GCE EXAMINERS' REPORTS

GCE (NEW)
BIOLOGY
AS/Advanced

SUMMER 2019

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BIOLOGY

General Certificate of Education (New)

Summer 2019

Advanced Subsidiary/Advanced

UNIT 1

General Comments

There was a range in standards seen in the scripts; with the better candidates gaining very high marks. However, a significant number of candidates have failed to grasp many of the core concepts and principles associated with unit one, and as a result struggled to answer questions involving application of knowledge. The responses to the practical based questions were very poorly answered with many candidates failing to attempt an answer.

Comments on individual questions/sections

Q.1 Overall, the majority of candidates poorly answered this question. Although it was intended to be an easy introduction to the paper, it clearly demonstrated that candidates struggle to understand the biology involved in both mitosis and meiosis. In part (a) less than 50% of the candidates could work out the haploid number of chromosomes and why the diagram showed mitosis and not meiosis. In part (b) only the minority identified the anther or the ovary as the organ of meiosis, however the majority could order the photomicrographs. In (b) (iv) the majority of candidates' answers were either about the sources of genetic variation or the significance of genetic variation, only the better candidates did both and gained three marks.

Q.2 This question was also intended to be straightforward and a lot of information was provided to key candidates into the fact that this question was about osmosis. Unfortunately, many candidates either failed to use the information or were unable to apply their knowledge in the context of the question. In part (b), the majority of candidates appreciated that the contractile vacuole prevented osmotic lysis, however for some the quality of written communication was poor in their explanations of osmosis. The better candidates did use the information provided and gained full marks. Most candidates also identified the mitochondria and ribosomes, but many failed to link their explanation to the functioning of the contractile vacuole. Part (c), was poorly answered with many candidates failing to gain any marks. The majority failed to read the question carefully and did not describe the structure of the cell wall, even though it was labelled as cellulose.

Q.3 This question was designed to assess candidate's practical knowledge of the effect of substrate concentration on an enzyme catalysed reaction. The emphasis was placed upon the candidate's understanding of the need for controlled variables and evaluation of data. This proved extremely challenging for many candidates. In (a) it was apparent that many candidates didn't know what a buffer was and simply made 'knee-jerk' statements about water baths maintaining optimum temperatures or preventing enzymes denaturing and very few made reference to kinetic theory. The vast majority of candidates were able to calculate the mean and plot the data; however, many candidates extrapolated their line to the origin.

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It was also apparent that many candidates do not know what range bars are and either didn't attempt to draw them or drew a bar chart over their plots. In part (b) most candidates were able to use the graph to estimate the correct figures, although a minority of candidates saw the word 'estimate' and rounded their answers to whole numbers. The better candidates gave good evaluations of the data, although a significant number confused accuracy for reliability. Candidates struggled to express themselves when describing sources of inaccuracy, with many making vague statements about 'human error' or 'the results being collected by more than one person'. Many candidates had failed to read the method provided and many answers involved the use of more accurate equipment or a time delay in stopping the stop-watch.

Q.4 This question required the candidates to be able to draw upon their knowledge of the genetic code, protein synthesis and biochemistry. Very few candidates could give a definition of quaternary structure. The majority of candidates' knowledge of the genetic code was generally poor. Approximately 50% of the candidates divided the number of amino acids by three instead of multiplying. Many of the candidates could explain why the code was 'degenerate' but only the better candidates could explain why it was a 'triplet code'. The majority of candidates were able to demonstrate they understood complementary base pairing when completing the table, however a significant minority used the tRNA anticodons to identify the amino acids. Part (c) allowed the better candidates to produce well written responses that gained full marks. However, the quality of written communication was an issue for some candidates. Part (d) was intended to be challenging which was reflected in the marks awarded. Many candidates gave the correct mRNA codon and not the mutated DNA base sequence; however, the majority correctly identified the R-groups. Only the better candidates made the link between the properties of the two amino acids and their position in their proximity to other amino acids in the chain.

Q.5 Part (a) involved some basic biochemistry, which the majority of candidates answered well. In part (b) many candidates struggled to use the information provided to apply their knowledge of enzymes to the biosensor, instead they gave vague answers about 'lock & key theory' or simple recalled facts that they had been taught about biosensors. Part (c) proved to be a good discriminator. The better candidates gave a good account of competitive inhibition and linked this to the biosensor. However, many candidates did not recognise/appreciate that the structure of arabinose and glucose are similar and so gave accounts of both competitive and non-competitive inhibition and failed to make reference to the biosensor.

