



Examiners' Report June 2023

GCSE Biology 1BI0 2H

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Introduction

The Pearson Edexcel GCSE (9-1) Paper 2: Biology (Higher tier) paper is the second of two papers taken as part of the GCSE (9-1) Biology qualification. This is the sixth assessment of the GCSE (9-1) Biology specification, and the qualification follows a linear assessment model whereby candidates must complete the two papers in the same single year of certification.

Paper 2: Biology (Higher tier) is awarded a total of 100 marks, and it is assessed by a variety of question types, including, multiple-choice questions, short answer questions, calculations and extended open-response questions. Candidates should answer all questions in a time of 1 hour and 45 minutes. The extended open-response questions are identified by an asterisk (*) in the question paper to indicate that marks are also awarded for the ability to structure a response logically.

In addition, the GCSE (9-1) Biology qualification assesses practical knowledge and maths skills; the requirements of which are given in the specification. Furthermore, there are 8 mandatory core practical tasks that candidates must complete prior to the examination, as aspects of working scientifically are also assessed in questions throughout the paper.

The Paper 2: Biology (Higher tier) paper contains questions assessing the content from topics 1 and topics 6 to 9 as identified in the specification. In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of living indicators and the effect of pollution, osmosis and blood glucose regulation, aerobic and anaerobic respiration, diffusion, energy transfer in ecosystems, the hormones of the menstrual cycle, the carbon cycle, the role of the nephron and the action of ADH.

Questions designed to assess practical work included writing a plan to see the effect of temperature on photosynthesis, a thermoregulation practical including control variables, and setting up a control for the investigation. The maths skills assessment in this paper related to questions requiring the inverse square law for photosynthesis, interpretation of graphical information, conversion of units, and magnification calculations putting answers into standard form.

Most candidates were able to access both extended writing responses, demonstrating good knowledge of the carbon cycle and some knowledge of osmoregulation in the kidney. Higher ability candidates were able to apply their knowledge of the human hormones of the menstrual cycle and apply their knowledge of the blood related to molecules being able to enter the nephron and the role of ADH.

Question 1 (a)(ii)

The candidates were asked to state how the oxygen concentration changes from point A to point E. Any idea that the oxygen concentration increased was credited. Some responses referred to the calculation completed which was also acceptable for the mark.

(ii) State how the oxygen concentration changes from point A to point E.

(1)

It increases.



This was just enough for the mark as it refers to the oxygen concentration in the question.

(ii) State how the oxygen concentration changes from point A to point E.

(1)

it changes by 3ppm from 1.5 to 4.5



It changes by 3ppm is not enough for the mark as this could be increasing or decreasing but they qualify by saying from 1.5 – 4.5 so we can award the mark.



Make sure if you are quoting figures that you include whether it is increasing or decreasing to gain the mark.

Question 1 (a)(iv)

The question asks where biodiversity would be greatest in the stream. Acceptable answers were at point D or E as here the oxygen concentration was greatest and therefore more organisms can survive. Credit was also awarded for the idea of more organisms respiring and we also accepted more animals/plants or even species being more abundant. Credit was also given for the idea that biodiversity was higher before the factory if correctly explained.

(iv) Explain where the biodiversity will be highest in the stream.

(3)

E will have the most biodiversity because it has the most oxygen concentration which implies it is less polluted and cleaner. There are more variations in fresh water points.



E has the most biodiversity is Mark Point 1. It has the most oxygen concentration is Mark Point 2. More variation does not mention organisms, animals and plants so Mark Point 3 cannot be awarded.

(iv) Explain where the biodiversity will be highest in the stream.

(3)

Biodiversity will be highest at point E as there is a higher level of oxygen which is needed by organisms to survive. Furthermore this means that ~~diverse~~ different species can survive, ~~as they can~~ Furthermore due to the high oxygen concentration it means more animals are respiring which indicates high biodiversity.



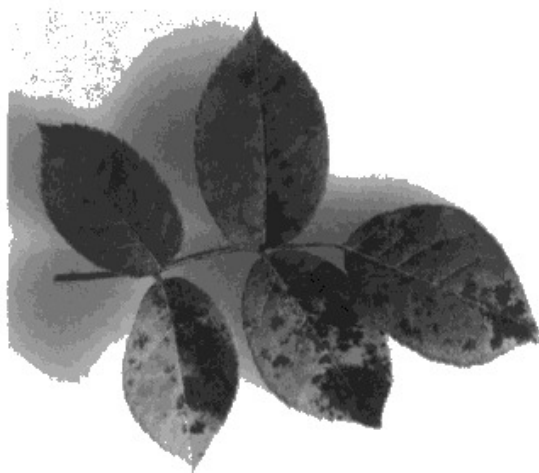
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Examiner Comments

Mark Point 1 is biodiversity highest at point E. A higher level of oxygen is enough for oxygen concentration is the highest for Mark Point 2. Different species can survive is more organisms survive for Mark Point 3.

Question 1 (b)

As both sulfur dioxide and blackspot fungus were referred to in the question, candidates were expected to link these together to state that blackspot fungus would not grow in areas where there is sulfur dioxide pollution. Just references to pollution were not credited and neither were references to increased fertilisers being used.

(b) Figure 3 shows rose leaves infected with blackspot fungus.



(Source: © Manfred Ruckzio/Shutterstock)

Figure 3

State why rose plants growing near this factory are not infected with blackspot fungus.

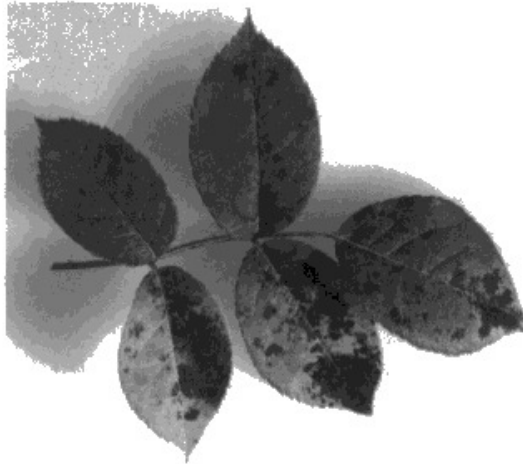
Sulphur dioxide ~~does~~ does not (1)
cause blackspot fungus



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Examiner Comments

This candidate is saying sulfur dioxide does not cause blackspot fungus but this is not the same as saying it kills the blackspot fungus. No marks can be awarded here.

(b) Figure 3 shows rose leaves infected with blackspot fungus.



(Source: © Manfred Ruckszio/Shutterstock)

Figure 3

State why rose plants growing near this factory are not infected with blackspot fungus.

The factory has fertiliser runoff⁽¹⁾ which means the rose plants aren't lacking any nutrients and therefore aren't infected.

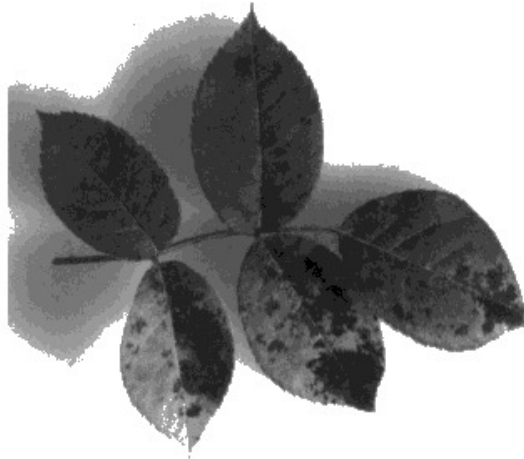
(Total for Question 1 = 7 marks)



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Examiner Comments

No marks awarded here as the candidate has not linked blackspot fungus to the sulfur dioxide concentration.

(b) Figure 3 shows rose leaves infected with blackspot fungus.



(Source: © Manfred Ruckzio/Shutterstock)

Figure 3

State why rose plants growing near this factory are not infected with blackspot fungus.

(1)

~~There is not enough oxygen for the fungus to respire.~~
The Sulfur dioxide kills the blackspot fungus.



Sulfur dioxide kills blackspot fungus is enough for this mark.

