

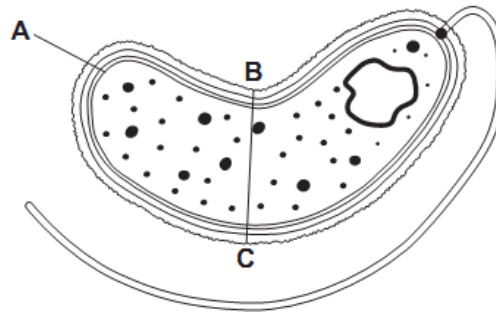
Unit 1

Biology and Disease

Cell structure & function

Practice Exam Questions

1 The diagram shows a cholera bacterium. It has been magnified 50 000 times.



1 (a) Name A.

.....
 (1 mark)

1 (b) Name **two** structures present in an epithelial cell from the small intestine that are **not** present in a cholera bacterium.

1

2

(2 marks)

1 (c) Cholera bacteria can be viewed using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

1 (c) (i) Give **one** advantage of using a TEM rather than a SEM.

.....

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(1 mark)

1 (c) (ii) Give **one** advantage of using a SEM rather than a TEM.

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(1 mark)

1 (d) Calculate the actual width of the cholera bacterium between points B and C. Give your answer in micrometres and show your working.

.....µm
 (2 marks)

2 (a) The structure of a cholera bacterium is different from the structure of an epithelial cell from the small intestine. Describe how the structure of a cholera bacterium is different.

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(5 marks)

(b) Scientists use optical microscopes and transmission electron microscopes (TEMs) to investigate cell structure. Explain the advantages and the limitations of using a TEM to investigate cell structure.

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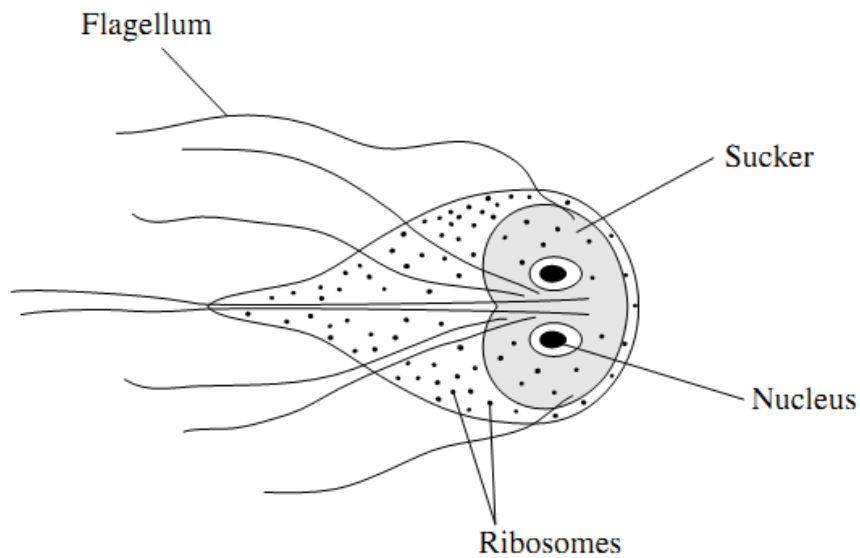
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(5 marks)

- 3 Giardiasis is an intestinal disease. It is caused by the microorganism *Giardia lamblia*. The drawing shows some of the structures present in *G. lamblia*.



- (a) Name **one** structure shown in the drawing which confirms that *G. lamblia* is a eukaryotic organism.

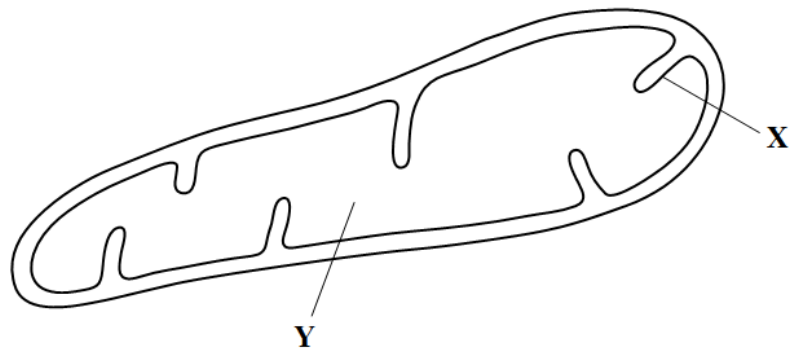
.....
(1 mark)

- (b) *G. lamblia* can attach itself with its sucker. Explain how this is an adaptation to living in the intestines.

