

Structured Questions: Paper 2

6.1 Digestion & Absorption

6.1.1 Digestion / 6.1.2 Villi & Absorption / 6.1.3 Absorption / 6.1.4 Skills: Digestion & Absorption

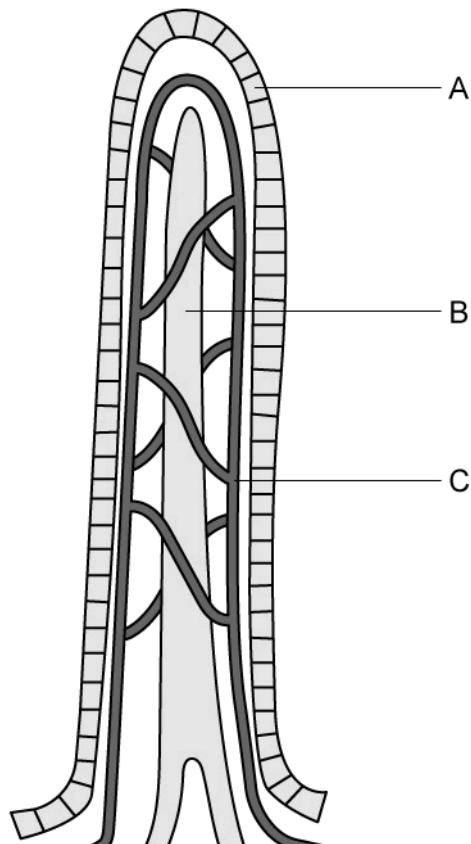
Easy (5 questions)	/40
Medium (5 questions)	/48
Hard (5 questions)	/46
Total Marks	/134

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Easy Questions

1 (a) The diagram below shows a structure found in the small intestine.



Identify this structure.

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(1 mark)

(b) Identify structures **B** and **C** in the diagram in part a).

.....
.....
(2 marks)

(c) (i) Identify structure **A** in the diagram in part a).

[1]

(ii) State **one** function of structure **A**.

[1]

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(2 marks)

(d) The products of digestion are absorbed by means of different membrane transport mechanisms.

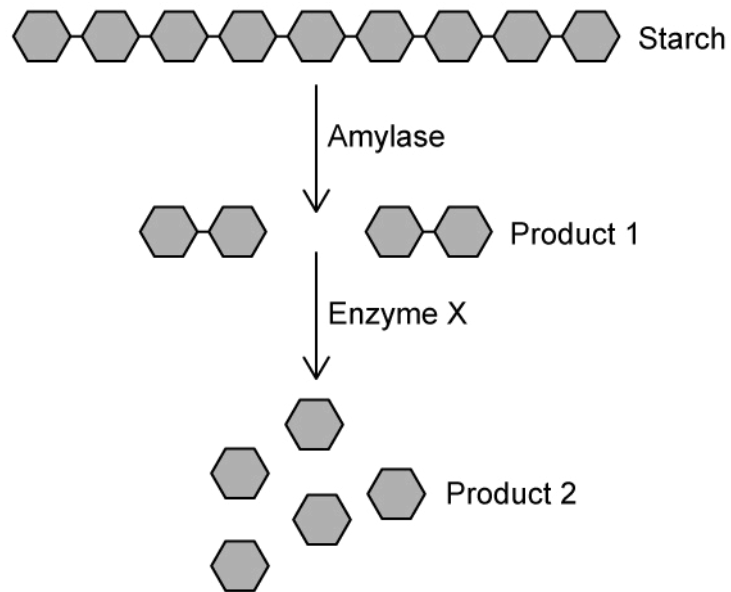
List **two** mechanisms by which the products of digestion can be absorbed.

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(2 marks)

2 (a) The following diagram illustrates the steps involved in the digestion of starch.



State the name of **product 1**.

.....
(1 mark)

(b) **Enzyme X** is responsible for completing the digestion of starch.

(i) State the name of **enzyme X**.

[1]

(ii) Identify the type of bond that is broken by **enzyme X** to form **product 2**.

[1]

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(2 marks)

(c) The digestion of starch occurs in various parts of the digestive system.

Identify **two** parts of the digestive system where starch digestion occurs.

