

Examiners' Report

June 2024

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 seventh 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 the chemical test for glucose, components and function of the blood, specialised plant cells and osmosis, decomposition and energy transfer in ecosystems, random sampling, measuring abiotic factors and parasitism, aerobic and anaerobic respiration, phototropism, transport in plants and photosynthesis, hormones of the menstrual cycle and their role in contraception, assisted reproductive technology, and the role of the nephron in ensuring no protein and glucose is found urine.

Questions designed to assess practical work included performing a chemical test, investigating the rate of decomposition, carrying out random sampling investigation and describing how to measure abiotic factors, the effect of glucose concentration on the rate of anaerobic respiration and setting up a control for the investigation. The maths skills assessment in this paper related to questions calculating the volume of red blood cells in a sample of blood to the nearest whole number, the rate of decomposition, and calculating the difference in cardiac output when at rest and when doing exercise to 3 significant figures, with the correct units.

Most candidates were able to access both extended writing responses, demonstrating good knowledge of assisted reproductive technology and some knowledge of the structure of the nephron. Higher ability candidates were able to apply their knowledge of Clomifene therapy and In Vitro Fertilisation in increasing the chances of a woman becoming pregnant and could apply their knowledge of the structure and function of the glomerulus, Bowman's capsule and proximal convoluted tubule in preventing proteins and glucose entering urine.

Question 1 (b)

This question required candidates to apply their knowledge of the chemical test that can be used to identify the presence of glucose in urine. Marks were awarded for using Benedict's reagent/solution, which must be heated and turns brick red in the presence of glucose. Other colours such as green and brown were also acceptable.

Many candidates were awarded maximum marks. However, a number of candidates described the incorrect chemical test. However, they could still be awarded Mark Point 2 and Mark Point 3 if they referred to heating and the correct colour change.

(b) Tasting urine was one of the first ways doctors tested for diabetes.

If the urine tasted sweet, the patient may have diabetes.

Describe the chemical test we now use to test for glucose in urine.

(3)

you would use benedicts reagent solution and add a few drops to the urine sample if reducing sugars were present for example glucose ~~be tested~~ the colour would change from blue to green, yellow, orange or red. The more of a colour change the more glucose present



ResultsPlus
Examiner Comments

This response is awarded two marks for correctly identifying Benedict's Reagent and the correct possible colour changes. Maximum marks could not be awarded because there is no mention of heating the sample.



ResultsPlus
Examiner Tip

Placing in a water bath does not necessarily imply heating.

(b) Tasting urine was one of the first ways doctors tested for diabetes.

If the urine tasted sweet, the patient may have diabetes.

Describe the chemical test we now use to test for glucose in urine.

(3)

add benedict's reagent to a urine sample and heat using a water bath. If there is a colour change to brick-red then glucose is present.



ResultsPlus
Examiner Comments

This gains maximum marks for identifying Benedict's, heating the sample (in a water bath) and brick-red colour indicating presence of glucose.



ResultsPlus
Examiner Tip

Ensure you know the four chemical tests for starch, glucose, protein and lipids.

Question 1 (c)

The question asked for two variables which must be controlled to compare the glucose concentration in the urine samples. Credit was given for the volume of urine, volume of Benedict's reagent, concentration of Benedict's reagent, temperature, and the incubation time.

Responses stating the 'amount' were not credited, as we want to see scientific units being used during investigations.

(c) A scientist wanted to compare the glucose concentration in two urine samples.

State **two** variables that need to be controlled for the comparison to be valid.

(2)

1 the volume of urine

2 amount of biuret solution



ResultsPlus
Examiner Comments

Candidate was awarded one mark for volume of urine. They have identified the incorrect reagent but also made another error, which lost many candidates marks, by stating amount instead of volume.



ResultsPlus
Examiner Tip

Always use volume or mass when referring to quantities.

(c) A scientist wanted to compare the glucose concentration in two urine samples.

State two variables that need to be controlled for the comparison to be valid.

1 Volume of urine tested

2 Volume of benedicts solution added



ResultsPlus
Examiner Comments

This response scored maximum marks for correctly identifying volume of urine and volume of Benedict's reagent as control variables.

Question 2 (a)(i)

This question required candidates to identify a component of blood after a blood sample had been centrifuged into its separate parts. All the components were labelled except for plasma. Nearly all candidates identified plasma as the correct component.

Question 2 (a)(iii)

Most candidates gained full marks for this question by giving two different types of white blood cell. Creditworthy responses included phagocytes and lymphocytes. Only one mark could be awarded if a candidate named two types of lymphocyte eg B cell and memory cell. If a candidate named a correct white blood cell which was not covered on the specification this was credited as an additional marking point eg neutrophil or monocyte. This was not uncommon and it was pleasing to see a greater depth of knowledge. Large numbers of candidates scored maximum marks.

(iii) Name **two** types of white blood cell.

(2)

- 1 lymphocyte
- 2 ~~antibodies~~ memory cell



This response gains only one mark as memory cells are examples of lymphocytes.

(iii) Name **two** types of white blood cell.

(2)

- 1 phagocytes
- 2 lymphocytes



Both marks were awarded for this response of phagocytes and lymphocytes.

Question 2 (b)(i)

Candidates were told that red blood cells make up 44% by volume of blood. They were asked to calculate the volume of red blood cells in a 470 cm^3 sample and to give their answer to the nearest whole number. Most candidates scored three marks for correctly answering 207. However, many candidates failed to round their answer to the nearest whole number so could only be awarded two marks.

(b) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)

$$\cancel{470} = \cancel{100\%}$$

$$470 \times 0.44 = 206.8$$

..... 206.8 cm^3



ResultsPlus
Examiner Comments

In this response, the candidate has correctly calculated the volume of red blood cells but they have not given their answer to the nearest whole number, so cannot be awarded full marks.

(b) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)

$$10\% = 47$$

$$1\% = 4.7$$

$$40\% = ~~188~~ 188$$

$$4\% = 18.8$$

$$44\% = 206.8$$

$$= 207$$

to nearest whole

207

cm^3



ResultsPlus
Examiner Comments

This response gains full marks. Calculations are correct, workings are shown and the answer has been correctly rounded to nearest whole number.



ResultsPlus
Examiner Tip

Read the question carefully and give your answer in the form requested.

Question 2 (b)(ii)

The question on precautions links to general practical skills covered in working scientifically. For taking a small blood sample, precautions a doctor should take that were credited included washing hands/wearing gloves/mask, sterilising/disinfecting/cleaning the skin of the donor, using a sterile/new needle, and covering the wound after taking the blood.

Many candidates identified two of these points but marks were lost where they described general laboratory rules eg tie hair back.

- (ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.

State **two** precautions a doctor should take when collecting this sample.

(2)

1 use a clean needle

2 wear gloves



ResultsPlus
Examiner Comments

This response gains one mark for 'wear gloves' but cannot be awarded full marks because 'clean needle' is not sufficient to indicate sterile needle.

- (ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.

State **two** precautions a doctor should take when collecting this sample.

(2)

1. ~~Where~~ Wear gloves and cover up clothes to avoid contact
2. Use sterile equipment



ResultsPlus
Examiner Comments

This response gains both marks for 'wearing gloves' and 'use of sterile equipment', which would include sterile needle.



ResultsPlus
Examiner Tip

General laboratory rules will not gain marks.

Question 3 (a)(i)

Candidates were asked to identify the vacuole from an unlabelled diagram of a root hair cell. This question was answered well by the majority of candidates.

