



Cell Structure

Name: _____

Class: _____

Date: _____

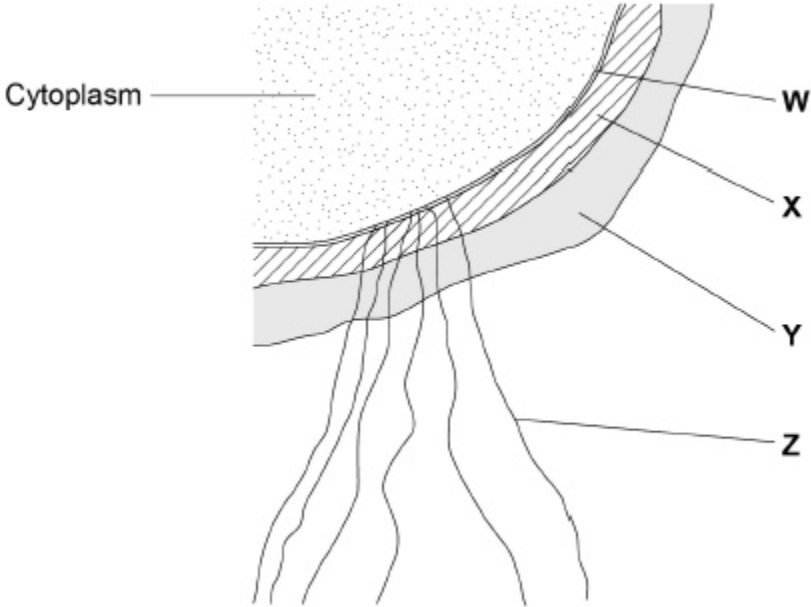
Time: **78 minutes**

Marks: **66 marks**

Comments:

1.

The diagram shows part of a prokaryotic cell.



(a) Name the structures labelled **W** to **Z** in the diagram.

W _____

X _____

Y _____

Z _____

(2)

(b) Name the main biological molecule in:

W _____

X _____

(2)

(c) Name the process by which prokaryotic cells divide.

(1)

- (d) Some prokaryotic cells can divide every 30 minutes. A liquid culture contained a starting population of 1.35×10^4 cells.

Assuming each cell divides every 30 minutes, calculate how many cells there will be after 3 hours. Assume no cells die during this time.

Answer = _____

(2)

(Total 7 marks)

2.

- (a) Structures **A** to **E** are parts of a plant cell.

- A** Cell Wall
- B** Chloroplast
- C** Nucleus
- D** Mitochondrion
- E** Golgi apparatus

Complete the table by putting the correct letter, **A**, **B**, **C**, **D** or **E** in the box next to each statement.

Statement	Letter
Has stacked membranes arranged in parallel and contains DNA.	
Is made of polysaccharide.	
Is an organelle and is not surrounded by two membranes.	

(3)

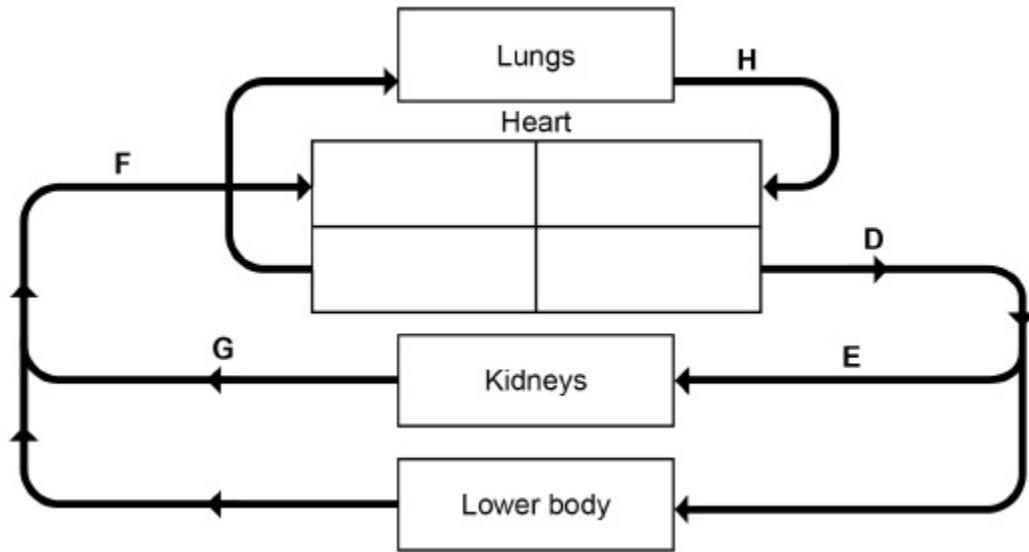
- (b) Human breast milk is produced and secreted by gland cells. These gland cells have adaptations that include many mitochondria and many Golgi vesicles. The milk contains a high concentration of protein.