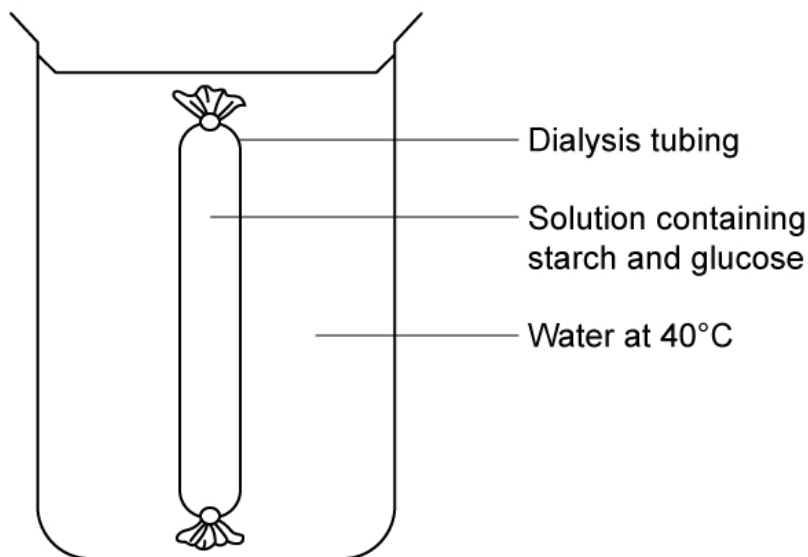
(2 marks)

(d) **Product 2** represents the final product of starch digestion.

Identify **product 2**.

(1 mark)

3 (a) A group of students set up an experiment to investigate membrane permeability using dialysis tubing. The diagram below shows their experimental set-up.



The students measured the mass of the dialysis tubing and its contents at the start of the experiment (0 minutes) and then again at 5 minute time intervals for 30 minutes. Their results are shown in the following table.

Time / min	Mass / g
0	15.4
5	15.8
10	16.1
15	16.5
20	16.9
25	17.2
30	17.6

Calculate the increase in mass. Show your working.

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(2 marks)

(b) Using the results in part a), state the direction in which water moved during the experiment.

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(1 mark)

(c) Dialysis tubing is often used to model digestion and absorption in the small intestine.

Describe **one** characteristic of dialysis tubing that makes it suitable for this purpose.

(2 marks)

(d) The students also tested the water surrounding the dialysis tubing for the presence of glucose and starch throughout the investigation.

State their expected results.

(1 mark)

4 (a) The following micrograph shows the different layers of the small intestine.

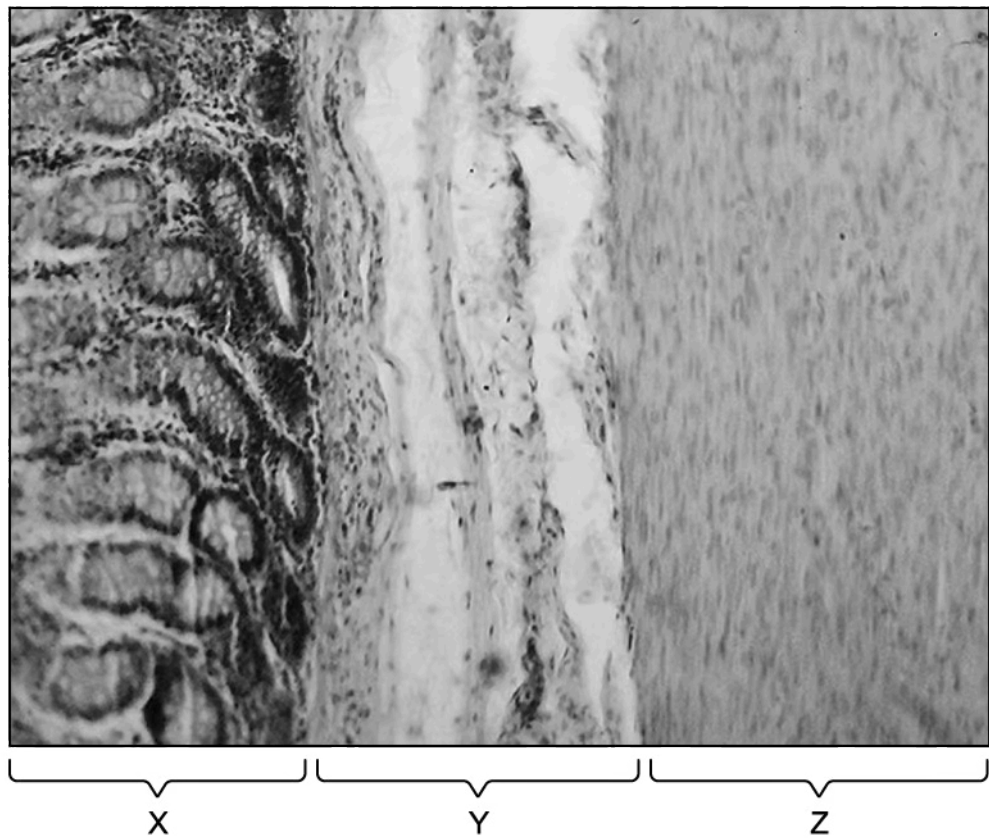


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Layer **Z** is responsible for peristalsis in the small intestine.