Question 2 (a)(ii)

Candidates were asked to explain why water moved out of the red blood cells of the person with diabetes. The correct response included the idea that water moved out of the cells by osmosis because the concentration of glucose was higher in the plasma than in the red blood cell across a partially permeable membrane. There were references to the glucose moving rather than the water, which was not credited. If candidates referred to water concentration from where water is in high concentration in the red blood cell to lower water concentration in the plasma, then this was credited but it is important that they refer to water or water potential here.

- (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 dm^3 .

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

(2)

There is less water outside the cell, in the blood so the water moves down the concentration gradient into the blood, out of the red blood cells because there is more glucose in blood than in cell.



Water moves down a concentration gradient means they are talking about a 'water concentration gradient' which is acceptable for Mark Point 2, for 1 mark.

- (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 dm^3 .

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

(2)

This is because the pancreas cannot produce enough insulin to turn the glucose into glycogen and therefore there is less room for the water in the blood so some water moves out.



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Examiner Comments

This does not score any marks, water moves out is not enough it must be via osmosis for the mark.

- (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 dm^3 .

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

(2)

The increase in glucose concentration makes the water concentration lower outside of the cell than the water concentration inside the cell, so water moves from high to low water concentration by osmosis.



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Examiner Comments

Mark Point 1 and Mark Point 2 can be awarded, here water moves out by osmosis Mark Point 1. From high to low water concentration Mark Point 2.



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Examiner Tip

When answering questions about osmosis or the movement of water ensure your answer is specifically about the water moving. Referring to water potential makes this explicit.

Question 2 (b)(ii)

The question asks how hormones get from where they are released to their target organ and any response linking this to the bloodstream, the blood plasma, or even the blood was credited. Inside red blood cells was not credited as this is incorrect. Acceptable answers are also through blood vessels or even named blood vessels.

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

(1)

through the blood



ResultsPlus
Examiner Comments

Through the blood is enough for 1 mark.

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

(1)

through red blood cells



ResultsPlus
Examiner Comments

In blood cells or through blood cells is incorrect and is not credited.

Question 2 (c)

The questions asked how type 2 diabetes was controlled. Most responses referred to controlling the diet to reduce blood glucose concentration or exercising to reduce blood glucose concentration. Credit was also awarded for the correct medication being taken such as metformin. Credit was not given for vague references to pills, tablets, or drugs being taken. Insulin injection/pumps was an acceptable answer as in some cases this is given.

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

(3)

Type 2 is caused by a persons rejection to their own insulin or when their body does not produce enough insulin. This can be controlled by a low ~~sugar~~ carbohydrate diet or spacing out meal times containing starchy carbs ^{so} as not to increase blood glucose levels greatly. They can also be administered insulin which breaks down glucose in the blood. (Total for Question 2 = 9 marks)
Or they can ~~re~~ exercise regularly.



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Examiner Comments

A low carbohydrate diet is in the accept column for Mark Point 2. Being administered insulin is for Mark Point 5. Exercise regularly is fine for Mark Point 1 so 3 marks awarded. Not to increase blood glucose levels could also be awarded for Mark Point 3 as this is the equivalent of lowering blood glucose levels.



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Examiner Tip

When answering questions about diabetes always refer to blood glucose levels or blood glucose concentrations not blood sugar.

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

(3)

Eat a balanced diet and exercise more because body becomes immune to insulin. Lose weight.



Eat a balanced diet is not enough for Mark Point 2, the diet must be controlled or be low in sugar/carbohydrate for Mark Point 2. However, exercising more and losing weight are Mark Point 1 and Mark Point 2. So two marks can be awarded.

Question 3 (b)(i)

Candidates were asked why the breathing rate of the athlete changed when running. The response required was either to absorb more oxygen for more respiration to release more energy or to remove more carbon dioxide from more respiration. These were alternative responses. The essential point here is that more was important, this could have been said to increase the oxygen taken in or words to that effect. Occasionally candidates referred to provide more glucose and this was not credited.

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

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

When running the body requires more energy, (2)
so breathing rate increases to increase oxygen
levels in the body. This allows for more
aerobic respiration, which allows more
energy to be released.



ResultsPlus
Examiner Comments

The word more only needs to appear once in the response so this is awarded 2 marks for more energy, more aerobic respiration is the same mark and increased oxygen is a mark so 2 marks can be awarded.

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

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

(2)

They need to get enough oxygen to the working muscles so there isn't a build up of lactic acid so that cramp doesn't set in.



This does not score any marks, enough oxygen is not enough for more oxygen and we can ignore any references to anaerobic respiration or lactic acid.

Question 3 (b)(ii)

Candidates were asked to state two differences between aerobic and anaerobic respiration and the majority of answers included aerobic uses oxygen and anaerobic produces lactic acid which was correct for 2 marks. Alternative answers included aerobic releases more energy or more ATP than anaerobic, Aerobic takes place in the mitochondria whereas anaerobic takes place in the cytoplasm. No credit was awarded for references to different types of exercise.

- (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. anaerobic respiration is respiration without oxygen that produces lactic acid.
2. aerobic respiration is with oxygen ~~practically~~ doesn't produce lactic acid.



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Examiner Comments

The question asks for two differences so both marks could be given for the first statement. Anaerobic is without oxygen and anaerobic produces lactic acid. The second sentence is just the converse.

Question 3 (c)(i)

This question was based on a practical for measuring photosynthesis using the indicator bromothymol blue. A table showing colour changes at different pH levels was given. Candidates were asked to explain why the air breathed out turned the BTB solution yellow. The response required was that the air breathed out contained more carbon dioxide which forms a weak acid when dissolved in water. Credit was given for turning the solution acidic or lowering the pH. If only the formula was written then this must be correct to be credited.

(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)

Because particles in your breath are acidic, and turn the BTB yellow. For example carbon, and oxygen, nitrogen.



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Examiner Comments

Particles in your breath are acidic is enough for the mark. We could also accept particles in the breath lowers the pH.

(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 |
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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)

because it contains CO_2 gas which is acidic so its pH is below 7



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Examiner Comments

Both marks can be awarded here as the candidate has referred to carbon dioxide and lowering the pH.



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Examiner Tip

If you want to use a chemical formula in your answer the chemical formula must be correct, if you are unsure then write the name of the substance as you will not be credited for incorrect formulae.

Question 3 (c)(ii)

This question followed on with the practical with pondweed being added to the BTB solution and one test tube being kept in the dark and the other in the light. Candidates were asked to explain the results for the different tubes. Credit was given for recognising that photosynthesis can happen for the tube in the light which removes carbon dioxide from the solution. For the tube in the dark, credit was awarded for either only respiration was taking place causing more carbon dioxide to be released or no photosynthesis took place so no carbon dioxide was removed.

- (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.

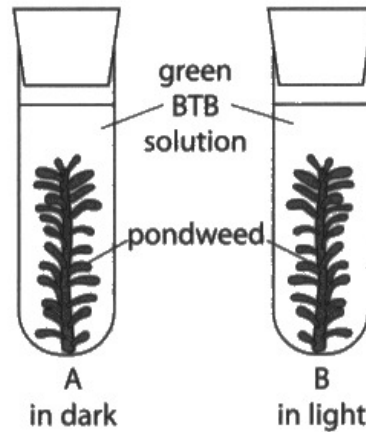


Figure 6

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)

Tube B stays green because this pondweed was in light and used CO_2 for photosynthesis and instead produced neutral oxygen. Tube A becomes yellowy green because it wasn't in light and so to release energy it used respiration which releases ~~to~~ acidic carbon dioxide.



This response gains both marks, a reference to respiration happening in tube A and photosynthesis in tube B.

- (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.

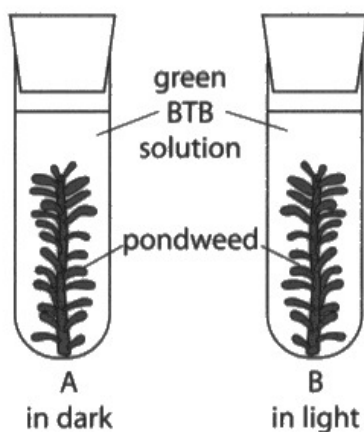


Figure 6

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)

In order for photosynthesis to happen the plant needs light ~~like~~ and produce oxygen, Tube A is going under anaerobic respiration releasing CO_2 ~~producing~~ making it yellow green.



