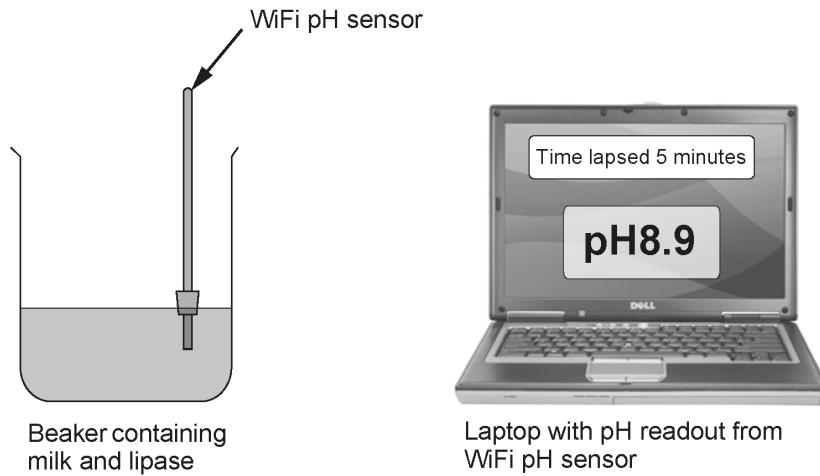


1.

An experiment was set up to investigate the digestion of fat in milk by lipase. The following apparatus was used.



The beaker containing milk and lipase was kept at a constant temperature in a water bath. The pH readout on the laptop was recorded every 5 minutes for 40 minutes. The results are shown below.

time (minutes)	pH
0	9.1
5	8.9
10	8.8
15	8.7
20	8.6
25	7.5
30	7.0
35	6.4
40	5.9

(a) Explain why the pH changed during the experiment.

[2]

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- (b) (i) The average rate of fall in pH in the first 20 minutes is 0.025 pH units per minute. After 20 minutes bile was added to the beaker. Calculate the average rate of fall in pH units per minute in the 20 minutes after the bile was added. [1]

..... pH units per minute

- (ii) Explain why the rate of fall in pH increased when bile was added. [3]

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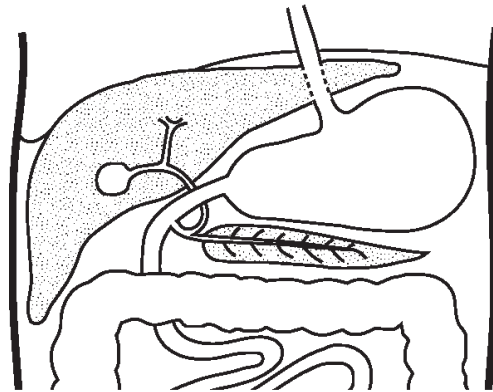
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2.

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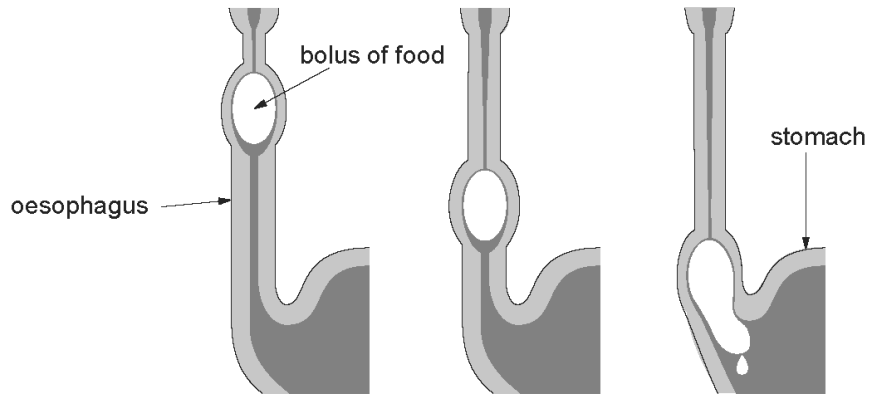
- (iii) Apart from fatty acids, name another product of lipid digestion which could have been tested for during this experiment. [1]

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6

3.