Question 3 (a)(ii)

This question asked candidates to state one way that the structure of the root hair cell increases the volume of substances it absorbs. A simple description of how it is adapted for its function gained a mark. The majority of responses stated that it has a large surface area or a hair like structure for the mark. Although mitochondria are shown in the diagram very few responses explained that many mitochondria would also allow a greater volume of substances to be absorbed.

(ii) State **one** way that the structure of the root hair cell increases the volume of substances it absorbs.

(1)

Has many ~~hairs~~ cilia

↳ photosynthesis



ResultsPlus
Examiner Comments

This response incorrectly described cilia present and cannot be awarded the mark as these are plant cells.



ResultsPlus
Examiner Tip

Root hair cells do not have cilia.

(ii) State **one** way that the structure of the root hair cell increases the volume of substances it absorbs.

(1)

Has small, hair-like structures coming out of the cell to increase surface area and therefore contact with substances.



ResultsPlus
Examiner Comments

This response could gain full marks for 'hair like structure' or for increased surface area.

Question 3 (a)(iii)

Candidates were asked to explain why root hair cells do not contain chloroplasts. The majority of candidates scored all three marks for correctly explaining that root hair cells are underground, where there is no light so they cannot photosynthesise. Some responses were awarded one mark for linking chloroplasts with photosynthesis.

(iii) Explain why root hair cells do not contain chloroplasts.

(3)

Because root hair cells are situated in the roots of plants and not on the surfaces / leaves. ~~in~~ Chloroplasts aren't needed in the roots because these cells can't photosynthesise because of the lack of sunlight. Chloroplasts are needed to help photosynthesis.



ResultsPlus
Examiner Comments

This response correctly identifies that these cells can't photosynthesise because of the lack of sunlight. It does not gain Mark Point 1 as it does not explain that the root hair cell is underground or in the soil.

(iii) Explain why root hair cells do not contain chloroplasts.

(3)

root hair cells are under the soil,
therefore have no sunlight on them
and don't need to photosynthesise



This response gains the maximum three marks. It identifies that root hair cells are underground, where there is no light present, and so don't need to/cannot photosynthesise.

Question 3 (b)(i)

Candidates could be awarded two marks for describing two ways that the *Elodea* cells in 10% salt solution are visibly different from *Elodea* cells in tap water. Acceptable answers described how the chloroplasts are near the cell wall/membrane/edge of the cell in tap water for one mark and in salt water the chloroplasts have clumped together or are in the middle of the cell for the second mark. Many candidates described the differences correctly for two marks. No marks were given if they did not include chloroplasts in their answer. However, a mark could be awarded for describing the cells in salt water appearing larger.

(i) Describe **two** ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.

- 1 They're towards the centre of the cell
- 2 They're closer together.



ResultsPlus
Examiner Comments

This response cannot be awarded any marks because it describes *Elodea* cells and does not identify that they are describing chloroplasts, despite them being labelled on the diagram.

(i) Describe **two** ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.

(2)

1. The chloroplasts are in the centre of the cell in the 10% salt solution
2. The *Elodea* cells are wider in the 10% salt solution



ResultsPlus
Examiner Comments

This response gained both marks for describing chloroplasts in the centre of the cells in 10% salt solution and describing the cells as being wider (the equivalent of larger) which was an additional marking point.

Question 3 (b)(ii)

In this question candidates were asked to explain why placing the *Elodea* cells in the 10% salt solution causes changes in the appearance of the cells. Most responses gained at least one mark with many gaining all three marks for explaining that water moves by osmosis from a high water concentration to a low water concentration/down a water potential gradient and through a partially/selectively/semi-permeable membrane. Membrane unqualified was not accepted for the award of the mark.

It was pleasing to see that a number of candidates used high water potential to low water potential or down a water potential gradient.

(ii) Explain why placing the *Elodea* cells in the 10% salt solution causes the changes seen in Figure 3.

(3)

When placed in 10% salt solution the cell wall dissolves from the salt just leaving the cell membrane. Osmosis occurs in the cell so some salt makes it in and causes the chloroplasts to ~~the~~ go to the middle of the cell because the chloroplasts repel the salt solution so it can keep carrying out it's function.



ResultsPlus
Examiner Comments

This response identifies osmosis as a key process but does not describe the movement of water down a concentration gradient.

(ii) Explain why placing the *Elodea* cells in the 10% salt solution causes the changes seen in Figure 3.

(3)

In the 10% salt solution, the *Elodea* cells swell up as they are absorbing water by osmosis, from a high concentration to a low concentration of water through a partially permeable membrane.

Chloroplasts move to the middle because of the water in the cell causing pressure on the cell walls.



This response gains the maximum three marks for correctly identifying osmosis as the movement of water from high to low concentration and also includes 'through a partially permeable membrane'.

Question 4 (a)

This question enabled the practical skill of identifying and controlling variables to be demonstrated, in an investigation of the rate of decomposition of two different types of leaves. Candidates were required to identify two variables which would need to be controlled. Many correctly identified that temperature and humidity levels must be kept constant. However, very few candidates recognised that the size/volume/material of the bag must also be controlled. A number of responses giving light intensity or oxygen concentration were seen but these were not creditworthy.

4 A student investigated the decomposition of two different types of leaf.

The student placed 200 grams of holly leaves in a net bag.

The student placed 200 grams of oak leaves in another net bag.

The bags were left in a classroom.

The mass of the leaves in each bag was recorded every 10 days for 50 days.

(a) State **two** variables that would need to be controlled in this investigation.

1 Temperature

2 Amount of oxygen available



ResultsPlus
Examiner Comments

This response is awarded one mark for 'temperature' but controlling the amount of oxygen available is not creditworthy because it could not be achieved in this experiment. Another uncreditworthy response seen was controlling light intensity, which is not a factor in the rate of decomposition.

- 4 A student investigated the decomposition of two different types of leaf.
The student placed 200 grams of holly leaves in a net bag.
The student placed 200 grams of oak leaves in another net bag.
The bags were left in a classroom.
The mass of the leaves in each bag was recorded every 10 days for 50 days.
(a) State **two** variables that would need to be controlled in this investigation.

1 Using the same type of net bag

2 controlling room temperature.



This response is awarded two marks for stating two variables which need to be controlled ie using the same type of net bag and controlling room temperature.

Question 4 (b)(i)

Using data from a table of results for this investigation, candidates were asked to calculate the rate of decomposition per day of holly leaves over 50 days. One mark was awarded for calculating the loss of mass of the holly leaves (120). It was pleasing to see that candidates used a number of methods to calculate this answer. The second mark was awarded for calculating the loss in grams per day over 50 days. Two marks were awarded for the correct answer of 1.6.

(i) Calculate the rate of decomposition of holly leaves from 0 to 50 days.

(2)

$$\frac{200 - 191 - 176 + 159 + 147 + 120}{6}$$
$$200 - 120 = 80$$
$$\frac{80}{6} = 13.3$$

~~6~~ 13.3 grams per day



ResultsPlus
Examiner Comments

Candidate has been awarded one mark for correctly calculating total mass lost over the 50 days but has incorrectly divided by 6 rather than the number of days (50) so rate of mass lost on answer line is incorrect.

Figure 4

(i) Calculate the rate of decomposition of holly leaves from 0 to 50 days.

(2)

$$200 - 120 = 80$$

$$80 \div 50 = 1.6$$

.....1.6..... grams per day



ResultsPlus
Examiner Comments

This response gains two marks for correctly calculating total loss in mass (120) and dividing by 50 to give mass lost per day.

