



Examiners' Report

June 2024

GCSE Combined Science 1SC0 2BH

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.



Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus. Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2024

Publications Code 1SC0_2BH_2406_ER

All the material in this publication is copyright

© Pearson Education Ltd 2024

Introduction

The Pearson Edexcel GCSE (9-1) Paper 4: Combined Science (Higher tier) paper is the second of two biology papers taken as part of the GCSE (9-1) Combined Science qualification and the fourth science paper. This is the seventh year of the GCSE (9-1) Combined Science specification, and the qualification follows a linear assessment model whereby candidates must complete the six papers, two in each science discipline at the end of the course.

Paper 2BH: Combined Science (Higher 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 one extended open-response question. Candidates should answer all questions in a time of 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 must be completed prior to the examinations and candidates can be assessed on these directly, or on their ability to apply knowledge to other practical context. Aspects of working scientifically are also assessed in questions throughout the paper.

The Paper 2BH: Combined Science (Higher tier) paper contains questions assessing the content from Topics 1 and Topics 6 to 9. In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of the components and function of the blood, specialised plant cells, photosynthesis and osmosis, measuring abiotic factors and parasitism as well as the role of nitrates for growth, aerobic and anaerobic respiration, the heart, hormones of the menstrual cycle and their role in contraception and assisted reproductive technology.

Questions designed to assess practical skills included safety precautions when taking blood, random sampling using quadrats and measuring 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 as the nearest whole number, and calculating the difference in cardiac output when at rest and when doing exercise to three significant figures, with the correct units. Most candidates were able to access the extended writing response, demonstrating some good knowledge of assisted reproductive technology including IVF or the use of hormones to increase fertility.

Question 1 (a)(i)

This question required candidates to identify plasma as the liquid component of blood after a blood sample had been centrifuged into its separate parts. All the components were labelled except for plasma. Candidates found this challenging because it was in an applied context and not straight recall.

Question 1 (a)(iii)

Many higher ability candidates gained full marks for this question by giving two different types of white blood cell. Creditworthy responses included phagocytes and lymphocytes or named lymphocytes. One mark was awarded if two lymphocytes were named. Tolerance was given for phonetically correct spellings of the names. Some candidates gave the roles of white blood cells but did not name them. Candidates were credited for naming white blood cells not covered on the specification.

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

(2)

- 1 Some white blood cells release antibodies
- 2 some white blood cells prevent blood poisoning
Engulf antigens - release antibodies



These are functions and not the names of white blood cells so no marks were awarded.

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

(2)

- 1 B-lymphocytes
- 2 Memory lymphocytes



These are two names of lymphocytes so the response scored one mark.

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

(2)

- 1 phagocytes
2 lymphocytes



ResultsPlus
Examiner Comments

Two marks were awarded for this response. There is some tolerance for spelling errors and phonetically correct spellings were accepted.



ResultsPlus
Examiner Tip

Learn the spellings of difficult scientific terms.

Question 1 (b)(i)

This question assessed maths skills. 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 were able to access the maths in the question with a good proportion of candidates scoring full marks for correctly answering 207, some scored two marks for not rounding their answer to the nearest whole number.

(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)

$$470 \times 0.44 = 206.8$$
$$207 \text{ cm}^3$$

..... 207 cm^3



This shows a correct calculation with the answer rounded to the nearest whole number scoring maximum 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)

$$\begin{aligned} 47 \times 4 &= 188 \\ 4.7 \times 4 &= \frac{18.8}{206.8} \\ &= 206 \end{aligned}$$

..... 206 cm^3



ResultsPlus
Examiner Comments

This has the correct calculation of 206.8 in the workings for two marks. They have incorrectly rounded to the nearest whole number.



ResultsPlus
Examiner Tip

Make sure you round numbers correctly in calculations.

(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)

$$470 \times 0.56 = 263.2$$

..... 263 cm^3



ResultsPlus
Examiner Comments

This candidate has used 56% for their calculation which is the remaining percentage of blood. However, they have calculated the percentage correctly and rounded it to the nearest whole number so they were awarded two marks.

Question 1 (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 described ideas around making sure the patient didn't have diseases or to sit down which are not precautions taken by the doctor.

- (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 sterile needle to prevent infection and keep the blood healthy.
- 2 wear clean gloves to again prevent infection



ResultsPlus
Examiner Comments

This shows two marking points, a sterile needle and wearing gloves are two precautions a doctor would take when collecting blood.

- (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. Clean the needle and skin where you ^{are} taking the sample from.
2. Wear gloves to stop the blood from becoming infected.



ResultsPlus
Examiner Comments

Cleaning the needle is not sufficient for this mark but the candidate was still awarded full marks as they have cleaned the skin and wear gloves.

- (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. Ensure all wounds or cuts are covered.
2. Wear protective gloves to prevent blood sample making contact with skin.