Explain the role of these cell adaptations in the production and secretion of breast milk.

(2)
(Total 5 marks)

3. (a) **Figure 1** shows part of the blood circulation in a mammal.

Figure 1



Use **Figure 1** to give the letter that represents each of these blood vessels.

- Aorta
- Renal vein
- Vena cava

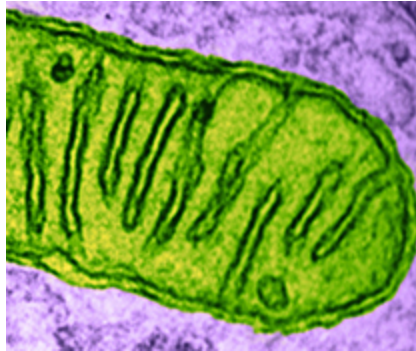
(3)

- (b) Name the blood vessels that carry blood to the heart **muscle**.

(1)

- (c) **Figure 2** shows a photograph of part of a mitochondrion from a mouse liver cell taken using a transmission electron microscope at $\times 62\,800$ magnification.

Figure 2



Produce a scientific drawing of the mitochondrion in **Figure 2** in the box below.

Label the following parts of the mitochondrion on your drawing.

- Matrix
- Crista

(4)
(Total 8 marks)

4.

(a) Glycogen and cellulose are both carbohydrates. Describe **two** differences between the structure of a cellulose molecule and a glycogen molecule.

1. _____

2. _____

(2)

(b) Starch is a carbohydrate often stored in plant cells. Describe and explain **two** features of starch that make it a good storage molecule.