Question 4 (b)(ii)

This question required the candidates to compare the trends shown in the data for holly leaves and oak leaves. One mark was awarded for identifying that both holly and oak leaves decreased in mass and a second mark for recognising that oak leaves decreased in mass at a faster rate. The majority of candidates were awarded two marks for this question. Indeed, responses explaining that holly leaves decompose faster could be awarded both Mark Points, which the majority of candidates gave.

(ii) Compare the trends shown in the data for holly leaves and oak leaves.

(2)

Over the 50 - day period, the mass of both bags of leaves decreases. The rate of decomposition is faster for holly leaves than for oak leaves. The oak leaves ~~to~~ decreased by 50 grams more than the holly leaves by day 50.



This response gains one mark for describing the mass of both types of leaves decreasing and a second mark for the oak leaves decreasing in mass quicker than the holly leaves. The candidate has quoted data illustrating this which would also gain both marks.

(ii) Compare the trends shown in the data for holly leaves and oak leaves.

(2)

The mass of the oak ~~bag~~^{leaves} decreased quicker than the mass of the holly leaves.

Oak leaves → 200 to 70 g

Holly leaves → 200 to 120 g

- They began at the same mass.



ResultsPlus
Examiner Comments

This response only scores one mark for 'both bags of leaves decrease'. It cannot score maximum marks because it incorrectly states that the holly leaves decomposed faster than the oak leaves, which is the reverse of the trend shown in the data.



ResultsPlus
Examiner Tip

Remember if you are asked to compare two things then words with 'er' at the end are the best to use, eg 'faster', 'thicker', 'larger' etc.

Question 4 (c)

Candidates were asked to explain why it is important for the environment that leaves are decomposed. One of two approaches was taken. Some candidates explained that decomposition released minerals into the soil for one mark and that other organisms/plants use these minerals for the second mark. Recycling of nutrients or minerals was awarded both marks.

The second approach described how the leaves could build up, covering some plants for one mark and these plants could no longer get light or be able to photosynthesise for the second mark.

(c) Explain why it is important for the environment that dead leaves are decomposed.

(2)

The nutrients in the leaves are absorbed by the soil which can be absorbed by other plants to help with growth.



ResultsPlus
Examiner Comments

This response was awarded two marks for the idea that the minerals/nutrients in the leaves are released into the soil and for describing their use by other organisms eg plants.

(c) Explain why it is important for the environment that dead leaves are decomposed.

(2)

They would cover grass on the floor, blocking them from the sun, causing it to stop the grass from photosynthesis.



ResultsPlus
Examiner Comments

This response shows that marks were also awarded for describing the consequences if decomposition did not occur. Here the description of dead leaves covering plants on the ground and preventing them getting light for photosynthesis would gain two marks.

Question 4 (d)

This question asked candidates to name one type of organism that decomposes leaves. Many candidates named fungi or bacteria. Some named a detritivore eg worm. A wide range of organisms were accepted.

- (d) Name **one** type of organism that decomposes leaves.

(1)

fungi



ResultsPlus
Examiner Comments

This response gains the mark for a named organism that decomposes leaves.

- (d) Name **one** type of organism that decomposes leaves.

(1)

worms



ResultsPlus
Examiner Comments

Detritivore would be an acceptable answer, here a named detritivore, 'worms' gains the mark.

Question 4 (e)

This question was poorly answered by many candidates. Data was provided in a table and candidates were asked to explain why the change in mass of the leaves is not the same as the change in mass of the snails kept in a tank for one month. Many candidates simply described the decrease in mass of the leaves being due to snails eating the leaves which resulted in the snails increasing in mass. This was not creditworthy as it did not explain the difference in change in mass. The first mark point recognises the increase in mass of the snails is much less than the decrease in mass of the leaves, as not all the mass of the leaves is transferred to the snails. Only 120g or 10% is transferred. The second mark is for recognising that some of the leaves were not digested or were excreted by the snails.

There was some confusion as to how energy is transferred, with candidates often stating it was lost to the environment when they needed to state how this energy was transferred eg used in respiration, providing energy to the snails for movement.

Some candidates recognised that some leaf mass was digested by decomposers.

Explain why the change in mass of the leaves is not the same as the change in mass of the snails.

(2)

Because ~~when~~ the snails benefit from the leaves and eat them which increases their mass but the leaves mass decrease because the snails eat the leaves.



This is a common response which just describes the data or the feeding relationship. It is not an explanation and is not creditworthy.

Explain why the change in mass of the leaves is not the same as the change in mass of the snails.

When an organism eats another, not all biomass⁽²⁾ is transferred, usually only 10% is, this is because biomass can be wasted in the process.



This response identifies that not all the mass from the leaves is passed on to the snails and gains one mark. The candidate has not explained where biomass is lost in the transfer and does not gain a second mark.

Explain why the change in mass of the leaves is not the same as the change in mass of the snails.

(2)

As a lot of energy was used by the snails to respire. Therefore ~~transferred to~~ ~~be~~ not all of the biomass/energy went was used for growth. Moreover energy used for movement.



This response gains the maximum two marks because they have explained two ways that energy was used: for respiration and movement.

Question 5 (a)(i)

In this Topic 9 core practical, candidates were asked to devise a plan to randomly sample the number of plant species in a garden. This was generally well-answered with most candidates identifying the use of a quadrat and a random number generator/random coordinates to decide the area to be sampled. The third mark was for counting the number of plant species. We ignored 'sample the number of plant species' as this was merely repeating the question. Very few candidates suggested using a key to identify the plant species.

5 (a) A scientist decided to study the variety of living organisms in a garden.

(i) The scientist wanted to use a random sampling technique.

Devise a plan the scientist could use to randomly sample the number of plant species in the garden.

(3)

The scientist can throw a Punnett square on the ground of a garden at random. He must then count the number of plant species within that square and record it. This way the sample will be random.



ResultsPlus
Examiner Comments

This response gains no marks for incorrectly naming a Punnett Square as suitable to use for sampling or throwing a square at random (which is not truly random). It gains one mark for counting the number of plant species in the square.



ResultsPlus
Examiner Tip

Throwing a quadrat is not random. It is also dangerous.

5 (a) A scientist decided to study the variety of living organisms in a garden.

(i) The scientist wanted to use a random sampling technique.

Devise a plan the scientist could use to randomly sample the number of plant species in the garden.

(3)

First, he would use a transect belt and place this all along the garden. Then using a random-number generator, he would ~~use a random~~ ^{take ten co-ordinates} and place a quadrat in these places to ensure there is no bias. Then he would count the ~~species~~ ^{number} of plants in each square and calculate an average.



ResultsPlus
Examiners Comments

In this response belt transect is ignored as it does not result in random sampling. It goes on to say use a random number generator which can be credited. A further mark is awarded for identifying a quadrat but counting the number of plants does not gain a mark. Two marks were awarded.

5 (a) A scientist decided to study the variety of living organisms in a garden.

(i) The scientist wanted to use a random sampling technique.

Devise a plan the scientist could use to randomly sample the number of plant species in the garden.

(3)

The scientist can plot the garden coordinates in a random number generator and p.5 times and place 1m^2 quadrats at those coordinates. She could then count how many species are in each quadrat and find the mean number. She could then multiply the mean number with the total area of the garden to see the variety.



ResultsPlus
Examiner Comments

This gained all three marks for using a random number generator, quadrat and counting the number of species in the quadrat (plant species is inferred from the question).

