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Examiners' report

BIOLOGY A

H420
For first teaching in 2015

H420/03 Summer 2018 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper H420/03 series overview

H420/03 is one of the three examination components for the new revised A Level examination for GCE Biology A. This component assesses content from across all areas of Biology, and links together the different areas, within different contexts, some practical, some familiar and some novel. To do well on this paper, candidates need to be comfortable applying their knowledge and understanding to unfamiliar contexts and be familiar with a range of practical techniques. They must also be able to analyse, interpret and evaluate ideas and evidence to be able to reach conclusions and develop and refine practical design and procedures. This, together with the fact it relies on learning and applying knowledge from two years of work, has proved a difficult test for some candidates. However, all questions were accessible to candidates, and there seemed to be no time issues with completing the examination. The examination produced a good spread of marks and most candidates attempted all the questions.

Examiners were pleased to see that many candidates used the additional answer spaces provided in the paper, rather than continuing their answers outside the provided lines, and this is something we would encourage all centres to advise their candidates to do.

Candidate performance overview

Candidates who do well on this paper generally did the following.

- Have well developed mathematical skills enabling them to perform calculations: Q2(c), Q4(b) Q5(b).
- Produced clear and concise responses for Level of Response questions: Q3a(ii) and Q6(a).
- Have a good practical knowledge, with the ability to understand and apply the information given to the questions being asked: Q2(b)Q 3(a)(i) Q3(a)(ii) Q5(c)(ii).

Candidates who do less well on this paper generally did the following.

- Found it difficult to apply what they had learnt to unfamiliar situations, scoring most of their marks on questions involving recall and understanding.
- Produced responses which lacked depth, particularly to practical based questions: e.g.Q3(a)(ii).
- Produced responses which were often peripheral to what had been asked, sometimes simply repeating information provided; e.g. Q2(a), Q5(a)(ii).
- Found it difficult to answer mathematical based calculations: e.g. Q2(c), Q4(b), Q5(b).

Centres are advised to encourage candidates to spend a little time reading the question and ensuring that they supply information that relates to and answers the question. Even if the science is correct, if it does not answer the question then it will not be credited marks.

Question 1 (a)

1 The onion plant, *Allium cepa*, is grown as a food crop around the world.

(a) The table below contains statements about the root cells of an onion.

Place ticks (✓) in the boxes in the table to indicate whether the statements are true or false.

Statement about onion root cells	True	False
contain chloroplasts		
contain mitochondria		
contain 70S ribosomes in the cytoplasm		
have pili		
have cellulose cell walls		

[2]

Most candidates scored 1 mark for this question, with the most common errors being to believe that the onion cells have 70s ribosomes and pili.

Question 1 (b)

(b) Fig. 1 shows a cross section of the root of an onion plant.

Identify the **tissues** shown at **M** and **N**.

M .....

N .....

[2]

The majority of candidates correctly identified tissues M and N. In some cases, candidates made reference to vessels, elements or sieve tubes which were not given credit as these are cells rather than tissues.

Question 1 (c) (i)

(c) The colour of onion bulbs is determined by two genes, **A/a** and **B/b**.

- **A** is a dominant allele and codes for the production of a red pigment.
- Onion bulbs that are homozygous for the recessive allele, **a**, produce no pigment and are white.
- **B** is a dominant allele that inhibits the expression of allele **A**.
- The recessive allele, **b**, allows the production of the red pigment.

A white onion plant was cross-pollinated with a red onion plant. All 15 offspring had the genotype **AaBb**.

(i) Identify the following:

The genotype of the white onion plant .....

The genotype of the red onion plant .....

The phenotype of the offspring .....

[3]

The majority of candidates gained at least one mark for this question, with a high proportion gaining 2 or 3 marks. Where marks were not credited it was often for candidates selecting one copy of each allele instead of two (AB,ab) or for giving the heterozygous genotypes (AaBb , Aabb).

Question 1 (c) (ii)

(ii) State the type of gene interaction shown by the genes **A/a** and **B/b**.

..... **[1]**

The majority of candidates correctly identified the type of gene interaction as epistasis, though co dominance was a common incorrect term seen. A few candidates gave recessive epistasis as the answer which was not credited.

Question 1 (c) (iii)

(iii) Suggest how allele **B** inhibits the expression of allele **A**.

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..... **[2]**

This question proved to be a good discriminator. Many candidates talked about 'allele B turning off allele A', rather than 'allele B producing a product that prevented the expression of allele A', and so did not gain credit. A few candidates mentioned allele B coding for repressor proteins or transcription factors which can bind to promoter regions and prevent transcription of allele A.