1. _____

2. _____

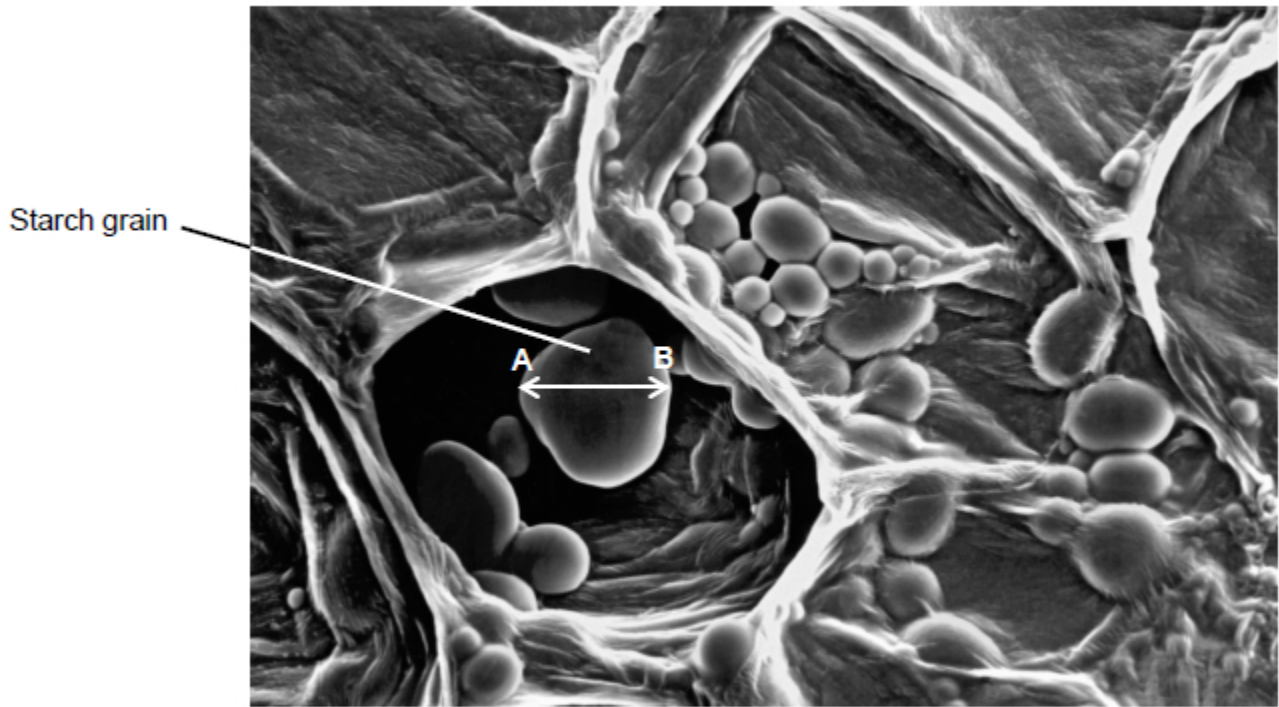
(2)

(c) Tick (✓) the box that identifies the test which would be used to show the presence of starch.

- Acid hydrolysis test
- Benedict's test
- Emulsion test
- Iodine/potassium iodide test

(1)

(d) The diagram shows a section through a plant tissue at a magnification of $\times 500$.



Calculate the actual diameter of the starch grain between points **A** and **B**.

Answer = _____ μm

(2)

(e) What type of microscope was used to obtain the image shown in the diagram above?

Give **one** piece of evidence to support your answer.

Type of microscope _____

Evidence _____

(2)

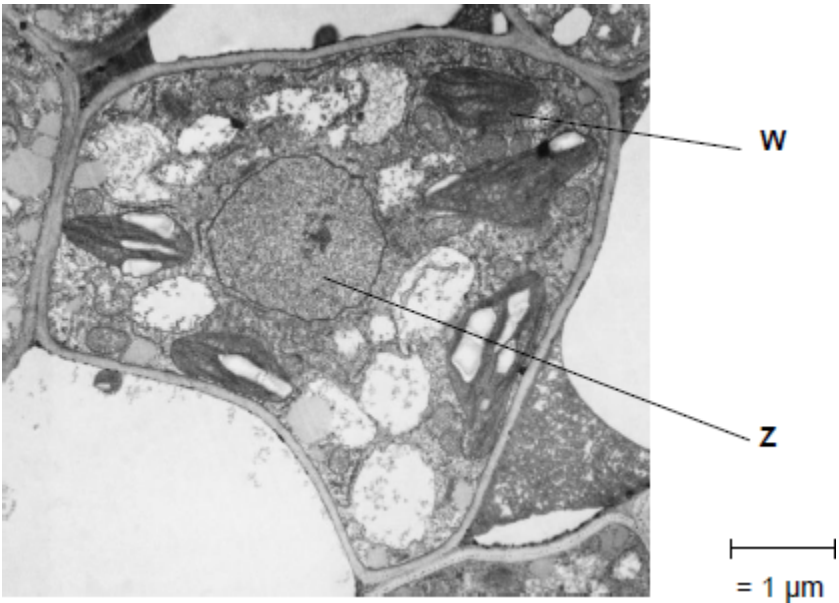
(Total 9 marks)

5.

(a) Describe how you could make a temporary mount of a piece of plant tissue to observe the position of starch grains in the cells when using an optical (light) microscope.

