7. Human nutrition

7.4 Chemical digestion

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 **(c)** Protein is a large molecule.

Table 3.1 shows the names of some large molecules, the enzymes that catalyse the breakdown of these large molecules and the smaller molecules they are made from.

Complete Table 3.1 by writing the correct large molecule, enzymes and small molecule in the boxes.

Table 3.1

large molecules	enzymes	small molecules
protein	.....	amino acids
.....	amylase	glucose
fats and oils	.....	fatty acids and .....

[4]

2 **(c)** Enzymes are involved in chemical digestion in humans.

Define the term chemical digestion.

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.....

..... [2]

(e) The acid in gastric juice provides an acid pH for enzymes.

(i) State **one** other function of the acid in gastric juice.

.....

..... [1]

(ii) State the name of the acid that is found in gastric juice.

..... [1]

(f) Table 3.2 shows the names of some enzymes, the substrate they act on and the products of the reaction they are involved in. It also shows the organ that secretes the enzyme.

Complete Table 3.2.

Table 3.2

enzyme	substrate	products	organ that secretes the enzyme
amylase	starch	.....	.....
.....	.....	fatty acids and glycerol	pancreas
protease	.....	amino acids	.....

[6]

3 Complete the sentences about food and digestion using words from the list.

Each word may be used once, more than once, or not at all.

absorbed	**antibodies**	**bacteria**	**duodenum**	
egested	**enzymes**	**fat**	**stomach**	**water**

The ..... secretes hydrochloric acid. One function of this acid in the body is to kill ..... in the food. Most food that is eaten has to be digested before it can be ..... by the body. Most chemical digestion is carried out by special proteins called ..... . One component of the diet that does not need to be digested is ..... . [5]

4 **(b)** Lipase is involved in the breakdown of fats.

State the **two** products of fat digestion.

1 .....

2 .....

[2]

5 **(c)** Digestive enzymes are used in chemical digestion to break down large insoluble molecules to smaller soluble molecules.

The boxes show some large insoluble molecules, some digestive enzymes and some smaller soluble molecules that are produced during digestion.

Draw **one** straight line from each enzyme to the insoluble molecule it acts on.

Draw another line from each enzyme to the smaller soluble molecule that is produced.

Draw a total of **six** lines.

insoluble molecule	**enzyme**	**soluble molecules**
fat	amylase	amino acids
protein	lipase	fatty acids and glycerol
starch	protease	sugars

[5]

6 During digestion enzymes act on different types of food to produce simpler substances that can be absorbed.

Complete Table 8.1 by inserting the missing information.

Table 8.1

food type	enzyme acting on the food type	simpler substances produced
protein	protease	
	amylase	
		fatty acids and glycerol

[5]

[Total: 5]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

7 **(c)** Starch and sucrose are made by plants after photosynthesis.

(i) State the name of the tissue that transports sucrose around the plant **and** the name of **one other** biological molecule that is transported in this structure. **(extended only)**

tissue .....

biological molecule .....

[2]

(ii) Describe how starch is broken down in the human digestive system so that it can be absorbed into the blood. **(extended only)**

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..... [6]

8 **(b)** A student investigated the effect of bile on the digestion of fat in milk.

They set up three different test-tubes:

- test-tube **A** contained milk and bile
- test-tube **B** contained milk and lipase
- test-tube **C** contained milk, lipase and bile.

They used an indicator that is pink in alkaline solutions and colourless in acidic solutions. They added the same volume of indicator to each test-tube.

The student observed and recorded the colour of the contents of each test-tube at 0 minutes, 20 minutes and 40 minutes.

Table 1.1 shows the results of the investigation.

Table 1.1

test-tube	indicator colour observed		
	0 minutes	20 minutes	40 minutes
A	pink	pink	pink
B	pink	pink	colourless
C	pink	colourless	colourless

(i) Explain the results for test-tubes **B** and **C** in Table 1.1. **(extended only)**

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.....

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..... [4]

(ii) Explain the purpose of test-tube **A** in Table 1.1. **(extended only)**

.....

.....

.....

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..... [2]

9 Digestive enzymes catalyse the breakdown of large insoluble molecules.

(a) (i) Explain why it is important that large insoluble molecules are broken down by chemical digestion.

.....

.....

.....

.....

..... [2]

(ii) State the name of the substance that is the solvent for most molecules that have been digested by enzymes.

..... [1]

(b) The activity of two protease enzymes, **A** and **B**, was measured at different pHs. Both enzymes are found in the human alimentary canal.

The results are shown in Fig. 2.1.