Question 5 (a)(ii)

This question had never been asked before and resulted in very few maximum marks being awarded. Candidates were asked to describe how three abiotic factors could be measured in the garden. Using a pH meter to measure the pH of the soil was given as an example in the question. For all mark points the mark was awarded for identifying the abiotic factor and naming a correct measuring device. There was a wide variety of answers given, with most candidates scoring at least one mark. Most marks were lost because candidates could not name the relevant piece of equipment to take the measurements. Common responses included measure temperature with a thermometer, measure light using a light/lux meter, measure rainfall using a measuring cylinder (any receptacle to catch the rain for measurement was accepted) or measure the depth of soil with a ruler.

(ii) The scientist also measured abiotic factors in the garden.

The pH of the soil was measured using a pH meter.

Describe how **three** other abiotic factors could be measured in the garden.

(3)

1 light intensity

2 temperature

3 CO₂ concentration.



ResultsPlus
Examiner Comments

No marks can be awarded for this response which simply names abiotic factors. Most candidates lost marks because they merely named abiotic factors without correctly describing how they could be measured.

(ii) The scientist also measured abiotic factors in the garden.

The pH of the soil was measured using a pH meter.

Describe how **three** other abiotic factors could be measured in the garden.

(3)

1 ~~the~~ TEMPERATURE WITH THERMOMETER

2 WIND INTENSITY

3 ~~sun~~ AVG RAINFALL USING MEASURING
CYLINDER.



ResultsPlus
Examiner Comments

This response gains one mark for measuring temperature with a thermometer and one mark for measuring rainfall with a measuring cylinder.

(ii) The scientist also measured abiotic factors in the garden.

The pH of the soil was measured using a pH meter.

Describe how three other abiotic factors could be measured in the garden.

(3)

- 1 Light intensity can be measured, using a light meter or a lux meter, at different areas of the garden.
- 2 Temperature can be measured, using a thermometer, at different areas of the garden.
- 3 Wind speed can be measured, using a wind meter, or a wind speedometer, at different parts of the garden.



ResultsPlus
Examiner Comments

This response gains the maximum three marks because it identifies three abiotic factors and in each case correctly names an instrument that can be used to measure the abiotic factor.



ResultsPlus
Examiner Tip

Read the question carefully so you don't repeat it in your answer.

Question 5 (a)(iii)

Candidates were told that mistletoe is a parasite that grows on trees and were asked to describe the feeding relationship between mistletoe and the tree. Credit was given for identifying the tree as the host, describing how mistletoe gains nutrients or water from the tree and the tree is damaged by the mistletoe. No marks were awarded for describing the relationship as parasitic as this was given in the question. Many candidates described mistletoe as benefitting from the relationship and the tree not benefitting which is not creditworthy as this does not describe the feeding relationship.

Describe the feeding relationship between the mistletoe and the tree.

(2)

Parasitic relationship where one organism
benefits and the other organism is harmed.



ResultsPlus
Examiner Comments

This response gained no marks. Stating that one organism benefits is too vague and the response does not identify which of the two is harmed and thus cannot be awarded Mark Point 3.

Describe the feeding relationship between the mistletoe and the tree.

(2)

It's ~~an~~ a parasitic feeding relationship as the mistletoe steals resources (water and nutrients) from the tree. The tree gains nothing from this relationship, whereas the mistletoe gains water and resources.



ResultsPlus
Examiner Comments

This was worth one mark for the idea that mistletoe gains water and nutrients from the tree – either would have gained the mark. It is not sufficient to say that the tree does not gain from the relationship, we need the idea that the tree is damaged or harmed in some way.

Describe the feeding relationship between the mistletoe and the tree.

(2)

The mistletoe (parasite) feeds off of the tree (the host) but the tree does not gain anything from the mistletoe whilst the mistletoe does (parasitism).



ResultsPlus
Examiner Comments

This gained two marks for the mistletoe feeding off the tree and identifying that the tree is the host.

Question 5 (b)

This question asked candidates to explain why nitrate fertilisers are used in the garden. Nearly all candidates recognised that nitrates are used to increase plant growth/yield. Only a few candidates recognised that nitrates are used by plants to make proteins/amino acids/DNA for the award of Mark Point 2.

(b) Nitrate fertilisers are used in the garden.

Explain why nitrate fertilisers are used in gardens.

(2)

Fertilisers are used to help grow plants found in gardens. Nitrate fertilisers repel insects.



This response gains one mark for stating that they promote growth.

(b) Nitrate fertilisers are used in the garden.

Explain why nitrate fertilisers are used in gardens.

(2)

Nitrates are used by plants to create amino acids and proteins and other things that plants also need for them to grow. That is why nitrate fertilisers are used.

(Total for Question 5 = 10 marks)



This is worth two marks for identifying that nitrates are used by plants to create amino acids and proteins to help them grow.

Question 6 (a)(i)

This question is related to the core practical 'respiration in living organisms'. Candidates were given a detailed method, used to investigate the effect of glucose concentration on the rate of anaerobic respiration in yeast. They were asked to describe how to set up a control for the investigation. Mark Point 1 was for recognising that the student would need to repeat the experiment exactly the same while Mark Point 2 was awarded for describing the use of water instead of glucose solution (0% glucose solution was accepted).

Many candidates incorrectly described controlling variables, confusing this with a control.

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

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

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

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

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

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

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

(2)

Make sure the temperature is the same each time you do the experiment so that the enzymes work at same rate each time by doing the experiment in a lab where it is easier to control the variable like temperature.

no oxygen

glucose → lactic acid + some energy



ResultsPlus
Examiner Comments

There is no creditworthy content here. The candidate has described controlling a variable. The question asked how a control could be set up.



Do not confuse setting up a control with controlling a variable.

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

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

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

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

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

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

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

(2)

Have this exact apparatus in its initial setup, only that there should be no glucose - independent variable.



This response gained one mark for 'have this exact apparatus and the initial set up' (enough for repeat) but no glucose is insufficient for the second mark as this experiment would not work without water or a solution.

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

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

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

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

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

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

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

(2)

repeat the method with a glucose concentration of 0% to ensure that it is only glucose ^{concentration} affecting the rate of anaerobic respiration and not any other factors.



ResultsPlus
Examiner Comments

This response was awarded both marks for repeat the method but with a glucose concentration of 0%.

Question 6 (a)(ii)

Following on from the investigation, candidates were asked how it could be improved by increasing the rate of reaction. The only two accepted answers were increasing the temperature or adding more yeast, which most candidates answered.

A number of candidates incorrectly suggested adding a catalyst.

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

use a water bath.



This response gains no marks as 'use a water bath' without reference to temperature or heating is insufficient.

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

(1)

the scientist could place the reaction in a water bath at 35°C



This response gains the mark as it describes an increase in temperature by using a water bath.

Question 6 (b)(i)

Candidates were asked to identify the anomalous result in a table of data and explain why it is anomalous. This was well-answered by the majority of candidates, who identified the 15% glucose concentration as it didn't follow the trend or pattern of the data. Identification of the result at 10% was also credited as being higher than expected.

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

Explain which of these results is anomalous.

20% → 9 is the anomalous result⁽²⁾
as the difference is the highest between 3
and 9.



This response cannot be awarded any marks. It incorrectly identifies the result at 20% glucose as anomalous and thus no marks can be awarded for an explanation either.

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

Explain which of these results is anomalous.

15%. because the heights decrease when it should have increased ~~between 6-8~~ to follow the trend.



ResultsPlus
Examiner Comments

This response gains both marks, one for identifying the result at 15% glucose and one for explaining that it decreased when it should have increased, to follow the trend.

Question 6 (b)(ii)

From the investigation results, candidates were asked to explain why the height of the foam was greatest with 25% glucose solution. Marks were given for identifying that this solution contained more glucose (or had the highest concentration), which would result in more respiration and release of carbon dioxide to produce foam. Marks were also given for recognising that more glucose would result in more enzyme-substrate complexes and that glucose is the limiting factor in this reaction. Most candidates were awarded two marks for Mark Point 1 and Mark Point 3. Few candidates were awarded Mark Point 2 or Mark Point 5.