.....
.....
(1 mark)

4

The diagram shows a mitochondrion.



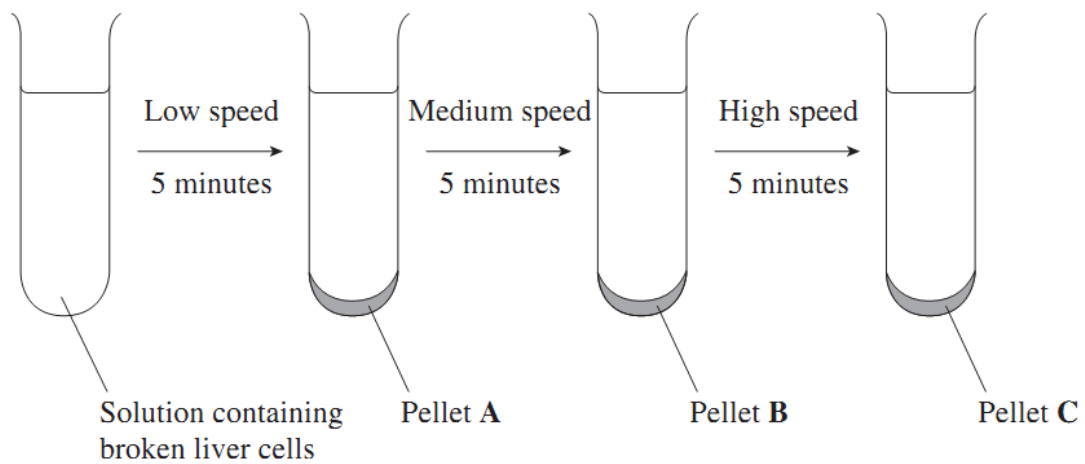
(a) Name the parts labelled **X** and **Y**.

(a) (i) **X**

(a) (ii) **Y**

(2 marks)

Scientists isolated mitochondria from liver cells. They broke the cells open in an ice-cold, isotonic solution. They then used a centrifuge to separate the cell organelles. The diagram shows some of the steps in the process of centrifugation.



(b) Suggest which pellet, **A**, **B** or **C** contained the mitochondria.

(1 mark)

(c) Explain why the solution used was

(c) (i) ice-cold

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.....
(1 mark)

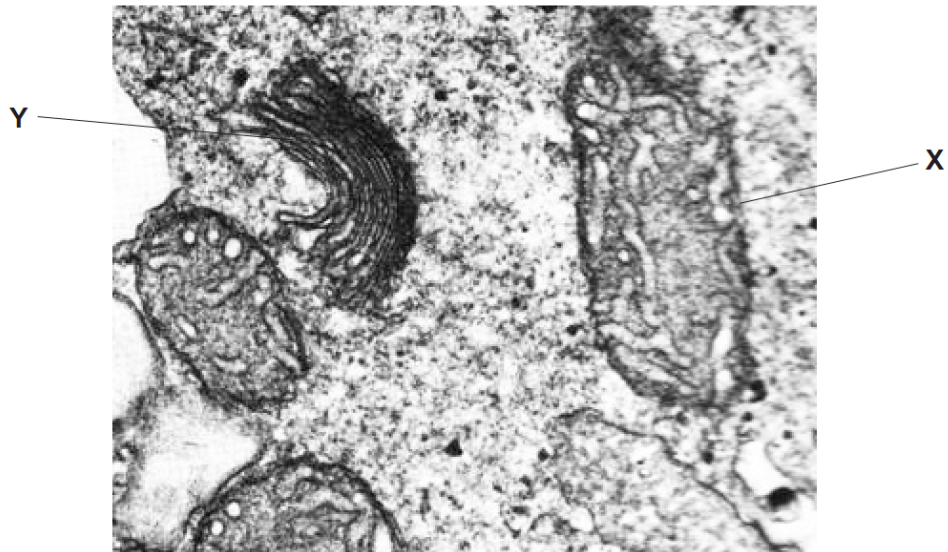
(c) (ii) isotonic.