Question 2 (a)

2 ATP can be produced in various ways. Each stage of respiration contributes to the production of ATP.

(a) Describe the production of ATP by **substrate-level phosphorylation** in different stages of respiration with reference to the number of ATP molecules produced.

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..... **[4]**

The production of ATP by substrate level phosphorylation was well understood by many. Candidates began their answer by stating that there would be a net production of 2ATP in glycolysis, or that 4 ATP would be produced but 2 were used up at the start. While many referred to triose phosphate being the source of phosphate, few then added that TP would be converted to pyruvate.

Many candidates were unclear as to how many ATP would be generated in Krebs' cycle although higher ability ones commented that one ATP would be made per turn of the cycle, or two per molecule of glucose. Some correctly described where in the cycle ATP would be made while others thought it would be between citrate and the 5C compound, or at multiple points in the cycle.

Some candidates believed that ATP would be produced in the link reaction and many went on to describe oxidative phosphorylation , which gained no credit.

Question 2 (b)

(b) Glucose and other carbohydrates are present in respiring cells. The concentrations of carbohydrate molecules vary between tissues.

A student conducted tests on three tissues, **A**, **B** and **C**. Table 2 shows the results of these tests.

Tissue	Colour after Benedict's test	Colour after treatment with HC*l* and Benedict's test	Colour after iodine test
A	red	red	yellow
B	yellow	red	black
C	orange	orange	black

Table 2

Two of the tissues were known to be phloem tissue and liver tissue.

Use the evidence in Table 2 to identify which tissue, **A**, **B** or **C**, is phloem and which tissue is liver. Explain your answer.

Tissue ..... must be phloem because .....

.....

.....

Tissue ..... must be liver because .....

.....

.....

[3]

Many candidates identified tissue B as phloem since it contained sucrose, or a non-reducing sugar, which would result in a red precipitate with Benedict's reagent after treatment with hydrochloric acid. Fewer mentioned that this treatment would hydrolyse sucrose into its monosaccharide constituents. Some candidates lost the mark for stating that sucrose is a reducing sugar.

Most candidates correctly identified tissue A as liver due to the fact that it contained no starch resulting in a negative result for the iodine test. Lower ability candidates identified C as the liver stating that it would contain both glycogen and reducing sugars such as glucose, but ignoring the fact that tissue C also contained starch.

Question 2 (c) (i)

(c) Cells can use fatty acids instead of carbohydrates as respiratory substrates. A process called beta oxidation is used to break down fatty acids to acetyl CoA for use in respiration.

Fig. 2 shows a simplified example of beta oxidation.

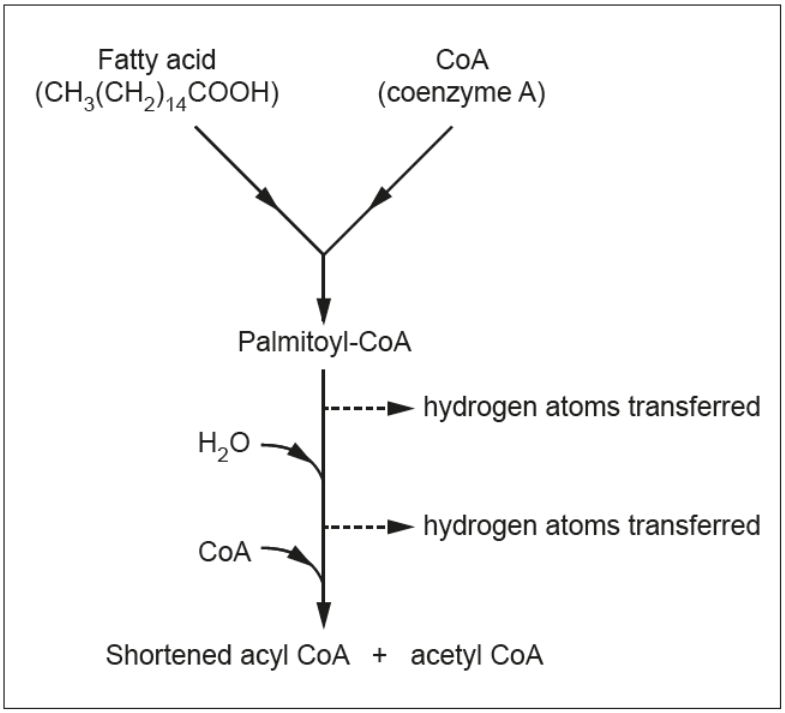

Fig. 2

(i) Using the information in Fig. 2, calculate the percentage of carbon atoms in the fatty acid that are able to enter the Krebs cycle.