ResultsPlus
Examiner Comments

This has covering wounds which refers to the doctor because doctor is in the stem of the question and therefore this is the additional guidance for the first marking point. Wear gloves is the same marking point so only one mark was awarded.

Question 2 (a)(i)

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

Question 2 (a)(ii)

This question asked candidates to use the diagram 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 with some indicating the cell wall was thin. Although mitochondria are shown in the diagram very few responses referred to the role of mitochondria.

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

(1)

increases surface area - via protusion of
'hair like' structure.



This gained one mark for an increased surface area.

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

(1)

~~Very~~ Very thin walls.



Thin walls was accepted for the mark as the question asks about the root hair cell.

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

(1)

It absorbs the substance and the

vacuole expands causing structure to increase vol.



ResultsPlus
Examiner Comments

This did not gain the mark as it is not a way the structure increased the volume of substances absorbed.

Question 2 (a)(iii)

This question was answered well by many candidates. They were asked to explain why root hair cells do not contain chloroplasts. Marks were given for the idea that root hair cells are underground, where there is no light and for they cannot photosynthesise. Weaker responses were awarded one mark for linking chloroplasts with photosynthesis.

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

(3)

Root hair cells are not a site for photosynthesis, as they aren't in contact with sunlight



This concise response scored two marks for linking the lack of chloroplasts to the lack of photosynthesis and the lack of sunlight.

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

(3)

Root hair cells don't need them because they are found ~~in the~~ on the tip of a root on a plant which is under the ground. Chloroplast capture sun light for photosynthesis so they would be pointless in this cell so they have become adapted for their function.



This gains its first mark for underground and because they have linked chloroplasts to needing sunlight for photosynthesis two further marks are awarded.

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

(3)

root hair cells are found in the roots of plants therefore meaning they do not make contact with the sun. Chloroplasts are used for photosynthesis which requires sunlight to provide energy therefore meaning chloroplasts would be useless in the root hair cell.



This has a mark for no contact with the sun/sunlight. As the question states that they contain no chloroplasts the link in the answer of chloroplasts being used for photosynthesis is sufficient for a second mark. There was no reference to underground or in the soil so a third mark was not awarded.

Question 2 (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 and in salt water the chloroplasts have clumped together or are in the middle of the cell. No marks were given if they did not include chloroplasts in their answer as some candidates indicated that the cells had moved and not the chloroplasts. However, a mark was awarded for describing the cells in salt water appearing larger.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Figure 3 shows *Elodea* cells in tap water and in a 10% salt solution.

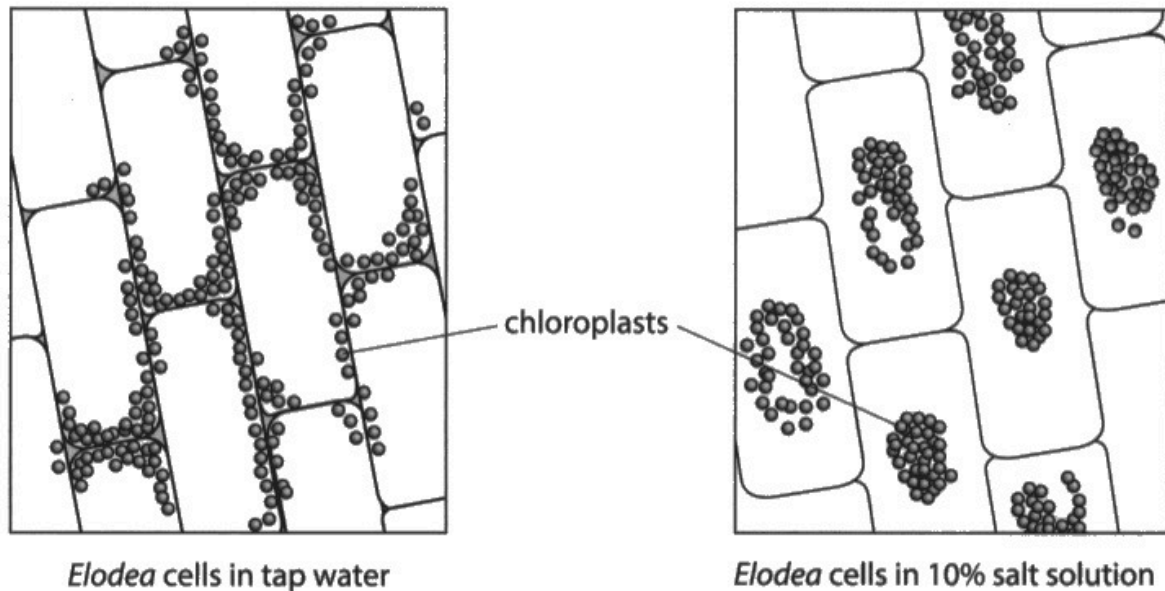


Figure 3

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

- 1 In the tap water they are more (2)
close to the cell membranes
- 2 In the 10% salt solution they are
clumped together in circle like shapes



This response did not refer to the chloroplasts and it cannot be implied from the question which asks about *Elodea* cells. In order to gain the marks the response would need to have referred to the chloroplasts at least once. Many responses seen referred to the *Elodea* cells moving and not the chloroplasts.