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(2 marks)

(d) People with mitochondrial disease have mitochondria that do not function properly. Some people with mitochondrial disease can only exercise for a short time. Explain why a person with mitochondrial disease can only exercise for a short time.

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(2 marks)

The photograph shows part of the cytoplasm of a cell.



- (a) (i) Organelle X is a mitochondrion.
What is the function of this organelle?

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(1 mark)

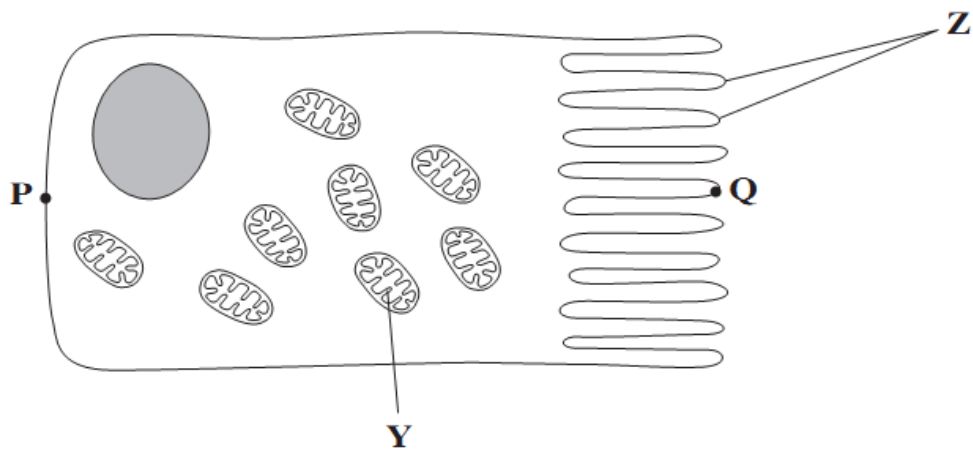
- (a) (ii) Name organelle Y.

.....
(1 mark)

- (b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical (light) microscope. Explain why.

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(2 marks)

6 The diagram shows an epithelial cell from the small intestine.



(a) (i) Name organelle **Y**.

.....
 (1 mark)

(a) (ii) There are large numbers of organelle **Y** in this cell. Explain how these organelles help the cell to absorb the products of digestion.

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 (2 marks)

(b) This diagram shows the cell magnified 1000 times. Calculate the actual length of the cell between points **P** and **Q**. Give your answer in μm . Show your working.

