

Digestive System

Mark Scheme



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1. Below are five questions related to the processes that occur within the human digestive system.

a. The figure below shows the human digestive system. Which part absorbs the most water?

1 – is the only correct answer.	1 mark
	Total: 1 mark

b. Which organ produces bile, which emulsifies lipids?

B – is the only correct answer.	1 mark
	Total: 1 mark

c. Which organ is the primary site for the absorption of digested food molecules into the bloodstream?

D – is the only correct answer.	1 mark
	Total: 1 mark

d. Which enzyme is responsible for the breakdown of carbohydrates in the mouth?

C – is the only correct answer.	1 mark
	Total: 1 mark

e. Which organ secretes hydrochloric acid?

3 – is the only correct answer.	1 mark
	Total: 1 mark

(Total for Question 1 is 5 marks)

2. Dialysis tubing has an artificial membrane. This membrane shares similar properties with the natural lining of the intestine.

a) Describe and explain the student's results shown in the table above.

An explanation to include any three of the following:	
The Benedict's test changes from blue to brick red over time.	1 mark
This shows that glucose is moving out of the dialysis tubing into the surrounding water.	1 mark
Glucose moves by diffusion from a higher concentration inside the tubing to a lower concentration outside.	1 mark
The dialysis tubing is partially permeable, allowing glucose molecules to pass through.	1 mark
The colour change in Benedict's test indicates an increasing concentration of glucose in the water over time.	1 mark
	Total: 3 marks

- b) The student then conducted the same investigation, but with a higher concentration of glucose inside the dialysis tubing. Based on this change, predict the results they would observe.

An explanation to include three of the following:	
The Benedict's test would change colour more quickly (e.g. from blue to red in a shorter time).	1 mark
The colour at each time point would be more intense / darker (e.g. reach brick red earlier).	1 mark
More glucose would diffuse out of the dialysis tubing into the surrounding water.	1 mark
There is a steeper concentration gradient, so the rate of diffusion increases.	1 mark
The final Benedict's test result would still be brick red, but reached faster than in the original experiment.	1 mark
	Total: 3 marks

- c) In terms of muscles, describe what is happening at R.

A description to include:	
Circular muscles contract at point R.	1 mark
Accept: "Muscles contract behind the food to push it forward."	
This causes the longitudinal muscles to relax, narrowing the intestine and pushing the food along.	1 mark
Do not accept vague answers like "muscles move" or "muscles push food" without specifying which muscles or what they are doing.	
	Total: 2 marks

- d) Identify the three labelled structures shown in the figure above. For each structure, describe its function within the intestinal cell.

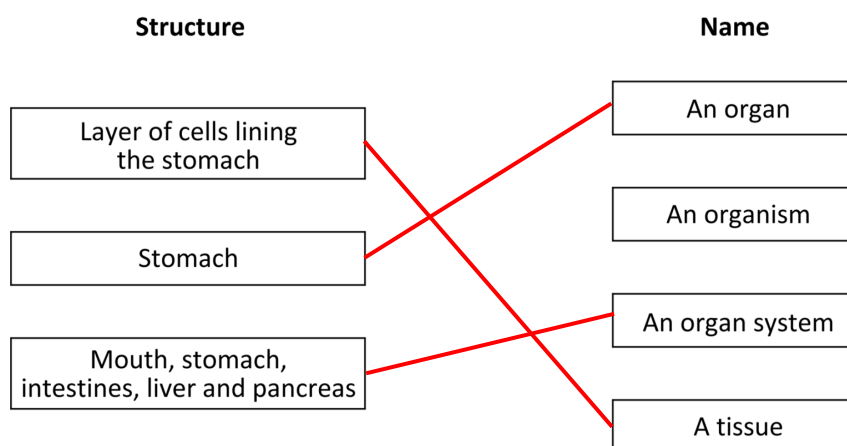
Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	One structure is correctly identified and its role within the cell is described accurately.
Level 2	3 - 4	Two structures are correctly identified and their roles within the cell are described accurately.
Level 3	5 - 6	All three structures are correctly identified and their roles within the cell are described accurately.

