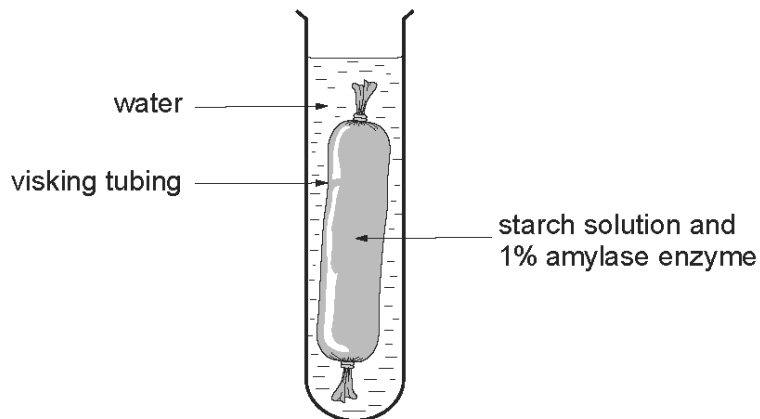


WJEC (Wales) Biology GCSE
Topic 1.3 Digestion and the
Digestive System in Humans
Questions by Topic

1. An experiment was set up using visking tubing as a model gut. This is shown in the following diagram. The visking tubing was filled with a starch solution and 1% amylase enzyme. After 30 minutes the water surrounding the visking tubing was tested and found to contain glucose but no starch.



Explain why glucose appeared in the water surrounding the visking tubing but no starch was found. Include in your account a description of how the water was tested for glucose using Benedict's solution and for starch using iodine solution giving the expected observations.

[6 QWC]

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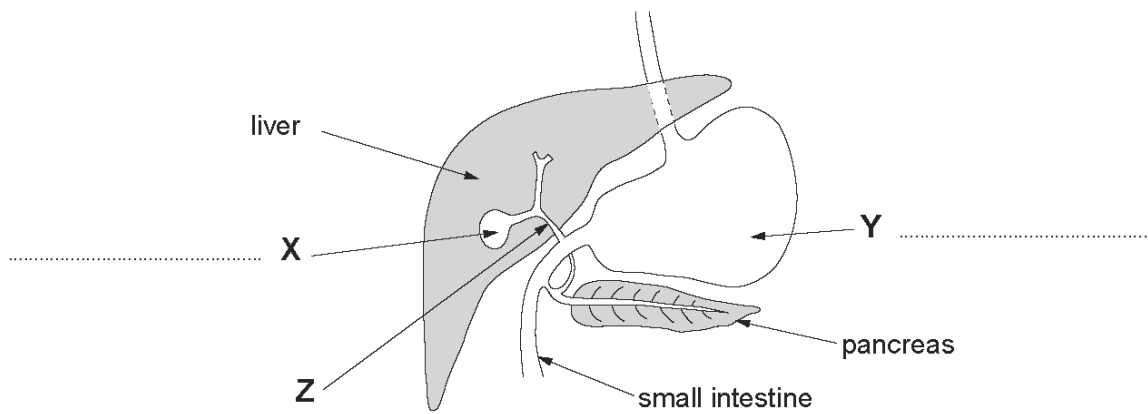
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2. The diagram below shows the liver and some other parts of the digestive system.



(a) Complete labels X and Y on the diagram above. [2]

(b) (i) Fats are digested in the small intestine. Complete the sentence below. [3]

The liver secretes a substance called This helps the enzyme named to digest fats into fatty acids and

(ii) State the function of structure Z shown on the diagram above. [1]

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3.

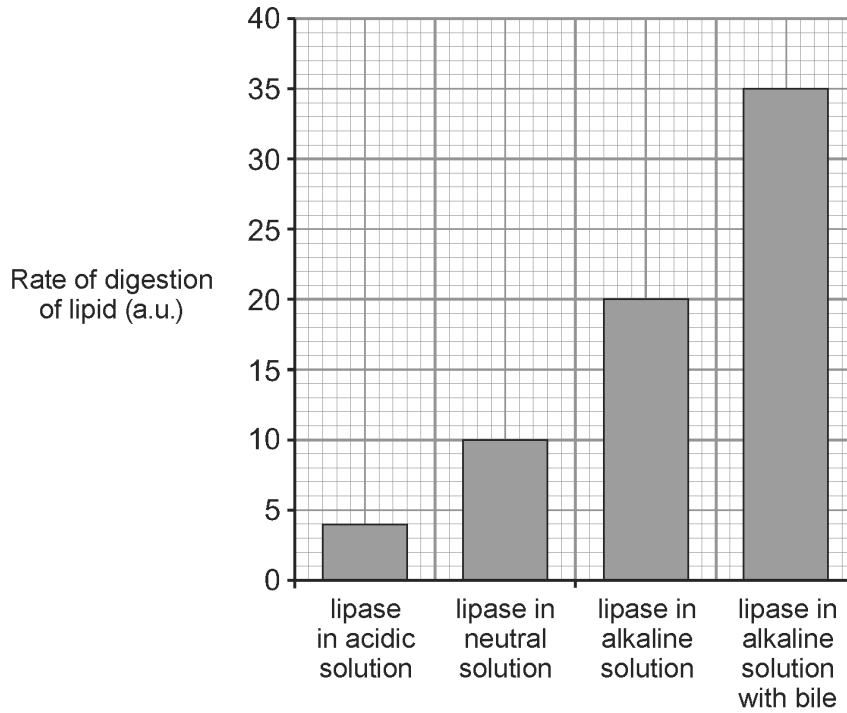
(a) Why do we need to digest large food molecules?

[1]

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(b) The graph below shows the rate of digestion of lipids by lipase under different conditions.



(i) Describe the effect of pH on the rate of digestion of the lipids.

[1]

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(ii) Explain the effect of bile on the rate of digestion of the lipids.

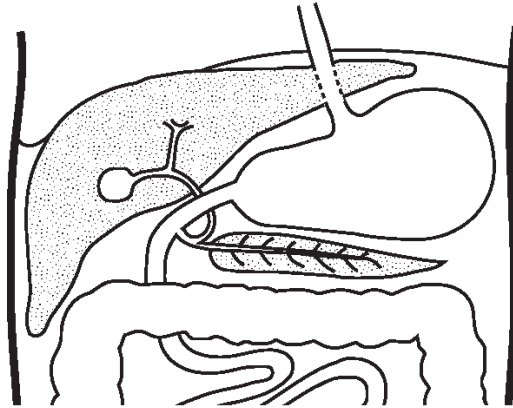
[2]

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4.

The diagram shows part of the human digestive system.



(a) (i) Name the organ shown in the diagram above which: [1]

I. secretes bile;

II. label this organ on the diagram above.

(ii) Name the organ shown in the diagram above which: [1]

I. stores bile;

II. label this organ on the diagram above.

(b) The table below shows the results of an experiment to investigate the digestion of olive oil (a lipid). The contents of three test tubes are shown in the table. The contents of the test tubes were analysed for the presence of fatty acids every 5 minutes for a period of 30 minutes.

Tube	Test samples	Time (minutes)						
		0	5	10	15	20	25	30
1	water + oil	-	-	-	-	-	-	-
2	water + oil + bile	-	-	-	-	-	-	-
3	water + oil + bile + lipase	-	+	++	+++	++++	++++	++++

Key: - = no fatty acids present

+ = fatty acids present

- (i) Bile plays a very important role in the digestion of lipids but the results in Tube 2 show that it is not directly involved in the production of fatty acids. Describe the role played by bile in the digestion of lipids. [2]

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- (ii) The production of fatty acids in Tube 3 did not increase after 20 minutes. Suggest a reason for this. [1]

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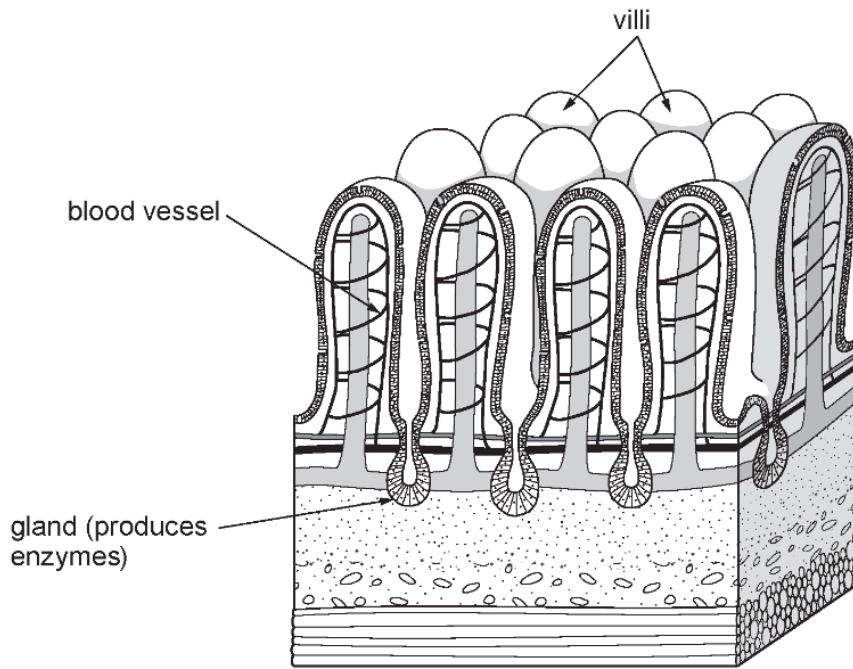
- (iii) Apart from fatty acids, name another product of lipid digestion which could have been tested for during this experiment. [1]

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5.

The drawing shows the lining of part of the digestive system.



(a) Name the part of the digestive system that has this lining. [1]

(b) If the surface area of a single villus is 5 mm^2 , calculate the total surface area of all the villi shown. Assume that all the villi are complete and include a unit in your answer. [1]

Total surface area =

unit =

(c) State **two** functions carried out in this part of the digestive system. [2]

Function 1.

Function 2.

(d) State **one** feature of the digestive system which helps this part carry out each function named in (c). [2]

Function 1.

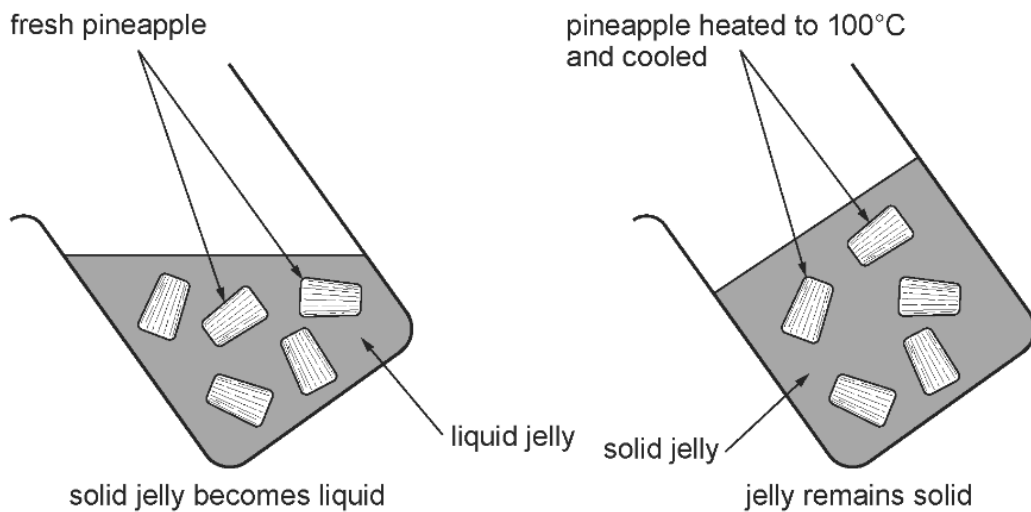
Function 2.

