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EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Key Concepts in Biology (1)

GCSE Biology (Higher) Topic 1

18 questions · 175 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Higher Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

18 questions · 175 marks · lowest tariff first



7-MARK QUESTIONS

1 question in this booklet



- 3** (a) Figure 3 shows a beaker containing a potato cylinder in distilled water.

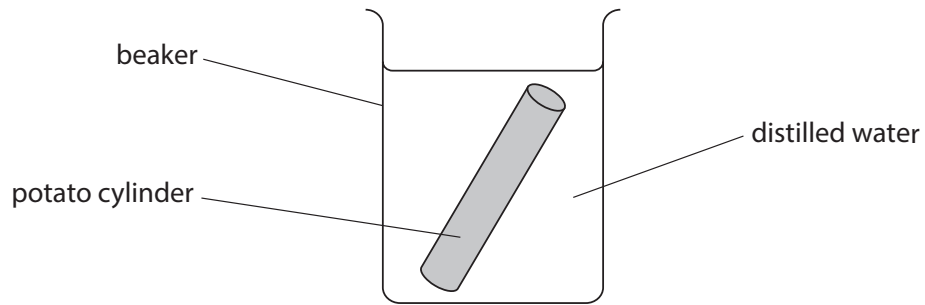


Figure 3

Explain why the mass of this potato cylinder will change when it is placed in distilled water.

(3)

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(b) A scientist investigated the rate of diffusion using three agar cubes of different sizes.

Each cube contained a pH indicator that changed from pink to colourless when placed in acid.

The cubes were placed in a beaker containing an acid.

Figure 4 shows some information about each cube.

cube	length of each side of cube in cm	surface area in cm ²	volume in cm ³	surface area to volume ratio	time taken for the cube to become colourless in seconds
A	1.0	6	1	6 : 1	170
B	2.0	24	8	3 : 1	260
C	3.0	54	?	2 : 1	500

Figure 4

(i) Calculate the volume of cube C.

(2)

..... cm³

(ii) Explain the difference in the times taken for cubes A and B to become colourless.

(2)

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(Total for Question 3 = 7 marks)

8-MARK QUESTIONS

1 question in this booklet



6 A student investigated the effect of glucose concentration on the rate of anaerobic respiration in yeast.

(a) The student used five concentrations of glucose: 5 %, 10 %, 15 %, 20 % and 25 %.

A teaspoon of dried yeast was added to 20 cm³ of the 5 % glucose concentration in a measuring cylinder.

A drop of washing up liquid was added and the mixture was stirred.

A reaction occurred and bubbles collected as foam on the surface of the mixture.

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

(i) Describe how to set up a control for this investigation.

(2)

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(ii) State how the scientist could improve this investigation to increase the rate of the reaction.

(1)

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(b) The results of this investigation are shown in Figure 7.

glucose concentration (%)	height of foam after 5 mins in mm
5	2
10	5
15	3
20	9
25	11

Figure 7

(i) The student thought one of the results was anomalous.

Explain which of these results is anomalous.

(2)

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(ii) Explain why the height of the foam was greatest for the 25 % glucose concentration.

(3)

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(Total for Question 6 = 8 marks)



9-MARK QUESTIONS

7 questions in this booklet



3 (a) Figure 5 shows two potato chips.

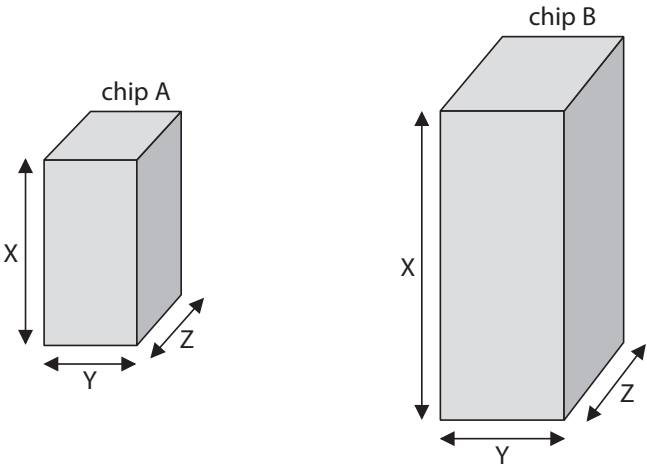


Figure 5

Figure 6 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm ²	total surface area of top and bottom in cm ²	total surface area of chip in cm ²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 6

- (i) Calculate the total surface area of potato chip B using the formula,
Total surface area = $2XY + 2XZ + 2YZ$

(2)

total surface area = ... cm²



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 7 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 7

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

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(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

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(b) The potatoes of a potato plant develop underground.

Explain **one** difference in the sub-cellular structures in a cell in the potato and those in a cell in the leaf of the potato plant.

(2)

DO NOT WRITE IN THIS AREA

(Total for Question 3 = 9 marks)



3 A slide of potato cells was viewed using a light microscope.

Figure 4 is a drawing of the slide showing starch grains in the potato cells.

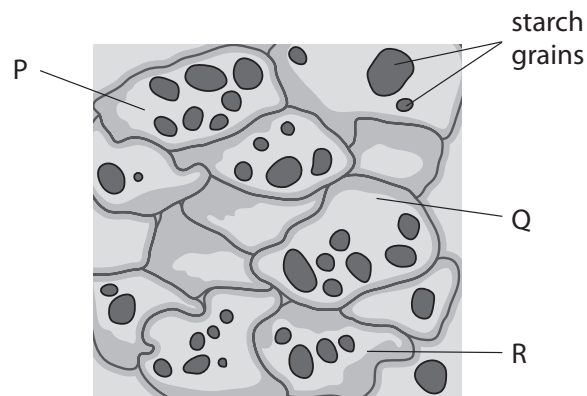


Figure 4

(a) (i) Calculate the mean number of starch grains in potato cells P, Q and R.

(1)

..... starch grains

(ii) Which structures are found in plant cells but are **not** found in animal cells?

(1)

- ☒ A cell membrane, nucleus, chloroplast
- ☒ B cell wall, cell membrane, cytoplasm
- ☒ C nucleus, large vacuole, chloroplast
- ☒ D cell wall, chloroplast, large vacuole

- (b) 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.



© rodimov/Shutterstock

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 in potato 2 were measured after 5 weeks in the dark.

The length of starch grains in potato 3 were measured 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 μm
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)

.....%

(ii) State **two** variables the scientist should have controlled to improve this investigation. (2)

1.....

.....

2.....

.....

(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 3 = 9 marks)



2 (a) DNA molecules contain base pairs.

Describe how the base pairs are bonded together in a DNA molecule.

(2)

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(b) Figure 1 shows part of a DNA molecule.

T	T	G	A	T	T	G	C	G	T	A	A

Figure 1

(i) Write the code for the complementary DNA strand in Figure 1.

(2)

(ii) Three bases code for each amino acid.

Which is the maximum number of amino acids coded for by this strand of DNA?

(1)

- ☐ **A** 3
- ☐ **B** 4
- ☐ **C** 6
- ☐ **D** 12

(iii) What is the shape of a DNA molecule?

(1)

- ☐ **A** triple stranded
- ☐ **B** single stranded
- ☐ **C** single helix
- ☐ **D** double helix

(c) A student wanted to extract the DNA from fresh peas.

The student crushed the peas and added washing up liquid and water.

The enzyme protease was then added to this mixture.

(i) Explain why the enzyme protease was added to the mixture.

(2)

(ii) The mixture was then heated and filtered.

Finally, the student poured the filtrate into a test tube and ice cold ethanol was poured down the side of the test tube into the filtrate.

State why ice cold ethanol was poured into the filtrate.