State **one** function of peristalsis in the small intestine.

(1 mark)

(b) Layer **Z** contains two layers of smooth muscle.

(i) Identify the two layers of smooth muscle.

[1]

(ii) State the role of each muscle layer.

[2]

(3 marks)

(c) Layer **X** is responsible for absorption.

State what is meant by the term 'absorption'.

(2 marks)

(d) Layer **Y** contains important structures that facilitate transport of absorbed substances.

(i) Identify layer **Y**.

[1]

(ii) Identify **two** structures found in layer **Y** that facilitate the transport of absorbed substances.

[1]

(2 marks)

5 (a) *One mark is available for clarity of communication throughout this question.*

Absorption of digested food molecules, vitamins, and minerals occurs in the ileum.

State **three** adaptations of the ileum that increases the surface area for absorption.

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(3 marks)

(b) Draw a labelled diagram of the digestive system.

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(5 marks)

(c) Outline the roles of pancreatic juice. Include the names of relevant enzymes in your answer.

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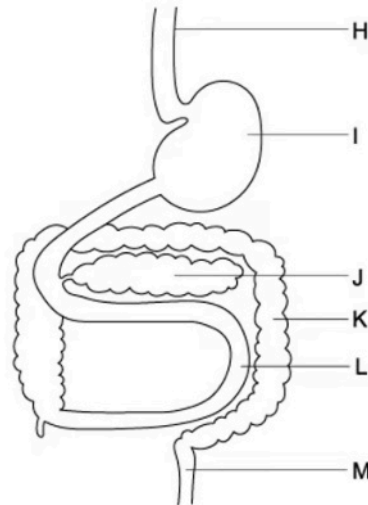
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(5 marks)

Medium Questions

- 1 (a) The diagram below shows part of the human digestive system. The different organs are labelled H - M.



Give the letter of an organ where peristalsis does not occur.

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(1 mark)

- (b) Outline how peristalsis ensures one way movement of food through the alimentary canal.

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(2 marks)

- (c) Name organ L in the diagram above, and identify a digestive enzyme that it produces.

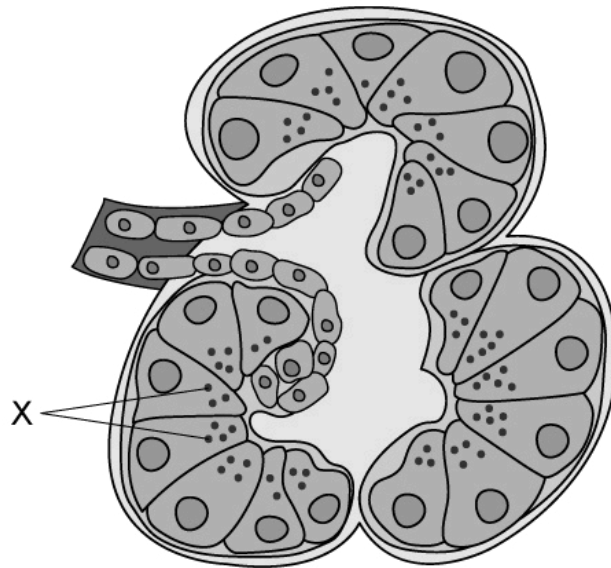
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(2 marks)

- (d) The glucose concentration in blood rises after eating a meal that contains carbohydrates. The increase in glucose concentration occurs at a slower rate if the carbohydrate ingested is starch, rather than sucrose.

Explain why this is.

(3 marks)

2 (a) The diagram shows some acinar cells in the pancreas.



Identify the structures labelled **X** and state what is contained within these structures.