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This response is not credited as there is no reference to either tube in the answer.

Question 4 (a)(ii)

The questions asked for one variable to be controlled in a thermoregulation experiment. Credit was given for the volume of water in each beaker, the mass/weight/thickness of the material and the starting temperature being the same. Responses stating the amount were not credited, as we want to see scientific units being used during investigations.

(ii) State **one** variable that should be controlled in this investigation.

(1)

The amount of each material wrapped around the beaker.



There are no marks for vague terms like amount it must be mass, volume etc.



Always use scientific units like mass or volume when controlling variables.

(ii) State **one** variable that should be controlled in this investigation.

(1)

the temperature in the room.



Temperature is not acceptable for the mark, it must be starting temperature.

Question 4 (a)(iii)

The question asked for 'a control' used during this investigation which was to repeat the experiment but without the insulating material. Some responses still confuse 'a control' with controlling a variable. Responses that included controlling a variable were not credited.

(iii) Describe a control that could be used for this investigation.

(2)

A similar setup can be used without any material wrapped around. This is to see if there is a change with or without any materials.



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Examiner Comments

This is enough for the mark, a similar setup is fine for Mark Point 1 without insulating material is the second mark.



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Examiner Tip

Do not confuse controlled variables and 'a control' when answering questions based on practical work.

Question 4 (b)(i)

This question asked the candidates to compare and contrast the data for two different insulating materials. This means that a similarity and a difference should be given. The similarity is that in both cases the temperature dropped over time and the difference was that polyester dropped more than wool. Also credited were responses that referred to final temperatures being similar despite starting temperatures being different.

(b) The results for this investigation are shown in Figure 9.

| wool | | polyester | |
|-----------------|-------------------|-----------------|-------------------|
| time in minutes | temperature in °C | time in minutes | temperature in °C |
| 0 | 64 | 0 | 82 |
| 2 | 61 | 2 | 74 |
| 4 | 56 | 4 | 68 |
| 6 | 53 | 6 | 63 |
| 8 | 49 | 8 | 59 |
| 10 | 45 | 10 | 53 |
| 12 | 42 | 12 | 48 |

22 Figure 9

34

(i) Compare and contrast the temperature changes for wool and polyester in this investigation.

(2)

The polyester temperature decreased by 34°C and the wool temperature decreased by 22°C . Therefore the wool decreased at a slower rate than the polyester.



The wool decreased at a slower rate than the polyester is enough for both marks as it implies both are decreasing and one is decreasing faster than the other.

(b) The results for this investigation are shown in Figure 9.

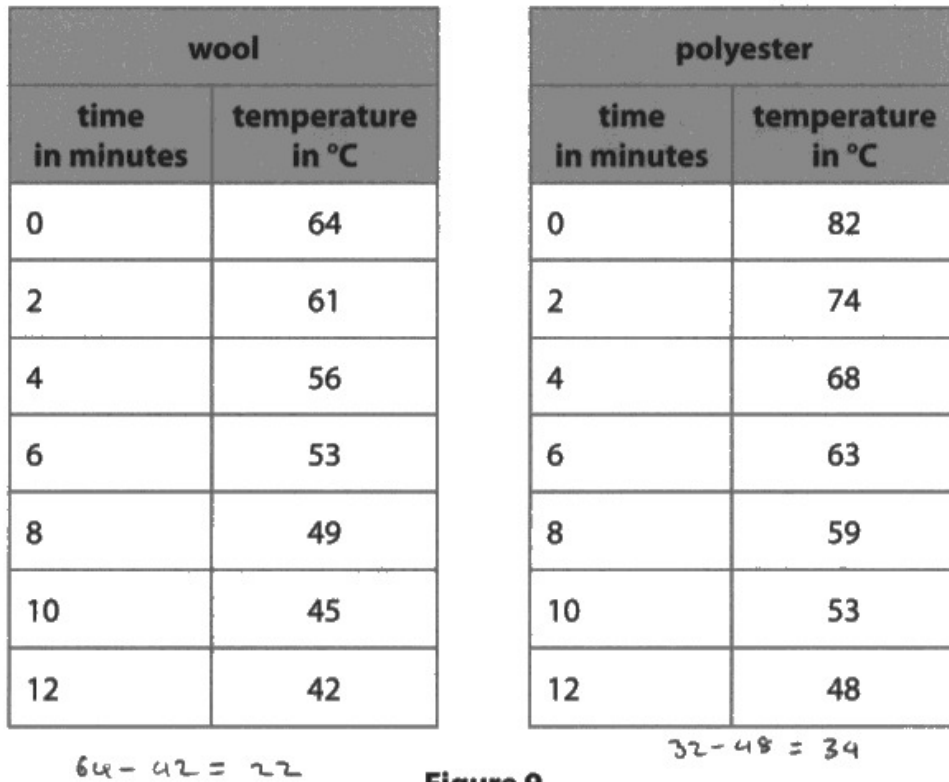


Figure 9

(i) Compare and contrast the temperature changes for wool and polyester in this investigation.

(2)

The polyester resulted in the greatest change in temperature of ~~22~~ 34°C whereas the wool as a lower change in temperature of 22°C . ~~There were both a~~ ^{temperatures} ~~and~~ final ~~temperatures~~ were ~~relatively~~ relatively similar despite having a large difference in starting temperatures.



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Examiner Comments

This candidate has only referred to temperature change so cannot be awarded Mark Point 1 or Mark Point 2. They have stated the final temperatures were similar despite a large difference in starting temperature which is acceptable for 1 mark.

Question 4 (b)(ii)

The question asked for an improvement to the experiment to make the results more comparable. The starting temperature being the same was the obvious answer looking at the data but we also credited continuing the investigation until the temperature stopped dropping.

Question 4 (c)(i)

This question asked how sweating regulated temperature in humans. Most correct answers related to sweat being released onto the surface of the skin which evaporated and cooled the body down. There was no credit for just referencing the term sweat as this was given in the question.

(c) (i) Wearing an insulated jacket may cause a person to sweat.

Explain how sweating helps to regulate temperature in humans.

(2)

The sweat evaporates from the surface of the skin, transferring heat to the surroundings, regulating temperature by making the body cooler.



Sweat is in the stem of the question so we cannot award this in isolation. Sweat evaporates is Mark Point 2, from the surface of the skin is Mark Point 1. Causing the body to cool down Mark Point 3. Only 2 marks available for the question so 2 marks awarded.

Question 4 (c)(ii)

This question asked where and how urea was produced in the human body. There are some misconceptions that urea is made in the kidneys, this is incorrect. The accepted responses referred to urea being made in the liver from excess amino acids or by the process of deamination.

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

(2)

urea is produced in the kidneys and is used as
one of the particles found in urine as it travels from
the kidney to the bladder



Urea being made in the kidneys is a common error. 0 marks.

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

(2)

Urea is produced in the liver



1 mark for urea is produced in the liver.

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

(2)

- urea is produced in the liver

- through the breakdown of amino acids.



Urea is produced in the liver Mark Point 1 through the breakdown of amino acids Mark Point 2. We do not need **excess** amino acids.

Question 5 (a)(i)

This is a question based on the photosynthesis core practical task looking at how light intensity affects the rate of photosynthesis. The question asks candidates to state why the student included a water bath. Acceptable answers included maintaining a constant temperature or as a heat shield to prevent the heat from the light affecting the experiment.

5 A student investigated the effect of light intensity on the photosynthesis of pondweed.

A light source was placed at different distances from the pondweed.

The bubbles produced were counted for 2 minutes.

Figure 10 shows the apparatus that was used.

