



# **Examiners' Report**

## **June 2023**

**GCSE Combined Science 1SC0 2BF**

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## Introduction

The Pearson Edexcel GCSE (9-1) Paper 4 Combined Science (Foundation tier) is the fourth paper taken as part of the GCSE (9-1) Combined Science qualification, and the second biology component of the course. The qualification follows a linear assessment model whereby candidates must complete all papers in the same year of certification.

Paper 4: Combined Science (Foundation tier) is awarded a total of 60 marks and it is assessed by a variety of question types including multiple-choice questions, short answer questions, calculations, and an extended open response question. Candidates should answer all questions in 1 hour and 10 minutes. The extended open response question is 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) Combined Science qualification assesses practical knowledge and maths skills, the requirements of which are given in the specification. Furthermore, there are 6 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.

Paper 4: Combined Science (Foundation tier) 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 feeding relationships, the carbon cycle, enzymes, the circulatory system, hormones including those involved with the menstrual cycle, animal and plant biodiversity, diabetes and respiration.

Questions designed to assess practical skills included using a belt transect, which is linked to a core practical and devising a plan. The assessment of maths skills in this paper included taking readings from graphs to calculate a difference in blood pressure and a change in the concentration of glucose in the blood.

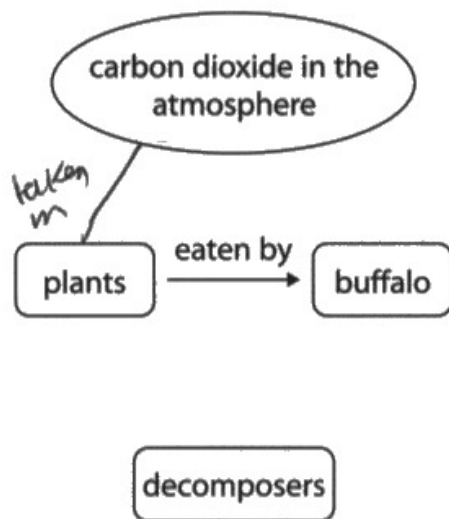
In general, most candidates could access questions throughout the paper. Questions where marks could be gained by extracting and interpreting information, such as from tables and graphs, were answered well. Relatively few candidates scored full marks on the 'explain' questions because they did not give the extra scientific information needed to support their answers. A large proportion of candidates seemed to be unfamiliar with fieldwork techniques, even though there is a mandatory core practical on the specification. As a result, they found it difficult to write about the use of a belt transect. Most candidates made an attempt to answer the extended open response question, but many were unfamiliar with the principles of devising a plan, which often limited their responses to Level 1. However, in addition to having the relevant practical knowledge, some candidates made good use of the information provided in the question, enabling them to produce a response in Level 2 and Level 3.

## Question 1 (a)(ii)

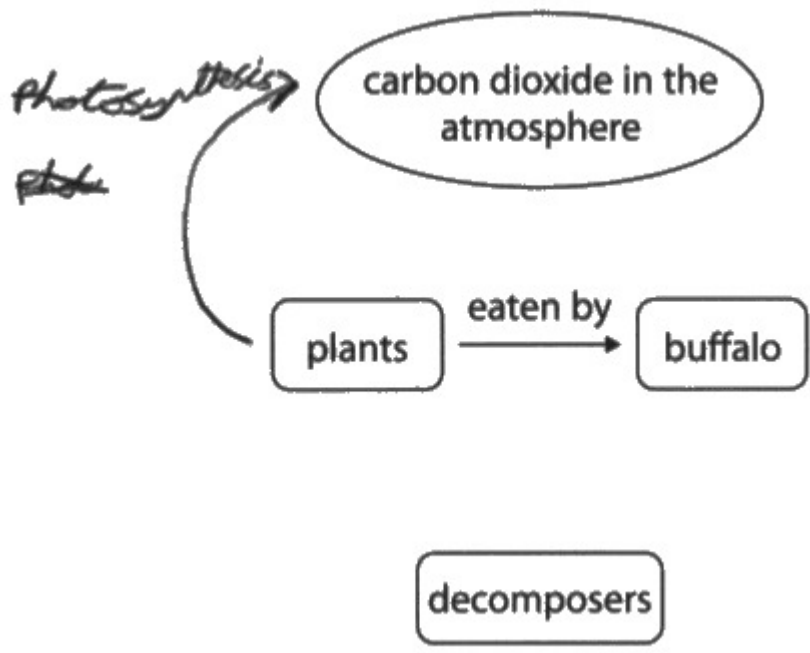
This sentence completion question was about a part of the carbon cycle. Most candidates were able to select at least one of the words correctly.

### Question 1 (a)(iii)

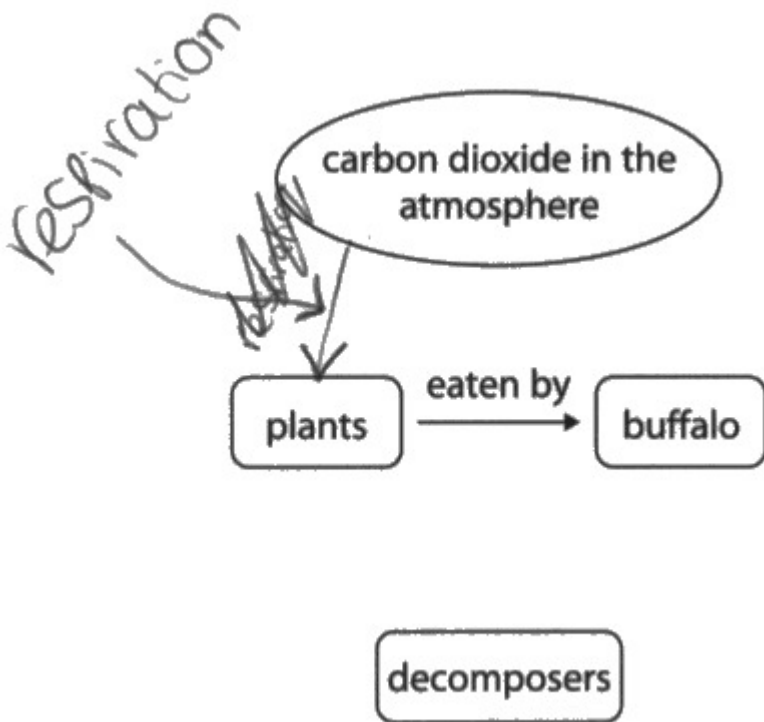
This question required candidates to draw and label an arrow on a diagram of the carbon cycle. This proved to be a difficult challenge for the majority of candidates, with few linking the process described in the question to photosynthesis. It was not unusual to see several arrows drawn, often without labels.



This candidate has drawn a line, not an arrow. No mark can be awarded because direction is unknown. The label is incorrect, so no marks for this response.

