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GCE AS / A LEVEL – BIOLOGY UNIT 2 QUESTION PACK

1072-01 (Legacy BY2) · New spec Unit 2 Topic 4 · AS unit, first sat 2016, 80 marks, 1h 30min paper

REVISE

.wales

BIOLOGY – UNIT 2 · MAMMALIAN DIGESTION & GUT

BY2.2.3 Adaptations for nutrition – the mammalian alimentary canal, digestion and absorption

Structure and function of the mammalian gut from mouth to colon, including villi, microvilli, digestive enzymes, bile-salt emulsification and the histology of the small intestine.

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~2 h 3 min

Derived from the legacy BY2 paper's pace of ~1.1 min/mark, padded for long-prose answers (77 marks over 7 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY2 papers (2008 modular spec, 2011–2017) that maps onto new-spec AS Unit 2 Topic 4 (2.3).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

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| Q | Source | Max | Mark | Q | Source | Max | Mark |
|---|-----------|-----|------|--------------|-----------|-----------|------|
| 1 | Jan 12 Q1 | 10 | | 5 | Jun 14 Q1 | 15 | |
| 2 | Jun 11 Q7 | 10 | | 6 | Jun 15 Q2 | 10 | |
| 3 | Jun 12 Q6 | 11 | | 7 | Jun 17 Q1 | 9 | |
| 4 | Jun 13 Q4 | 12 | | Total | | | |
| | | | | | | 77 | |

Mammalian Digestion & Gut – what the new spec asks

WJEC GCE AS / A Level Biology (from 2015) · Unit 2: Biodiversity & Physiology of Body Systems · Topic 2.3.

Regions of the mammalian gut

- Mouth, oesophagus, stomach, small intestine (duodenum, ileum), large intestine, rectum, anus.
- Each region has structures suited to its function.
- Wall: serosa, muscularis (longitudinal + circular), submucosa, mucosa.

Digestion

- Mechanical: teeth, muscular churning.
- Chemical: amylase, proteases (pepsin, trypsin), lipases.
- Bile salts emulsify lipids ⇒ larger surface area for lipase.

Absorption & villi

- Villi & microvilli increase SA for absorption.
- Epithelial cells: facilitated diffusion, active transport, co-transport.
- Capillaries (sugars, amino acids), lacteals (lipids in chylomicrons).

Peristalsis & secretions

- Peristalsis: longitudinal & circular muscle propel bolus.
- Saliva (amylase), gastric juice (pepsin, HCl), pancreatic juice, bile.
- Goblet cells secrete mucus to protect mucosa.

Mammalian Digestion & Gut in one page

Quick-reference notes – revisit before each question.

Gut wall layers

Serosa (outer) – Muscularis (long. + circ.) – Submucosa – Mucosa (inner).
Mucosa contains glands, capillaries, lacteals.

Mouth, stomach

Salivary amylase: starch → maltose.
Stomach: HCl (pH 2), pepsin (protein → polypeptides).
Mucus protects stomach lining.

Small intestine

Duodenum: bile + pancreatic juice empty in.
Ileum: villi & microvilli – SA for absorption.
Lipase, trypsin, maltase, peptidase – complete digestion.

Bile & emulsification

Bile made in liver, stored in gall bladder.
Bile salts emulsify large lipid droplets into micelles.
Increases SA for lipase action.