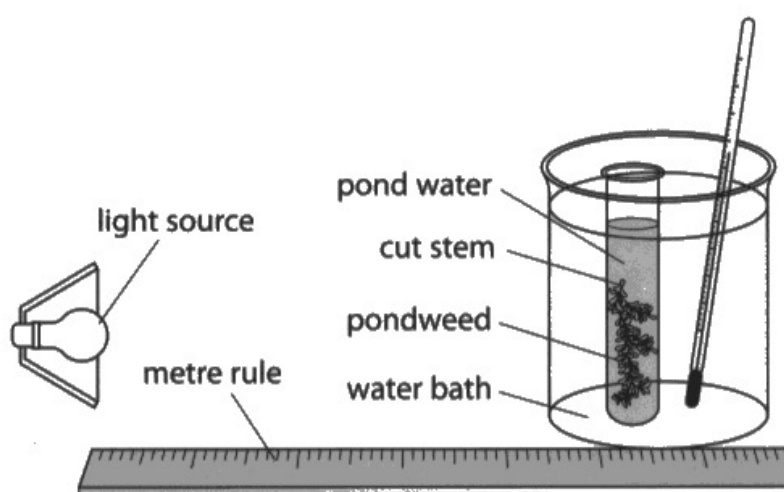


Figure 10

(a) (i) State why the student included a water bath in the apparatus.

(1)

So that the energy from the light source is concentrated on the test tube containing pondweed



We are looking for the idea of a heat shield or to control temperature here. This is neither so no marks can be awarded.

5 A student investigated the effect of light intensity on the photosynthesis of pondweed.

A light source was placed at different distances from the pondweed.

The bubbles produced were counted for 2 minutes.

Figure 10 shows the apparatus that was used.

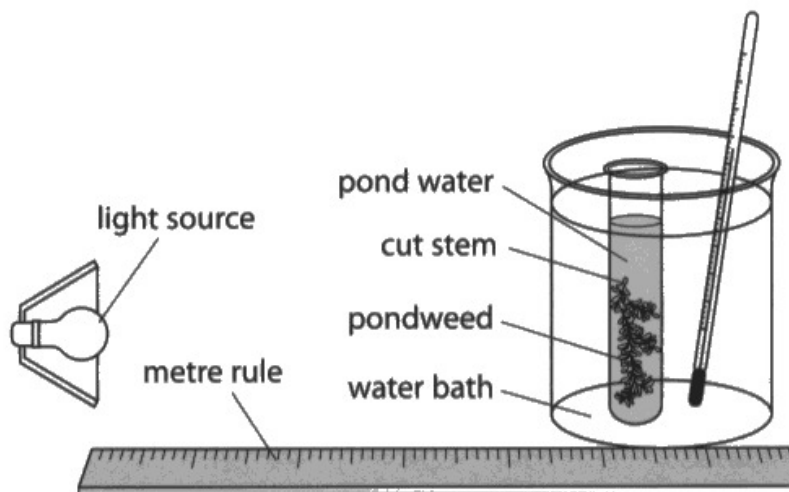


Figure 10

(a) (i) State why the student included a water bath in the apparatus.

To stop heat from the light affecting the temperature of the plant. ^{to make a} control variable. (1)



This is a description of a heat shield for 1 mark.

Question 5 (a)(ii)

Candidates were asked to state two variables that needed to be controlled. In this case, there were several possible answers including temperature, volume of pond water, mass of pond water, and carbon dioxide concentration. Once again, we do not credit the amount of water/pondweed as we are expecting scientific units to be used.

(ii) State **two** variables that should be controlled when completing this investigation.

(2)

1 the mass of pondweed used

2 the same light source



Mass of pondweed is Mark Point 4. The same light source is in the additional guidance column for Mark Point 1. 2 marks.

(ii) State **two** variables that should be controlled when completing this investigation.

(2)

1 the temperature of the waterbath
and pondweed

2 the mass of pondweed used



Both variables are valid and on the mark scheme, 2 marks. Please note, controlling temperature is enough for the mark.

(ii) State **two** variables that should be controlled when completing this investigation.

(2)

1 *The distance of the light source from the pondweed.*

2 *The amount of pondweed used.*



The distance from the light source is changing so no mark. We do not credit the amount of pondweed, must be mass/length or type.
0 marks.

Question 5 (b)(i)

Candidates were asked to calculate the light intensity at 25cm from the lamp. A table of values was given where the light intensity had been calculated for four other values. The candidates were also informed to use the inverse square law for photosynthesis. They had to apply their knowledge either by trial and error using the calculated values in the table or by applying the inverse square law. They scored 2 marks for writing out the calculation $1 \div 25^2$ and all three marks for the correct answer of 0.0016 (arbitrary units) on the answer line. It is always important to show working in all calculations.

(b) Figure 11 shows the results of this investigation.

| distance from the lamp in cm | number of bubbles in two minutes | light intensity in arbitrary units |
|------------------------------|----------------------------------|------------------------------------|
| 5 | 62 | 0.04 |
| 10 | 60 | 0.01 |
| 15 | 43 | 0.0044 |
| 20 | 32 | 0.0025 |
| 25 | 11 | ? |

Figure 11

- (i) The light intensity was calculated using the inverse square law for photosynthesis.

Calculate the light intensity at a distance of 25 cm from the lamp.

Include the equation for the inverse square law in your answer.

(3)

$$\begin{array}{ll} 5^{-2} & 0.04 \\ 10^{-2} & 0.01 \\ 15^{-2} & 0.0044 \\ 20^{-2} & 0.0025 \\ 25^{-2} & 0.0016 \end{array}$$

0.0016 arbitrary units



Even though there is no evidence of the equation, the correct answer is on the answer line for 3 marks.

(b) Figure 11 shows the results of this investigation.

| distance from the lamp in cm | number of bubbles in two minutes | light intensity in arbitrary units |
|------------------------------|----------------------------------|------------------------------------|
| 5 | 62 | 0.04 |
| 10 | 60 | 0.01 |
| 15 | 43 | 0.0044 |
| 20 | 32 | 0.0025 |
| 25 | 11 | ? |

- (i) The light intensity was calculated using the inverse square law for photosynthesis.

Calculate the light intensity at a distance of 25 cm from the lamp.

Include the equation for the inverse square law in your answer.

(3)

$$\text{light} = \frac{1}{x^2}$$

$$\frac{1}{25^2} = 1.6 \times 10^{-3}$$

$$0.0016$$

.....0.0016 arbitrary units



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Examiner Comments

This candidate has shown the correct equation (replaced d for x but that is acceptable). They have substituted correctly for Mark Point 2. Incorrect calculation out by a power of 10 so only 2 marks can be awarded.



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Examiner Tip

Always show your working in mathematical questions.

Question 5 (b)(ii)

For the investigation, the candidates were told that the number of bubbles was counted and they were then asked how this method could be improved to get a more accurate measurement of the gas. Answers included using a gas syringe to collect the gas or to get a measurement of the volume. Alternatively, they could use a data logger or video camera and playback in slow motion to ensure they counted every bubble. Also accepted was to use an inverted measuring cylinder with water where the oxygen displaced the water giving them a measure of volume.

- (ii) Explain how the student could improve this investigation to get a more accurate measurement of the gas produced.

(2)

They could collect the gas in a gas syringe with a water bubble and measure the amount of gas produced by the how far the water bubble moves



Collect the gas produced in a gas syringe is Mark Point 1 in a gas syringe is Mark Point 2. 2 marks.

- (ii) Explain how the student could improve this investigation to get a more accurate measurement of the gas produced.

(2)

The student could put a heat filter in front of the lamp so that the waste heat produced by the lamp does not affect the temperature of the plant.



A heat shield is already in place so this cannot be credited. 0 marks.

(ii) Explain how the student could improve this investigation to get a more accurate measurement of the gas produced.

(2)

retake the investigation to see if the results are similar or different.



Repeating the experiment does not make the measuring more accurate. 0 marks.

Question 5 (c)

Candidates were asked to devise a plan to show that temperature is a limiting factor in photosynthesis using the apparatus given. Marks were awarded for keeping the light at the same distance or a given distance or keeping the same light intensity. Counting the number of bubbles produced or measuring the volume of gas produced was also awarded a mark. Repeating the experiment at different temperatures or giving a list of temperatures was awarded a mark and the idea of controlling the mass or pondweed, type of pondweed, or the carbon dioxide concentration was also awarded a mark.