(4)

The figure below shows a microscopic image of a plant cell.



© Science Photo Library

(b) Give the name and function of the structures labelled **W** and **Z**.

Name of **W** _____

Function of **W** _____

Name of **Z** _____

Function of **Z** _____

(2)

- (c) A transmission electron microscope was used to produce the image in the figure above. Explain why.

(2)

- (d) Calculate the magnification of the image shown in the figure in part (a).

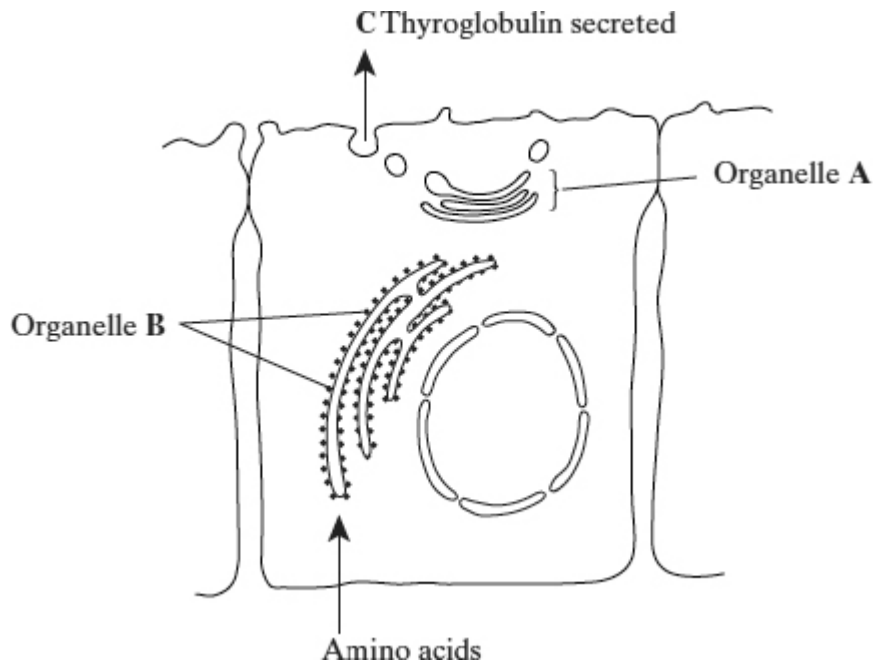
Answer = _____

(1)

(Total 9 marks)

6.

The thyroid gland is an organ in the neck. The diagram shows the process in which epithelial cells from the thyroid gland make and secrete a protein called thyroglobulin.



- (a) Name

- (i) organelle A;

(1)

(ii) the process by which thyroglobulin is secreted from the cell at **C**.

(1)

(b) (i) Describe the part played by the organelles labelled **B**.

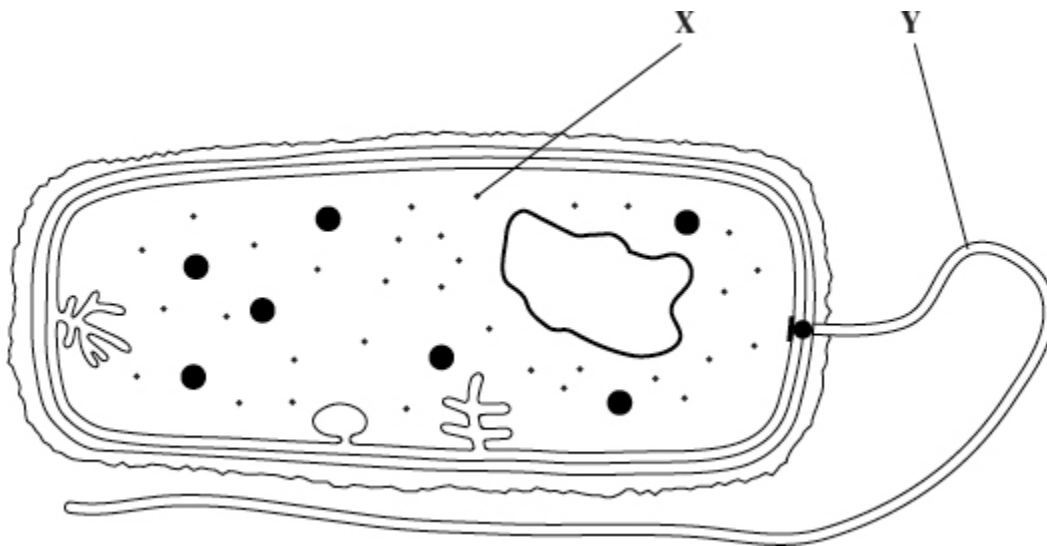
(1)