Do not use terms such as 'it' or 'they' in your answers. Make sure you are clear what you are referring to.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Figure 3 shows *Elodea* cells in tap water and in a 10% salt solution.

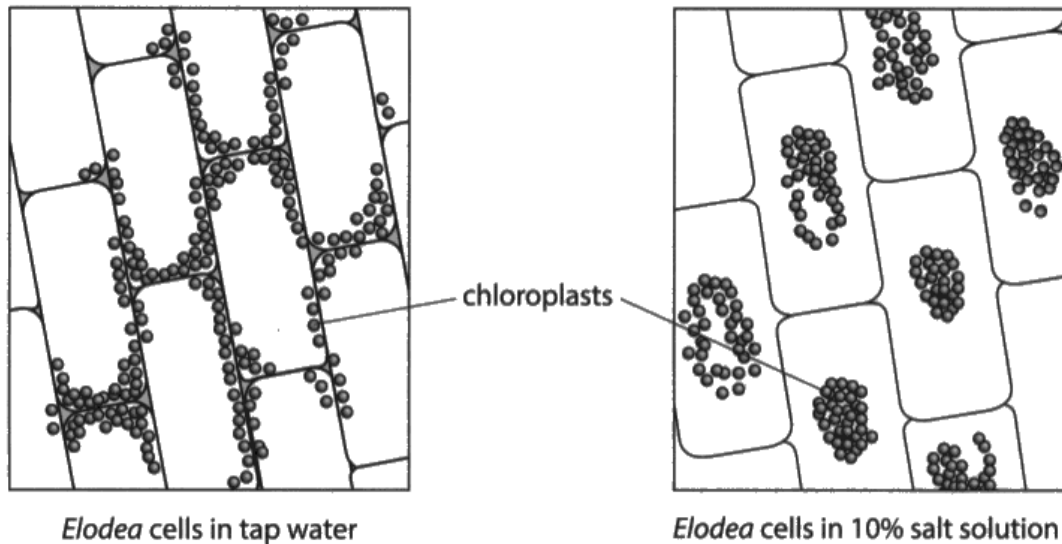


Figure 3

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

(2)

- The chloroplasts
1. ~~They~~ are in the center of the cell
2. ~~They~~ are more separated from each other
- The chloroplasts



This gained one mark for the first statement, it was assumed that the response is referring to the cells in salt solution based on the question unless it was otherwise stated. The second statement cannot be credited as they have not indicated that they are close to the edges of the cell in the tap water. Separated from each other does not clarify the arrangement of chloroplasts.

Question 2 (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. The applied nature of this osmosis question challenged many candidates. Candidates either scored well for recognising that osmosis had occurred and successfully describing it or did not score any marks, often because they thought the chloroplasts moved in response to sunlight. Marks were awarded for 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.

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

(3)

Because, ~~the solution is moving~~ there is a higher concentration of salt on the outside than on the inside, so, the solution moves from outside the cell to the inside, which makes them fill up with the solution, becoming ~~rigid~~ rigid. As the cell fills up the chloroplasts move to provide more room, so they all remain close in the cell centre. (This is through osmosis)



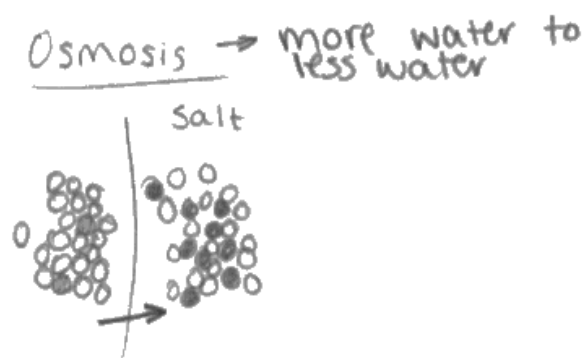
This response indicated the salt solution is moving rather than the water, so neither the mark for water moving or the concentration gradient could be awarded. Osmosis was credited as a standalone mark for recognising that the changes were as a result of osmosis.

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

(3)

Osmosis is where water moves from an area with more water to (dilute) to an area with less water (concentrate) down the concentration gradient across a partially permeable membrane. Here the solution is more concentrate than inside the cell so the water moves out, so the chloroplasts have moved to where there is the most water (in the middle of the cell) so photosynthesis can continue.

(Total for Question 2 = 10 marks)



ResultsPlus
Examiner Comments

This response illustrates all four marking points. They correctly explain the process of osmosis including the direction of water movement across a partially permeable membrane.