(1)

(Total for Question 2 = 9 marks)



- 2 People with diabetes cannot always control the concentration of glucose in their blood.

(a) Two people eat identical meals.

One person has diabetes, the other person does not have diabetes.

Figure 4 shows the concentration of glucose in the blood of these two people after eating the meals.

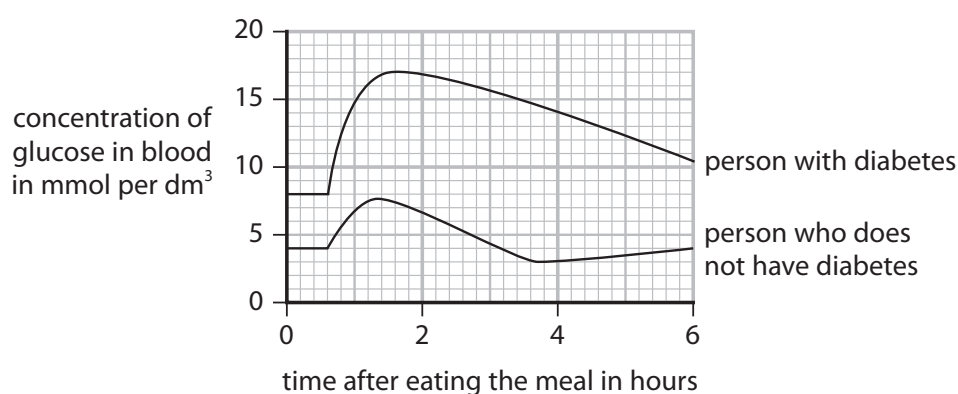


Figure 4

- (i) Calculate the maximum increase in the concentration of glucose in the blood of the person with diabetes.

(1)

..... mmol per dm³

- (ii) Water moved out of the red blood cells of the person with diabetes when the concentration of glucose in the blood was above 15 mmol per dm³.

Explain why water moved out of the red blood cells of the person with diabetes.

(2)

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(b) The pancreas produces a hormone that causes the concentration of glucose in the blood to decrease.

(i) Name this hormone.

(1)

(ii) State how this hormone is transported from the pancreas to its target organs.

(1)

(iii) Which is the target organ for the hormone that controls the concentration of glucose in the blood?

(1)

- ☐ A kidney
- ☐ B pancreas
- ☐ C liver
- ☐ D lung

(c) Explain how type 2 diabetes can be controlled.

(3)

(Total for Question 2 = 9 marks)



3 Respiration occurs in cells.

(a) Why do cells respire?

(1)

- ☐ **A** to produce nitrogen
- ☐ **B** to release oxygen
- ☐ **C** to produce glucose
- ☐ **D** to release energy

(b) An athlete runs every day as part of their training.

(i) Explain why the breathing rate of the athlete increases when running.

(2)

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(ii) When the athlete is running, their muscle cells use both aerobic respiration and anaerobic respiration.

State **two** differences between aerobic respiration and anaerobic respiration.

(2)

1

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2

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(c) Bromothymol blue (BTB) solution is an indicator of pH.

Figure 5 shows the colour of BTB at different pH levels.

pH	4	5	6	7 (neutral)	8
colour	yellow	yellowy green	light green	green	blue

Figure 5

When air is passed through green BTB, for one minute, the solution stays green.

When a person breathes out through a straw into BTB for one minute the solution turns yellow.

(i) Explain why the air breathed out turns the BTB solution yellow.

(2)

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- (ii) A scientist placed pondweed into two sealed test tubes containing green BTB solution.

Test tube A was kept in the dark.

Test tube B was kept in the light.

All other conditions were kept the same.

Figure 6 shows these test tubes at the start of the investigation.

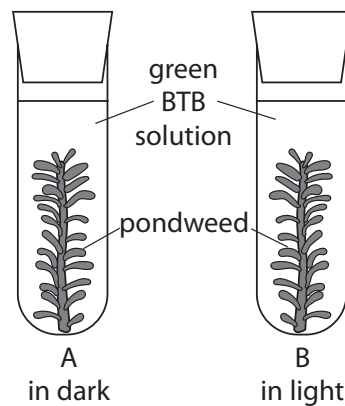


Figure 6

Figure 7 shows the colour of the BTB solution after 5 hours.

Tube A (in dark)	Tube B (in light)
yellowy green	green

Figure 7

Explain the results for tube A and tube B shown in Figure 7.

(2)

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(Total for Question 3 = 9 marks)

- 2 (a) Pepsin and trypsin are enzymes that break down proteins.

Figure 3 shows the results of an investigation into the activity of pepsin and trypsin at different pH levels.

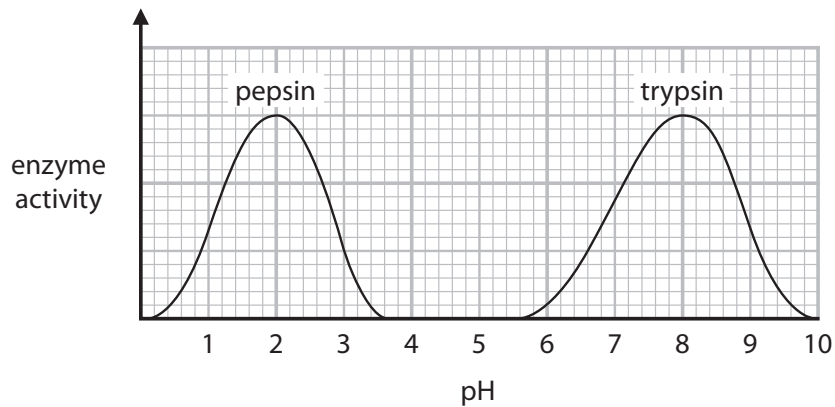


Figure 3

- (i) Which molecules are produced when a protein is broken down?

(1)

- ☐ A sugars
- ☐ B amino acids
- ☐ C fatty acids
- ☐ D starches

- (ii) Describe the trend in the graph for the enzyme pepsin.

Use data from the graph to support your answer.

(3)

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(iii) State the optimum pH for the enzyme trypsin.

(1)

(iv) Explain why there is no trypsin activity at pH 5.

(3)

(v) Temperature is a variable that should be controlled in this investigation.

Give **one** way the temperature could be controlled.

(1)

(Total for Question 2 = 9 marks)



- 5 (a) A teacher was demonstrating a process to students.

The teacher had a beaker of water and added five drops of food colouring to the beaker.

The time it took for the food colouring to spread evenly through the water was recorded.

Figure 10 shows this process.

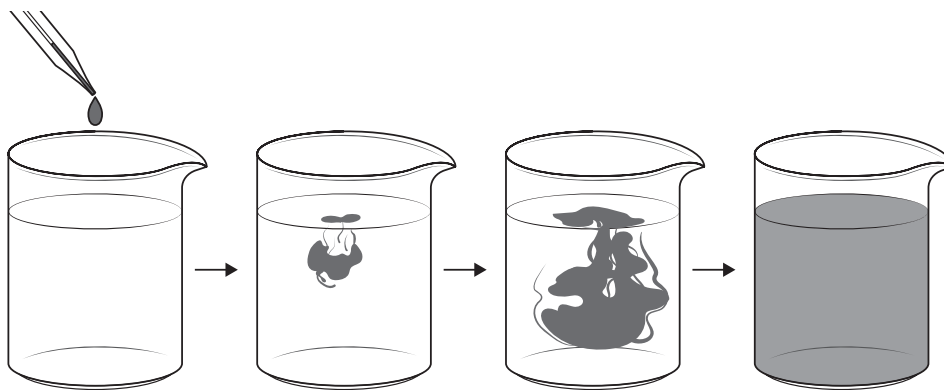


Figure 10

- (i) State the process being demonstrated.