(ii) Organelle **B** is very small. It cannot be seen when thyroid cells are examined with an optical microscope but it can be seen with an electron microscope. Explain why this organelle can be seen with an electron microscope.

(2)

(Total 5 marks)

7. The diagram shows a bacterium.



(a) Give the function of

(i) organelle **X**;

(ii) organelle Y.

(2)

(b) (i) Give **two** ways in which the structure of this bacterium is similar to the structure of a cell lining the human small intestine.

1. _____

2. _____

(2)

(ii) Give **two** ways in which the structure of this bacterium differs from the structure of a cell lining the human small intestine.

1. _____

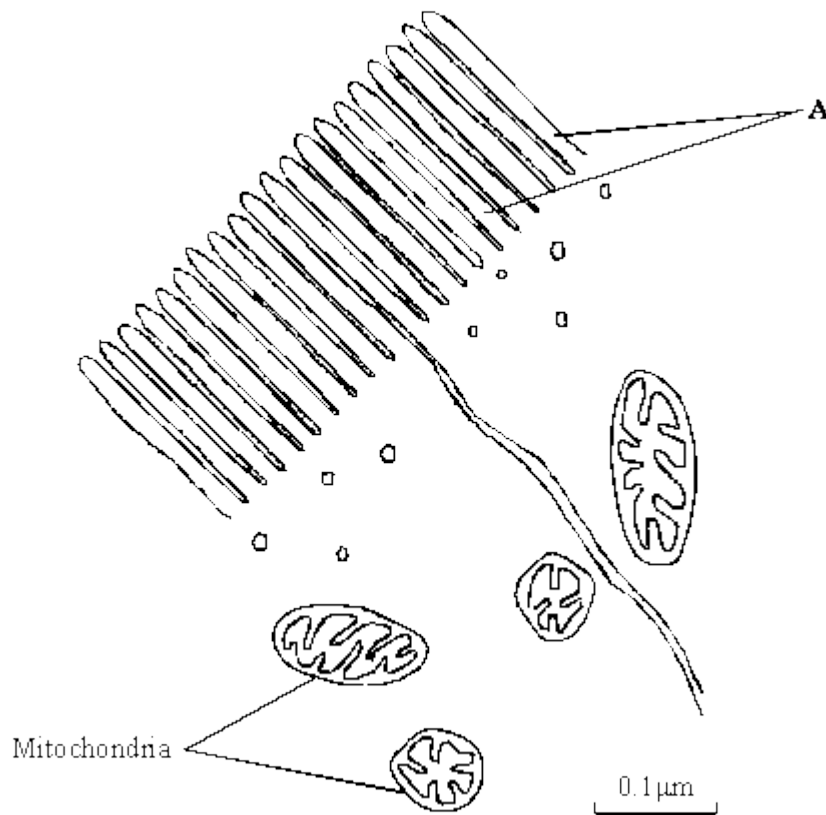
2. _____

(2)

(Total 6 marks)

8.

The drawing shows an electron micrograph of parts of epithelial cells from the small intestine.



(a) (i) Name the structures labelled **A**.

(1)

(ii) Explain how these structures help in the absorption of substances from the small intestine.

(1)

(b) (i) The scale bar on this drawing represents a length of 0.1 μm. Calculate the magnification of the drawing. Show your working.