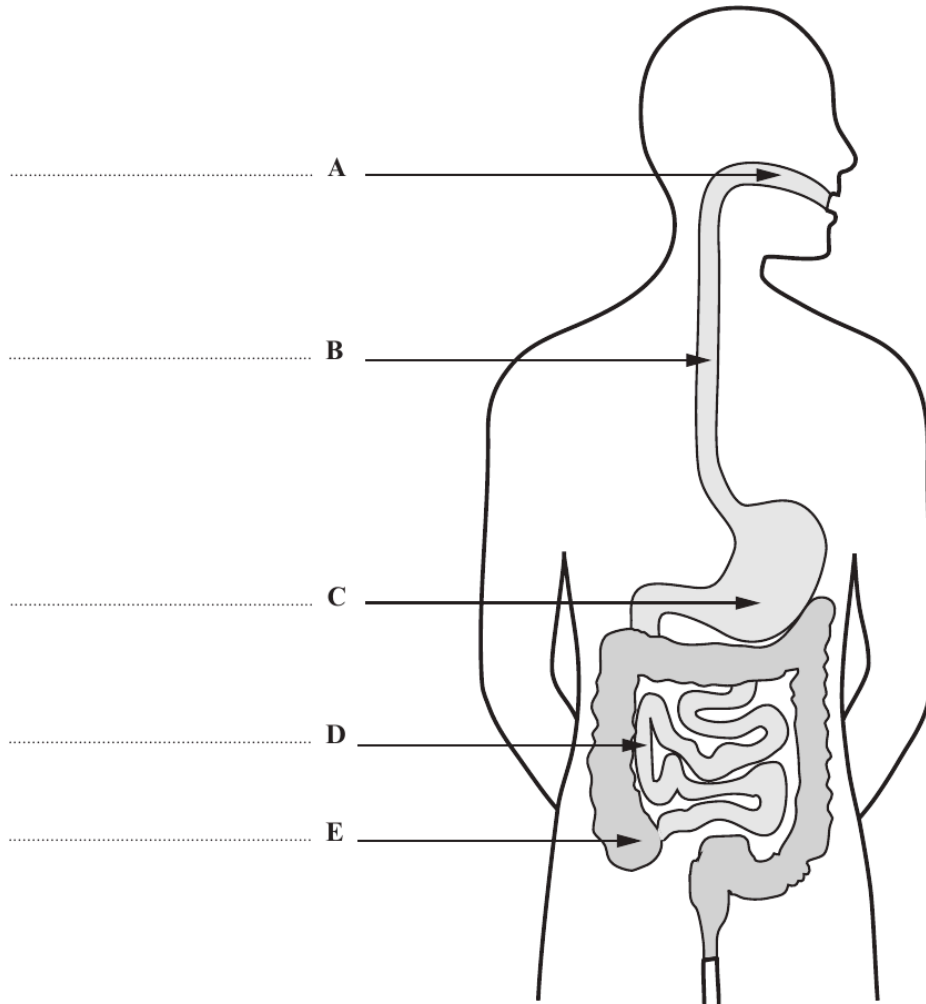
Absorption mechanisms

Glucose / amino acids: co-transport with Na^+ .
Fatty acids / glycerol: pass into epithelial cells; reform triglycerides; pack as chylomicrons; lacteal.
Water: osmosis along solute gradient.

Large intestine

Reabsorbs water and ions.
Bacterial fermentation of fibre; some vitamin synthesis.
Faeces stored in rectum, expelled at anus.

1. The diagram below shows a simplified diagram of the human digestive system.



(a) Label parts A to E on the diagram. [1]

(b) Using letters from the diagram identify the **main** regions in the human gut where the following processes take place.

(i) Digestion

(ii) Absorption [2]

(c) Explain why the human digestive system is divided into several regions. [1]

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Examiner
only

(d) The adult pork tapeworm, *Taenia solium*, is a parasite of the region labelled **D** on the diagram opposite.

(i) What is meant by the term *parasite*? [2]

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(ii) Suggest why it is of benefit to the tapeworm to live in this region of the digestive system. [1]

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(e) Describe how tapeworms such as *Taenia solium* are adapted to overcome the following problems associated with living in the human digestive system. [2]

Peristalsis.

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Digestive enzymes.

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(f) Suggest why tapeworms produce large numbers of eggs. [1]

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(Total 10 marks)

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7. An experiment was carried out to determine the effect of bile salts on the digestion of lipids. After equilibration at 37°C each tube contained:

1 cm³ enzyme
5 cm³ full cream milk
2 cm³ sodium carbonate
6 drops of phenolphthalein pH indicator.

Bile salts were added to tube B and boiled enzyme used in tube C.

In alkaline solutions above pH10 phenolphthalein indicator is pink.
In solutions below pH 8.3 it is colourless.

The colour changes of the solutions are shown in the table below.

| | <i>Tube A</i> <i>No bile salts</i> | <i>Tube B</i> <i>Plus bile salts</i> | <i>Tube C</i> <i>Boiled enzyme</i> |
|---|---------------------------------------|---|---------------------------------------|
| Initial colour of indicator in experiment | Pink | Pink | Pink |
| Colour of indicator after 5 minutes | Pink | Colourless | Pink |
| Colour of indicator after 10 minutes | Pink | Colourless | Pink |
| Colour of indicator after 15 minutes | Colourless | Colourless | Pink |

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only

(a) Name the enzyme used in this experiment. [1]

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(b) (i) Explain the change in colour of indicator from pink to colourless. [2]

