

**Questions**

**Q1.**

The tips of plant roots are where many cells are dividing by mitosis.

(i) Which term describes the area of a root where many cells are dividing by mitosis?

**(1)**

- A** meristem
- B** root hair cell
- C** xylem
- D** phloem

(ii) Plant root cells contain an enzyme that joins glucose molecules together to make starch.  
Devise a plan to investigate the effect of pH on the activity of this enzyme.

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**(Total for question = 4 marks)**

**Q2.**

A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as shown in Figure 5.

The drop of oil rose to the surface of the water.



(Source: © Nana\_studio/Shutterstock)

**Figure 5**

5 cm<sup>3</sup> of milk B and 1 cm<sup>3</sup> of lipase were added to a different test tube.

The pH of this mixture was pH 7.

This test tube was placed in a water bath for 10 minutes.

The pH of the mixture changed from pH 7 to pH 5.

(i) Explain what caused this change in pH.

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(ii) This procedure was repeated with milk A.

There was no change in the pH of this mixture after 10 minutes.

Explain why there was no change in the pH of the mixture containing milk A.

(2)

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(iii) The student repeated this procedure with lipase that had been boiled and left to cool.

This was added to another sample of milk B.

Describe why the pH did not change in this mixture.

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**(Total for question = 8 marks)**

**Q3.**

A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as shown in Figure 3.

The drop of oil rose to the surface of the water.



(Source: © Nana\_studio/Shutterstock)

**Figure 3**

The student then placed a drop of milk A into one test tube of water and a drop of milk B into a different test tube of water.

The drop of milk A sank to the bottom and the drop of milk B rose to the surface.

Give **one** reason for the drop of milk B rising to the surface.

(1)

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**(Total for question = 1 mark)**

**Q4.**

A scientist investigated how the length of starch grains in potatoes changed when the potatoes were stored in the dark.

Figure 5 shows a potato after being stored in the dark.



**Figure 5**

Three potatoes were used in the investigation.

The length of starch grains in potato 1 were measured at the start.

The length of starch grains were measured in potato 2 after 5 weeks in the dark.

The length of starch grains were measured in potato 3 after 10 weeks in the dark.

Figure 6 shows the results.

potato	time after placing in the dark in weeks	mean length of starch grains in $\mu\text{m}$
1	0	64
2	5	50
3	10	30

**Figure 6**

(i) Calculate the percentage difference in the mean length of starch grains in potato 2 at 5 weeks and in potato 3 at 10 weeks.

(2)

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(ii) State **two** variables the scientist should have controlled to improve this investigation.

(2)

1 .....

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2 .....

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(iii) The starch grains in the potatoes became smaller as the starch was converted into glucose.

State why the potatoes need glucose.

(1)

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(iv) Describe how starch is broken down into glucose.

(2)

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**(Total for question = 7 marks)**

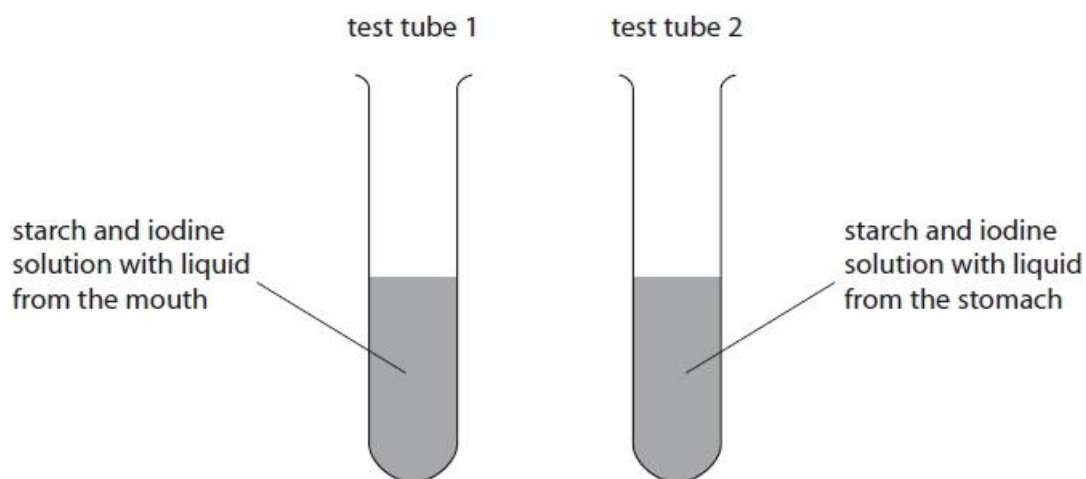
**Q5.**

Starch is a nutrient in food.

Starch is a source of energy.

Enzymes from different parts of the digestive system were used to investigate the breakdown of starch.

Figure 10 shows the apparatus used in this investigation.



**Figure 10**

The colour of the contents of each test tube was recorded every two minutes for a total of ten minutes.

The results are shown in Figure 11.

time in minutes	colour of the contents of each test tube	
	test tube 1 starch and iodine solution with liquid from the mouth	test tube 2 starch and iodine solution with liquid from the stomach
0	blue-black	blue-black
2	blue-black	blue-black
4	brown	blue-black
6	orange	blue-black
8	orange	blue-black
10	orange	blue-black

**Figure 11**

(i) Give **one** reason why the contents of both test tubes were blue-black at the beginning of the investigation.

(1)

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(ii) Explain the results of this investigation after ten minutes.

(3)

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**(Total for question = 4 marks)**



Q6.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Trypsin is a protease enzyme used in the manufacture of food for babies.

(i) Which food group is digested by trypsin?

(1)

- A carbohydrates
- B lipids
- C fibre
- D proteins

(ii) The food is mashed before the trypsin is added.

Explain the advantage of mashing the food before adding the trypsin.

(2)

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(Total for question = 3 marks)

Q7.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Chymosin is an enzyme that causes milk to curdle.

When milk curdles the proteins in the milk clump together and become solid.

As part of an investigation, milk was heated in test tubes to different temperatures using a Bunsen burner.

Two drops of chymosin solution were added to each test tube and the time taken for the milk to curdle was recorded.

Figure 11 shows the results.

temperature of the milk in °C	time taken for milk to curdle in seconds
25	125
30	105
35	90
40	70
45	75

Figure 11

(i) Which variables need to be kept constant in this investigation?

(1)

- A the volume of milk and the time
- B the temperature and the time
- C the volume of milk and the concentration of chymosin
- D the temperature and the concentration of chymosin

(ii) Explain why the time taken for the milk to curdle decreases from 30°C to 40°C.

(2)

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(iii) Explain what the expected result would be if two drops of chymosin were added to the milk at 70°C in the test tube.

(2)

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(iv) As part of this investigation, test tubes containing only milk were heated to each temperature and no chymosin solution was added.

State why these test tubes containing only milk were used.

(1)

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(v) Describe **two** improvements that could be made to the method of this investigation so that the optimum temperature for chymosin can be found.

(2)

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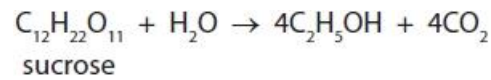
2 .....

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**(Total for question = 8 marks)**

Q8.

The balanced equation for the production of ethanol from the carbohydrate sucrose is



Calculate the minimum mass of sucrose needed to produce 26.9 g of ethanol.

(relative formula masses:  $\text{C}_2\text{H}_5\text{OH} = 46$ ,  $\text{C}_{12}\text{H}_{22}\text{O}_{11} = 342$ )

(2)

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minimum mass of sucrose = ..... g

(Total for question = 2 marks)

Q9.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

At high pH values the active site of the enzyme pepsin changes shape.

When the active site of the enzyme changes shape, the enzyme is

(1)

- A specific
- B denatured
- C digested
- D dead

(Total for question = 1 mark)

Q10.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

A group of pupils investigated the effect of temperature on mould growth on bread. Figure 8 shows the bread after being kept at different temperatures for seven days.

