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Examiners' Report
June 2019

IGCSE Biology 4BI1 2B

ResultsPlus

Introduction

This is the first time this style of paper has been taken since the new instructions for assessment came into place. There were many new features that candidates had to contend with, such as multiple choice questions, more mathematics and the challenge of new command words. The paper was 10 marks longer but the additional 15 minutes allocated allowed candidates to attempt all questions without time pressure.

There were pleasing signs that the new style of paper did not detract from performance, suggesting that candidates had been well-prepared and had been familiarised by the SAMs papers.

Candidates seem to have a better understanding of certain command words such as 'suggest' and 'explain', and the new command word 'evaluate' which appears in this paper caused little difficulty.

The examiners sensed that candidates would benefit from being exposed to novel investigative work as often as possible and being challenged to explain procedures and to analyse data.

Question 1 (a)

The comprehension examined ecological aspects relating to Australia's Great Barrier reef.

Question 1(a) required a definition of the term ecosystem, and most candidates were able to achieve at least one mark. The examiners rewarded answers that made it clear that an ecosystem involves all the living organisms in an environment and their interaction with abiotic factors.

(a) What is meant by the term **ecosystem** (line 3)?

(2)

A community of different living species in an environment with Abiotic factors.

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Examiner Comments

This answer gained both marks by mentioning community or different species in an environment with abiotic factors.

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Examiner Tip

When seeing a question worth two marks it is sensible to think of two ideas to include in your answer.

(a) What is meant by the term **ecosystem** (line 3)?

(2)

An ecosystem is an area where animals live, and where their habitat is based.

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Examiner Comments

This answer lacks any reference to abiotic factors so only gains one mark.

(a) What is meant by the term **ecosystem** (line 3)?

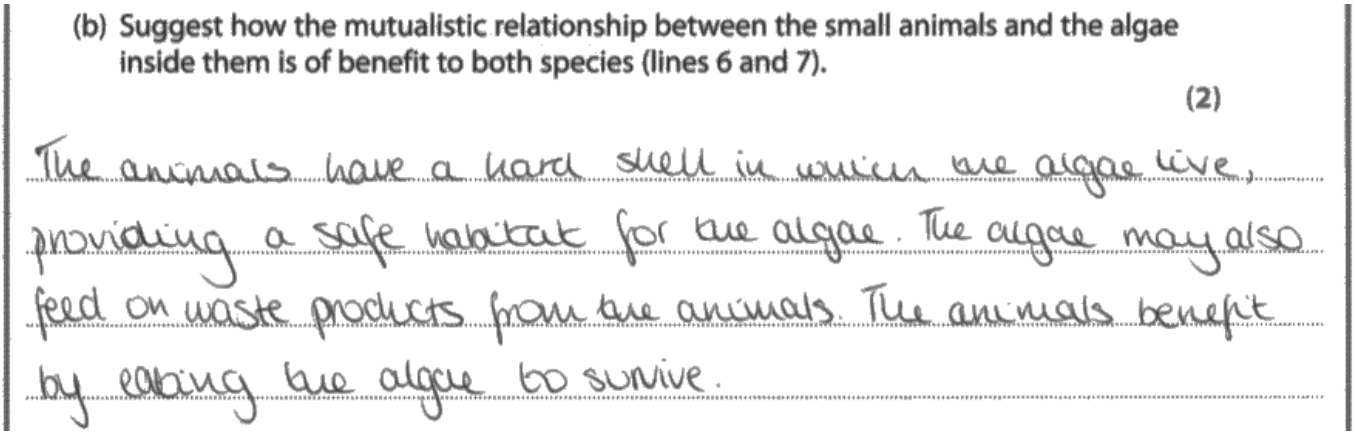
(2)

Ecosystem is the community of organisms along with their non-living environment.

Another answer that fulfils the requirement of showing an interaction between living organisms and their physical environment.

Question 1 (b)

In question 1(b), most candidates appreciated that algae get protection, and the better candidates also stated that they obtain carbon dioxide from animal respiration and, in return, the animals obtain glucose or oxygen from algal photosynthesis.



(b) **Suggest how the mutualistic relationship between the small animals and the algae inside them is of benefit to both species (lines 6 and 7).**

(2)

The animals have a hard shell in which the algae live, providing a safe habitat for the algae. The algae may also feed on waste products from the animals. The animals benefit by letting the algae to survive.

ResultsPlus
Examiner Comments

This answer makes it clear that the algae gain protection so gains one mark. It also shows a common error where candidates believed that the animal component of the coral used the algae as food.

(b) Suggest how the mutualistic relationship between the small animals and the algae inside them is of benefit to both species (lines 6 and 7).

(2)

The algae produce glucose from photosynthesis, providing a source of food for coral. The coral provide algae with CO_2 & a shelter to grow in. The algae photosynthesise, absorbing CO_2 and releasing oxygen. The coral respire using oxygen produced

ResultsPlus
Examiner Comments

This answer distinguishes between the algae getting carbon dioxide and oxygen being available for (coral) respiration, so two marks were awarded.

Question 1 (c) (i)

Most candidates appreciated that shallow, clear water allows light to be available for photosynthesis, and as a result question 1(c)(i) was well-answered.

(c) (i) Explain why coral grows best in shallow, clear water (lines 3 and 4).

(2)

This is because the coral will get more sunlight for photosynthesis. The water also will be warmer - the optimum temperature for coral is 25°C.

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Examiner Comments

This is a typical answer that gained both marks.

(c) (i) Explain why coral grows best in shallow, clear water (lines 3 and 4).

(2)

There is no dirt and bacteria that would cause damage and disease.

ResultsPlus
Examiner Comments

Some candidates connected clear water with turbidity ideas and gained no marks, as shown in this example.

(c) (i) Explain why coral grows best in shallow, clear water (lines 3 and 4).

(2)

The coral would grow best in clear water because it would have better access to light and oxygen for respiration

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Examiner Comments

This candidate appreciates that clear water allows light to penetrate but fails to link this idea with photosynthesis.

Question 1 (c) (ii)

In question 1(c)(ii), credit was given for appreciating that moving water would supply the coral with food, minerals, oxygen and carbon dioxide, and would remove waste. This question was well-answered.

(ii) Suggest why coral grows best in moving water (lines 3 and 4).

(2)

because this keeps the movement of minerals in the water ~~continues~~ continuous so it can be absorbed before more ~~other~~ oxygen or ~~the~~ carbon dioxide is passed along and used by the coral.

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Examiner Comments

This answer makes it clear that moving water supplies minerals, oxygen and carbon dioxide.

(ii) Suggest why coral grows best in moving water (lines 3 and 4).

(2)

it means that the water does not heat up and kill them

ResultsPlus
Examiner Comments

Many candidates linked moving water to cooling but this idea was not credited.

(ii) Suggest why coral grows best in moving water (lines 3 and 4).

(2)

the moving water will transport nutrients such as oxygen and mineral ions, and food so that the coral can grow. If the water wasn't moving the nutrients would be less likely to reach the coral.

ResultsPlus
Examiner Comments

The term 'nutrients' was ignored, but this candidate names two acceptable responses - oxygen and mineral ions, so gains both marks.

ResultsPlus
Examiner Tip

Try to avoid the use of the term 'nutrient' when better, more specific, terms are available.

Question 1 (d)

Question 1(d) challenged candidates to state how scientists were able to find the percentage of coral that had died in a section of reef. Most candidates gained credit for the idea of random sampling using a quadrat and repeating for reliability. A mark was available for showing how to calculate the percentage, but only the better candidates appreciated not to use the percentage change formula.

(d) Suggest how scientists are able to find the percentage of coral that has died in a section of the reef.

(3)

They know the area of the overall corals and they can then find an estimate of how much ~~coral~~ area is dead.

The ~~number~~ Area of dead / Total area x 100.

Or if possible the number of corals can be counted instead of area.

number of dead corals / total area x 100

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Examiner Comments

This candidate appreciates that the coral needs to be counted, but offers no detail as to how that might be done. The candidate also offers an acceptable description of how to calculate the percentage.

(d) Suggest how scientists are able to find the percentage of coral that has died in a section of the reef.

(3)

Using a random number generator the scientists select random areas of coral (in the reef). Using a quadrant, they count how many corals are alive, and how many are dead. Then using this equation they calculate the percentage of coral that is dead: $\frac{\text{number of dead corals}}{\text{total number of corals}} \times 100$

They then should repeat this process a few times, and from all the results they calculate a mean (average).

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Examiner Comments

This candidate provides detail of how to count the coral - using random placing of more than one quadrat. The method of calculating percentage is also acceptable.

(d) Suggest how scientists are able to find the percentage of coral that has died in a section of the reef.

(3)

Use quadrat to count number of coral reefs initally present. Use another one and count new number of coral reef.

$$\% \text{ died} = \frac{\text{remaining number} - \text{original number}}{\text{original number}} \times 100$$

Repeat and study area well for more accurate results

ResultsPlus
Examiner Comments

This candidate gains full marks for using more than one quadrat to count. No mark was given for the formula that calculates percentage change.

Question 1 (e)

The examiners were strict with question 1(e), only accepting answers that made it clear that there was less coral to eat.