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(ii) Using your knowledge of lipid digestion in the gut, explain the results seen in the tubes **A** and **B**. [3]

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(c) Explain fully the results of tube **C**. [3]

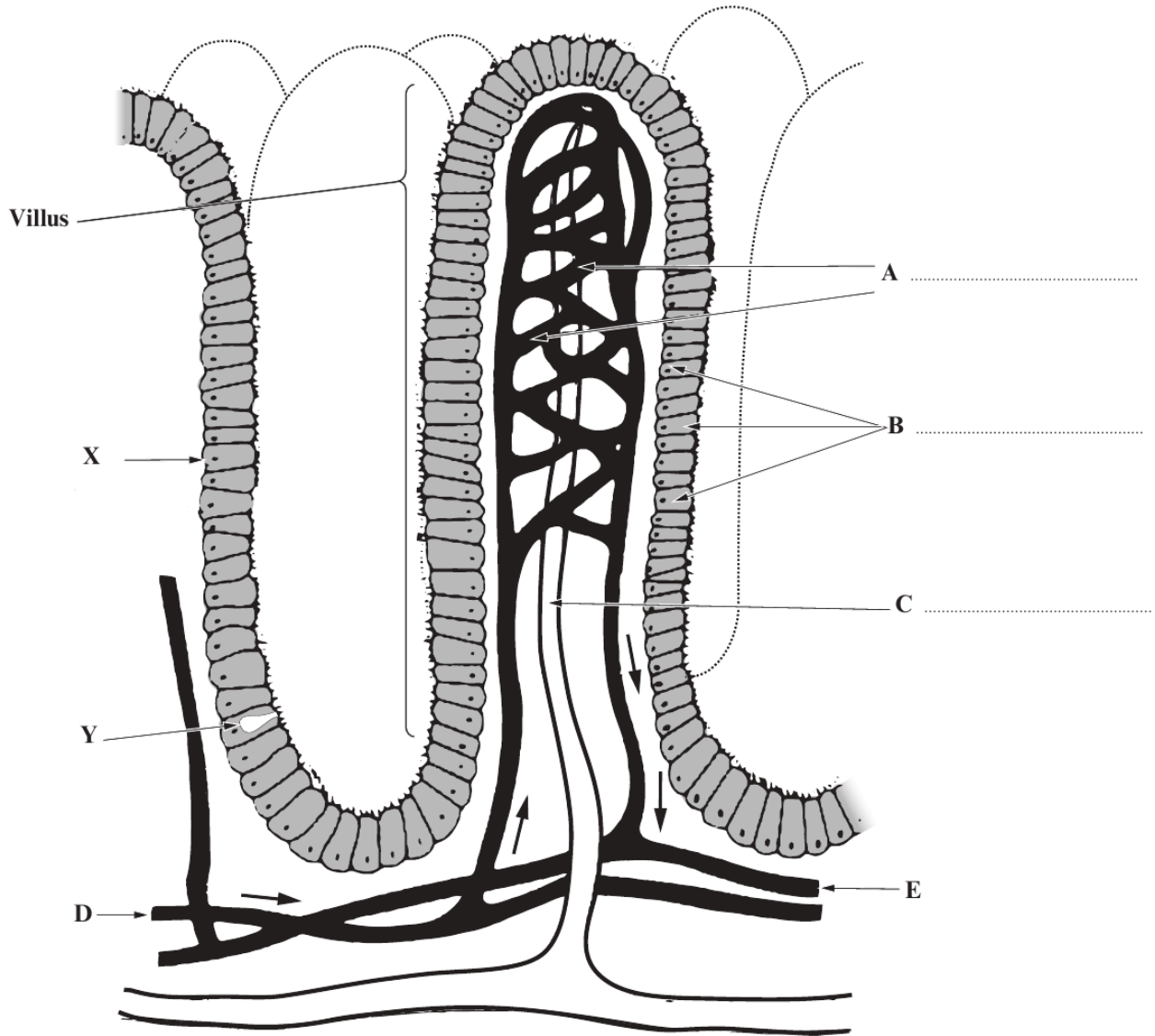
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(d) Suggest why the experiment was carried out using full cream milk. [1]

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(Total 10 marks)

6. The following diagram shows a longitudinal section of the small intestine.



(a) Complete the diagram by labelling structures **A**, **B** and **C**.

[3]

(b) Identify the types of blood vessels shown by **D** and **E**.