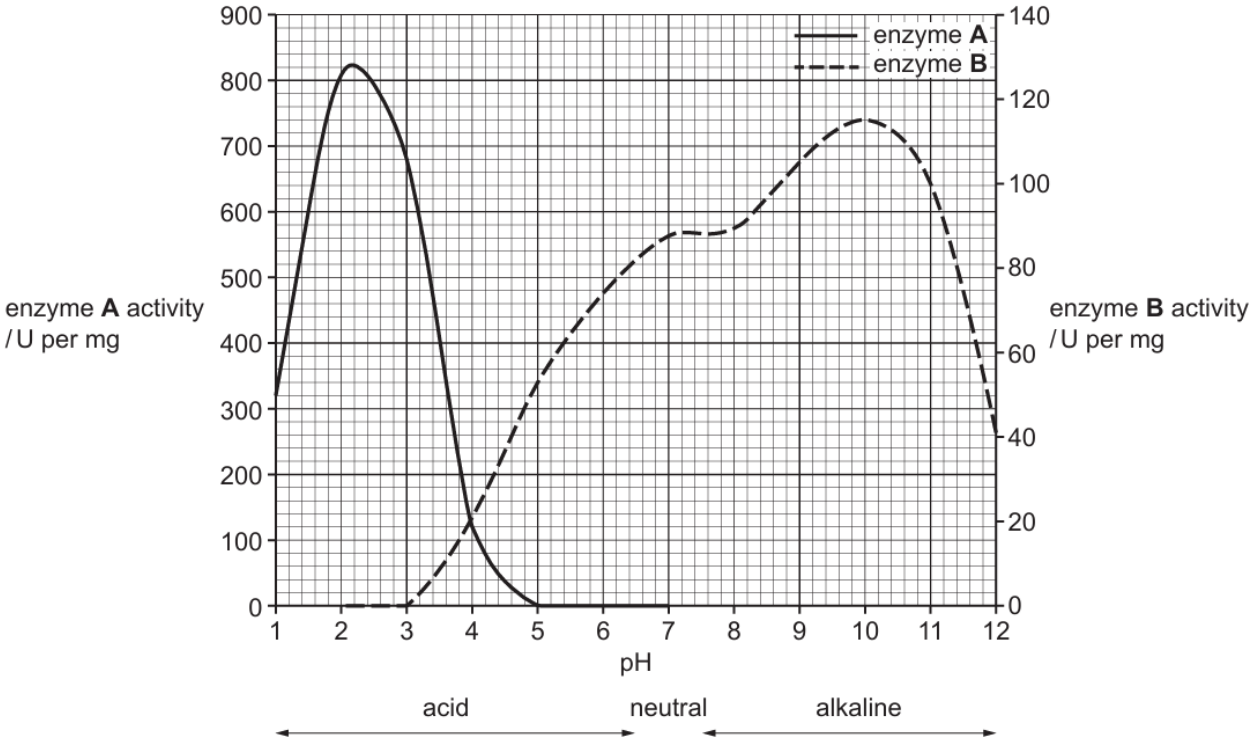

Fig. 2.1

Describe **and** explain the roles of the two protease enzymes, **A** and **B**, in the alimentary canal.

Use the information in Fig. 2.1 to support your answer. **(extended only)**

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..... [6]

(c) Maltase is a digestive enzyme that acts in the small intestine.

State the exact location of maltase in the small intestine. **(extended only)**

..... [1]

10 Fig. 2.1 is a diagram of the human alimentary canal and associated organs.

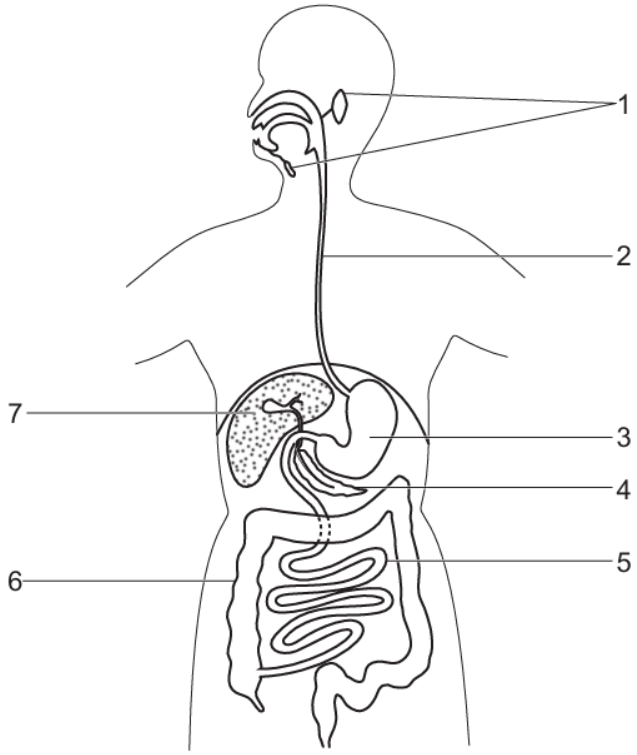

Fig. 2.1

(a) Table 2.1 shows enzymes, the organs that secrete these enzymes, their substrates and products.