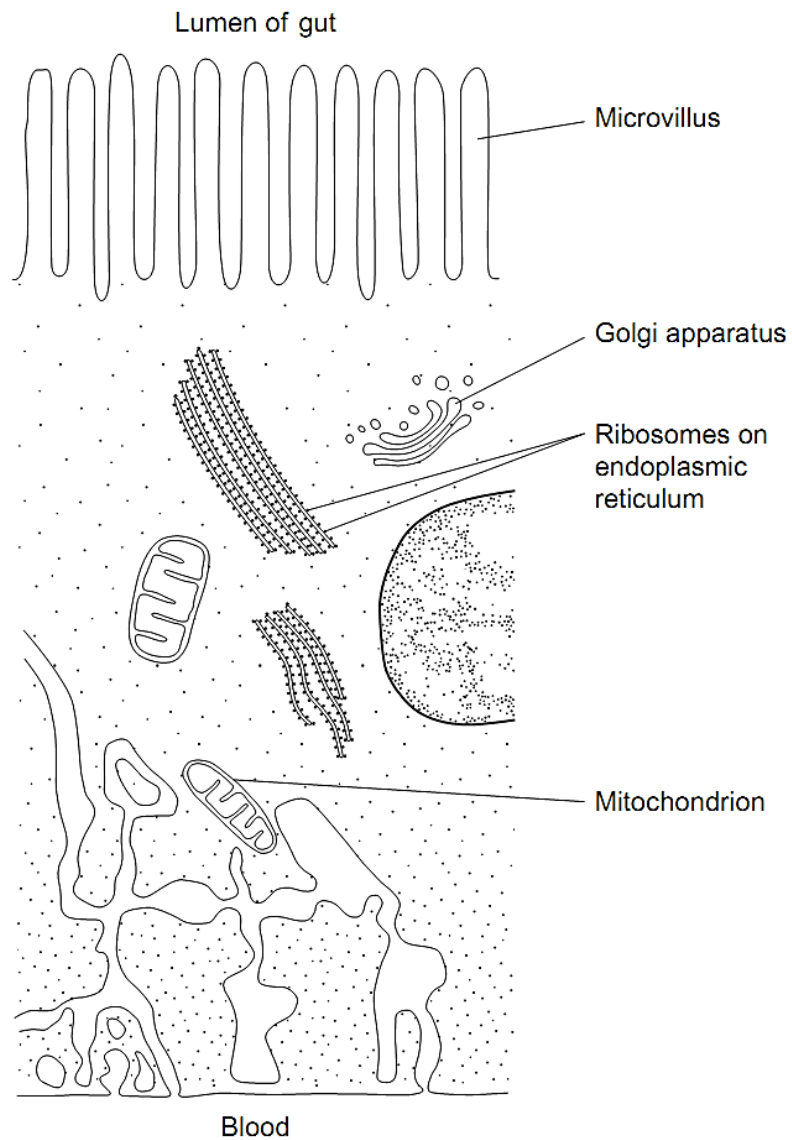
Answer μm
 (2 marks)

- (a) The table shows some features of cells. Complete the table by putting a tick in the box if the feature is present in the cell.

Feature	Cell		
	Cholera bacterium	Epithelial cell from intestine	Epithelial cell from alveolus of lung
Cell-surface membrane			
Flagellum			
Nucleus			

(3 marks)

- (b) The diagram shows part of an epithelial cell from an insect's gut.



This cell is adapted for the three functions listed below. Use the diagram to explain how this cell is adapted for each of these functions.

Use a **different** feature in the diagram for each of your answers.

(b) (i) the active transport of substances from the cell into the blood

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(2 marks)

(b) (ii) the synthesis of enzymes

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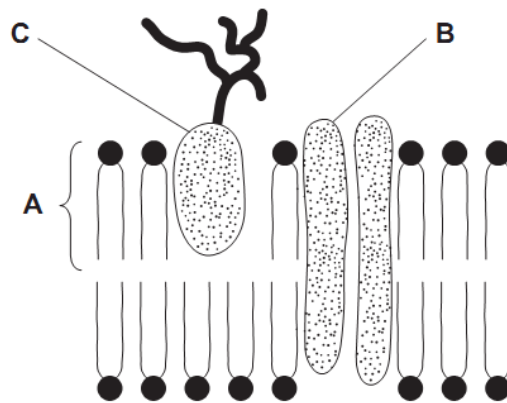
(2 marks)

(b) (iii) rapid diffusion of substances from the lumen of the gut into the cytoplasm

.....
.....
.....

(1 mark)

The diagram shows the structure of the cell-surface membrane of a cell.



(a) Name **A** and **B**.

A

B

(2 marks)

(b) (i) **C** is a protein with a carbohydrate attached to it. This carbohydrate is formed by joining monosaccharides together.

Name the type of reaction that joins monosaccharides together.

.....

(1 mark)

(b) (ii) Some cells lining the bronchi of the lungs secrete large amounts of mucus. Mucus contains protein.

Name **one** organelle that you would expect to find in large numbers in a mucus-secreting cell and describe its role in the production of mucus.

Organelle

Description of role

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(2 marks)

(a) Describe how phospholipids are arranged in a plasma membrane.