(e) Fresh pineapple is sometimes added to meat to make it tender. Fresh pineapple contains a protease enzyme.

Alan investigated how this took place. He used the following:

- fresh pineapple
- pineapple that had been heated to 100°C and cooled
- a solid jelly made from protein called gelatin

Two samples of solid jelly were made and the pineapple was pushed into them. After 24 hours the results were shown below:



Explain the results with:

(i) fresh pineapple; [3]

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(ii) pineapple heated to 100°C and cooled. [3]

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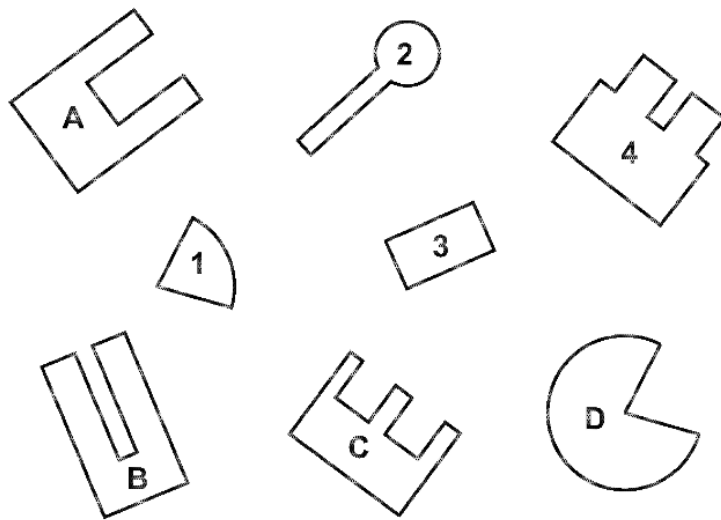
6. (a) Use some of the following words to complete the table about enzymes.

[3]

fatty acids lipids amino acids glucose glycerol

Enzyme	Substrate	Products
protease	protein	.....
lipase	.....	..... and

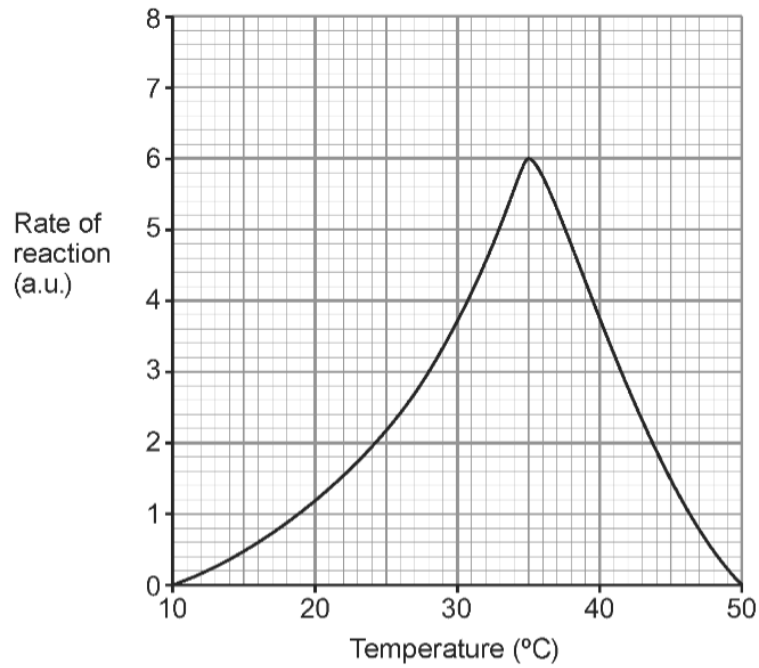
(b) The diagram shows four enzymes A – D and four substrates 1 – 4.



Use your knowledge of the lock and key theory to complete the table below by matching each enzyme to its substrate. [1]

Enzyme	Substrate
A
B
C
D

- (c) The graph shows the effect of temperature on the rate of an enzyme controlled reaction between 10°C and 50°C.



- (i) From the graph, describe the effect of temperature on the rate of the reaction between 10°C and 50°C. [3]

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- (ii) Most enzymes are denatured by boiling. Use your answer to part (b) to help explain why a denatured enzyme can no longer work. [2]

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7.

Describe the functions of bile and lipase in the breakdown of fats.

[6 QER]

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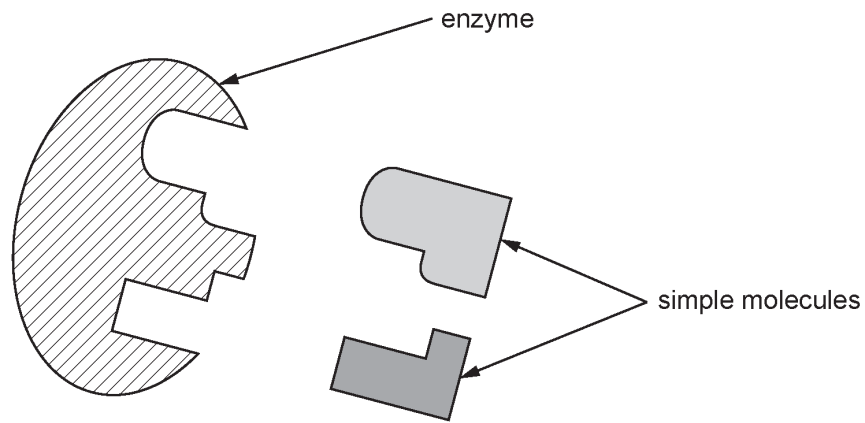
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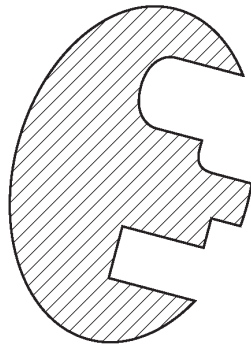
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8.

- (a) (i) The diagram shows an enzyme which builds up complex molecules from simple molecules.



Complete the diagram below to show the next stage in the reaction between this enzyme and the two simple molecules shown above. [2]



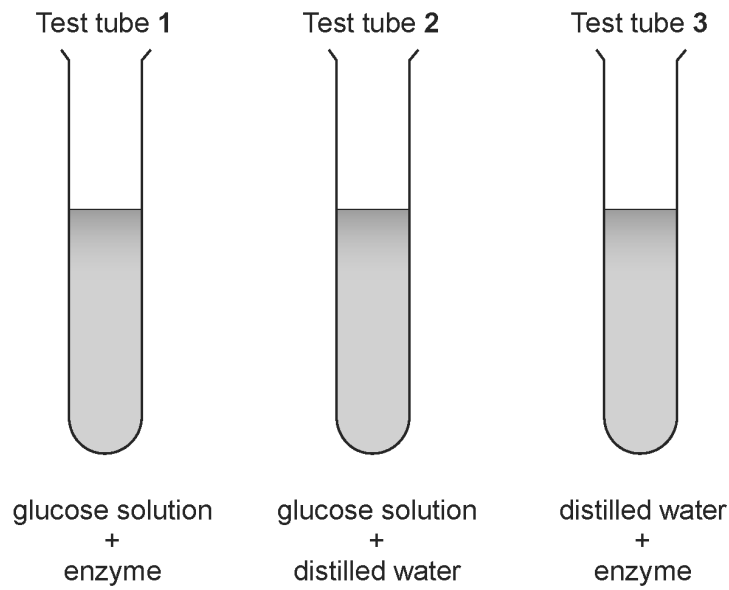
- (ii) What name is given to this **model** of enzyme action? [1]

.....

- (iii) Explain how boiling would affect the action of the enzyme shown in the diagrams above. [2]

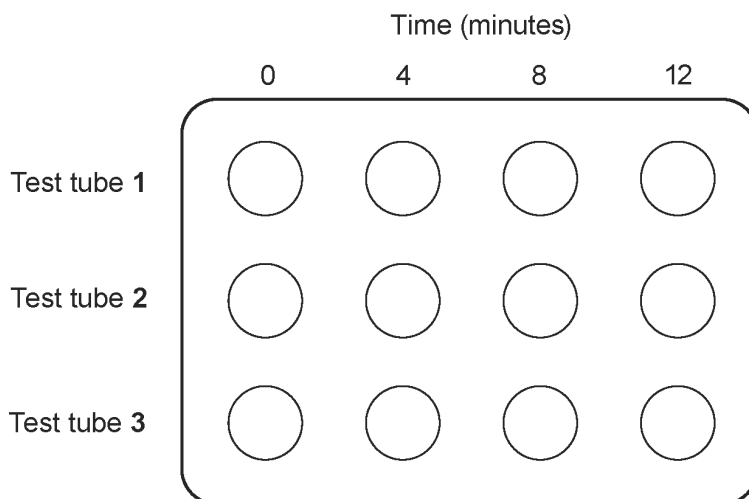
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- (b) Potatoes contain an enzyme which converts glucose molecules into starch molecules. In the following experiment three test tubes were set up as shown in the diagram below.



At the start of the experiment, and at four minute intervals, samples from each of the test tubes were added to each of the cavities in a spotting tray and then iodine solution was added to each sample.

Complete the diagram below by shading the cavities you would expect to show the presence of starch when tested with iodine solution. [3]



9.

- (a) (i) During digestion in the human body, large food molecules are broken down. Draw lines joining the large food molecules to the smaller molecules into which they are broken down. [2]

Large food molecules

Smaller molecules

protein

glucose

starch

fatty acids and glycerol

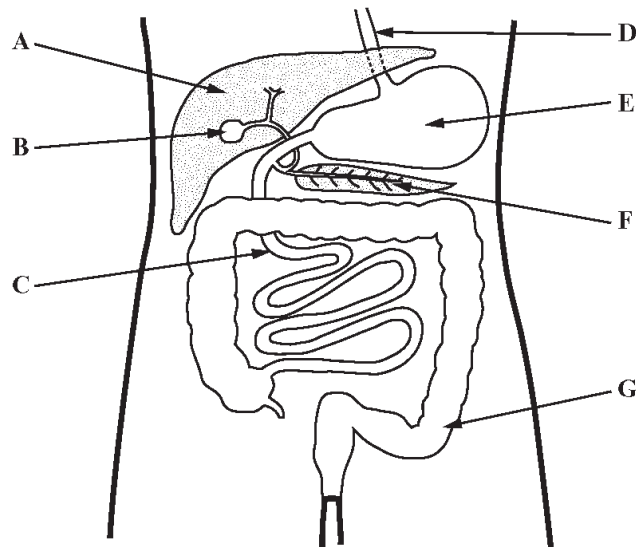
fats

amino acids

- (ii) Why is it necessary for these large food molecules to be broken down? [1]

- (iii) State the function of carbohydrate foods in the human body. [1]

- (b) The diagram below shows part of the digestive system in the human body.



From the diagram opposite.