Complete Table 2.1. **(extended only)**

Table 2.1

enzyme	organ that secretes the enzyme	number identifying the organ on Fig. 2.1	substrate	product or products
amylase		1		
		3	protein	
lipase		4		
maltase				

[4]

(b) Explain the role of hydrochloric acid in the alimentary canal.

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..... [3]

11 **(b)** The pancreas secretes hormones into the blood and enzymes into the pancreatic duct. The enzymes are released into the alimentary canal.

Complete Table 3.1 by stating the hormones and enzymes that are secreted by the pancreas.

Table 3.1

hormones secreted by the pancreas	enzymes secreted by the pancreas
.....	.....
.....	.....
	.....

[5]

12 **(b)** Scientists used enzymes and bile in the early development of biological washing powders.

Outline the roles of bile in the body. **(extended only)**

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..... [4]

13 **(c)** Table 6.1 lists some enzymes and the reactions that they catalyse.

Complete Table 6.1. **(extended only)**

Table 6.1

enzyme	reaction
maltase	breakdown of maltose to .....
.....	breakdown of proteins to amino acids
lipase	breakdown of fats to ..... and .....
.....	breakdown of lactose to simpler sugars
.....	insertion of a short length of DNA into a plasmid
restriction enzyme	.....

[6]

14 Biological washing powders contain enzymes that break down food stains.

(a) Complete Table 2.1 by naming the enzymes that break down three substances in food stains and by stating the product or products.

Table 2.1

substance	enzyme	product(s)
starch		
fat		
protein		

[3]

15 **(b)** Yeast is used in the production of ethanol to manufacture a type of biofuel.

Fig. 4.2 is a flow chart of the process.

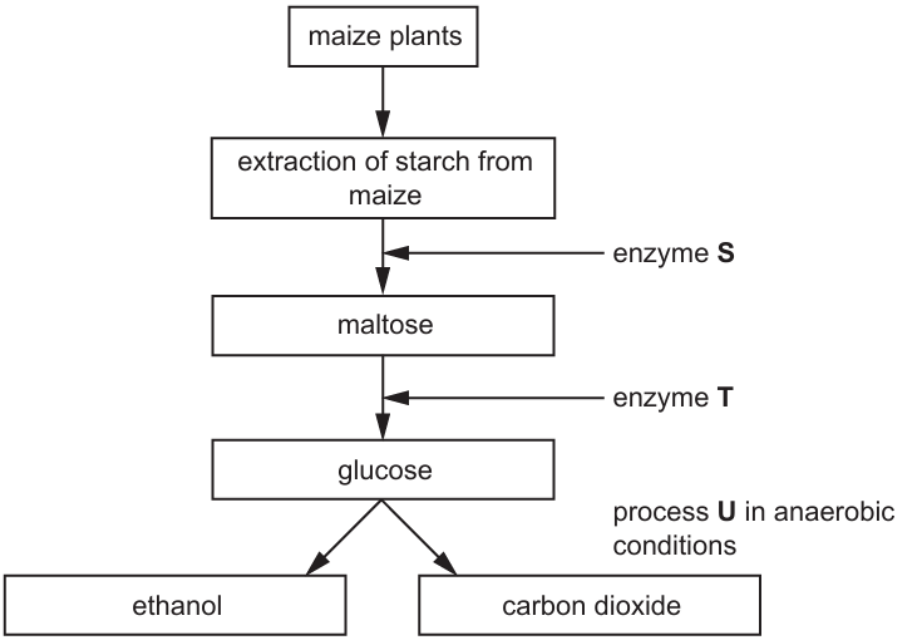

Fig. 4.2

(i) State the names of enzymes **S** and **T**. **(extended only)**

S .....

T .....

[2]

16 Cells in the lining of the stomach secrete gastric juice, which contains hydrochloric acid and pepsin.

(a) (i) State **two** roles of hydrochloric acid in the stomach.

1 .....

2 .....
[2]

(ii) Describe the function of pepsin.

.....

.....

.....

..... [2]

17 **(b)** Explain the importance of chemical digestion.

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.....[2]

18 **(b)** The digestive systems of young mammals are not fully developed.

Enzymes such as amylase, maltase and protease are often added to baby food to aid chemical digestion.

(i) Complete Table 6.1 by stating the substrate and product(s) for each enzyme reaction.

(extended only)

Table 6.1

enzyme	substrate	product(s)
amylase		
maltase		
protease		

[3]

19 **(b)** Galapagos iguanas feed on seaweed which contains starch and other carbohydrates.

(i) State the name of the enzyme that digests starch.

..... [1]

(ii) State the names of **two** parts of the alimentary canal where starch is digested.

1 .....

2 .....

[2]