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



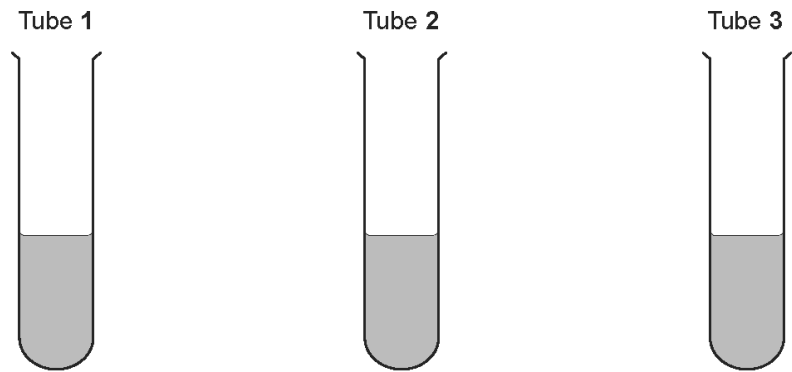
(a) (i) Name the process shown in the diagram. [1]

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

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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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4.

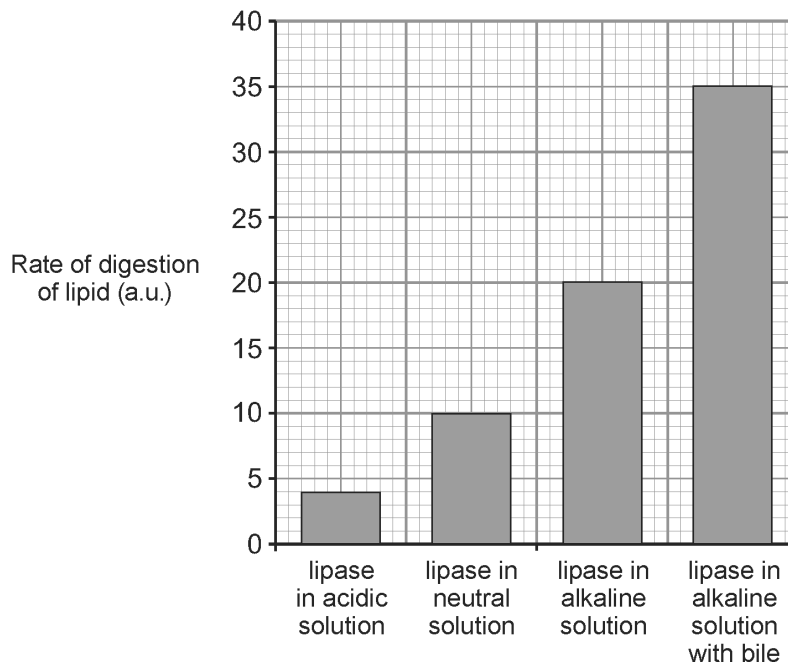
(a) Why do we need to digest large food molecules?

[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.

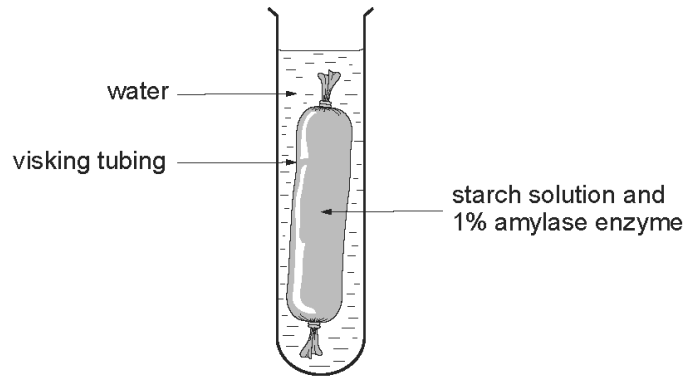
[2]

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5.

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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6.

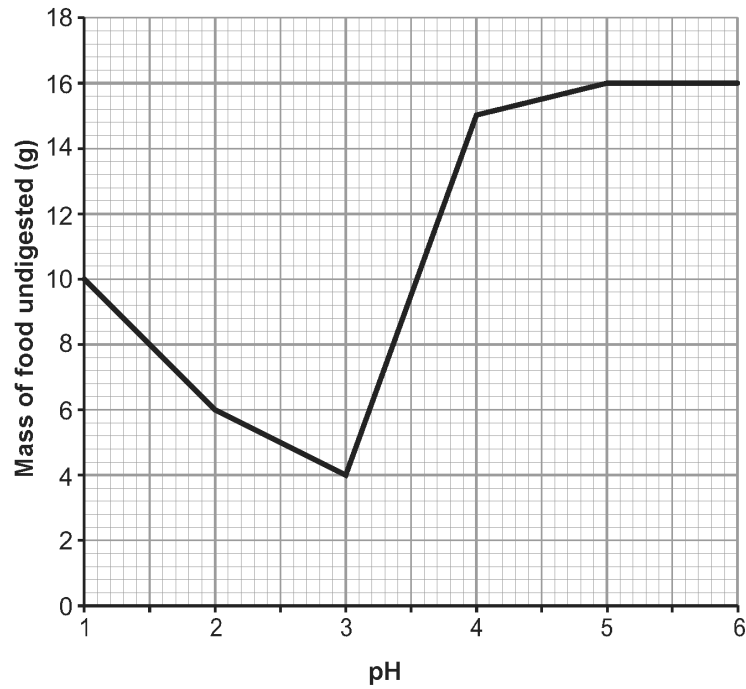
- (a) The following statement refers to a process that occurs in the digestive system.
'The muscles in front of the food relax whilst the muscles behind the food contract.'