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

(3)

- There was the most glucose in the solution
- meaning the dried yeast + washing up liquid have more glucose to react with.
- causing a greater reaction.



ResultsPlus
Examiner Comments

Only one mark for the most glucose. Causing a greater reaction is not enough for Mark Point 3 – we need respiration to be named.

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

(3)

Because glucose provides yeast with more energy, therefore are able to respire more, creating more foam, the more glucose the greater the rate of reaction, the rate of anaerobic respiration was greater.



ResultsPlus
Examiner Comments

This gains two marks for the more glucose, the greater the rate of anaerobic respiration. Respire on line 2 is incorrect and is ignored.

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

(3)

There was a greater concentration of glucose. Glucose is needed for anaerobic respiration. Increased reactant meant a ~~more~~ greater rate of respiration and more of the foam was produced. More enzyme-substrate complexes formed due to increased amount of substrate.



ResultsPlus
Examiner Comments

This response was awarded three marks.

A greater concentration of glucose for Mark Point 1, followed by greater rate of respiration for Mark Point 3. More enzyme-substrate complexes for Mark Point 2.

Few candidates linked respiration to enzyme activity.

Question 7 (b)(i)

Candidates were told that sunflowers face different directions at different times of day and that this is an example of phototropism. This question asked for an explanation of how the sunflower changed direction, throughout the day, in response to the light. Many candidates were awarded three marks for recognising that it is controlled by auxins, which collect in the shaded part of the stem, making the plant bend/grow/move/face towards the sun or light. A common error was saying that auxins caused the stem to elongate. For Mark Point 3 to be awarded they must say auxins cause cell elongation.

(i) This movement of the flower was in response to the light.

Explain how the sunflower changed direction throughout the day.

(4)
The sunflower changed direction to where the sun was as it moves throughout the day. This is because the sunflower wants to absorb as much sunlight as it can to photosynthesise. The plant absorbs

the sunlight through its chlorophyll so the plant faces the sun to get a higher concentration of energy from it to photosynthesise so it can grow and repair.



ResultsPlus
Examiner Comments

There is just enough for Mark Point 4 here as it implies the sunflower is moving towards the sun.

(i) This movement of the flower was in response to the light.

Explain how the sunflower changed direction throughout the day.

(4)

• as the sun was moving over the sky throughout the day the sunflower, auxin in the plant allowed it the tip to bend towards the light where it needed most in order to photosynthesise and respire

• meristem



ResultsPlus
Examiner Comments

Mark Point 1 for naming auxins and Mark Point 4 for causing the tip to bend towards the light.

- (i) This movement of the flower was in response to the light.

Explain how the sunflower changed direction throughout the day.

(4)

~~The~~ During phototropism there is the plant hormone auxins which are found at the tips of plants which go onto the shaded side of the plant, causing the plant to elongate and grow towards the light. So throughout the day the sun would have kept changing direction causing the ~~auxin~~ shaded side in the tips to also change so the auxins would constantly be moving towards the shaded side causing the plant to constantly grow towards the light.



A good response that names auxins, states that they accumulate in the shaded side of the plant which causes the plant to move/grow towards the light. Mark Point 3 was not awarded because plant elongating is not credited – we are looking for cell elongation.

Question 7 (b)(ii)

The question asked candidates to explain how water moves through the stem of the sunflower plant to its leaves. Many candidates scored maximum marks, demonstrating an excellent understanding. Credit was given for naming xylem and for describing xylem as a hollow tube and also saying it is lignified or consists of dead cells. Marks were also awarded for describing travel from the root, by transpiration and water evaporation or diffused through the stoma.

A few candidates described that water is a cohesive molecule which forms a column of water, this was an additional Mark Point.

(ii) Explain how water moves through the stem of the sunflower plant to the leaves.

(3)

Water moves by osmosis, osmosis is the flow of water from a high to low concentration through a partially permeable membrane.



ResultsPlus
Examiner Comments

Zero marks, water enters the root by osmosis. However, the candidate has not said the water is in the root for Mark Point 2.

(ii) Explain how water moves through the stem of the sunflower plant to the leaves. ~~Phloem~~ ^{Xylem} (3)

Water is collected through the roots as they absorb the water from soil. The water travels up the phloem and into the leaves



ResultsPlus
Examiner Comments

Water collected through the roots is enough for Mark Point 2. Phloem is incorrect.



ResultsPlus
Examiner Tip

Remember xylem transports water and mineral ions, phloem transports sucrose.

(ii) Explain how water moves through the stem of the sunflower plant to the leaves.

(3)

by the xylem. Water is taken up by roots of plant via osmosis. The xylem moves water up the plant (unidirectional as it only goes up) towards the leaves where it evaporates via transpiration. Xylem is made of lignin for strength and is mostly dead cells.



Xylem named for Mark Point 1, water taken up by the roots is Mark Point 2, and transpiration is named for Mark Point 6. Maximum three marks. This also describes xylem as made of lignin and mostly dead cells. This is an excellent answer.

Question 7 (b)(iii)

Using the large leaves of sunflowers as an example, candidates were asked to explain why large leaves are an advantage to a plant. Marking Points included describing a large surface area, gaining more light and describing production of glucose by photosynthesis. Many candidates recognised that a larger surface area would result in more photosynthesis but did not link this to the production of glucose and thus could not be awarded Mark Point 3.

(iii) Sunflower leaves are large.

Explain why large leaves are an advantage to the plant.

(3)

The leaves are larger for more photosynthesis to occur making it a healthier plant.



ResultsPlus
Examiner Comments

Zero marks. Leaves are larger gains no marks. This information is given in the question. For Mark Point 1 we need larger surface area. Mark Point 3 cannot be awarded as, although they named photosynthesis, there is no mention of glucose production.



ResultsPlus
Examiner Tip

Always state photosynthesis produces glucose.

(iii) Sunflower leaves are large.

Explain why large leaves are an advantage to the plant.

(3)

Large leaves have a large surface area. This allows for maximum rate of diffusion for gases or water. Large leaves also allow for better water loss or gain as they will have more stomata. The leaves will also contain more chloroplasts and chlorophyll in order to photosynthesis and get ~~the~~ glucose for energy.



ResultsPlus
Examiner Comments

Large surface area for Mark Point 1, but this is not linked to gaining more light. Mark Point 3 is gained for describing photosynthesis to get glucose.

(iii) Sunflower leaves are large.

Explain why large leaves are an advantage to the plant.

(3)

Large leaves means that there is a larger surface area to absorb sunlight. It is an advantage to the plant because more sunlight would allow more photosynthesis so ~~plants are~~ the plant is able to produce more glucose through photosynthesis.



ResultsPlus
Examiner Comments

This gains three marks for large surface to absorb more sunlight for more photosynthesis producing more glucose.

Question 8 (a)(i)

Candidates were presented a diagram of the human heart and asked to draw arrows showing the direction of blood flow through the left side of the heart. No marks were awarded if any arrows were drawn on the right hand side of the heart. The arrows must indicate that blood flows through the valves to be awarded marks.

8 (a) Figure 9 shows a human heart.