Question 3 (a)(i)

This question assessed the core practical of field-work techniques. Candidates were asked to devise a plan to randomly sample the number of plant species in a garden. Most candidates identifying the use of a quadrat with a few recognising the need to use a random number generator/random coordinates to decide the area to be sampled. Many candidates just repeated the question that the quadrat should be placed randomly without giving a method. A mark was awarded for counting the number of plant species, 'sample the number of plant species' was insufficient as this was merely repeating the question. Very few candidates suggested using a key to identify the plant species.

3 (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)

~~You first can give us~~ You can use quadrats to randomly sample the number of plant species in the garden. You can do this by turning the whole area in to 1 metre by 1 metre quadrats and use a random number generator to plot co-ordinates to randomly sample the number of plant species then once you do that you times it by the total number of quadrats to find the total amount.



ResultsPlus
Examiner Comments

This response scored two marks for the use of quadrats and the use of a random number generator. Randomly sampling plant species repeats the question so was not credited.



ResultsPlus
Examiner Tip

Avoid repeating information given in the question.

3 (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 should use quadrats to sample the number of species. The quadrat should be placed randomly ~~along~~ on the garden floor. The ~~the~~ number of plant species within the quadrat should be counted, and recorded. ~~the~~ The investigation could then be repeated in other parts of the garden.



This gained one mark for quadrats and a second mark for counting the number of plant species. They did not address how the sampling would be randomised nor how the species would be identified so only two marks were awarded.

Question 3 (a)(ii)

This question assessed an area of the specification that hasn't previous been assessed in this way. Very few responses scored maximum marks. 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 to guide candidate responses. 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 many candidates only scoring one mark for measuring the temperature with a thermometer. Most responses named abiotic factors or an abiotic factor without a valid description of how it would be measured, often just referring to measuring devices which were not qualified.

(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 Pollution could be measured by taking ~~a~~ samples of the soil in various places and sending them to a lab to be analyzed
- 2 Average temperature measured by a thermometer and recorded throughout each day
- 3 Average rainfall could be measured using a rain gauge and recording the amount in it everyday.



Soil sample analysis was not credited as the question referred to measuring abiotic factors in the garden. This response gains two marks for measuring temperature with a thermometer and a rain gauge was accepted as a way that rainfall would 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 can be measured

2 The water concentration

3 Light level intensity



ResultsPlus
Examiner Comments

This response identifies abiotic factors but does not describe how they could be measured so no marks were awarded.



ResultsPlus
Examiner Tip

Make sure you read the question carefully so that you give sufficient details to gain credit.

(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 using photometer

2 Air flow using wind mill

3 ~~Water~~ Temperature using a thermometer



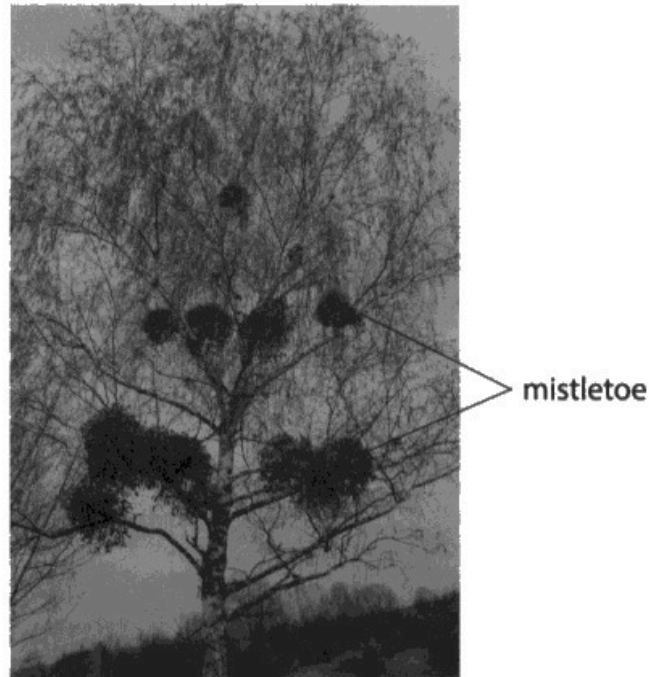
This showed a good level response. Two marks were awarded for measuring light intensity using a photometer and temperature using a thermometer. A windmill is not a suitable method for measuring airflow.

Question 3 (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.

(iii) Mistletoe is a parasite that grows on some trees.

Figure 4 shows a tree with mistletoe growing on it.



(Source: © NagyDodo/Shutterstock)

Figure 4

Describe the feeding relationship between the mistletoe and the tree.