(e) Give one reason why coral that survives higher sea temperatures is under increased threat from predators (lines 22 to 24).

Snails and crown-of-thorns starfish ~~can survive~~ prefer (1)
these higher temperatures ~~also~~, and these
animals feed ~~feed~~ on coral.

ResultsPlus
Examiner Comments

This answer mentions that the predators feed on the coral, but there is no indication that they have less to feed on.

(e) Give one reason why coral that survives higher sea temperatures is under increased threat from predators (lines 22 to 24).

because there is less alive coral that the (1)
predators could eat.

ResultsPlus
Examiner Comments

This answer makes it clear that there is less coral to eat, so gains the mark.

Question 1 (f)

There were many excellent answers to question 1(f), where candidates were asked to make suggestions about what should be included in a sustainability plan for the coral reef. The reduction in greenhouse gases, such as carbon dioxide, by burning less fossil was the most common thread of ideas. However, many candidates referred to other acceptable ideas such as controlling predators, reducing tourism or reintroducing coral grown in a laboratory.

(f) Suggest what recommendations should be included in the sustainability plan for the coral reef (lines 26 and 27).

(3)

~~ITAF~~ Do beach clean ups to reduce the amount of waste that is being let into the ocean. Maintain coral reefs by not allowing the public to harm them by swimming etc.

ResultsPlus
Examiner Comments

This answer gets one mark for the idea of keeping swimmers away.

(f) Suggest what recommendations should be included in the sustainability plan for the coral reef (lines 26 and 27).

(3)

To make the coral reefs more sustainable fishing should be reduced as anchors from boats can damage /destroy the reefs. To reduce coral bleeching ~~g to~~ the global rate of fossil fuels has to decline - this should be publicised. The amount of divers allowed should be restricted as sun cream also contributes to coral bleeching as well as breaking off coral. They should defintely limit human interferance.

ResultsPlus
Examiner Comments

This answer gets one mark for keeping boats and divers away, and a second mark for indicating that a reduction in the use of fossil fuel would help.

(f) Suggest what recommendations should be included in the sustainability plan for the coral reef (lines 26 and 27).

(3)

reduced burning of fossil fuels to reduce green house gasses and climate change therefore increase in sea temperatures. increase in electric cars for less Co2 emissions. Stop the use of motor boats in and around the ~~to~~ coral reef.

ResultsPlus
Examiner Comments

This answer gains full marks for the reduction of a named greenhouse gas by reducing burning of fossil fuels. The answer also mentions reducing boat visits to the reef.

Question 2 (a)

Question 2 tested knowledge and understanding of leaf structure and function.

Question 2(a) required basic recall of a standard practical, but many candidates failed to gain full credit. The examiners rewarded answers that made it clear that hot ethanol and iodine needed to be used, and that the colour blue black should be obtained. Many candidates failed to appreciate that the ethanol needed to be hot if the chlorophyll is to be successfully removed and weaker candidates wrote about Benedict's and the colour brick red.

2 The leaves of plants make starch.

(a) Describe how you would test a leaf to show that it contains starch.

(3)

First, ~~sterelise~~ sterilise the leaf, then add Benedict's solution. Add to ~~the~~ a water bath at 90°C and wait for 15 minutes. If the leaf contains starch it will have gone black.

ResultsPlus
Examiner Comments

This candidate fails to recall the procedure correctly, but gets one mark for appreciating that the final colour should be black.

ResultsPlus
Examiner Tip

Make sure you learn the methods of all practicals in the specification.

2 The leaves of plants make starch.

(a) Describe how you would test a leaf to show that it contains starch.

(3)

- Take a healthy leaf that has been grown in good conditions with air, minerals and light
- Dip the leaf in ethanol to decolorise it and to stop the chloroplasts from producing starch
- Now add a few drops of iodine solution onto the leaf. If the leaf turns from yellow to blue-black, it contains starch.

ResultsPlus
Examiner Comments

This answer fails to score full marks because the ethanol is not heated to an acceptable temperature.

2 The leaves of plants make starch.

(a) Describe how you would test a leaf to show that it contains starch.

(3)

you would first prepare the leaf by first ~~removing the leaves~~ washing it with water then leaving it in ethanol in a 70°C water bath so that the chlorophyll is removed, you would then remove after minutes and wash again with water (should be bleach white) then add iodine solution and if it ~~remains~~ goes blue/black then it has starch

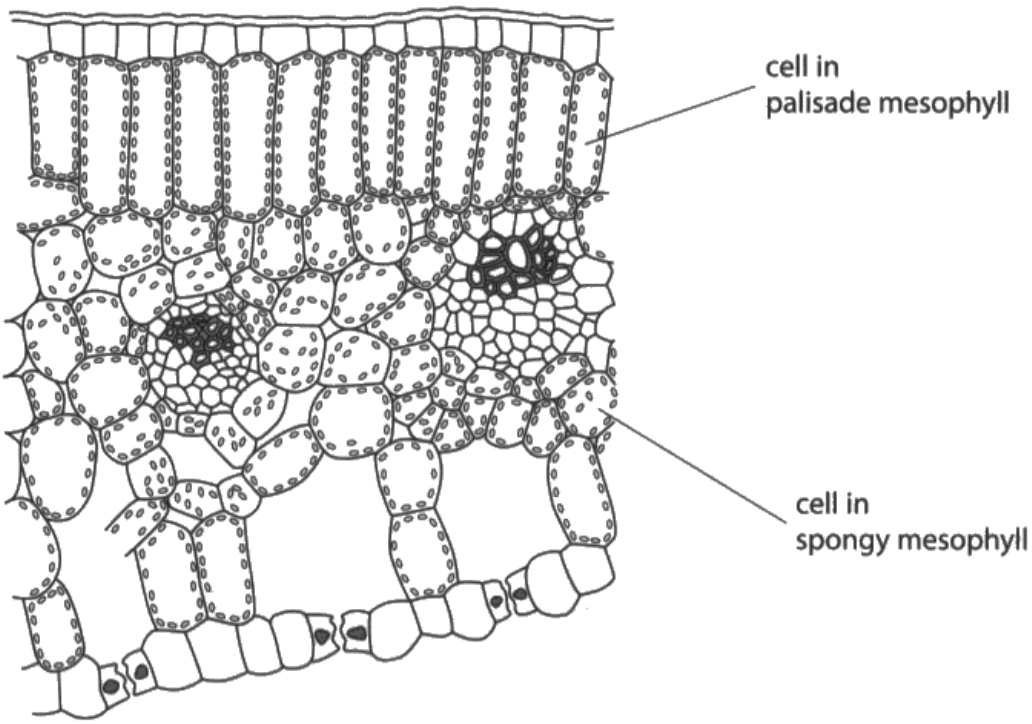
ResultsPlus
Examiner Comments

In this answer, the ethanol is heated at a suitable temperaure, iodine is added and the colour blue black is indicated: full marks.

Question 2 (b)

Those who understood the structure and function of leaves scored highly in question 2(b). The examiners gave credit to answers that stated the position of the palisade mesophyll or spongy mesophyll, the structure of these tissues in terms of shape or chloroplast content, and the function of the palisade mesophyll in light absorption and the spongy mesophyll in diffusion of gases. A common error was to state that the palisade cells are found close to the surface without making it clear whether it is the upper or lower surface.

(b) The diagram shows the structure of part of a leaf.



Explain the differences between the palisade mesophyll and the spongy mesophyll.

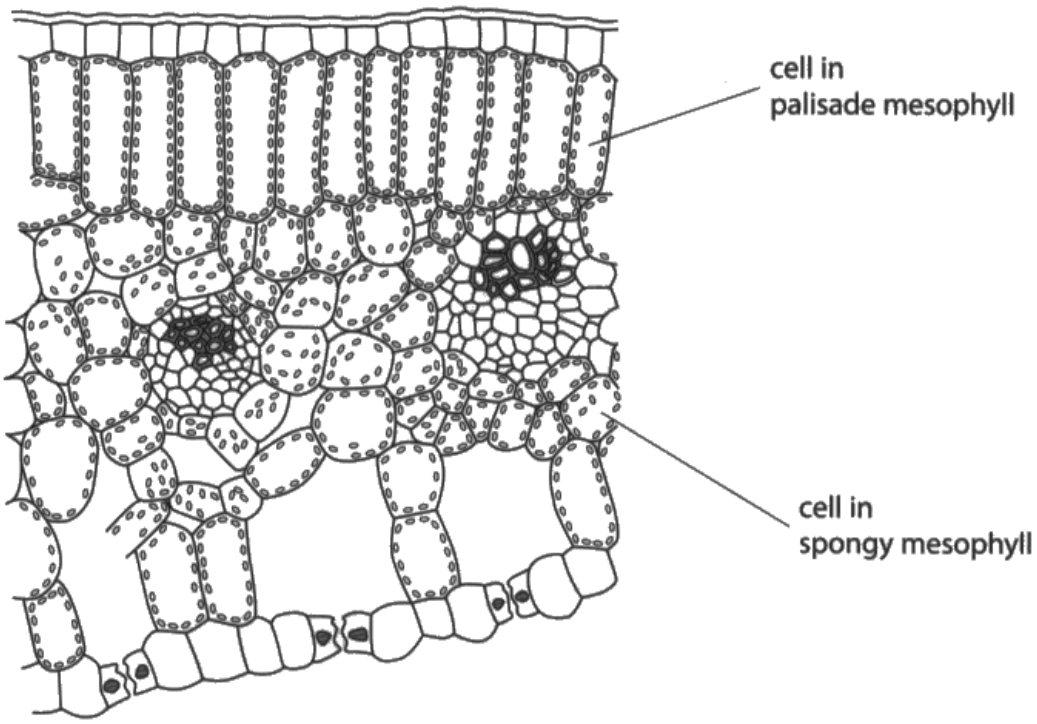
(4)

The palisade mesophyll contain lots of elongated palisade cells which are close to the surface of the leaf. This is because it contains lots more chloroplasts as it can absorb more sunlight here and the majority of photosynthesis occurs here. The spongy mesophyll is in the middle of the leaf and is not as tightly packed as the palisade cells because the spongy mesophyll is the main site of gas exchange and diffusion. The air gaps in between allow carbondioxide and oxygen to diffuse in and out of the cells.

