glucose ; glycosidic, bonds / linkages ; **A** glucosidic (β) 1–4 (glycosidic) bonds ; **R** if 1–6 also given *ref.* to (β) glucose units, linked at 180° to each other / alternately orientated / AW ; unbranched (polymer) / straight chain / linear ; able to form hydrogen bonds with parallel chains / AW ;	3
(a)(ii)	chloroplast / granum / thylakoid / middle lamella / large vacuole / nucleus at edge of cell ;	1
(a)(iii)	provide energy (for the cell) ; **R** produce energy any two examples ;; e.g. biosynthesis **A** named example active transport / proton pumping movement / described, e.g. movement of, vesicles / chromosomes endocytosis / exocytosis	3
(b)	*any two from* water molecules are dipoles ; **A** polar (each water molecule has) σ+ hydrogen (atoms) and a σ– oxygen (atom) ; the positively charged hydrogen (atom) of one water molecule is attracted to the negatively charged oxygen (atom) of another water molecule ; weak attraction between water molecules ;	2
(c)	*any two from* water molecules are polar ; ions are charged ; *ref.* attraction between water molecules and ions ; AVP ; e.g. oxygen σ– faces positive ion	2