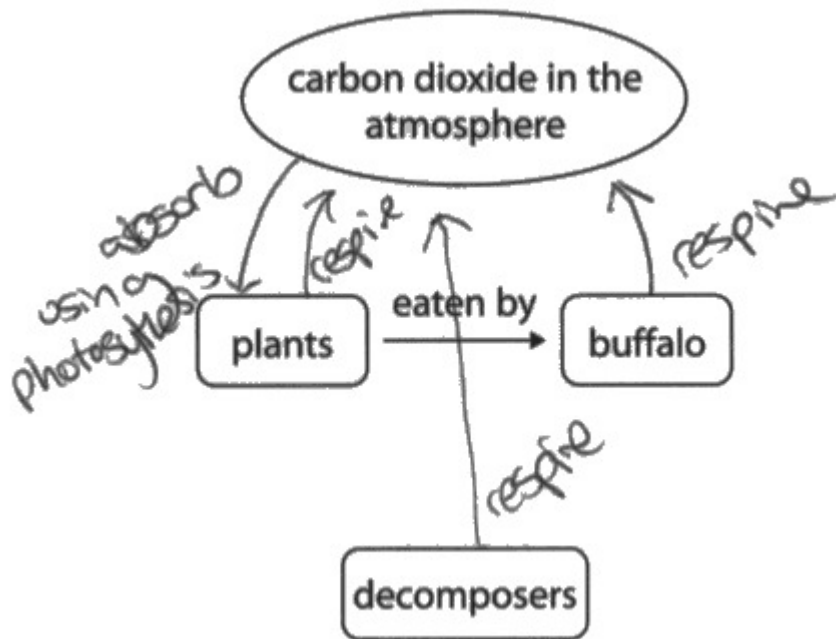


The arrow is pointing in the wrong direction, but photosynthesis labelled on the arrow scores one mark.



**ResultsPlus**  
Examiner Comments

The arrow is in the correct place and is pointing in the correct direction, so this scored one mark. It is clear that the second arrow is a label line for respiration, but since the label is incorrect, a second mark cannot be awarded.



**ResultsPlus**  
Examiner Comments

This candidate has gone beyond what was asked for in the question, but all the additional arrows are labelled and can be ignored because it is clear what they are showing. The correctly labelled photosynthesis arrow scores two marks.



**ResultsPlus**  
Examiner Tip

Always follow the instructions in the question. Adding extra information could result in marks being lost. Only one arrow was needed to answer this question.

## Question 1 (b)

A surprisingly large number of candidates struggled to answer this question accurately. This was often because correct terminology relating to enzymes was not used. Enzymes become denatured was the most common response for one mark and a typical answer scoring two marks usually mentioned that the active site changes shape. Explanations stating that the protein will not fit into the active site were seen less frequently.

Explain how boiling the enzyme stops the protein being digested.

(2)

It stops the protein being digested because it damages the enzyme.



**ResultsPlus**  
Examiner Comments

Damages the enzyme is too vague to be awarded a mark.



**ResultsPlus**  
Examiner Tip

Always try to use the correct scientific terms in explanations.

The heat from boiling the enzyme denatures it.



This was the most common answer scoring one mark.

Boiling the enzyme means that it will denature and the lock will now not fit the key. (Active site change and the protein won't fit in the active site).



This scored two marks for denature and protein will not fit in the active site. The candidate has also stated that the active site changes, but not that it changes shape, so the second marking point would not be awarded for that comment.

## Question 2 (a)(i)

Many candidates knew that blood vessel X is an artery, but it is disappointing that the vast majority were unable to specifically name the aorta.

## Question 2 (b)

The majority of candidates were awarded both marks for this question, but a relatively large number made errors when taking readings from the graph and so failed to score.

(b) Figure 5 shows the pressure of blood flowing through the arteries, capillaries and veins of a person.

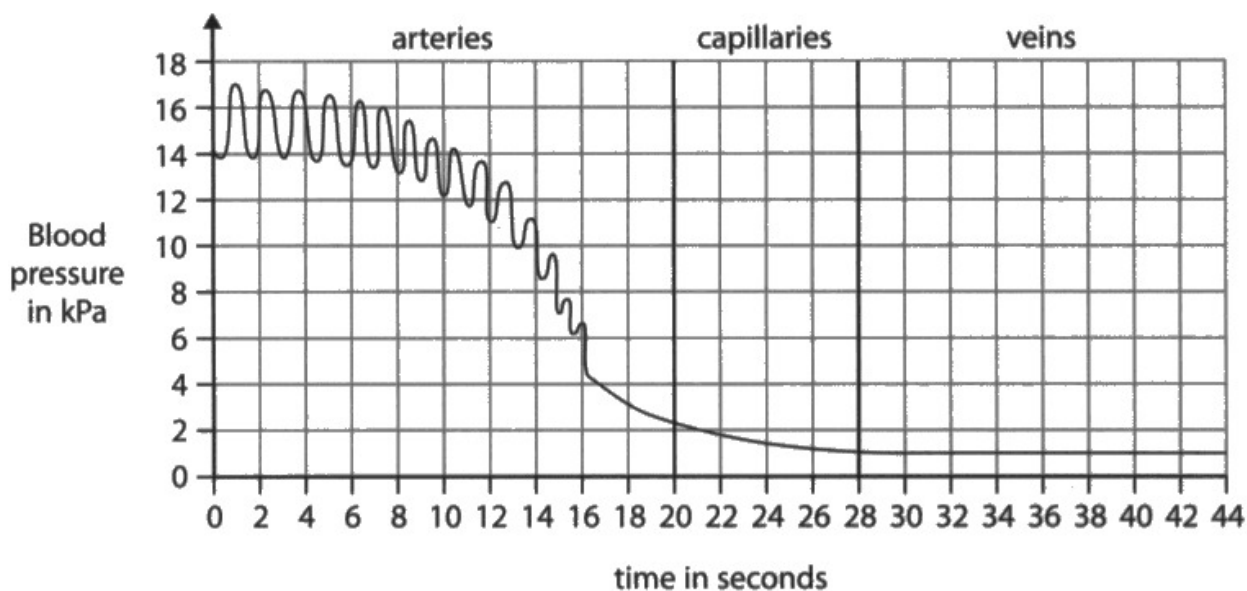


Figure 5

Calculate the difference in blood pressure from the maximum in the arteries to the minimum in the veins.

1 (2)

$$15 - 1 = 14$$

..... 14 ..... kPa



The candidate has misread the maximum blood pressure in arteries. There is no error carried forward in this instance, so the answer scores zero marks.



Always check that you understand the scales on graphs and be careful when taking readings.

14  
|  
arterias  
~~kPa~~  
~~kPa~~  
kPa

13  
|  
veins  
~~kPa~~  
kPa

..... 13? ..... kPa



The candidate has taken a reading from the bottom of the fluctuating line (14) as the maximum blood pressure in arteries. Subtracting the correct minimum pressure in veins gives an answer of 13, which was awarded one mark.

Arteries = 14  
Veins = 1  
 $14 - 1 = 13$

..... 16 ..... kPa



This response scores two marks. The candidate has shown the readings taken from the graph and the evaluation is correct.

## Question 2 (c)(i)

The majority of candidates were unable to identify the structure shown on the diagram of a vein as a valve.

## Question 2 (c)(ii)

Unsurprisingly, the proportion of candidates who scored the mark for this question was very similar to the proportion who identified structure Q as a valve.

(ii) State the function of structure Q.

Stops backflow in the vein.