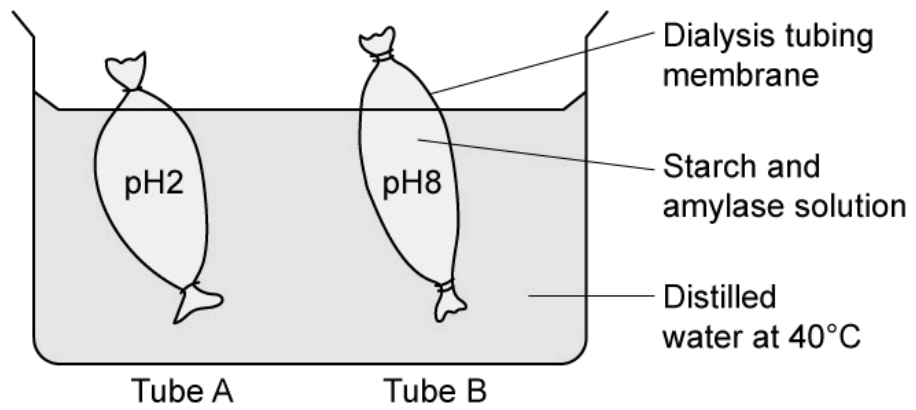
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(1 mark)

(b) Pancreatitis is a medical condition that can lead to the pancreatic duct becoming blocked. It can also cause protein-digesting enzymes to be released into the bloodstream.

Suggest one reason why this might be harmful.

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(2 marks)

(c) The image below shows an investigation carried out into the effect of pH on the activity of amylase enzymes.



In the investigation, two sections of dialysis tubing were set up containing the following mixtures:

Tube A	Tube B
<ul style="list-style-type: none"> • 1 ml of 1% amylase solution • 10 ml of 1% starch solution • 5 ml of pH 2 buffer solution 	<ul style="list-style-type: none"> • 1 ml of 1 % amylase solution • 10 ml of 1% starch solution • 5 ml of pH 8 buffer solution

After 30 minutes, the substances were tested using iodine solution.

Using the information given, deduce the results that would be expected from the mixtures tested in **tube A**.

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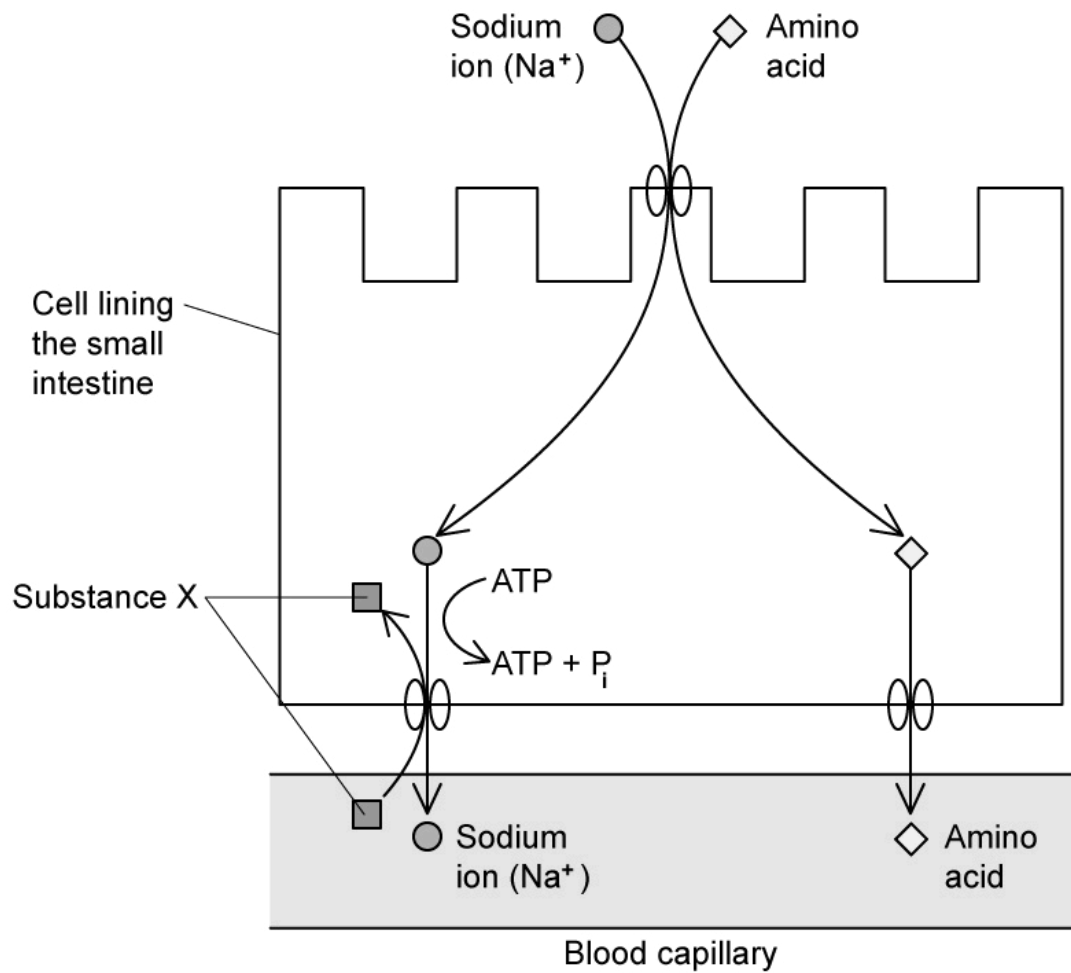
 (2 marks)