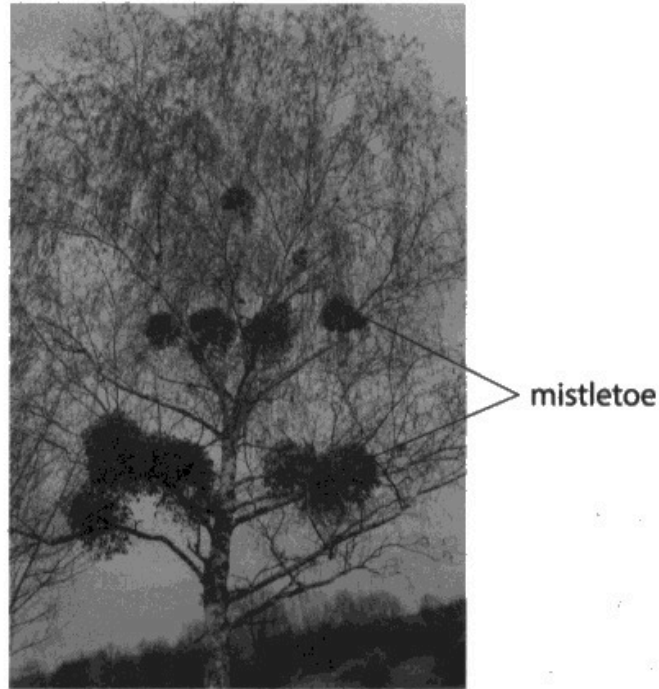
It is a non-mutualistic relationship. (2)
The mistletoe feeds on the tree and takes all the nutrients made for the tree for itself, killing the tree or making it sick as it is deficient of nutrients.
The tree is a host for the parasite and the parasite is competition for the tree as it needs the same nutrients.



This shows all the marking points. It has the idea of the mistletoe feeding off the tree which was accepted, causing harm to the tree and that the tree is the host.

(iii) Mistletoe is a parasite that grows on some trees.

Figure 4 shows a tree with mistletoe growing on it.



(Source: © NagyDodo/Shutterstock)

Figure 4

Describe the feeding relationship between the mistletoe and the tree.

(2)

parasitic relationship as the tree doesn't benefit from the mistletoe the parasite just uses the tree for food and a place to grow they don't both benefit



The tree doesn't benefit was not credited as the response needed to convey that there was damage/harm/detriment. This response gained one mark for using the tree for food which was just sufficient.

Question 3 (b)

This question asked candidates to explain why nitrate fertilisers are used in the garden. Most candidates scored one mark by recognising that nitrates are used to increase plant growth but very few recognised that nitrates are used by plants to make proteins/amino acids/DNA which was needed for a second mark.

(b) Nitrate fertilisers are used in the garden.

Explain why nitrate fertilisers are used in gardens.

(2)

Nitrates can be turned into ammonia by nitrogen fixing bacteria which can be absorbed by plants which gives them nutrients to grow.



The connection between nitrates and plant growth was sufficient for one mark.

(b) Nitrate fertilisers are used in the garden.

Explain why nitrate fertilisers are used in gardens.

(2)

nitrates are essential for making proteins within plants, they absorb the nitrates through their roots to help them grow faster as they make more proteins



This response scored full marks for making proteins for growth.

Question 4 (a)(i)

This question assesses practical skills and required candidates to apply their knowledge to a practical on anaerobic respiration in yeast. 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. One mark was awarded recognising that the student would need to repeat the experiment exactly the same while the second 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.

4 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)

To set up a control you need to make sure you are using the same volume of each ~~concentration~~ each concentration of glucose and use the exact same teaspoon of dried yeast.



ResultsPlus
Examiner Comments

This is a description of controlled variables not a control and did not gain the marks.



ResultsPlus
Examiner Tip

Know the difference between a control and controlled variables for practical work.

4) A student investigated the effect of glucose concentration on the rate of anaerobic ^{ana + wane} 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)

Set up a separate measuring cylinder. With the same steps except don't include any glucose in it.



ResultsPlus
Examiner Comments

This gained one mark for the separate measuring cylinder with the same steps. Not including glucose is insufficient it needed to be the idea of water or 0% glucose solution.

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

(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)

Use Set up the equipments listed above.

Instead of using a glucose concentration,
use distilled water. (20 cm³)



ResultsPlus
Examiners Comments

This gained full marks for the idea of repeating with the same equipment but using distilled water not a glucose concentration.

Question 4 (a)(ii)

Following on from the previous question, candidates were asked how the rate of reaction could be increased. Marks were awarded for increasing the temperature or adding more yeast. A number of candidates incorrectly suggested adding a catalyst or adding more washing up liquid.

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

(1)

Use more than a tea spoon of dried yeast.



More yeast would increase the rate of reaction and gained the mark.

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

(1)

put it in a waterbath with higher temperature.



Increasing the temperature of the reaction was accepted for the mark.

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

(1)

they could change the temperature



This is not sufficient, it needed to be the idea of increasing the temperature.

Question 4 (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.

(b) The results of this investigation are shown in Figure 5.

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

Figure 5

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

Explain which of these results is anomalous.

(2)

The second result of 10% and 5mm as it is the one that stands out as not going up in order it would have gone up and then gone down.