[2]

D

E

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(c) Describe **two** features associated with cell **X** and explain why each is important for the cell to function efficiently. [4]

Feature 1

Importance

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Feature 2

Importance

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(d) Cell **Y** is vital to the functioning of the intestine. What is the name of this cell and what is its function? [2]

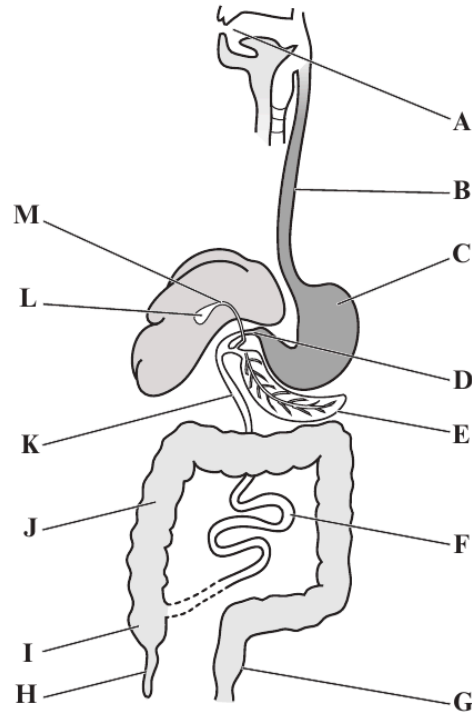
Name

Function

(Total 11 marks)

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4. The diagram below shows the human alimentary canal.

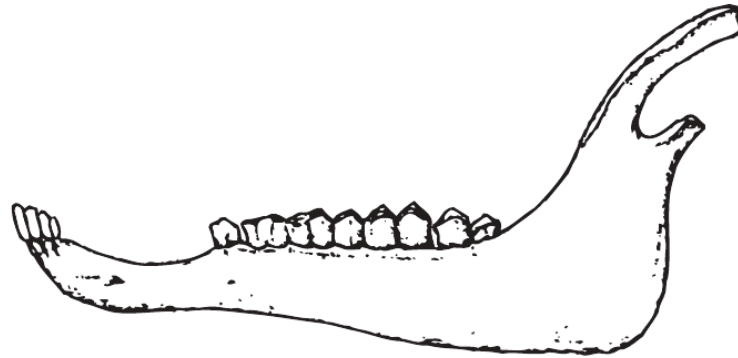


(a) Use a letter or letters from the diagram above to answer the following questions. [6]

| | | |
|-------|--|--|
| (i) | Which is the most acidic region of the alimentary canal? | |
| (ii) | In which two areas are proteins, carbohydrates and lipids digested together? | |
| (iii) | Where does the process of protein digestion begin? | |
| (iv) | Where is the main site of lipase production? | |
| (v) | The section of the alimentary canal where most absorption of digested products occurs. | |
| (vi) | The section of the alimentary canal whose main function is to absorb water. | |



The diagram below shows the lower jaw of a mammal.



Examiner
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(b) Use the information in the diagram above to:

(i) State the name given to describe the mode of nutrition of this mammal. [1]

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(ii) Explain how the jaw and teeth shown above are adapted for this mode of nutrition. [3]

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(iii) Explain how the **gut** of this mammal is adapted for digestion. [2]