(d) Suggest how **tube B** provides an accurate representation of absorption in the small intestine.

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 (2 marks)

- 3 (a) The diagram below illustrates the co-transport mechanism for the absorption of amino acids into the blood by a cell lining in the small intestine.



Identify the substance **X** on the diagram.

(1 mark)

- (b) Use the diagram in part (a) and your knowledge of the co-transport mechanism, to explain why cells in the small intestine contain a large number of mitochondria.

(3 marks)

(c) Describe the role that enzymes play in the digestion and complete breakdown of starch into glucose.

(4 marks)

(d) State the property of glucose which prevents it from passing into the blood by simple diffusion.

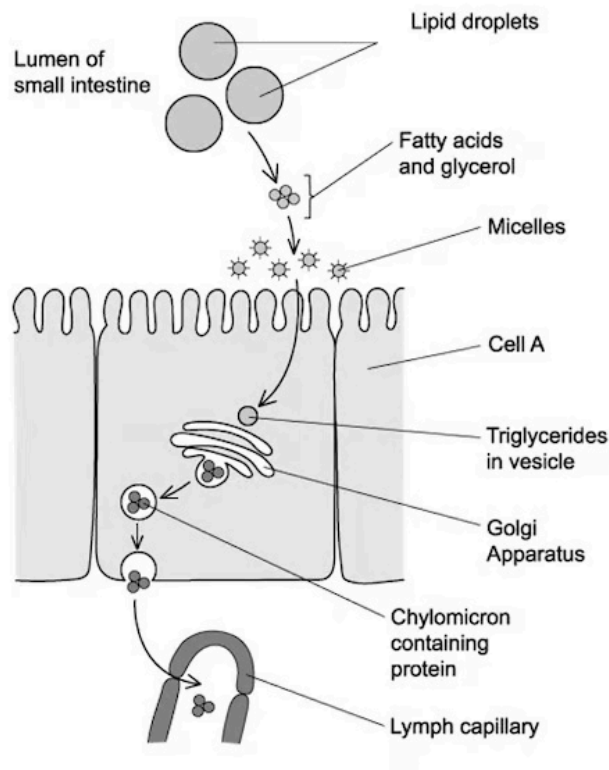
(1 mark)

4 (a) Bile salts bind to fat droplets and break them down into smaller fat droplets.

Explain how this process makes lipid digestion more efficient.

(2 marks)

(b) The diagram below outlines the mechanism of lipid digestion and absorption.

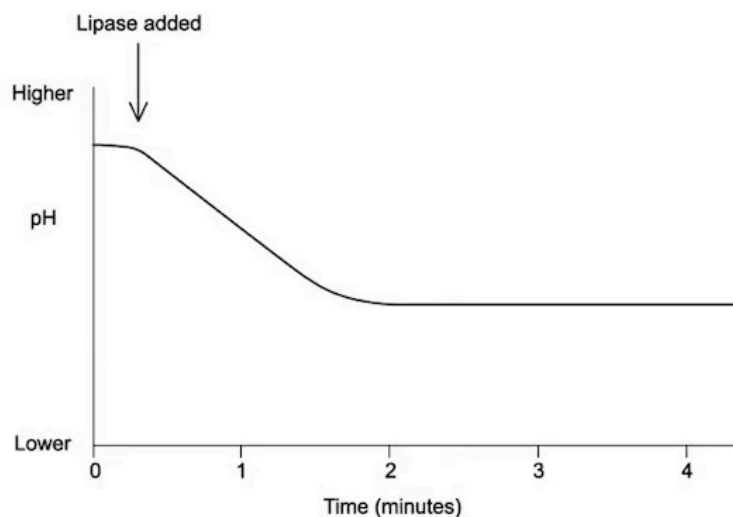


State what type of cell **A** is

(1 mark)

(c) A student wanted to investigate the breakdown of triglycerides in cow milk by human lipase at 20 °C.