Q.6 The QER question enabled the candidates to gain the full range of marks. The better candidates gave a good account of the structure of water and used the information provided to explain how the relevant properties of water would support life on Enceladus. Many candidates made the link between the need for phosphorous for the synthesis of ATP, nucleic acids and phospholipids, but only the better candidates made the link between sulfur and proteins. Many candidates failed to use the information provided and explained all of the properties of water; they failed to appreciate that the layer of ice 40 km thick would prove problematic for pond skaters walking on the surface of the ocean or that light wouldn't be able reach aquatic plants. The weaker candidates picked up some marks for listing the properties of water without explaining why they would be important to living organisms. When describing the structure of water, some didn't know the difference between a molecule and an atom.

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Summary of key points

To improve on their performance I would recommend that candidates are encouraged to:

- Highlight the key information provided in the stem of the question, so that they are better able to use it to answer application of knowledge questions.

- Highlight command words, within the stem of the question, so that they provide relevant answers to the question being asked.

- Take note of the number of marks available for each part of a question so that they can ensure they have answered in enough detail. If the question is worth three marks, they must make three relevant points at AS level standard.

- During practical lessons, candidates need to appreciate that they are not simply completing a practical to produce a graph to then describe and explain their results. They also have to understand the methodology involved in practical biology; the ability to evaluate results produced and consider that the method they followed could account for variation in data. It is extremely important that they have been given the opportunity to practice all of the relevant practical skills, as listed in appendix A, in preparation for the AS exams.

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BIOLOGY

General Certificate of Education (New)

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Advanced Subsidiary/Advanced

UNIT 2

General Comments

Generally, this paper was answered well with some responses showing a good understanding of the AS Biology course. These candidates showed evidence of being able to apply their knowledge, used the correct terminology and structured their answers in a coherent manner. However, in some cases, the standard of response was poor, showing a lack of understanding and thought to the requirements of the questions.

On a positive note, the mathematical questions showed improvement on previous years with many candidates gaining full marks in these sections.

Comments on individual questions/sections

Q.1 Most sections were answered well, however a few candidates did not know the meaning of the term 'extremophile'. Part (b)(ii) was answered poorly with only a handful identifying the eye as an analogous structure.

Q.2 The maths in part (a) was answered well with most candidates gaining both marks. The majority of candidates could describe a closed circulatory system but could not explain its role. Their explanations were vague, e.g. 'to supply substances all over the body' with no reference to body tissues or cells. In part (c), many candidates stated that the amphibian exchanged gases through its skin surface and were able to compare the SA:Vol ratio of an amphibian and mammal, but only a handful were able to relate this to the organism's oxygen requirements.

Q.3 Candidates struggled with the risk assessment in part (biii) with very few making reference to an action i.e. handling the paper. The responses to (c)(ii) were extremely poor with many only gaining the mark for describing a method for obtaining random coordinates. This was also true for part (e). Many did not attempt this section and where an attempt was made, the responses showed a lack of understanding of genetic polymorphism or were lacking in detail. The other sections were answered well.

Q.4 Part (a) was answered poorly with many responses referring to a large SA:Vol ratio. In addition, too many candidates made reference to a large SA resulting in the cell being able to carry more oxygen, rather than more oxygen being absorbed. Very few made reference to a lack of nucleus and its advantage.

In (b) the maths did not prove an issue with many candidates obtaining full marks. However, a large proportion failed to answer to the nearest micrometre, despite it being highlighted in the question.

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Part (c) was answered well with the majority being able to apply their answer to (c)(i) to identify whether the person had macrocytic anaemia in (c)(ii).

In (c)(iii), a few candidates understood that a larger cell would increase the diffusion pathway or would result in difficulty passing through capillaries. Many stated that fewer cells would merely result in the transport of less oxygen, or if they did realise that it would cause a decrease in SA, they failed to state the total SA.

Q.5 Part (a) was answered well.

In part (b), rather than stating the effect of a decrease in plasma proteins, most candidates explained the usual role of plasma proteins in lowering the water potential of the blood. This did not fulfil the requirements of the question and was not creditworthy. In addition, a large number gave absolute responses, i.e. no water would be reabsorbed, rather than less.

Q.6 Many candidates gained both marks in part (a), however a few referred to carnassial teeth which were not present in the photograph.

Many candidates stated that lipid digestion began in the small intestine in (b) rather than specifically stating the duodenum. Most correctly identified where starch and protein digestion begins.

Overall, candiates understood that the shortening of villi would result in a reduction in SA and therefore less absorption would occur in (c) but failed to state a named product of digestion or incorrectly identified these as starch/protein. Many also suggested that a lack of absorption alone would result in diarrhoea rather than relating it to water absorption. Again, absolute answers were given, such as no absorption of products of digestion or no water reabsorption, rather than less.

