Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel GCE
In Biology B (9BI0/03)
Paper 3: General and Practical Principles in Biology

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Introduction

This is the fourth series of the new 9BIO specification. This paper has questions from topics 1-10, with synoptic questions drawing on two or more different topics.
Over a third of the marks are available from AO3; in these questions students are required to analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to

- make judgements and reach conclusions
- develop and refine practical design and procedures.

Successful students:

- showed detailed knowledge of all areas of the specification and were able to link concepts together to answer synoptic questions;
- were familiar with the core practicals and were able to consider how to modify them in the light of novel situations;
- were able to analyse data to draw conclusions and to explain these using their biological knowledge;
- were able to structure an extended answer to the nine-mark levels-based question drawing on the information given in the questions and their existing biological knowledge, and using accurate scientific vocabulary;
- perform well with mathematical skills.

As has been commented previously, some students do not have secure knowledge of all of the core practicals. While many students can recall the 'recipes' of the core practicals, some have difficulty in understanding why some of the steps are carried out and therefore struggle when answering questions requiring them to justify the method. These students would benefit from being encouraged to think about the reasons for each step rather than simply following instructions.

Question 1

1(a)(i)

Many students could describe the route taken by gases in the insect respiratory system and knew that diffusion was involved, but few mentioned the concentration gradient. A surprising number thought that insects had blood cells with haemoglobin to transport oxygen.

1(b)(i)

This proved challenging for many students; the key was recognising that a **valid** comparison was needed. Most realised that units of length or volume were needed, and many included per unit time. Very few standardised the comparison by comparing equal masses of insects, ie cm min^{-1} g^{-1}.

1(b)(ii)

This question tested knowledge of Core Practical 9. Most students were able to name a factor which could affect the results from the respirometer, and describe how to control it. The most common errors were to describe using a water bath, rather than a thermostatically-controlled water bath and to control the number of insects rather than the mass.

1(b)(iii)

The role of soda lime in absorbing carbon dioxide was understood by most students, but they were not always able to explain clearly why it must be replaced. Some referred to it being used up, rather than that it had absorbed the maximum amount of carbon dioxide. Many did not go on to explain the consequences if it was not replaced, ie that the coloured liquid in the glass tube would not move so much (or may not move at all), or that the results would be invalid. This student achieved both marking points with a very clear explanation.

> The soda lime absorbes the CO_2 produced by the insects when respiring. Therefore the soda lime has to be replaced so that it absorbs the ~~[illegible]~~ CO_2 at the same rate for each species of insect. It makes sure that the soda lime is not fully saturated with CO_2 by the time it ~~used~~ was used for the next insect. This is so that the movement of the coloured liquid is not effected.

Question 2

This tested knowledge of enzymes and many students were very comfortable with the topic.

2(a)

Most students could describe the rounded or 3D shape of the enzyme and could name at least one type of bond. A few described the exterior as being hydrophilic and the interior as hydrophobic, but without mentioning R-groups or amino acids, so did not get these marking points. A small number wrote at length about primary structure and secondary structure which did not gain any credit.

2(b)

Faced with a novel situation, it was encouraging that so many students were able to plan a valid investigation into the effect of pepsin concentration on digestion of solid albumin. Most realised that five different concentrations should be tested and gave a relevant way of measuring the dependent variable, eg length or mass of albumin remaining after a constant time. Many could name relevant variables which should be controlled and state how to control them, and most could describe why repeat readings were needed. The most comminly controlled variables were temperature, pH, concentration of albumin and time for pepsin to digest albumin. A small number described at length how to boil the albumin to make it set, then added differing concentrations of pepsin without saying what to measure at the end of the investigation.

3(a)

Despite this being part of Core Practical 2, students struggled to use the graticule and stage micrometer in the diagram, with very few gaining any credit. This is an area which requires more practice.

3(b)(i)