This was the most common answer scoring one mark.

## Question 2 (d)

Although this was an accessible question for most candidates, relatively few scored three marks. The heart pumping blood was the most common mark awarded; references to the heart having muscular walls were infrequent and descriptions of the route blood takes from the heart to the lungs were often muddled, with the names of chambers and blood vessels being confused.

(d) Describe how the heart causes blood to move to the lungs.

(3)

The right side of the heart pumps blood to the lungs to help with breathing and respiration.



This scored two marks for knowing the right hand side of the heart pumps blood to the lungs. Many candidates forgot to refer to the right ventricle or right hand side of the heart but were frequently awarded one mark for simply stating that the heart pumps blood.

The blood from the right ventricle gets pumped into the pulmonary arteries to the lungs by the heart's contractions.

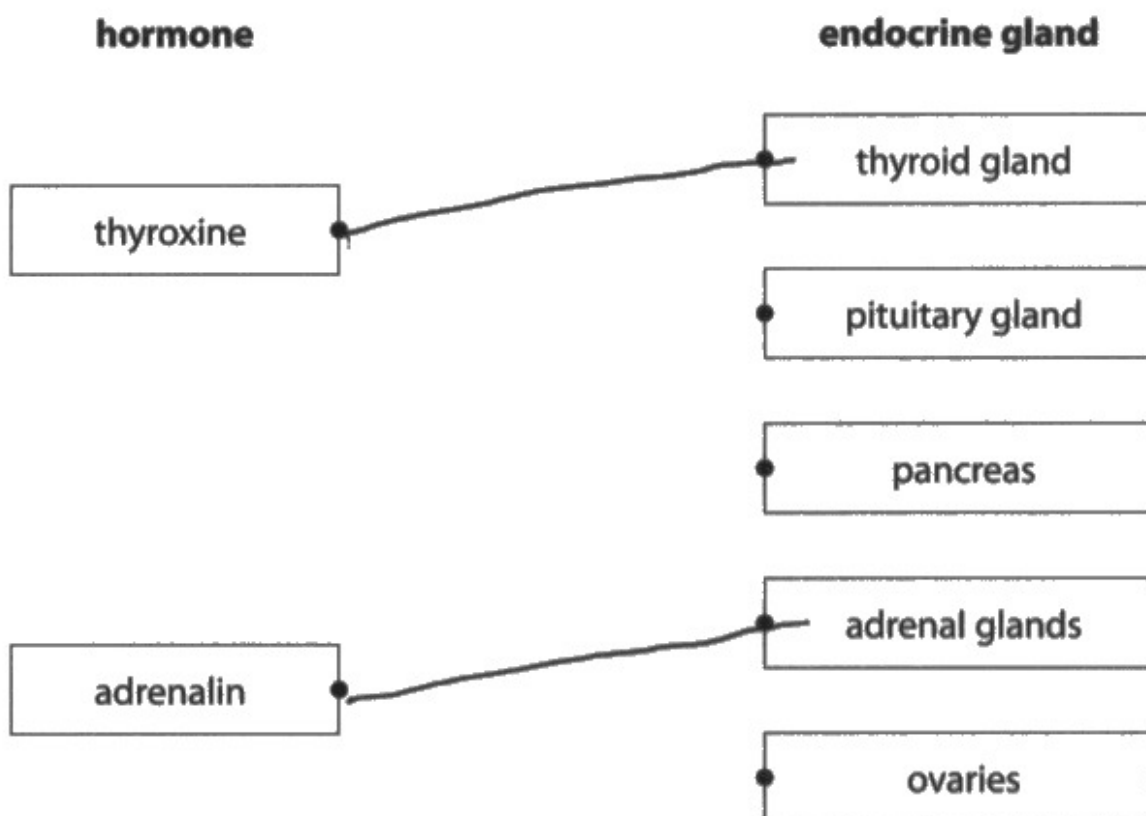


This concise description scores marks for right ventricle pumping blood by the heart contracting. A correct spelling of pulmonary would have given a fourth potential marking point in this answer.

### Question 3 (a)

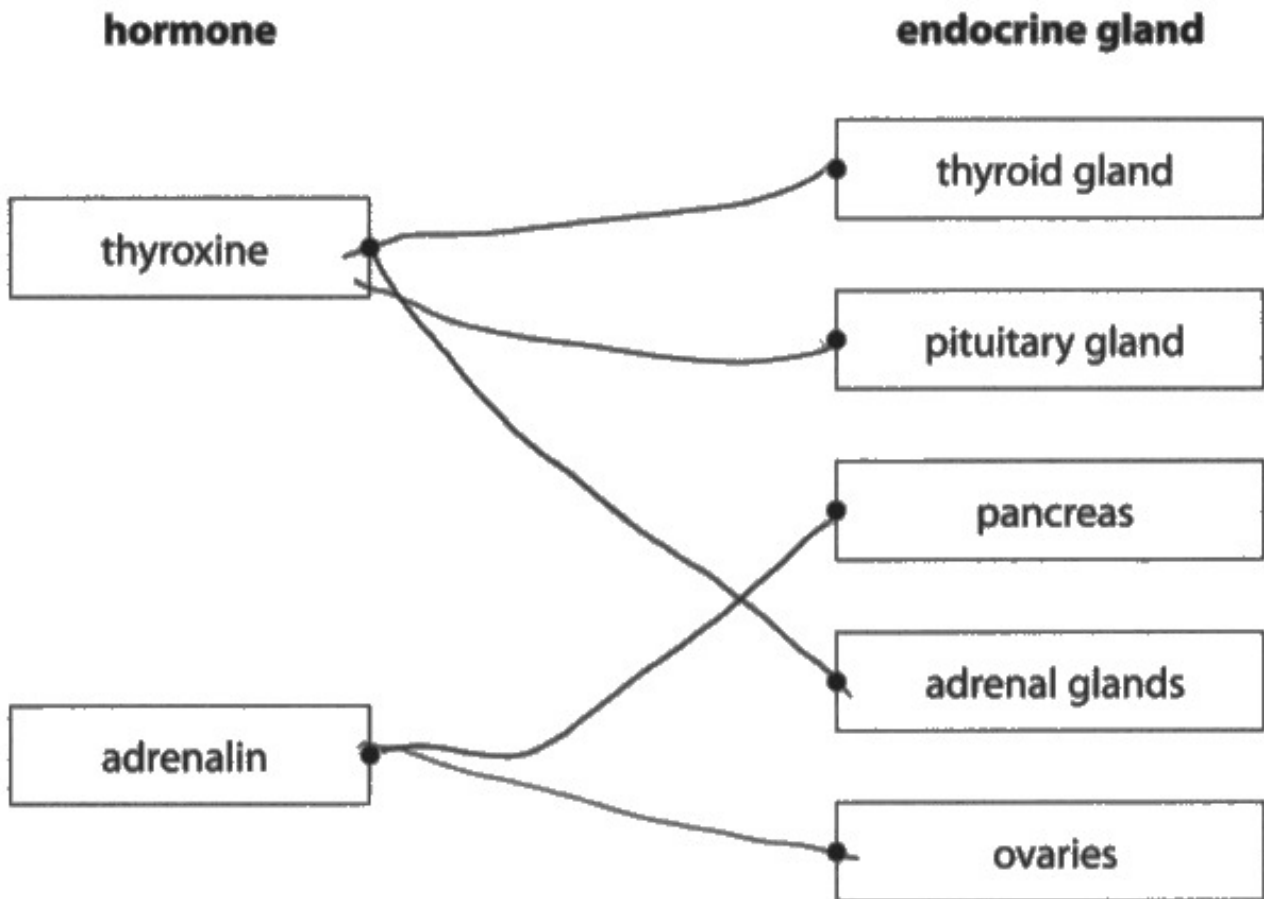
Candidates are familiar with matching boxes questions and the vast majority scored both marks by correctly linking the hormone to the gland that produces it. A minority of candidates still forgot to follow the instruction to draw one straight line from each hormone and were not credited with any marks.