They recorded the pH of a sample of cow's milk before and after adding human lipase, using a pH meter to measure the pH. Their results are shown in the graph below.



Describe and explain the changes in pH after human lipase is added.

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(4 marks)

- (d) The student carried out his experiment at a controlled temperature of 20 °C. They repeated the experiment at 25 °C.

Draw a line on the graph in part (c) to show the results you would expect at 25 °C.

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(2 marks)

5 (a) *One mark is available for clarity of communication throughout this question.*

Compare and contrast the action of endopeptidases and exopeptidases in the small intestine.

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(4 marks)

(b) Explain how the small intestines are adapted to maximise absorption.

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(7 marks)

(c) Outline the structure **and** function of the following layers of the wall of the small intestine:

- Muscle layer
- Submucosal layer

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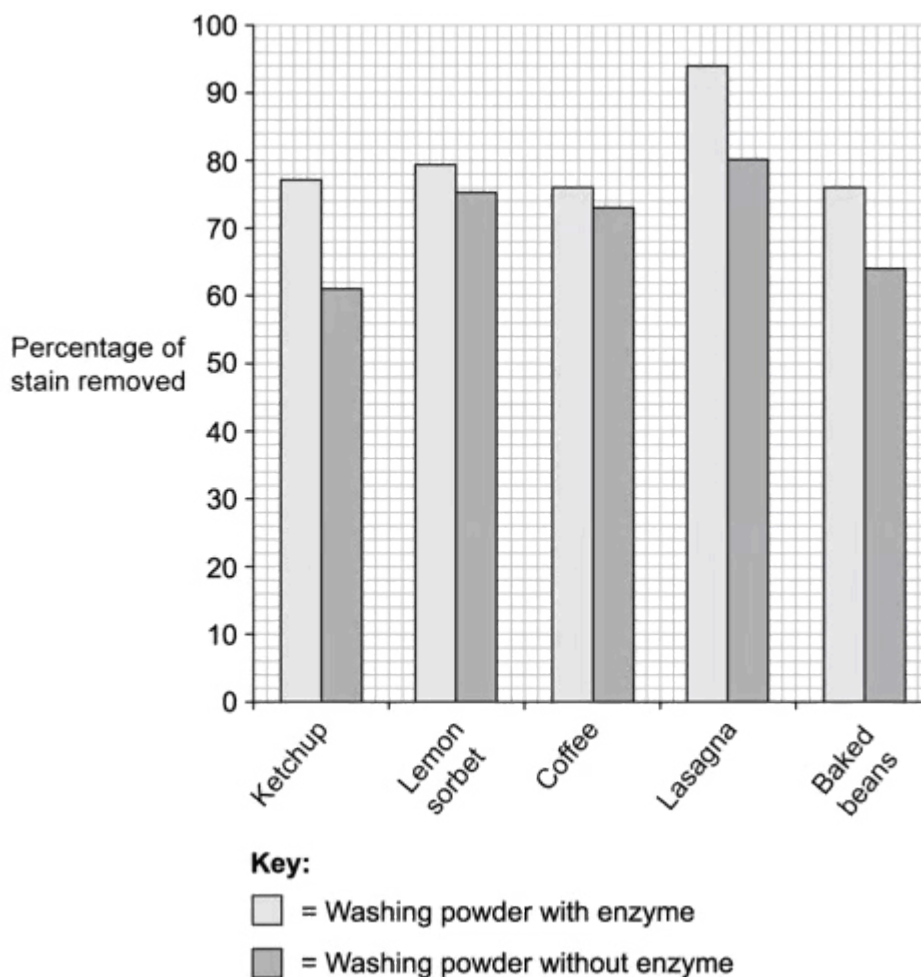
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(4 marks)

Hard Questions

1 (a) Washing powders often contain different types of enzymes that break down substances in stains. An investigation was carried out into washing powder that contained enzymes and washing powder that did not contain enzymes. The graph below shows the results of this investigation.



Some of the substances that cause food stains are large insoluble proteins.

Explain how washing powder containing enzymes would be able to remove these stains.

(2 marks)

- (b) The manufacturers of the washing powder containing enzymes claimed that their washing powder was more effective at removing tough stains compared to the washing powder without enzymes.

Based on the results of the investigation in part a), evaluate the claim of the manufacturers.

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(3 marks)

- (c) The investigation at part a) was carried out at 40 °C.

Suggest a reason for this.