The level of responses in (d) were poor, with many only gaining the marks for the mode of transport in and out of the cell. Many just described the diagram given in the stem of the question rather than relating the movement of molecules to a change in concentration gradient.

Q.7 Many correctly identified the structural features in a guard cell in (a) and the maths in (b)(i) was answered well with only a few failing to answer to 3 sig fig.

The responses to (b)(ii) were poor, with many candidates referring to the relative number of epidermal cells and stomata, rather than the relative size and number of epidermal cells.

Candidates understood the need to cut a stalk underwater in (c)(i), but some were not specific enough, stating to prevent air entering the stem/shoot, rather than the xylem. Very few were able to explain the effect of an air bubble on cohesive forces.

In section (c)(ii), the change in humidity was clearly identified and the benefit of this change to the plant was explained well. Candidates struggled with explaining the decrease in humidity in terms of stomatal closure and the subsequent reduction in transpiration. Many candidates still refer to a loss of water from the leaf rather than water vapour.

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Q.8 The first part was answered well with many candidates giving detailed descriptions of the passage of water across the root cortex. The only caveat was their description of the vacuolar pathway, with many stating that it moved from vacuole to vacuole rather than through the cytoplasm or tonoplast.

In the second part, many candidates understood the role of the casparian strip in blocking the apoplast pathway, but only a few could relate this to the subsequent active transport of mineral ions and the effect this had on the water potential in the xylem.

The last part was a non-starter with most referring to waterlogged soil reducing the water potential gradient between the soil and root hair cells. Only a few related this to a lack of oxygen and its effect on respiration and active transport.

Summary of key points

- Candidates need to read questions carefully and take more time in constructing their responses in a coherent manner.
- Candidates need to use all information given in the question as a lot of care goes into ensuring that all the information required to answer the questions is present, in particular where the candidates need to apply their knowledge.
- Centres need to consider allowing more candidates to use a PC to answer questions as the quality of handwriting is deteriorating and may be costing candidates marks.

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BIOLOGY

General Certificate of Education (New)

Summer 2019

Advanced Subsidiary/Advanced

UNIT 3

General Comments

There was a range of standards seen in many of the answers, but all of the marking points were seen during the marking process. There were several questions in which many candidates lost marks by not reading the questions carefully enough and following instructions, especially in the calculations. Some candidates attempted rote learning answers to questions that required application.

Poor handwriting of many candidates is a perennial problem. Examiners can only mark what they can read and sometimes we find it difficult to understand what is in front of us. We do make a great effort to interpret what is there.

Comments on individual questions/sections

Q.1 **(a)** Many candidates gained the 2 marks for the calculation. Some lost a mark as they did not follow the instructions to give the answer to the nearest millisecond. Most candidates realised that there was no action potential as threshold had not been reached and some went on to explain that this was because not enough sodium ions had entered the neurone.

(b) The most common loss of mark was due to not following the instructions to give the answer in standard form

(c) This was answered well by many candidates.

Q.2 **(a)** Most gained the mark for part i) and many gained the marks for the calculation.

(b) Some very good answers were seen, but a lot of candidates became fixed on one point and didn't gain many marks. Many candidates wrote about the habitats being maintained and light reaching the ground allowing new plant growth. A pleasing number wrote about secondary succession and seeds from the uncut areas reaching the cut areas.

Q.3 **(a)** A range of answers were accepted due to pi being rounded down/not rounded down. A mark was allowed just for working out the area of the field of view.

(b) **(i)** Answered reasonably well, although some gave methods that would not lead to a 10^{-5} dilution. Credit was still given for a sterile technique.

(ii) For part bii) the credit was for too many/few <u>colonies</u> or merging of <u>colonies</u>, not bacteria. The candidates had to relate the human body temperature being the optimum for the bacteria. It was decided that larger peptidoglycan layer is not the same as thick layer.

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Q.4 **(a)** **(i)** It was very disappointing to see so many candidates not knowing what a dependent variable is.

(ii) Many spotted that the glucose would be used up if the solution was not changed, although cell death was also credited.

(iii) Bubbles of different sizes was the most common answer. “Too fast to count” and “too many to count in a minute” were given marks but “too many to count” wasn’t given credit as I’m sure that A-level candidates can count to quite high numbers. Measuring the volume of gas produced (we didn’t penalise the wrong gas) was the most commonly accepted answer, but bubble counting machines and digital counters were not accepted.

(iv) Some lost marks for thinking “more acidic” is the same as “higher pH”.