Answer = ... % **[1]**

The percentage of carbon atoms of palmitoyl CoA entering the Krebs cycle was frequently incorrectly calculated, with many candidates failing to read the question and thus stating 100% for complete oxidation. Few appreciated that in Figure 2, only two of the 16 carbon atoms would enter the Krebs cycle, giving a percentage of 12.5. Many divided a seemly arbitrary number by 16.

Question 2 (c) (ii)

(ii) The percentage of carbon atoms that a reaction makes available for use in the Krebs cycle can be described as the efficiency of the reaction.

Calculate the efficiency of the **link reaction**. Using your answer to part **(i)**, state whether the link reaction is **more**, **less** or **equally** efficient when compared to the reactions described in Fig. 2.

Show your working.

Answer = ...%

Link reaction is ..... efficient
[1]

The calculation of the efficiency of the link reaction was also often incorrect, with candidates giving an array of different answers. Higher ability candidates provided the correct answer of 67% and then stated that the link reaction would be more efficient than beta oxidation.

Question 2 (c) (iii)

(iii) Fig. 2 shows the role of coenzyme A in beta oxidation.

Suggest a role for coenzymes **other than coenzyme A** in beta oxidation.

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..... **[1]**

The role of co-enzymes in beta oxidation was well understood by many candidates, with comments such as NAD/FAD would act as hydrogen acceptors or transfer hydrogen atoms. Some also stated that the carriers would become reduced. Common errors included the co-enzymes simply removing hydrogen atoms, rather than accepting or transporting them, or an incorrect reference to hydrogen ions or molecules.

Question 3 (a) (i)

3 Temperature and light intensity are two factors that affect the rate of photosynthesis.

A student investigated how temperature and light intensity affected the rate of photosynthesis in the aquatic plant *Elodea canadensis*. The rate of photosynthesis was measured by counting the number of bubbles produced by the plant per minute.

The student's results are shown in Table 3.

Light intensity	Temperature (°C)	Number of bubbles produced / minute
8	25.0	10
32	25.0	31
127	25.0	102
510	25.0	108
8	40.5	25
32	40.5	28
127	40.5	118
510	40.5	133
8	70.0	2
32	70.0	4
127	70.0	12
510	70.0	16

Table 3

(a) (i) Identify the anomalous result in Table 3 and explain how this result could be confirmed as an anomaly.

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.....

..... **[2]**

A number of candidates correctly identified the anomaly and often went onto say why they considered 28 bubbles an anomaly. Not all of the candidates went onto mention repeats being the way to confirm it as the anomaly. Some incorrectly mentioned drawing a graph and seeing whether the result did or did not fit the normal trend. Some candidates seemed to have difficulty in making it clear which result was anomalous, but this could have been achieved by circling the result in the table provided.

A number of candidates wrongly identified the anomaly, but mentioned repeats and therefore got credited a mark for that.

Question 3 (a) (ii)

(ii)* Describe how the student could improve their experimental method **and** the presentation of their data.

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..... **[6]**

This question was on the whole answered well, particularly with regard to descriptions of improvements to the method. Less able candidates were able to score marks on this question by giving correct descriptions of improvements to both method and presentation. Marks were lost by candidates for lack of detailed descriptions, in particular to do with the presentation. For example, with the improvement to the method, some stated correctly that counting bubbles was not a precise method of measuring the rate of photosynthesis but did not suggest a more precise method. A large number suggested that a potometer could be used to measure the rate of photosynthesis, or that the bubbles were carbon dioxide rather than oxygen. Many candidates suggested that a control should be set up or that other variables in the experiment needed to be controlled and gained credit for this, but did not to say what the control variables should be. Candidates also often mentioned that the light and temperature should be increased in regular intervals but did not state what these intervals should be. For improvements to presentation they stated that there should be units in the table for light intensity but did not give an example of a unit. They also did not often mention recording results in separate tables for temperature and light intensity to make comparisons of light intensity easier.

It was seen that suggestions for improving presentation were sometimes missing from answers and as a consequence these candidates scored no marks, even if they had given or described a detailed improvement to the method, . This is because for Level 1 we needed an improvement to method and presentation.

Other common loss of marks were for the use of the term average instead of mean, drawing a bar chart rather than a line graph and mentioning repeats to remove anomalies.

The overall impression though is that candidates are being taught well, to analyse practical methods and the presentation of data.