(1)

- (ii) A student asked if different food colourings spread evenly in the same amount of time.

Give **two** variables that would need to be controlled if the investigation was repeated with different food colourings.

(2)

1

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2

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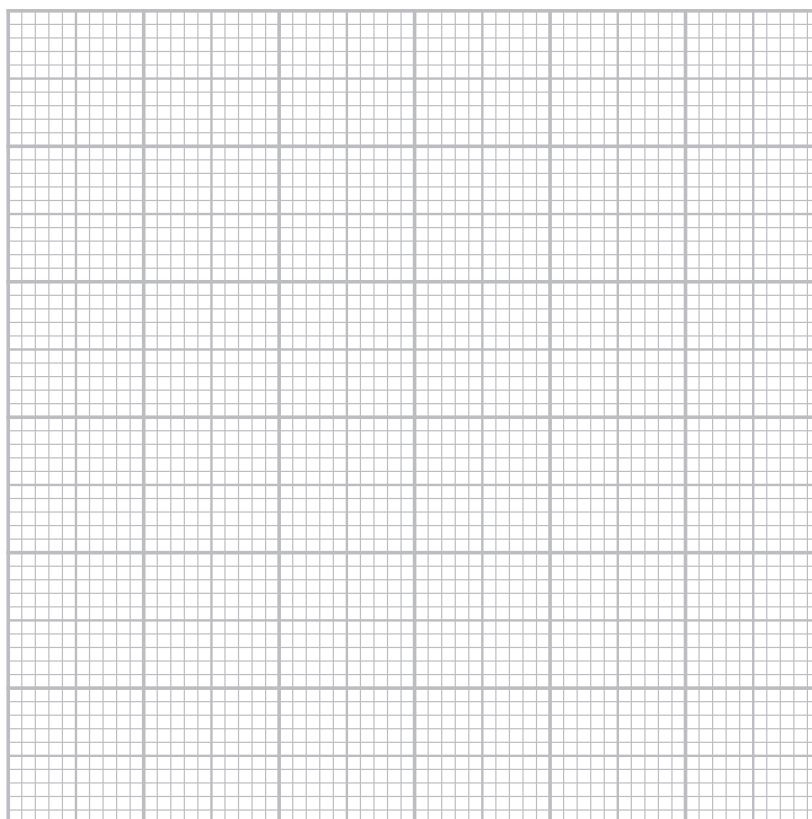
- (b) The teacher repeated this process with water at different temperatures. Figure 11 shows the results of this experiment.

water temperature in °C	time taken for food colouring to spread evenly through the water in seconds
20	116
25	101
30	75
35	52
40	33

Figure 11

- (i) Draw a line graph to show the results in Figure 11.

(4)



(ii) Explain why the time taken decreased.

(2)

(Total for Question 5 = 9 marks)



10-MARK QUESTIONS

3 questions in this booklet



- 6 (a) A student mixed 10 cm^3 of starch solution with 5 cm^3 of amylase solution and kept the tube in a water bath at 25°C .

The student tested the solution for starch and for glucose every 30 seconds.

Figure 6 shows the results.

time in seconds	starch detected	glucose detected
0	Yes	No
30	Yes	No
60	Yes	Yes
90	Yes	Yes
120	Yes	Yes
150	No	Yes
180	No	Yes

Figure 6

- (i) Give **one** reason for the result at 150 seconds.

(1)

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- (ii) Another student repeated the investigation with the same volumes of solutions and at the same temperature of 25°C .

Give **two** other variables that would need to be controlled in the investigation.

(2)

1

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2

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(iii) Both students also included a tube containing 10 cm^3 of starch solution with 5 cm^3 of distilled water instead of 5 cm^3 of amylase solution.

They tested the solution for starch and for glucose every 30 seconds.

Give **one** reason why this tube was included in their investigations.

(1)

(b) Amylase has an optimum pH of 6.8.

Devise a method the students could use to confirm the optimum pH for amylase.

(3)



(c) Amylase is produced by salivary glands and the pancreas.

Explain why amylase is not produced in the stomach.

(3)

(Total for Question 6 = 10 marks)



- 6 (a) Figure 7 shows images of two stone tools.

Scientists think that tool A was probably used by *Homo erectus* around 1.6 million years ago.

Tool B was probably used by *Homo habilis* around 2 million years ago.

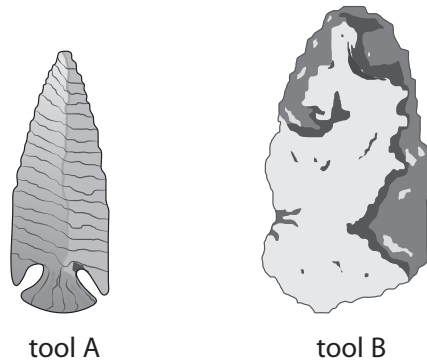


Figure 7

- (i) Give **one** reason, using Figure 7, why scientists think that tool A was used by a more recent human ancestor.

(1)

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- (ii) Describe how scientists can date stone tools using information from where the tools were discovered.

(2)

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- (b) Differences in fossilised bones indicate structural changes that have occurred during the evolution of humans.

Describe **two** structural changes that have occurred during human evolution.

(2)

1

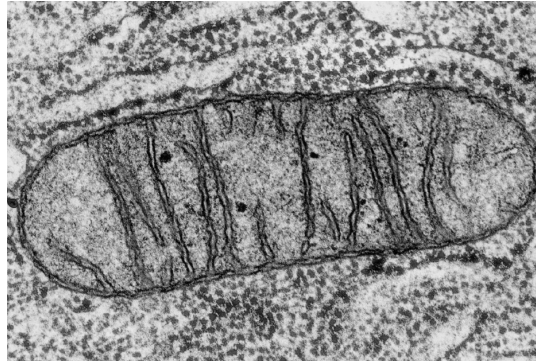
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- (c) The migration patterns of humans can be tracked by analysing DNA in mitochondria.

Figure 8 shows a mitochondrion viewed using an electron microscope.



(Source: © CNRI/SCIENCE PHOTO LIBRARY)

Figure 8

- (i) At a magnification of $\times 62\,000$ this mitochondrion has a length of 434 mm.

Calculate the actual length of this mitochondrion.

Give your answer in micrometres (μm).

(3)

..... μm

- (ii) Explain why an electron microscope is used to see mitochondria clearly.

(2)

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(Total for Question 6 = 10 marks)

5 (a) A report stated that *Homo habilis* was a hominin species that lived on Earth between 2.4 million years ago and 1.5 million years ago.

(i) State the number of years that *Homo habilis* lived on Earth.

(1)

(ii) Fossil evidence suggests that *Homo habilis* used tools.

State **one** use of these tools.

(1)

(iii) Scientists use fossil discoveries to suggest the structure of the whole body.

Lucy is a fossil of the species *Australopithecus afarensis*.

Describe how the body structure suggested for *Australopithecus afarensis* is different from the body structure suggested for *Homo habilis*.

(2)



(iv) Explain what could have caused the extinction of *Australopithecus afarensis*.

(3)

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(b) Figure 6 shows how the three-domain classification system was developed.

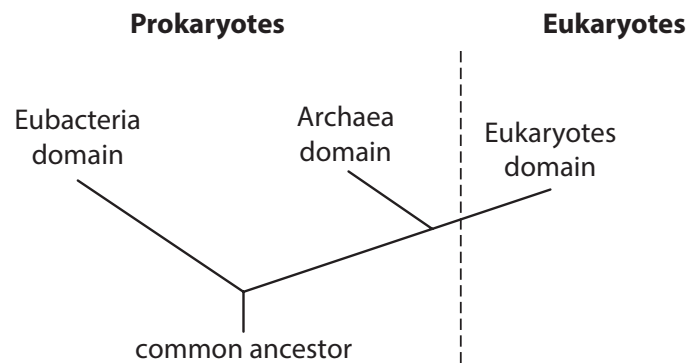


Figure 6

Describe the differences between prokaryotes and eukaryotes and why the three domain classification system was introduced.