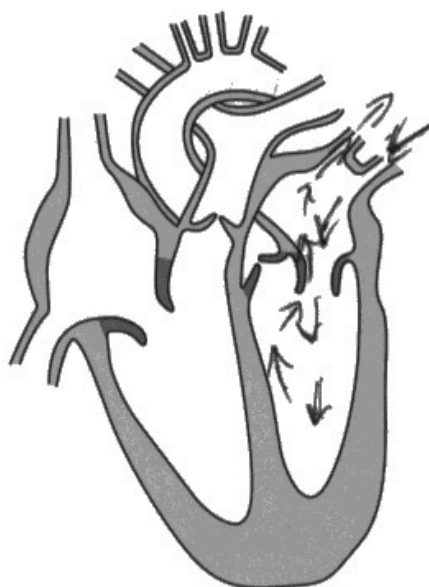


Figure 9

(i) Draw arrows on Figure 9 to show the direction of blood flow through the left side of the heart.

(2)



One mark for arrow showing blood flow through the atrioventricular valve. No second mark for blood flow going back the same way.

8 (a) Figure 9 shows a human heart.



Figure 9

(i) Draw arrows on Figure 9 to show the direction of blood flow through the left side of the heart.

(2)



ResultsPlus
Examiner Comments

Both marks awarded for flow through atrioventricular valve and then through semi-lunar valve.

Question 8 (a)(ii)

This question asked candidates to name the main blood vessel carrying deoxygenated blood to the heart. It was pleasing that the majority of candidates correctly stated vena cava.

Question 8 (b)(i)

Data was given showing the heart rate and stroke volume of a person when at rest and during exercise. Candidates were asked to calculate the difference in cardiac output when at rest and when doing exercise, give their answer to 3 significant figures and include correct units.

- (b) Figure 10 shows the heart rate and stroke volume of a person when at rest and when doing exercise.

| level of activity | heart rate in beats per minute | stroke volume in cm ³ |
|-------------------|--------------------------------|----------------------------------|
| at rest | 68 | 72 |
| during exercise | 112 | 124 |

Figure 10

- (i) Calculate the difference in cardiac output when at rest and when doing exercise.

Give your answer to 3 significant figures and include units in your answer.

(4)

$$112 - 68 = 44$$

$$\frac{44}{68} = 0.647 \times 100 = 64.75$$

$$124 - 72 = 52$$

$$\frac{52}{72} = 0.72 \times 100 = 72.2$$

$$64.75 + 72.2 = 136.97$$

$$= 137$$

answer 137 beats/min



Because this candidate showed their workings for their incorrect calculations, they could be given one mark for correctly expressing their incorrect answer to 3sf.

(b) Figure 10 shows the heart rate and stroke volume of a person when at rest and when doing exercise.

| level of activity | heart rate in beats per minute | stroke volume in cm ³ |
|-------------------|--------------------------------|----------------------------------|
| at rest | 68 | 72 |
| during exercise | 112 | 124 |

Figure 10

(i) Calculate the difference in cardiac output when at rest and when doing exercise.

Give your answer to 3 significant figures and include units in your answer.

(4)

At Rest $\rightarrow 68 \times 72 = 4896$

during exercise $\rightarrow 112 \times 124 = 13888$

Difference = ~~13888~~ $13888 - 4896 = 8992$

answer 8992 m/cm³



ResultsPlus
Examiner Comments

Two marks were awarded for the correct calculation for 8992. Answer is not expressed to 3sf and the unit is incorrect.



ResultsPlus
Examiner Tip

m is not accepted as the unit for minutes; min is the correct unit for minute.

- (b) Figure 10 shows the heart rate and stroke volume of a person when at rest and when doing exercise.

| level of activity | heart rate in beats per minute | stroke volume in cm ³ |
|-------------------|-----------------------------------|-------------------------------------|
| at rest | 68 | 72 |
| during exercise | 112 | 124 |

Figure 10

- (i) Calculate the difference in cardiac output when at rest and when doing exercise.

Give your answer to 3 significant figures and include units in your answer.

(4)

$$\begin{aligned} 68 \times 72 &= 4896 \\ 112 \times 124 &= 13888 \\ &= 8992 \end{aligned}$$

answer 8990 cm³/minute



An excellent answer which was awarded four marks for correct answer given to 3sf and with correct units.

Question 8 (b)(ii)

Candidates were asked to explain why cardiac output needs to increase during exercise. Credit was given for recognising that oxygen, glucose and energy demand would all increase, respiration would increase, more carbon dioxide would need to be removed and the build-up of lactic acid would be undesirable. Merely stating that oxygen is required for respiration, for energy, gains no credit since this is also true at rest and does not answer the question.

(ii) Explain why the cardiac output needs to increase during exercise.

(4)

this needs to increase as more oxygen is required in the muscle for aerobic respiration as the heart pumps oxygenated blood around the body and supplies the muscles. If the oxygen isn't reached to the muscle anaerobic respiration occurs producing lactic acid which results in cramp causing pain.



This gained three marks; more oxygen (Mark Point 1) for aerobic respiration (Mark Point 5). It also gains Mark Point 4 for describing lactic acid build up. The idea of more/increased/faster is only required once in the entire response.

(ii) Explain why the cardiac output needs to increase during exercise.

(4)

The cardiac output needs to increase during exercise so that the volume of blood being pumped and supplied to the muscle cells increases. This is because during exercise, the muscle cells require ~~and~~ an increased supply of oxygen and glucose through the blood ~~to~~ so that their mitochondria perform ~~at~~ respiration and release more energy required during ~~exercise~~ to ^{continuously} contract and relax during at a faster rate ~~of~~ during exercise.

(Total for Question 8 = 11 marks)



ResultsPlus
Examiner Comments

This gained four marks; increased supply of oxygen (Mark Point 1), increased supply of glucose (Mark Point 2), for respiration (Mark Point 5). It also gains Mark Point 6 for describing more energy is required. The idea of more/increased/faster is only required once in the entire response.



ResultsPlus
Examiner Tip

Energy cannot be produced. Respiration releases energy.

Question 9 (a)(ii)

The question asked how the hormones in contraceptive pills prevent ovulation. Many candidates were awarded two marks. Mark Point 1 was awarded for oestrogen inhibiting FSH, if they said oestrogen inhibits FSH and LH the mark was not awarded. Many candidates linked the inhibition of FSH to preventing an egg/follicle from maturing for the award of Mark Point 2. Mark Point 3 was the most commonly awarded mark for saying progesterone inhibits LH/FSH.

Many candidates described the effect of oestrogen and progesterone on the build-up and maintenance of the uterus lining. This was not creditworthy as it does not answer the question.

(ii) Explain how the hormones in contraceptive pills prevent ovulation.

(3)

Contraceptive pills are drugs that contain LH and FSH. The hormone FSH's job is to mature the egg in stage 1 ^(menstrual cycle). And the LH ~~key~~ is released the the pituitary gland at day 14 to ~~release~~ stimulate the releasing of an egg from the ~~ovaries~~ ovaries ~~AT~~ (ovulation). The contraceptive pills stops the release of the ~~fs~~ hormones, ~~so~~ and so the maturation and ~~ovulation~~ of the egg.



Only Mark Point 2 can be awarded for linking FSH with egg maturation, from accept column. Although LH and FSH are named, oestrogen and progesterone are not so no other marks can be awarded.

(ii) Explain how the hormones in contraceptive pills prevent ovulation.

(3)

The high levels of oestrogen inhibits FSH and LH so inhibits egg ovulation and egg maturation over time. A constant high amount of oestrogen and progesterone inhibits ~~FSH~~ FSH so no more egg maturation so no more egg ~~ovulation~~ ovulation - as egg does not mature to be in the ovary to be able to go down the duct



ResultsPlus
Examiner Comments

Mark Point 1 is not awarded because oestrogen inhibiting LH is rejected as incorrect. Mark Point 2 can be given for egg maturation is inhibited and Mark Point 3 for progesterone inhibits FSH, two marks.