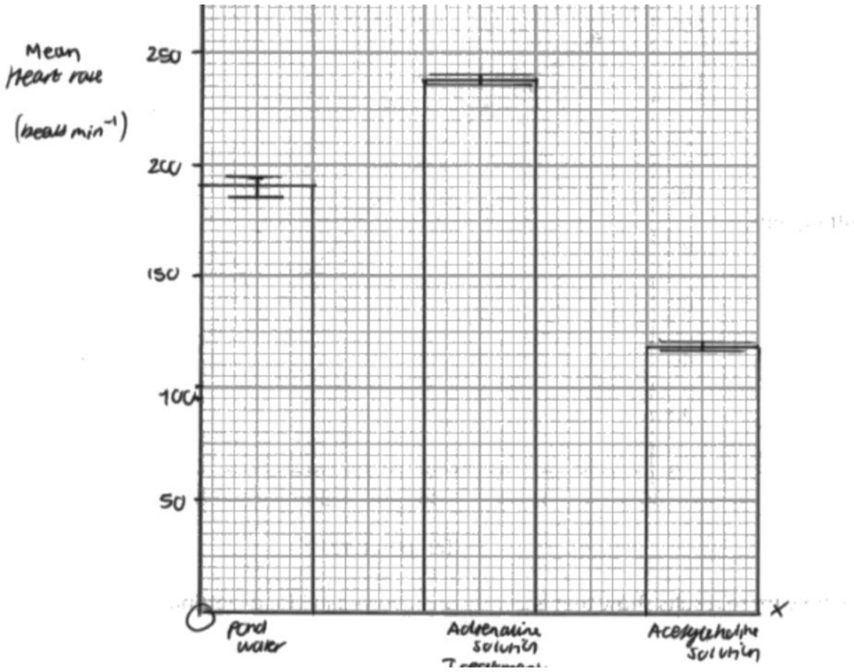
Given the diameter of the heart, the resting heart rate and the formula required, students were asked to calculate the cardiac output of the water flea. Most could use this information to get to a value in mm^3 min^{-1}, but almost all were unable to convert this to dm^3 min^{-1} , and therefore did not get the third marking point.
The most common errors were to ignore the value of π given in the question and to ignore the instruction to use $4/3\ \pi r^3$. Both of these led to errors which affected the final answer if students rounded values at intermediate stages in the calculation. The final answer should be given to an appropriate number of significant figures – here it was not more than four, as the value of π was given to four significant figures.

3(c)(i)

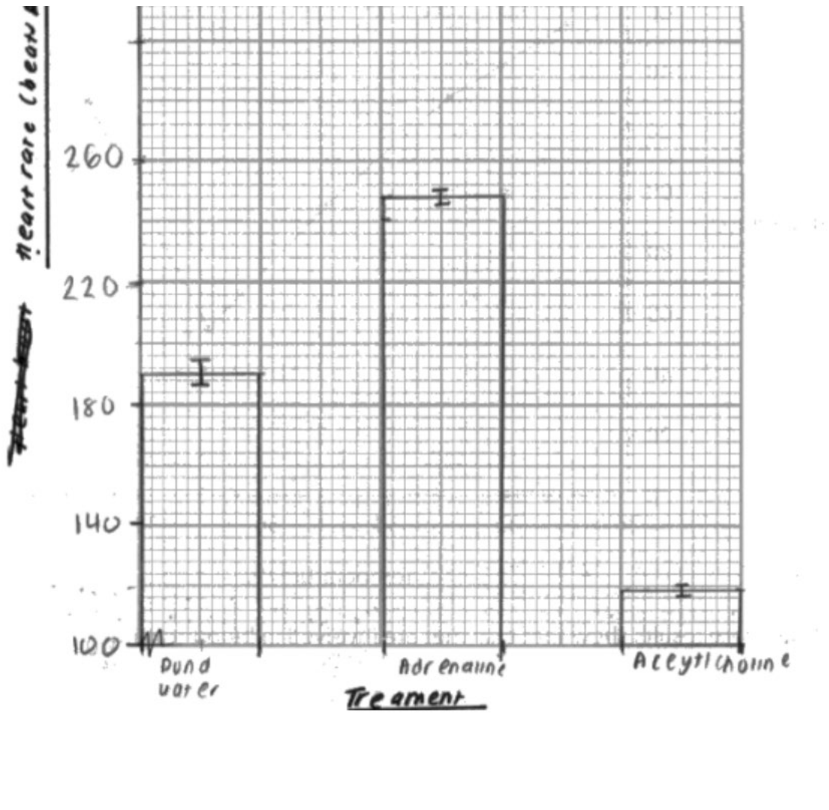
A considerable number of students were unable to use the formula given to calculate the standard deviation. Where students did calculate the correct value the final answer should have been given to one decimal place as other values in the table were also given to one decimal place.

3(c)(ii)

Students were asked to plot a graph to show the data for mean heart rate and SD for each treatment – a bar graph showing mean heart rate with an indication of standard deviation added to each bar (like a range bar) was required. A lot of students seemed confused by this and tried to plot heart rate against standard deviation.
This student achieved full marks:



When plotting a bar chart, it is important not to use a broken scale, as it does not show the relative sizes of the bars correctly.



3(c)(iii)
Most students scored two marks on this question as they understood that controlling abiotic variables was necessary to get a valid result and could explain why a named variable should be controlled. The most commonly named variables were temperature and pH.