Name the process being described.

[1]

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- (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]

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

[1]

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- (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

6

Marking Scheme

1.		Question	Marking details	Marks Available
5	(a)		Lipase {digests/ breaks down/hydrolyses} <u>fat</u> (in milk) to fatty acids (and glycerol); Fatty acids {decrease pH/ cause it to become acid}; 2 nd mark only given if 1 st mark awarded	2
	(b)	(i)	0.135;	1
		(ii)	Bile breaks large globules of fat into smaller globules/ bile emulsifies fat; (accept 'pieces', 'chunks', lumps' of fat but <i>NOT molecules</i>) Increasing the surface area for (the action of) {lipase/ enzyme}; More fatty acids produced/ fatty acids produced faster; 3 rd mark only awarded if 2 nd mark awarded	3
Question 5 Total				[6]
2.		Question	Marking details	Marks Available
5	(a)	(i)	Liver – arrow & name;	1
		(ii)	Gall bladder – arrow & name;	1
	(b)	(i)	Bile breaks {down/ up} large {lipid/fat/oil} drop(lets) <u>into</u> small drop(lets); Accept bile emulsifies lipid/fat/oil NOT large molecules into small molecules Ref to pH is neutral for <u>increased/bigger/larger surface area</u> for enzyme/lipase action;	2
		(ii)	All {lipid/ olive oil} digested/enzyme working flat out;	1
		(iii)	Glycerol;	1
Question 5 total				[6]

3.

Question			Marking details	Marks Available
5	(a)	(i)	Peristalsis;	1
		(ii)	<u>Muscles</u> contract; and push/force the food along; 2 nd mark is linked to 1 st mark	2
	(b)	<ul style="list-style-type: none"> Washing-up liquid emulsifies the milk fat/ OWTTE; Increasing the <u>surface area</u> for the action of enzymes/ lipase; enzyme digests (milk) <u>fat</u> into <u>fatty acids</u> (and glycerol) which {<u>lower pH/ more acidic</u>}; 2 nd mark linked to 1 st mark, 3 rd mark is independent	3	
Question 5 Total				[6]

4.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
		(a)		1	Any one from: <ul style="list-style-type: none"> (small enough) to be absorbed/ to make food soluble/ to pass {into the blood/ through the intestine wall}; 	ORA	To make them smaller	
		(b)	i	1	the rate (of digestion) increases when {pH/ alkalinity} increases; it = rate of digestion	ORA At high pH it is faster		
			ii	2	bile emulsifies fat/ bile turns fat into {droplets/ globules}; bile creates greater surface area for {lipase/enzyme} to work on;	Bile breaks down fats into droplets	Bile breaks down fats	
Total Mark				4				

5.

Question		Marking details	Marks Available
9/4		<p>Indicative content:</p> <p>amylase digests/breaks down starch to glucose {pores/holes} in visking tubing/visking tubing is selectively permeable too small for starch <u>molecules/particles</u> to pass through/or ref to molecule size big enough to allow glucose <u>molecules/ particles</u> to diffuse through/or ref to molecule size water heated strongly/boiled with Benedict's reagent positive colour change (reference blue to green/orange/red) iodine solution added to water remains brown</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p> <p>Question 9/4 Total</p>	6
			[6]

6.

Question Number		Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	5					
		(a)	1	Peristalsis;	phonetic spelling		
		(b) i	2	(Mass of food remaining undigested) increases until pH5; {levels off/ plateaus} at pH5; It increases until pH 5 where it levels off (2 marks)			
		ii	1	3;			
		iii	2	Stomach; Protein;			
Total Mark			6				