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(1 mark)

- (d) The investigation was repeated at a temperature of 85 °C.

Predict, with a reason, the expected results from this investigation.

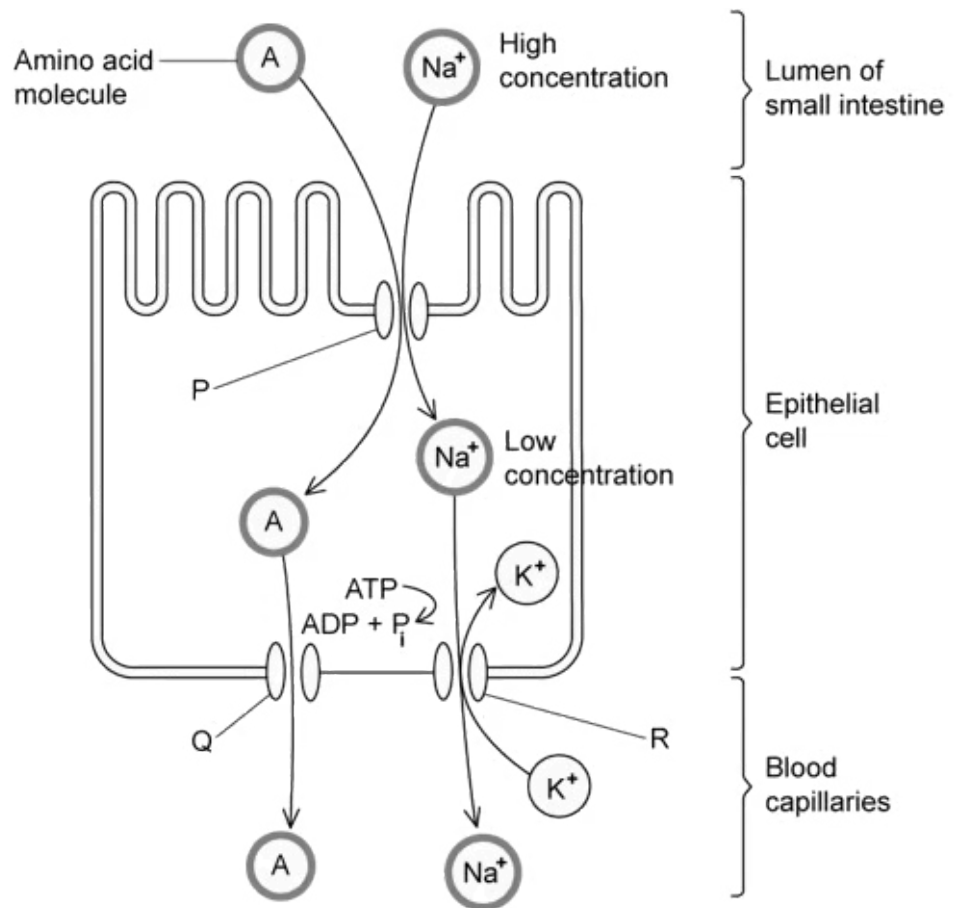
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(3 marks)

2 (a) The following diagram shows the absorption of amino acids from the small intestine into the blood.



The absorption of amino acids involves the process of facilitated diffusion.

Explain where this occurs in the diagram.

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(2 marks)

(b) Cyanide is a potentially deadly chemical that inhibits the functioning of mitochondria.

(i) Suggest the effect that cyanide would have on the concentration of sodium ions inside the intestinal epithelial cells shown in part a).

[1]

(ii) Explain your answer to part i).

[1]

(2 marks)

(c) Suggest, with a reason, the effect that cyanide would have on the absorption of amino acids.

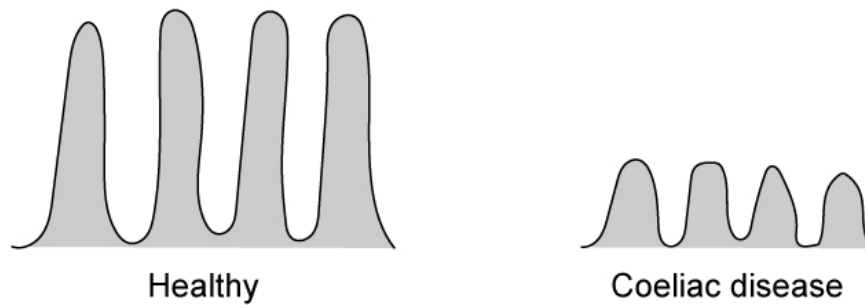
(3 marks)

(d) Explain why amino acids cannot be absorbed by simple diffusion.