An explanation to include:	
S is identified as microvillus or microvilli.	
Function of S: Increases surface area and for absorption (of digested food/nutrients).	
Q identified as mitochondrion,	
Function of Q: Site of <u>aerobic</u> respiration and releases energy / produces ATP (needed for active transport / cell processes).	
P is identified as Ribosomes	
Function of Q: Site of protein synthesis / makes proteins (e.g., enzymes, carrier proteins).	
	Total: 6 marks

(Total for Question 2 is 14 marks)

3. Tissues, organ and organ systems have different functions within an organism.

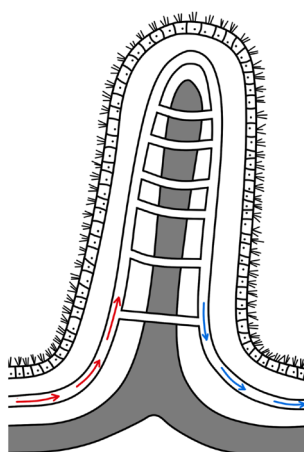
Draw a line from each structure to its correct scientific name.



1 mark for each line correctly drawn.	
	Total: 3 marks

(Total for Question 3 is 3 marks)

4. The figure below shows a villus from the small intestine.



Describe how the structure of a villus is adapted to its function in absorption of the products of digestion.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	A simple description of one or two basic adaptations (e.g., mentions large surface area or thin wall). Links between structure and function may be weak or absent. Answer addresses one distinct point from the indicative content, possibly with limited explanation.
Level 2	3 - 4	A description of several adaptations. Links between structure and function are present but may lack detail or clarity in places. May cover fewer points or explain them less thoroughly than Level 3. Answer addresses two or three distinct points from the indicative content reasonably well.
Level 3	5 - 6	A detailed and coherent description of multiple adaptations. Clear links are made between structural features (e.g., microvilli, thin wall, blood supply, lacteal) and how they facilitate efficient absorption (e.g., SA, diffusion path, transport, gradient). Answer addresses at least four distinct points from the indicative content.

An explanation to include:	
Villi / finger-like shape / folds. Function – accept any explanation that these increase surface area. Epithelial cells – have microvilli. Function – further increase surface area for faster / more efficient absorption / diffusion (of digested food). Wall of villus / epithelium is thin / one-cell thick. Function – provides a short diffusion path(way). Capillary network Function – transports absorbed (named e.g. glucose, amino acids) products away quickly / maintains a steep concentration gradient. Lacteal function – absorbs / transports fats / fatty acids and glycerol. Mitochondria function – provide energy from aerobic respiration for active transport.	
	Total: 6 marks

(Total for Question 4 is 6 marks)

5. The figure below shows the human digestive system.

a) Identify the structures numbered 1 to 4 in the figure above.

1 mark to be given for each correct pair .	
1 = colon or large intestine.	
2 = ileum or small intestine	
3 = stomach	
4 = liver	
	Total: 2 marks

b) Explain the results that were obtained from test tubes 2 and 3.

An explanation to include any four of the following:	
Lipase breaks down fat (lipids) into fatty acids.	1 mark
Fatty acids lower the pH, turning the indicator from pink to colourless.	1 mark
In test tube 2, the change is slower because it only contains lipase, so fat digestion occurs at a slower rate.	1 mark
In test tube 3, bile is present, which emulsifies fats, increasing their surface area.	1 mark
This makes it easier and faster for lipase to break down the fats.	1 mark
Therefore, the pH drops more quickly in test tube 3, which is why it turns colourless faster than test tube 2.	1 mark
	Total: 4 marks

c) Explain the purpose of test tube 1 in the student's experiment.