(c) Devise a plan to show that temperature is a limiting factor in photosynthesis.

Use the apparatus shown in Figure 10.

(3)

1. set up the experiment the exact same way except this time ~~the~~ as we are testing the effect of temperature, we want this to be our independent variable so each time fill the beaker with different temperatures of water eg. 5°C then 10°C then 15°C etc.
 2. Make sure the distance of the light stays in the same position as well as the type of pondweed. A ruler is not needed + keep pond ^{water} same.
 3. Repeat experiment with different temperatures of water in beaker and see the effect it has on the pondweed in a given time.
- (Total for Question 5 = 11 marks)



Different temperatures can be said in many ways, candidates could list the temperatures or have several different test tubes at different temperatures for Mark Point 3. The light in the same position is Mark Point 1. Same type of pondweed is a variable Mark Point 4. 3 marks.

(c) Devise a plan to show that temperature is a limiting factor in photosynthesis.

Use the apparatus shown in Figure 10.

(3)

cut the stem of pondweed and place it in a ^{test-tube} ~~beaker~~ with pondweed
and place it in a beaker. However, do not place it in a waterbath.
Keep moving the beaker along the ruler to see how
many bubbles produced at a certain distance away
from the light source in a known time. Keep doing
this until the volume of bubbles produced remains
constant. At this point, temperature becomes limiting factor.



This candidate is testing light intensity again, not temperature. They are counting bubbles, so Mark Point 2 can be awarded.

Question 6 (a)(iii)

Candidates were asked to explain how gases move from the alveolus to the capillary. Answers included diffusion for one mark down a concentration gradient or from high concentration to low concentration for one mark. Through a membrane was also awarded a mark. Some responses included osmosis rather than diffusion which was not credited.

(iii) The capillary wall is only one cell thick.

Explain how gases move from the alveolus to the capillary.

(3)

The gasses diffuse across the cell wall which is quick and easy as it is only one cell thick, so they diffuse into the capillary.



1 mark can be awarded for gases diffuse. We are not awarding cell wall is one cell thick as this is given in the stem of the question.

(iii) The capillary wall is only one cell thick.

Explain how gases move from the alveolus to the capillary.

(3)

The carbon dioxide diffuses out of the capillary into the alveolus,
the oxygen diffuses out of the ^{alveolus} ~~alveoles~~ into the capillary. The
alveolus has a moist lining to help with diffusion. There is a large
concentration gradient, kept constant by the good blood supply in
the capillary. ~~2~~

x across a partially permeable membrane



ResultsPlus
Examiner Comments

Carbon dioxide diffuses is Mark Point 1. Although the candidate talks about a concentration gradient it is not clear what this applies to so we cannot award that mark. At the bottom of the page is across a partially permeable membrane which is Mark Point 3. 2 marks.

Question 6 (a)(iv)

This was an applied question and was aimed at the higher-grade responses. Candidates were asked to explain the advantages of blood cells passing through one at a time along a capillary. Acceptable answers included slowing the blood flow so more diffusion can take place across a shorter diffusion distance. Gas exchange was acceptable for diffusion and also acceptable was the idea that this maximised the uptake of oxygen to each red blood cell. Several responses referred to blood clotting or higher and lower blood pressure, these were not credited.

(iv) Explain the advantages of red blood cells passing one at a time through this narrow capillary.

(3)

The advantages are that it can allow maximum gas exchange for each red blood cell allowing more oxygen to go to the red blood cell forming oxyhaemoglobin and to remove carbon dioxide from every single red blood cell in order for it to be oxygenated again.



ResultsPlus
Examiner Comments

More oxygen to enter the red blood cell is the equivalent of maximise the uptake of oxygen. More gas exchange is Mark Point 4. 2 marks can be awarded.

(iv) Explain the advantages of red blood cells passing one at a time through this narrow capillary.

(3)

One advantage is the the ~~blood~~
~~with~~ red blood cells won't get
blocked up in the capillary and won't
prevent blood flow



ResultsPlus
Examiner Comments

No marks awarded for not blocking blood vessels. This was a common misconception.

Question 6 (b)

This question was a mathematical calculation for the surface area of a human lung. One mark was awarded for the correct calculation of 70 and one mark for including the correct units for the area which was mm^2 . Some candidates tried to convert this into cm^2 which was credited if calculated correctly.

(b) The average number of alveoli in each human lung is 280 million.

The surface area of 1 million alveoli is 0.25 m^2 .

Calculate the total surface area of a human lung.

(2)

$$0.25 \times 280 \text{ million} = 70 \text{ million m}^2$$

70 million m^2



ResultsPlus
Examiner Comments

1 mark can be awarded for the units. 70 million is incorrect. 1 mark only.

Question 7 (b)(i)

This question was about a food web in the Antarctic Ocean with several feeding relationships given. Candidates were asked why the removal of cod could cause the numbers of squid and penguins to decrease. The answer was that seals would eat or predate upon more squid and penguins because the cod was not available. There were some misconceptions regarding the food web and candidates incorrectly reading the feeding relationships. Several answers included the squid and penguins eating the seals which was not credited.

(b) Humans are removing large numbers of cod from the Antarctic Ocean.

(i) State why the removal of cod could lead to a decrease in the numbers of squid and penguins.

Seals would be more likely to hunt squid and penguins if the number of cod decreases (1)



More likely to hunt penguins and squid is 1 mark.

(b) Humans are removing large numbers of cod from the Antarctic Ocean.

(i) State why the removal of cod could lead to a decrease in the numbers of squid and penguins.

Penguins and squid have less food so some will starve. (1)
~~there will be less fish to eat therefore~~
~~less food and some penguins will starve~~



Penguins and squid will actually have more food, so this is incorrect.

Question 7 (b)(ii)

Relating to the food web again, candidates were asked why the penguins and squid numbers would increase if the cod was removed. This answer should be the idea that there was less competition for food as more shrimps will be available for 2 marks. Again there were some misconceptions regarding the feeding relationships with responses stating that the shrimps will eat more penguins, this was not credited.

- (ii) Explain why the removal of cod could lead to an increase in the numbers of squid and penguins.

(2)

It could lead to a decrease in the number of seals as there they don't have enough food leading to less predation of squids and penguins leading to their populations increasing.



This response has taken the argument one step further. We are not crediting any reference to seals dying out as this is not a direct consequence.

(ii) Explain why the removal of cod could lead to an increase in the numbers of squid and penguins.

(2)

The cod eat shrimp just like penguins and squid so with no cod there will be less competition for food for the penguins and squid so they will increase in numbers.



ResultsPlus
Examiner Comments

Less competition for food is 1 mark we cannot award Mark Point 2 because we need more food / more shrimps available not just the fact that they are eaten.

Question 7 (c)(i)

Candidates were asked to draw and label a pyramid of biomass for a food chain. The values for this were given and a squared grid was provided to draw the pyramid. One mark was awarded for the correct labelling from bottom to top with phytoplankton on the bottom and seals at the top. The second mark was awarded for the correct proportions applied. There was some leeway with this, as long as each respective bar was 50% or less than the one below, credit was given. There were no marks for drawing a triangle for the pyramid mark but the labelling mark could still be awarded if it was correctly labelled.