(a) Draw **one** straight line from each hormone to the endocrine gland that produces it.



**ResultsPlus**  
Examiner Comments

This scores two marks for correctly linking boxes together.



**ResultsPlus**  
Examiner Comments

The candidate has drawn more than one line from each hormone, so no marks awarded.



**ResultsPlus**  
Examiner Tip

Always follow the instructions in the question. In this question you should draw **one** line from the hormone to the gland that produces it.

### Question 3 (b)(i)

This was a challenging question for most candidates, who were often confused by the diagram. Many candidates were unable to answer correctly, partly because they did not link the oestrogen graph to changes in the follicle. Few of the successful candidates referred to the follicle rupturing; terms such as breaking open were frequently used.

### Question 3 (b)(ii)

The majority of candidates could access this question and a large number scored at least one mark. This was usually for describing an increase in the thickness of the uterus lining. Candidates scoring two marks added a comment about progesterone levels increasing. Candidates rarely mentioned changes to the blood vessels in the uterus lining.

(ii) Describe the effect of progesterone on the uterus lining from day 13 to day 21.

(2)

The progesterone helps break down the uterus lining after day 14.



**ResultsPlus**  
Examiner Comments

The candidate has misinterpreted the diagram. The uterus lining becomes thicker from day 13 to day 21, it does not break down.



**ResultsPlus**  
Examiner Tip

Always check what the question is asking you to do and look carefully at linked graphs and diagrams.

The progesterone begins to maintain the uterus lining so no egg will be released.



**ResultsPlus**  
Examiner Comments

Progesterone maintains the uterus lining scores one mark. There is no reference to progesterone levels or blood vessels.

As Progesterone increases between day 13 and 21 the thickness of the uterus lining also increases



**ResultsPlus**  
Examiner Comments

The graph and diagram have been interpreted correctly and this is a good response worth two marks.

### Question 3 (c)

Candidates found this question very accessible, with the full range of acceptable responses seen. However, many responses simply repeated the information from the stem of the question and stated that the condom is a barrier contraceptive and prevents pregnancy.

(c) The condom is an example of a barrier contraceptive.

State **one** advantage and **one** disadvantage of using this barrier method of contraception.

(2)

Advantage

reduces chances of pregnancy

Disadvantage

Some people are allergic to the material



The advantage stated does not score a mark but being allergic to the material (latex) is a correct disadvantage for one mark.

Advantage

98% effective if used correctly

Disadvantage

could tear/slip off during sexual intercourse



**ResultsPlus**  
Examiner Comments

This response scores two marks. The reference to 98% effective if used correctly, is equivalent to high success rate.

### Question 3 (d)

This was a challenging question for many candidates. Few responses demonstrated knowledge of the hormones in the contraceptive pill. A mark was awarded most frequently for the pill preventing ovulation or thickening mucus; stopping the menstrual cycle or periods was also accepted for the same marking point. Candidates scoring two marks usually added a comment about sperm not being able to fertilise an ovum.

(d) The contraceptive pill is an example of a hormonal method of contraception.

Explain **one** way that the contraceptive pill stops a woman from becoming pregnant.

(2)

~~Stops the~~ ~~ovary~~ changes the balance in hormones and takes away fertility of ovaries



The comments in this response are insufficient to score marks. If the candidate had written that the contraceptive pill contains oestrogen and/or progesterone, then the first marking point could be awarded. The reference to the fertility of the ovaries is vague; there needs to be a specific comment about the pill preventing ovulation.



Always try to use specific scientific language that links to the topic being assessed.

But the egg development and release will stop completely and prevents the ovaries from realising it's time to release an egg.

(Total for Question 2 = 2 marks)



**ResultsPlus**  
Examiner Comments

One mark was awarded for the pill preventing the ovaries releasing an egg.

one way that the contraceptive pill stops a woman from becoming pregnant is that it stops the egg woman's egg cells being released which means there would be no egg cells for the sperm cell to go to.



**ResultsPlus**  
Examiner Comments

This response scores two marks. One mark is awarded for egg cells not being released and one mark for the idea that sperm will not be able to reach or fertilise an egg.

### Question 4 (b)(i-ii)

This was generally an accessible question. Many candidates wisely used a ruler to draw an appropriate line of best fit through the points on the graph, but lines were also frequently drawn from 0, 2000. The latter were not credited because they do not show the trend in the data. Some candidates found it difficult to extrapolate their line of best fit to estimate animal biodiversity in 2022.