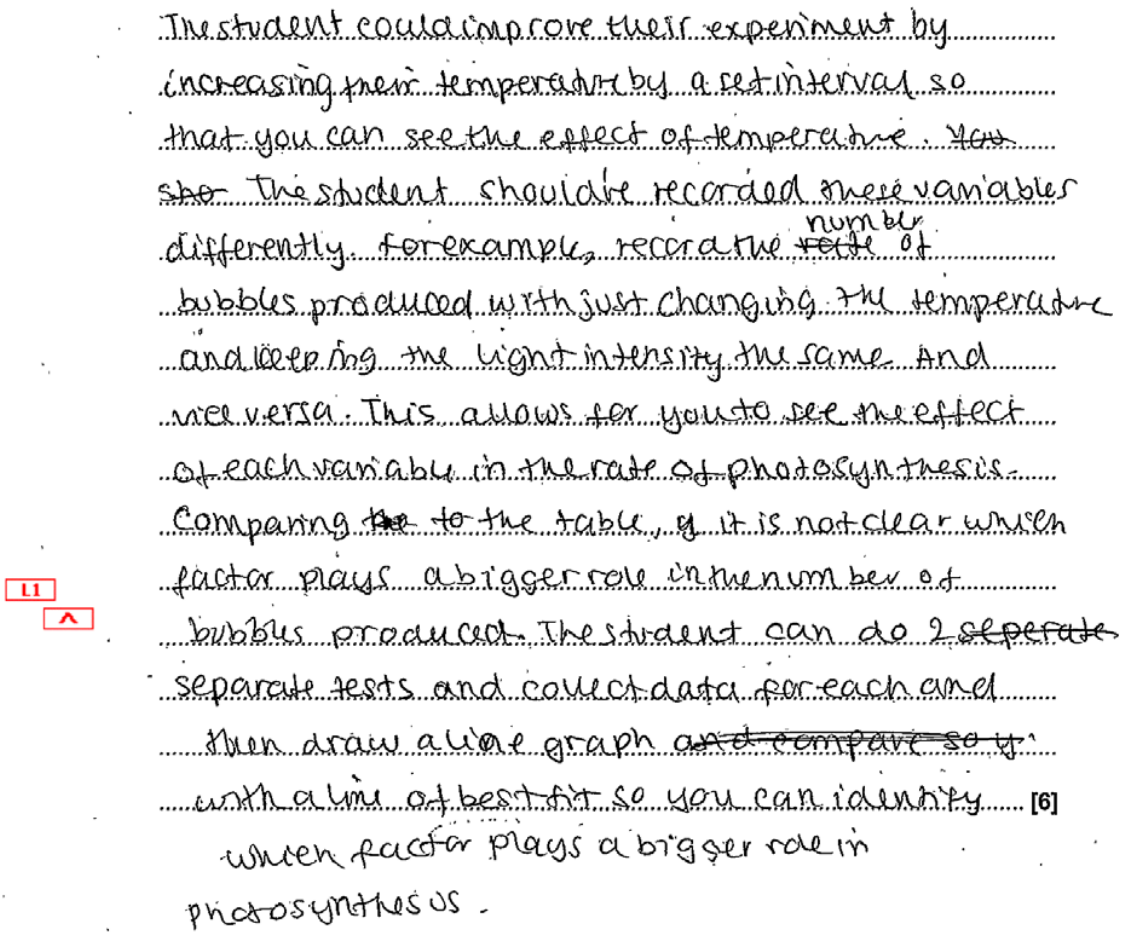
Exemplar 1

It is important that CO_2 is bubbled through the water that the plant will be in. This will ensure that CO_2 concentration is not a limiting factor in photosynthesis and that only the effect of light intensity and temperature are investigated. Rather than counting bubbles, use a gas syringe (with Soda lime to absorb (CO_2) to record the volume of bubbles given off that is oxygen as there may be too many bubbles to count and the bubbles may be different volumes to one be bubbles of CO_2. The plants should also be given time to acclimatise to the light and temperature for 10 minutes so the rate of photosynthesis reflects the environment. Repeat the experiment 3 times, identify and eliminate anomalies and find a mean. For the presentation, 3 seperate tables should be used for the temperatures (eg one table for 25 °C). Also the unit for light intensity should be included in the ~~heading~~ table. It should be changed that the mean volume of bubbles (with a unit) was recorded. A line graph could be plotted, for one line for each temperature. [6]

L3

In this answer, the candidate gave several correct detailed improvements to the method and two detailed improvements for the presentation (use of separate tables, and use of a line graph with separate lines for each temperature), with a well-structured answer gaining all 6 marks.