ResultsPlus
Examiner Comments

This answer gained full marks for palisade cells being elongated with lots of chloroplasts to absorb light and for the spongy mesophyll allowing gas exchange and diffusion. The statement that the palisade cells are close to the surface of the leaf fails to indicate enough detail to gain a mark but this candidate does state that the spongy mesophyll occupies the middle of the leaf which is credit worthy.

(b) The diagram shows the structure of part of a leaf.



Explain the differences between the palisade mesophyll and the spongy mesophyll.

(4)

In the palisade mesophyll the cells are arranged regularly whereas in the spongy mesophyll they're irregular. This is because in the spongy mesophyll they have air gaps between the cells to allow for gases to diffuse and exchange between cells because of the increased surface area efficiently. The spongy mesophyll also contains xylem and phloem to transport water, vitamins and minerals and glucose around the plant and to the leaves and cells efficiently.

ResultsPlus
Examiner Comments

This answer only gains two marks for indicating that the spongy mesophyll has air gaps for gases to diffuse.

Question 2 (c)

Question 2(c) posed a real challenge with only the better candidates gaining full marks. Most, but not all, appreciated that the conclusion is not supported and most made it clear that stomata are found in the lower epidermis. However, describing the loss in mass when the various surfaces of the leaf were covered posed difficulty. To gain credit, candidates needed to make reference to mass loss, not water loss and to make it clear that mass is lost from the lower surface or when the upper surface is covered, or that least mass is lost from the upper surface or when the lower surface is covered.

The student concludes that transpiration occurs mainly from the upper surface of leaves.

Evaluate this conclusion.

(3)

The student is incorrect. When the upper surface of the leaf is covered, a large mass is still lost by the leaf. When the lower side of the leaf, the side with stomata and guard cells adapted for gas exchange a very small mass is lost. The graph showing both covered sides shows that no matter what is covered, mass will be lost even if this is a very small mass. Hence we can see that the upper surface of the leaf barely contributes from to transpiration. The Therefore, transpiration must mainly occur from the lower surface of leaves.

ResultsPlus
Examiner Comments

This candidate gains full marks by disagreeing with the conclusion and explaining why by making reference to mass loss from the lower surface, which is also the location of stomata.

The student concludes that transpiration occurs mainly from the upper surface of leaves.

Evaluate this conclusion.

(3)

I agree with the statement because the results say that the mass of I disagree with this statement because the perroleum jelly prevents transpiration from happening. This means that the largest rate of transpiration happened when the the top was covered so transpiration couldn't of happened their put only slightly . I believe transpiration happens mainly at the lower part of the leaf.

ResultsPlus
Examiner Comments

This is a weaker answer which only gains a mark for disagreeing with the conclusion.

Question 3 (a) (iii)

Question 3 tested knowledge and understanding of decomposition and protein synthesis.

The multiple choice questions in 3(a)(i) and 3(a)(ii) were well-answered.

Question 3(a)(iii) allowed candidates to show their knowledge of protein synthesis. The examiners were pleased by the quality of many answers, though some included detail that would be more suited to A level. The examiners gave credit for appreciating that transcription produces mRNA that leaves the nucleus to bind to a ribosome. Credit was then given for recalling that tRNA has an anticodon and that tRNA brings an amino acid to the complementary codon in translation. Some candidates confused the role of the nucleic acids, or failed to mention that mRNA leaves the nucleus.

(iii) Amylase is a protein.

Describe how protein is made in a cell.

(5)

the protein are made by ribosome using a thread of the DNA called mRNA, this acts a code for which tllype of protein is going to be produce. The ribosome use amino acids in a sequence of codon

ResultsPlus
Examiner Comments

This is a weak answer that only gains one mark for mention of ribosomes.

(iii) Amylase is a protein.

Describe how protein is made in a cell.

(5)

DNA in the nucleus is too big to move at so transcription occurs. MRNA polymerase unzips one strand of the ~~to~~ DNA and creates mRNA using ~~base~~ coding coabrs pairing to create a complementary strand of DNA. This mRNA moves at of the nucleus to the ribosomes where ~~transcription~~ translation occurs. MRNAs ~~lines up with tRNA which carries codons~~ line up with tRNAs anticodons, the tRNA carries amino acids. Using complementry based pairing the codon match with anticodons create a chain of amino acids which is a protein. Once the tRNA matches it moves of away leaving a long chain amino acid which is a protein.

ResultsPlus
Examiner Comments

This answer mentions all the ideas in the mark scheme, gaining full marks.

ResultsPlus
Examiner Tip

Be able to recall detail when writing about biological processes mentioned in the specification.

(iii) Amylase is a protein.

Describe how protein is made in a cell.

(5)

~~through translation and~~

first, transcription takes place and the RNA are matched ATCG.

then translation of the data in the DNA.

ResultsPlus
Examiner Comments

Another weak answer that gains marks for mention of transcription and translation but offers no detail.

Question 3 (b) (iii)

There were many pleasing answers to question 3(b)(iii). The examiners credited the need to use the same thickness or surface area of squares, the need to remove surface soil before weighing, the need to control abiotic factors that affect decomposition, the need to use the same mass or type of soil, the need to repeat and the use of a greater range of pH values.

(iii) Explain how the student could improve her method so that she can obtain more accurate results.

(4)

- Use larger squares
- calculate their area
- place more than 1 square in each beaker
- Repeat the whole experiment again.

ResultsPlus
Examiner Comments

This is an example of one of the weaker answers. It only gets a mark for the idea of replication.

(iii) Explain how the student could improve her method so that she can obtain more accurate results.

(4)

She should make sure the surface area : volume ratio of each square is roughly the same (e.g. same shape & mass). In addition, she should repeat the experiment 3 times and find an average of the results to make sure this is not an anomaly (reliability). She should keep the type of soil the same and sterility (same ~~number~~ number of microorganisms roughly). The squares should both come from the same bag (same type of starch). Temperature and O_2 availability should also be kept the same in both.

ResultsPlus
Examiner Comments

This is a good answer that gains full marks for use of the same size of squares, replication, and control of soil, temperature and oxygen.

Question 3 (b) (i) - (ii)

Parts (b)(i) and (b)(ii) asked students to calculate a percentage change and then to calculate the difference between their answer and the one provided in the table. The examiners were surprised that these tasks posed a real challenge to many. If their answer to part (i) was incorrect the error was carried forward to allow the student to gain credit in part (ii), though many struggled.

(b) A student investigates the effect of soil pH on the decomposition of bags made from starch.

She uses this method.

- cut two small squares from a bag
- measure the mass of each small square
- place one square in a beaker of soil with a pH of 7.0
- place the other square in a beaker of soil with a pH of 9.0
- after 10 days, remove the squares and measure their mass again

The table shows the student's results.

pH of soil	Mass of square in g		Percentage loss in mass (%)
	at start	after 10 days	
7.0	2.00	1.00	50.0
9.0	2.10	0.62	

(i) Calculate the percentage loss in mass shown by the square in pH 9.0 soil. (1)

$2.10 - 0.62$

$\frac{1.48}{2.10} \times 100 = 70.5\%$

percentage = ...

(ii) Calculate the difference between the percentage loss in mass for the two squares. (1)

$70.5 - 50$

$\frac{20.5}{50} \times 100 = 41\%$

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Examiner Comments

This candidate gets part (i) correct but fails to get part (ii) correct.

(b) A student investigates the effect of soil pH on the decomposition of bags made from starch.

She uses this method.

- cut two small squares from a bag
- measure the mass of each small square
- place one square in a beaker of soil with a pH of 7.0
- place the other square in a beaker of soil with a pH of 9.0
- after 10 days, remove the squares and measure their mass again

The table shows the student's results.

pH of soil	Mass of square in g		Percentage loss in mass (%)
	at start	after 10 days	
7.0	2.00	1.00	50.0
9.0	2.10	0.62	

(i) Calculate the percentage loss in mass shown by the square in pH 9.0 soil.