ResultsPlus
Examiner Comments

This gained two marks from the additional guidance. They have identified the results at 10% / 5mm and that it doesn't go up in order is sufficient for the explanation.

(b) The results of this investigation are shown in Figure 5.

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

Figure 5

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

Explain which of these results is anomalous.

(2)

The height - 3 which glucose concentration 15%. This is anomalous as it goes against the trend of gradual increase, rather goes lower instead.



This response successfully identifies the anomaly and links it to an explanation for two marks.

Question 4 (b)(ii)

Using 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. Many candidates recognised that there was more glucose or more respiration or more carbon dioxide gaining one mark, some combined aspects of this to gain two marks but very few candidates offered detailed explanations.

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

(3)

This is because in plants, the word equation for anaerobic respiration is glucose \rightarrow ^{carbon dioxide +} ~~CO₂~~ and ethanol. Glucose is a limiting reactant in anaerobic respiration. Therefore, as glucose concentration increases, so does the rate of ethanol and carbon dioxide production. This means that the volume of foam will also increase, and hence, so does the height of foam.



ResultsPlus
Examiner Comments

This gained three marks for linking that the limiting factor is glucose and therefore increased glucose will increase carbon dioxide production through anaerobic respiration.

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

(3)

The height of foam was greatest for the 25% glucose concentration because the rate of anaerobic respiration in the yeast was at its highest / optimum.



This gained one mark for the rate of anaerobic respiration being the highest. They just repeated the 25% glucose concentration from the question.

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

(3)

As glucose is $C_6H_{12}O_6$, the more CO_2 that's made increases the gas bubbles, therefore increasing the height.



This has one mark for more carbon dioxide. Although they state glucose they do not indicate that there is more glucose.

Question 5 (a)(i)

Candidates were given 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

5 (a) Figure 6 shows a human heart.

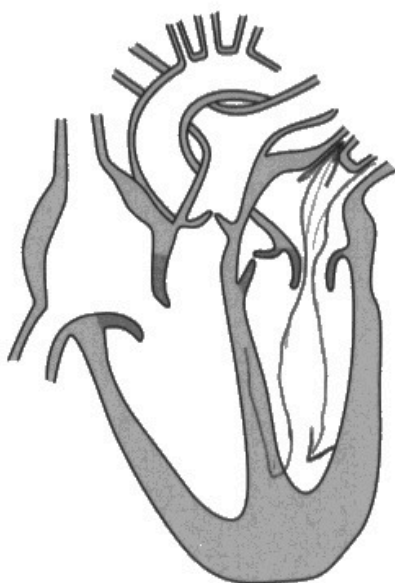


Figure 6

(i) Draw arrows on Figure 6 to show the direction of blood flow through the left side of the heart.

(2)



This gained one mark but the blood is not exiting through the aorta for the second mark.

5 (a) Figure 6 shows a human heart.

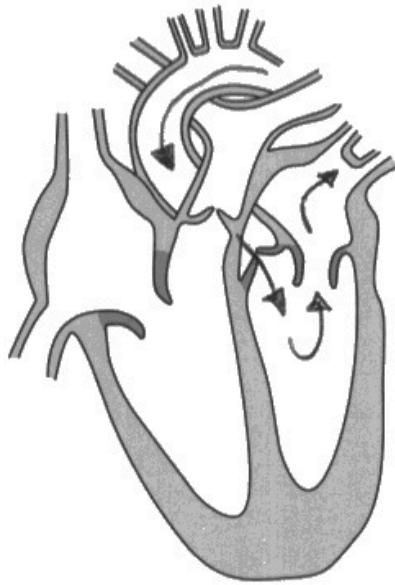


Figure 6

(i) Draw arrows on Figure 6 to show the direction of blood flow through the left side of the heart.

(2)



This does not have the correct blood flow and did not gain any credit.

5 (a) Figure 6 shows a human heart.



Figure 6

(i) Draw arrows on Figure 6 to show the direction of blood flow through the left side of the heart.

(2)



ResultsPlus
Examiner Comments

This indicates the blood flow through the left side of the heart.



ResultsPlus
Examiner Tip

Know which side is the left and right side of the heart on a diagram.

Question 5 (a)(ii)

This question asked candidates to name the main blood vessel carrying deoxygenated blood to the heart. Candidates found this question challenging and not many named the vena cava.

Question 5 (b)(i)

Candidates had a figure with a table of data 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 three significant figures and include correct units. Many candidates attempted a successful calculation, many did not give the answer to three significant figures and very few successfully gave the units. Candidates must recognise that m is metres and not minutes.

- (b) Figure 7 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 7

- (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.

Cardiac output = Stroke volume \times heart rate - (4)

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

exercise $\rightarrow 112 \times 124 = 13888$

$13888 - 4896 = 8992$

8990

cm³/min
l/min
litres/min

answer 8990 cm³/min.....