(3)

(Total for Question 5 = 10 marks)

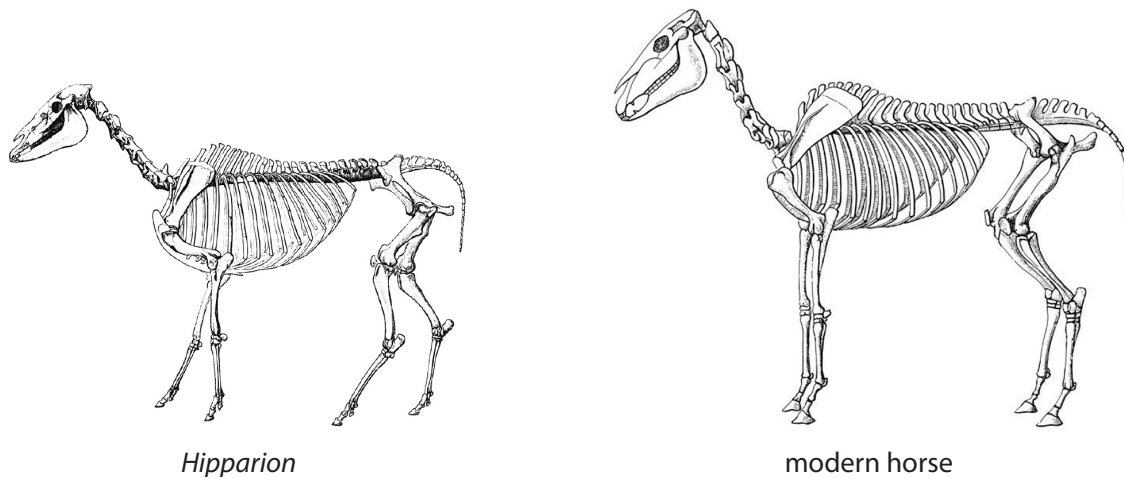
11-MARK QUESTIONS

5 questions in this booklet



- 7 *Hipparion* is an extinct genus of horse that lived between approximately 20 million and 0.8 million years ago.

Figure 10 shows the skeletons of a *Hipparion* and a modern horse.



(Sources: © Morphart Creation/Shutterstock and © Hein Nouwens/Shutterstock)

Figure 10

- (a) (i) Give **one** method that can be used to date a fossil of a *Hipparion*.

(1)

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- (ii) Give **one** reason why scientists have concluded that the modern horse has evolved from *Hipparion*.

(1)

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(3)

(6)



8 Chymosin is an enzyme that causes milk to curdle.

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

- (a) 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)

1

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2

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(b) Chymosin can be produced by genetically modified bacteria.

Figure 12 shows a bacterial cell.

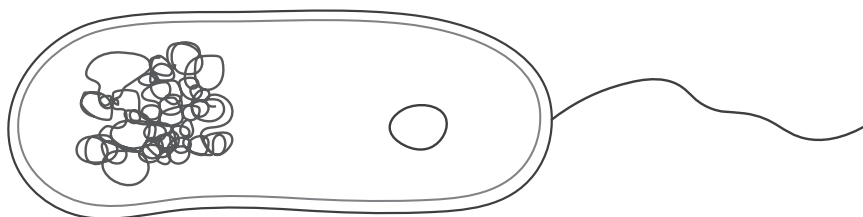


Figure 12

Explain how to genetically modify a bacterial cell to produce chymosin.

(3)

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(Total for Question 8 = 11 marks)

8 A student investigated the movement of water in potatoes.

The student used three identical cubes of potato.

The size of a cube is shown in Figure 12.

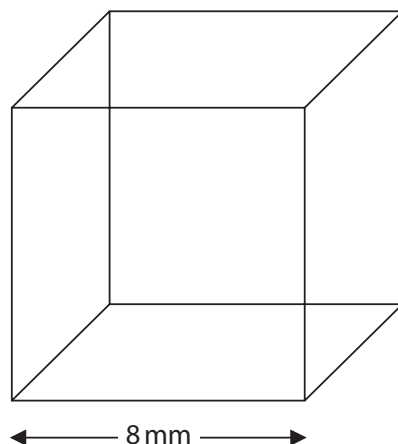


Figure 12

(a) (i) Calculate the volume of this cube.

Include the units in your answer.

(2)

.....

One cube was placed in water and each of the other two cubes were placed in solutions with different concentrations of salt.

The cubes were left for 20 minutes.

Figure 13 shows the student's results.

	starting mass in grams	final mass in grams
water	0.95	1.08
dilute salt solution	0.95	0.98
concentrated salt solution	0.94	0.88

Figure 13

- (ii) Give **one** way the student could ensure the measurement of the mass of the cubes is accurate.

(1)

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- (iii) Explain the mass change in the cube in the concentrated salt solution.

(3)

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- (iv) The student wanted to find the concentration of salt solution where the potato cube did not change mass.

Describe how the student could modify this investigation to find this concentration.

(3)

- (b) Explain why potato cells do not burst when placed in water.

(2)

(Total for Question 8 = 11 marks)



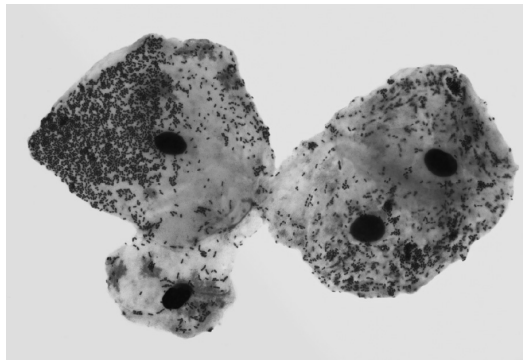
5 (a) A student made a microscope slide of cells taken from the inside of their mouth.

(i) The student wore gloves while using a swab to collect cells from their mouth.

Give **one** other safety precaution the student should take.

(1)

(ii) A light microscope was used to obtain an image similar to the one shown in Figure 6.



(Source: © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY)

Figure 6

Describe how the student used the light microscope to view these cells at a magnification of $\times 400$.

(3)

- (b) The cytoplasm of a cell contains a nucleus.

Explain the role of **one** other structure in the cytoplasm of a human cell.

(2)

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- (c) DNA can be extracted from human cells in a similar way to the method used to extract DNA from fruits.

Describe the stages of the method used to extract DNA from cells.

(3)

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- (d) The Human Genome Project sequenced the order of the bases in the human genome.

Give **two** other outcomes from the Human Genome Project.

(2)

1

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2

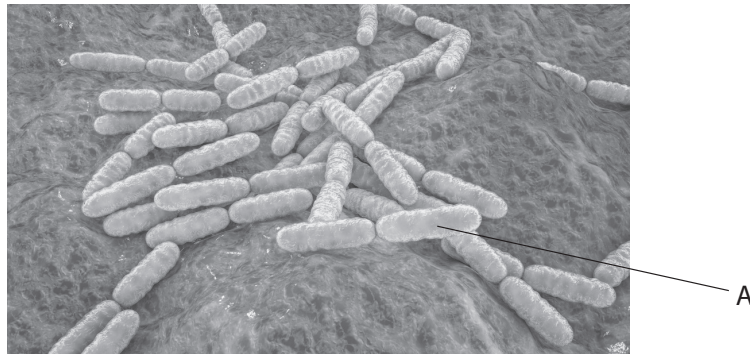
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(Total for Question 5 = 11 marks)



- 4 (a) Figure 7 shows a type of bacteria (*Lactobacillus acidophilus*) that is found in cow's milk.