- (i) Give the letters which show [1]

I. the pancreas,

II. the large intestine.

- (ii) Give the two letters which show where protein is digested. [1]

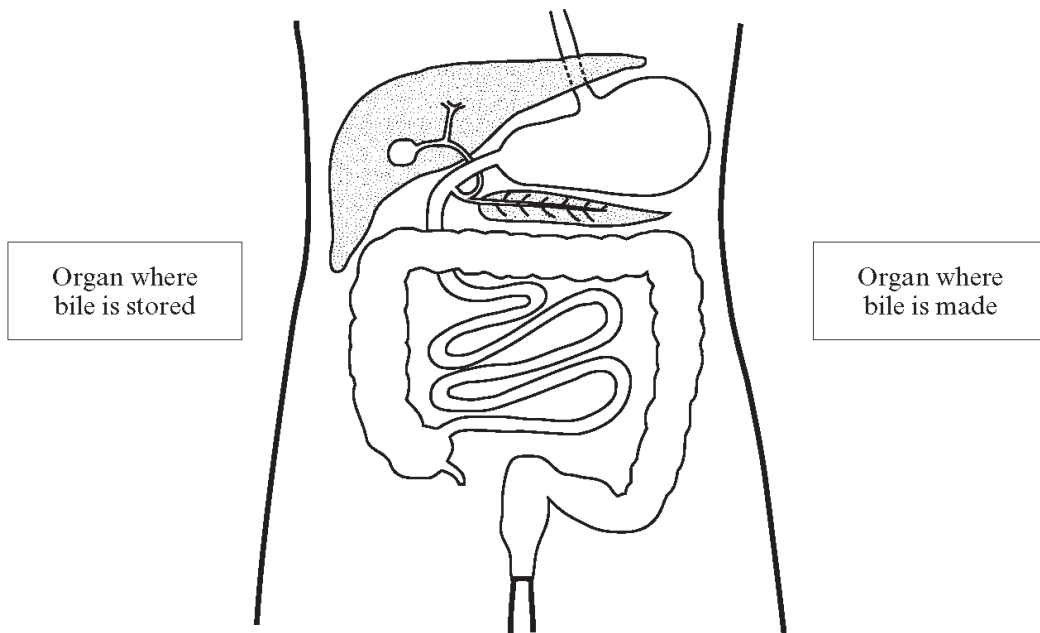
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- (c) Complete the table below to show the test solutions used to identify food substances. [2]

Food Substance	Test solution
glucose	.....
.....	biuret

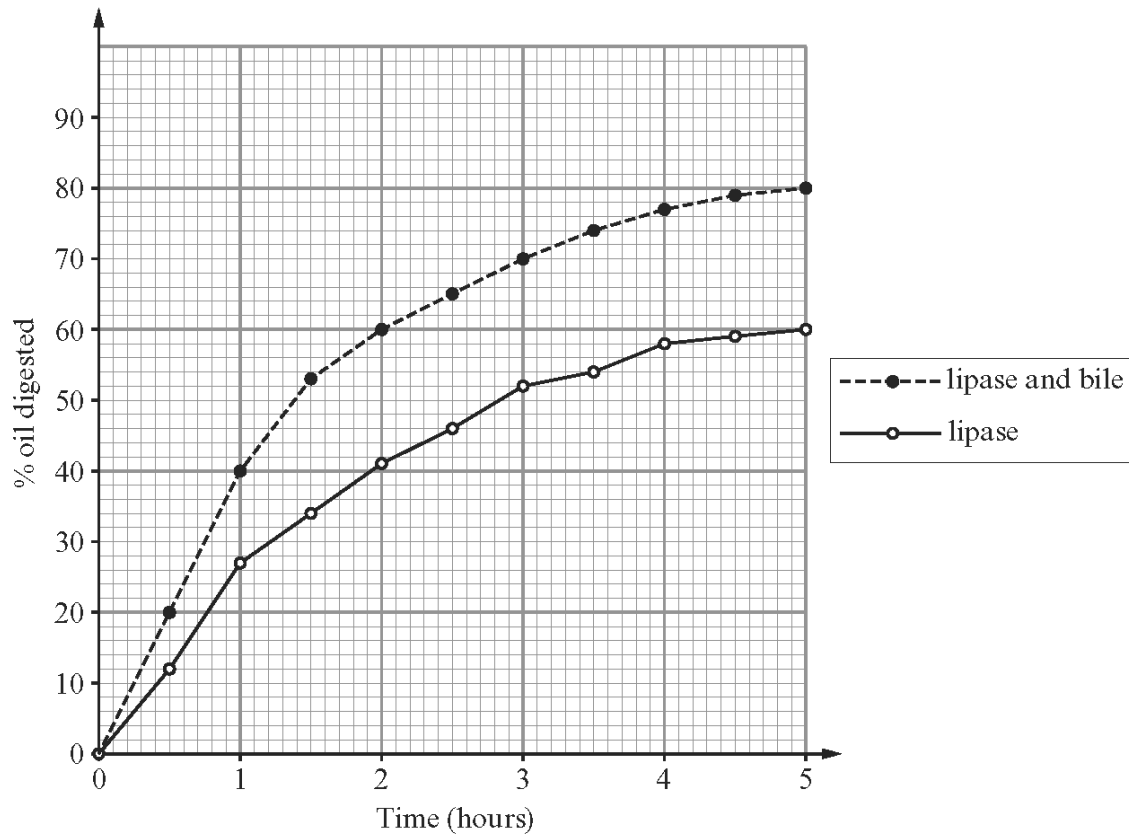
10.

The diagram below shows part of the digestive system.



- (a) On the diagram above carefully draw an arrow from each box to show the organ where:
- (i) bile is made; [1]
 - (ii) bile is stored. [1]

(b) The graph below shows the digestion of olive oil (fat) by lipase enzyme at pH9 in the presence and absence of bile.



(i) Using only the information in the graph above **describe** the effect of bile on the rate of digestion of olive oil. [1]

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(ii) **Explain** the effect of bile on the digestion of olive oil. [3]

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11. Sian and Rhys were investigating the use of visking tubing as a model gut. The following is an extract from their notebook showing the method they used.
- (i) Soak a piece of visking tube in water for 10 minutes.
 - (ii) Tie a knot in one end of the visking tube.
 - (iii) Fill the visking tube with starch solution and tie the open end of the tubing.
 - (iv) Suspend the visking tubing in a beaker of water.
 - (v) Test the water in the beaker every 15 minutes for the presence of starch and glucose.
 - (vi) After 45 minutes inject amylase enzyme into the visking tubing.
 - (vii) Continue to test the water for starch and glucose every 15 minutes.

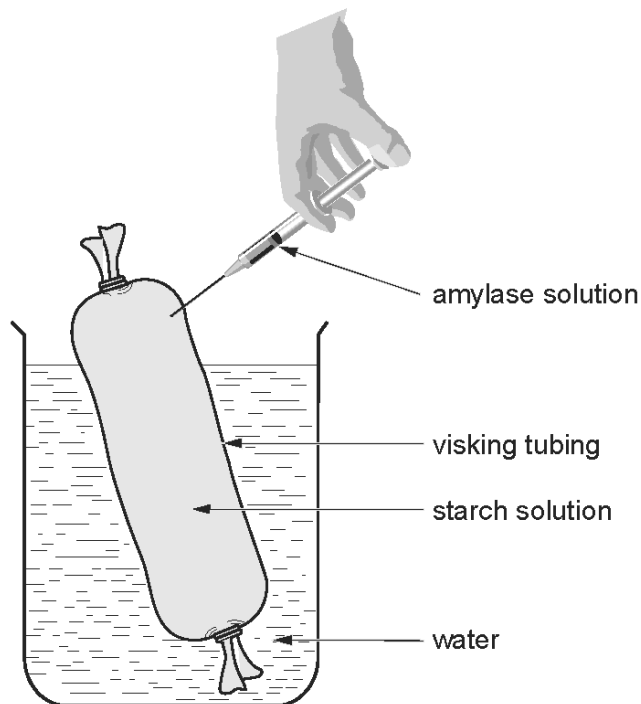


Table of results.

Time (minutes)	Starch present	Glucose present
0	No	No
15	No	No
30	No	No
45	No	No
60	No	Yes
75	No	Yes
90	No	Yes

Amylase added →

- (a) After the amylase was added, glucose was present in the sampled water. Explain this result. [3]

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- (b) State why starch was not found in the sampled water. [1]

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- (c) In the model gut shown opposite, what does the water surrounding the visking tubing represent in the living body? [1]

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- (d) Complete the following table about food tests. [2]

Substance tested for	Reagent used	Colour of reagent	Colour with positive result
	Iodine solution		blue-black
Glucose		blue	

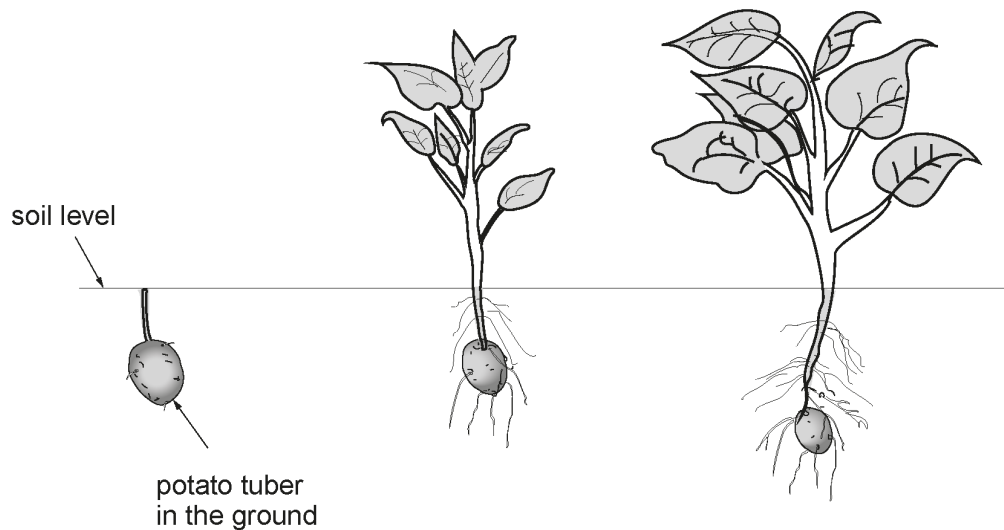
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12.

The photograph shows a potato tuber with leaves and stems starting to grow.



In order to grow potato plants, potato tubers are planted in the ground. Soon after planting, roots, stems and leaves start to grow from the tuber.