Exemplar 2



The student could improve their experiment by increasing their temperature by a set interval so that you can see the effect of temperature. You ~~sho~~ The student should also recorded these variables differently. for example, record the ~~rate~~ number of bubbles produced with just changing the temperature and keeping the light intensity the same. And vice versa. This allows for you to see the effect of each variable in the rate of photosynthesis. Comparing ~~the~~ to the table, it is not clear which factor plays a bigger role in the number of bubbles produced. The student can do 2 ~~seperate~~ separate tests and collect data for each and then draw a line graph ~~and compare so~~ with a line of best fit so you can identify which factor plays a bigger role in photosynthesis. [6]

L1

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In this answer, the candidate gave one correct improvement to the method (increasing temperature by set intervals) and a correct improvement to the presentation(draw a line graph), but neither improvement is detailed - so credited Level 1. The response contains a lot of irrelevant material and has little structure, so was not given the communication mark.

Question 3 (b)

(b) Photosynthesis occurs in two stages: the light-dependent stage and the light-independent stage. The light-independent stage is affected by temperature more than the light-dependent stage.

Explain why temperature has a greater effect on the rate of the light-independent stage.

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..... **[2]**

Many candidates recognised that enzymes control the light independent reactions and Rubisco was frequently quoted. References about the effect of temperature were often vague. The idea of increasing the kinetic energy of the enzyme molecules, number of successful collisions or number of ESCs was rarely addressed, and marks were frequently lost for not relating high temperatures to denaturation. A few candidates thought that the light independent stage required photons, or that temperature excited the enzymes.

Question 3 (c)

(c) Scientists are able to clone desirable plants that show a high rate of photosynthesis. The following passage describes how plants are cloned.

Complete the passage using the most appropriate words or phrases.

Cells are removed from the meristem tissue in axial buds or ..... tips. The tissue sample that is removed is called the ..... . Ethanol can be used to ..... the plant tissue. Hormones are used to stimulate mitosis, which produces a mass of cells called a ..... .

[4]

A straightforward question testing AO1, with many correct answers gaining full marks. Most candidates managed root/shoot and sterilise. There was a division between more confident candidates who gained all 4 marks and those who seemed to be guessing the answers.

Common errors were giving 'cutting' for explant, confusion between callus (the correct response) and 'callose', and a wide range of answers for 'mass of cells,' such as embryo, blastocyst or zygote.

Question 4 (a) (i)

4 Agammaglobulinemia and Vici syndrome are both genetic diseases.

(a) Agammaglobulinemia results in a lack of mature B lymphocytes in a person's blood.

(i) Suggest and explain one symptom of agammaglobulinemia.

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..... **[2]**

This question was generally well answered, with the majority of candidates achieving 1 or 2 marks. Some candidates were not credited a mark for using the term 'illness' or 'disease' rather than referring to an increased risk of infection or susceptibility to pathogens. Fewer candidates were credited the second mark point, but for those that were, the majority stated 'less plasma cells' or 'less antibodies'. Some candidates missed out on this mark by stating what they knew about B cells, but not answering the actual question. For example, only saying 'fewer B lymphocytes are present' or that 'B cells make antibodies', rather than there being fewer B cells making fewer antibodies. There was a misconception amongst a few candidates that B lymphocytes were involved in phagocytosis.

Question 4 (a) (ii)

(ii) Fig. 4 shows the inheritance pattern of agammaglobulinemia in a family.

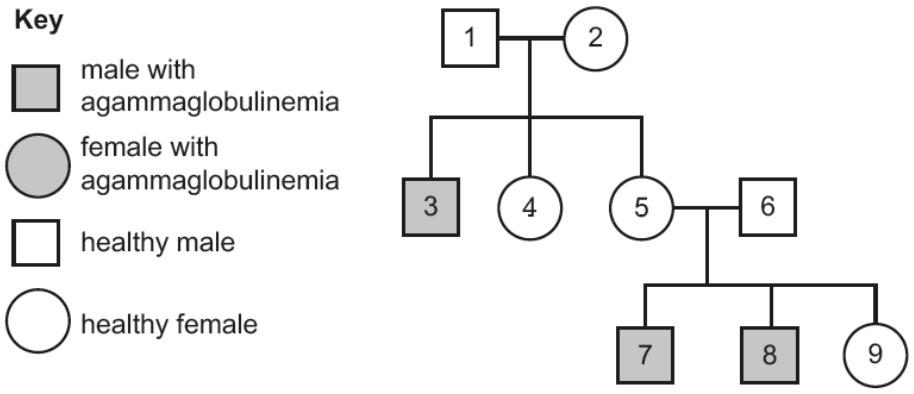

Fig. 4

What conclusions can you draw about the location and nature of the allele responsible for causing agammaglobulinemia? Explain your conclusions.