(Source: © Kateryna Kon/Shutterstock)

Figure 7

The magnification of this image is $\times 18\,000$.

Measure the length of the bacterium labelled A.

Use your measurement to calculate the actual length of this bacterium in millimetres.

Give your answer in standard form.

(3)

..... mm

(b) Figure 8 shows the growth rate of two species of bacteria at different pH values.

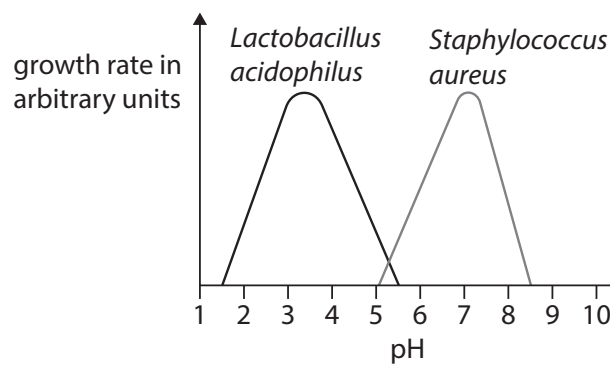


Figure 8

- (i) State a pH that allows the growth of both *Lactobacillus acidophilus* and *Staphylococcus aureus*.

(1)

- (ii) Describe the relationship between pH and the growth of *Staphylococcus aureus*, as shown in Figure 8.

(2)

(c) A student investigated the effect of temperature on the decay of milk.

Milk was placed in a beaker in a water bath at 5 °C for 72 hours.

The pH of the milk was measured every 24 hours using a pH probe.

The investigation was repeated at different temperatures.

Figure 9 shows the results of this investigation.

temperature in °C	pH			
	at 0 hours	at 24 hours	at 48 hours	at 72 hours
5	6.6	6.6	6.6	6.5
10	6.6	6.5	6.4	6.3
20	6.6	6.0	5.6	5.2
30	6.6	5.8	5.0	4.8

Figure 9

(i) Which is a variable that the student needs to control in this investigation?

(1)

- ☐ **A** pH of the milk
- ☐ **B** temperature of the milk
- ☐ **C** incubation time
- ☐ **D** volume of the milk

- (ii) Describe the changes in the pH of the milk at 30 °C from 0 hours to 72 hours, as shown in Figure 9.

(2)

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- (iii) Calculate the rate of decay of the milk at 20 °C for the 72 hours of this investigation.

Use the equation:

$$\text{rate of decay} = \frac{\text{change in pH}}{\text{time taken}}$$

(2)

..... change in pH per hour

(Total for Question 4 = 11 marks)



12-MARK QUESTIONS

1 question in this booklet



8 Potato cells contain the enzyme catalase.

This enzyme catalyses the breakdown of hydrogen peroxide into oxygen and water.

Figure 15 shows what happened when a student placed a potato disc in a 5% hydrogen peroxide solution.

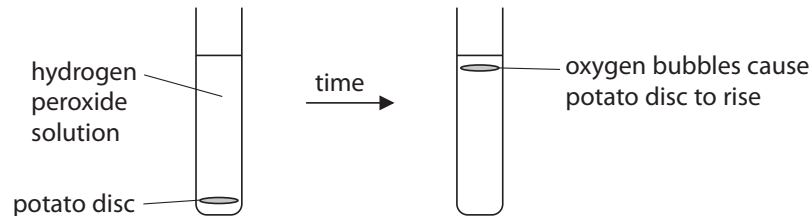


Figure 15

The student measured the time taken for the potato disc to rise.

The student repeated the investigation using 10%, 15% and 20% concentrations of hydrogen peroxide solution.

(a) (i) Which term describes the hydrogen peroxide in this reaction?

(1)

- ☒ **A** product
- ☒ **B** substrate
- ☒ **C** active site
- ☒ **D** control

(ii) The potato discs all had the same mass.

Explain why the student used potato discs with the same mass.

(2)

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(iii) State **two** other factors that need to be kept the same to improve this investigation. (2)



27



(b) Figure 16 shows the results of this investigation.

The student calculated the rate of reaction using

$$\frac{1}{\text{time in seconds}}$$

concentration of hydrogen peroxide solution (%)	time taken for disc to rise (s)	rate (s ⁻¹)
5	325	0.003
10	245	0.004
15	132	0.008
20	72	0.014

Figure 16

(i) State and explain a conclusion based on these results.

(4)

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- (ii) The student repeated the investigation with a 25% hydrogen peroxide solution and recorded a time of 75 seconds.

Calculate the rate of reaction for the 25% hydrogen peroxide solution.

(2)

..... s^{-1}

- (iii) The student decided that the rate for the 25% hydrogen peroxide solution was not anomalous.

Give the reason why the result was not anomalous.

(1)

.....

.....

.....

.....

(Total for Question 8 = 12 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Additional guidance	Mark
3(a)	An explanation including three from: (the mass) will increase (1) because water will move into the potato (cells) (1) water moves across a {partially / semi} permeable membrane (1) by <u>osmosis</u> (1) from a high water concentration to low water concentration (1)	accept weight for mass accept potato absorbs water accept references to down a water concentration gradient / water potential / low to high {solute / named solute} concentrations maximum two marks if mass change or direction of water movement incorrect	(3) AO2 1

Question number	Answer	Additional guidance	Mark
3(b)(i)	$3 \times 3 \times 3 / 3^3$ (1) 27 (cm³)	award full marks for the correct answer with no working accept $54 \div 2$	(2) AO2 1

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An explanation linking two from: - cube A takes less time (1) - because cube A {is smaller / has a smaller volume} / surface area to volume ratio of cube A is greater (1) - as A has a shorter diffusion distance (1)	accept reverse argument for B against all three marking points ignore the surface area of cube A is smaller	(2) A03 1a1b

Total for Question 3 = 7 marks

Question number	Answer	Additional guidance	Mark
6(a)(i)	A description including: - repeat the experiment / use a measuring cylinder with yeast and washing up liquid (1) - add water only (1)	accept 0% glucose solution	(2) AO2 2

Question number	Answer	Additional guidance	Mark
6(a)(ii)	increase the temperature (so the reaction happens faster) / add more yeast	accept heat it up	(1) AO3 3b

Question number	Answer	Additional guidance	Mark
6(b)(i)	An explanation including: - the result of 3 / the result at 15% (1) - because the result does not follow the pattern / because the height of foam is less than expected / it is less than the 10% concentration (1)	accept height of the foam {did not increase / decreased} / all the other values show an increase accept the result of 5 / result at 10% (1) because it was higher than expected (1)	(2) AO3 1ab

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation linking three of the following: • at 25% concentration there is more {substrate / glucose} (1) • to bind with the {enzymes / active site} / enzyme-substrate complexes formed (1) • more respiration takes place (1) • so carbon dioxide is produced (1) • because the glucose is the limiting factor (1)	accept glucose concentration is high accept respiration occurs for longer	(3) A02 1

(Total for question 6 = 8 marks)

Question Number	Answer	Additional guidance	Mark
3(a)(i)	$(2 \times 5.0 \times 2.0) + (2 \times 5.0 \times 2.0) + (2 \times 2.0 \times 2.0)$ or $20 + 20 + 8$ (1) 48.0	allow full marks for correct final answer accept 48	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	- chip B has greater surface area (1) - therefore more water {absorbed / moved into the potato chip} (1)	accept chip B is bigger / has more cells	(2) AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
3(a)(iii)	An explanation that links the following: (cells) lose water / become plasmolysed (1) followed by (water moves out) by <u>osmosis</u> (1) - from a high concentration of water molecules (in the potato) to a low concentration of water molecules (in the solution) / through the partially permeable membrane (to the salt solution) (1)	accept get smaller/shrink/lose mass accept from low solute concentration to a high solute concentration accept from high to low water potential	(3) AO 1 1