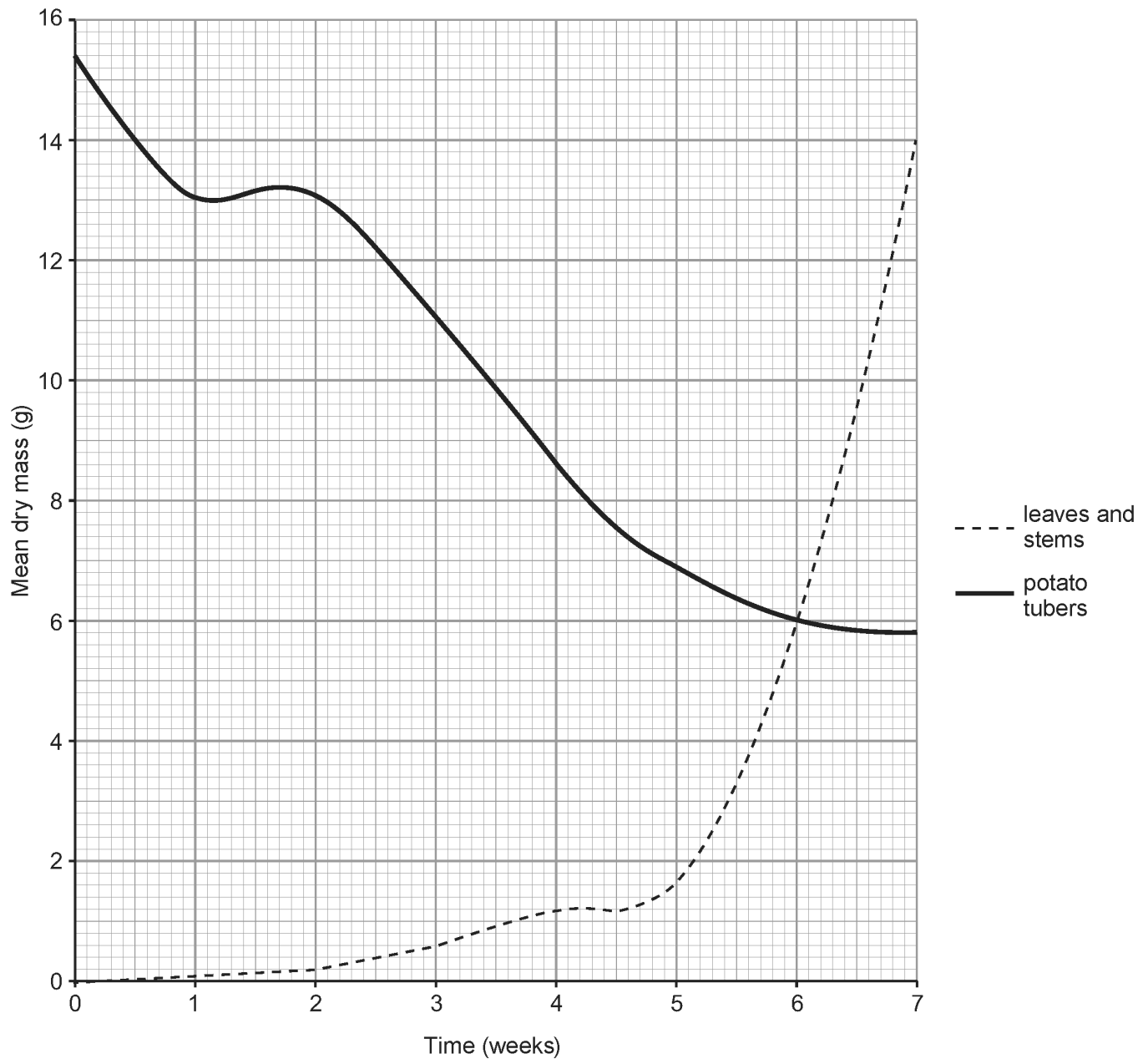
growth of potato plant during the first 7 weeks

A scientist investigated the changes in the dry mass of the leaves, stems and potato tubers of a group of plants during their first 7 weeks of growth.

dry mass = fresh mass – mass of water contained in plant

The plants were grown in identical conditions. Each week 10 plants were collected and their mean dry mass was recorded.

The following graph shows the changes in the mean dry mass of the potato tubers and the mean dry mass of the leaves and stems during the 7 week period.



(a) From the graph state:

- (i) the relationship between the dry mass of the potato tubers and the dry mass of the leaves and stems. [1]

.....

- (ii) the time taken for the mean dry mass of the stem and leaves to equal the mean dry mass of the potato tubers. [1]

..... weeks

(b) A potato tuber was cut in half and its surface was flooded with iodine solution. The iodine changed from a brown to a blue-black colour.

(i) Name the substance that caused this colour change. [1]

.....

(ii) Explain the changes in mean dry mass of the potato tubers during the first 7 weeks of growth of the plants. [2]

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(iii) Between weeks 6 and 7 the mean dry mass of the tuber decreased by 0.2 g but the mean dry mass of the leaves and stems increased by 8.0 g. Explain how a process taking place in the plant caused the dry mass of the leaves and stems to increase. [2]

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13.

(a) Complete the sentences below. [2]

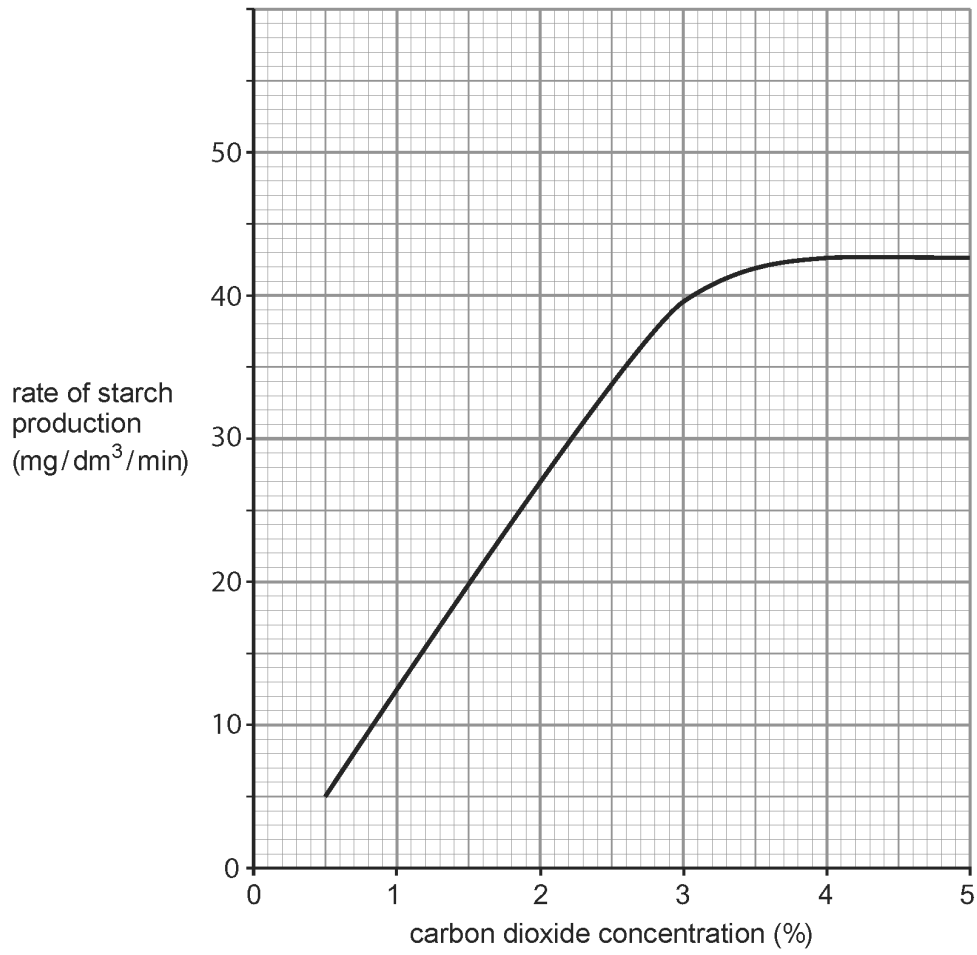
During photosynthesis chlorophyll absorbs energy. Carbon dioxide and are converted into glucose and

(b) The glucose formed in photosynthesis may be stored as starch. Scientists investigated the effect of different concentrations of carbon dioxide on the rate of photosynthesis in algal cells. They recorded the mass of starch produced.



Large numbers of algal cells in containers with different concentrations of carbon dioxide.

The results of the investigation are shown on the graph below.



From the graph

- (i) Describe the effect of increasing carbon dioxide concentration on the rate of starch production. [2]

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.....

- (ii) Calculate the change in the rate of starch production between levels of 1.5% and 2.5% carbon dioxide. [2]

..... (mg/dm³/min)

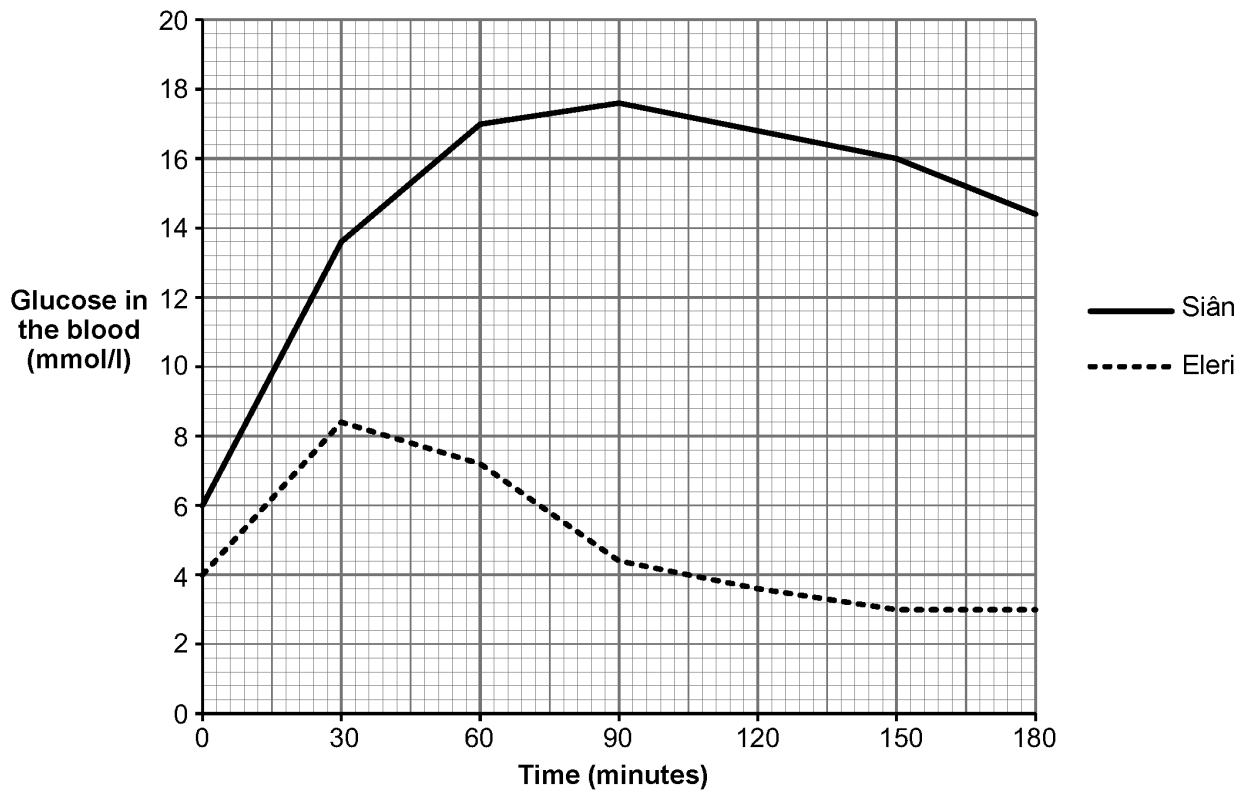
- (c) A chemical is used to indicate the presence of starch.
Name the chemical and describe the colour change that would indicate a positive result. [2]

Chemical:

Colour change:

14.

Eleri and Siân ate identical meals. After the meal the concentration of glucose in their blood was measured at regular intervals over the next 180 minutes. The graph below shows the results obtained.



- (a) The meal both Eleri and Siân ate contained no added glucose or other sugars. Suggest which type of food in the meal could have caused the increase in blood sugar. [1]

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- (b) It is important that the concentration of glucose in the blood remains between 3.5 and 7.5 mmol/l. Explain how the level of glucose in Eleri's blood is reduced after 30 minutes. [2]

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(c) What evidence, shown in the graph, suggests that Siân is suffering from diabetes? [1]

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.....

(d) A student tested an artificial urine sample for the presence of glucose.

In the table below **circle**

- **one** correct **chemical test** for glucose.
- the correct **process** for that test.