(1)

$\frac{2.1 - 0.62}{2.1} = 70.47\%$

$= 70.5\%$

percentage = 70.5%

(ii) Calculate the difference between the percentage loss in mass for the two squares.

(1)

~~70.5-50=20.5~~

70.5 − 50 = 20.5

difference = ~~20.~~ 20.5%

ResultsPlus
Examiner Comments

This answer gets a mark for part (i) and a mark for part (ii).

(b) A student investigates the effect of soil pH on the decomposition of bags made from starch.

She uses this method.

- cut two small squares from a bag
- measure the mass of each small square
- place one square in a beaker of soil with a pH of 7.0
- place the other square in a beaker of soil with a pH of 9.0
- after 10 days, remove the squares and measure their mass again

The table shows the student's results.

pH of soil	Mass of square in g		Percentage loss in mass (%)
	at start	after 10 days	
7.0	2.00	1.00	50.0
9.0	2.10	0.62	29.5

(i) Calculate the percentage loss in mass shown by the square in pH 9.0 soil.

(1)

~~2.1 x = 0.62~~

$\frac{0.62}{2.1} \times 100$ ~~x = 0.29~~

$= 29.5\ \%$

percentage = 29.5 %

(ii) Calculate the difference between the percentage loss in mass for the two squares.

(1)

$50 - 29.5$

$= 20.5$

difference = 20.5

ResultsPlus
Examiner Comments

This answer gets part (i) incorrect but part (ii) is correct.

(b) A student investigates the effect of soil pH on the decomposition of bags made from starch.

She uses this method.

- cut two small squares from a bag
- measure the mass of each small square
- place one square in a beaker of soil with a pH of 7.0
- place the other square in a beaker of soil with a pH of 9.0
- after 10 days, remove the squares and measure their mass again

The table shows the student's results.

pH of soil	Mass of square in g		Percentage loss in mass (%)
	at start	after 10 days	
7.0	2.00	1.00	50.0
9.0	2.10	0.62	

(i) Calculate the percentage loss in mass shown by the square in pH 9.0 soil.

(1)

2.10 - 0.62 x100 59.9%

148

percentage = 59.9%

(ii) Calculate the difference between the percentage loss in mass for the two squares.

(1)

difference = 38

ResultsPlus
Examiner Comments

In this answer, neither part (i) nor part (ii) are correct.

Question 4 (b) (i)

Question 4 tested knowledge and understanding of the kidney and the behaviour of the kangaroo rat to ensure survival in the desert.

The multiple choice questions in 4(a) were well-answered with most candidates recalling that ultrafiltration occurs at A, that glucose reabsorption occurs at B and that D, the collecting duct, responds to ADH.

In question 4(b)(i), the examiners gave credit to answers that made it clear the water would be reabsorbed into the blood by osmosis and that the urine would be more concentrated. Common errors included the belief that the ions would be reabsorbed, and to omit reference to osmosis and the volume or concentration of urine produced.

(b) A kangaroo rat is a mammal that lives in hot desert regions of America.

(i) In kangaroo rats, the tissue surrounding the collecting duct contains a high concentration of ions.

Explain how this feature enables kangaroo rats to survive in the desert.

(3)

The high concentration of ions encourages the net movement of water up the a concentration gradient called osmosis to take place so that more water is reabsorbed back into the blood and less is removed with urea. So no less, more concentrated urine is produced. Less water loss means lower demand for water so can survive in hot desert where water is scarce.

ResultsPlus
Examiner Comments

This is a good answer that gains full marks for correctly stating that water would be reabsorbed into the blood by osmosis and that the urine would be more concentrated.

(b) A kangaroo rat is a mammal that lives in hot desert regions of America.

(i) In kangaroo rats, the tissue surrounding the collecting duct contains a high concentration of ions.

Explain how this feature enables kangaroo rats to survive in the desert.

(3)

The kangaroo rat can survive because this means when there is high concentration of ions, ~~the~~ the volume of the urine released is concentrated, volume decrease to main body water percentage no too much ~~volume~~ water is lost due to urine.

ResultsPlus
Examiner Comments

This answer only gains one mark for stating that the urine would be concentrated.

(b) A kangaroo rat is a mammal that lives in hot desert regions of America.

(i) In kangaroo rats, the tissue surrounding the collecting duct contains a high concentration of ions.

Explain how this feature enables kangaroo rats to survive in the desert.

(3)

Due to this feature, it allows reabsorbtion of water to take place more faster so a kangaroo rat does need to obtain much faster.

ResultsPlus
Examiner Comments

This answer mentions that water is rebsorbed but no other detail is provided.

When a question is worth 3 marks try to include at least three ideas in your answer.

Question 4 (b) (ii)

Question 4(b)(ii) challenged students to explain why kangaroo rats stay underground during the day. Many appreciated that this behaviour would prevent the high temperatures of the day causing dehydration and would allow the animal to hide from predators. The examiners allowed the idea of reduced sweating even though this is not a physiological response in these particular mammals.

(ii) Kangaroo rats stay underground during the day and only come out to feed at night.

Explain how this behaviour enables kangaroo rats to survive in the desert.

(2)

It is cooler at night so ~~the~~ kangaroo rats lose less water by sweating due to heat so are able to keep higher leveles of water so in their blood stream, ~~meaning~~ they thrive in the desert. ~~Doom~~,

ResultsPlus
Examiner Comments

This answer makes it clear that it is cooler at night and that less water will be lost. Therefore, it gained full marks.

(ii) Kangaroo rats stay underground during the day and only come out to feed at night.

Explain how this behaviour enables kangaroo rats to survive in the desert.

(2)

It is very hot in the desert during the day and therefore them staying underground during the day prevent them from loosing water through sweat and decreases there need for water of which there is very little in the desert.

ResultsPlus
Examiner Comments

A well-written answer that gains full marks for acknowledging that it is cooler underground which reduces the risk of water loss.

(ii) Kangaroo rats stay underground during the day and only come out to feed at night.

Explain how this behaviour enables kangaroo rats to survive in the desert.

(2)

if they are out during the day they will sweat and water will be loss but at night water is not loss so it will be needed ~~to~~ ~~respiration~~ ~~is~~ to survive more

ResultsPlus
Examiner Comments

This answer makes it clear that less water will be lost but makes no mention of the temperature during the day or underground.

Question 4 (b) (iii)

Many candidates in question 4(b)(iii) appreciated that water could be obtained from the food eaten, or by respiration. Weaker candidates made incorrect reference to underground water or streams, despite the stem of the question stating that the animal rarely drinks water.

(iii) Kangaroo rats rarely drink water.

Suggest where they get their water from.

(1)

From plants that grow in the desert.

ResultsPlus
Examiner Comments

This is an example of an answer that gained the mark.

(iii) Kangaroo rats rarely drink water.

Suggest where they get their water from.

(1)

In deserts, water is found in the underground.

ResultsPlus
Examiner Comments

This is an example of an answer that failed to gain the mark.

Question 5 (a)

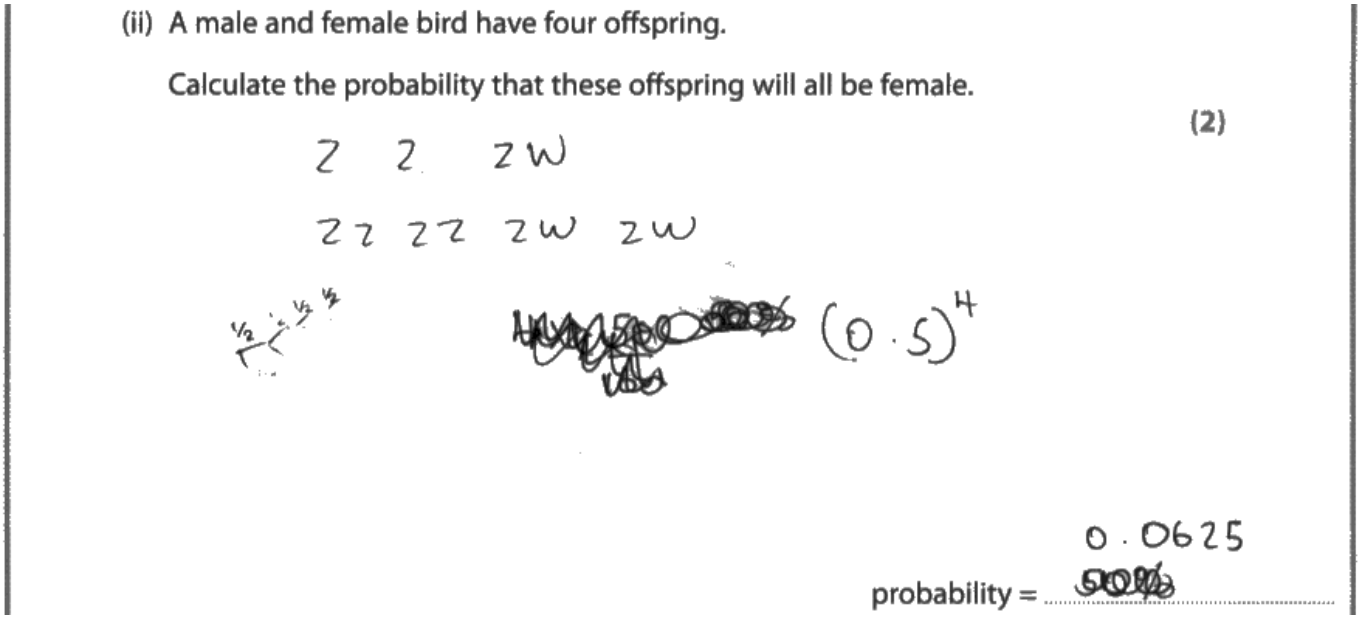
Question 5 tested knowledge and understanding of sex inheritance and the hormones involved in the menstrual cycle.