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that links: - no chloroplasts (in the potato) (1) (as there is no light) for photosynthesis / potato cells do not photosynthesise / ORA (1)	accept fewer chloroplasts / chlorophyll (in the potato) more amyloplasts / starch grains in the potato (1) for storage (1)	(2) AO 2 1

Total for Question 3 = 9 marks

Question number	Answer		Mark
3(a)(i)	6 / six		(1)

Question number	Answer	Mark
3(a)(ii)	D cell wall, chloroplast, large vacuole. The only correct answer is D cell wall, chloroplast, large vacuole A is incorrect because both the cell membrane and nucleus are also found in animal cells B is incorrect because the cell membrane and cytoplasm are also found in animal cells C is incorrect because the nucleus is also found in animal cells	(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	Substitution $(50 - 30 =) 20$ (1) $(20 \div 50 \times 100 =) - 40(\%)$	Accept 40% award full marks for answer without working	(2)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	Any two from: • variety of potato (1) • mass of potato (1) • age of potato (1) • temperature (1) • storage conditions/humidity (1)	accept type / species accept weight/size accept potato cells taken from the same part of each potato	(2)

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

Question number	Indicative content	Additional guidance	Mark
3 (b)(iv)	Any two from: - enzyme / amylase / carbohydrase (1) - starch fits into the active site (1) - bonds (between glucose molecules in starch) broken (1)	accept maltase accept polymer broken down into monomers	(2)

Question 3 = 9 marks



Question number	Answer	Additional guidance	Mark
2(a)	A description linking two from: • weak (1) • hydrogen bonds (1) • complementary bases (1) • A – T / C – G (1)	accept H bonds reject hydro bonds accept the names of the base pair	(2) AO1 1

Question number	Answer	Additional guidance	Mark																								
2(b)(i)	<table><tr><td>T</td><td>T</td><td>G</td><td>A</td><td>T</td><td>T</td><td>G</td><td>C</td><td>G</td><td>T</td><td>A</td><td>A</td></tr><tr><td>A</td><td>A</td><td>C</td><td>T</td><td>A</td><td>A</td><td>C</td><td>G</td><td>C</td><td>A</td><td>T</td><td>T</td></tr></table> award 1 mark for all the As and Ts in the top line correctly paired (1) award 1 mark for all the Cs and Gs in the top line correctly paired (1)	T	T	G	A	T	T	G	C	G	T	A	A	A	A	C	T	A	A	C	G	C	A	T	T	accept lower case letters	(2) AO2 1
T	T	G	A	T	T	G	C	G	T	A	A																
A	A	C	T	A	A	C	G	C	A	T	T																

Question number	Answer	Mark
2(b)(ii)	B 4 The only correct answer is B <i>A is incorrect because each 3 amino acids would need 9 bases to be present</i> <i>C is incorrect 6 amino acids would need 18 bases</i> <i>D is incorrect because 12 amino acids would need 36 bases</i>	(1) AO2 1

Question number	Answer	Mark
2(b)(iii)	D double helix The only correct answer is D <i>A is incorrect because a DNA molecule is not three separate strands</i> <i>B is incorrect because the DNA molecule consists of two strands</i> <i>C is incorrect because a DNA molecule is a double helix not a single helix</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
2(c)(i)	An explanation linking two from: • (protease) breaks down proteins (1) • in the {cell/nuclear} membrane (1) • destroys enzymes (that may break down the DNA) (1)	accept break down the {cell/nucleus/cell wall}	(2) AO1 2

Question number	Answer	Additional Guidance	Mark
2(c)(ii)	to precipitate the DNA / because DNA is insoluble in ethanol	accept to see the DNA	(1) AO1 2

Total marks for question 2 = 9 marks



Question number	Answer	Mark
2(a)(i)	9 (mmol per dm ³)	(1)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	An explanation including: (water moves out) by osmosis (1) - because the concentration of glucose is higher in the blood (plasma) (1) - across a partially permeable membrane (1)	accept from a high water potential inside the cell to a low water potential outside the cell	(2)

Question number	Answer	Mark
2(b)(i)	insulin	(1)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	in the blood / plasma	accept dissolved / in solution	(1)

Question number	Answer	Mark
2(b)(iii)	The only correct answer is C liver A is incorrect because the target organ is not the kidney B is incorrect because the pancreas produces insulin D is incorrect because the target organ is not the lungs	(1)

Question number	Answer	Additional guidance	Mark
2(c)	An explanation including three from: • exercise (1) • control diet / lose weight (1) • to {reduce / control} blood glucose (1)	accept avoid {sugar / carbohydrate} in your diet accept methods of testing blood for signs of diabetes (1) accept take {medication / metformin / insulin} (1)	(3)

(Total for question 2 = 9 marks)

Question number	Answer	Mark
3(a)	The only correct answer is D to release energy A is incorrect because nitrogen is not involved in respiration. B is incorrect because oxygen is used during respiration, not released C is incorrect because glucose is used during respiration, not produced	(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	An explanation linking two from: - to absorb more oxygen (into the blood / body) (1) - so that more respiration can occur / more energy is released (1) OR - to remove more carbon dioxide (from the blood / body) (1) - from more respiration / because carbon dioxide makes the blood more acidic (1)	accept to absorb oxygen (into the blood) more quickly accept so that respiration can occur more quickly / energy is released more quickly	(2)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer including two from: - aerobic respiration uses oxygen / anaerobic does not use oxygen (1) - aerobic respiration releases more energy / anaerobic releases less energy (1) - aerobic produces {carbon dioxide / water} / anaerobic respiration produces lactic acid (1)	accept ATP for energy accept lactate for lactic acid accept aerobic respiration takes place in the mitochondria / anaerobic respiration takes place in the cytoplasm (1) ignore references to types of exercise / when the types of respiration occur	(2)

Question number	Answer	Additional guidance	Mark
3(c)(i)	An explanation linking: - you breathe out (air with a high concentration of) carbon dioxide (1) - which forms a (weak) acid (when it dissolves) (1)	accept it contains carbon dioxide accept lowers the pH	(2)

Question number	Answer	Mark
3(c)(ii)	An explanation linking: - tube A - respiration took place (producing carbon dioxide) / photosynthesis did not take place (1) - tube B – photosynthesis took place (using up the carbon dioxide) (1)	(2)

(Total for question 3 = 9 marks)



Question number	Answer	Mark
2(a)(i)	B amino acids The only correct answer is B <i>A is incorrect because sugars are not produced when a protein is broken down.</i> <i>C is incorrect because fatty acids are not produced when a protein is broken down.</i> <i>D is incorrect because starches are not produced when a protein is broken down.</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
2(a)(ii)	A description including three from: • (activity) increases (1) • from pH 0.2 / to pH 2 (1) • optimum (activity) at pH 2 (1) • (pepsin activity) decreases {from pH 2 / to pH 3.5} (1)	accept best / maximum / most active / optimal / peak for optimum accept pH 3.6	(3) AO3 1a 1b

Question number	Answer	Mark
2(a)(iii)	(pH) 8 / 8.0 / eight accept phonetic spellings of eight	(1) A03 1a

Question number	Answer	Additional guidance	Mark
2(a)(iv)	An explanation including three from: - pH 5 is too {acidic / low} (1) - active site (of the enzyme) has changed (1) (so the) substrate will not {fit into / bind with} (the active site) (1) - no enzyme-substrate complex is formed (1) - because the enzyme is denatured (1)	accept proteins for substrate accept enzyme and substrate are no longer complementary ignore references to collisions between the substrate and the active site the active site is denatured is two marks	(3) A02 1