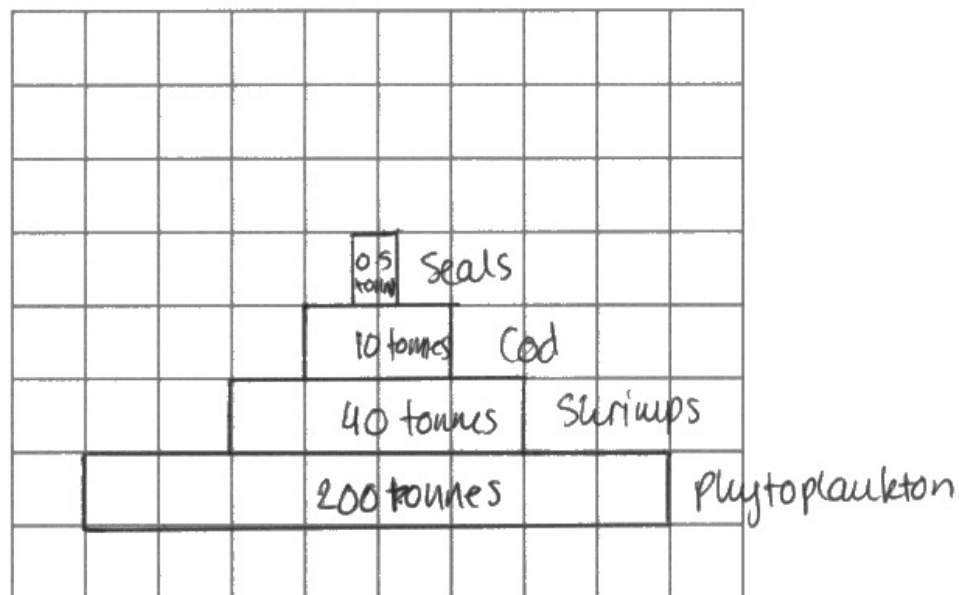
(c) Figure 14 shows information about the biomass of some organisms in one part of the Antarctic Ocean.

| organism | biomass in tonnes |
|---------------|-------------------|
| phytoplankton | 200 |
| shrimps | 40 |
| cod | 10 |
| seals | 0.5 |

Figure 14

(i) Draw and label a pyramid of biomass for this food chain.

(2)



Each bar is 50% or less than the 1 below so Mark Point 1 can be awarded. Mark Point 2 can be awarded for the correct organisms in the correct order.



For a pyramid of biomass you must show the different bars, never a triangle.

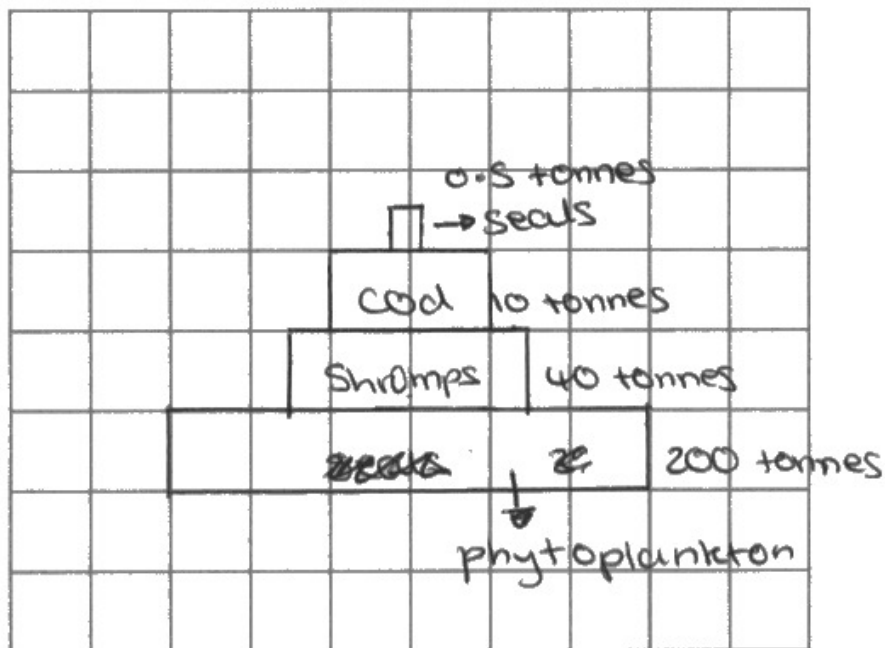
(c) Figure 14 shows information about the biomass of some organisms in one part of the Antarctic Ocean.

| organism | biomass in tonnes |
|---------------|-------------------|
| phytoplankton | 200 |
| shrimps | 40 |
| cod | 10 |
| seals | 0.5 |

Figure 14

(i) Draw and label a pyramid of biomass for this food chain.

(2)



1 mark for correctly named organisms in the correct order. The bar for cod is not 50% or less than shrimps so the pyramid mark cannot be awarded.

Question 7 (c)(ii)

The question asked why the biomass conversion was less for cod to seals rather than phytoplankton to shrimps. The idea that seals have to maintain a constant body temperature so there is more heat loss therefore more food needed to be consumed was expected. Also, we accepted the idea that less of the cod could be eaten than the phytoplankton.

(ii) Seals are mammals.

Explain why the conversion of biomass from phytoplankton to shrimps is more efficient than the conversion of biomass from cod to seals.

(2)

More energy is lost through ^{movement} respiration in seals as they chase their food and not all of the cod is digested e.g. bones, making the phytoplankton → shrimp more efficient



ResultsPlus
Examiner Comments

Not all of the cod can be digested is 1 mark. There is no credit for references to movement as all the organisms move.

(ii) Seals are mammals.

Explain why the conversion of biomass from phytoplankton to shrimps is more efficient than the conversion of biomass from cod to seals.

(2)

The conversion of biomass from phytoplankton to shrimp is more efficient because the shrimp has less metabolic processes to use up energy competing whereas seals require a lot of energy to maintain internal body temperature as well as the metabolic processes.



Seals need to maintain a body temperature 1 mark, shrimp have fewer metabolic processes is not creditable. 1 mark awarded.

Question 7 (d)

The question asked about two actions that could be taken by humans to increase the number of cod in the Antarctic Ocean. Acceptable answers included less fishing for cod or the idea of fishing quotas. The idea that cod could be bred in captivity and released, fish farms was included in this. Only catching larger fish so having nets with larger holes. Not fishing for cod in protected zones or conservation areas. Finally the idea of not removing shrimps, which were the cod's main food or culling/removing seals as these were their main predator.

(d) Cod are being overfished in the Antarctic Ocean.

Suggest **two** actions that could be taken by humans to increase the number of cod in the Antarctic Ocean.

(2)

1. Alternative food eat less fish and eat other foods
2. Introduce more prey for cod so they can eat more and reproduce



Eat less fish is not enough but we would have credited eat less cod. No mark for introducing more shrimps / prey. 0 marks awarded.

(d) Cod are being overfished in the Antarctic Ocean.

Suggest **two** actions that could be taken by humans to increase the number of cod in the Antarctic Ocean.

(2)

- 1 Reduce the no. of seals in the area by introducing a new species that feeds on seals.
- 2 ~~Increase the no. of shrimp in the area~~ Add another new species that cod can feed on.



Reduce the number of seals is cull seals Mark Point 6. No mark for introducing a new species as this is unlikely to be practical.

Question 8 (a)(ii)

This question asked candidates to explain how two of the hormones shown in the diagram could cause ovulation. The reference to LH or luteinising hormone was awarded a stand-alone mark here. Alternatively, candidates could give the process that FSH causes the egg to mature in the follicle. FSH stimulates the release of oestrogen. High levels of oestrogen cause an LH surge. This causes the egg to be released from the follicle.

(ii) Explain how **two** of the hormones shown in Figure 15 cause ovulation.

(3)

FSH (follicle stimulating hormone) causes an egg in the ovary to mature into an egg cell. LH (luteinising hormone) causes the mature egg to be released from the ovary, leaving the corpus luteum behind. This is ovulation.



FSH causing egg to mature is Mark Point 1. LH is Mark Point 3, causing a mature egg to be released is Mark Point 3.

(ii) Explain how **two** of the hormones shown in Figure 15 cause ovulation.

(3)

FSH stimulates the maturation of egg follicles which increases the oestrogen levels which causes the lining of the uterus to begin to thicken again which triggers the release of LH which causes ovulation.



ResultsPlus
Examiner Comments

FSH stimulates egg maturation is Mark Point 1. Which increases oestrogen Mark Point 2. Triggering the release of LH is enough for Mark Point 3. 3 marks. Please note Mark Point 4 is the release of an egg from an ovary which is a description of ovulation for 1 mark but ovulation is in the stem of the question and therefore cannot be credited.