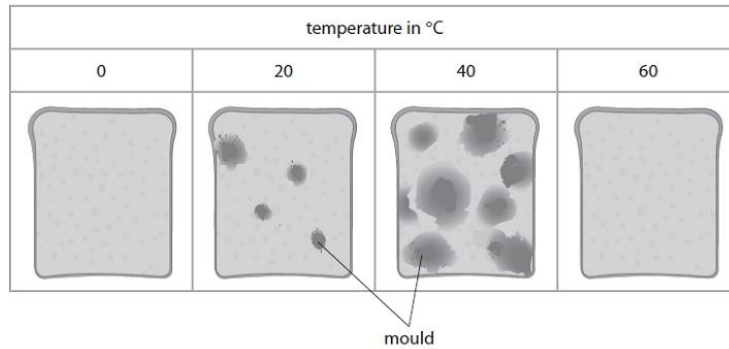


Figure 8

(i) Which is the best estimate of the percentage cover of mould on the bread at 40 °C?

(1)

- A 0%
- B 25%
- C 50%
- D 75%

(ii) State **two** conclusions that can be made about the growth of mould on the bread from 0 °C to 40 °C shown in Figure 8.

(2)

1 .....

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(iii) Explain why there was no mould growing on the bread kept at 60 °C.

(2)

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**(Total for question = 5 marks)**

Q11.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Chymosin is an enzyme that causes milk to curdle.

When milk curdles the proteins in the milk clump together and become solid.

As part of an investigation, milk was heated in test tubes to different temperatures using a Bunsen burner.

Two drops of chymosin solution were added to each test tube and the time taken for the milk to curdle was recorded.

Figure 7 shows the results.

temperature of the milk in °C	time taken for milk to curdle in seconds
25	125
30	105
35	90
40	70
45	75

Figure 7

(i) Which variables need to be kept constant in this investigation?

- A the volume of milk and the time
- B the temperature and the time
- C the volume of milk and the concentration of chymosin
- D the temperature and the concentration of chymosin

(1)

(ii) Explain why the time taken for the milk to curdle decreases from 30 °C to 40 °C.

(2)

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(iii) Explain what the expected result would be if two drops of chymosin were added to the milk at 70 °C in the test tube.

(2)

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(iv) As part of this investigation, test tubes containing only milk were heated to each temperature and no chymosin solution was added.

State why these test tubes containing only milk were used.

(1)

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(v) Describe **two** improvements that could be made to the method of this investigation so that the optimum temperature for chymosin can be found.

(2)

1 .....

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2 .....

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**(Total for question = 8 marks)**

**Q12.**

Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

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**(Total for question = 2 marks)**



## Q13.

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.

Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

The investigation used the enzyme pepsin from the stomach, at a temperature of 37°C and at a pH of 7.

(i) Which statement gives one way to increase the mass of product formed in this investigation?

- A increase the pH
- B decrease the temperature
- C decrease the enzyme concentration
- D increase the substrate concentration

(1)

(ii) Explain why a temperature of 80°C was not used in this investigation.

(3)

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(Total for question = 4 marks)

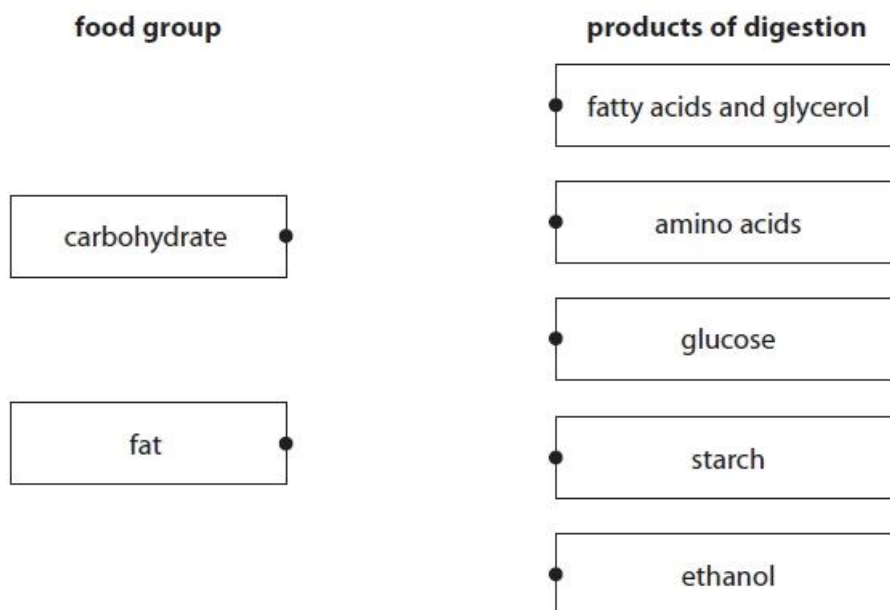
Q14.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Some enzymes are involved in the breakdown of food substances.

(i) Draw **one** straight line from each food group to the products of digestion for that food group.

(2)



(ii) Which enzyme breaks down fat?

(1)

- A carbohydrate
- B amylase
- C protease
- D lipase

(Total for question = 3 marks)

Q15.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Why are enzymes called biological catalysts?

(1)

- A because they slow down biological processes
- B because they speed up biological processes
- C because they denature biological processes
- D because they stop biological processes

(Total for question = 1 mark)

Q16.

Starch is a nutrient in food.

Starch is a source of energy.

Name the enzyme that breaks down starch.

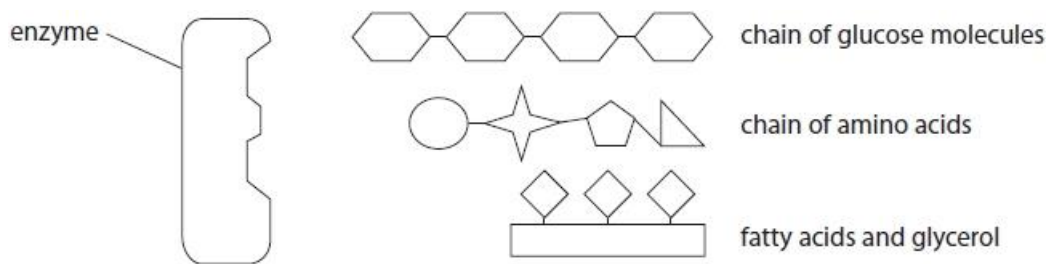
(1)

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(Total for question = 1 mark)

**Q17.**

Figure 15 shows an enzyme and three substrates found in plant cells.

**Figure 15**

The enzyme will only break down one of these substrates.

State the name of this enzyme.

(1)

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**(Total for question = 1 mark)**

**Q18.**

State what is produced when proteins are digested.

(1)

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**(Total for question = 1 mark)**

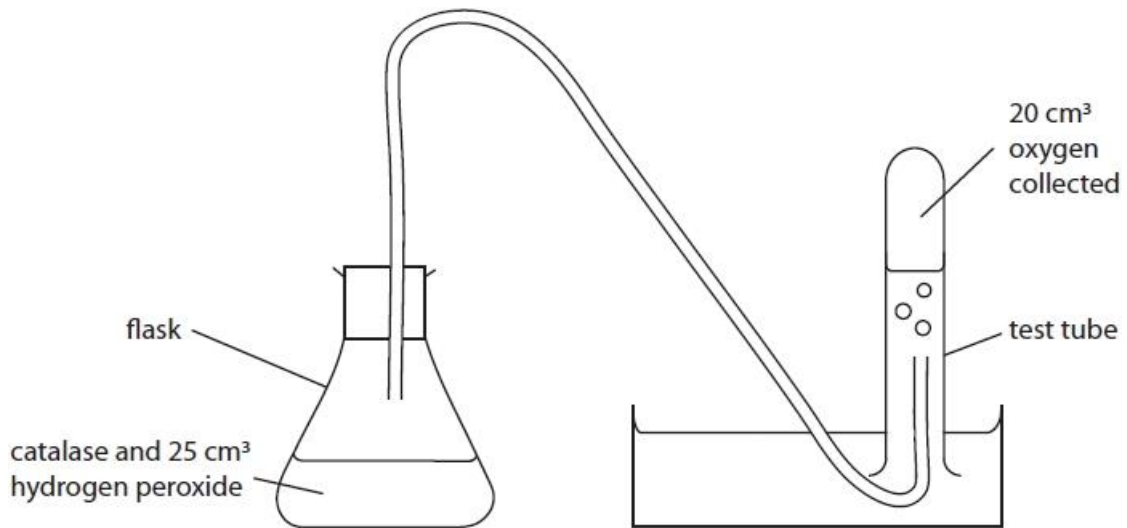
**Q19.**

Many cells contain an enzyme called catalase.