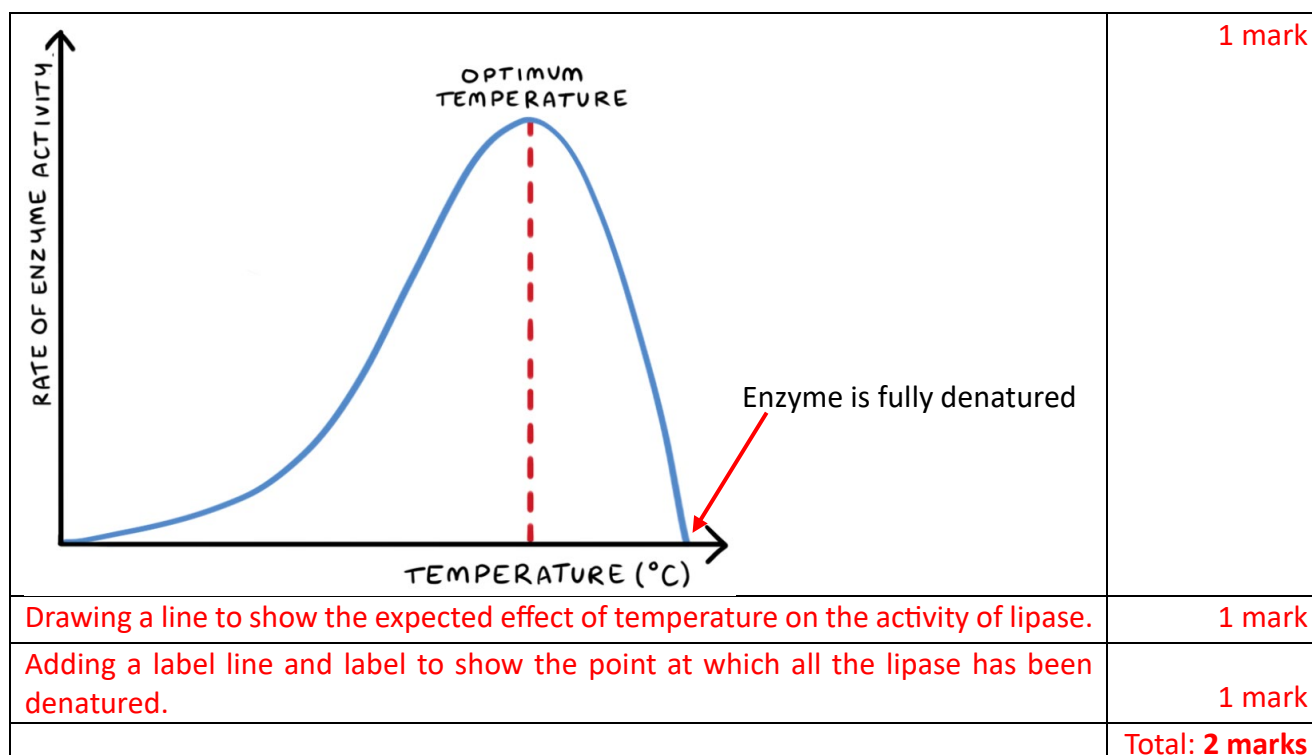
An explanation to include:	
Test tube 1 is used as a <u>control</u> to show what happens without the enzyme (lipase) .	1 mark
It shows that no digestion occurs without lipase, as the indicator stays pink (no fatty acids are produced, so pH does not change).	1 mark
	Total: 2 marks

d) The action of lipase is affected by temperature.

The figure below shows the axes for a graph of the effect of temperature on the activity of lipase.

Complete the graph by:

- Drawing a line to show the expected effect of temperature on the activity of lipase.
- Adding a label line and a label to show the point at which all the lipase has been denatured.



e) Explain, in terms of active sites, why lipase enzyme cannot be used to catalyse the breakdown of proteins.

An explanation to include three of the following:	
Enzymes have active sites with a specific shape.	1 mark
The active site of lipase is complementary to lipids, not proteins.	1 mark
Protein molecules have a different shape, so they do not fit into lipase's active site and cannot form an enzyme-substrate complex.	1 mark
Only protease enzymes have an active site that is the correct shape to catalyse the breakdown of proteins.	1 mark
	Total: 3 marks

(Total for Question 5 is 13 marks)

6. The figure below shows part of the human digestive system. Use the figure below to answer the following questions.

a) Identify the structures labelled in the figure above.

1 mark to be given for each correct pair.	
A = Gallbladder	
B = Duodenum	
C = Ileum or small intestine	
D = Pancreatic duct	
Award one mark for each correct pair of structures.	
	Total: 2 marks

b) Give the name of the enzyme that digests lipids.

Lipase	1 mark
	Total: 1 mark

c) State the products of the chemical digestion of lipids and give the location where this reaction occurs.

1 mark to be given for the correct products. Fatty acids and glycerol.	1 mark
Location: ileum or small intestine.	1 mark
	Total: 2 marks

(Total for Question 6 is 5 marks)