(v) Many realised that sucrose is a disaccharide and needed to be hydrolysed but some gave the wrong monosaccharides (glucose and galactose) and so negated a mark.

(b) Many candidates did not refer to where the processes were taking place (glycolysis in the cytoplasm, pyruvate entering the mitochondria where the link reaction takes place).

(c) The question asked about energy not incorporated into ATP. This is released as heat so any answer about keeping the baby warm/maintaining body temperature was given credit. One mark was given for spotting that the brown adipose tissue had more capillaries (most candidates got that mark) then some went on to link this with more oxygen/glucose/nutrients are supplied to the tissue so more heat can be carried to the rest of the body. It does not mean that the baby breathes faster/more oxygen gets into the baby.

Q.5 **(a)** Many gave the type of competition and what the adults competed for. They also realised why *Semibalanus* could not survive in that area, with not being able to survive out of water for long being the common correct answer. Very few mentioned interspecific competition lower down the shore.

(b) **(i)** A variety of methods were accepted. The important thing was to use several statues, not just different areas on the same statue. Vague answers such as “the barnacles were calculated” did not gain marks.

(ii) This tested knowledge on osmosis within the context of the question. There were vague references to water moving but not where or why. The candidates who referred to the water potential being higher in the sea water than inside the cells were often the ones who gained all of the marks.

(c) **(i)** DNA sequencing was not enough to gain the mark. DNA base sequencing was.

(ii) Very few candidates gained a mark in what was thought to be a relatively easy question. Radiation on its own was not enough, it needed to be qualified (ionising radiation, high energy radiation were accepted) as were examples (X-rays, UV light). Pollution was also too vague.

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(d) Good answers were seen that referred to ecological and economic problems. The most common marks were for the invasive species outcompeting the native barnacles and reducing biodiversity, and for damage to boats/harbours and cost for the removal. Some gave answers referring to the ecotourism of Wales declining, tourists being "put off" by the aesthetically unpleasing sight of barnacles on statues, and the Welsh barnacle harvesters being put out of business.

Q.6 The most common cause of losing a mark was due to the lack of a unit after the number. Part c was answered very well by many candidates. Those that did not gain higher marks usually only gave one side of the difference.

Q.7 Again, the "essay" question varied widely!
This was a question that showed the rote-learning approach to answering. Urea was not on the graph and we did not ask for reference to it in the answer. Some candidates also wrote everything they knew about ADH and the collecting duct. It may have been correct but was not on the graph and so was irrelevant. This was also true of the glomerulus and Bowman's capsule. Many gave very good accounts of what happened to the glucose, sodium ions and water in the various parts on the nephron named on the graph. Structure of the proximal convoluted tubule were not needed in order to gain marks.

Summary of key points

- Answer the question that is set. If a question asks why something happens candidates may not gain credit for saying why it doesn't happen.

- Always give the units at the end of a calculation if they are not provided.

- Don't use vague terms. "Amount" is not an alternative term for number or volume.

- Follow the instructions in the question. This is especially true for calculations. If a question asks for an answer to the nearest millisecond candidates will lose a mark if they are unable to round up or down.

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BIOLOGY

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UNIT 4

General Comments

Poor handwriting and the use of sloppy figures (is it 0 or 8, 1 or 7, 6 or 8 ?) are becoming an increasing problem. Many candidates are not using the additional pages at the end of the examination booklet if they run out of space and they are not taking care to number the question(s) correctly as stated clearly in the instructions to candidates on the front page of the examination booklet.

Comments on individual questions/sections

Q.1 **(a)** Although clearly stated in the specification that the role of the tapetum in pollen grain development should be covered, less than half of the candidates were able to do so. Common errors were to state that the tapetum nourished the gametes or that it was the layer of cells which underwent cell division to produce the pollen grains. The majority of candidates were able to describe the appearance of a tetrad and link it to meiosis.

(b) **(i)** This was the most poorly answered question on the paper with numerous candidates incorrectly stating that the tube nucleus makes, contains or secretes enzymes rather than controls the synthesis or codes for the enzymes.

(ii) Very few candidates were unable to calculate the rate of growth of the maize pollen tube. The main error was not to give the answer to one decimal place. Some credit was given to candidates giving the answer to more than one decimal place but only if it was correctly rounded.

(iii) Very good responses but both polar nuclei had to be labelled!

(iv) There were very clear responses from about half of the candidates but many remain confused between mitosis and meiosis.

(v) The majority of candidates clearly understood the meaning of double fertilisation although some considered that the male gamete fertilised the female gamete and then went on to fertilise the polar nuclei as well! The terms diploid and triploid were often used to clarify the explanation.

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Q.2 **(a)** There were many excellent responses with approximately 50% of the candidates being awarded 4 marks.