Catalase breaks down hydrogen peroxide into water and oxygen.

A scientist investigated the effect of hydrogen peroxide concentration on the time taken to produce 20 cm<sup>3</sup> of oxygen.

Figure 12 shows the equipment used.



**Figure 12**

(i) State how the scientist could control the temperature of the flask.

(1)

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(ii) Explain why the temperature should be controlled in this investigation.

(3)

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(iii) This investigation used five different concentrations of hydrogen peroxide.

Figure 13 shows the results of this investigation.

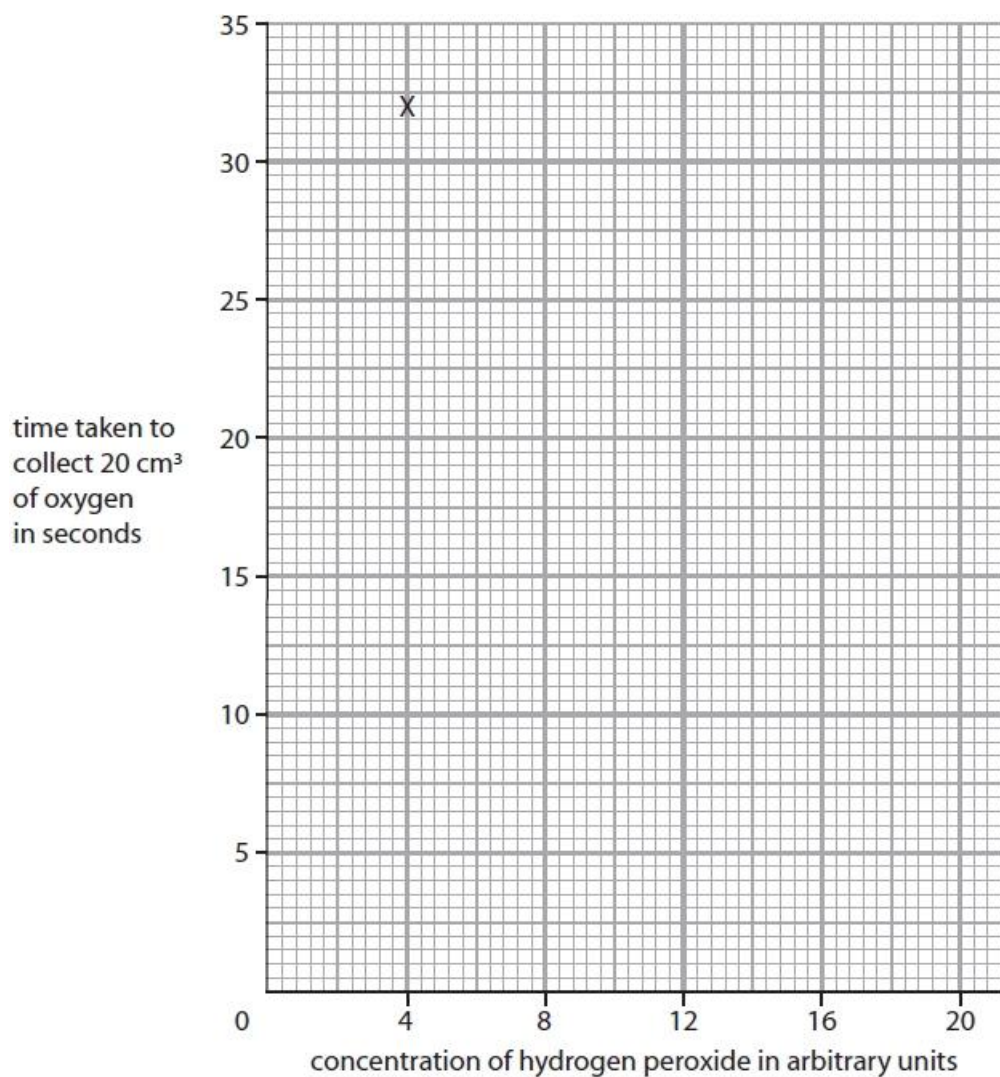
concentration of hydrogen peroxide in arbitrary units	time taken to collect 20 cm <sup>3</sup> of oxygen in seconds
4	32
8	14
12	9
16	7
20	6

Figure 13

Complete the graph by plotting the points and drawing a line to show the trend in the data.

The first point has been plotted for you.

(2)



(iv) Describe the trend shown in the graph.

Use data from the table in Figure 13 to support your answer.

(3)

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**(Total for question = 9 marks)**

**Q20.**

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.

Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

**Figure 6**

The ratio of enzyme concentration to the mass of product formed, using an enzyme concentration of 40 arbitrary units, is 1:1.

Calculate the ratio of enzyme concentration to product formed when the enzyme concentration is 5 arbitrary units.

(2)

ratio .....

**(Total for question = 2 marks)**



Q21.

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.

Figure 6 shows the results of this investigation.

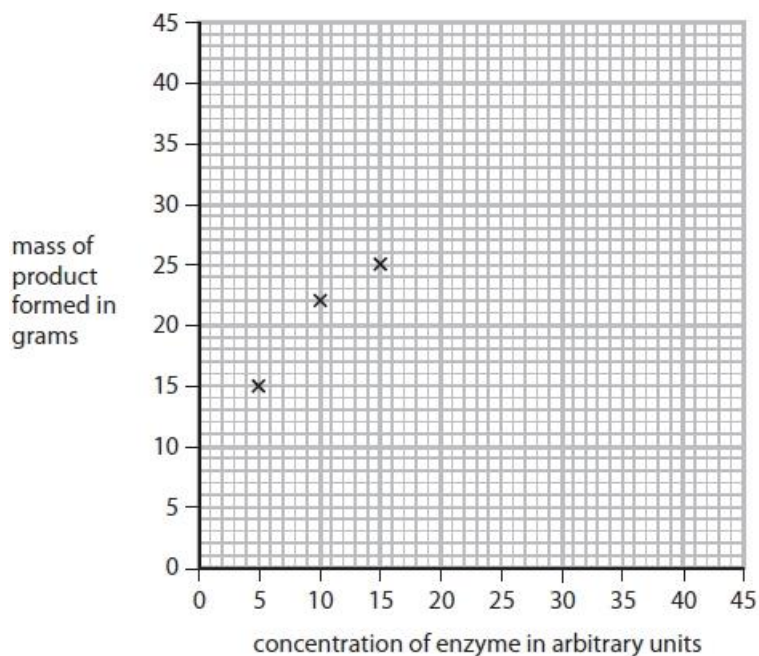
concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

Complete the graph by plotting the points and drawing a line to show the trend in the data.

The first three points have been plotted for you.

(2)



(Total for question = 2 marks)

Q22.

A calorimeter can be used to measure the energy content of food.

Figure 6 shows a simple calorimeter.