Magnification _____

(2)

- (ii) Explain why an electron microscope shows more detail of cell structure than a light microscope.

(2)

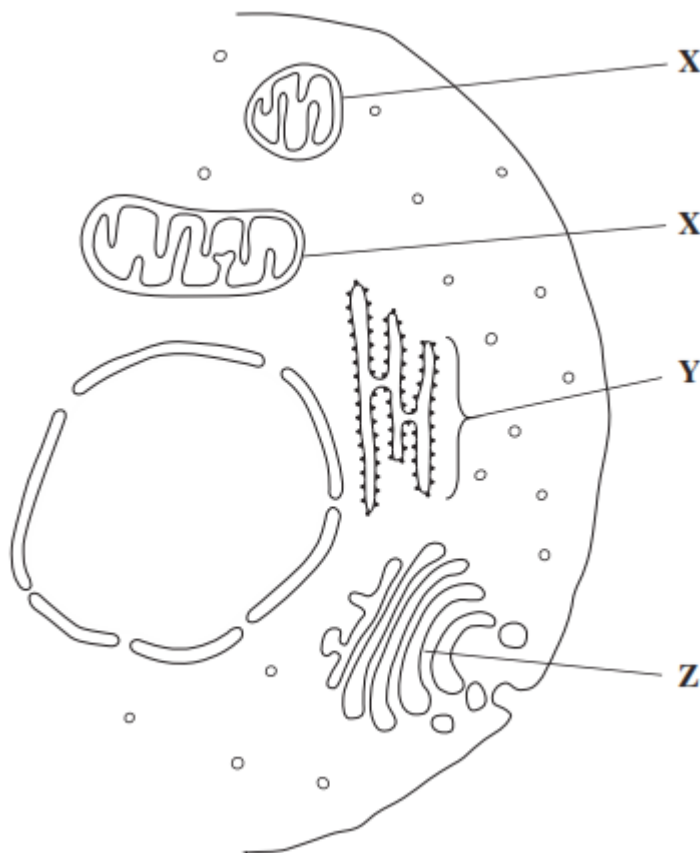
- (c) The length of mitochondria can vary from $1.5\ \mu\text{m}$ to $10\ \mu\text{m}$ but their width never exceeds $1\ \mu\text{m}$. Explain the advantage of the width of mitochondria being no more than $1\ \mu\text{m}$.

(1)

(Total 7 marks)

9.

The drawing shows part of a human cell.



- (a) Name organelles

X _____

Y _____

(2)

- (b) (i) The organelles labelled **X** all have very similar shapes in this cell. Explain why they appear to have different shapes in this drawing.

(Extra space) _____

(1)

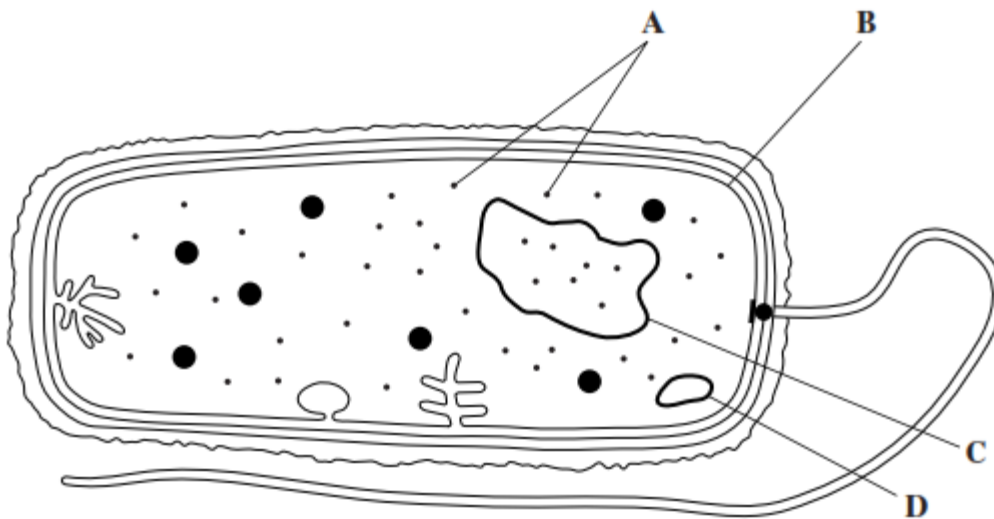
- (ii) Large numbers of organelles **X** and **Z** are found in mucus-secreting cells. Explain why.