(b) Many candidates realised that sickle cell trait was an advantage in malarial regions but disadvantageous in non-malarial regions. Very few stated that individuals who were HbSHbS were not likely to survive irrespective of living in malarial or non-malarial regions. It was rare to see a reference made to HbAHbA being selected against in malarial zones but an advantage in non-malarial zones.

(c) Candidates struggled to clearly state what information has been obtained from Genome Projects but were able to give some uses of the information. Unfortunately, there were some who listed methods used to control malaria and Anopheles mosquitoes and made no reference to the genome project.

Q.3 **(a)** Caused very few problems although anthers and stigmas hanging outside the plant / leaves were not accepted.

(b) **(i)** The majority of candidates were able to give at least two ways in which one could ensure that the extracts were comparable. There remain far too many candidates who consider that the word 'amount' is an acceptable unit in science and lost marks accordingly!

(ii) Clear reasons for washing the seeds were usually given.

(iii) Candidates found it difficult to express themselves clearly but usually got there in the end.

(iv) A pleasing number of candidates were able to describe a suitable control but there were many who stated that the control would be to boil the seeds to denature enzymes, cool them and repeat the experiment. Some candidates considered that a suitable control would be to use glass beads to replace the seeds, ingenious but alas incorrect. Suitable explanations for the need of a control were often missing or referred to enzyme experiments.

Q.4 **(a)** The question was the third most poorly answered question on the paper. The definitions of the terms, Proto-oncogene, Epigenetics were imprecise but more assurance with the definition of a Stem cell was shown.

(b) **(i)** The processes of transcription and translation were usually identified correctly.

(ii) There were many well- argued accounts of how DNA methylation results in tumour growth were given.

(iii) There were many very good suggestions how cancer cells switch the suppressor genes off but some candidates referred to blocking the binding site for acetyl groups rather than removing the acetyl groups.

(iv) Very few candidates made reference to the gametes being affected and in consequence being passed onto the next generation.

Q.5 **(a)** **(i) & (ii)**

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There were some excellent responses showing a clarity of understanding.

(b) A significantly large number of candidates did not seem to realise that environmental factors influenced the phenotype.

Q.6 **(a)** Some candidates did not make a clear connection between FSH and the development of follicles but referred to 'follicle production', 'egg' production 'gamete production and development of the primary follicle into a secondary oocyte.

(b) **(i)** A large number of candidates considered that prolactin 'makes milk' or stimulates the ducts in the mammary glands to make milk. The reasons why prolactin reduces the chance of conception were usually correctly stated.

(ii) Most candidates had a clear understanding of positive feedback but some lost marks by stating that the endometrium was contracting or by not linking the contraction of the myometrium to an increased production of oxytocin to a further increase level of contraction.

Q.7 There were many very clear accounts and a clear understanding of the function of reverse transcriptase, DNA polymerase, Restriction endonuclease and DNA ligase was shown. In some cases there was confusion about where the enzyme was being used for example it was not unusual to see reference to beta cells from the Islets of Langerhans. Irrelevant material was uncommon and candidates identified the three areas of the question and answered each separately and succinctly.
The concerns over the use of such a technique was often generic and did not fully apply to the genetic modification described in the stem of the question but there were many well-argued points.

Option A

Q.8 **(a)** **(i)** The majority of candidates correctly gave three natural barriers to infection, but an alarming number assumed that lysosomes were the same as lysozymes.

(ii) A clear understanding of the term 'host' was shown but many candidates used a virus as an example. A virus cannot be considered as a living organism.

(iii) Most candidates were able to state that rhinovirus caused cell death by lysis.

(iv) Many candidates showed an excellent understanding of the cell-mediated response and all points on the mark scheme were seen.

(b) **(i)** Detailed descriptions of the effect of antibiotics on bacteria were given and the reasons why they were ineffective against a viral infection stated clearly.

(ii) In most cases candidates were able to calculate the total dosage of amoxycillin required in treatment of a patient with *S.pyrogenes*.

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(iii) Many candidates tried to answer this question without reference to the terms ‘bactericidal’ and ‘bacteriostatic’ although clearly given in the specification.

(iv) Responses were often spoilt by the use of the term ‘amount’ but most candidates were able to state at least one factor which would need to be controlled.

(v) The examiners wanted a reference to the human body not just body.

(c) **(i)** References to high mutation rate and many strains were often seen but these statements had to refer to a virus and not to a cold.

(ii) Candidates commonly stated that it would be unethical to make vaccination against flu compulsory because of religious objections or human rights. These objections were acceptable but arguments relating to cost were not.