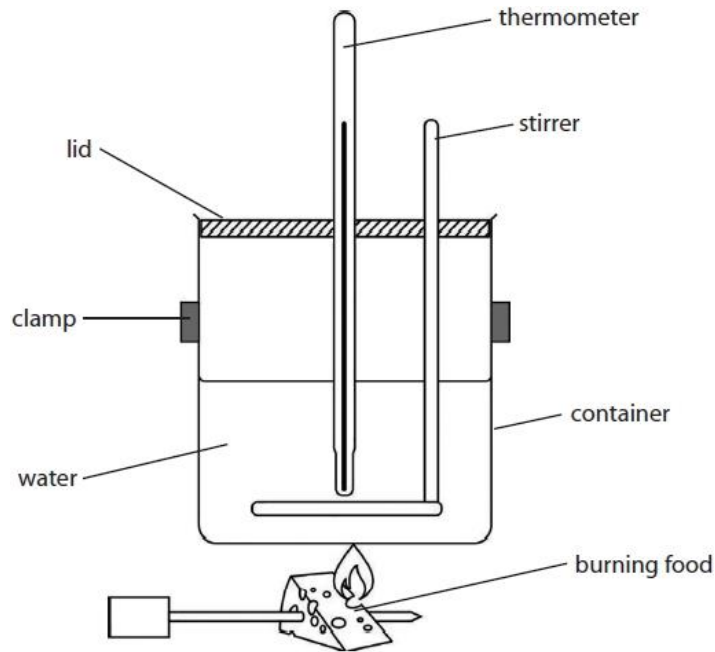


Figure 6

(i) Use words from the box to complete the sentences.

(2)

air	clamp	food
lid	thermometer	water.

The stirrer distributes heat evenly in the .....  
 The calorimeter has a ..... to prevent the loss of heat.

(ii) This calorimeter was used to measure the energy content of a piece of cheese.

Figure 7 shows some of the results.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C
25	21	85

Figure 7

Calculate the energy content of this piece of cheese.

(2)

Use the equation

energy in joules (J) = mass of water × 4.2 × temperature change

energy content of the piece of cheese = ..... J

(iii) The same method was used to calculate the energy content of a different type of cheese.

The results are shown in Figure 8.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C	temperature change in °C
25	21	76	55

Figure 8

Explain **one** reason why the results are different for this type of cheese.

(2)

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(Total for question = 6 marks)

**Q23.**

Gregor Mendel used pea plants in plant breeding experiments. He discovered the basis of genetic inheritance.

Peas contain small amounts of fat.

Describe a test to identify fat.

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(Total for question = 2 marks)

**Q24.**

Describe the chemical test for starch.

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**(Total for question = 2 marks)****Q25.**

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.

Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

**Figure 6**

Describe the effect that enzyme concentration has on the mass of product formed.

**(2)**

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**(Total for question = 2 marks)**

Q26.

Crop plants provide a source of energy in the form of carbohydrates such as starch and sugars.

(i) Describe the test to identify starch.

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(ii) The amount of energy in the sugars extracted from crop plants can be measured using the calorimeter shown in Figure 16.

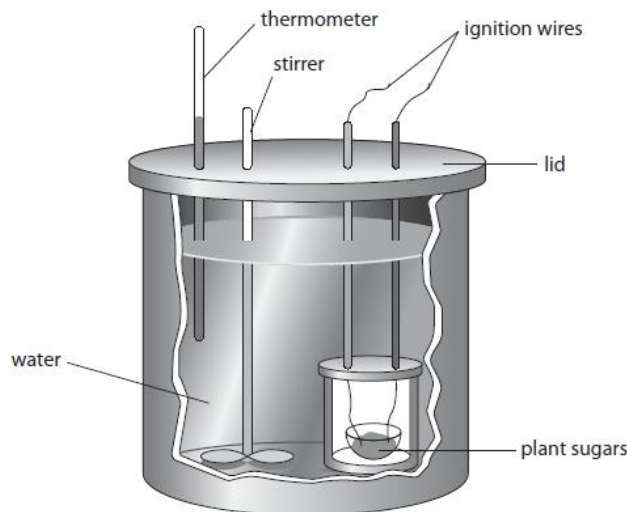


Figure 16

Explain why the calorimeter has a lid.

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(iii) State why it is important to stir the water in the calorimeter.

(1)

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(Total for question = 5 marks)

Q27.

Figure 3 shows the activity of the enzymes pepsin and trypsin at different pH levels.

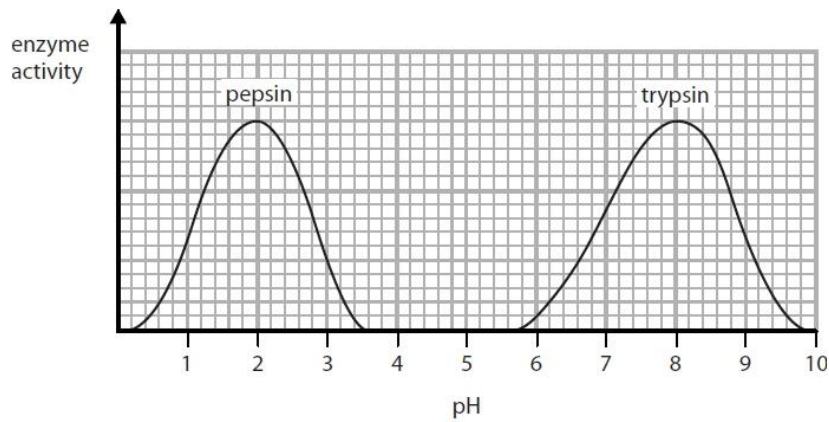


Figure 3

(i) Describe the trend in the graph for the enzyme **trypsin**.

Use data from the graph to support your answer.

(4)

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(ii) State the optimum pH for the enzyme **pepsin**.

(1)

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(iii) Pepsin only works effectively in the stomach.

Describe the conditions in the stomach that allow pepsin to work effectively.

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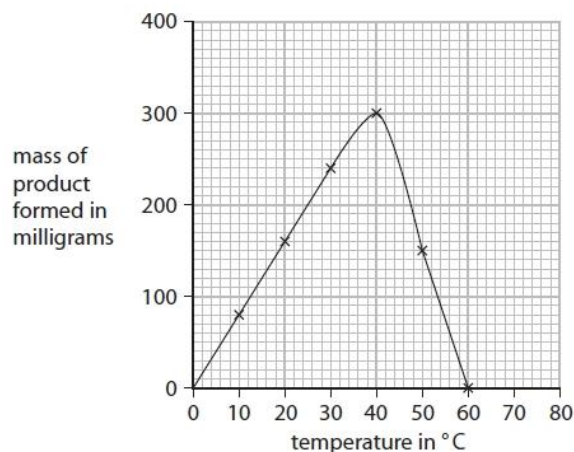
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(Total for question = 7 marks)

**Q28.**

A student investigated the activity of a human enzyme at different temperatures. The student measured the mass of product formed after 10 minutes at different temperatures.

Figure 10 shows the results of this investigation.



**Figure 10**

(i) Describe the trends shown in Figure 10.

(2)

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(ii) Explain the results obtained for temperatures from 40°C to 60°C.

(2)

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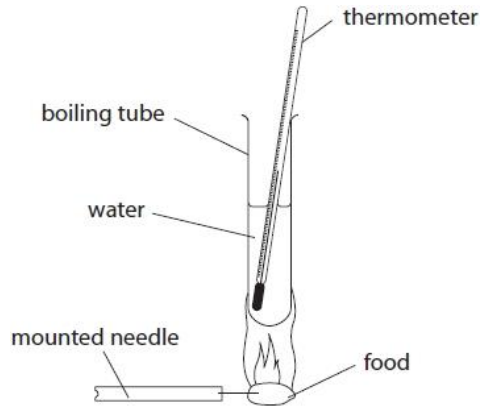
**(Total for question = 4 marks)**

**Q29.**

Starch is a nutrient in food.

Starch is a source of energy.

The diagram shows equipment that can be used to measure the energy content of different foods.



**Figure 12**

Devise a method to compare the energy content of two foods using this equipment.  
Include details of how to control the variables.