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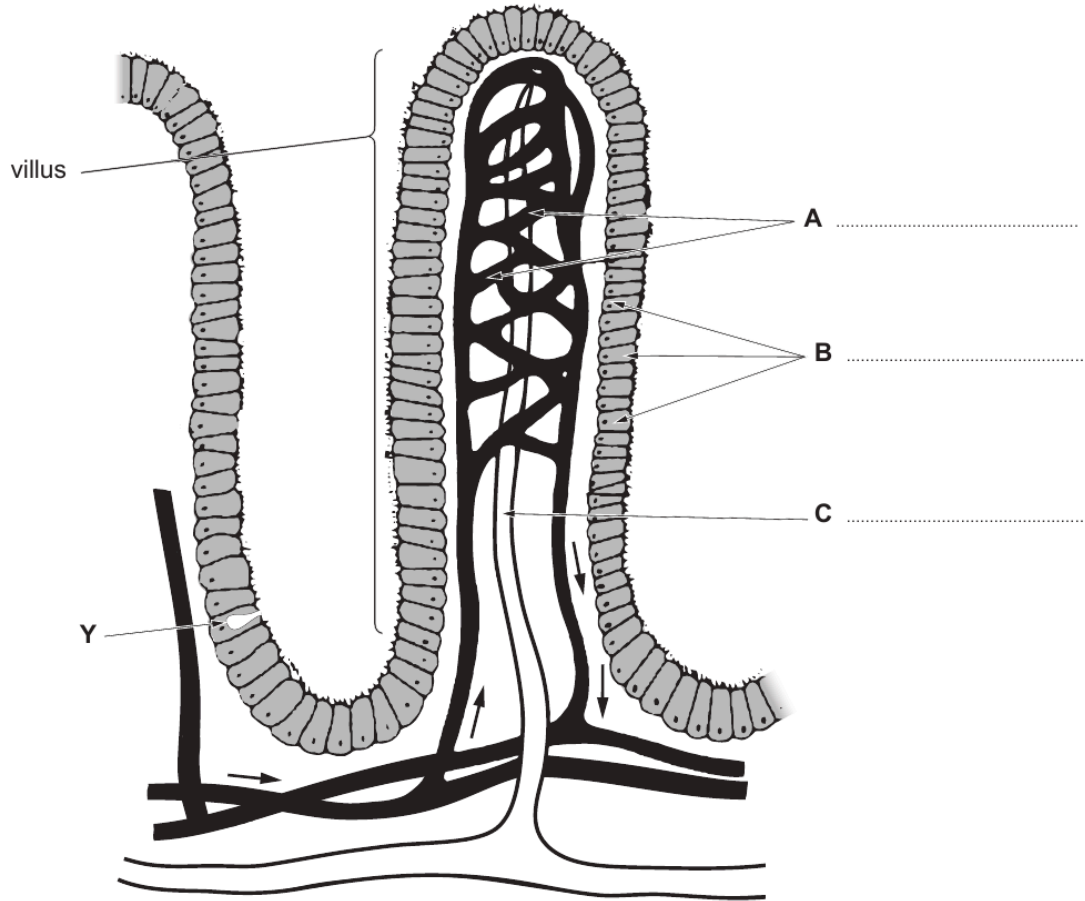
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Answer all questions.

Examiner only

1. The diagram below shows a villus of the small intestine.



- (a) Complete the diagram above by naming the structures **A**, **B** and **C**. [3]
- (b) With reference to the diagram **only**, describe and explain **two** features that are important in the functioning of the villus. [4]

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Examiner
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(c) (i) Name the substance secreted by cell type **Y**. [1]

(ii) Explain **two** functions of the secretion of cell type **Y** in the process of digestion. [2]

(d) Layers of smooth muscle are found in the wall of the small intestine. Explain the role of these muscle layers in the process of digestion. [3]

(e) Amino acids absorbed by structure **A** are transported to the liver. Describe the fate of the **excess** amino acids absorbed. [2]

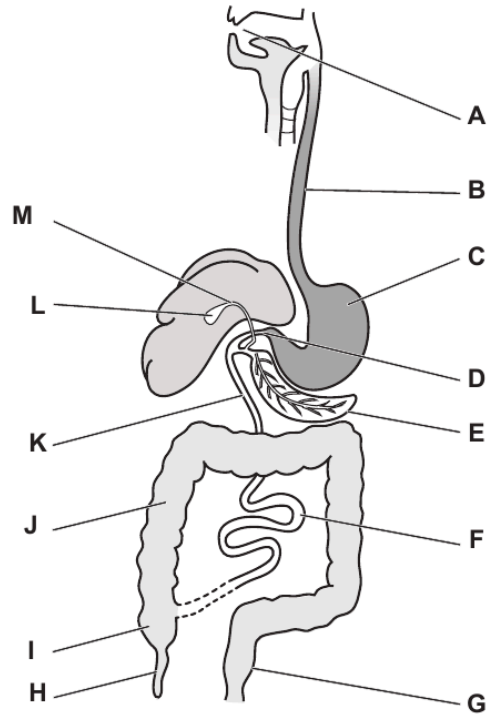
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2. Below is a diagram of the human gut.

Examiner only



(a) Using the letters from the diagram, indicate where the following occur.
(Letters may be used once, more than once or not at all.)

[4]

| | Letter(s) |
|--|-----------|
| The main sites of mechanical digestion | |
| The site of lipase production | |
| The chemical digestion of protein begins | |
| The final stages of carbohydrate digestion | |



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(b) The liver produces bile which contains both bile salts and hydrogen carbonate ions. Bile is stored in the gall bladder and is secreted into the duodenum. Bile salts emulsify lipids by breaking large lipid droplets into many smaller lipid droplets.