[2 marks]

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(b) Cells that secrete enzymes contain a lot of rough endoplasmic reticulum (RER) and a large Golgi apparatus.

(b) (i) Describe how the RER is involved in the production of enzymes.

[2 marks]

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(b) (ii) Describe how the Golgi apparatus is involved in the secretion of enzymes.

[1 mark]

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Cells – Answers & Markscheme

Question	Marking Guidance	Mark	Comments
1(a)	(Plasma / cell) membrane;	1	Reject: nuclear membrane
1(b)	Nucleus / nuclear envelope / nuclear membrane / nucleolus; Mitochondrion; (Smooth / rough) ER; Lysosome; Microvillus / brush border; Golgi; Linear / non-circular DNA / chromosome; 80S / denser / heavier / larger ribosomes;	2 max	Accept: membrane-bound organelles only if an example has not been given Neutral: villi Neutral: DNA strands Neutral: ribosomes
1(c)(i)	Higher resolution / higher (maximum) magnification / higher detail (of image); OR Allows internal details / structures within (cells) to be seen / cross section to be taken;	1	Accept: 'better' instead of 'higher' Neutral: shorter wavelength Reject: longer wavelength Reject: can be used on living specimens Q Do not accept 'clearer' image
1(c)(ii)	Thin sections do not need to be prepared / shows surface of specimen / can have 3-D images;	1	Accept: can be used on thick(er) specimens Reject: can be used on living specimens Neutral: refs. to staining / preparation / artefacts / colour
1(d)	Two marks for correct answer of 0.42 – 0.46;; One mark for incorrect answers in which candidate clearly divides measured width by magnification;	2	Correct answer = 2 marks outright Accept: 0.4 or 0.5 only if working is correct for 2 marks Do not award a mark for 0.4 or 0.5 if there is no working out Ignore rounding up

2

Part	Sub Part	Marking Guidance	Mark	Comments
(a)		1 Cholera bacterium is prokaryote; 2 Does not have a nucleus/nuclear envelope/ has DNA free in cytoplasm/has loop of DNA; 3 and 4 Any two from No membrane-bound organelles/no mitochondria / no golgi/ no endoplasmic reticulum/etc; 5 Small ribosomes only; 6 and 7 Any two from Capsule/flagellum/plasmid / cell wall/etc;	5 max	Maximum of 2 marks for points 3 and 4. Maximum of two marks for points 6 and 7.
(b)		Advantages: 1 Small objects can be seen; 2 TEM has high resolution; 3 Wavelength of electrons shorter; Limitations: 4 Cannot look at living cells; 5 Must be in a vacuum; 6 Must cut section / thin specimen; 7 Preparation may create artefact 8 Does not produce colour image;	5 max	Advantages: allow maximum of 3 marks. Accept better Limitations: allow maximum of 3 marks.

3

(a)		Nucleus;	1	
(b)		Enables organism to remain in area (of food source) / prevent its removal;	1	Q 'To attach' is not sufficient unless qualified;

Cells – Answers & Markscheme

Part	Sub Part	Marking Guidance	Mark	Comments	
4	(a)	(i)	Crista/ <u>inner</u> membrane;	1	
	(a)	(ii)	Matrix;	1	
	(b)		B;	1	
	(c)	(i)	Reduce/prevent <u>enzyme</u> activity;	1	
	(c)	(ii)	Prevents osmosis / no (net) movement of water; So organelle/named organelle does not burst/shrivel;	2	Q Allow reference to cell rather than organelle for first mark point only. Regard damage as neutral
	(d)		(Mitochondria) use aerobic respiration; Mitochondria produce ATP/release energy; Energy/ATP required for <u>muscles</u> (to contract);	2 max	Q Do not accept reference to making/producing energy.