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**(Total for question = 6 marks)**



Q30.

\* Figure 10 shows the rate of reaction for the enzyme pepsin at different temperatures.

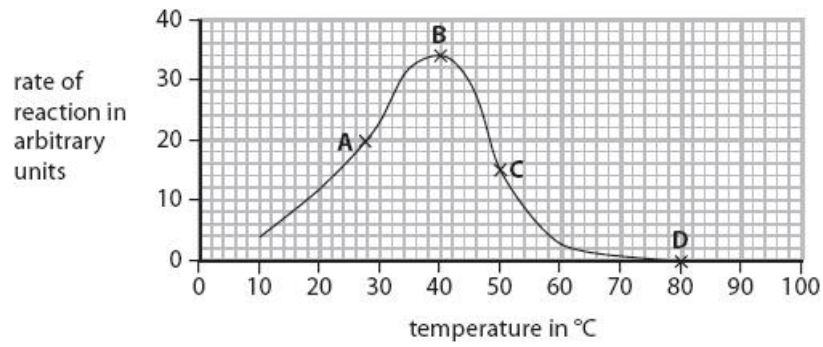


Figure 10

Explain why the rate of reaction is different at points A, B, C and D.

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(Total for question = 6 marks)

Q31.

Figure 2 shows some information about the results of the test for reducing sugar.

colour of Benedict's solution after testing food sample	concentration of reducing sugar
blue	zero
green	low
yellow	↓
orange	↓
brick red	high

Figure 2

A student wanted to compare the amount of reducing sugar in three types of biscuit.

(i) Give **one** variable the student should control.

(1)

.....

.....

Figure 3 shows the student's results.

type of biscuit	colour with Benedict's solution
A	green
B	brick red
C	orange

Figure 3

(ii) State **two** conclusions that can be made from the data in Figure 3.

(2)

1 .....

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2 .....

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(Total for question = 3 marks)

**Q32.**

Figure 2 shows the results of some food tests.

food sample	Benedict's test	Biuret test	ethanol (alcohol) test
J	brick red	blue	colourless
K	brick red	purple	colourless
L	blue	blue	white emulsion

**Figure 2**

(i) Give the letter of the food sample that contains fat.

(1)

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(ii) Give the letter of the food sample that contains reducing sugars and protein.

(1)

.....

**(Total for question = 2 marks)**

**Q33.**

Name the product formed when the protein in boiled egg white is broken down.

(1)

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**(Total for question = 1 mark)**

Q34.

Figure 8 shows how a student set up equipment to investigate the effect of pH on the action of the enzyme pepsin on boiled egg white.

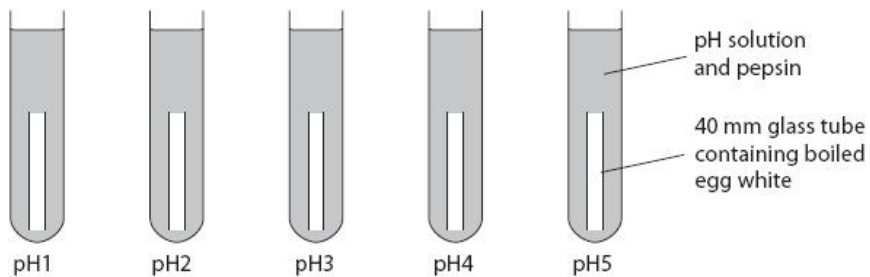
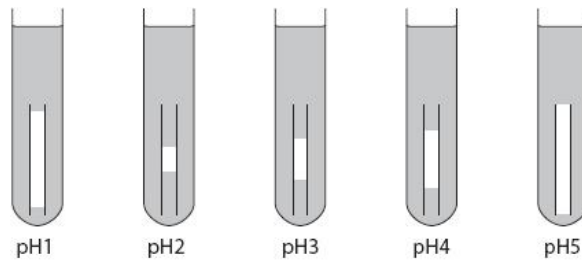


Figure 8

The length of egg white in each of the tubes was measured after 24 hours.

The results are shown in Figure 9.



pH of the solution	length of egg white in glass tube after 24 hrs / mm
1	36
2	10
3	24
4	28
5	40

Figure 9

(i) State the pH at which pepsin was most effective.

(1)

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(ii) State how the pH of a solution can be measured.

(1)

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(iii) The student noticed that the boiled egg white in some of the tubes also became thinner.  
Describe how the method could be improved to obtain a more accurate measure of how much boiled egg white was digested by the pepsin.

(2)

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**(Total for question = 4 marks)**

**Mark Scheme**

Q1.

Question number	Answer	Mark	
(i)	<p>A meristem</p> <p><b>The only correct answer is A</b></p> <p><i>B is incorrect because root hair cells are not the area of the root where many cells are dividing by mitosis.</i></p> <p><i>C is incorrect because xylem is not the area of the root where many cells are dividing by mitosis.</i></p> <p><i>D is incorrect because phloem is not the area of the root where many cells are dividing by mitosis.</i></p>	<p><b>(1)</b></p> <p><b>A01 1</b></p>	
Question number	Answer	Additional guidance	Mark
(ii)	<p>An answer including <b>three</b> of the following</p> <ul style="list-style-type: none"> <li>• add {enzyme (solution) / plant root cells} to glucose (solution) (1)</li> <li>• test for presence of starch (1)</li> <li>• test {each minute / at set <b>time</b> intervals} / <b>time</b> until a positive result for starch (1)</li> <li>• repeat at more than one pH / (in buffers) of different pH values (1)</li> <li>• reference to controlling one variable, e.g. same volume of solutions / same temperature (1)</li> </ul>	<p>accept use iodine</p>	<p><b>(3)</b></p> <p><b>A03 3a</b></p>

Q2.

Question number	Answer		Mark
(i)	<p>An explanation including the following:</p> <ul style="list-style-type: none"> <li>lipase digests {fat/lipid} (1)</li> <li>forming fatty acids (and glycerol) (1)</li> <li>which are acidic / <b>lowering</b> the pH of the mixture / making the mixture more acidic (1)</li> </ul>	<p>accept breakdown for digest</p> <p>accept removing fat makes the milk more acidic</p>	<p>(3)</p> <p><b>A01 2</b></p>

Question number	Answer	Additional guidance	Mark
(ii)	<p>An explanation linking <b>two</b> from:</p> <ul style="list-style-type: none"> <li>milk A did not contain any/much fat (1)</li> <li>fatty acids were not produced</li> <li>as there was no <b>substrate</b> (1)</li> </ul>	<p>accept lipids</p> <p>accept fewer fatty acids were produced</p>	<p>(2)</p> <p><b>A02 2</b></p>

Question number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation linking <b>three</b> of the following:</p> <ul style="list-style-type: none"> <li>the temperature is above the optimum (1)</li> <li>the {lipase / enzyme} <b>denatures</b> (1)</li> <li>so <b>active site</b> changes shape (1)</li> <li>no enzyme -substrate complexes formed / no longer complementary to the substrate / cannot bind the substrate (1)</li> </ul>	<p>accept the temperature was high</p> <p>reject {enzyme / lipase} is killed</p> <p>accept so it could not break down the fat / no fatty acids produced</p>	<p>(3)</p> <p><b>A02 2</b></p>

Q3.

Question number	Answer	Additional guidance	Mark
	milk B contains fat / milk B had a high fat content	accept milk B is less dense accept lipid / oil	(1) A02.2

Q4.