Complete the third column to show a positive result for the artificial urine test you have chosen. [2]

chemical test	process	colour of positive result for glucose
Biuret test	dip in urine sample	
Benedict's test	mix with urine sample and heat gently	
Iodine test	mix with urine sample and cool in refrigerator	
Diastix / Clinistix	mix with urine sample and heat strongly	

15. (a) State the meaning of the term diffusion. [1]

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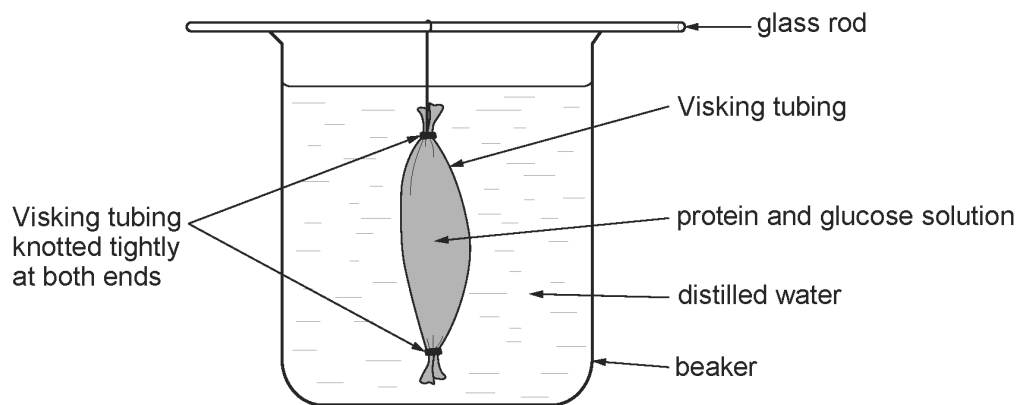
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(b) After a lesson on the properties of cell membranes a year 10 class was asked to investigate some of these properties using Visking tubing. They were given the following instructions:

- Soak a 15 cm length of Visking tubing in water to soften it.
- Tie a knot in one end of the tube.
- Fill the tube with a solution made up of protein and glucose dissolved in water.
- Tie a knot in the open end of the tube.
- Wash the tube under a stream of tap water for 15 seconds.
- Using a glass rod suspend the Visking tubing in a beaker of distilled water.



The diagram below shows how your apparatus should appear.



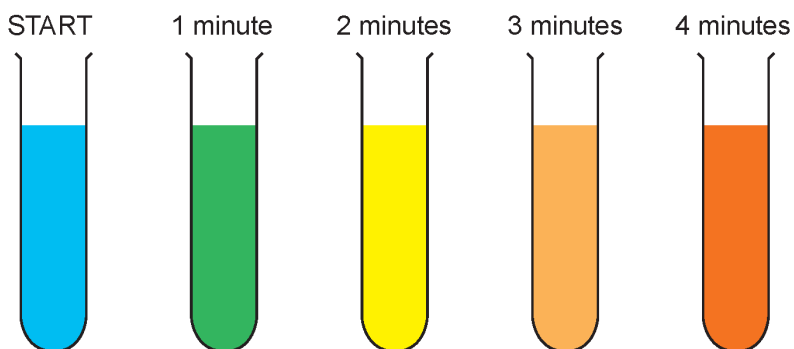
(i) Why were the students instructed to 'wash the tube under a stream of tap water for 15 seconds'? [1]

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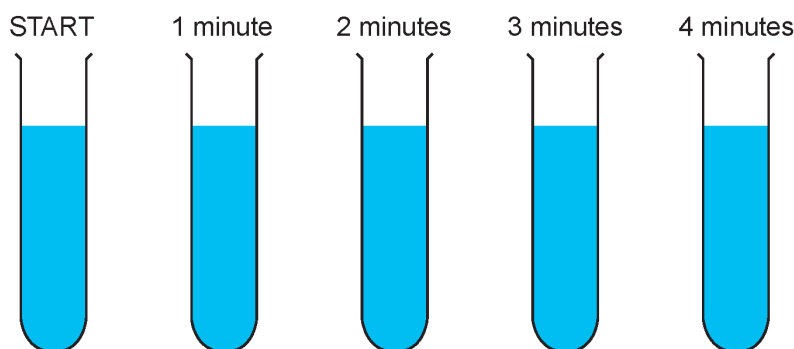
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The students were asked to sample the distilled water **in the beaker** for the presence of both glucose and protein at the start of the experiment and every minute for the next four minutes. Dafydd decided to photograph his results on his smart phone. The photographs he obtained are shown below.

Benedict's test for glucose



Biuret test for protein



- (ii) Explain Dafydd's results, **at four minutes**, for the contents of the **beaker** for both the Benedict's test and the Biuret test.

Benedict's test

[3]

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Biuret test

[3]

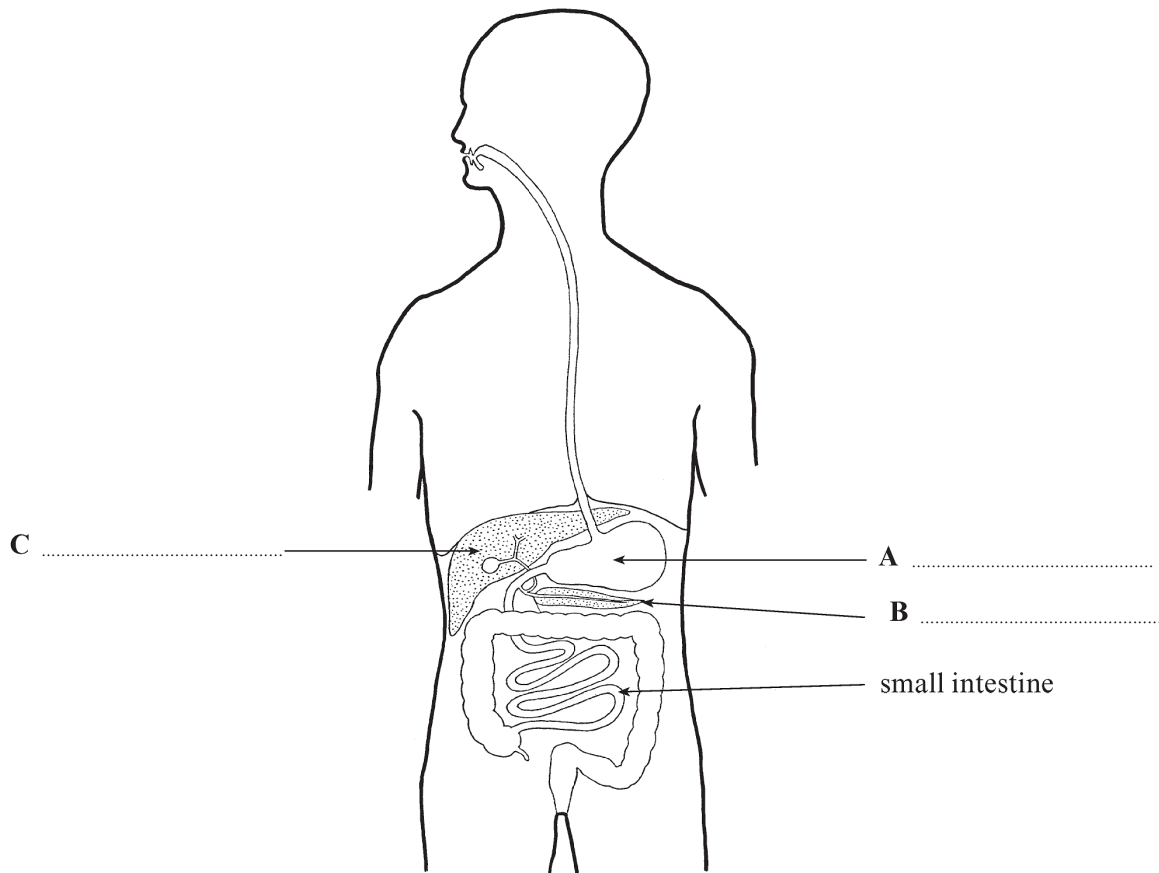
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16. (a) Label **A**, **B** and **C** on the diagram of the human digestive system shown below. [3]



- (b) Complete the table below by writing your answers on the dotted lines [3]

Digestion in the small intestine

Substance digested	Enzyme	Digested product(s)
.....	carbohydrase	glucose
fats	.....	fatty acids and

- (c) Which solution would be used to identify protein in a sample of food? Underline the correct answer below. [1]

Benedict's solution

Biuret solution

bicarbonate solution

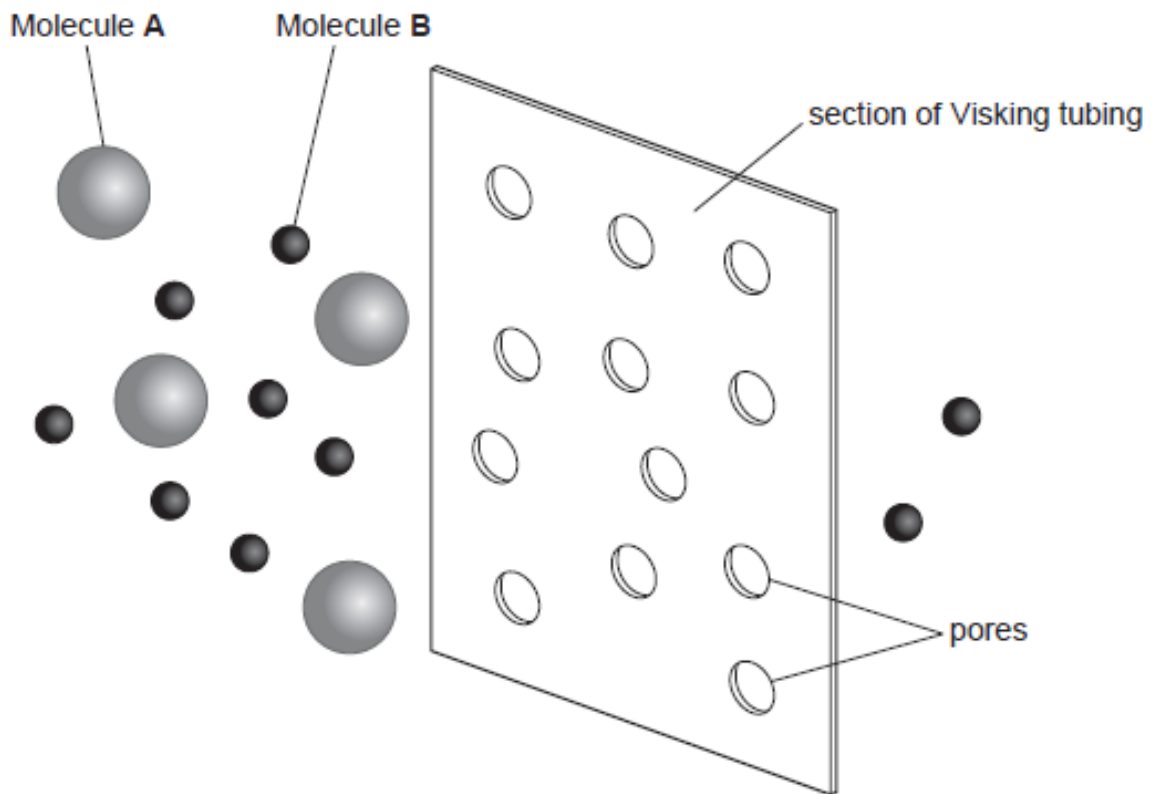
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17. (a) What is meant by the term selectively permeable membrane?

[1]

Visking tubing can be used as a model of the cell membrane.

The diagram below shows a section of Visking tubing working in the same way as a selectively permeable membrane.