In question (a), most candidates recalled that the sex chromosomes found in a body cell of a human male would be XY.

Question 5 (b) (ii)

The multiple choice question in 5(b)(i) challenged candidates to appreciate the combination of sex chromosomes in birds differs from that in humans. That said, the correct answer D was chosen by many.

In part 5(b)(ii), the only answers accepted were 0.0625 / 6.25% / 1/16 and 1 in 16. If these answers were not seen, the examiners gave one mark for 0.5 or ½ if seen in the working, or on the answer line.


(ii) A male and female bird have four offspring.

Calculate the probability that these offspring will all be female.

(2)

Z Z ZW

ZZ ZZ ZW ZW

½ ½ ½ ½

$(0.5)^4$

probability = 0.0625

ResultsPlus
Examiner Comments

This answer gained full marks.

(ii) A male and female bird have four offspring.

Calculate the probability that these offspring will all be female.

(2)

	Z	W
Z	ZZ	ZW
Z	ZZ	ZW

½ male ½ female

probability = 50%

ResultsPlus
Examiner Comments

This is an example of an answer that gained one mark only.

(ii) A male and female bird have four offspring.

Calculate the probability that these offspring will all be female.

(2)

	Z	W
Z	ZZ	ZW
W	ZW	WW

50%.

0.5 × 0.5 × 0.5 × 0.5

probability = ½ 1/16

ResultsPlus
Examiner Comments

Another example of an answer that gained full marks. The working also shows how the correct answer was deduced.

Question 5 (c) (i)

The sources of FSH and oestrogen in question 5(c)(i) were correctly recalled by many, but only the better candidates were able to give an acceptable function of LH and progesterone. A common error was to state that progesterone repaired the uterus lining, or was involved in its breakdown.

(c) Human females generally reach puberty between the ages of 11 and 16.

At puberty, hormonal changes occur that cause females to start ovulating.

(i) The table lists the four hormones involved in controlling the menstrual cycle. It also shows the source of secretion and a function of each hormone.

Complete the table by giving the missing information.

(4)

Hormone	Source	Function
FSH	pituitary	stimulates follicle growth
LH	pituitary	stimulates the releases ~~the~~ of egg.
oestrogen	ovary.	repairs the uterus lining
progesterone	ovary	keeps the uterus lining intact.

ResultsPlus
Examiner Comments

This response shows an answer that gained full marks.

(c) Human females generally reach puberty between the ages of 11 and 16.

At puberty, hormonal changes occur that cause females to start ovulating.

(i) The table lists the four hormones involved in controlling the menstrual cycle. It also shows the source of secretion and a function of each hormone.

Complete the table by giving the missing information.

(4)

Hormone	Source	Function
FSH	Pituitary	stimulates follicle growth
LH	pituitary	
oestrogen	brain/ovary	repairs the uterus lining
progesterone	ovary	Sexual reproductive growth

ResultsPlus
Examiner Comments

This weak answer only gained a mark for identifying the source of FSH.

(c) Human females generally reach puberty between the ages of 11 and 16.

At puberty, hormonal changes occur that cause females to start ovulating.

(i) The table lists the four hormones involved in controlling the menstrual cycle. It also shows the source of secretion and a function of each hormone.

Complete the table by giving the missing information.

(4)

Hormone	Source	Function
FSH	pituitary	stimulates follicle growth
LH	pituitary	stimulates release of the egg.
oestrogen	ovary	repairs the uterus lining
progesterone	ovary	provides female secondary sexual characteristics

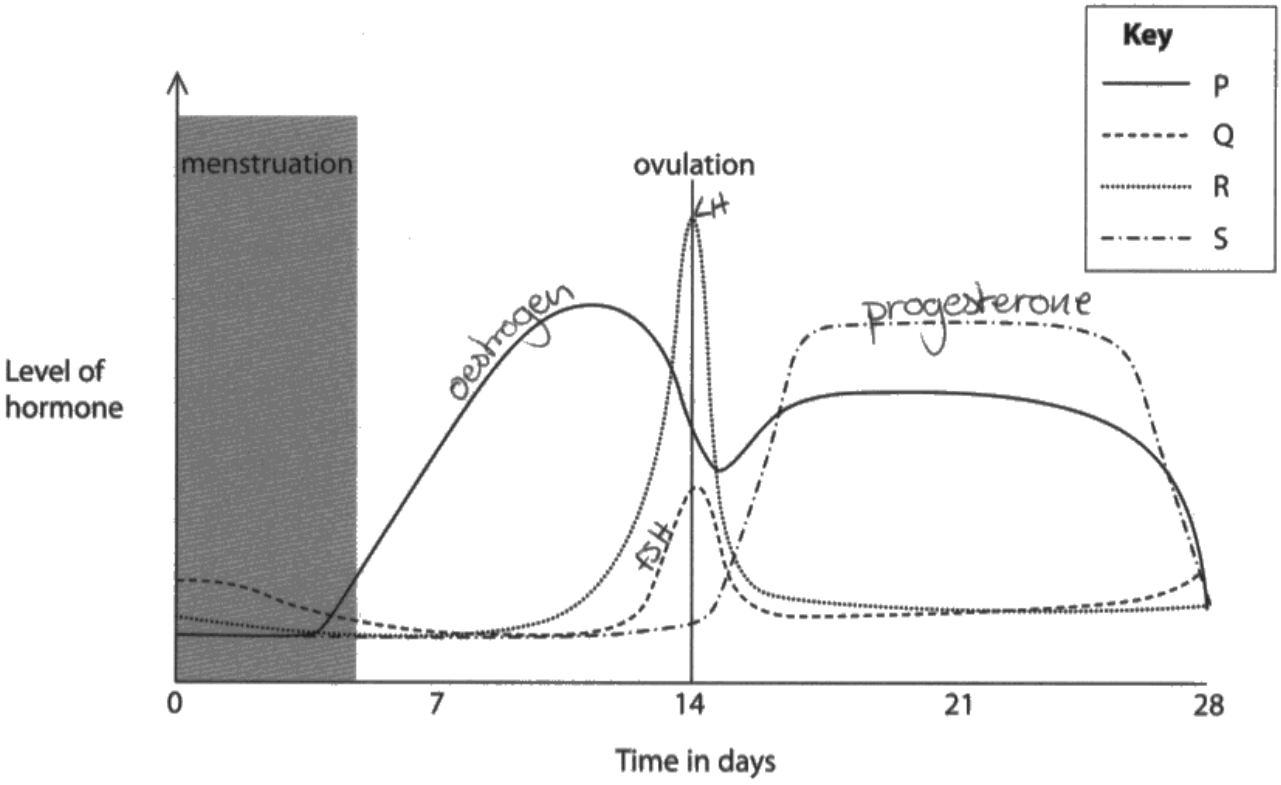
ResultsPlus
Examiner Comments

This answer shows a common error, that progesterone is responsible for secondary sexual characteristics.

Question 5 (c) (ii)

Question 5(c)(ii) challenged students and discriminated very well. Only the better candidates deduced that Q represented FSH, R represented LH, P represented oestrogen and S represented progesterone. A wide variety of letter combinations was evident.

(ii) The chart shows the changes in the levels of the four hormones during the menstrual cycle.



Each letter, P, Q, R and S, represents a different hormone.

Give the correct letter for each hormone.

(3)

FSH ..... Q .....

LH ..... R .....