Question number	Answer	Additional guidance	Mark
(i)	Substitution  (50 - 30 =) 20 (1)  (20 ÷ 50 × 100 =) - 40(%)	Accept 40%  award full marks for answer without working	(2) A02.1

Question number	Answer	Additional guidance	Mark
(ii)	Any <b>two</b> from: <ul style="list-style-type: none"> <li>• variety of potato (1)</li> <li>• mass of potato (1)</li> <li>• age of potato (1)</li> <li>• temperature (1)</li> <li>• storage conditions/humidity (1)</li> </ul>	accept type / species accept weight/size  accept potato cells taken from the same part of each potato	(2) A02.2

Question number	Indicative content	Additional guidance	Mark
(iii)	for energy / respiration	ignore make / produce energy  accept to produce ATP	(1) A02.1



Question number	Indicative content	Additional guidance	Mark
(iv)	Any two from: <ul style="list-style-type: none"> <li>enzyme / amylase / carbohydrase (1)</li> <li>starch fits into the <b>active site</b> (1)</li> <li>bonds (between glucose molecules in starch) broken (1)</li> </ul>	accept maltase  accept polymer broken down into monomers	<b>(2)</b>  <b>AO2 1</b>

## Q5.

Question number	Answer	Additional guidance	Mark
(i)	starch is present / iodine reacts with starch (1)	accept starch hadn't reacted / hadn't been broken down (by liquids from mouth and stomach)	<b>(1)</b>  1.12 AO1

Question number	Answer	Additional guidance	Mark
(ii)	An answer linking three from: <ul style="list-style-type: none"> <li>in test tube 1 starch has been broken down (1)</li> <li>in test tube 2 starch has not been broken down (1)</li> <li>because amylase is present in the mouth / no amylase in the stomach (1)</li> </ul>	Accept reverse argument for both marking points in test tube two  accept starch is still present in tube 2  accept carbohydrase	<b>(3)</b>  A03 2a+2b

Q6.

Question number	Answer	Mark
(i)	D proteins  The only correct answer is <b>D</b> proteins  A is incorrect because carbohydrates are broken down by carbohydrases /amylase  B is incorrect because lipids need to be digested by lipase  C is incorrect because fibre is not broken down by enzymes	(1)  <b>A01.2</b>

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking the following: <ul style="list-style-type: none"> <li>to increase the surface area of the food (1)</li> <li>so trypsin will break down more protein (1)</li> </ul>	accept the food molecules are smaller  accept there is a faster rate of reaction	(2)  <b>AO2.2</b>

Q7.

Question Number	Answer	Mark
(i)	C the volume of milk and the concentration of chymosin  <b>The only correct answer is C</b>  <i>A is not correct because time is being measured</i>  <i>B is not correct because the temperature is being changed</i>  <i>D is not correct because the temperature is being changed</i>	(1)  <b>AO2 2</b>

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation linking <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• 40°C is the {optimum / closer to the optimum} / there is a faster <b>rate of reaction</b> (1)</li> <li>• because as temperature increases (kinetic) energy increases (1)</li> <li>• more chance of collision (between the chymosin and the milk protein) (1)</li> <li>• more enzyme-substrate complexes are formed (1)</li> </ul>	accept the enzyme works faster	(2)  AO2 1

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation linking:</p> <ul style="list-style-type: none"> <li>• time taken would be longer / the milk would not curdle (1)</li> <li>• because the enzyme is denatured / the active site has changed shape (1)</li> </ul>	accept slow rate of reaction / a time greater than 75 seconds	(2)  AO2 1

Question Number	Answer	Additional Guidance	Mark
(iv)	<p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• it is a control (1)</li> <li>• to confirm that the milk doesn't curdle at that temperature without chymosin (1)</li> <li>• allows for a comparison with the results (1)</li> </ul>	accept to see the effect of not adding chymosin	(1)  AO2 2

Question Number	Answer	Additional Guidance	Mark
(v)	<p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• use a smaller interval between the temperatures (1)</li> <li>• measure temperatures between the range of 35°C and 45°C (1)</li> <li>• controlling a variable not identified in the method (1)</li> <li>• keep the tubes at the required temperature after adding chymosin by using a water bath (1)</li> <li>• repeat the test at each temperature (1)</li> </ul>	<p>ignore a wider range of temperatures</p> <p>accept e.g. volume of milk / type of milk / enzyme concentration</p> <p>accept use a water bath to control temperature</p> <p>accept calculate a mean / identify anomalies</p>	<p>(2)</p> <p><b>A03b</b></p>

Q8.

Question number	Answer	Mark
	<p>moles of sucrose = <math>\frac{\text{moles of ethanol}}{4}</math> (1) (= <math>\frac{26.9}{4 \times 46} = 0.146</math>)</p> <p>mass of sucrose = <math>\frac{\text{moles of ethanol}}{4} \times 342</math> (1) (= <math>\frac{26.9 \times 342}{4 \times 46} = 49.999</math> g)</p> <p>allow 50 g for 2 marks</p>	<p>(2)</p> <p><b>A02</b></p>

Q9.

Question	Answer	Mark
	<p>B denatured</p> <p><b>The only correct answer is B</b></p> <p><i>A is not correct because the enzyme is not specific when it changes shape</i></p> <p><i>C is not correct because the enzyme is not digested when it changes shape</i></p> <p><i>D is not correct because the enzyme is not dead when it changes shape</i></p>	<p><b>(1)</b></p> <p>AO1 (1)</p>

Q10.

Question Number	Answer	Mark
(i)	<p>C 50%</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because 0% is too low</i></p> <p><i>B is not correct because 25% is too low</i></p> <p><i>C is not correct because 75% is too high.</i></p>	<p><b>(1)</b></p> <p><b>A01.1</b></p>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An answer including <b>two</b> from</p> <ul style="list-style-type: none"> <li>as the temperature increases (up to 40°C) the % of mould increases (1)</li> <li>no (growth of) mould at {0°C / below 20°C} (1)</li> <li>more growth of mould at 40°C than at 20°C (1)</li> </ul>	accept 40°C is the optimum temperature for mould (growth)	(2)  A03.1ab

Question Number	Answer	Additional guidance	Mark
(iii)	<p>An explanation including <b>two</b> from:</p> <ul style="list-style-type: none"> <li>enzymes don't work (at 60°C) / enzymes are denatured (1)</li> <li>active site shape changed so can't fit with substrate (1)</li> <li>so (biochemical) reactions won't {take place / occur quickly enough} (1)</li> </ul>	<p>accept mould is killed (1)</p> <p>accept the bread was too dry (for the mould to grow) (1)</p>	(2)  A03.2ab

Q11.

Question Number	Answer	Mark
(i)	<p>C the volume of milk and the concentration of chymosin</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because time is being measured</i></p> <p><i>B is not correct because the temperature is being changed</i></p> <p><i>D is not correct because the temperature is being changed</i></p>	<p>(1)</p> <p>AO2 2</p>

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation linking <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• 40°C is the {optimum / closer to the optimum} / there is a faster <b>rate of reaction</b> (1)</li> <li>• because as temperature increases (kinetic) energy increases (1)</li> <li>• more chance of collision (between the chymosin and the milk protein) (1)</li> <li>• more enzyme-substrate complexes are formed (1)</li> </ul>	<p>accept the enzyme works faster</p>	<p>(2)</p> <p>AO2 1</p>

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation linking: <ul style="list-style-type: none"> <li>time taken would be longer / the milk would not curdle (1)</li> <li>because the enzyme is denatured / the active site has changed shape (1)</li> </ul>	accept slow rate of reaction / a time greater than 75 seconds	(2)  AO2 1

Question Number	Answer	Additional Guidance	Mark
(iv)	Any <b>one</b> from: <ul style="list-style-type: none"> <li>it is a control (1)</li> <li>to confirm that the milk doesn't curdle at that temperature without chymosin (1)</li> <li>allows for a comparison with the results (1)</li> </ul>	accept to see the effect of not adding chymosin	(1)  AO2 2

Question Number	Answer	Additional Guidance	Mark
(v)	Any <b>two</b> from: <ul style="list-style-type: none"> <li>use a smaller interval between the temperatures (1)</li> <li>measure temperatures between the range of 35°C and 45°C (1)</li> <li>controlling a variable not identified in the method (1)</li> <li>keep the tubes at the required temperature after adding chymosin by using a water bath (1)</li> <li>repeat the test at each temperature (1)</li> </ul>	ignore a wider range of temperatures  accept e.g. volume of milk / type of milk / enzyme concentration  accept use a water bath to control temperature  accept calculate a mean / identify anomalies	(2)  AO3b



Q12.