Use the diagram above and your own knowledge to answer the following:

(b) (i) State the process by which molecules could pass through the Visking tubing. [1]

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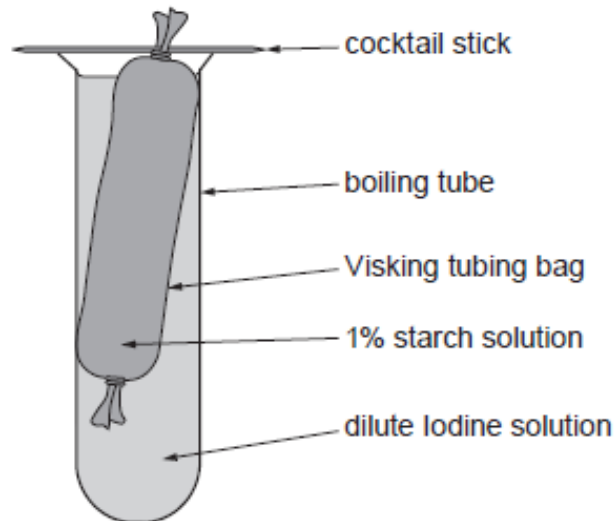
(ii) Identify which molecules pass through the Visking tubing. Explain your answer. [2]

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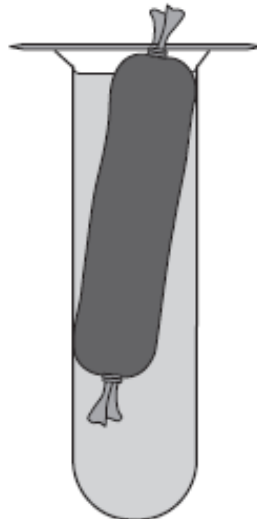
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(c) Students were instructed to set up the following apparatus.



The appearance of the apparatus after 15 minutes is shown below.



(i) Explain why the colour of the contents inside the Visking tubing turned blue black. [3]

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(ii) Explain why the colour of the Iodine solution in the boiling tube did not change. [2]

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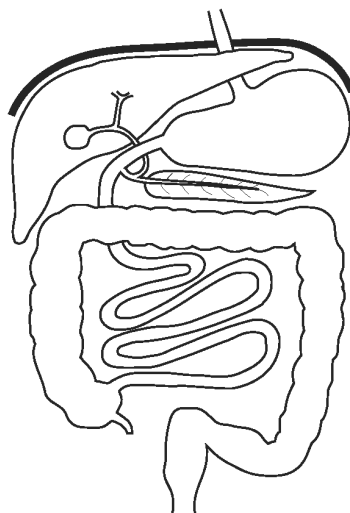
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(d) Name **one** substance required for respiration that would pass into a cell. [1]

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18.


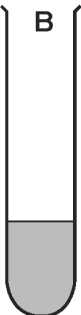
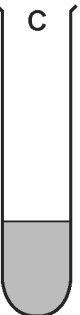


The diagram below shows part of the human digestive system.



(a) On the diagram above label the following: [2]

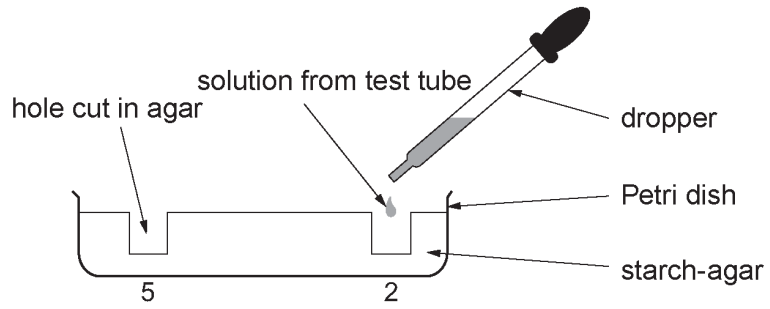
- A pancreas
- B bile duct

(b) The diagram below shows five test tubes A – E and their contents. The pH and temperature of each is also shown.

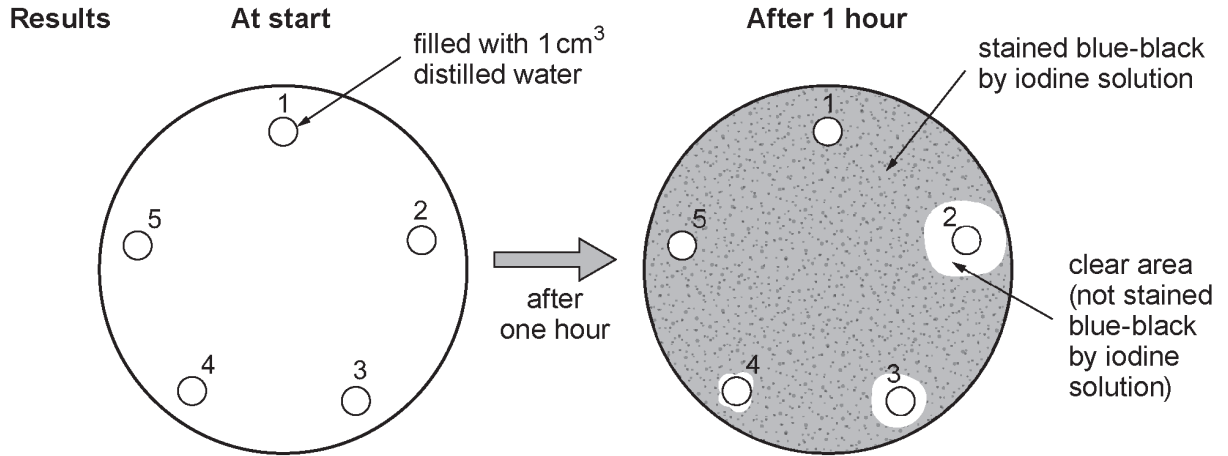
	Solution				
	Distilled water	0.5% amylase	1% amylase	1% amylase	2% amylase
tube	A 	B 	C 	D 	E 
temperature (°C)	37	37	100	37	37
pH	7	7	7	7	7

A pupil carried out the following procedure:

- She took a Petri dish containing starch-agar (a set jelly in which starch had been dissolved).
- She cut five small holes in the jelly (holes 1 – 5).
- She put 1 cm³ distilled water from Tube A into hole 1.
- Holes 2 – 5 were each filled with 1 cm³ of a different solution from one of test tubes B, C, D or E.
- After one hour she flooded the Petri dish with iodine solution.



Cross-sectional diagram showing two of the five holes.



(i) Explain the appearance of the clear areas. [1]

.....

.....

(ii) State the solution that was added to hole 2. Explain your answer. [2]

.....

.....

(iii) Which hole contained the contents of tube C? Explain your answer. [4]

Hole number

Explanation

.....

.....

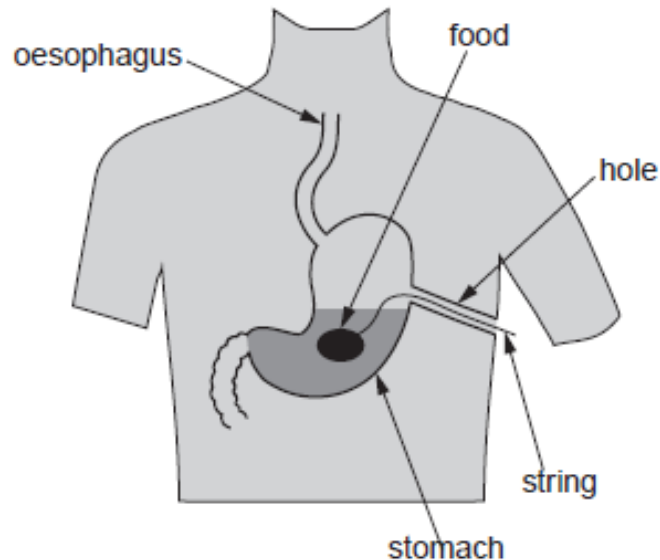
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(c) State the purpose of tube A, the contents of which was put into hole 1. [1]

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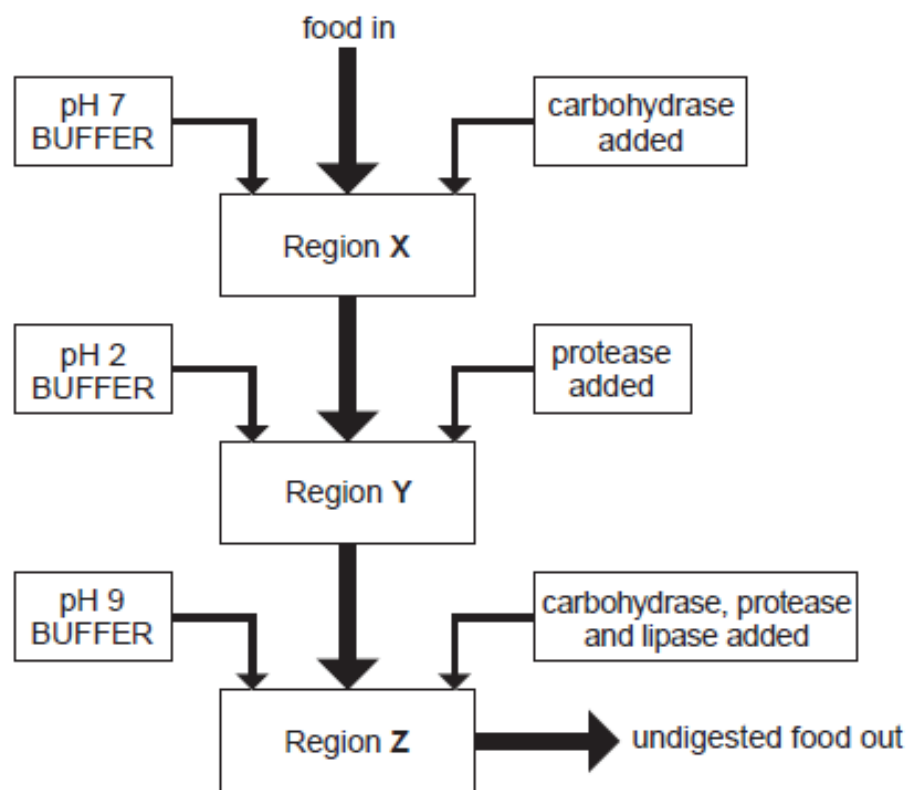
19. On June 6, 1822 Alexis St. Martin, was accidentally shot in the stomach from close range. Dr. William Beaumont treated his wound, but expected Alexis to die from his injuries. Alexis survived, but with a hole through his abdomen wall into his stomach that never fully healed.
- Dr. Beaumont began to carry out experiments on digestion by tying a piece of food to a string and inserting it through the hole into Alexis' stomach. Every few hours, Beaumont would remove the food and assess how much digestion had happened. Beaumont also extracted a sample of gastric juice from the stomach. Analysis showed that the gastric juice was acidic.

Fig 1 – Diagram showing Dr. Beaumont's experiment



Scientists can now follow the digestion of food in detail by using an artificial gut. The diagram below shows how an artificial gut works. (Note: a pH buffer is a chemical that keeps pH constant.)

Fig 2 – Flow chart of an artificial gut



(a) (i) State the region of the artificial gut that represents the stomach. [1]

.....

(ii) Explain why the pH of each region needs to be different. [2]

.....

.....

(iii) State **one other** factor that would need to be controlled to ensure valid results from an artificial gut. [1]

.....

(iv) State the role of lipase in region **Z**. [1]

.....

(b) One of Dr. Beaumont's experiments involved inserting meat on a piece of string through the hole in Alexis' stomach and observing the time taken for the meat to disappear.

Explain why the meat disappeared. [2]

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.....