4(a)
Students were given a graph and asked to explain how it showed enzymes were involved in blood clotting. This was well understood and many scored full marks. Where marks were lost, it was usually because the answer lacked detail, eg saying that at low temperatures reactants had less energy rather than less kinetic energy. A few students gave a generic answer about the effect of temperature on enzyme activity, rather than linking it to clotting time.

4(b), 4(c)(i), 4(c)(ii)
Most students knew that there are three bases in a codon so could determine the number of codons in the gene by subtracting to find the number of bases and then dividing by three for Q4b.

In Q4ci almost all recognised that this was a point or substitution mutation and could state the probability of a blood clot correctly in Q4cii. A few did not simplify the ratio and stated it as 20 in 1000, rather than 1 in 50.

4(c)(iii)
Here students were asked why thrombophilia **increases** the risk of producing a blood clot, rather than to simply describe the process of clotting, so it was important that the answer reflected this, ie that there is **more** thrombin, so there is **increased** conversion of fibrinogen to fibrin, and that fibrin is insoluble so traps blood cells.

4(d)(i)
Although most students were able to state the role of restriction endonuclease clearly, a significant minority did not refer to DNA and therefore did not get credit here.

4(d)(ii)
This was a straightforward question asking students to describe the process of PCR.
The majority knew that primers were required and could describe the steps – heating to 95°C, then cooling to 55°C – but very few remembered to include the times for each step. Most knew that it was then heated to 72°C with polymerase but some forgot that the cycle was repeated many times.

5(b)(i)
Students were given a diagram of a cell from the aleurone layer and told that gibberellin binding to a receptor in the membrane stimulated transcription. They were then asked to describe transcription. Credit was given for stating that DNA strands separate (DNA unwinds was not enough, unless qualified by hydrogen bonds breaking); the antisense strand is used as a template (many referred simply to the template strand, which was not detailed enough); and RNA polymerase is used to synthesise mRNA. In the last marking point some students did not include enough detail, referring to polymerase rather than RNA polymerase and RNA rather than mRNA. Some wrote at length about the process by which gibberellin stimulates transcription, which was not the question asked.

5(b)(ii)
Here students were asked to describe the processes occurring after transcription resulting in the release of amylase **from the cell shown in the diagram.** Many realised that they should refer to the diagram and produced excellent answers achieving full marks. They were able to describe the role of the ribosomes, how tRNA brings amino acids to the ribosome and peptide bonds form between amino acids, the role of the Golgi and the process of exocytosis. A few forgot to refer to mRNA leaving the nucleus through the pores in the nuclear membrane, but were still able to achieve full marks.

5(c)
Students were asked to devise an investigation to show the effect of salt concentration on amylase production in cereal grains. This proved very challenging for some, even though it required them to modify Core Practical 14: investigate the effect of gibberellin on the production of amylase in germinating cereals using a starch agar assay.
Many realised that they should use five different salt concentrations, achieving the first marking point. To gain further marks they needed to describe the steps in the correct order: sterilising the grains (or other reference to aseptic technique), washing or cutting the grains and placing on starch agar, leaving for an appropriate time (24-48 hours), adding iodine solution and measuring the area or diameter of the clear zone.
Where students did know the steps of the process, the most common errors were to simply measure the clear zone (rather than the area or diameter) or refer to it as the zone of inhibition. This was incorrect as bacterial growth was not involved in this investigation – the "clear zone" was the area where starch had been digested by amylase friom the cereal grain.

6(a)
Most students knew that there is hydrogen bonding between the two strands of DNA and correctly stated that hydrogen bonds are lost when thymine dimers form.

6(b)