Question number	Answer	Additional guidance	Mark
2(a)(v)	(use a) water bath / incubator / idea of how the temperature can be set in a room	accept a description of a water bath ignore in the same room / use a thermometer	(1) AO1 2

(Total for question 2 = 9 marks)



Question number	Answer	Mark
5(a)(i)	diffusion accept phonetic spellings	(1)

Question number	Answer	Additional Guidance	Mark
5(a)(ii)	Any two from: • volume of water (1) • beaker (1) • temperature (1) • volume / concentration of food colouring (1) • pipette / {volume / size} drop of food colouring (1)	ignore amount accept the number of drops of food colouring ignore amount	(2)

Question number	Answer	Mark
5(b)(i)	plotted graph • axes labelled with units (1) • X axis water temp / Y axis time (1) • linear scale (1) • correctly plotted points and line drawn correctly (1)	(4)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation linking two from: • temperature increases (1) • because the particles move faster / there are more collisions / particles diffuse faster (1) • due to more kinetic energy (1)	accept particles {spread out / mixed} faster	(2)

Total for Question 5 = 9 marks



Question number	Answer	Mark
6(a)(i)	all the starch has been converted into glucose / all the starch has reacted with the amylase / all the starch is digested (1)	(1)

Question number	Answer	Mark
6(a)(ii)	Any two from: - pH of the solution (1) - concentration of amylase (1) - concentration of starch (1) - amount of mixing (1) - size of the tube used (1) - time interval must be the same (1)	(2)

Question number	Answer	Additional guidance	Mark
6(a)(iii)	it is a control/to check that starch doesn't breakdown into glucose without amylase (1)	ignore control variable ignore allow results to be compared	(1)

Question number	Answer		Mark
6(b)	A plan including three of the following: • mix starch solution with amylase (1) • use different pH values (1) • using buffers / test at pH solutions between pH 6.5 and 7.5 (1) • control named variables (1) • a method of testing for glucose/a method of testing for starch • the sample that produces glucose in the shortest time is closest to the optimum (1)	ignore mix the solutions accept ranges around 5 to 8 accept test the sample for starch/glucose	(3)

Question number	Answer	Mark
6(c)	An explanation linking: • the stomach is {acidic/low pH/pH 2}(1) • which will denature the {amylase/enzyme} (1) • changes the shape of the active site/substrate will not {bind/fit} into the active site (1)	(3)

(Total for question 6 = 10 marks)



Question number	Answer	additional guidance	Mark
6(a)(i)	it is more sophisticated / it is more shaped / it is sharper / been carved	accept ideas around more complex	(1) A03 1a

Question number	Answer	additional guidance	Mark
6(a)(ii)	An answer including two from: - location in the rock layer / how deep the tool is found (1) - older tools are deeper / ORA (1) - using other fossils found in the location (1)	accept stratigraphy accept radiometric dating of the rock layer (1) ignore carbon dating ignore measure the radiation in rocks	(2) A01 1

Question number	Answer	additional guidance	Mark
6(b)	An answer including two from: - larger skull / indication of larger brain (1) - bipedalism / description of bipedalism (1)	list rule applies accept (changes to) skull shape / larger brain / changes to teeth accept (walking) upright / pelvic changes / straighter	(2) A01 1

Question number	Answer	Mark
5(a)(i)	900 000 / 0.9 million / 900 thousand / 9 hundred thousand / nine hundred thousand / 9×10^5 (years) ignore 0.9	(1) AO2 1

Question number	Answer	Additional guidance	Mark
5(a)(ii)	Any one from: • hunting (1) • skinning (1) • making other tools (1) • preparing food / cooking (1) • fighting / weapons / defence (1) • building / making shelters (1) • making fire (1)	accept any other reasonable use of tools accept to break rocks ignore protection unqualified accept to date fossils (1)	(1) AO1 1

Question number	Answer	Additional guidance	Mark
5(a)(iii)	Any two from: - Lucy was shorter (1) - Lucy had a smaller skull (1) - Lucy was less upright (1) - Lucy had {longer arms / shorter legs} (1)	accept reverse arguments for <i>Homo habilis</i> for all mark points accept smaller brain / (changes to) skull shape or jaw / changes to teeth ignore bipedal / walked upright accept Lucy had a larger big toe / longer fingers (1)	(2) AO1 1

Question number	Answer	Additional guidance	Mark
5(a)(iv)	An explanation linking: - selection pressure / change in environment (1) - no advantageous adaptations (1) - unable to compete / they are outcompeted (1)	accept examples e.g. disease / predator / lack of food / natural disaster accept they cannot adapt (to the change) accept another species was better adapted accept there was competition	(3) AO2

Question Number	Answer	Additional Guidance	Mark
7(a)(i)	location in the rock layer / age of fossils surrounding it	accept radiometric dating / stratigraphy / comparison to other <i>Hipparion</i> fossils ignore carbon dating	(1) A02 1

Question Number	Answer	Additional Guidance	Mark
7(a)(ii)	similar (pentadactyl) limb structure / similarities in the {skeleton / bone} structure	ignore similar body shape	(1) A03

Question Number	Answer	Additional Guidance	Mark
7(b)	An answer including: • breed two animals that can run fast (1) • selection of offspring that can run fast (1) • repeat the process over many generations (1)	accept beneficial characteristic for running fast	(3) A02 1

Question Number	Indicative content	Mark
7 *(c)	AO1 6 marks Sexual reproduction Advantages • creates variations in a species • some organisms in a species can survive selection pressure • allows for evolution Disadvantages • requires a mate to be found • time for fertilisation / pollination means the process takes longer • offspring can have features that are less advantageous than the parents. Asexual reproduction Advantages • no requirement to find a mate • rapid productive cycle • organisms with beneficial characteristics of the parent can be produced Disadvantages • there is no variation • a selection pressure could affect all organisms of a species.	(6)



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents an explanation with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed. - Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Additional Guidance

Level 1	1-2	- A brief discussion of advantages or disadvantages for sexual OR asexual reproduction. - The response identifies the statements as advantageous or disadvantageous.
Level 2	3-4	- A brief discussion of advantages or disadvantages for sexual and asexual reproduction OR a brief discussion of the advantages and disadvantages for sexual or asexual reproduction. - The response is mainly error free and identifies the descriptions as advantageous or disadvantageous.
Level 3	5-6	- A detailed discussion of the advantages and disadvantages for sexual and asexual reproduction including the consequences of being genetically identical or genetically different. - The response is error free identifies all the discussion points as advantageous or disadvantageous.