Option B

Q.9 **(a)** **(i)** Many candidates had not learnt the names of the long bones of the body.

(ii) The calculation was carried out by many correctly. Some candidates struggled to measure the image accurately and then made errors in the formula for calculating the magnification.

(iii) Most candidates correctly identified hydroxyapatite, whilst many others simply wrote calcium.

(iv) Candidates were able to describe the haversian canal as containing blood vessels, but the majority could not explain how the cells within the bone gained their nutrients.

(v) Mostly done well.

(vi) The majority of responses gained a mark for stating that the use of percentage fibres allowed comparison, but many failed to explain that the number of fibres in the sample would vary.

(vii) ‘Fair test’ is not an acceptable answer for this question. Candidates didn’t appreciate that the controlled variables allowed the independent variable to be the clear cause of any differences.

(viii) This question was well done, with most candidates correctly identifying the percentage fibre types as the reason for B being the weightlifter.

(b) **(i)** Well answered in general, however in some cases it was unclear what protection was for. Candidates should be more explicit in their answers.

(ii) Spelling of thoracic was a concern.

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(iii) This question was answered well.

(c) **(i)** A range of answers was given for this question.

(ii) Good responses using the information given in the stimulus material.

Option C

Q.10 **(a)** **(i)** The table comparing the sympathetic and parasympathetic nervous systems was well done.

(ii) Candidates had difficulty explaining themselves in response to this question. Their responses required some reference to an increase in complexity or degrees of movement related to the area of motor cortex shown.

(iii) Again, poor expression meant that few candidates gained this mark.

(b) **(i)** Well answered and good to see candidates using the information given to answer.

(ii) Well answered.

(c) **(i)** Candidates understood that the colony allowed division of labour, but many focussed on the ants gaining protection or more food but hadn't explained why.

(ii) well answered

(iii) Candidates could identify the type of selection operating in the scenario, but then couldn't continue to explain the consequences of this in terms of the offspring's characteristics.

(iv) Well answered by the majority.

(v) Well answered in most cases. Candidates could clearly identify the critical value and compare their calculated value to this. They showed a good understanding of why there is a significant difference between the two environments and the use of the null hypothesis.

Summary of key points

It is strongly recommended that candidates:

- read the questions and follow the instructions given.
- revise **all** the practicals in the lab book in preparation for the external examinations.
- be able to apply key principles to different situations.

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BIOLOGY

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UNIT 5

General Comments

Practical Examination – Experimental Task

Centres are required to trial the experimental method supplied to centres one week before Test 1. They are also required to submit a set of results in the same format as is expected of the candidates. Quite a number of centres did not submit a set of results for the practical this year. Of those that did, many did not follow the rubric of the paper and submitted percentage changes to two decimal places, not one as set out in the method.

Teacher awarded marks were not entered for some candidates. This may have been an oversight but in some cases one of the marks was marked with a 1 and the other left blank. If a teacher decides to award 0 for one of these marks then a 0 needs to be entered on the front cover of the examination paper.

In cases where candidates are unable to collect results, centres can provide a set of results to that candidate. If a candidate is able to collect a set of results, regardless of the quality of those results, they should not be provided with 'better' data. If candidates are provided with results, the candidate's paper must be annotated to show this and a copy of the results provided to the candidate submitted with the paper. This was not evident in a number of cases.

Candidates are required to carry out the investigation individually. In some centres it was evident that candidates had worked in groups of 2 or 3 as they had identical sets of results. If there was a valid reason for this then the centre must provide a valid explanation or contact WJEC before the examination if, for example, access to equipment is an issue. If there is no valid reason, then the centre is in infringement of the examination rules and regulations and may be subject to an enquiry.

Raw data should be recorded in the examination book provided or in an official additional pages booklet. Candidates must not be provided with lined paper as was the case in many centres. This is also true of graphs. Official graph paper should be provided if a candidate needs to redraw his / her graph. However, some centres provided loose-leaf graph paper and candidates did not use the graph paper in the examination booklet.

As this is an external examination, teachers are not allowed to check candidates' answers. The practical sessions should be invigilated by an external supervisor who has responsibility for ensuring that no assistance is provided by the teacher other than to correct problems with apparatus or to provide results in the case of a candidate being unable to generate their own results.

Practical Analysis Task

Language use remains a problem. Candidates have been advised in the past to avoid the use of 'it' and be specific: 'it' may grammatically refer to something other than what is in the candidate's mind. Even if examiners imagine a candidate actually understands the biology, they can only mark what is written and if this is not clear, no marks can be awarded.

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Candidates are advised to read widely as it is likely that those candidates who do so are better able to express themselves in written language.