This scored full marks for the numerical value being correct to three significant figures and the correct units.

- (b) Figure 7 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 7

- (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)

rest $68 \times 72 = 4896$
 81.6 cm^3 per second

exercise $112 \times 124 = 13,888$
 $= 231.48$ per second

ANS - $81.6 = 149.86...$
answer $= 150 \text{ cm}^3/\text{s}$



ResultsPlus
Examiner Comments

This response was awarded full marks as it is the correct calculation with a correct unit. The candidate has converted it to cm³/second.



ResultsPlus
Examiner Tip

Know the units for calculations.

- (b) Figure 7 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 7

- (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.

$$C = H \times S$$

$$68 \times 72 = 4896 \rightarrow \text{At rest}$$

$$112 \times 124 = 13888 \rightarrow \text{Exercise}$$

$$13888 - 4896^{(4)} = 8992$$

answer 8992



ResultsPlus
Examiner Comments

This was a commonly seen response. The calculation is correct but it is not given to the correct number of significant figures nor does it have the unit.



ResultsPlus
Examiner Tip

Always read maths questions carefully to ensure you present the answer to your calculation correctly.

Question 5 (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)

Because during exercise the body needs more oxygen and energy. Everything increases to help meet the bodies needs. So the Cardiac output needs to increase so the blood with oxygen in it gets around body fast enough, and most efficiently, to the working organs and muscles, so the person can keep exercising.



This response scored two marks for identifying that an increased cardiac output would provide more oxygen and more energy for the body.

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

(4)

When someone is exercising they require more energy than at rest therefore more respiration needs to occur. Respiration when more respiration occurs more energy is released therefore heart beat is raised as the heart need to pump blood around the body quicker. This is so the oxygen can be absorbed by the body cells so more respiration will occur.



This scored three marks for more energy and more respiration. They gain the mark for oxygen as they have already stated the idea that the whole process is increased by using more at the start of the answer.

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

(4)

so that because during exercise more oxygenated blood is needed, ^{to diffuse into} ~~from~~ the muscle that are being used to exercise. The heart needs to increase its cardiac output in order to increase the rate at which blood is pumped around the body so that the body has enough energy to ~~exercise~~ exercise and for aerobic respiration (~~oxygen + glucose~~ ^{oxygen + glucose} → carbon dioxide + water + energy)



ResultsPlus
Examiner Comments

Full marks were awarded for this response. More oxygenated blood is the first mark. As the response indicated an increase we credited the energy for exercise and aerobic respiration. They then gained marks from the equation as it indicates the requirement for glucose and that carbon dioxide is released.



ResultsPlus
Examiner Tip

State the equation for respiration in your answer.

Question 6 (a)(ii)

The question asked how the hormones in contraceptive pills prevent ovulation. Marks were awarded for oestrogen inhibiting FSH, if they said oestrogen inhibits FSH and LH the mark was not awarded, that the inhibition of FSH prevents an egg/follicle from maturing and for progesterone inhibits LH/FSH. Many candidates of a range of abilities were awarded two marks for the role of FSH and that progesterone inhibits FSH. Candidates lost marks for stating that oestrogen inhibits FSH and LH preventing the mark being awarded.

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

(3)

- Oestrogen inhibits FSH

Meaning that the follicle cannot mature

- Progesterone inhibits LH which starts ovulation process and inhibits

FSH Oestrogen from stimulating LH

also thickens the uterine lining



This gained the mark for oestrogen inhibits FSH, for the follicle cannot mature and for progesterone inhibits LH. To gain this mark either LH or FSH would be accepted. Preventing ovulation is in the question so no mark was awarded for this or the idea of stopping the egg being released.

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

(3)

There ^{are} hormones ~~inside~~ of oestrogen and progesterone inside, they inhibit FSH and LH. FSH stimulates the maturation of a follicle in the ovaries and LH releases it ~~down the tube~~ towards uterus. Since there's low FSH and LH now, no egg will be released and ovulation will not happen.



ResultsPlus
Examiner Comments

The link in this answer meant that the first marking point could not be awarded as they indicate that oestrogen inhibits LH which is rejected. They still gained two marks for progesterone inhibiting LH and FSH and for the role of FSH is to mature the follicle from the additional guidance.



ResultsPlus
Examiner Tip

Make sure you are specific for the role of each hormone in the menstrual cycle or in relation to hormonal contraception.

Question 6 (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)

Barrier methods such as a
condom prevent sperm
cells from reaching the egg cell
meaning ovulation can't occur and neither
can pregnancy.



ResultsPlus
Examiner Comments

This has one mark for the sperm not reaching the egg. Ovulation was ignored and there is no reference to fertilisation.

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

(2)

A physical ~~method~~ barrier method - the condom or diaphragm
is worn during intercourse and prevents any either
any sperm from being released - or with a diaphragm - worn
by women have spermicides which kill any sperm entered.