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..... **[4]**

Again, a well answered question with plenty of opportunities to pick up marks. The majority of candidates were credited 3 or 4 marks here. Most were able to identify that the allele was recessive, sex linked and located on the X chromosome. Marks were lost when candidates misunderstood the reasoning behind only males being affected, and linking this to the Y chromosome. Some candidates gave imprecise answers which did not gain credit e.g. '2 and 5 were carriers' or saying 'males are more likely to have the disease' rather than 'only males have the disease'.

Question 4 (b) (i)

(b) Vici syndrome is a genetic disease that shows a recessive inheritance pattern. The allele responsible for Vici syndrome is found on chromosome 18.

(i) Two carriers of Vici syndrome have six children.

Calculate how many of the six children you would expect to:
- have Vici syndrome
- be carriers of Vici syndrome.

Vici syndrome .....

Carriers .....
[1]

Question 4 (b) (ii)

(ii) A daughter of these parents and a male carrier of Vici syndrome have a child.

Calculate the probability of the child having Vici syndrome.

Answer = ... **[1]**

The calculations in Q4(b) were challenging. Generally, Q4 (b) (i) was well answered, with most errors occurring because of 1.5 children being produced, rather than the answer being rounded to either 1 or 2 children.

Q4(b)(ii) was designed as a stretch and challenge question, but most candidates attempted to produce an answer and many successfully gave the correct answer of 25%.

Question 4 (c) (i)

(c) DNA profiling can be used to analyse the risk of inheriting conditions such as agammaglobulinemia and Vici syndrome.

(i) To produce a DNA profile, DNA first needs to be purified.

Explain why a protease enzyme is added to the mixture during the DNA purification process.

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..... **[1]**

Another challenging question. Some candidates did not get credit due to a lack of detail in answers, e.g. 'protease breaks down protein in the mixture', or 'breaks peptide bonds in DNA'.

To gain credit answers needed to refer to the breakdown of proteins associated with the DNA, such as histones.

Question 4 (c) (ii)

(ii) DNA samples can be amplified using the polymerase chain reaction (PCR).

In theory, how many fragments of DNA might be present after 12 cycles of PCR?

Assume one DNA fragment was present at the beginning of the PCR process. Represent your answer as a $\log_{10}$ value.

..... fragments **[2]**

Few candidates got this question entirely correct. Some achieved one mark for stating 4096 or 3.61. Candidates seemed unable to convert logs to give the correct response.

Question 4 (c) (iii)

(iii) Suggest why the figure you calculated in **(ii)** may not be achieved in practice.

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..... **[1]**

A small proportion of candidates achieved the mark in this question, with the majority of correct responses being credited for a lack of primers or free nucleotides, or the primers failing to anneal. Common incorrect responses included 'DNA is lost', 'DNA is not replicated correctly' or 'RNA/DNA polymerase is denatured at high temperatures'.

Question 4 (c) (iv)

(iv) State the name of the enzyme used in PCR to synthesise new DNA strands.

..... **[1]**

The majority of candidates got this question correct, giving either polymerase or DNA polymerase as their answer. Incorrect responses included 'RNA polymerase', 'DNA ligase' and 'DNA helicase'.

Question 4 (c) (v)

(v) DNA fragments are separated to produce a DNA profile using electrophoresis.

A student wrote the following description of the electrophoresis procedure:

> We will set up an agarose gel plate and place the DNA samples in the wells at the cathode. Voltage will be passed through the gel for one minute. The gel will then be placed in purified water and we will be able to see the banding pattern of each DNA sample.

Describe **two** changes you would make to the student's procedure and explain how these changes would improve electrophoresis.

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..... **[2]**

Not many candidates achieved full marks on this question as many were unable to fully explain the changes they suggested. Many candidates identified the need for a buffer, running it for longer or adding a stain, but often lost the mark because they did not explain why the change was needed. The extra time was often linked to the DNA needing to move further, rather than to separate more. The buffer was to keep the pH constant, rather than allow current to flow, and many did not link the dye to better visualisation of the bands/patterns. There was also a lot of confusion between anode and cathode and which way the DNA moved.

Question 5 (a) (i)

5 Accurate analysis of an ecosystem's biodiversity requires a detailed classification of organisms.

The spruce pine plant is given the binomial name *Pinus glabra*.

(a) (i) Place a tick (✓) in the box next to the species most closely related to *Pinus glabra*.

Diplodia pinea ☐

Ilex glabra ☐

Pinus resinosa ☐

Annona glabra ☐

[1]

This was generally well answered. Most candidates understood that organisms in the same genus were more closely related than those in different genera that had the same species name.