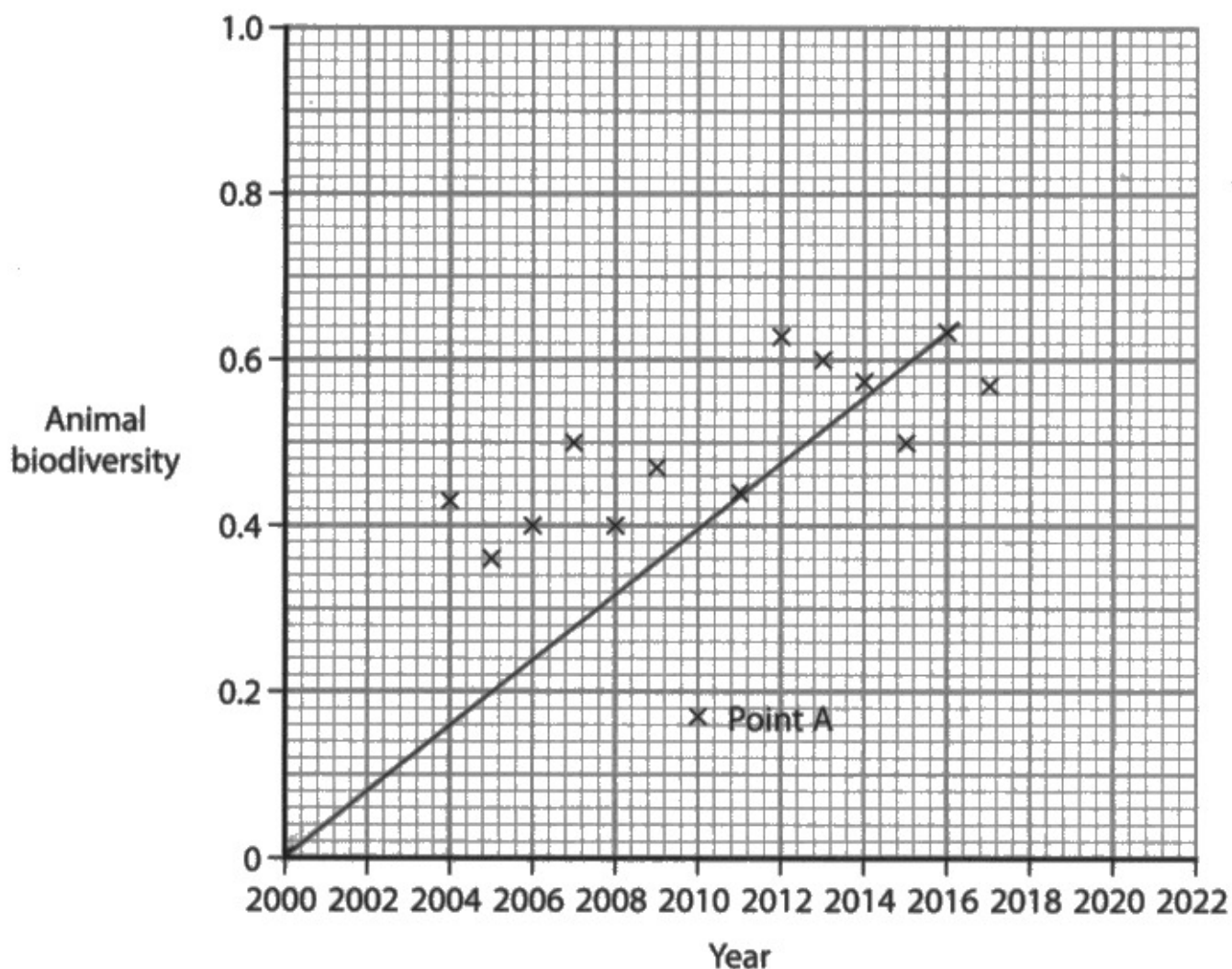
(b) The animal biodiversity in this reforested area was measured from 2004 to 2017.

Biodiversity is measured on a scale from 0 to 1.

0 = low biodiversity

1 = maximum biodiversity

Figure 8 shows the results.



- (i) Draw a straight line of best fit on Figure 8 to show the main trend in this data.
- (ii) Estimate the animal biodiversity of the reforested area in 2022.

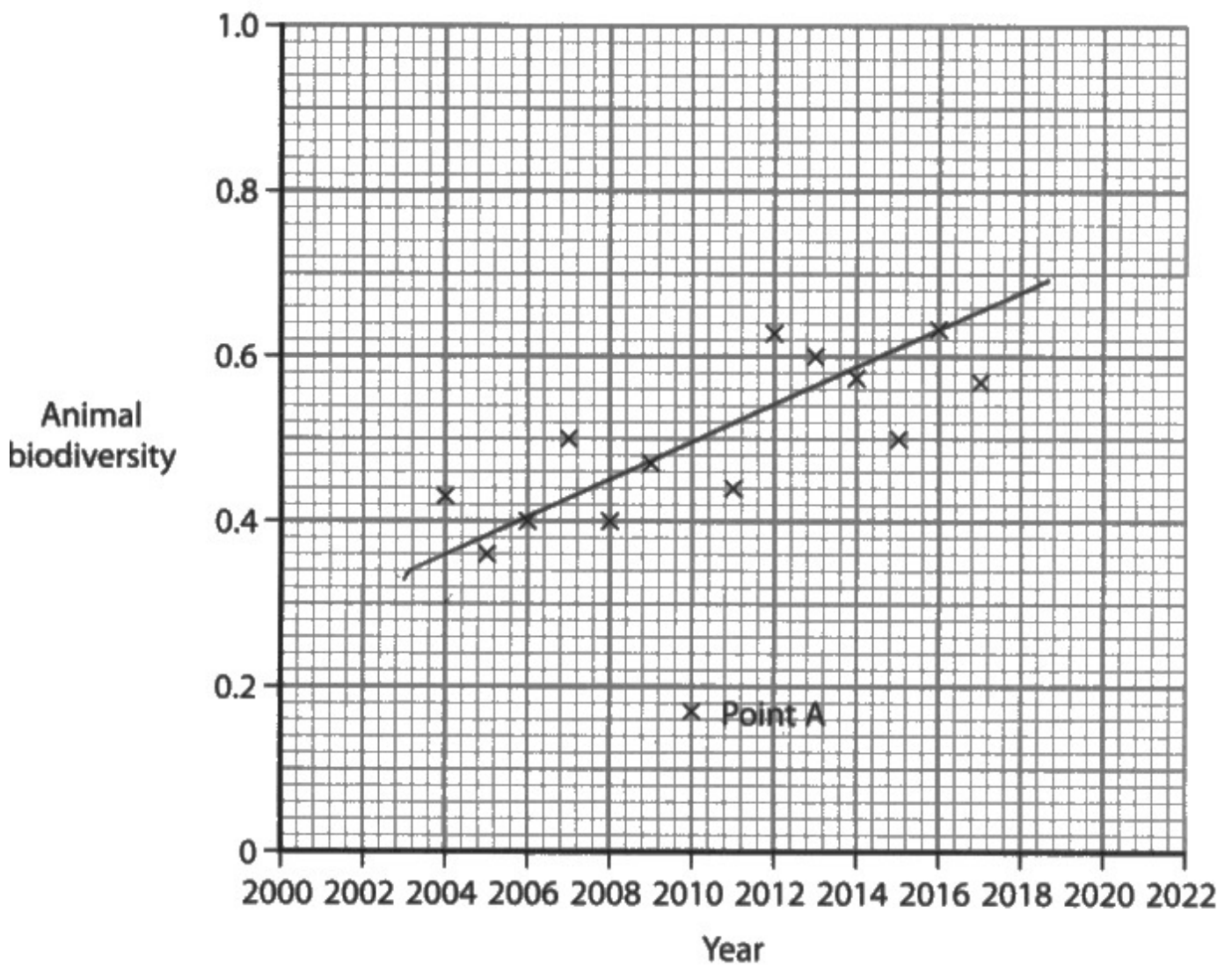
0.8

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The line of best fit has been drawn from 0, 2000. This line does not show the trend in the data, so no mark awarded.

The candidate has not visibly extrapolated their line of best fit, but the biodiversity estimate of 0.8 is at the upper limit of acceptability, so this scored one mark.



