GCE EXAMINERS' REPORTS

GCE (NEW)
BIOLOGY
AS/Advanced

SUMMER 2018

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BIOLOGY

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UNIT 1

Generally, the paper was well attempted by many candidates. The quality of written communication should be emphasised particularly in relation to the inclusion of key terminology. The importance of spelling and clear handwriting should also be emphasised. Centres are reminded of the importance to spell awarding body prescribed terms such as meiosis and mitosis correctly, but also highlight the need to ensure responses are not a different biological term, for example, ethanol was often written as ethanal, amylose and amylase. In these instances, it can be difficult to determine an 'o' from an 'a' and could make a significant difference to some answers.

A weakness in responses was evident for questions that assessed AO3 and evaluation of practical procedures. Responses for a control experiment and a fair test were often confused and additional guidance on data analysis would have benefitted several students.

In several instances, there was evidence that candidates had clearly read through their answers and written in additional information, often securing marks, which was pleasing. However, some of these additions were difficult to read due to where they were inserted, or the size of the writing where responses were squeezed into the original text. Similarly, candidates should be informed to re-write corrections more clearly and not around the incorrect answer that has been crossed out. Candidates should take greater care when labelling their answers written on the additional pages.

When requiring additional space, care should be taken to ensure the additional pages are used and avoid using the lines provided for the extended response.

Q.1 (a) Answered well by nearly all candidates. A minority of candidates incorrectly identified ribosomes as rough endoplasmic reticulum as they did not appreciate that the purpose of the multiple arrows.

(b) (i) & (ii) There were a significant number of candidates that were unable to give the correct function of each organelle or cell feature. Candidates were not required to identify each structure, but were penalised if when named the structure was not correctly matched to the function.

(ii) Candidates often incorrectly suggested that RER synthesises enzymes. They failed to understand that enzymes are not activated until within the Golgi body. It was often unclear which vesicle the candidate was describing and poor written communication in this question was a hindrance to the allocation of marks. An example of this, is that it was often indiscernible whether the candidate understood that the contents of a vesicle left the cell during exocytosis or were suggesting the vesicle itself passed across the membrane. Another example would be a lack of clarity to which membrane within a cell the vesicle was fusing.

(b) (iii) Although nearly all candidates were aware that mitochondria produced ATP, a significant number of candidates were unable to link the requirement of ATP to a correct function. Many used vague terms such as 'use for energy requiring purposes' and very few appreciated that exocytosis is an active process or simply included the question stem. A minority incorrectly identified the mechanism of transport as endocytosis.

Q.2 (a) (i) Nearly all candidates were able to identify and name the phosphate group, but surprisingly many candidates did not secure full marks for this question. Exam technique may have played a role here, with candidates failing to appreciate the significance between the request for a name as opposed to generic terms. Many gave incorrect answers such as pentose and nitrogenous base. Some candidates confused adenine with adenosine.

(ii) Poor exam technique meant many candidates failed to secure a mark. The question requested two uses for the mark and candidates should be reminded that emboldened words should be used to guide their responses. Common errors including stating the use of ATP in animals. Other answers were too vague and did not demonstrate sufficient knowledge of A level content; growth and repair were not credited.

(b) Many candidates successfully navigated the calculation and secured 3 marks. Some candidates did not know how to give their answer to 3 significant figures. Candidates that struggled with the full calculation were often able to secure 1 mark for multiplying 30.6kJmol 1 by the number of molecules.

Q.3 (a) Candidates were not confident in answering this question. Many only gave one letter / cell. Candidates are reminded to use the stem and the marks allocated for the question (in this case 2) as a guide to how much they should be including in their answer. Candidates who gave multiple letters often negated a mark point by incorrectly including a fourth incorrect letter. Most letters made equal appearances across the cohort of papers, again indicating confidence in interpreting and understanding the terms haploid and diploid is low.

(b) (i) Satisfactory attempts at this question.

(ii) Improved exam technique would have assisted several candidates. Many began to discuss asexual and sexual reproduction when the entire question was about distinguishing between mitosis and meiosis. Some candidates were not able to spell the types of cell division correctly.

(c) (i) Candidates were able to identify that different cells may be in different stages of the cell cycle and that the events of these varying stages would have a bearing on the mass of DNA. Candidates that gave full responses and stated specific cell processes (in this case DNA replication) and phases, not just a type of cell division secured full marks. Some candidates did not have an appreciation that the DNA mass during interphase would be different at the end when compared to early interphase, others are not clear on the importance of stating DNA replication (as opposed to DNA synthesis) to explain the doubling of DNA mass.

Q.4 (a) (i) Most candidates correctly indicated the formation of water and many candidates were able to correctly draw the peptide bond formation. Accurate transcription of the amino acid molecules was also required to secure the mark.

(ii) Some candidates were not able to correctly name the bond formed between two amino acids; ester, glycosidic and hydrogen were common.