Candidates should be aware of the space allotted to each answer and to use that as a guide to the extent of their writing. If significantly more space is used, the candidate should question whether they have understood what is being asked.

Comments on individual questions/sections

Experimental Task

(a) Table

The rubric of the question asked candidates to record the percentage changes **after** each time interval in minutes, to 1 decimal place, and also the mean percentage changes. Candidates who calculated percentage changes **between** time intervals were not penalised. When investigating the effect of time as the independent variable, values at the start, i.e., time = 0, are usually included in the table of results. Again, candidates were not penalised for not doing so on this occasion.

Headings: Many candidates did not include change in **mass** in their headings, especially when they included mean % change as a separate column.

Units: Quite a number of candidates changed time to seconds even though the time intervals were given in minutes. Percentage change in grams was seen on many papers rather than just % or the word percentage.

Data / Calculations / Mean:

Many candidates included the actual change in mass in their table and therefore lost a mark. Percentages were commonly calculated to 2 or more decimal places even though they were told to record % change to 1dp. In almost all papers, the cylinders of potato / swede lost mass. It was therefore expected that candidates would calculate their percentage changes as negative numbers if mass decreased and positive numbers if the mass increased. Many calculated % change for the individual pieces of vegetable as being negative but then recorded mean % change as positive and vice versa. While it is acceptable to calculate the mean to one more decimal place than the rest of the data, inaccuracies were seen in rounding, basic calculations and inconsistency in the number of decimal places recorded.

(b) Graph

Use of grid: No major problems here; the vast majority made very good use of the plotting area available.

Axis labels: More candidates did include **mean** in their y axis label this year but the labels for the x axis should be on the x axis and not at the bottom of the page.

Axis units: No major problems here.

Scales: Most candidates included numbers at the origins of the axes. However, many candidates seem to have little idea that negative numbers go down from the 0 point of the x axis – not up?

Plotting: Most candidates used suitable scales.

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Many candidates calculated negative means and then plotted them as positive values on the graph. Candidates who included a value for 0 minutes in their tables should have plotted a point at (0,0) – many did not and many who did not include a value for 0 minutes in their table did! Most data points were, however, correctly plotted.

Line: If a value is plotted at (0,0) then the line should connect to that point. However, if that value is not plotted then the line should not be extended to 0.

Range Bars: Most candidates correctly plotted their maximum and minimum values correctly.

(c) (i) Percentage change

Most candidates were able to explain that calculating % change is needed when starting masses are different so as to make the results comparable. However, many lost the mark due to references to accuracy and / or reliability being improved.

(ii) Range bars

Many candidates only stated that they show the maximum and minimum readings at each time without referring to their providing information about the repeatability of the readings.

(iii) Prediction

The main problem here was a result of either incorrect calculation of mean percentage changes as positive or plotting negative changes as positive on their graphs. Calculation of % change between each time period also hindered some candidates in wording their answer. A large number lost a mark when referring to the potato / swede pieces becoming isotonic with the external solution rather than referring to the cells or cell contents.

(iv) Inconsistent drying

Most candidates gained both marks here. Marks were lost when candidates did not provide enough detail, could not communicate their answers clearly or referred to cell contents being lost rather than the presence / absence of unwanted external solution on the surface of pieces of vegetable.

(v) Control experiment

Test 1:
Incorrect use of terminology cost marks here. Many referred to the cell membrane being denatured or damage to the cell wall rather than the cell membrane being destroyed / damaged. Quite a few referred to boiling the vegetable as being a control for an enzyme experiment with no attempt made to explain boiling is not a suitable control for an osmosis experiment.

Test 2:
Of the small number of candidates who sat this paper there were no major problems in their explanation of why sodium chloride solution may not be an accurate representation of the effects of sea water on the mass of the pieces of swede.

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Practical Analysis Task

Q.1 **(a)** **(i)** In this and several other questions, candidates have used the concept of 'validity' in their answers. This would only get credit had they explained the source of validity, which is what the question asks. This means that using the word was, in all cases seen, superfluous.

(ii) Many candidates appeared to have memorised and quoted an answer to a similar question from a past paper. In this experiment, however, 'distance from the sea', for example, is not relevant. Candidates are reminded to answer in the context of the question they are currently answering and not to assume that a stock response is required. This is an experiment about the effect of a physical factor in the environment i.e. light intensity and other physical factors were expected in reply to this question. Precision is required in scientific writing and so examiners credited, for example, 'volume of water' or 'water availability', rather than 'water' or 'rain'. Candidates should note that water is not a 'nutrient'. Reference to light intensity did not receive credit, as this is described in the stem of the question.