(Total for Question 7 = 11 marks)



Question Number	Answer	Mark
8(a)(i)	C the volume of milk and the concentration of chymosin The only correct answer is C <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) AO2 2

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	An explanation linking two from: 40°C is the {optimum / closer to the optimum} / there is a faster rate of reaction (1) - because as temperature increases (kinetic) energy increases (1) - more chance of collision (between the chymosin and the milk protein) (1) - more enzyme-substrate complexes are formed (1)	accept the enzyme works faster	(2) AO2 1

Question Number	Answer	Additional Guidance	Mark
8(a)(iii)	An explanation linking: - time taken would be longer / the milk would not curdle (1) - because the enzyme is denatured / the active site has changed shape (1)	accept slow rate of reaction / a time greater than 75 seconds	(2) A02 1

Question Number	Answer	Additional Guidance	Mark
8(a)(iv)	Any one from: - it is a control (1) - to confirm that the milk doesn't curdle at that temperature without chymosin (1) - allows for a comparison with the results (1)	accept to see the effect of not adding chymosin	(1) A02 2

Question Number	Answer	Additional Guidance	Mark
8(a)(v)	Any two from: - use a smaller interval between the temperatures (1) - measure temperatures between the range of 35°C and 45°C (1) - controlling a variable not identified in the method (1) - keep the tubes at the required temperature after adding chymosin by using a water bath (1) - repeat the test at each temperature (1)	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) A03b

Question Number	Answer	Additional Guidance	Mark
8(b)	An explanation linking three from: • plasmid is cut with restriction enzymes/ chymosin gene is cut with a restriction enzyme (1) • sticky ends are complementary (1) • ligase is used to connect the chymosin gene and the plasmid (1) • recombinant plasmid is inserted back into the bacterial cell (1)	accept insert a plasmid with chymosin gene into the bacteria	(3) AO2 1

(Total for question 8 = 11 marks)



Question number	Answer	Mark
8(a)(i)	evaluation $(8 \times 8 \times 8) = 512$ (1) units mm^3 (1)	(2)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	dry the cube / check the balance is on zero	accept use a balance accurate to 1000^{th} gram ignore repeat the investigation	(1)

Question number	Answer	Additional guidance	Mark
8(a)(iii)	An explanation linking three from: - mass has decreased (1) - water has moved out (of the cube) (1) - water moves by <u>osmosis</u> (1) - across a partially permeable membrane (1) - from a high water molecule concentration to a low water molecule concentration (1)	accept the {cube / potato} has lost water accept semi-permeable membrane accept down a water potential gradient	(3)

Question number	Answer	Additional guidance	Mark
8(a)(iv)	An answer including three from: • (repeat with) different salt concentrations (1) • between the dilute and the concentrated solution (1) • make repeated readings at each concentration (1) • plot a graph to find the concentration with no mass change (1)	accept at concentrations closest to where there is little mass change accept find an average for each concentration accept idea of finding the point where the line crosses the x axis accept control all variables / control an example of a variable e.g. temperature (1)	(3)

Question number	Answer	Additional guidance	Mark
8(b)	An explanation linking: • (potato cells) have a cell wall (1) • which provides {structure / support} / which contains cellulose (1)	accept strong / rigid for idea of structural support accept cells become turgid (1) accept water enters the vacuole (1)	(2)

(Total for question 8 = 11 marks)



Question number	Answer	additional guidance	Mark
5(a)(i)	One from: • use a sterile {swab / equipment} • avoid the swab touching another surface • dispose of the swab in disinfectant • don't swab too {hard/far back}	accept sanitise / disinfect for sterile ignore clean / new accept idea of disposal of the {swab/gloves} after ignore general laboratory rules / slide preparation / cleaning the area	(1) A02 2

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An answering including: - start with the lowest objective lens (1) - use the focusing wheel / focus (1) (increase magnification to) ×40 objective lens (1) - with a 10x eye piece lens (1)	accept lowest {magnification / lens} / x4 lens accept use {adjustment / focus} knob / move the stage accept 400x objective lens if no eye piece magnification given If neither of the final two points are given: accept both named lenses with alternative magnifications that total ×400 for 2 marks accept use a x40 and x10 lens for 1 mark accept named objective and eye piece lens without	(3) AO1 2

Question number	Answer	additional guidance	Mark
5(b)	An explanation linking: - mitochondria (1) - which release energy / are where respiration occurs (1) OR - ribosomes (1) - which is where proteins are made / protein synthesis (1)	ignore makes / produces energy ignore respire / anaerobic respiration accept produce ATP accept a description of protein synthesis / translation	(2) AO1 1

Question number	Answer	additional guidance	Mark
5(c)	An answer including three from: - crush the cells (1) - add detergent / add a protease / add salt (1) - heat the sample (1) - filter (the extract) (1)	accept crush the fruit accept named detergents / soap accept named protease accept use a water bath	(3) AO2 2

Question number	Answer	additional guidance	Mark
5(d)	An answer including two from: • {map / find} the genes (1) • find the amino acid sequences / find the functions of proteins (1) • identify {alleles / mutations} (1) • genetic testing / prediction of disease risk (1) • personalised medicines / production of new medicines (1)	accept find the location of genes on chromosomes accept find the role of each gene accept better understanding of {diseases / inherited disorders} accept development of {new / better} treatments / gene therapy accept the idea of studying migration / ancestry (1)	(2) AO1 1

(Total for question 5 = 11 marks)

Question number	Answer	Additional guidance	Mark
4(a)	Measurement 15 mm (1) Substitution $15 \div 18\,000 = 0.00083$ (1) Standard form 8.3×10^{-4}	accept correct answer for full marks with no working. accept 14mm –16mm accept reading in cm Accept 0.00078 / 0.00086 / 0.00089 accept 8.9×10^{-4} 8.6×10^{-4} 7.8×10^{-4}	(3)

Question number	Answer	Mark
4(b)(i)	5 / 5.0 / 5.1 / 5.2 / 5.3 / 5.4	(1)

Question number	Answer	Mark
4(b)(ii)	A description including - from pH 5 to pH 7 the growth of the bacterium increased (1) - pH 7 is optimum (1) - from pH 7 to pH 8.5 the growth of the bacteria decreased (1)	(2)

Question number	Answer	Mark
4(c)(i)	The only correct answer is D volume of the milk A is incorrect as pH is an dependent variable B is incorrect as temperature is a independent variable C is incorrect as incubation time is set by the student	(1)

Question number	Answer	Additional guidance	Mark
4(c)(ii)	An answer including: - pH decreases (1) (from 6.6) to 4.8 / by 1.8 (1)	accept becomes more acidic	(2)

Question number	Answer	Additional guidance	Mark
4(c)(iii)	Substitution Change in pH = 1.4 (1) Evaluation: answer divided by 72 0.019	award full marks for correct answer with no working accept 0.0194 / 0.02	(2)

Total for Question 4 = 11 marks

Question Number	Answer	Mark
8(a)(i)	B substrate 1. The only correct answer is B <i>A is not correct because oxygen and water are the products</i> <i>C is not correct because the active site is part of the catalase enzyme</i> <i>D is not correct because a control would use water and not hydrogen peroxide</i>	(1) AO 2 1

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	- mass is a variable/ controlling a variable (1) - so the results could be compared/equal amount of catalase in each reaction (1)	accept the idea that different masses would need more or less oxygen/rise quicker or slower ignore references to fair test or reliable results accept enzyme for catalase	(2) AO 2 2

Question Number	Answer	Additional guidance	Mark
8(a)(iii)	Any two from: temperature (1) volume of hydrogen peroxide (1) the distance the potato had to rise (1) pH (1) size of test tube (1) age/variety/type of potato (1) surface area of potato (1)	ignore amount of hydrogen peroxide accept mass for volume accept all discs from the same potato the same stock solution of hydrogen peroxide (1)	(2) AO 3 3b

Question Number	Answer		Mark
8(b) (i)	Conclusion for 1 mark - increasing the concentration of hydrogen peroxide {increases the rate of reaction/decreases the time taken for the disc to rise} (1) and any three from: - provides more substrate (1) - increases collisions (1) - more active sites occupied (1) - forming more enzyme-substrate complexes (1) - oxygen is released faster (1)	accept hydrogen peroxide for substrate accept more oxygen released	(4) AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	substitution $1 \div 75 = 0.013333$ / 0.01 (1) correct number of decimal places 0.013 (s^{-1}) (1)	2 marks for correct answer to 3 decimal places with no working	(2) AO 2 2

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	substrate is not the rate limiting factor/all active sites (of catalase) are occupied	accept the {enzyme/another factor} is the limiting factor	(1) AO 2 1

Total for Question 8 = 12 marks