(Extra space) _____

(2)

(Total 5 marks)

10. The diagram shows a bacterium.



- (a) Name

(i) organelle **A** _____

(1)

(ii) structure **B** _____

(1)

(b) Give **two** ways in which the structure of this bacterium is different from the structure of cells lining the alveoli of a human lung.

1. _____

2. _____

(2)

(c) Structures **C** and **D** are made of the same type of biological molecule. They have a similar function.

What is the function of **C** and **D**?

(1)

(Total 5 marks)

Mark schemes

1.

- (a) W – (cell surface) membrane
X – cell wall
Y – capsule
Z – flagellum

Four correct = 2 marks.

Three or two correct = 1 mark.

Y - Ignore references to slime/mucus

Y - Reject capsid

Z - accept flagella

2

- (b) W - Phospholipids;
X - Murein / glycoprotein;
X - Accept peptidoglycans.
Accept phonetic spellings

2

- (c) Binary fission;
Reject binary fusion

1

- (d) 8.64×10^5 ;;
Accept 864 000 however expressed, e.g. 864×10^3
Allow one mark for
 $2^6 = 64$
OR
 $64 / 26 \times (1.35 \times 10^4)$

2

[7]

2.

- (a) B;
A;
E;

3

- (b) 1. (Many mitochondria) release energy / ATP **for** movement of vesicles / synthesis of protein / active transport;
*Must include function of organelle **and** use in context of milk production.*
Ignore reference to lipid / triglyceride
Reject reference to mitochondria undergoing anaerobic respiration
Reject “produce energy”.
Reject “energy for respiration”
2. (Many Golgi) vesicles transport protein / glycoprotein / milk **to** cell membrane / **out of** cell;
*Must include function of organelle **and** use in context of milk production.*
Ignore reference to lipid / triglyceride
Accept exocytosis as transport and release
Ignore references to protein synthesis

2

[5]

3.

- (a) D;
 G;
 F;

3

- (b) Coronary arteries;

Accept coronary artery
Ignore aorta, arteriole and capillary
Reject coronary veins
Do not accept coronary by itself
Accept phonetic spelling

1

- (c) 1. No sketched / hanging / crossing lines / shading;
Ignore stippling
2. Must look similar;
3. Matrix **and** crista correctly labelled;
Ignore any other labels
4. Correct scale stated (x 62 800);
Accept other suitable scale given

4

[8]

4.

- (a)
1. Cellulose is made up of β -glucose (monomers) **and** glycogen is made up of α -glucose (monomers);
 2. Cellulose molecule has straight chain **and** glycogen is branched;
 3. Cellulose molecule has straight chain **and** glycogen is coiled;
 4. glycogen has 1,4- and 1,6- glycosidic bonds **and** cellulose has only 1,4-glycosidic bonds;

Ignore ref. to H bonds / microfibrils

2 max

(b) Any **two** from:

1. Insoluble (in water), so doesn't affect water potential;
2. Branched / coiled / (α -)helix, so makes molecule compact;
OR
Branched / coiled / (α -)helix so can fit many (molecules) in small area;
3. Polymer of (α -)glucose so provides glucose for respiration;
4. Branched / more ends for fast breakdown / enzyme action;
5. Large (molecule), so can't cross the cell membrane

*Require feature **and** explanation for 1 mark*

1. *Accept Ψ or WP*

1. *Accept Insoluble so doesn't affect osmosis*

1. *Do **not** allow ref to 'doesn't affect water leaving cells*

4. *Ignore 'surface area'*

4. *Accept 'branched so glucose readily released'*

2 max

(c) Iodine/potassium iodide;

1

(d) For correct answer of 40 (μ m) award 2 marks;
Evidence of division by 500: award 1 mark

Allow tolerance of 0.5mm i.e. 20 ± 0.5 mm

2

- (e)
1. Scanning electron (microscope);
 2. 3D (image);

Accept SE(M)

2. *Ignore any other correct features*

2

[9]

5.