(iii) 'To ensure a fair test' or 'to make the test valid' need explaining. This is a matter of examination technique: candidates should understand that contextual information is required, rather than a generalised answer.

(b) The mean quoted for leaves grown at low light intensity should have indicated that only one decimal place is required here.

(c) **(i)** This question is about the t test so an answer that describes why the chi^2 test was not used did not gain credit.
The concepts of applying the t test to sets of continuous, normally distributed data were rarely seen in answers; most candidates who were awarded credit knew that the test compares means.

(ii) The statement of a null hypothesis is frequently asked in examinations. Candidates should be aware that wording is crucial. They should realise the meaning of 'null'. The word 'significant' must describe the parameter being tested, and, for a t test, the word 'mean' must describe, in this case, the thicknesses being compared.

(iii) Most candidates could apply the formula given and provide a correct answer.

(iv) Having noted the critical value of 2.048, a surprising number of candidates wrote that this is larger than the calculated value 2.386. Of those that noted that 2.048 is smaller than 2.386, many gave generalised, rote answers that did not receive credit as they did not discuss this particular experiment.
It is not enough to say that the null hypothesis is rejected and so 'there is no significant difference'. The candidates need to state that, in this case there is no significant difference between the mean leaf thicknesses at the two light intensities. Here was another situation where poor language prevented marks being awarded. The t test tests

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whether there is a significant difference between the mean thicknesses of two sets of leaves, not between mean leaf thickness and the light intensity. References to observed and expected values, and hence the concept of deviation, were not relevant and indicated that students had merely memorised answers concerning the chi^2 test.

(v) Several candidates were not awarded this mark and they answered in terms of the level of significance only, without considering the critical and calculated values of t.

(d) This question asks about leaves grown at low light intensity. Carbon dioxide concentration is not a limiting factor in the situation described here and answers about stomata are not relevant.

Marks are awarded for the candidate understanding that the feature they suggest leads to 'more light being absorbed' but this statement can only be credited in the appropriate context.

Wording is once again important. Leaves are not thicker 'in order to' absorb more light. They are thicker 'and therefore' absorb more light. Candidates should understand that teleological arguments are not accepted.

(i) Candidates should read the question carefully so they know they are answering specifically what is being asked. They should not waste time and space with an answer relating to high light intensity.

(ii) Many candidates understood that a larger leaf area is a common solution to the problem described here. Rather than write 'a larger surface area' some wrote that the leaf was wider and longer, which was accepted. But those who wrote that being thicker produced a larger surface area did not, partly because it does not, and also because the question stipulates that the leaf remains thin.
This is another example where some did not read the question carefully. More photosynthetic pigments allow absorption of more wavelengths of light. The extra pigments do not, however, allow absorption of green light. Even if plants were able to absorb such wavelengths, they would not 'widen the range' but would fall within the range already absorbed.

Q.2 **(a)** **(i)** Many lost marks through not reading the question carefully. The stem states the source of this image i.e. the oviduct, so candidates should have been aware that these are cilia not microvilli.

(ii) Most were able to accurately measure the width W, but an incorrect measurement only lost one mark, if the written working took into account the conversion to µm and division by the magnification.

(b) **(i)** Although the internal structure of cilia is not required in this specification, candidates are expected to recognise the overall shape of cilia and, consequently, to recognise that the sections in Images 1 and 2 are perpendicular to each other. Given that Image 2 is described in the question as a transverse section, the words longitudinal or vertical were accepted as a description of Image 1.

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Describing the sections as 'in different planes' was allowed as an alternative. Candidates' knowledge of villus structure might have indicated to them that Image 2 is not a villus. Some might then have reappraised their answer to (a)(i).

(ii) As with (a)(ii), an incorrect measurement only forfeited one mark. Full credit was given even if an incorrect answer from (a)(ii) was incorporated, as long as the working showed conversion of the measurement to µm and division by the measurement calculated in (a)(ii).

(iii) Light and electron microscopes 'focus' and 'magnify' but do not 'zoom'.
The terms resolution or magnification should be used in preference to 'power', which could mean either.

(c) **(i)** Candidates frequently do not distinguish between microvilli, villi and cilia and so lost this mark by citing parts of the small intestine for this answer.

(ii) Cuboidal epithelium was rarely seen as an answer, despite its presence in the Teachers' Guide.

Summary of key points

- Candidates are reminded to use the space provided as a guide to the length of their responses.
- The context of the question should be considered when answering that question.
- Candidates are reminded of the necessity for good English/Welsh in their responses.
- Centres are reminded to read thoroughly the information documents received prior to the practical examination being carried out.

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