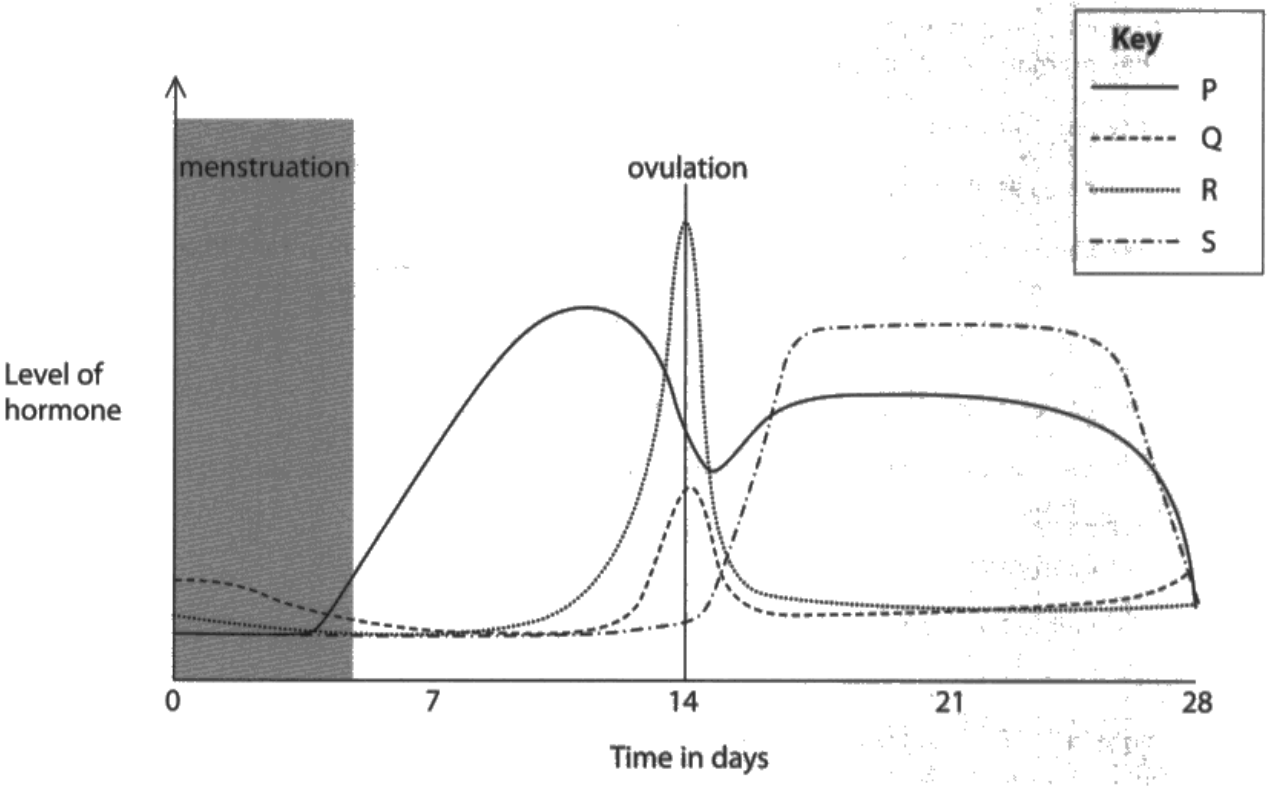
Oestrogen ..... P .....

Progesterone ..... S .....

ResultsPlus
Examiner Comments

This shows the correct combination of letters, gaining full marks.

(ii) The chart shows the changes in the levels of the four hormones during the menstrual cycle.



Each letter, P, Q, R and S, represents a different hormone.

Give the correct letter for each hormone.

(3)

FSH ..... Q .....

LH ..... R .....

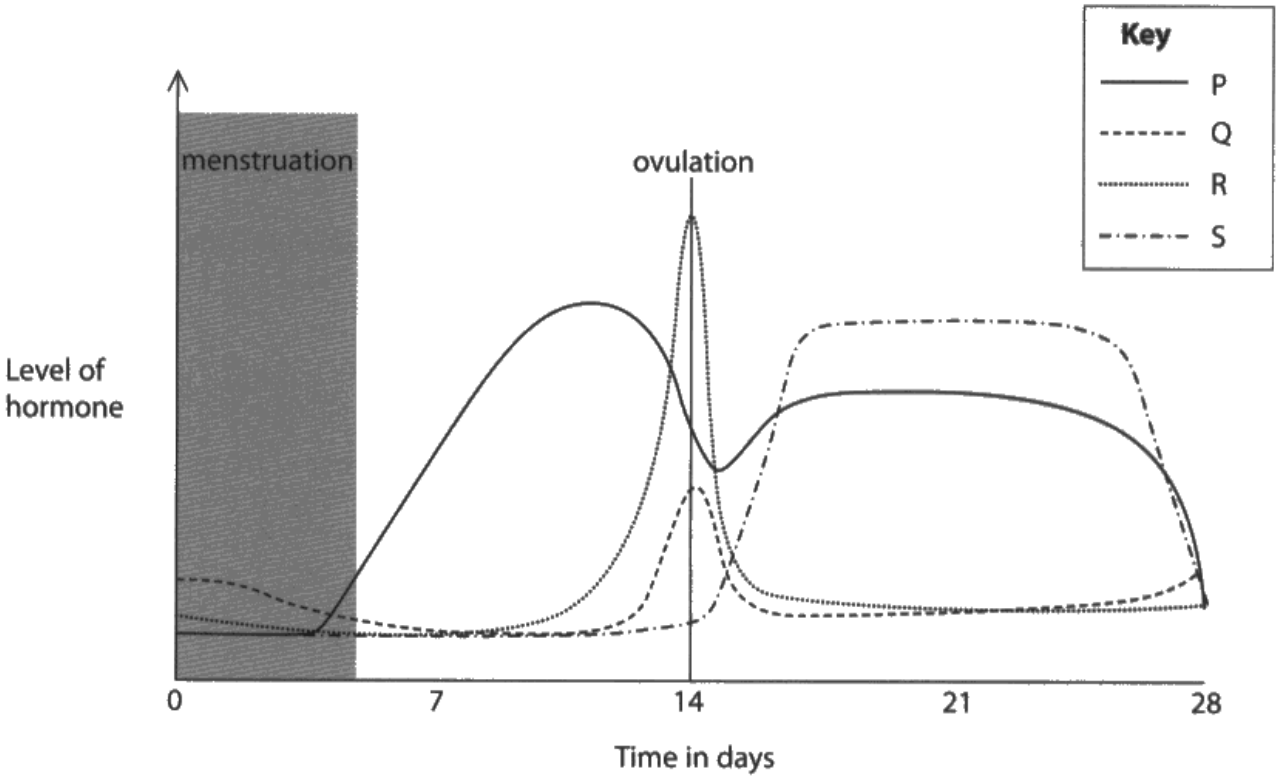
Oestrogen ..... ~~Q~~ S .....

Progesterone ..... ~~Q~~ P .....

ResultsPlus
Examiner Comments

This shows an example of where two correct letters (Q and R) gained two marks.

(ii) The chart shows the changes in the levels of the four hormones during the menstrual cycle.



Each letter, P, Q, R and S, represents a different hormone.

Give the correct letter for each hormone.

(3)

FSH ..... S .....

LH ..... R .....

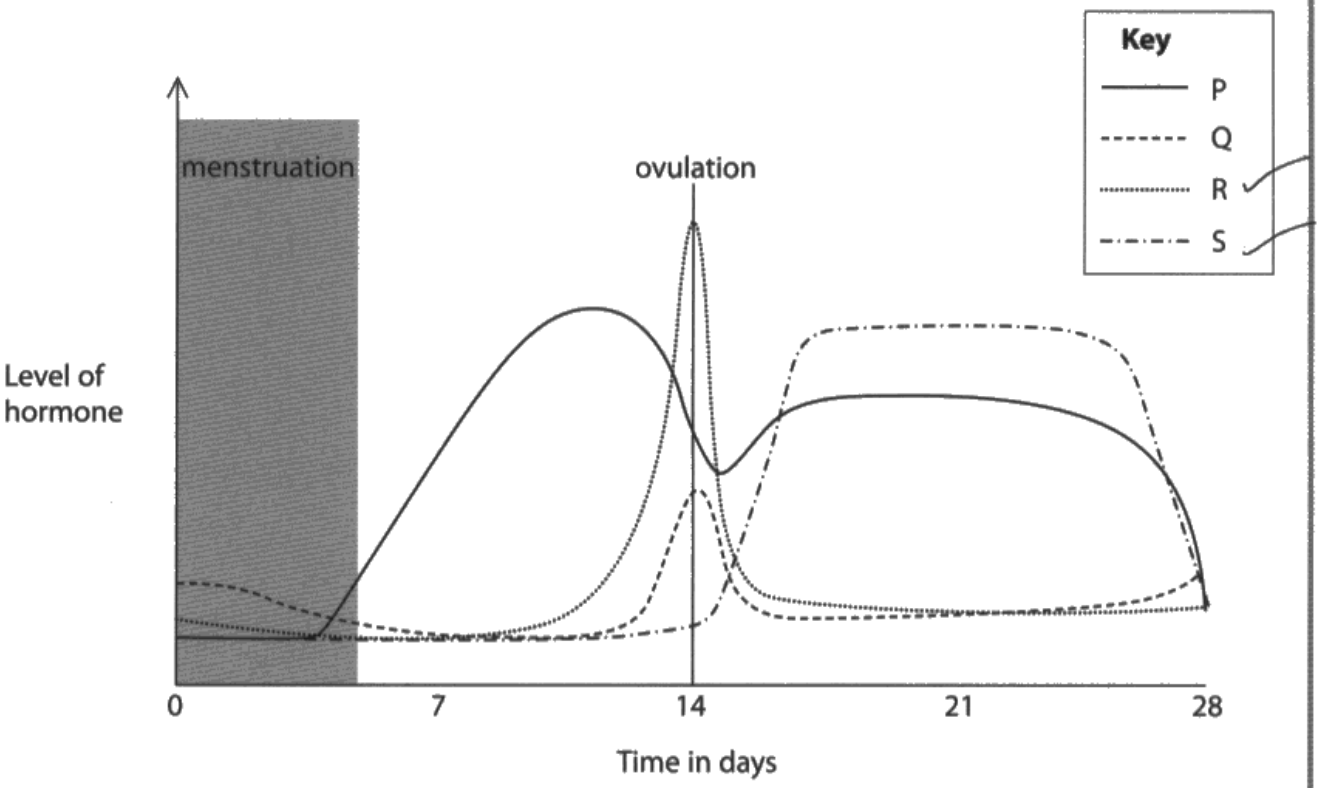
Oestrogen ..... R .....