Question	Marking Guidance	Mark	Comments
5	5(a)(i)	(Aerobic) respiration;	1 Accept ATP production/energy release Reject <u>anaerobic</u> respiration Reject energy production
	5(a)(ii)	Golgi (apparatus/body);	1 Ignore smooth ER
	5(b)	('It' = Optical microscope) 1. Has low resolution/not high enough resolution; 2. (Because) wavelength of light not short enough/too long;	2 Ignore reference to magnification Accept converse relating to EM Accept larger wavelength Accept statements that microscopes have a wavelength

Part	Sub Part	Marking Guidance	Mark	Comments
6	(a)	(i)	Mitochondrion;	1 Neutral: cristae
	(a)	(ii)	(Site of aerobic) respiration / ATP production / energy release; Active transport / transport against the concentration gradient;	2 Q Reject: anaerobic respiration Q Reject: energy produced Accept: energy produced in the form of ATP
	(b)		89 – 91 gains 2 marks; Principle of: <u>correct measured length</u> gains 1 mark; magnification	2 Correct answer gains 2 marks outright 89-91 (mm) / 1000 <u>or</u> 8.9-9.1 (cm) / 1000 gains 1 mark

Cells – Answers & Markscheme

Question	Marking Guidelines	Mark	Comments									
7(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </table>	✓	✓	✓	✓				✓	✓	3	<p>Mark across, one mark for each correct row.</p> <p>If crosses are used and no ticks, accept cross as equivalent to tick.</p> <p>If crosses are used as well as ticks, mark tick only.</p>
✓	✓	✓										
✓												
	✓	✓										
7(b)(i)	<ol style="list-style-type: none"> 1. Mitochondria respire; 2. Release energy/ produce ATP; 3. Transport against gradient; <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> 4. Infolding of membrane; 5. Increases area; 6. More proteins for active transport; 	2 max	<ol style="list-style-type: none"> 2. Do not credit make energy 3. Do not credit active transport as this is given in question. 3. Do not accept diffusion against. 4. Reject microvilli but if mentioned can still accept points 5 and 6. 									
7(b)(ii)	<ol style="list-style-type: none"> 1. Ribosomes make proteins/ enzymes; 2. Enzymes are proteins; <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> 3. Mitochondria respire; 4. Release energy/produce ATP; 5. (Energy/ATP) for protein / enzyme synthesis; 	2	Ignore references to Golgi or rough ER.									
7(b)(iii)	Microvilli increase area / have large area;	1	Ignore references to other properties of microvilli.									

Cells – Answers & Markscheme

Question	Marking Guidelines	Marks	Comments
8(a)	1. A: phospholipid (layer); 2. B: pore/channel/pump/carrier/transmembrane/intrinsic/transport protein;	2	1. Reject hydrophobic / hydrophilic phospholipid 2. Ignore unqualified reference to protein
8(b)(i)	Condensation (reaction);	1	
8(b)(ii)	Organelle named; Function in protein production/secretion; eg 1. Golgi (apparatus); 2. Package/process proteins; OR 3. Rough endoplasmic reticulum/ribosomes; 4. Make polypeptide/protein/forming peptide bonds; OR 5. Mitochondria; 6. Release of energy/make ATP; OR 7. Vesicles; 8. Secretion/transport of protein;	2	Function must be for organelle named Incorrect organelle = 0 1. Accept smooth endoplasmic reticulum 3. Accept alternative correct functions of rough endoplasmic reticulum. ER/RER is insufficient 3. Accept folding polypeptide/protein 6. Reject produce/make energy 6. Accept produce energy in the form of ATP

Question	Marking Guidance	Mark	Comments
9(a)	1. Bilayer; 2. Hydrophobic / fatty acid / lipid (tails) to inside; 3. Polar / phosphate group / hydrophilic (head) to outside;	2 max	1. Accept double layer 1. Accept drawing which shows bilayer 2. & 3. need labels 2. & 3. accept water loving or hating
9(b)(i)	1. (Rough endoplasmic reticulum has) <u>ribosomes</u> ; 2. To make protein (which an enzyme is);	2	1. accept "contains / stores" 2. Accept amino acids joined together / (poly)peptide 2. Reject makes amino acids 2. Ignore glycoprotein
9(b)(ii)	(Golgi apparatus) modifies (protein) OR packages / put into (Golgi) vesicles OR transport to cell surface / vacuole;	1	Accept protein has sugar added Reject protein synthesis Accept lysosome formation