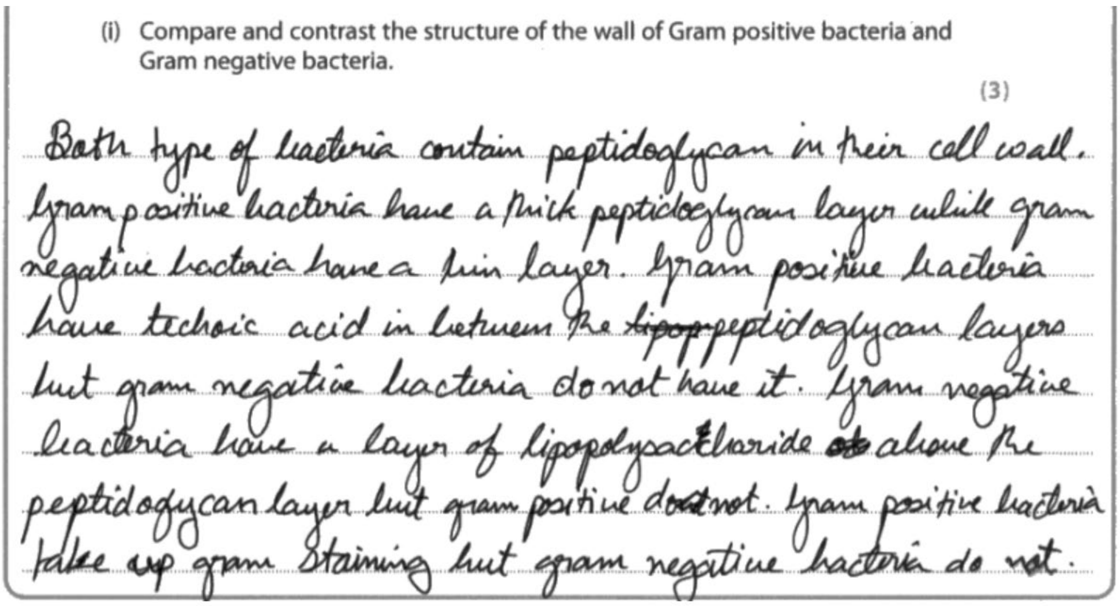
Students were asked why preventing the replication of DNA produces aseptic conditions. A lot of information was given in the stem of the question which gave the context for the answer – that complementary base pairing cannot occur as thymine is not able to bond with adenine. Therefore binary fission cannot occur and transcription cannot occur. Although many had a basic understanding of the process the terminology used was sometimes imprecise, eg that bacteria cannot grow, or that mitosis cannot occur (mitosis occurs only in eukaryotic cells).

6(c)

This question links to Core Practical 12, and it was clear that most students were familiar with practical work involving bacteria and could recall details of aseptic technique. However the question asked them to **justify** two methods, rather than simply describe them. This required them to give evidence to support their choice, in this case explaining why the steps are necessary or how they ensure aseptic conditions. Although they knew what to do in a practical context, some students lost marks by not explaining the reason for the action, eg clean surfaces with disinfectant **to kill bacteria**.

6(d)(i)

Students were asked to compare and contrast the structure of the wall of Gram positive and Gram negative bacteria. This command word requires the clear identification of at least one similarity and one difference. Although the level of knowledge was generally very good in this question, some students lost marks by not stating a clear similarity, eg "they both have peptidoglycan" and by not referring to both Gram positive and Gram negative bateria when stating a difference. This student achieved full marks.



(i) Compare and contrast the structure of the wall of Gram positive bacteria and Gram negative bacteria.

(3)

Both type of bacteria contain peptidoglycan in their cell wall. Gram positive bacteria have a thick peptidoglycan layer while gram negative bacteria have a thin layer. Gram positive bacteria have techoic acid in between the ~~lipop~~ peptidoglycan layers but gram negative bacteria do not have it. Gram negative bacteria have a layer of lipopolysaccharide ~~ab~~ above the peptidoglycan layer but gram positive ~~doe~~ not. Gram positive bacteria take up gram staining but gram negative bacteria do not.

Some students gave information about the different colours seen after Gram staining, but this did not gain credit as the question asked for differences in the structure of the wall, not just differences between the two types of bacteria.

6(d)(ii)

Students were given a graph showing the number of living bacteria each hour over a four hour period when UV radiation was applied and asked to calculate the percentage change in numbers of one species after two hours of exposure. This required them to read off the number at time zero and subtract the number at two hours to find the change, and then convert this to a percentage. The scale on the y axis was a log scale, and some students found this very challenging.

Number of *E. coli* at time zero	10^8 = 100 000 000
Number of *E. coli* after 2 hours	10^2 = 100
Difference in number of *E. coli*	99 999 900
Percentage difference	$\frac{99\,999\,900}{100\,000\,000} \times 100 = 99.9999\%$

It was important not to round the answer as, for example, 99.99% would have been the answer if the difference had been 10^8 minus 10^4.

A small number of students read the wrong values from the graph or were unable to calculate the difference through subtraction.

6(d)(iii)

Students were asked to criticise the validity of the conclusion: if food is exposed to UV radiation it removes all risk of food poisoning. The command word criticise requires students to look at the merits and faults of the information presented and to support the judgements made by giving evidence. Many students realised that the time the bacteria were exposed to the radiation determined the effectiveness of the treatment and that the investigation tested the effect of radiation on only three species of bacteria, so that this could not be extended to all species. A few correctly stated that toxins may remain after the bacteria had been killed and that these could cause food poisoning.

Question 7

This question focused on the capture-mark-recapture technique to determine the population of wood mice in a woodland habitat.

7(a)

Almost all students were able to use the data given to determine that 50 mice in the second sample had leg bands.