Progesterone ..... P .....

ResultsPlus
Examiner Comments

This shows an example of where one correct letter (R) gained one mark only.

(ii) The chart shows the changes in the levels of the four hormones during the menstrual cycle.



Each letter, P, Q, R and S, represents a different hormone.

Give the correct letter for each hormone.

(3)

FSH ~~R~~ S P

LH Q

Oestrogen P S

Progesterone ~~S~~ R

ResultsPlus
Examiner Comments

This shows an example of where none of the letters is correct, so the response gained no marks.

Question 6 (a)

Question 6 tested knowledge and understanding of surface area to volume ratio and the biology of human lungs.

In question 6(a)(i), many candidates struggled to complete the table correctly ie giving 6 as the surface area, and 48 000 as the total surface area. This allowed candidates to get the correct ratio of 20:1 in 6(a)(ii). If candidates made an error with their total surface area figure, they could still gain credit in 6(a)(ii) by using their incorrect number to 2400 as the ratio.

6 The surface area of a lung is increased because there are many small alveoli rather than one large one.

(a) A student uses cubes as a model to estimate the additional surface area gained by having many small alveoli.

He uses this method.

- calculate the volume of a large cube with side length 20 cm
- calculate the number of small cubes with side length 1 cm that have the same total volume as the large cube
- calculate the surface area of the large cube
- calculate the total surface area of all the small cubes

The student assumes that the small cubes are not touching so all their surfaces are exposed.

The table shows the student's results.

(i) Complete the table by giving the missing information.

(2)

Side length in cm	Surface area of one cube in cm^2	Total surface area in cm^2	Volume of one cube in cm^3	Total volume in cm^3
20	2400	2400	8000	8000
1	6	48000	1	8000

(ii) Calculate the ratio of the total surface area of the small cubes to the surface area of the large cube.

(1)

small : large

48000 : 2400

= 2400

= 20 : 1

ratio = 20 : 1

ResultsPlus
Examiner Comments

This answer scored full marks for determinimg the surface areas correctly and calculating the correct ratio.

6 The surface area of a lung is increased because there are many small alveoli rather than one large one.

(a) A student uses cubes as a model to estimate the additional surface area gained by having many small alveoli.

He uses this method.

- calculate the volume of a large cube with side length 20 cm
- calculate the number of small cubes with side length 1 cm that have the same total volume as the large cube
- calculate the surface area of the large cube
- calculate the total surface area of all the small cubes

The student assumes that the small cubes are not touching so all their surfaces are exposed.

The table shows the student's results.

(i) Complete the table by giving the missing information.

(2)

Side length in cm	Surface area of one cube in cm^2	Total surface area in cm^2	Volume of one cube in cm^3	Total volume in cm^3
20	2400	2400	8000	8000
1	6	6	1	8000

1 x 1 = 1 x 6 = 6

(ii) Calculate the ratio of the total surface area of the small cubes to the surface area of the large cube.

(1)

2400 : 6

400 : 1

ratio = 1 : 400

ResultsPlus
Examiner Comments

This answer gets one mark for determining the surface area of one cube. The ratio also gets one mark because 6:2400 is 1:400.

6 The surface area of a lung is increased because there are many small alveoli rather than one large one.

(a) A student uses cubes as a model to estimate the additional surface area gained by having many small alveoli.

He uses this method.

- calculate the volume of a large cube with side length 20 cm
- calculate the number of small cubes with side length 1 cm that have the same total volume as the large cube
- calculate the surface area of the large cube
- calculate the total surface area of all the small cubes

The student assumes that the small cubes are not touching so all their surfaces are exposed.

The table shows the student's results.

(i) Complete the table by giving the missing information.

(2)

Side length in cm	Surface area of one cube in cm^2	Total surface area in cm^2	Volume of one cube in cm^3	Total volume in cm^3
20	2400	2400	8000	8000
1	1	1	1	8000

(ii) Calculate the ratio of the total surface area of the small cubes to the surface area of the large cube.

(1)

ratio = 1 : 2400

ResultsPlus
Examiner Comments

This answer gets no marks for determing the surface areas but the error carried forward allows one mark for the ratio.

6 The surface area of a lung is increased because there are many small alveoli rather than one large one.

(a) A student uses cubes as a model to estimate the additional surface area gained by having many small alveoli.

He uses this method.

- calculate the volume of a large cube with side length 20 cm
- calculate the number of small cubes with side length 1 cm that have the same total volume as the large cube
- calculate the surface area of the large cube
- calculate the total surface area of all the small cubes

The student assumes that the small cubes are not touching so all their surfaces are exposed.

The table shows the student's results.

(i) Complete the table by giving the missing information.

(2)

Side length in cm	Surface area of one cube in cm^2	Total surface area in cm^2	Volume of one cube in cm^3	Total volume in cm^3
20	2400	2400	8000	8000
1	~~120~~ 6	~~2400~~ ~~48000~~ ~~120~~ 48000	1	8000

(ii) Calculate the ratio of the total surface area of the small cubes to the surface area of the large cube.

(1)

2400 : 48000

1 : 20

ratio = 1 : 20

ResultsPlus
Examiner Comments

This answer gets both marks for determining the surface areas but the calculated ratio is wrong so gets no mark.

Question 6 (b)

In question 6(b) credit was given for appreciating that on a positive note the model did explore the concept of surface area to volume ratio by using many cubes (alveoli), but that on a negative note the model fails to take into account that alveoli are not cuboid and that their surfaces touch.

(b) Evaluate the student's model as a representation of the lungs.

(2)

The students model is a good representation of the lungs because he has lots of small cubes that represent the alveoli because we have lots of small alveloli and not one big one.

ResultsPlus
Examiner Comments

This answer gets one mark for recognising that the model uses lots of cubes to represent lots of alveoli.

(b) Evaluate the student's model as a representation of the lungs.

(2)

Not entirely accurate as alveoli are [redacted] spherical in shape, not cubic, which changes their surface area. Some alveoli may be touching so not all their surfaces are completely exposed.

ResultsPlus
Examiner Comments

This answer makes it clear that the model does not allow for the shape of the alveoli or that their surfaces touch, but only one mark could be given as the question asks for an evaluation. Only one mark was available for negative aspects of the model and one mark for any positive aspects.

ResultsPlus
Examiner Tip

When asked to evaluate try to include arguments that support and arguments that do not support in your answer.

(b) Evaluate the student's model as a representation of the lungs.

(2)

It is accurate as the lungs do are made up of many small alveoli which have a high combined surface area. however alvioli are circular in shape so have a different surface area. It is accurate as they have all sides exposed like alveoli and are not touching like alveoli

ResultsPlus
Examiner Comments

This answer gains both marks. One mark in support of the model by making reference to many alveoli and one mark not in support of the model by making reference to shape differences and the idea of touching.

Question 6 (c)

Question 6(c) gave candidates the opportunity to explain how alveoli are adapted for gas exchange. The examiners gave credit to answers that linked moist surfaces to the dissolving of gases, blood flow to the maintaining of a concentration gradient and thin walls to shorten diffusion distance. Only the better candidates provided this level of detail for all three adaptations.

(c) The results show that many alveoli increase the surface area, which will increase the rate of diffusion.

Explain three other ways that alveoli are adapted to maximise gas exchange.

(3)

1 Have a good blood supply by capillarys, increasing concentration gradient for efficient gas exchange.

2 1 cell thick walls, creating a short diffusion distance, increasing rate of gas exchange.

3 Moist surface, so gases dissolve quickly into the alveoli from the blood.

ResultsPlus
Examiner Comments

This answer gained full marks by explaining how each way helps to maximise gas exchange.

(c) The results show that many alveoli increase the surface area, which will increase the rate of diffusion.

Explain three other ways that alveoli are adapted to maximise gas exchange.

(3)

1 high blood supply
steep concentration gradient

2 moist the diffusion is faster

3 have thin walls, faster diffusion

ResultsPlus
Examiner Comments

This answer only gets one mark for correctly linking blood supply to concentration gradient. The other responses merely repeat what is in the stem of the question as their explanation.

ResultsPlus
Examiner Tip

Repeating information from the stem of any question does not gain credit.