ResultsPlus
Examiner Comments

This did not gain the mark as preventing the sperm being released was insufficient. The idea that they wouldn't be released into the vagina or uterus was required.

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

(2)

The barrier prevents sperm reaching the mature egg to fertilize it into a baby



ResultsPlus
Examiner Comments

This had both marking points for preventing the sperm reaching the egg and therefore not fertilising it.

Question 6 (b)

The final question of the paper was the extended open-response question. Candidates were asked to explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant. The main two components of the indicative content relate to IVF and to the use of hormones to increase ovulation including Clomifene therapy. The level was determined by the detail given in the response for the use of hormones or an explanation of IVF. If their explanations of the processes were linked to the names of the processes the top of the level could be 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 therapy is a type of assisted reproductive therapy ^(ART) where Lutenising Hormone (LH) and and Follicle Stimulating Hormone (FSH) are injected into the woman. The FSH stimulates the eggs in the ovary to mature and also causes oestrogen to be released. Oestrogen thickens the ~~the~~ lining of the uterus, inhibits the ^{release} ~~production~~ of FSH and stimulates the release of LH. LH causes ovulation to occur and also causes progesterone to be released. ~~This~~ Progesterone maintains the thick lining of the uterus. Clomifene therapy ^{also} prevents the negative feedback of progesterone on oestrogen. As a result, the uterus lining remains thick enough for the egg to embed itself into if it is fertilised and ^{therefore} increases the chances of a woman ^{pregnant} becoming pregnant.

Ⓜ In vitro fertilisation is also a type of ART where FSH and LH are injected into the woman. This causes many eggs to be released ^{into the uterus}. These eggs are then able to be taken outside of the ~~vaginal~~ uterus for fertilisation with a sperm egg in a petri dish. ^{Once it is fertilised} ~~This sperm~~ it is placed back into the woman's uterus and means that there is a higher chance of the woman becoming pregnant.

(Total for Question 6 = 12 marks)



This is a Level 3 response scoring six marks. The first 5 lines are a detailed response for Clomifene as they link a named hormone to its role in increasing the chance of someone becoming pregnant. The middle part of the response describes the menstrual cycle which was just ignored. The end of the response has a detailed explanation of IVF. They have named both IVF and Clomifene linked to the description so are awarded the top of the band.



Consider how to present your answers to extended response. Use subheadings and bullet points to help construct your answer.

*(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 can be used to increase the chances of a woman becoming pregnant as ~~it~~ the egg and sperm is handled manually. The egg is collected ~~from~~ from the females body and so is the sperm from the male. The egg is handled and the sperm is placed ~~to~~ to fuse with the egg. The embryo of the fused egg and sperm is placed back into the woman's body for her to have a chance of becoming pregnant.



This is a Level 1 response worth two marks. This response describes IVF but it is classed as brief as it does not include the idea that fertilisation occurs in glass/test tube/dish or that the embryo is inserted into the uterus. There is no reference to Clomifene so this is a brief explanation of IVF but it does have the idea of external fertilisation so two marks are 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)

Give women drug clomifene drug so they produce FSH and release eggs. Then take out the eggs from the ovary. Put the eggs and sperm cell in a dish to fertilise the eggs. It will become tiny balls called embryos. Put one or two embryos into the uterus. This might lead to ~~born~~ ~~more~~ babies born more than 1 which is harmful for mother the mother.



ResultsPlus
Examiner Comments

This was a good effort to identify Clomifene. Linking a named hormone (LH or FSH) correctly to maturing or releasing an egg is sufficient. However, this response links FSH to releasing the egg so it is not sufficient or detailed. The response then describes IVF including using a dish for fertilisation and placing the embryo into the uterus so it is classed as detailed. Detailed IVF and brief Clomifene is Level 2, as they name IVF making a link they can be awarded the top of the level.

*(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)

They are able to use Hormones to cause a woman to ovulate multiple eggs. They retrieve the eggs and separate the healthiest eggs they then bring them into contact with healthy sperm to be fertilised. They then grow the embryo in a test tube until ready to be inserted back into the females uterus to grow into a zygote improving the chance of the woman having a child drastically.



ResultsPlus
Examiner Comments

This gained Level 2 for three marks. They have a detailed explanation of IVF but do not name it and there is no reference to Clomifene.

Paper Summary

Based on their performance on this paper, candidates should:

- Ensure they answer the actual question in the paper. Written responses to a number of questions indicated that candidates used past papers as part of their revision process which is commendable but care must be taken to ensure that candidates answer the actual question in the paper, as although the knowledge may be similar the question is rarely identical.
- Learn key terms including the names of cells or cell structures and definitions of key terms such as mutualism and osmosis.
- Recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given.
- Avoid repetition of information given on the question paper as part of their answers as it will not be credited.
- 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 molecule concentrations or water potential to show that it is the water moving not another substance.
- Know the units associated with mathematical calculations in the specification.
- 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>