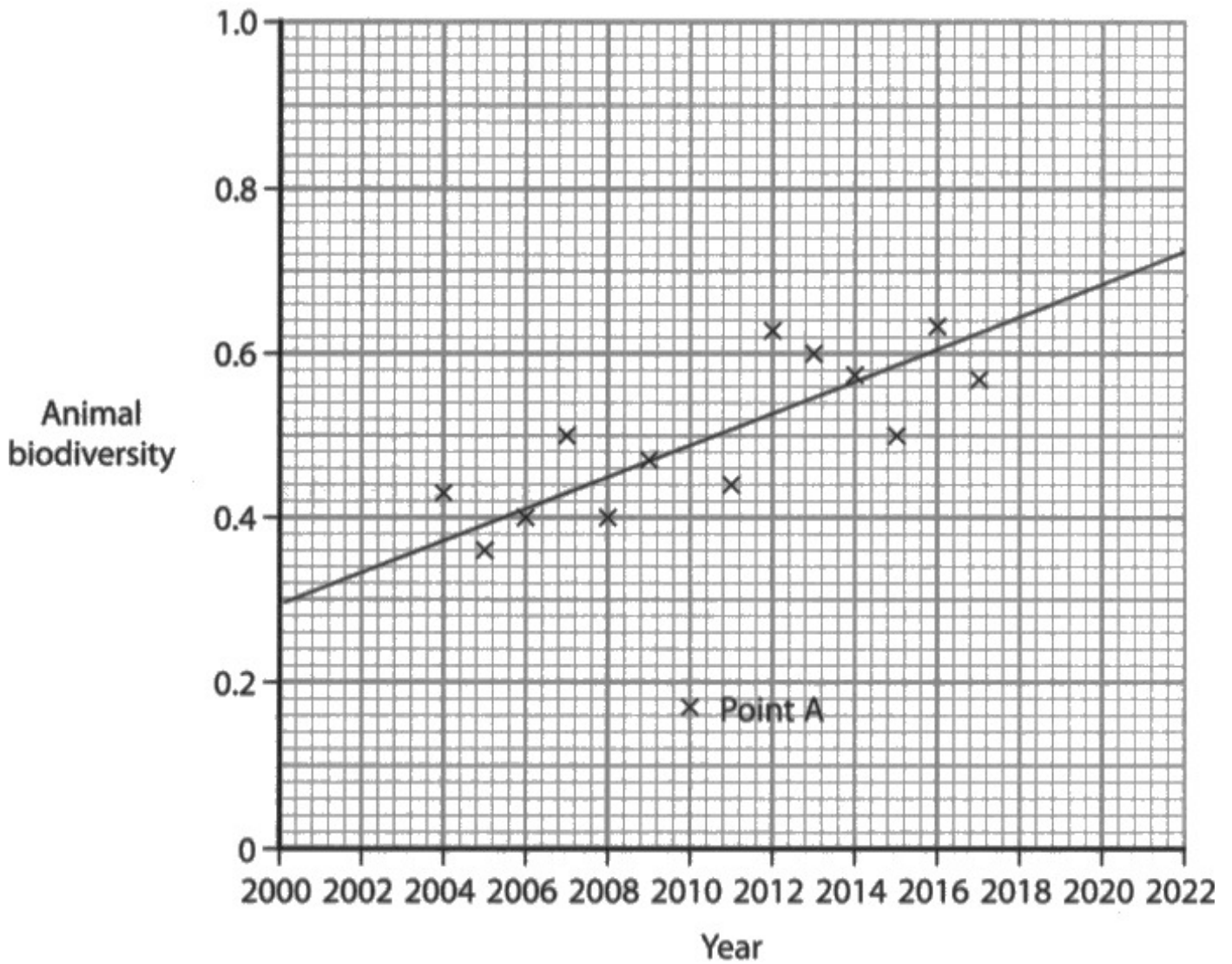
(i) Draw a straight line of best fit on Figure 8 to show the main trend in this data.

(ii) Estimate the animal biodiversity of the reforested area in 2022.

0.7



This scored one mark for the line of best fit and one mark for correctly estimating biodiversity in 2022. The line has not been extrapolated, but the candidate's estimate that biodiversity will be 0.7 in 2022 is acceptable.



- (i) Draw a straight line of best fit on Figure 8 to show the main trend in this data.
- (ii) Estimate the animal biodiversity of the reforested area in 2022.

0.62



The candidate has drawn a suitable line of best fit, so this scored one mark.

Taking a reading from the extrapolated line of best fit gives a biodiversity value of 0.72 in 2022. The candidate has given an estimate of 0.62, so zero marks awarded for this.

## Question 4 (c)(i)

A significant number of candidates were unfamiliar with using quadrats to sample animal populations and calculate biodiversity. This was reflected in many of the confused responses seen. However, the information in the question provided a basis for suggesting improvements and many candidates took advantage of this, often by stating that a larger area could be sampled, or more quadrats could be used.

(c) (i) The data to calculate animal biodiversity was collected using the following method.

- a 100 m<sup>2</sup> area was chosen
- three 1 m<sup>2</sup> quadrats were placed randomly on the ground
- animals inside the quadrat were counted
- the number of each species of animal was recorded

State **two** ways that the quality of the results from this method could be improved.

1. Place ~~quadrates~~ quadrats in a straight line.
2. Use more than 3 quadrats.



Placing the quadrats in a straight line would not be a suitable improvement, but using more than three quadrats can be awarded one mark.

- 1 more than three  $1\text{m}^2$  quadrats<sup>(2)</sup>
- 2 bigger area.



**ResultsPlus**  
Examiner Comments

This concise answer scores two marks.

- 1 place up to 10  $1\text{m}^2$  quadrats instead of 3 on the ground.
- 2 Record overnight/over a few days and use the mean number of animals.



**ResultsPlus**  
Examiner Comments

This is two marks. The first statement scores one mark and the second statement actually includes two marking points: one mark could be awarded for recording over a few days and one mark could be awarded for use the mean number of animals.

## Question 4 (c)(ii)

The majority of candidates were awarded the mark for this question. All acceptable responses were routinely seen. When candidates could not remember the correct term to use, their comments were usually insufficient to score the mark, such as point A is too low.

### Question 4 (c)(iii)

The majority of candidates were successful in scoring one mark, usually for explaining that many animals hibernate in winter. Only a small proportion of candidates answered the question fully and stated that biodiversity would be lower because animals hibernate in winter. Relatively few candidates could spell hibernate or hibernation correctly.

(iii) The data shown in Figure 8 was collected during the summer.

Explain why animal biodiversity would be different if the data had been collected in the winter.

(2)

because each animal adapts to their surrounding and environment is different in the winter.



This is not a creditworthy response. If the candidate had stated how the environment is different in winter, such as it is colder, then one mark could have been awarded.

Animal biodiversity would be different if the data had been collected in the winter because it is a colder time for these animals.



The candidate has stated that biodiversity would be different in winter, but not that it will be lower. This response scores one mark for explaining that the winter is a colder time.

Due to most animals going into hibernation  
all winter meaning the results will be lower



**ResultsPlus**  
Examiner Comments

This scores two marks. Although the candidate has written that the results will be lower, it can be inferred that this is biodiversity.

## Question 4 (d)

The responses to this question clearly demonstrated that practical experience of using belt transects was very limited. Since this is a core practical, greater awareness of the technique would be expected. Only a small proportion of candidates scored marks and of those, few gained full marks. Those that were awarded marks had clearly experienced or witnessed this type of investigation. A large number of responses described the effect of light intensity on photosynthesis and the growth of plants and ignored the sampling process.

(d) A scientist observes that trees at the edge of a forest shade part of a field.

Describe how a belt transect could be used to see how light intensity affects the biodiversity of plants growing in the field.