(ii) Explain how the hormones in contraceptive pills prevent ovulation.

(3)

: Oestrogen inhibits FSH which prevents egg maturation from occurring

Progesterone inhibits both FSH and LH preventing an egg from being released from the ovaries



ResultsPlus
Examiner Comments

Maximum three marks demonstrating an excellent understanding of how hormones in the contraceptive pill prevents ovulation; oestrogen inhibiting FSH which prevents an egg maturing, and progesterone inhibiting FSH and LH.

Question 9 (a)(iii)

Candidates were asked to explain how a barrier method of contraception prevents pregnancy. The answer required an explanation of how it prevents sperm from reaching the egg and therefore no fertilisation will occur.

(iii) Explain how a barrier method of contraception prevents pregnancy.

(2)

A ~~physical~~ physical barrier will prevent the sperm from entering the uterus. One example of this is the ~~the~~ condom, which goes around the man's penis, and prevents the sperm from being released into ~~the~~ the woman.



ResultsPlus
Examiner Comments

Preventing the sperm from entering the uterus is Mark Point 1. They have not said that fertilisation is prevented so Mark Point 2 cannot be awarded.

(iii) Explain how a barrier method of contraception prevents pregnancy.

(2)

Condoms prevents pregnancy as it ~~as it~~ stops the sperm cells entering the uterus to bind with the egg cell.

If no sperm cells get to the egg then ~~the~~ the woman can't become pregnant.



ResultsPlus
Examiner Comments

Stopping the sperm from entering the uterus is Mark Point 1, binding with the egg cell is not enough for Mark Point 2, which requires fertilisation, one mark.

(iii) Explain how a barrier method of contraception prevents pregnancy.

(2)

Stops sperm from going into the vagina, therefore there is no risk of the woman getting pregnant. There is no way of sperm getting ~~to~~ to the egg to fertilise it because their path is blocked for example condom.



ResultsPlus
Examiner Comments

Stopping sperm getting into the vagina so cannot get to the egg and no way to fertilise it is both Mark Points.

Question 9 (b)

This was the first extended open-response question. Candidates produced some excellent responses to this question which asked for an explanation of how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant. It is evident that candidates now have a firm grasp of Clomifene therapy. The two main ART protocols/methods include the use of Clomifene and In Vitro Fertilisation (IVF).

Many candidates explained how the use of Clomifene increases the release of FSH so more eggs mature inside follicles, or increase the release of LH so there is more chance of ovulation. This is a detailed response.

IVF was also described in detail by many candidates, including the knowledge that the egg is fertilised by a sperm externally in a petri dish and the developing embryos are returned to the woman's uterus.

To be awarded six marks, candidates had to name both ART methods and describe them in detail.

*(b) Hormones can be used as part of assisted reproductive technology.

Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.

(6)

For the FSH hormone can be amplified to release eggs in ovary so the sperm can merge with the egg. Fertilising that they can use nanobots to steer sperm towards the egg (increasing the chances of fertilization) especially if the male sperm count is low due to low testosterone, testosterone can be also used in males to higher sperm count. They can also use previously frozen eggs to get a older woman pregnant with a higher fertilization rate for an older lady.



ResultsPlus
Examiner Comments

Other ART techniques were credited at Level 1, here increasing sperm count is linked with giving testosterone, two marks. FSH is mentioned but is not linked to correct function.

*(b) Hormones can be used as part of assisted reproductive technology.

Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.

(6)

~~the~~ If a woman lacks for example enough LH to release the egg, she can get prescribed some LH pills or injections to increase its levels and release it. If she doesn't produce enough FSH the egg wouldn't mature and so she couldn't have a child, so giving FSH tablets or boosts would increase the chance of falling pregnant.

A technology could be strapped to the shoulder that measures the levels of each hormone and injects more of the lacking ones if needed, to regulate the hormones to normal.



ResultsPlus
Examiner Comments

Although Clomifene is not described as a fertility drug, the idea of maturing/releasing eggs by increasing LH and FSH is accepted as a detailed description of Clomifene therapy and thus is a Level 2 response. Clomifene is not named so lower mark in Level 2 is awarded, three marks.

*(b) Hormones can be used as part of assisted reproductive technology.

Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.

(6)

ART is when you mature and fertilise the egg outside the body. To increase the chance becoming pregnant you can do IVF (in vitro fertilisation). This means you could give the woman a pill which contains FSH and LH, this is to ensure ovulation occurs and the woman's eggs are matured. Then you could take ~~at least~~ some of the woman's eggs once matured out of her body and ~~in~~ fertilise them with the man's sperm in a laboratory. Once these eggs have been fertilised they will develop into embryos. Once the embryos have developed into tiny balls of cells you take one or two of these and place it into the woman's uterus. This would then increase the chance of the woman getting pregnant as they are now tiny balls of cells and are fertilised.



ResultsPlus
Examiner Comments

This is a Level 3 response, a detailed description of IVF which also includes a detailed description of Clomifene therapy, although only IVF is named Clomifene is not so only five marks were awarded.

*(b) Hormones can be used as part of assisted reproductive technology.

Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.

(6)

Clomifene

↳ A woman who cannot ovulate is given a drug called Clomifene which contains ^{high levels of} FSH and LH. These hormones increase the chances of a woman becoming pregnant as FSH causes the egg inside an egg follicle to ^{mature} ovulate, therefore and LH triggers ovulation so ^{an} the egg is released, increasing the chance of fertilisation. This increases the chances of pregnancy.

IVF (in vitro fertilisation)

↳ A woman is given high levels of FSH and LH to increase chances of ovulation. These released eggs from ovulation is made to ~~fertilise~~ fertilise with ^{some} sperm. Then this forms embryos and a few are ^{placed} placed in the uterus of a woman, increasing the chances of ovulation, and also the chances of a woman becoming pregnant.



ResultsPlus
Examiner Comments

Maximum marks for this Level 3 response which gives detailed information for both Clomifene and IVF, both are named, six marks.

Question 10 (a)(ii)

Candidates were asked how waste products travel from the liver to the kidneys. The required response was in the blood, in the plasma or in the renal artery. Most candidates were awarded one mark for plasma.

(ii) State how the waste products travel from the liver to the kidneys.

(1)

dipusion



ResultsPlus
Examiner Comments

This was the most common incorrect answer.



ResultsPlus
Examiner Tip

Read the question carefully. It asks how waste products travel from the liver to the kidneys.

(ii) State how the waste products travel from the liver to the kidneys.

(along)

through the renal artery



ResultsPlus
Examiner Comments

Here, through the renal artery would gains the mark.

(ii) State how the waste products travel from the liver to the kidneys.

in the bloodstream, dissolved in plasma. ⁽¹⁾



ResultsPlus
Examiner Comments

In the bloodstream or dissolved in plasma gains the mark. Either is correct.

Question 10 (b)(i)

Candidates were asked to evaluate the results of an investigation of the effect of a high protein, low carbohydrate diet on a person's body (person A) in comparison to a person on a normal diet (person B). Data was given on levels of protein, glucose and urea in the urine of the two people. Creditworthy responses gave a key observation from the table and a valid reason for this.

(i) Evaluate the results shown in Figure 12.

(3)

Person A is not on the diet, this means they have no excess protein and no excess glucose, they have lots of extra urea as they are not having lots of protein in their system.