(i) Explain the importance of this process in the digestion of lipids. [2]

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(ii) Using your knowledge of digestion, suggest a function of the hydrogen carbonate ions. [1]

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(c) Humans are the primary host of the pork tapeworm, *Taenia solium*.

(i) Draw a labelled arrow on the diagram opposite to show where the adult tapeworm would be located. [1]

(ii) Using your knowledge of the tapeworm, explain why the tapeworm would be located in this region. [2]

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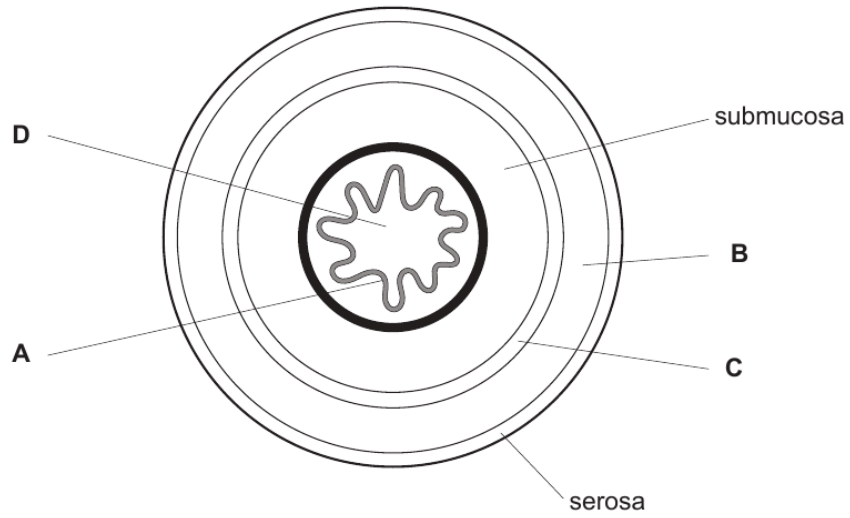
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Answer **all** questions.

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1. The diagram below shows a transverse section through the gut of a mammal.



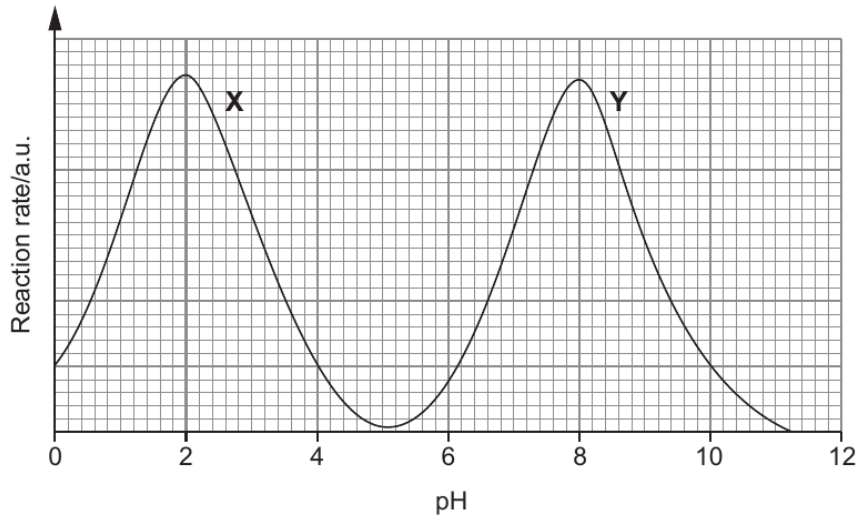
- (a) Name **A** to **D** shown on the diagram above.

[4]

- A**
- B**
- C**
- D**

Examiner only

(b) The graph below shows the rate of activity of two protein digesting enzymes, X and Y.



- (i) State the optimum pH for each of the enzymes. [1]
Enzyme X: Enzyme Y:
- (ii) State the region of the gut where each of these enzymes would be active. [2]
Enzyme X: Enzyme Y:
- (iii) Enzyme X is an endopeptidase and enzyme Y is an exopeptidase. Explain why enzyme X needs to act on the protein before enzyme Y. [2]

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END OF QUESTION PACK

7 questions · 77 marks · ~2 h 3 min

Source: WJEC BY2 (2008 modular spec, 2011–2017)

Curated for WJEC Biology 2015 spec AS Unit 2 – Topic 4 (2.3)

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