- (a)
1. Add drop of water to (glass) slide;
 2. Obtain thin section (of plant tissue) and place on slide / float on drop of water;
 3. Stain with / add iodine in potassium iodide.

3. *Allow any appropriate method that avoids trapping air bubbles*

4. Lower cover slip using mounted needle.

4

- (b) 1. **W** – chloroplast, photosynthesis;
 2. **Z** – nucleus, contains DNA / chromosomes / holds genetic information of cell.

2

- (c) 1. High resolution;
 2. Can see internal structure of organelles.

2

- (d) Length of bar in mm \times 1000.

1

[9]

6.

- (a) (i) Golgi;

1

- (ii) Exocytosis;

1

- (b) (i) Joining together of amino acids / synthesis / production of thyroglobulin / makes protein;

Do not credit synthesis of amino acids

1

- (ii) Electron microscope has high / greater resolution;
 Because it uses electrons which have smaller wave(length);

2

[5]

7.

- (a) X protein synthesis / translation;
 Y movement;

2

- (b) (i) cytoplasm;
 ribosomes;
 phospholipid membranes / cell membrane / semipermeable membrane;

(accept folded membrane for two marks)

2 max

- (ii) *(it = bacterium)*
 cell wall;
 capsule;
 flagellum;
 mesosome;
 no nucleus / nuclear membrane / DNA free;
 no mitochondria;

(accept 'no membrane-bound organelles' if neither nucleus nor mitochondria mark scored)

- no microvilli;
 no Golgi;
 no ER;
 70S / smaller ribosomes;

2 max

[6]

- 8.** (a) (i) microvilli; (*reject brush border*) 1
- (ii) increased surface area (for diffusion); 1
- (b) (i) $\frac{16 \times (1000)}{0.1}$ principle of $\frac{\text{measuring scale bar}}{\text{dividing by 0.1}}$; 2
(15 – 17 tolerance)
- 160000; 2
(correct answer award 2 marks)
- (ii) electron microscope has a greater resolving power / objects closer together can be distinguished; 2
 electron (beams) have a shorter wavelength;
- (c) short diffusion pathway / short pathway to the centre / large SA:V ratio for faster, more diffusion; 1
- [7]**

- 9.** (a) X = mitochondria; 2
 Y = (rough) endoplasmic reticulum;
Accept ribosomes/ER/RER for Y
Reject smooth endoplasmic reticulum for Y
- (b) (i) (Sections cut at) different angles/in different planes; 1
Ignore name given to organelle
- (ii) Z modifies/packages/transport/secretes mucus/ Z adds sugars to proteins; 2
 X provides ATP/energy (for this);
Accept makes in relation to Z but not X
Ignore names of organelles if function correct
- [5]**

- 10.** (a) (i) Ribosome(s); 1
- (ii) Plasma/cell (surface) membrane; 1
Accept membrane unless disqualify with, e.g. nuclear membrane

(b) **Two** suitable comparisons, accepting bacterial cell has;

Examples,

Bacterial cell has capsule/slime layer;

Cell wall;

(Bacterial) flagellum;

Mesosome;

Different size ribosomes;

Circular DNA;

Human cell has nucleus;

Membrane-bound organelles;

Two named examples of membrane-bound organelles;

Reject ref to thin and flat

2 max

(c) Carry genetic information/genes;

Reject/ignore to carry DNA to carry genetic code

*Accept genetic material with coded information –
information for protein synthesis*

Ignore genetic material on its own

1

[5]