(3)

- use belt transect to see the biodiversity in the shaded part of the field and then in more sunny areas

- Compare them both and see which ones better



This response is worth one mark. The candidate has conveyed the idea that sampling should take place in a shaded area and in a sunny area, which is an acceptable alternative to 'repeat at different distances (from the forest)'.

use a quadrat and throw it randomly in your located area, some under the tree others in the sun, then measure the light intensity ~~of~~ where you have placed your quadrat, by using the belt transect. Then you can see whether plants grow as well as they would if not beneath the tree.



**ResultsPlus**  
Examiner Comments

Throwing the quadrat randomly is not the correct technique for using a belt transect. However, the idea of sampling in a shaded area and in a sunny area scores one mark and measuring light intensity can also be awarded a mark.



**ResultsPlus**  
Examiner Tip

Make sure that you are familiar with the techniques for all the core practicals.

could place ruler to measure distance  
plants are ~~away~~ <sup>away</sup> from the tree. At  
set distances (1m<sup>2</sup>) place ~~the~~ <sup>against</sup> quadrat <sup>ruler</sup>  
and count the species in each quadrat.  
Use a light meter to see how much  
light is hitting the area <sup>in each quadrat</sup>. If there is more  
light in an area, there will be more  
biodiversity. Compare the biodiversity in  
areas of low light intensity to areas with high.



**ResultsPlus**  
Examiner Comments

Overall, this is a very good response. Using a ruler is insufficient, it needs to be a line or tape. However, the same point is not penalised twice, so 'place a quadrat against the ruler' scores one mark. A second mark can be awarded for 'at set distances' and a third mark for using a light meter (to measure light intensity).

## Question 5 (a)(i)

Most candidates understood this question but struggled to word their answers in a clear, logical manner. In comparison questions, candidates should remember to use 'er' words, such as higher instead of high. Some candidates wrote about blood pressure and others wrote about food and insulin to explain diabetes instead of comparing the data. In addition, it was common for candidates to repeat themselves; many wrote the person with diabetes had high blood glucose levels, followed by the person without diabetes had low glucose levels, instead of referring to another difference.

- (i) Describe **two** differences in the concentration of glucose in the blood of the two people shown in Figure 9.

The person with the diabetes has gone up

The person with no diabetes has gone down.



**ResultsPlus**  
Examiner Comments

This is not a clear description of differences in the concentration of glucose in the blood of the two people. The points stated are true for both people. Zero marks scored.



**ResultsPlus**  
Examiner Tip

If the question asks you to describe differences, check that you have not described similarities instead.

- 1 Person with diabetes has higher concentration
- 2 Person without diabetes has lower concentration.



The candidate has used the comparatives higher and lower, but only one difference has been described, so this response scored one mark.

- 1 The person with diabetes has a higher concentration of glucose in blood.
- 2 The person with diabetes takes longer for the concentration to go down.



This is a very clear response. Two marks were awarded for making different comparative statements about the concentration of glucose in the blood and the time taken for the concentration of glucose to decrease.

### Question 5 (a)(ii)

It was surprising that only a minority of candidates could correctly calculate the maximum increase in concentration of glucose in the blood of the person with diabetes. Many candidates showed good practice by drawing lines on the y axis to mark the points where they were taking readings. Unfortunately, many of these readings were inaccurate and errors when subtracting numbers were not uncommon.

### Question 5 (a)(iii)

This was an extremely challenging question for the vast majority of candidates. Very few made the connection between water moving out of red blood cells and osmosis and most answers showed confused science. Many candidates thought that water moved out of the red blood cells to make room for glucose.

- (iii) 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<sup>3</sup>.

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

(2)

THIS IS BECAUSE THE BLOOD HAD A LOW WATER POTENTIAL SO IT TRANSFERRED OUT THROUGH DIFFUSION



The candidate has referred to water potential, but a comparative statement is needed if a mark is to be awarded. For example, the blood has a low water potential and red blood cells have a high water potential, or the water potential of the blood is lower than the water potential inside red blood cells.

fr for the concentration of ~~the~~ water in the blood was lower than the concentration outside causing ~~a~~ osmosis to occur



**ResultsPlus**  
Examiner Comments

The first part of the response is confused and there is no clear comparison of water concentration between the inside and outside of red blood cells. However, the candidate is aware that water moves by osmosis, so one mark can be awarded.



**ResultsPlus**  
Examiner Tip

Always check that your explanations are clear.

The concentration of glucose was too high so the water moved out to create a lower concentration through osmosis, where a water concentration goes from a high to a low.



**ResultsPlus**  
Examiner Comments

This scores two marks. The candidate knows that water moved out of the red blood cells by osmosis and they have conveyed the idea that water moved down a water concentration gradient (water concentration goes from a high to a low).

### **Question 5 (b)(i)**

The majority of candidates could name insulin as the hormone that causes the concentration of glucose in the blood to decrease.

## Question 5 (b)(ii)

The majority of candidates were awarded the mark for stating that insulin is transported in the blood. However, the transport of the hormone in blood cells was not credited.

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

through the blood



**ResultsPlus**  
Examiner Comments

This is one mark for through the blood.

Through the blood vessels



**ResultsPlus**  
Examiner Comments

Through the blood vessels also scores one mark.

through the white blood cells



**ResultsPlus**  
Examiner Comments

This scored zero as we are looking for the idea of insulin being transported in the blood or plasma, but not in blood cells.

## Question 5 (c)

Most candidates had some idea of how type 2 diabetes can be controlled and the full range of acceptable answers was seen. Exercise and take medication were common responses, but references to diet were often vague and not specific to diabetes. Few candidates explained that the measures they had stated would reduce blood glucose concentration.

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

(3)

Shots given by a doctor to take  
at certain times  
medication.



This response gained one mark for medication. On its own, the first sentence is too vague to be awarded a mark.

Type 2 diabetes can be controlled by  
losing weight, exercising more, ~~or~~  
having a diet.



This scored two marks. Losing weight and exercising more are the creditworthy points. Explaining that these measures reduce blood glucose concentration would score a third mark.

Having a diet is insufficient to score a mark; it is the idea that the diet is controlled which is important.

## Question 6 (b)(i)

Candidates found this question very challenging. Some candidates gained a mark for recognising the need for more oxygen, but most did not go on to relate this to more respiration or energy release. The reference to 'more' was only needed once. Very few candidates linked increased breathing rate to the removal of more carbon dioxide. Many responses discussed increased heart rate and the transport of oxygen around the body instead of focusing on the question asked.

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

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

(2)

When doing vigorous exercise there is less oxygen as you are respirating anaerobically.



**ResultsPlus**  
Examiner Comments

This is zero marks. The response does not explain why the breathing rate increases when running. The key points – that more oxygen is needed so that more respiration can occur – are missing from the answer.



**ResultsPlus**  
Examiner Tip

Always check that scientific terms are spelled correctly. Respirate is not acceptable for respiration.

So the body can get more ~~oxy~~ oxygen and get things like lactic acid out of the muscles.



**ResultsPlus**  
Examiner Comments

This response scored one mark for get more oxygen. The reference to removing lactic acid is ignored.

because their muscles require more oxygen which is recieved through breathing ~~and~~. The muscles require more oxygen in order to be able to respire and release more energy to be able to keep exerci...ha.