7(b)

Faced with an unfamiliar piece of equipment (a humane trap to catch the wood mice) the majority of students were able to use the information in the diagram to explain that the food would attract the mouse causing it to move to the back of the trap, and that the weight of the mouse on the board would cause the board to tilt, pulling on the wire and making the trap door close. A few also realised that the size of the entrance was big enough for mice to enter, but too small to allow larger animals to enter. There were some excellent descriptions of how the trap worked.

7(c)

Students were asked to explain why wood mice cannot maintain their body temperature if left in the trap, and this proved difficult for many. Credit was given for stating that the mice have a large surface area to volume ratio, and therefore lose a lot of heat; this heat is generated by respiration, and there is not enough food in the trap to release enough energy if they are left in the trap for a long time; and that there is no insulation or bedding to prevent heat loss. Many students attempted the explain the effect of surface area to volume ratio, although some mistakenly thought wood mice have a small surface area to volume ratio. Only a few realised the importance of the small amount of food, with some thinking that the mouse would lack oxygen as the trap was airtight, and would die because it would suffocate. Some thought that it could not generate any heat if it was unable to move around, and that the trap was too small to allow movement. A surprisingly large number thought that mice are ectotherms which depend on their environment to regulate their body temperature, and that confinement in the trap prevented them being warmed by the sun.

7(d)

Students were asked to comment on the claim that the capture-mark-recapture method produces an accurate measure of the population size of mice in the woodland.

This command word required the synthesis of a number of variables from information to form a judgement.

The method was described in detail at the start of Q7 and students were required to identify which aspects of the method would lead to an accurate measure of population size and which lead to loss of accuracy. Credit was given for explaining that the traps were randomly placed, avoiding bias; that there were a large number of traps (since 250 mice were caught) and that they were left long enough (a week) for random dispersal of marked mice to occur: all of these increase the accuracy of the estimate.

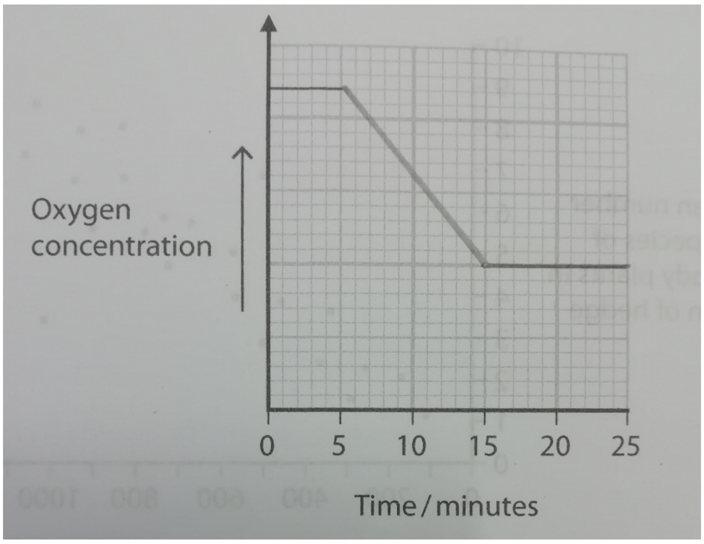
However other factors lead to inaccuracies: the population size may change as mice are born, die or migrate; mice may lose bands or bands may affect their survival; and the use of the trap may affect the number of mice caught, ie some mice may be more likely to enter to get the food (often described as trap-happy mice) whereas some may never enter traps (often described as trap-shy).

Many students correctly identified the factors causing population size to change, that bands may be lost or affect survival and that the random placement of traps was a factor leading to an accurate estimate. It was rare to see comments on the number of traps or the length of time before the second sample was taken. Overall this question was done well, with many students achieving 3 or 4 marks.

8(b)(i)
Given a diagram of the electron transport chain and information about how cyanide affects the enzyme cytochrome oxidase, students were asked why hydrogen cyanide gas could kill an animal. Most realised that a non-competitive inhibitor would change the shape of the active site and achieved the first marking point. Some went on to say that this would stop the electron transport chain, and that this leads to less ATP being produced. Unfortunately the majority of students did not go on to explain why this causes the death of the animal – that without ATP muscles cannot contract and therefore breathing stops and the heart stops contracting; and that without ATP active transport cannot occur.

8(b)(ii)
Students were asked to calculate how many minutes it would take for an animal to obtain a fatal dose of hydrogen cyanide, given information about the lethal dose, the mass of the animal and the breathing rate.
Calculations were often not logically set out, but most could calculate that the mass of cyanide that would kill the animal was 10mg. Some went on to calculate the mass inhaled per minute and then the time to inhale the lethal dose. The question asked for an answer to three significant figures, so the only correct answer was 2.78 minutes; some students lost the final marking point by rounding to less decimal places or by giving an answer to too many decimal places.