Question number	Answer	Additional guidance	Mark
	<p>An explanation linking</p> <ul style="list-style-type: none"> <li>yeast provides enzymes (1)</li> <li>(at 80°C) the enzymes {not effective / denatured} (1)</li> </ul>	<p>allow yeast provides a biological catalyst allow yeast provides zymase</p> <p>allow yeast {contains/is} an enzyme</p> <p>allow yeast is denatured ignore enzyme is killed</p> <p>allow yeast grows well at 30°C but yeast cells are killed at 80°C .</p>	(2)

Q13.

Question Number	Answer	Mark
(i)	<p>D increase the substrate concentration</p> <p><b>1. The only correct answer is D</b></p> <p><i>A is not correct because increasing the pH will not increase the mass of product formed in this investigation</i></p> <p><i>B is not correct because decreasing the temperature will not increase the mass of product formed in this investigation</i></p> <p><i>C is not correct because decreasing the enzyme concentration will not increase the mass of product formed in this investigation</i></p>	<p><b>(1)</b></p> <p>AO 2 1</p>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>Any three from:</p> <ul style="list-style-type: none"> <li>37°C is the optimum for this enzyme (1)</li> <li>80°C /it will <b>denature</b> the enzyme/pepsin (1)</li> <li>change in the shape of the enzyme/active site (1)</li> <li>No reaction will take place / no enzyme-substrate complexes formed / no product formed (1)</li> </ul>	<p>accept 37°C is best temperature for this enzyme (1)</p> <p>accept high temperatures will <b>denature</b> the enzyme</p> <p>accept substrate no longer fits active site (1)</p>	<p>(3)</p> <p>AO 2 1</p>

## Q14.

Question number	Answer	Mark
(i)	<p>Two lines drawn correctly as shown.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><b>food group</b></p> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">carbohydrate</div> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">fat</div> </div> <div style="text-align: center;"> <p><b>products of digestion</b></p> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">fatty acids and glycerol</div> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">amino acids</div> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">glucose</div> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">starch</div> <div style="border: 1px solid black; padding: 5px; width: 100px; margin: 10px auto;">ethanol</div> </div> </div> <p>Reject more than one line from each food group</p>	<p>(2)</p> <p>AO1 1</p>

Question number	Answer	Mark
(ii)	<p>D lipase</p> <p><b>The only correct answer is D</b></p> <p><i>A is not correct because carbohydrase does not break down fat</i></p> <p><i>B is not correct because amylase does not break down fat</i></p> <p><i>C is not correct because protease does not break down fat</i></p>	<p><b>(1)</b></p> <p>AO1 1</p>

Q15.

Question Number	Answer	Mark
	<p>B because they speed up biological processes</p> <p><b>The only correct answer is B</b></p> <p><i>A is not correct because enzymes do not slow down biological processes</i></p> <p><i>C is not correct because enzymes do not denature biological processes</i></p> <p><i>D is not correct because enzymes do not stop biological processes</i></p>	<p><b>(1)</b></p> <p>AO1 1</p>

Q16.

Question number	Answer	Additional guidance	Mark
	amylase (1)	accept carbohydrase	<p><b>(1)</b></p> <p>1.12 AO1</p>

Q17.

Question number	Answer	Mark
	<ul style="list-style-type: none"><li>carbohydrase / amylase (1)</li></ul>	<b>(1)</b> AO 2 1

Q18.

Question number	Answer	Mark
	amino acids	<b>(1)</b> AO1 1

Q19.

Question Number	Answer	Mark
<b>(i)</b>	use a water bath / description of a water bath	<b>(1)</b> <b>AO1 2</b>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation linking <b>three</b> from:</p> <ul style="list-style-type: none"> <li>enzymes have an optimum temperature (1)</li> <li>so temperature will affect the rate of enzyme activity / the time taken to produce 20cm<sup>3</sup> of oxygen (1)</li> <li>enzyme activity increases as temperature increases (up to the enzyme's optimum temperature) (1)</li> <li>{enzymes / active sites} are <b>denatured</b> / enzyme activity stops at high temperatures (1)</li> </ul>	<p>accept hydrogen peroxide concentration is the independent variable, so other variables (such as temperature) must be controlled (1)</p>	<p>(3)</p> <p><b>AO2 1</b></p>

Question Number	Answer	Additional guidance	Mark
(iii)	<ul style="list-style-type: none"> <li>all 4 points plotted accurately (<math>\pm</math> half a small square) (1)</li> <li>smooth curve / dot-to-dot line drawn (1)</li> </ul>	<p>ignore extrapolations</p>	<p>(2)</p> <p><b>AO3 1a 1b</b></p>

Question Number	Answer	Additional guidance	Mark
(iv)	<p>A description including:</p> <ul style="list-style-type: none"> <li>the time taken to collect 20 cm<sup>3</sup> oxygen decreases as hydrogen peroxide concentration increases (1)</li> <li>the curve flattens (1)</li> <li>the correct use of data from the table (1)</li> </ul>	<p>accept negative correlation</p> <p>data must be used not just quoted from the table</p>	<p>(3)</p> <p><b>AO3 1a</b></p> <p><b>1b</b></p>

## Q20.

Question Number	Answer	Additional guidance	Mark
	<ul style="list-style-type: none"> <li>5:15 (1)</li> <li>1:3</li> </ul>	allow full marks for correct final answer with no working	<p>(2)</p> <p>AO 2 1</p>

## Q21.

Question Number	Answer	Additional guidance	Mark
	<ul style="list-style-type: none"> <li>all points plotted correctly to +/- ½ small square (1)</li> <li>a line showing a steady increase that levels off at 30au/40g (1)</li> </ul>	accept dot-to-dot line	<p>(2)</p> <p>AO 2 2</p>

Q22.

Question Number	Answer	Additional guidance	Mark
(i)	water (1)  lid (1)	answers must be in the correct order	(2)  AO2 2

Question Number	Answer	Additional guidance	Mark
(ii)	interpretation (85 - 21) = 64 (1)  calculation (25 x 4.2 x 64)  6720 (J)	full marks for correct answer without any working    award one mark for an answer correctly calculated from an incorrect temperature change	(2)  AO2 1

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation including <b>two</b> from: <ul style="list-style-type: none"> <li>• the {temperature change / rise in temperature} was smaller (1)</li> <li>• this type of cheese contained less {energy / fat} / the piece of cheese had a smaller mass / a smaller mass of the cheese burned / the cheese was held further away from the container (1)</li> <li>• therefore less energy was transferred to the water (1)</li> </ul>	accept other valid variables	(2)  AO3 2a 2b

Q23.

Question number	Answer	additional guidance	Mark
	An answer linking: <ul style="list-style-type: none"> <li>• mix the food in ethanol and pour into water (1)</li> <li>• white emulsion forms (1)</li> </ul>	accept add water and ethanol and mix  accept white precipitate / goes cloudy /emulsion test  accept rub pea / food on filter paper (1) and look for a translucent mark (1)	<b>(2)</b> AO1 2

Q24.

Question Number	Answer	Mark
	An answer including: <ul style="list-style-type: none"> <li>• (add) iodine (solution) (1)</li> <li>• (iodine solution changes from brown to) blue-black / black (1)</li> </ul>	<b>(2)</b>  <b>AO1 2</b>

Q25.

Question Number	Answer	Additional guidance	Mark
	Any two from: <ul style="list-style-type: none"> <li>• mass of product formed increases as enzyme concentration increases (1)</li> <li>• then (the mass of product formed) remains the same (1)</li> <li>• 30 au/40 g is point where mass of product remains the same (1)</li> </ul>	accept then levels off (1)	<b>(2)</b>  AO 3 1a AO 3 1b



Q26.