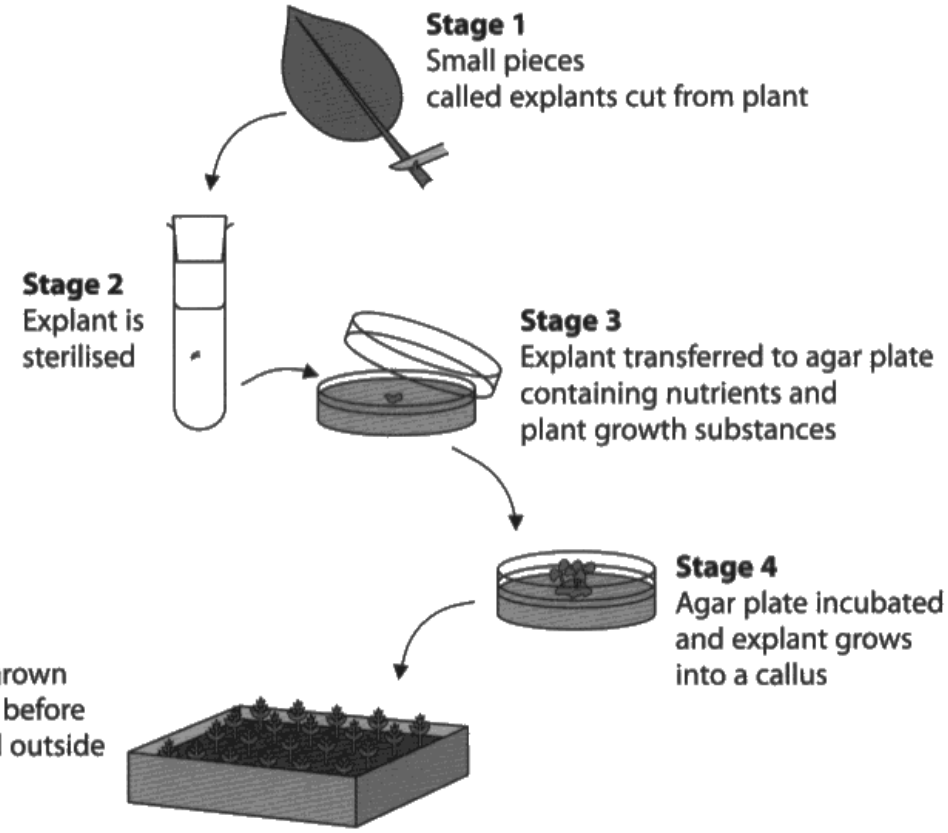
Question 7 (a) (i)

Question 7 tested knowledge and understanding of micropropagation.

In question 7(a)(i), the examiners noted that there were many correct answers such as dipping in bleach, alcohol or exposure to radiation. Many candidates think boiling in water or alcohol are good methods, failing to appreciate that these procedures would kill the seeds.

7 Scientists produce large numbers of genetically identical plants using micropropagation.

The diagram shows some of the stages of micropropagation.



(a) (i) Give a method that could be used to sterilise the explants in stage 2.

(1)

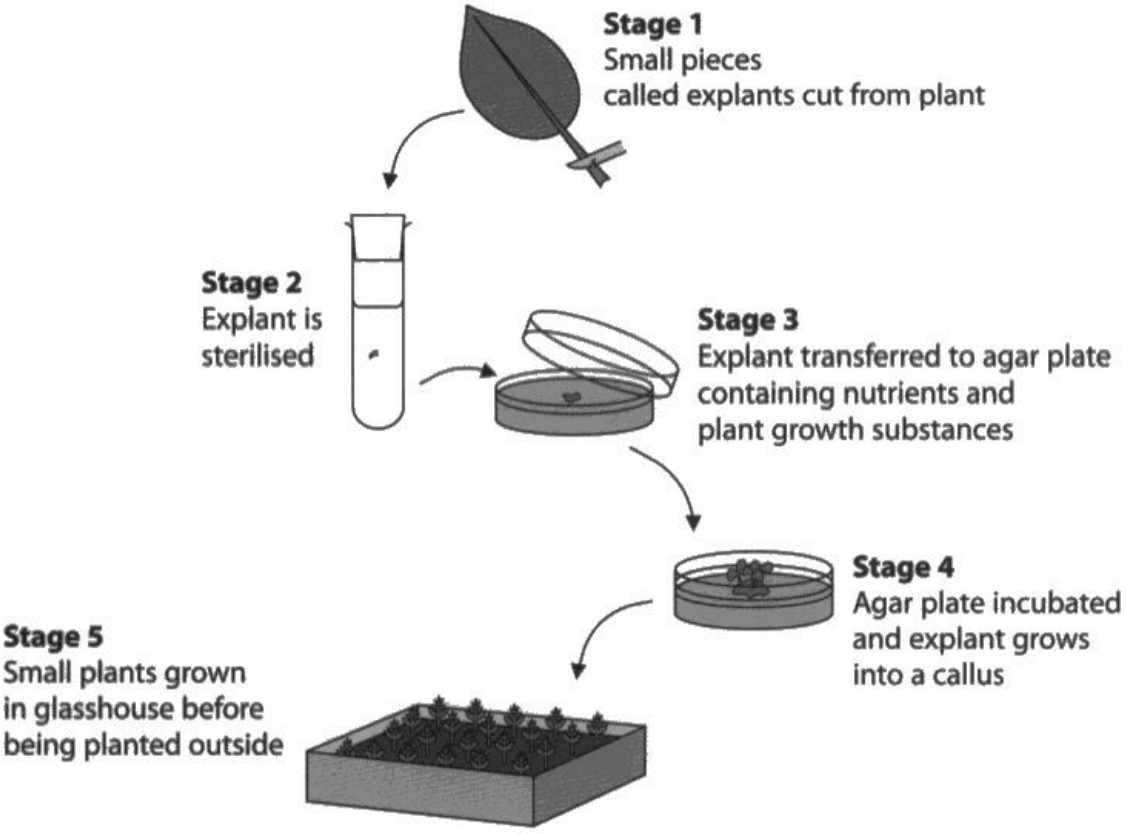
Boiling it in ethanol

ResultsPlus
Examiner Comments

Boiling in ethanol would kill the seeds so was not credited.

7 Scientists produce large numbers of genetically identical plants using micropropagation.

The diagram shows some of the stages of micropropagation.



(a) (i) Give a method that could be used to sterilise the explants in stage 2.

(1)

The student can use an acid like Hydrochloric acid to remove any micro-organisms

ResultsPlus
Examiner Comments

Use of hydrochloric acid was not credited.

Question 7 (a) (ii)

Question 7(a)(ii) was well-answered with most opting for nitrates. Other correct mineral ions were accepted as were amino acids and glucose.

(ii) Give the name of one of the nutrients that should be added to the agar plate in stage 3.

(1)

Carbon Dioxide

ResultsPlus
Examiner Comments

This answer was not given the mark.

(ii) Give the name of one of the nutrients that should be added to the agar plate in stage 3.

(1)

nitrate ions.

ResultsPlus
Examiner Comments

This answer gained the mark.

Question 7 (b)

Candidates found question 7(b) challenging. Many knew the answer but struggled to express their thoughts in an erudite manner. The examiners gave credit to those who stated that the cells in the tissue were specialised and that further differentiation was not possible. They also gave credit to answers that stated that only stem cells found in embryo, bone marrow or umbilical cord had the ability to differentiate and that the tissue in question did not contain stem cells.

(b) In micropropagation, small pieces of plant tissue can grow into new individuals.

Explain why small pieces of animal tissue cannot grow into new individuals.

(2)

~~Not~~ Tissues are differentiated cells that can only develop into only one type of cell as it is specialised and adapted to a certain function.

ResultsPlus
Examiner Comments

This answer was given a mark for recognising that the tissue was made of cells that had already differentiated.

(b) In micropropagation, small pieces of plant tissue can grow into new individuals.

Explain why small pieces of animal tissue cannot grow into new individuals.

(2)

they aren't stem cells and therefore can't differentiate into any cell, many cells are needed in the human body and tissue cells cannot regenerate fast enough.

ResultsPlus
Examiner Comments

This answer gained both marks for recognising that the cells in the tissue are not stem cells and that they have already differentiated.

(b) In micropropagation, small pieces of plant tissue can grow into new individuals.

Explain why small pieces of animal tissue cannot grow into new individuals.

(2)

It because they are not stem cells, do not have the potential to form specialised cells such as ~~emp~~ embryo, so therefore it is not possible to grow into new individuals.

ResultsPlus
Examiner Comments

This is an example of another good answer that gained both marks.

(b) In micropropagation, small pieces of plant tissue can grow into new individuals.

Explain why small pieces of animal tissue cannot grow into new individuals.

(2)

plants can reproduce asexually which animals cannot do. They can only reproduce sexually with the opposite sex.

ResultsPlus
Examiner Comments

This answer gained no marks, but typified the attempt made by many candidates who concentrated on cell division or reproduction ideas.

Paper Summary

Candidates are offered the following advice:

- Look at the number of marks allocated to each question and try to include at least that number of ideas in the answer.
- Always show your working when answering mathematics questions as a mark is usually available if the final answer is incorrect.
- Make sure to understand the meaning of all the command words.
- Learn the method of each practical in the specification.
- Understand why steps are taken in scientific investigations.
- Make every effort to spell scientific terms correctly - quadrat is so much better that quadrant.
- Avoid using unscientific terms such as 'amount'.