Question 5 (a) (ii)

(ii) Explain why *Pinus glabra* and humans, *Homo sapiens,* are classified in the same domain but in different kingdoms.

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..... **[2]**

The majority of candidates gained credit for stating that *Pinus glabra* and *Homo sapiens* are both eukaryotes. Many candidates described similarities in cell structure to justify this statement. Most candidates recognised that *Pinus glabra* are plants and *Homo sapiens* are animals but many did not gain credit by explaining why they are classified in this way. Many candidates who attempted to describe a difference between the two kingdoms did not make a comparative statement and so did not gain the mark.

Question 5 (b)

(b) A scientist sampled the species of trees present in two different habitats containing *Pinus glabra*.

The results of the sampling are shown in Table 5.

Species	Number of individuals in habitat A	Number of individuals in habitat B
P. glabra	45	60
M. grandiflora	23	10
F. grandiflora	55	20
L. styraciflua	0	10
L. tulipifera	0	0
S. shumardii	23	4

Table 5

Using Simpson's Index of Diversity, the scientist calculated the biodiversity (*D*) of Habitat A as 0.71.

Use the formula given to calculate the biodiversity of Habitat B.

Show your working.

State which habitat, A or B, has the greater biodiversity.

$$D = 1 - \left(\Sigma\left(\frac{n}{N}\right)^2\right)$$

D (Habitat A) = 0.71

D (Habitat B) = ...

Habitat with the greater biodiversity = ...

[2]

Most candidates gained both marks here. Candidates who showed clear working and an understanding of the method to calculate Simpson's index scored well, but without clear workings, answers were often wrong. Some candidates forgot to take their calculated number from 1. Most candidates who had correctly calculated the biodiversity for habitat B understood the significance of the result and stated that habitat A had a greater biodiversity.

Question 5 (c) (i)

(c) Habitat B was situated beside a lake and showed evidence of ecological succession.

The scientist planned to investigate how the biodiversity changed from the edge of the lake to the other side of habitat B.

(i) State the collective name of the animal and plant populations that are present at the end of primary succession.

..... **[1]**

Many candidates gained credit by making reference to the climax community. Unsuccessful responses often indicated that the candidate had not understood the question and their response related to the beginning of the process of primary succession. Common errors included pioneer species and climax population.

Question 5 (c) (ii)

(ii) Suggest how the scientist could achieve the following during their investigation:

Sample all stages of succession in the habitat .....

.....

Minimise sampling bias .....

.....

Sample insect biodiversity .....

.....

[3]

Successful responses referred to the use of a belt or line transect to sample stages of succession and a few referred to the use of stratified sampling.

Candidates were less successful in describing how to minimise sampling bias, the most common error was to refer to random sampling without stating in what context this would be used. Contradictory statements referring to the use of random sampling along a transect, lost many candidates marks.

Candidates showed a good understanding of methods to sample insect biodiversity, the most frequent successful responses referred to the use of pooters, sweep nets or pitfall traps.

Question 5 (c) (iii)

(iii) The scientist also measured primary production in both the woodland and lake habitats.

Suggest the units the scientist should use to measure primary production in the two habitats.

Woodland .....

Lake .....

[1]

This was a high level question, and as expected, only the most able candidates answered this question correctly. Very few understood the idea of mass/energy +area/volume + time, make up the unit.

Question 6 (a)

6 The process of ultrafiltration in the kidney shares similarities with the formation of tissue fluid.

(a)* Describe the similarities and differences between ultrafiltration and the formation of tissue fluid.

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..... **[6]**

This was the more difficult of the Level of Response questions, but examiners saw the full range of marks credited. Those candidates who took the lead from the question and organised their answer into similarities and then differences gave significantly more coherent responses and were credited communication marks. Those who jumped around in their thinking, which was reflected in the poor organisation of the answers, lost the communication mark. Similarly, some listed features of the 2 systems independently and made little attempt to compare them and the communication mark was deducted.

Similarities were more common – most candidates identified high hydrostatic pressure, small molecules to leave and large molecules (e.g. proteins) held back as similarities. Hence the majority of candidates succeeded in reaching at least L1 with 2 similarities.

Correct differences were less common. The most common differences mentioned were the differences in number of filtering layers, and the location of the 2 processes. Common misconceptions seen involved misunderstanding the role of oncotic pressure in both and lack of awareness that ultrafiltration occurred at the Bowman's capsule and nowhere else in the kidney tubule.

Weaker candidates confused ultrafiltration with selective reabsorption, and/or the formation of tissue fluid with its reabsorption and therefore wrote irrelevant answers. A tip for candidates would be to use sub headings to ensure they are covering both areas of the question.