(c) Suggest **two** reasons why scientists prefer to use an artificial gut rather than using human trials. [2]

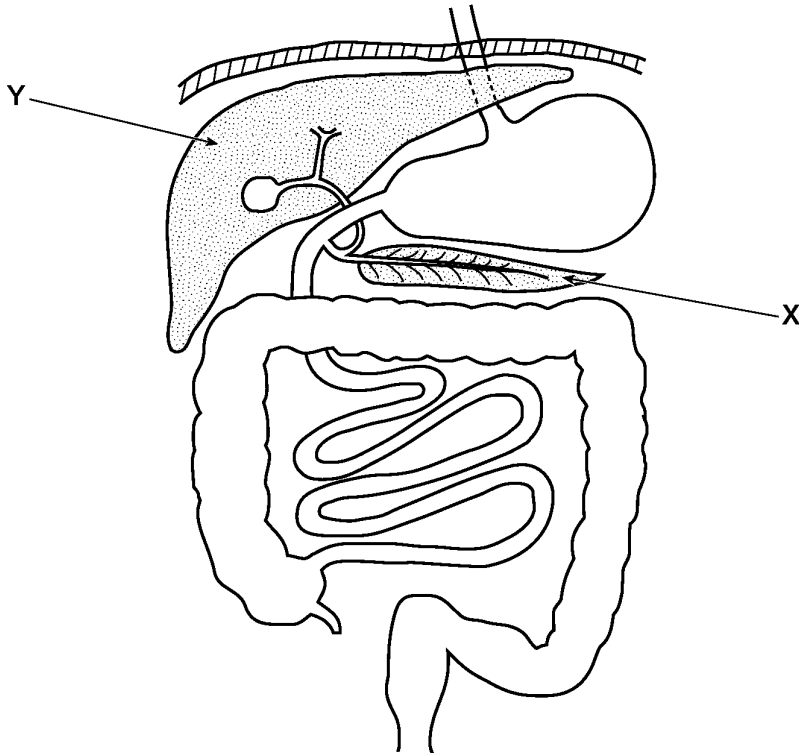
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20.

This question is about the control of blood sugar.

(a) The diagram shows part of the human body with two labelled organs, X and Y.



(i) Insulin is produced in organ X.

State the name of organ X.

[1]

.....

(ii) Insulin has its effect in organ Y.

State the name of organ Y.

[1]

.....

(iii) How does insulin travel from organ X to organ Y?

[1]

.....

- (b) In Wales, in 2010, the cost of treating diabetes was £500 million.
1. The percentage of the population with type 2 diabetes is increasing.
 2. The percentage of the population who are obese is increasing.
 3. The population is increasing.

Using the three statements above, which of the following (A, B or C) shows that the cost of treating diabetes will increase in the future? [1]

- A. 1
- B. 1 and 2
- C. 1, 2 and 3

Answer

- (c) Complete the following sentence. [1]

Diabetes may be diagnosed by testing a sample of urine for presence of

.....

- (d) Suggest **two** healthy lifestyle choices which might help prevent the development of type 2 diabetes. [2]

.....

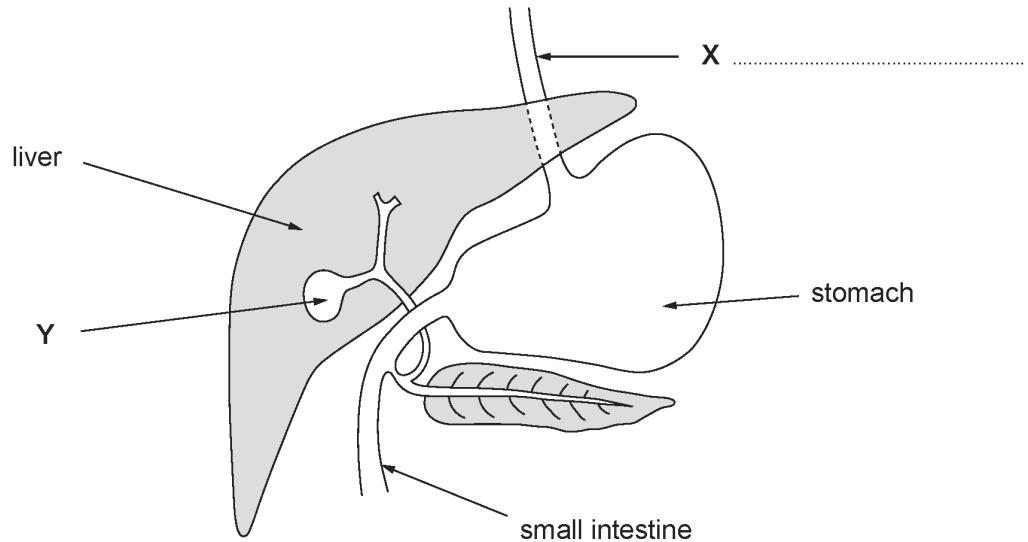
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21.

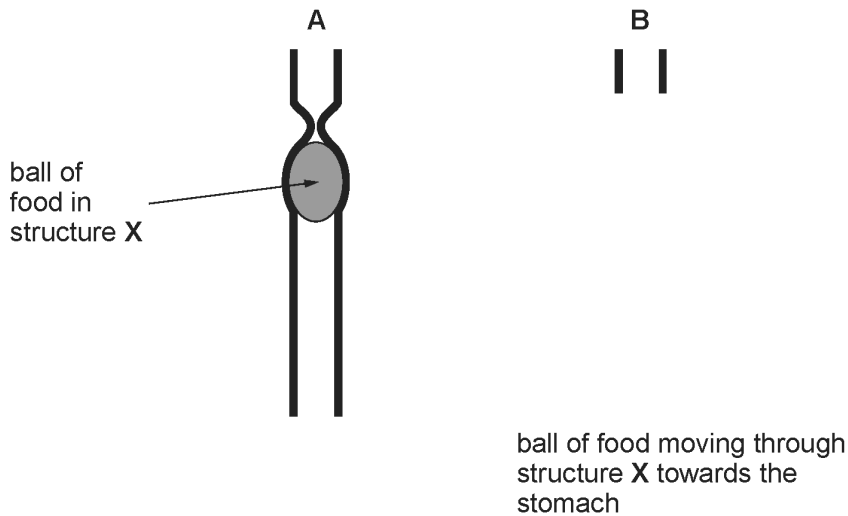
The diagram below shows part of the human digestive system.



(a) (i) **Label** the structure **X** on the **diagram**. [1]

(ii) The diagram below shows structure **X** in detail. In part **A** of the diagram, a ball of food has just entered structure **X**.

Complete part B of the diagram to show the ball of food after it has moved further towards the stomach. [2]



(iii) Name the process which causes the ball of food to move along structure **X** and state how muscles cause this movement to occur. [2]

I. Name of process

II. How muscles make the movement occur

(b) (i) Name structure **Y**, shown on the diagram of the digestive system, which stores bile from the liver. [1]

.....

(ii) Describe how bile helps in the digestion of food by enzymes. [2]

.....
.....

22.

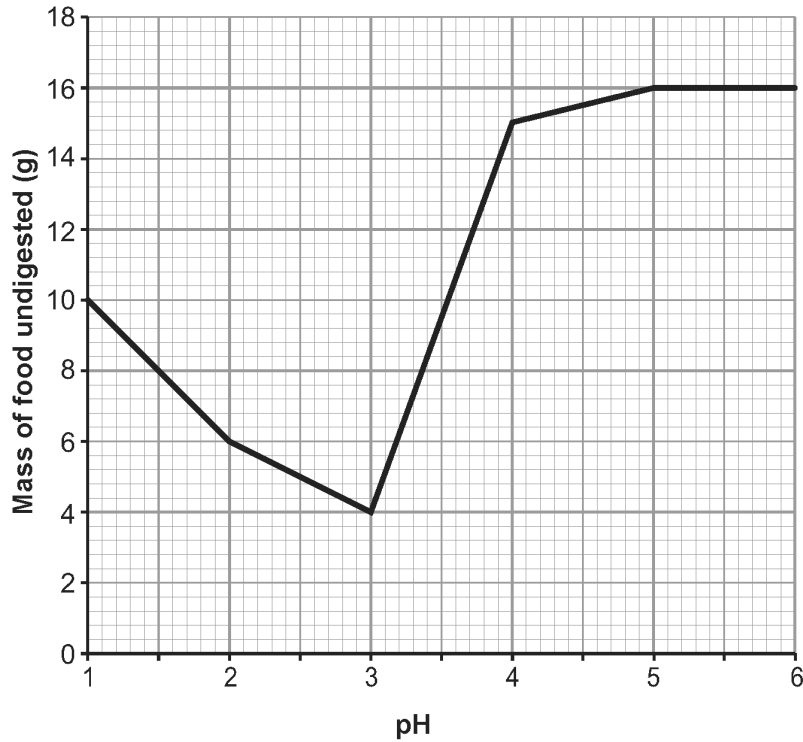
- (a) The following statement refers to a process that occurs in the digestive system.
'The muscles in front of the food relax whilst the muscles behind the food contract.'

Name the process being described.

[1]

.....

- (b) The graph shows the results of an investigation into the activity of an enzyme at various pH levels. The enzyme was acting on a food substance and the mass of this food substance remaining undigested at each of the pH levels was recorded.



- (i) State what happens to the mass of undigested food from pH3 to pH6. [2]

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

- (ii) State the optimum pH of this enzyme. [1]

.....

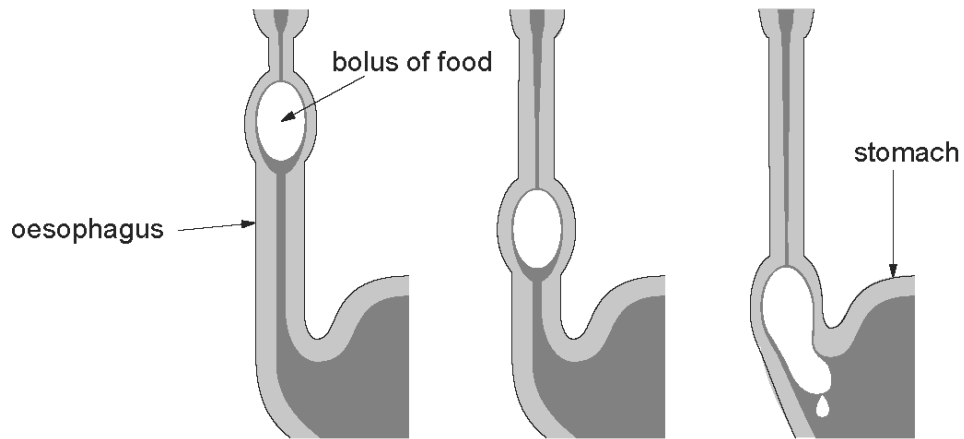
- (iii) Name the organ in the human body where this enzyme is found and name the class of food it acts on. [2]

organ

food substance

23.

The diagram shows a process occurring in the human digestive system.



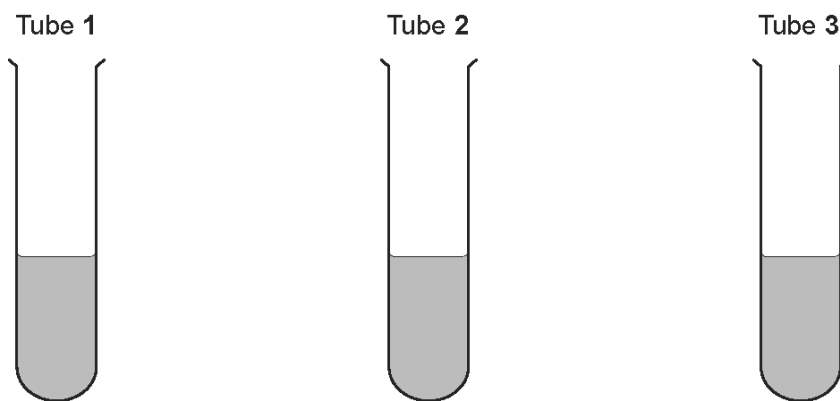
(a) (i) Name the process shown in the diagram. [1]

.....