Question 8 (a)(iv)

This question was aimed at the candidates achieving a grade 7 and above. They were asked to explain how the levels of each hormone would be different if the woman was pregnant. Each of the hormones should be mentioned including the inhibition of FSH by oestrogen and the inhibition of LH and FSH by progesterone. These were sometimes a little muddled. The role of FSH remaining low so no egg matured in the follicle was credited. LH remaining low to prevent ovulation was credited. Also credited was the idea that oestrogen and progesterone levels remain high to maintain the lining of the uterus. There were some responses linked to the uterus wall thickening rather than the lining and these were not credited.

- (iv) Explain how the levels of each hormone in the woman shown in Figure 15 would be different, if she was pregnant.

~~Ex~~ FSH ~~would~~ levels would ⁽⁴⁾ be low. Oestrogen levels will be low, or not present at all. ~~Ex~~ ~~levels~~ ~~would~~ ~~remain~~ ~~constant~~ ~~to~~ ~~maintain~~ ~~lining~~. LH levels would be low. Progesterone levels will be high, to not cause the lining to break.



This answer is an explanation so each statement must be an explanation. No marks are available for just stating the levels of hormones. 1 mark can be awarded for progesterone levels are high, to not cause the lining to break is just enough. 1 mark awarded.

(iv) Explain how the levels of each hormone in the woman shown in Figure 15 would be different, if she was pregnant.

- (4)
- FSH would be inhibited (less FSH), because a follicle no longer needs to be matured.
 - LH will be inhibited because there is no egg/follicle for it.
 - Oestrogen and progesterone will stay high because the uterus lining must be ~~maint~~ built and maintained to keep the fertilised egg.



Mark Point 1 can be awarded for less FSH because the follicle does not need to be matured. Mark Point 4 AND Mark Point 5 for oestrogen and progesterone to build and maintain uterus lining. 3 marks.

Question 9 (a)(ii)

This was a mathematical calculation for a magnification calculation. The most common error here was that candidates did not convert their answers into standard form as requested in the question. The correct answer was 4.0×10^{-2} .

(ii) The image has been magnified 150x.

Calculate the actual size of the guard cell.

Give your answer in standard form in mm.

(3)

$$M = \frac{I}{a} \quad \frac{150 = \frac{I}{6}}{150 = \frac{I}{6}} \quad \frac{150 \times 6 = I}{6} \quad \frac{6}{150} = 0.04$$

4×10^{-2} mm



ResultsPlus
Examiner Comments

Correct answer on the answer line is 3 marks.



ResultsPlus
Examiner Tip

Make sure you read the whole question. If it asks you to put the answer in standard form that is worth a mark.

(ii) The image has been magnified 150x.

Calculate the actual size of the guard cell.

Give your answer in standard form in mm.

(3)

$$\text{mag} = \frac{\text{Image}}{\text{real}}$$

$$\frac{\text{Image}}{\text{mag}} = \text{real}$$

.....0.4.....mm



ResultsPlus
Examiner Comments

No working and 0.4 on the answer line cannot be credited. 0 marks.

Always show the working in an answer.

Question 9 (b)

Candidates were asked to explain the role of denitrifying bacteria in the nitrogen cycle. There were a few misconceptions here with the conversion being given the incorrect way around but most candidates recognised that denitrifying bacteria converts nitrates into nitrogen gas. Nitrites were acceptable for nitrates were nitrogen compounds.

(b) Explain the role of denitrifying bacteria in the nitrogen cycle.

(2)

denitrifying bacteria changes nitrates in the soil back into the atmosphere as nitrogen



ResultsPlus
Examiner Comments

This could be nitrites or nitrates in the soil for Mark Point 1 back to nitrogen Mark Point 2. 2 marks.

(b) Explain the role of denitrifying bacteria in the nitrogen cycle.

(2)

To break down nitrogen into nitrates
which can be then taken up by plant roots within
the soil



ResultsPlus
Examiner Comments

This response is the incorrect way around. 0 marks.

Question 9 (c)

This was the extended open-response question and candidates were asked to describe how carbon is cycled through the biotic and abiotic components of the ecosystem. The response should include reference to the processes of photosynthesis, respiration, and decomposing as well as the idea of combustion or oceans becoming a carbon sink. The answer must also relate to the correct carbon compound, for example in the case of photosynthesis and respiration it is carbon dioxide. For the answer to attain a Level 3, all these need to be referred to correctly. For a Level 2 response there could be a detailed response of the abiotic or biotic carbon cycle or a simple description of how carbon is cycled in each. For a Level 1 response, a simple description of how carbon is cycled including the idea that animals eat plants or other animals and take on carbon.

***(c) Describe how carbon is cycled through the biotic and abiotic components of an ecosystem.**

(6)

Carbon is found in the air and atmosphere. During photosynthesis, plants absorb carbon compounds through carbon dioxide. Animals eat these plants and the carbon compounds are stored in them. When these animals excrete or die, their waste or decay ~~decomposes~~ is decomposed by decomposers (microorganisms). Carbon compounds are absorbed by the ground. Carbon compounds are released by animals in respiration.



ResultsPlus
Examiner Comments

This response is enough for Level 2, they have plants using carbon dioxide to photosynthesise. Animals are eating the plants with carbon compounds in them. Decomposers are mentioned as are carbon compounds released by animals in respiration. This is detailed about biotic but there is no abiotic reference. Maximum 4 marks.

* (c) Describe how carbon is cycled through the biotic and abiotic components of an ecosystem.

(6)

Carbon is cycled through the abiotic components as:

- When an animal dies, it releases carbon dioxide into the atmosphere.
- This means that it is absorbed by the nearby plants such as ~~leaves~~ leaves on a tree, and grass.*
- When the leaves fall off the tree, the biomass gathers as litter on ~~the~~ the ground, and is then reabsorbed through the soil and taken through the plants via roots, and the cycle happens again.

* It is absorbed through photosynthesis, which the plant needs to make energy. (water + carbon dioxide \rightarrow glucose + oxygen)
 $6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

It is cycled through the biotic components as follows:

- When the animal dies, it's eaten by other animals (carbon absorbed through that).
- When animals which are herbivores eat the plants it is eaten through that.
- This means the animals have some form of carbon in them, which they release when they die and the cycle continues.



The main body of this answer is not creditworthy as it does not refer to carbon dioxide cycling. The photosynthesis equation links the process to plants and carbon dioxide so is one process which puts it into Level 1. The process puts it to the top of Level 1. 2 marks.

* (c) Describe how carbon is cycled through the biotic and abiotic components of an ecosystem.

~~There~~

(6)

- ~~There is CO_2 in the atmosphere~~
- Abiotic = non-living while Biotic = living
- There is CO_2 in the atmosphere (abiotic)
- This is absorbed by plants (biotic) and converted into Glucose (a $\text{C}_6\text{H}_{12}\text{O}_6$) and O_2 in photosynthesis
- The plant uses some of this glucose in aerobic respiration, releasing CO_2 back into the atmosphere
- The plants are then eaten by an animal (biotic), so the glucose is transferred to the animal
- If the plant dies without being eaten / the animal doesn't eat all the plant decomposers (microorganisms - biotic) will break it down
- These microorganisms require energy for this, releasing CO_2 through aerobic respiration, returning to atmosphere
- The animal that ate the plant would have absorbed its glucose
- The animal requires energy for movement (reproduction / chemical reactions) so it breaks down the glucose through respiration, releasing CO_2 .
- ~~Once the animal dies, the~~ Decomposers break down animal waste (seces) and dead bodies - ~~once more~~ returning CO_2 to the atmosphere.
- CO_2 also ~~just~~ dissolves in the ocean (abiotic).

(Total for Question 9 = 12 marks)

There is carbon in glucose



This candidate has given many ways in which carbon is cycled through plants, animals and decomposers. They have stated the processes of respiration and photosynthesis. They have also referred to an abiotic process of oceans absorbing carbon dioxide, so can be put into Level 3. The top of the band needs respiration, photosynthesis and an abiotic process. They have this so can be awarded 6 marks.