Exemplar 3

6 The process of ultrafiltration in the kidney shares similarities with the formation of tissue fluid.

(a)* Describe the similarities and differences between ultrafiltration and the formation of tissue fluid.

Both processes rely on hydrostatic pressure to push out the contents of the capillary by mass flow. However in ultrafiltration this pressure is built by a narrower efferent capillary than afferent. Both capillary walls contain gaps or fenestrations to allow only small molecules through like glucose, ions Eg (Na+, K+). However the process of ~~dehydration~~ ultrafiltration has a basement membrane and podocytes which mean molecules bigger than a molecular mass of 69 000 cannot pass through. So, lymphocytes and small proteins can pass through to tissue fluid but not into the nephron. The leakiness of the ~~capillary~~ capillary at sites of tissue fluid formation can be altered by the production of histamine whereas the [6]
glomerulus does not. The process of ultrafiltration only occurs at the glomerulus, but tissue fluid is formed all over the body. (by the nephron)
Tissue fluid is drained into the lymphatic system but the nephron leads to the ureter then to the bladder. The formation of tissue fluid has a pressure working against hydrostatic pressure called oncotic pressure whereas, ultrafiltration does not.

L2

This candidate achieved a Level 3 for this response. It fulfilled the need for several similarities (both processes involve hydrostatic pressure and filtering of small molecules through capillary walls) and several differences (location of the processes, and what happens to the molecules following the two processes). Generally, the response is well organised, despite the incorrect statements about oncotic pressure and histamine.

Exemplar 4

6 The process of ultrafiltration in the kidney shares similarities with the formation of tissue fluid.

(a)* Describe the similarities and differences between ultrafiltration and the formation of tissue fluid.

Ultrafiltration in the kidneys happen when substances need to be excreted and so passes through the Glomerolous which are a bundle of capillaries. It enters through the efferent arterde which is larger in diameter than the ~~small~~ afferent arteride. This creates a high blood pressure within this space. This is similar to the formation of tissue fluid, this because the pressure of blood near the arteride is too high and so it diffuses to surrounding tissue space. The difference is that the blood in the kidney is going into the Bowman's capsule ~~or~~ through different layers to prevent any large substances entering. ~~However~~ However in the tissue fluid, it just surround the tissue and not entering in substances like Red blood cells can't be diffused in ~~both cases~~ kidney as ~~is~~ too big. ~~Like Both~~ to pass through pores. But can in tissue fluid formation [6]

In both circumstances, the blood ~~red~~ enters back into the arteriole space. In the tissue fluid, it goes toward the capilary bed whereas, after it has left Bowmans capsule in the kidney, it moves away from the bundle of a capillaries towards the DCT, PCT and collecting duct.

The final product of tissue fluid is the material that is not sent back into the blood and surrounds tissues, and the final product of ultrafiltration is the filtrate, with no ~~substan~~ large substances within.

→ eg. red blood cells

→ which can be sent to lymph ~~vette~~ vessels after

In this case, we have a similarity- the high pressure needed in both processes- and a difference - where the processes occur- so it achieves a Level 1. It is not easy to pick out these points as the terminology used is not clear. There is also a lot of irrelevant material and so this response loses its communication mark.

Question 6 (b) (i)

(b) A person's glomerular filtration rate (GFR) provides an indication of the health of their kidneys. The GFR is a measure of the volume of blood that can be filtered by the kidneys every minute.

GFR can be estimated by monitoring the blood concentration of creatinine, which is a breakdown product of creatine phosphate in muscles.

(i) Suggest **two** characteristics of a patient that must be taken into account when using this GFR measurement to diagnose kidney damage.

Explain why each characteristic must be considered.

1 .....

.....

.....

2 .....

.....

..... **[4]**

Many candidates used age, exercise or diet as the two characteristics. These were often explained well. Less able candidates did not comprehend the question fully, and listed causes of kidney failure or other medical conditions such as high blood pressure, diabetes and heart disease as factors to consider, which were not relevant to the way in which GFR was being measured.

Question 6 (b) (ii)

(ii) If kidney damage is suspected, the patient's urine is likely to be tested for the protein albumin.

Explain why the presence of albumin in the urine indicates kidney damage.

.....

..... **[1]**

Candidates generally had the right idea, but forfeited the mark through an inability to express themselves clearly. Better answers referred to the large molecular size of albumin.

Many thought the damage was a result of a problem with reabsorbing the protein. A very common error was in using the term 'filtered out' or 'not filtered out' – and it was difficult to understand what the candidate was trying to express with this terminology.

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