8(c)
Students were given an outline method to determine the effect of cyanide on oxygen uptake by mitochondria and asked to complete a graph to show the results over 20 minutes. Successful candidates realised that when the respiratory substrate and ADP were added the oxygen concentration in the flask would fall as mitochondria were using oxygen for aerobic respiration; and that when cyanide solution was added the oxygen concentration in the flask would remain stable as mitochondria were no longer able to use oxygen. This was not well understood by the majority of students.
This student gained both marks – the actual oxygen concentrations were not important as long as the concentration fell from 5 to 15 minutes and remained stable from 15 to 25 minutes.



9(a)
Given the formula for calculating a diversity index, the majority of candidates knew that the symbol for the total number of organisms of all species is N.

9(b)
Students were given a scattergraph showing the mean number of woody plant species in 30m of hedge plotted against the age of the hedge, and asked to analyse the data to explain why conservationists object to the destruction of hedgerows to increase the size of fields.
Almost all were able to recognise that there was a strong positive correlation between the age of the hedge and the number of species of woody plants; some lost this mark by referring to number of woody plants rather than number of species of woody plants. Many realised that if hedges were destroyed this would decrease biodiversity or that it would take many years for the biodiversity to recover.
Successful students realised that it is not only the number of woody plant species that increases as the age of the hedge increases, and that there would be more species of non-woody plants and animals living in older hedges, as these provide more niches.
Less successful students focused the whole answer on the number of woody plant species and were therefore limited to the first two marking points.
This student scored marking points 1, 2 and 4.

Analyse the data to explain why conservationists object to the destruction of hedgerows to increase the size of fields.

(4)

As the age of the hedge increases, so does the mean number of species of woody plants. There is positive correlation. Therefore, destroying hedges reduces the number of species of woody plants so reduces species diversity and so reduces biodiversity.

Also, removing the hedges means that less animals will be there as there are fewer niches, so the biodiversity is further reduced.

As the age of the hedge increases, so does the number of species because they are providing more nutrients and water in soil, so more plants can grow, e

9(c)

It was pleasing to see that almost all students knew that random sampling was used to avoid bias during the sampling process.

9(d)(i)

Students were told that wood consists of xylem tissue and asked why it is an advantage for older plants to contain more wood. The majority of students understood that this would make them stronger and that there would be increased uptake and transport of water.

9(d)(ii)

Students were asked to describe a method to show that the stem of an older plant contains more wood. Successful students suggested cutting a thin section, staining it to show the xylem and measuring the thickness of the xylem tissue; an alternative method would be to extract a core from the stem and measure the thickness of the rings. No credit was given for simply counting the number of rings. Some students suggested a method to determine water loss using a potometer and this gained a maximum of one mark, as it would not give a direct method of finding the amount of wood and would be affected by factors that are very difficult to control, eg leaf area.

9(e)

Students were asked to justify each step of a method that could be used to compare the water potential of potato tissue of different ages. This required them to modify Core Practical 6: placing standard sized potato cylinders in a range of concentrations of salt or sucrose solutions for a set time and finding the change in mass or length. This data would be used to plot a graph and the point at which there was no change, ie where the line crossed the x-axis, represents the water potential. This would then be repeated with potatoes of different ages and the results compared.

A lot of students found this very challenging as although they knew that they should measure change in mass or length of the potato cylinders, they placed the cylinders of different aged potatoes into a single concentration of salt solution (some even specifying that it should be isotonic). From this data alone they would not be able to derive the water potential.

The second issue preventing students scoring high marks on this question was that many did not justify each step of the method they were describing. Even where students were using the correct method, they could not get marks if they did not explain why each step was necessary. Some were able to explain that standard sized chips or cylinders were needed as this gave equal surface area; some described blotting the potato to remove excess water; and some measured change in mass or length to determine the loss or gain of water or to plot a graph. It was pleasing to see that some students attempted to control variables, eg temperature / time in the solution / variety of potato (not species) and recognised that these would affect osmosis.

This student gained full marks as they justified every step:

Justify each step of a method the student could use to compare the water potential of potato tissue of different ages.

(5)

First, use a cork borer to cut potatoes of same size and surface area to volume ratio ↗ as this affects rate of osmosis, so needs to be controlled. Use potatoes of varying ages, e.g 10 equal intervals.

Next, place the potato cylinder in sucrose solution of varying concentrations ↗ which should be a set volume, and weighed. e.g 0 mol dm^{-3}, 0.2 moldm^{-3}, 0.4 moldm^{-3} till 1 moldm^{-3}.

Leave for 20 minutes, to allow water to move in or out by osmosis.

Next, remove potato and weigh the sucrose solution after, and compare to weight before. Calculate the % change in mass.