Question 10 (a)(ii)

Candidates were asked to explain why protein is not usually found in urine and a table is given as to the relative sizes of different molecules. The response needed to refer to protein molecules being too large to fit through the membrane of the Bowman's capsule or through the glomerulus. We also accepted references to the molecule being too large to enter the nephron.

(ii) Molecule Z is a protein.

Explain why protein is not usually found in urine.

(2)

as its ~~is~~ diameter is too large to be
diffused ~~or~~ ~~process~~ into the glomerulus
~~so~~ and it is too large to be processed.



It's diameter is too large is Mark Point 1, to get into the glomerulus is Mark Point 2. 2 marks. Note 'it' must be the protein in the context of the question.

(ii) Molecule Z is a protein.

Explain why protein is not usually found in urine.

(2)

Proteins are reabsorbed back into the
blood as they are useful in^t the
body and are not a waste product



Although correct, this does not answer the question. 0 marks.

Question 10 (a)(iii)

This question was aimed at candidates who are achieving a grade 7 or above. It was an applied question explaining why haemoglobin may be found in the urine of a person with haemolytic anaemia. The expected answer is that haemoglobin is found in red blood cells which are too big to fit through the nephron. When the blood cell bursts the haemoglobin is released and is a much smaller molecule so can pass into the nephron and travel to the collecting duct where urine is formed.

(iii) Haemolytic anaemia is a disease that causes red blood cells to burst.

Haemoglobin is not found in the urine of people who do not have haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nm.

Explain why haemoglobin can be found in the urine of people with haemolytic anaemia.

(3)

Red blood cells burst to ~~also~~ release haemoglobin.

The ~~too~~ haemoglobin can travel in the blood to the kidney and is mixed with the urine.

The urine with the haemoglobin travels to the bladder and is ~~is~~ through the ~~urates~~ ureters and are excreted out. Haemoglobin is very small it can travel in an out without having to break down.



ResultsPlus
Examiner Comments

The first mark point can be awarded for haemoglobin is released when the cells burst. No further marking content can be awarded.

(iii) Haemolytic anaemia is a disease that causes red blood cells to burst.

Haemoglobin is not found in the urine of people who do not have haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nm.

Explain why haemoglobin can be found in the urine of people with haemolytic anaemia.

(3)

Haemoglobin is released when red blood cells burst. Haemoglobin is small enough to fit through the partially permeable membrane in the glomerulus. This means that during ultrafiltration, the haemoglobin is filtered out of the blood along with ~~water~~ other small molecules. Therefore, haemoglobin is not selectively reabsorbed ~~as~~ and travels through the nephron and is released with urine in the bladder.



Haemoglobin is released when red blood cells burst is Mark Point 1. Haemoglobin is small enough to pass through the membrane in the glomerulus is Mark Point 3. Haemoglobin is not selectively reabsorbed and travels to the nephron and is released in the urine can be awarded Mark Point 4 as this is in the additional guidance column.

Question 10 (b)

This final extended open-response question was to describe how the water content of the blood is controlled in the nephron. In order to achieve Level 3 there must be a detailed description of how the nephron controls both high and low water content in the blood, correctly linked to the hormone ADH released from the pituitary gland and the effect on the permeability of the collecting duct. For Level 2 this could be a simple description of both high and low water concentration control linked to ADH or a detailed description of either high or low water concentration. Level 2 can also be awarded where the candidate has given a good description of both but has mixed up how ADH affects the nephron. Level 1 can be awarded for linking water regulation to hormonal control.

*(b) Describe how the water content of the blood is controlled in the nephron.

(6)

The water content of the blood is regulated through osmoregulation. When blood enters the nephron it goes through the glomerulus this is where ultrafiltration will take place, which means that large proteins and blood cells remain in the blood and urea, glucose and water continue, they will go through the Bowman's capsule to the convoluted tubule, which is where selective reabsorption will take place, so that glucose is absorbed by active transport then at the loop of Henle water will be absorbed, the urine then continues to the collecting duct, where if necessary more water will be absorbed. Osmoregulation is an example of negative feedback. If the water concentration in the body is too low, it will be detected by receptors in the Hypothalamus which will release ^{ADH} ADH, which will go to the collecting duct and make sure more water is reabsorbed by the collecting duct so that water levels in the body go back to normal. However, if the water concentration in the body is too high, less ADH will be released by the Hypothalamus, so less water will be reabsorbed at the collecting duct so water levels go back to normal.

(Total for Question 10 = 12 marks)



ResultsPlus
Examiner Comments

Level 3 for 5 marks. We cannot award 6 marks as they have not mentioned the effect on the collecting duct/nephron. We need how it changes the permeability of either of these to award 6 marks.

*(b) Describe how the water content of the blood is controlled in the nephron.

(6)

◦ High water content

◦ Detected by hypothalamus, stimulating pituitary to release ~~more~~ ~~less~~ ADH ~~less~~ ADH

◦ ~~more~~ ~~less~~ Water is re-absorbed into the nephron by the loop of Henle or collecting duct.

◦ Water concentration in ~~urine~~ ^{blood} is lower

◦ Water concentration in urine is higher as it becomes more permeable

◦ Low water content

- Detected by the hypothalamus, signalling the pituitary gland to release more ADH

- This makes the collecting duct less permeable, so less water is re-absorbed into the nephron

- This means that ~~the~~ water concentration in the blood is higher.

- Water concentration in urine is lower.



ResultsPlus
Examiner Comments

This can only be Level 2 for 4 marks. They have mixed up the consequences of the effect of ADH on the kidney. Although they say less ADH for high water content they then describe how more water is reabsorbed. For low water content they state more ADH is released but then describe how less water is reabsorbed. As a result they can only be awarded Level 2 for 4 marks.

*(b) Describe how the water content of the blood is controlled in the nephron.

(6)

Water content of blood is controlled by the hormone ADH and is secreted from the pituitary gland. If water levels are too low, the brain detects this change and sends an impulse to the pituitary gland to secrete ADH. This ADH travels through the blood and is filtered out, and makes the collecting duct more permeable, allowing more blood water to enter the blood. The water content is then back to normal. If water levels are too high, the brain detects this and inhibits the release of ADH from the ~~pancreas~~ pituitary gland, making the ~~collecting~~ collecting duct less permeable, allowing less water back into the bloodstream. ~~This~~ is a negative feedback system. The water level turns back to normal. This is an example of a negative feedback system. Water is selectively reabsorbed and if filtered out by the Bowman's capsule, most of it is reabsorbed at the loop of Henle.



ResultsPlus
Examiner Comments

This response is a clear description of both low and high water levels in the blood with reference to the collecting duct. They also have ADH released from the pituitary gland so 6 marks can be awarded.

*(b) Describe how the water content of the blood is controlled in the nephron.

(6)

Water molecules are small enough to fit through the pores in the ~~glomerulus~~ Bowman's capsule, so they do. The water molecules then travel through the nephron, through the isthmus of Loop of Henle and the loop of Henle. This is where the ~~water~~ concentration of water in the blood is managed, if the water in the blood is too high, the water will travel into the ~~kidney~~ ~~via~~ ~~osmosis~~, if the water level is too low in the blood the water molecules are ~~diffused~~ transported back into the blood again via osmosis. Eventually the water, if there is too much, is excreted out ~~via~~ as urine.



ResultsPlus
Examiner Comments

This candidate has not described how water content in the blood is regulated but they have recognised that osmosis is a part of water regulation so 1 mark can be awarded.

Paper Summary

Based on their performance on this paper, candidates should:

- Always refer to scientific quantities when stating variables to be controlled using the terms volume, mass, etc. No credit is awarded for a quantity.
- Distinguish between controlling a variable such as the volume of a substance and 'a control' for an investigation which is where the experiment is repeated without the variable being tested.
- Ensure when answering questions about osmosis that water concentration is referred to or even better water potential to show that it is the water moving not another substance.
- Always look to the number of marks allocated for a question to ensure the maximum number of points has been applied.
- Always include the relevant units in a mathematical calculation.
- Make sure when drawing a pyramid of biomass that the dimensions are correct based on the information provided.
- Always check calculations for additional information such as putting the answer in standard form or to a specific number of decimal places.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

<https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html>