(1 mark)

- 3 (a)** Coeliac disease is an autoimmune disorder that occurs in some people when they consume gluten, a type of protein found in certain grains. During an autoimmune disorder the immune system launches an attack on healthy body tissue which involves lymphocytes.

The following diagram compares the lining of the small intestine of a healthy person and a person suffering from coeliac disease.



Based on the information provided, explain how coeliac disease will affect the absorption of nutrients.

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(2 marks)

- (b)** Suggest how the immune system would respond to the presence of gluten proteins.

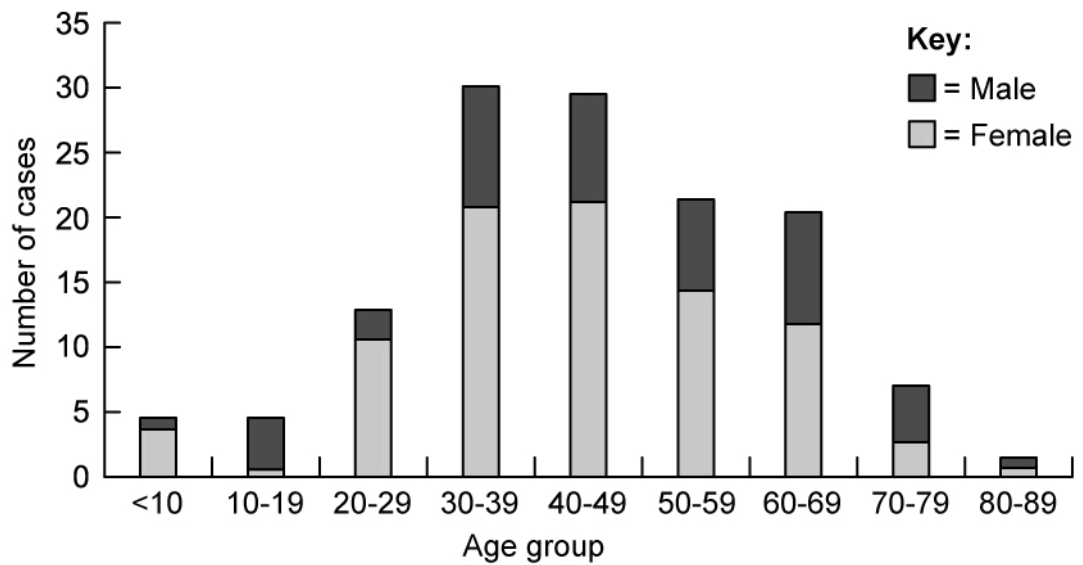
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(3 marks)

- (c)** The following graph shows the number of people at a hospital diagnosed with coeliac disease according to their age group.



Describe what the data show about age and number of cases of coeliac disease.

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(3 marks)

(d) Suggest an explanation for the observed prevalence of coeliac disease across different age groups shown in part c).

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(1 mark)

4 (a) People suffering from stomach cancer can undergo surgery to remove a part of their stomach. This type of surgery is known as a gastrectomy and can result in the patient developing a set of symptoms known as 'dumping syndrome'.

Usually the stomach will slowly release small amounts of partially digested food into the small intestine over a period of several hours, but in patients suffering from dumping syndrome large amounts of poorly digested food are released into the small intestine in a short period of time after a meal. This poorly digested food tends to be high in dissolved nutrients such as sugars.

(i) One symptom of dumping syndrome is a large volume of fluid in the small intestine.

Explain why this is the case.

[2]

(ii) Suggest **one** possible symptom that might result from this excess of fluid.

[1]

(3 marks)

(b) Patients will often suffer from nutrient deficiencies after developing dumping syndrome.

Suggest a reason for this.

(2 marks)

(c) Up to a third of dumping syndrome patients suffer from a form of the condition known as late dumping syndrome. These patients will experience symptoms 1-3 hours after eating due to the effects of the hormone insulin.

Suggest why these symptoms would arise 1-3 hours after eating.

(1 mark)

(d) One of the symptoms of late dumping syndrome is fatigue.

Using information provided in part c), explain why people suffering from late dumping syndrome would feel fatigued.

(3 marks)

5 (a) *One mark is available for clarity of communication throughout this question.*

Compare and contrast the process of peristalsis in the oesophagus and the small intestine.

(4 marks)

(b) The products of lipid digestion are absorbed by the villi of the small intestine.

Outline the process of lipid absorption.

(7 marks)