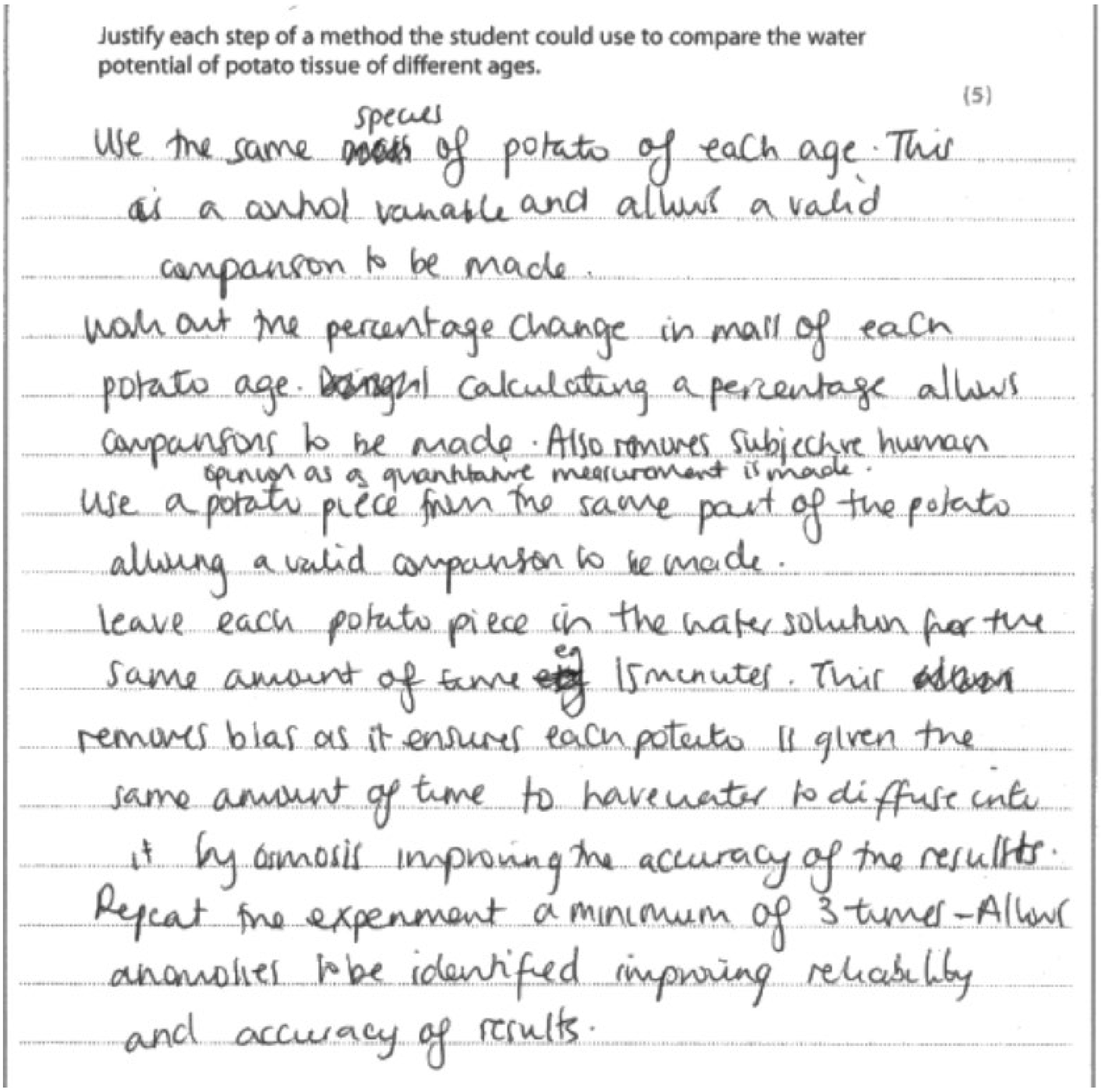
Plot a graph of % change in mass versus sucrose solution for each age of potato tissue.

The point at which the line crosses the x axis is the water potential (Ψ) of the potato as that is when the solute potential is equal to water potential and the solution is isotonic, so no net movement of water by osmosis.

Ensure the temp is controlled, with water bath as temp affects rate of osmosis. Also, the time of soaking should be the same, and the cylinders should be fully submerged, and of same size/SA:V ratio.

mean

This student gained marking point 7 as they controlled the time that the potato was in the solution, recognising that this would affect osmosis. The repeated references to allowing a valid comparison are too vague to gain credit.


Justify each step of a method the student could use to compare the water potential of potato tissue of different ages.