Person B also has no excess protein, which is surprising as they are on a high protein diet but they do have 0.2 mmol/Litre of glucose meaning they have sugar that wasn't used or turned into glycogen. Their urea levels are lower than person A probably because amino acids are broken down as they have consumed more protein.



Zero marks as the response merely describes what the table shows, with some quoted data from the table, but does not explain the results using their knowledge.

(i) Evaluate the results shown in Figure 12.

(3)

person A has healthy urine, whereas person B has ~~the~~ diabetes as they shouldn't have glucose in their urine as well as having low urea levels as it is very diluted.



ResultsPlus
Examiner Comments

This response links glucose in person B's urine with the explanation that they may have diabetes for the award of Mark Point 2.

(i) Evaluate the results shown in Figure 12.

(3)

Person A has much more urea as it is formed from ~~an~~ amino acids which is found in proteins. Person A also does not have any glucose in the urine as they have very low levels of carbohydrates in the blood. Person B has higher levels of glucose in the blood and less urea in the blood.



ResultsPlus
Examiner Comments

A description of person A having more urea, which is formed from amino acids found in proteins, is awarded Mark Point 3. Person A has no glucose in their urine as they have very low levels of carbohydrates in the blood. This is enough for Mark Point 2 as a direct comparison with person B is not required, two marks awarded.

(i) Evaluate the results shown in Figure 12.

(3)

for both A and B, despite being on a high protein diet (A) neither A or B have protein in the urine. This is because protein is too big to enter the Bowman's capsule during ultrafiltration in the glomerulus. As person A was on a low carb diet, all of the carbohydrates were broken down into glucose and as there were less carbohydrates ~~so~~ ^{all the} glucose was selectively reabsorbed into the blood so none ended up in the urine but for B the person had excess glucose so not all was reabsorbed so some ended up in the urine. Person A has over double the concentration of urea in his urine. This is because due to eating lots of protein lots of the protein was broken down into amino acids and as a result there was lots of excess amino acids so they were broken down in the liver and converted to urea so lots of urea was found in A. There was less urea in B, as although he didn't have as much urea isn't useful so it isn't selectively reabsorbed so there was some in the urine.



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Examiner Comments

Maximum three marks awarded. It identifies that neither person has protein in their urine and gives a correct explanation of the reason. It identifies low glucose for person A because of selective reabsorption and identifies high levels of urea in urine of person A as a result of proteins being broken down.

Question 10 (b)(ii)

This was an extended open-response question, with a level-based mark scheme. Following on from the investigation results, candidates were asked to explain how a nephron ensures that there is no protein and no urea in the urine of person A. Candidates must name glomerulus, Bowman's capsule and first convoluted tubule in the correct order to be a Level 3 response. To achieve six marks they must also describe how protein is too large to pass through the glomerulus/Bowman's capsule and that glucose is selectively reabsorbed in the proximal convoluted tubule. For a Level 2 response they need to name two structures linked to both substances. A Level 1 response requires one structure correctly linked to one of the substances.

***(ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.**

(6)

The ~~kidney~~ kidney has a bowman capsule which has nephrons attached to it. These nephrons ~~allow~~ for help to separate the large bits that shouldn't be let out through the urine from the small bits that should. These nephrons specifically ~~to~~ target proteins and glucose.



This is a Level 1 response which gets one mark for naming one structure.

* (ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.

(6)

First, the blood reaches the Bowman's capsule and the ^{urine} blood is forced through the glomerulus. Proteins however are filtered out and do not enter the nephron as they are too large. Glucose, ^{ions} and water are filtered into the nephron. This is known as Ultrafiltration. The urine ~~is then~~ travels through the convoluted tube and the loop of Henle. Here, sufficient ~~water~~ and minerals are reabsorbed back into the blood. Also, all the glucose in the urine is absorbed back into the blood. The urine then travels ~~from~~ along the nephron and into the collecting duct where sufficient water is reabsorbed back into the blood. The rest of the substances in the urine are waste and ~~pass then~~ travel through the ureter to the bladder and pass out of the body through the urethra. There is no glucose or proteins in the urine as the proteins are filtered out in Ultrafiltration and all the glucose is reabsorbed back into the blood as it ~~travels~~ the urine travels through the nephron.



The response has the Bowman's capsule and the glomerulus the wrong way round so cannot access Level 3. Even if in the right order they could not access Level 3 as convoluted tubule is not enough, it has to be PCT/proximal/first convoluted tubule. It is Level 2 for two named structures linked to both protein and glucose correctly. Four marks awarded.

* (ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.

(6)

The nephron filters his blood in the Glomerulus into the Bowman's capsule as urea, salts, glucose and water. In the proximal convoluted tubule glucose is reabsorbed through active transport. In the loop of Henle, salts and water are reabsorbed via diffusion and osmosis, the remaining products are then passed through the distal convoluted tubule and collected in the collecting ducts as urine.

Ultra-filtration & selective reabsorption.

~~permeability~~ * permeability of the collecting duct dictates how much water is reabsorbed, controlled by the hypothalamus.

The more water he has (osmoregulation) the less ADH released, resulting in a dilute urine, and the less water he has, the more ADH released, resulting in a concentrated urine.



The three main parts of the nephron are given in the correct order, so Level 3 can be awarded. It states glucose is reabsorbed which is not enough detail and there is no mention of protein being too large, thus the upper mark in the level is not given, five marks awarded.

* (ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.

(6)

- Once blood enters the nephron it enters the glomerulus. This ~~one~~
- Once the blood is in the glomerulus proteins are too big to ~~enter~~ the Bowman's capsule through diffusion so proteins stay in the blood stream.
- The glucose then travels into the Bowman's capsule to the first convoluted tubule where selective reabsorption takes place. When the body needs glucose the body first ~~uses~~ tubule and then absorbs glucose into the blood stream. So as the person has a low carbohydrate diet they would have low glucose levels so the body would absorb all the glucose leaving no glucose or proteins in the urine after the nephron.



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Examiner Comments

This Level 3 response names the main parts of the nephron, including the glomerulus, Bowman's capsule and proximal convoluted tubule in the correct order. The upper mark in the level is given because they have said protein molecules are too large to be filtered and glucose is selectively reabsorbed so six marks can be awarded.

*(ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.

(6)

When blood enters the glomerulus, ultrafiltration happens which removes water, mineral ions and glucose from the blood vessel into the Bowman's capsule of the nephron. ~~Protein~~
The gaps in the walls of the glomerulus are small which means that protein molecules are too large to be filtered out of the blood, meaning that none of it is in the urine of the person.

In the nephron, the proximal convoluted tubule carries out selective reabsorption to put all of the glucose that was filtered out of the blood back in to it. This is because glucose is ~~an~~ an important substance which the body needs in order to release energy in respiration. This means that all of it is selectively ~~reabsorbed~~ reabsorbed back into the blood from the nephron ~~because~~ meaning that none of it is in the person's urine because that would be a waste.



ResultsPlus
Examiner Comments

This Level 3 response names the main parts of the nephron, including the glomerulus, Bowman's capsule and proximal convoluted tubule in the correct order. The upper mark in the level is given because they have said protein molecules are too large to be filtered and the reason why, and glucose is selectively reabsorbed in the proximal convoluted tubule for six marks.

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.
- Always refer to scientific quantities when stating variables to be controlled using the terms volume, mass, etc. No credit is awarded for quantity or amount.
- Ensure that methods for core practicals are understood including the differences between controls and control variables.
- Remember when answering questions about osmosis, to refer to water concentration or, even better, water potential to show that it is the water moving not another substance.
- Apply rules for rounding up numerical answers consistently.
- Read mathematical questions carefully to note whether an answer is required to a specified number of significant figures.

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>