**ResultsPlus**  
Examiner Comments

This is a well-structured response that scored two marks. One mark is awarded for require more oxygen and a second mark for to be able to respire. The second mark could also be awarded for release more energy. 'More' only needs to be mentioned once in each pair of responses.

## Question 6 (b)(ii)

Relatively few candidates had a good grasp of the differences between aerobic respiration and anaerobic respiration. Aerobic respiration uses oxygen / anaerobic respiration does not use oxygen was the mark most frequently awarded. Very few candidates were able to compare the release of energy by these types of respiration, but some were familiar with the different products of each process. Many candidates wrote about respiration and different types of exercise, which was not relevant to the question.

- (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.

1 Aerobic respiration is respiration  
with oxygen

2 Anaerobic ~~is~~ respiration is respiration  
with out oxygen.



**ResultsPlus**  
Examiner Comments

This response was awarded one mark. The two statements are just the opposite of each other, so either would have gained the mark.



**ResultsPlus**  
Examiner Tip

If you are asked to state differences, writing two statements that are the opposite of each other will not score you two marks.

1 Aerobic respiration requires oxygen, Anaerobic doesn't

2 Anaerobic respiration produces lactic acid, Aerobic produces



**ResultsPlus**  
Examiner Comments

In this response the candidate has clearly stated two differences between aerobic respiration and anaerobic respiration. Relatively few candidates stated the products of aerobic respiration. Two marks awarded.

1 aerobic uses oxygen while anaerobic does not.

2 aerobic takes place in the mitochondria <sup>and</sup> anaerobic takes place in the cytoplasm.



**ResultsPlus**  
Examiner Comments

This response scored two marks. Aerobic respiration using oxygen was the most common answer seen, whereas references to where respiration takes place were seen very infrequently.

## Question 6 (c)(i)

Many candidates realised that the BTB solution turns yellow because the air breathed out contains carbon dioxide and this gained them one mark. Candidates who scored two marks usually added that carbon dioxide is acidic or that it lowers the pH (of BTB). Some confused responses referred to stomach acid being breathed out.

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)

This is because our breath is acidic changing the BTB from neutral to acidic.



This scored one mark. The idea that breath is acidic was accepted for the second marking point.

It lowered the pH level to 4 when carbon dioxide from the person mixed with it.



This response was awarded both marking points, for the idea that the carbon dioxide breathed out lowered the pH of BTB.

## Question 6 (c)(ii)

This planning question presented many candidates with a difficult challenge, even though there was clear guidance about what to include in the answer. Useful information about using BTB could also be obtained from the previous item, but some candidates ignored this. Many candidates simply gave a list of variables and did not follow the instructions given. Most Level 1 responses referred to athletes breathing out into BTB solution at the end of a run. Having athletes run at different speeds and/or relating the colour of BTB to pH (or how much carbon dioxide is breathed out), moved the response into Level 2 or Level 3. To gain the top mark in a level, candidates had to refer to the control of variables. Instead of devising a plan, some candidates wrote a conclusion about what would happen to the carbon dioxide levels when athletes breathe out; such responses did not gain credit.

- \*(ii) Devise a plan, using green BTB solution, to investigate the amount of carbon dioxide in the air athletes breathe out after they have been running at different speeds.

Include:

- how you would use green BTB solution.
- how you would control at least two variables.

(6)

If the athlete breaths out into the BTB solution then they will be able to see what pH level it changes to.  
keep the same:

↳ how long the athlete blows into the solution.

↳ how long the athlete was running for to make it at least a fair test.



**ResultsPlus**  
Examiner Comments

Just one part of a plan has been stated – breathe out into BTB solution – making this a Level 1 response. There are two relevant variables, so the top mark in the level can be awarded. Two marks scored.

BTB solution can be used when the athlete breathe out they have been running at different speeds and by breathing out through a straw of BTB for a few minutes and see which colour it would change too and would let out the oxygen in a person.

controlling two variables is the minutes of the BTB being a little higher and the different pH levels of what they are at.

if the solution stays the same colour or changes colour to tell the difference between a normal person breathing through a straw with a ~~per~~ athlete who runs everyday part of their training.



**ResultsPlus**  
Examiner Comments

The candidate has given two relevant parts of a plan – athletes running at different speeds and breathing out into BTB solution (and noting the colour). This puts the response into Level 2. There is no valid control of variables – breathing into BTB for a few minutes is insufficient. Overall, this is a Level 2 response scoring three marks.

Firstly I would keep the experiment in a enclosed space e.g. sports hall, just to make it easier to track air. Then I would have athletes run, keeping time as a variable, as well as, speed, both will be controlled. For example, all runners have the same time to run, however, the speeds will vary to get the best results. I will write all the information down and make a chart, e.g. the speed they ran and time. Lastly I will get all runners after they run to blow through a straw onto BTB solution and also record results on that.



**ResultsPlus**  
Examiner Comments

This Level 2 response scored four marks. There are two aspects of a plan – athletes running at different speeds and blowing into BTB solution. Athletes running for the same time is a suitable variable to control, so the top mark in Level 2 can be awarded.

To do this investigation you would have 3 different speed runners, one doing 100m sprint, one doing 800m ~~sprint~~ and the last one doing 1500m. You would time them and get them all to run their own ~~at~~ distances. To work out the CO<sub>2</sub> levels they breathe out you would have 3 ~~to~~ conical flask all containing the same amount of BTB solution. This would be your control variables. Each conical flask contains a straw and after each run the athlete will blow their maximum breathe ~~use~~ through the straw, to see the CO<sub>2</sub> change and amount you have a pH chart and record the colour change at the start and the end. This will tell us how much CO<sub>2</sub> is given, if this investigation went ~~as~~ correctly the 1500m runner should produce the most CO<sub>2</sub> meaning his conical flask should turn the most acidic. The second control variable would be ensuring the three runners run the right amount; not too much or too little.

**(Total for Question 6 = 13 marks)**



This response was awarded a mark in Level 3. The plan is not perfect, but it involves athletes running at different speeds, blowing into BTB solution and the subsequent colour change being used to determine how much carbon dioxide was breathed out. Same amount of BTB solution is insufficient as a controlled variable, it needs to be volume or a specified volume. This response stays at the bottom of Level 3, because there is no valid control of variables or reference to using a control. Five marks awarded.

## Paper Summary

Based on their performance on this paper, candidates should:

- Recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given.
- Use all the information given in the question to help them construct their answer but avoid repeating the information which has already been given or giving vague responses which will not gain credit.
- Consider the context of the question to ensure that they apply their scientific knowledge to the situation they are being asked about.
- Develop their practical skills knowledge to ensure they understand the difference between the factors being investigated and controlled variables.
- Check the number of marks given for the question and ensure that they have included enough facts to match the marks available.
- Use scientific terminology accurately, where possible, in responses.
- Always show the working when doing calculations, as a mark can be awarded for errors carried forward in this case.
- Think about the structure of the answer before starting to write, especially when tackling the extended questions, to ensure that the answer shows clarity of writing and it flows, while also remembering that accurate spelling and grammar in these questions is important.

## 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>