(5)

Use the same species of potato of each age. This is a control variable and allows a valid comparison to be made.
Work out the percentage change in mass of each potato age. calculating a percentage allows comparisons to be made. Also removes subjective human opinion as a quantitative measurement is made.
Use a potato piece from the same part of the potato allowing a valid comparison to be made.
Leave each potato piece in the water solution for the same amount of time eg 15 minutes. This removes bias as it ensures each potato is given the same amount of time to have water to diffuse into it by osmosis improving the accuracy of the results.
Repeat the experiment a minimum of 3 times - Allows anomalies to be identified improving reliability and accuracy of results.

10(a)(i)
Given a diagram showing energy flow in an ecosystem, students were asked to calculate the percentage efficiency of energy transfer from sunlight to the producers.
This should have been a very simple calculation and many scored both marks:

$$\frac{85\,000}{7\,000\,000} \times 100 = 1.21\%$$

However some students read the wrong values from the diagram and some calculated the energy lost (98.8%) rather than the energy transferred.

10(a)(ii)
It was pleasing to see that most students could give a reason why energy transfer from sunlight to producers is less than 100% efficient; most suggested that light is reflected or of the wrong wavelength to be absorbed.

10(a)(iii)
Many students recognised that some energy is lost as heat or through movement, and that some parts pf the plant are not eaten. Credit was given for parts of the plant not being digested but not for vague references to energy being lost in waste products.

10(b)
This was the nine mark levels-based question; students were given a table of data showing productivity at different latitudes and asked to discuss the validity of the conclusion that primary productivity is determined by abiotic factors affecting the light-dependent and light-independent stages of photosynthesis.

This topic was accessible to students of all abilities and there were some excellent Level 3 answers scoring full marks. Successful candidates recognised that while abiotic factors eg light, temperature and mineral availability are important, biotic factors eg disease, competition, grazing and anthropogenic factors also affect productivity.
Marking points were organised into three groups: light-dependent and light-independent points; other abiotic points; and biotic points. There were a large number of indicative marking points in each group and all other relevant material gained credit.

A minority of students wrote only about the light-dependent and light-independent stages of photosynthesis (some in great detail) and were therefore restricted to Level 1; students writing about abiotic factors in addition to light and temperature were able to access Level 2, with many writing strong accounts of the effects of water, carbon dioxide, named mineral ions and other edaphic factors. They could also access Level 2 by writing about biotic factors, but this was more rare, probably due to the wording of the conclusion they were discussing. Level 3 answers were a balance of light-dependent / independent, abiotic and biotic factors and some recognised the complex interactions between factors which ultimately determine productivity. Overall, students did well on this question with most achieving Level 2 or 3.

This student did just enough to achieve full marks as they had three descriptive points from the light-dependent / independent group (relating to the temperature at different latitudes and the effect of temperature on enzymes), three points from the abiotic group (reference to pH, soil composition and carbon dioxide concentration) and three points from the biotic group (reference to biotic factors affecting productivity, disease and limiting factors affecting productivity).

As latitude increases, productivity decreases. This is because as latitude increases, temperature decreases temperature being an abiotic factor. This means that the enzymes required for photosynthesis such as RUBISCO are unable to work as temperatures are too low. This means they produce less GALP and GP and also generate less ATP so productivity decreases.

However, not sufficient data is given to show that this conclusion is valid. Abiotic factors such as pH, soil composition are not shown.
Also biotic factors such as ~~composition~~ competition or disease could affect the productivity of the plant as it is unlikely that the abiotic factors are the same at all latitudes of the Earth.

Net primary productivity can be calculated by GPP-R.
Gross primary productivity can be calculated by NPP+R.

The stages of photosynthesis can be affected by abiotic factors such as pH, CO_2 concentration and temperature so as these change and become a limiting factor, photosynthesis will be affected affecting the primary productivity.

Paper Summary

Based on their performance on this paper, students are offered the following advice:

- look carefully at the command words in the question and make sure that you are giving the right type of response.
- when asked to compare and contrast, you should give similarities and differences to gain full marks. Make sure that the similarities are clearly stated not implied, and that the differences refer to both of the things you are contrasting.
- when asked to justify a method, you should always be prepared to give reasons for each of the steps carried out
- always show working in calculations as marks are often given for intermediate steps.
- in calculations do not round the answer at intermediate steps, as this can lead to errors in the final answer. Always make sure that the final answer is given to an appropriate number of significant figures – use the information in the question to determine what this is.
- answers often require comparative statements, particularly when describing graphs or changes, so make sure that you are using comparative words eg. faster, more slowly, less often etc.
- when you are carrying out practical work, think about the reasons behind the steps of the method you are following.
- when a question asks you to devise an investigation, try to identify which core practical it is linked to, then think about how the context is different. You will not gain full marks for exactly reproducing the method you have followed previously.

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