(ii) Explain how the bolus of food is moved along the oesophagus. [2]

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

The apparatus shown below was used to investigate the effect of washing-up liquid (detergent) on the digestion of fat by lipase.



Contents Tube 1	Contents Tube 2	Contents Tube 3
full fat milk (50 cm ³)	full fat milk (50 cm ³)	full fat milk (50 cm ³)
washing-up liquid (5 cm ³)	water (5 cm ³)	washing-up liquid (5 cm ³)
water (5 cm ³)	2% boiled lipase solution (5 cm ³)	2% lipase solution (5 cm ³)

The 3 tubes were left at 20 °C for 60 minutes and the pH of the contents of each tube was measured every 15 minutes. The results are shown in the table below.

Time (minutes)	pH		
	Tube 1	Tube 2	Tube 3
0 (start)	8.5	6.7	8.5
15	8.5	6.7	7.4
30	8.5	6.7	6.6
45	8.5	6.7	6.3
60	8.5	6.7	5.9

(b) Explain the results for Tube 3. [3]

.....

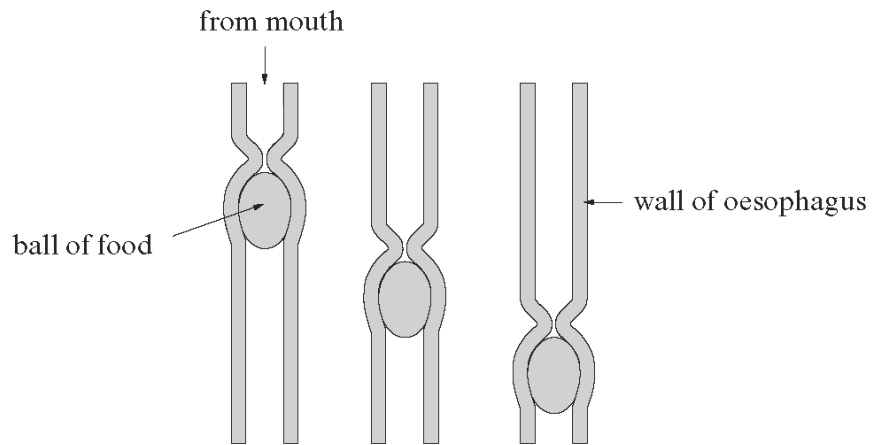
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24.

The diagram shows a ball of food moving along the oesophagus (gullet).



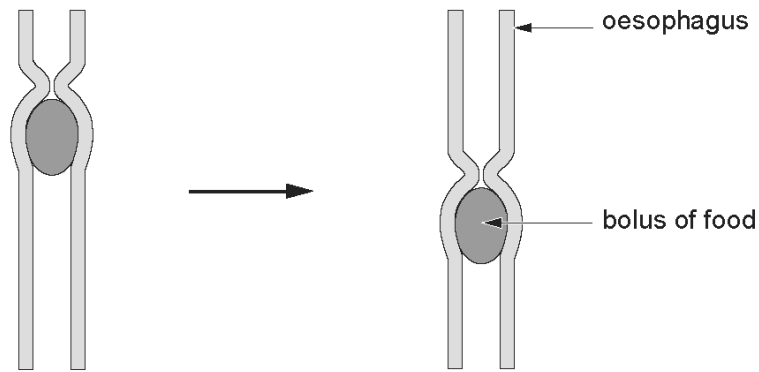
(a) What name is given to this process? [1]

(b) Explain how the ball of food is moved along the oesophagus. [2]

3

25.

The diagram below shows some food passing through part of the human digestive system.



(a) (i) Name the process by which the food is moved. [1]

.....

(ii) Food passes through different parts of the digestive system. Which letter, A, B, C or D shows the correct order? [1]

- A stomach → oesophagus → large intestine → small intestine
- B oesophagus → stomach → small intestine → large intestine
- C stomach → small intestine → large intestine → oesophagus
- D oesophagus → small intestine → stomach → large intestine

Answer

(b) Complete the table below about the digestion of food. [3]

food	enzyme	digested food
.....	carbohydrase	glucose
fat	.....	fatty acids and

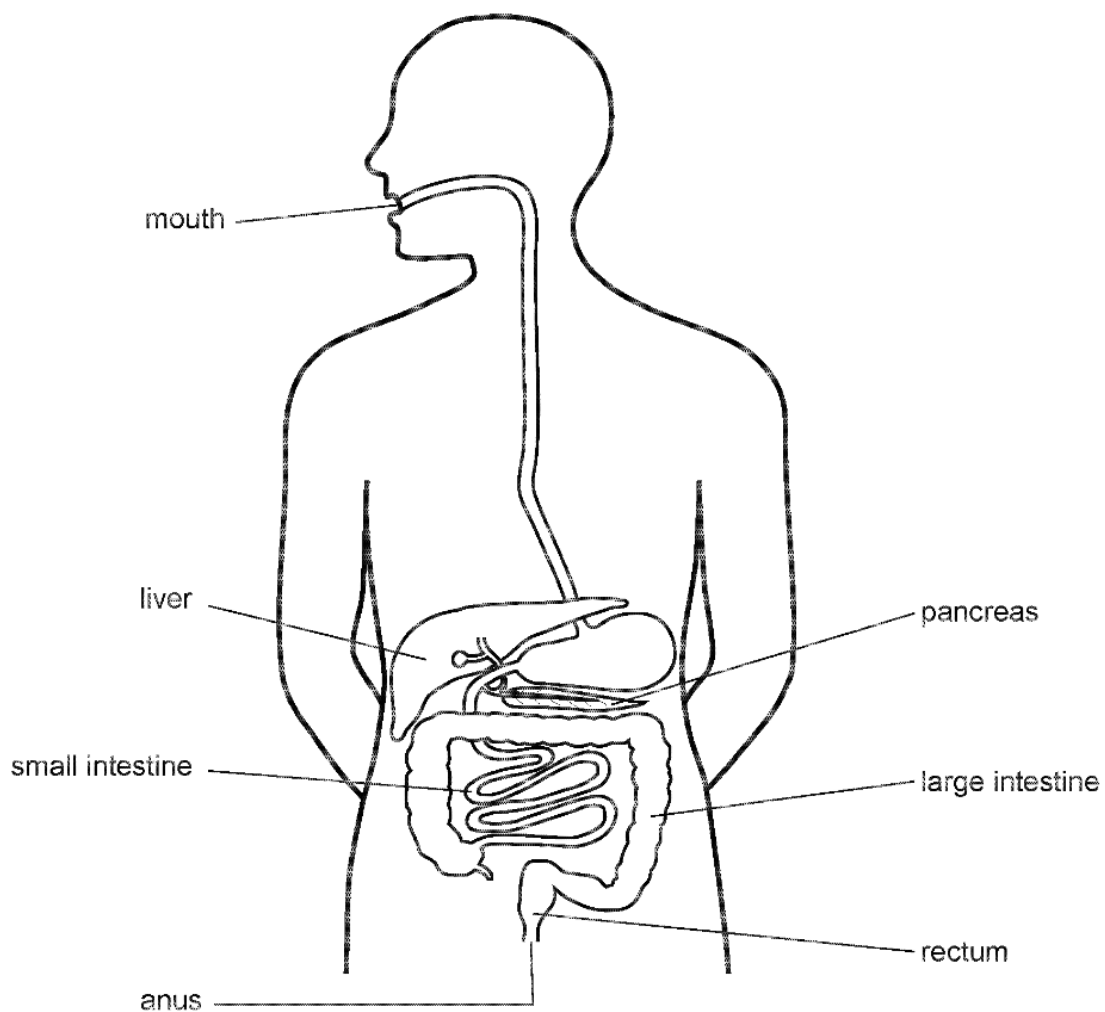
(c) State a function of the *large* intestine. [1]

.....

6

26.

The diagram shows the human digestive system.



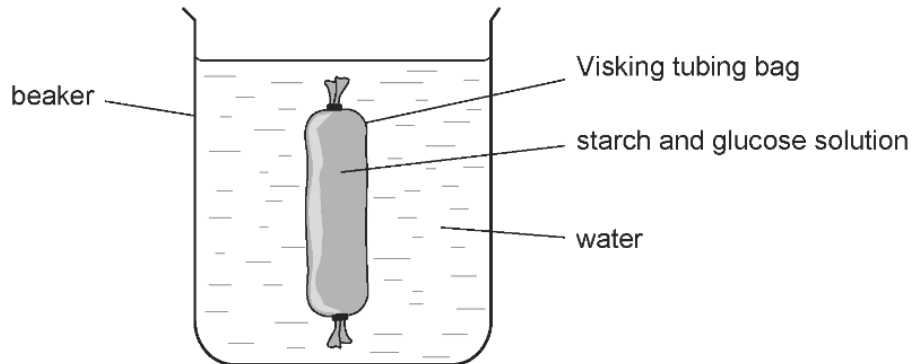
- (a) State which of the **labelled parts** in the above diagram absorbs digested food molecules. [1]

.....

(b) Visking tubing acts as a model of absorption in the digestive system.

The diagram shows a Visking tubing bag filled with a solution of starch and glucose, in a beaker of water.

Samples from inside the Visking tubing bag and the water in the beaker were tested for starch and glucose at the start. This was repeated after 10 and 20 minutes.



(i) Complete the table below by writing a ✓ or x in each space to show the expected results at 10 and 20 minutes. [3]

key: ✓ molecule present x molecule absent

Sample tested	Tested for	Start	Time after start (minutes)	
			10	20
Contents of Visking tubing bag	starch	✓	✓	✓
	glucose	✓	✓	.....
Water in the beaker	starch	x	.....	.....
	glucose	x	.....	.....

(ii) Use your knowledge of the size of starch and glucose molecules to explain the expected results at 20 minutes for the water in the beaker. [2]

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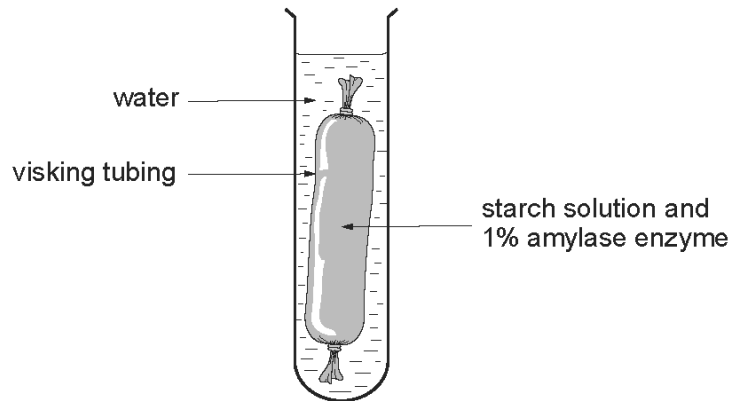
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27.

An experiment was set up using visking tubing as a model gut. This is shown in the following diagram. The visking tubing was filled with a starch solution and 1% amylase enzyme. After 30 minutes the water surrounding the visking tubing was tested and found to contain glucose but no starch.



Explain why glucose appeared in the water surrounding the visking tubing but no starch was found. Include in your account a description of how the water was tested for glucose using Benedict's solution and for starch using iodine solution giving the expected observations.

[6 QWC]

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