Question Number	Answer	Additional guidance	Mark
(i)	An answer that provides a description by making reference to: <ul style="list-style-type: none"> <li>• add iodine (solution) (1)</li> <li>• blue-black colour indicates presence of starch (1)</li> </ul>		(2) AO 1 2

Question Number	Answer	Additional guidance	Mark
(ii)	<ul style="list-style-type: none"> <li>• it is an insulator/reduces heat loss (1)</li> <li>• so energy from sugar is used to heat water / the result is more accurate (1)</li> </ul>	accept stops water loss	(2) AO 2 2

Question Number	Answer	Additional guidance	Mark
(iii)	<ul style="list-style-type: none"> <li>• ensures heat is distributed (evenly) throughout the water (1)</li> </ul>	accept all the water is at the same temperature	(1) AO 2 2

Q27.

Question	Answer	Additional guidance	Mark
(i)	An answer including: <ul style="list-style-type: none"> <li>reference to enzyme activity (1)</li> <li>(the enzyme activity) increases from pH 5.8 to pH 8 (1)</li> <li>optimum (activity) at pH 8 (1)</li> <li>(enzyme activity) decreases between pH 8 and pH 9.8 (1)</li> </ul>	accept a range of pH 5.6 to 6 for pH 5.8  accept activity peaks at pH 8  accept reference to range of pH 9.6 to 10 for pH 9.8	<b>(4)</b>  AO3 1a b

Question	Answer	Additional guidance	Mark
(ii)	(pH) 2	accept (pH) two / 2pH	<b>(1)</b>  AO3 1a

Question	Answer	Mark
(iii)	Two from: <ul style="list-style-type: none"> <li>conditions in the stomach are pH 2 / acidic / low pH (1)</li> <li>(The stomach secretes) hydrochloric acid (1)</li> </ul>	<b>(2)</b>  AO1

Q28.

Question number	Answer	Additional guidance	Mark
(i)	<p>Any two from:</p> <ul style="list-style-type: none"> <li>• mass of product increases up to 40°C /300mg (1)</li> <li>• mass of product decreases after 40°C /300mg (1)</li> <li>• mass of product decreases faster than it increases (1)</li> </ul>	<p>accept maximum mass is 300mg / 40°C is the optimum temperature (1)</p> <p>accept increases then decreases for 1 mark</p>	<p><b>(2)</b></p> <p>AO2 2</p>

Question number	Answer	Mark
(ii)	<p>An explanation linking two from:</p> <ul style="list-style-type: none"> <li>• (maximum product at 40°C) because the enzyme is at its optimum temperature (1)</li> <li>• (between 40°C and 60°C the amount of product decreases) because the enzyme is becoming less active/ is being denatured /at 60°C the enzyme is denatured (1)</li> <li>• (because) the active site is changing shape / substrate can't bind to the active site / fewer enzyme-substrate complexes formed (1)</li> </ul>	<p><b>(2)</b></p> <p>AO2 1</p>

Q29.

Question number	Indicative content	Mark
*	<p style="text-align: center;"><b>A03</b></p> <p><b>Using the equipment</b></p> <ul style="list-style-type: none"> <li>• add water to the boiling tube</li> <li>• place food/named food on mounted needle</li> <li>• take the starting temperature of the <b>water</b></li> <li>• ignite / burn the food</li> <li>• take the temperature of the water when the food stops burning /record the highest temperature of the water</li> <li>• repeat the test using the other food</li> </ul> <p style="text-align: center;"><b>A02</b></p> <p><b>Controlling variables</b></p> <ul style="list-style-type: none"> <li>• mass of food measured with a balance</li> <li>• volume of water measured with a measuring cylinder</li> <li>• starting temperature of water measured with a thermometer</li> <li>• distance of food from boiling tube measured with a ruler</li> <li>• burning time measured with a stopwatch</li> <li>• external temperature/draughts prevented by placing a screen around the apparatus</li> </ul>	<p>A03 3a + A02 2</p> <p><b>(6)</b></p>

Level	Mark	Descriptor
	0	<ul style="list-style-type: none"><li>• No awardable content</li></ul>
Level 1	1-2	<ul style="list-style-type: none"><li>• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question.</li><li>• Lines of reasoning are unsupported or unclear. (AO2)</li></ul>
Level 2	3-4	<ul style="list-style-type: none"><li>• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question.</li><li>• Lines of reasoning mostly supported through the application of relevant evidence. (AO2)</li></ul>
Level 3	5-6	<ul style="list-style-type: none"><li>• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question.</li><li>• Lines of reasoning are supported by sustained application of relevant evidence. (AO2)</li></ul>

Q30.

Question number	Answer	Mark
*	<p>Indicative content</p> <p style="text-align: center;"><b>AO2</b></p> <ul style="list-style-type: none"> <li>At point A there is low energy/few collisions</li> <li>As temperature increases the enzymes catalyse the reaction faster because the particles are moving faster and are therefore more likely to react</li> <li>At point B this is the optimum temperature for enzyme action/ the reaction is happening at its fastest rate</li> <li>At point C the enzyme is starting to denature slowing the rate of reaction as the substrate is less likely to bind to the active site</li> <li>At point D there is no reaction as enzymes have been denatured/active site has changed shape</li> </ul> <p style="text-align: center;"><b>AO3</b></p> <ul style="list-style-type: none"> <li>At point A the temperature is 28 °C the rate of reaction is at 20 arbitrary units/as temperature increases the rate of reaction increases</li> <li>At point B the temperature is 40 °C the rate of reaction is at 34 arbitrary units /point B is the peak</li> <li>At point C the temperature is 50 °C the rate of reaction is at 15 arbitrary units /as temperature increases the rate of reaction decreases</li> <li>At point D the temperature is 80 °C the rate of reaction is 0 arbitrary units/there is no reaction</li> </ul>	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> <li>The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)</li> <li>Interpretation and evaluation of the information attempted but will be limited with focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3)</li> </ul>
Level 2	3–4	<ul style="list-style-type: none"> <li>The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)</li> <li>Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3)</li> </ul>
Level 3	5–6	<ul style="list-style-type: none"> <li>The explanation is supported through linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)</li> <li>Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3)</li> </ul>

Q31.

Question number	Answer	Additional guidance	Mark
(i)	One from: <ul style="list-style-type: none"> <li>• mass of biscuit</li> <li>• volume of Benedict's solution</li> <li>• temperature of water (bath)</li> <li>• time left in water (bath)</li> </ul>	accept weight of biscuit. ignore references to 'amount'  ignore references to 'amount'	<b>(1)</b> AO2 2

Question number	Answer	Additional guidance	Mark
(ii)	Two from: <ul style="list-style-type: none"> <li>• all biscuits contain (reducing) sugar /glucose (1)</li> <li>• most in biscuit B (1)</li> <li>• least in biscuit A (1)</li> </ul>	accept high in B  accept low in A  accept B is greater than C is greater than A for 2 marks	<b>(2)</b> AO3 2a 2b

Q32.

Question Number	Answer	Mark
(i)	L	<b>(1)</b>  AO2 2

Question Number	Answer	Mark
(ii)	K	(1)  AO2 2

Q33.

Question number	Answer	Mark
	amino acids / polypeptides / dipeptides	(1)

Q34.

Question number	Answer	Mark
(i)	(pH) 2/two	(1)

Question number	Answer	Additional guidance	Mark
(ii)	using a pH probe/using universal indicator paper/using universal indicator solution	accept meter for probe  ignore references to other indicator paper or solutions	(1)



Question number	Answer	Additional guidance	Mark
(iii)	<p>An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification / reasoning which must be linked to the improvement (1 mark):</p> <p>measure the {mass/volume} of egg white (1)</p> <p>find the (percentage) change in (mass / volume) (1)</p>	<p>accept measure both length and width / area</p> <p>accept the difference between the start and the end</p>	(2)