(b) (i) This question was not answered well. Most students gave incorrect answers and when given, the spelling of the required answer, quaternary, was questionable but not critical to the mark point (phonetic spelling was acceptable). Once again, candidates are reminded to use the stem of the question to assist them when answering the question.

(ii) Answered well

(iii) Several students appeared to unfamiliar with the one gene – one polypeptide hypothesis and were unable to determine the link to secure a mark for this question. Additionally, whilst some students may have correctly identified that 2 genes were necessary, an incorrect conclusion was provided. Often students were mistaken in thinking this question was asking them to explain the degenerate code.

(c) (i) Not well answered by candidates. A significant number of candidates understood that this question related to the triplet code but had divided the number of nucleotides by 3 to give an incorrect answer of 40.

(ii) There were some excellent answers amongst the candidates, but it was clear that this was not a well understood area of the specification. A minority of candidates confused this with alternative splicing whilst others incorrectly discussed the degenerate code for amino acids. Terminology was poorly understood and therefore used incorrectly; introns and exons often being confused with codons and anti-codons. A significant number of students attempted to explain the difference in mass by the differences in purine and pyrimidines.

A significant number of candidates were unclear about where in the cell the removal of introns occurred or that some may remain. Poor communication often suggested that introns might remain in the polypeptide chain or that the production of mature mRNA occurred after the polypeptide chain.

Q.5 (a) Many candidates secured one mark, either commenting on the ability to compare data or that the worms would have different masses at the start. A significant number of candidates incorrectly gave answers relating to the validity of data. Several candidates only gained one mark, for one correct comparison; inclusion of two different observations and comparison between the two worms was required for full marks.

(b) (i) The markscheme is consistent with that of the practical assessment and required the same degree of accuracy. Candidates should be reminded that in biology, whilst it is still acceptable to draw a curve of best fit, standard practice is to connect data points with a ruled line that enters and leaves the centre of each point. Where data at the origin is provided, it should clearly be plotted at 0,0 and because of this, a scale break would be inappropriate. Although, one singular zero was allowed where clearly situated on the diagonal, it is not an advised technique. It is not advisable to use increments of three to scale as this makes it difficult to plot within an acceptable degree of accuracy.

(ii) This question was attempted well by most candidates. A minority gave only a description, or an explanation and students would benefit from further guidance how to answer questions on interpreting graphical data. Although candidates appreciated that the rate of percentage change decreased over time, very few were able to correctly explain why. A range of ways to explain osmosis were credited including correct description of solute or water potential, but simple reference to concentration gradients were insufficient. Students who consistently referred to appropriate terminology secured full marks. Clarity over which seawater the candidate was referencing was required to secure marks as undiluted seawater would have produced the opposite results.

(d) (i) Many candidates secured both marks for this question. Some candidates had failed to identify which worm they were referring to in their answer or they failed to include a comparative statement.

(ii) Overall, this question was answered quite poorly. Some candidates did not give their answer in the context of the question. Whilst they correctly deduced that the external water potential was lowered by the pumping of ions out of the cells of the worm, this is not why the worm actively pumps ions, rather that the worm increases the water potential of its cells to promote water movement by osmosis. Good answers detailed the advantage of the worm to remove ions, which is to increase the water potential in its cells, to create an osmotic gradient down which water leaves the cell by osmosis. Some candidates failed to secure two marks as they did not include the name of the process by which the water moves. Many candidates incorrectly inferred that the loss of ions was the direct cause of mass loss.

Q.6 (a) (i) Answered well.

(ii) Many candidates secured a mark for this question. However, the quality of some drawings was poor. The degree of accuracy was not expected to be in line with plotting and drawing graph skills, but failure to connect a single line carefully at either end of the given line was penalised. Many attempted to show the continuation of the line beyond where it joins and therefore the line appeared to increase or decrease the energy and was therefore penalised.

(b) This was surprisingly quite poorly answered, with many candidates failing to include key terminology to describe enzyme action. Again, exam technique in understanding the layout of exam questions might possibly have assisted the candidates in understanding how to answer the question, as many candidates discussed the role of an enzyme in reducing activation energy from part (a); as this was part (b) the candidates were required to write about a related property of an enzyme but different from the content covered in part (a).

Some candidates misuse the words specific and complementary. Many candidates failed to state that alcohol dehydrogenase was specific to its substrate.

(c) (i) A significant number of students did not know how to calculate a gradient.

(ii) Many students were able to compare the rate at P and Q successfully, referring to the concentration of substrate / ethanol at each region of the graph. Good answers included reference to the limiting factors which were affecting the rate and of these the understanding of how enzymes limit the rate was poorly understood and rarely seen.

(d) Many candidates were able to recognise that ethanol was a competitive inhibitor and that the rate of ethylene glycol production was reduced. Few candidates were able to communicate the mechanism of competitive inhibition well. Weaker responses also failed to use the labels of the x-axis correctly and suggested that the amount of ethylene glycol produced was decreased or not produced at all. Only a minority of candidates stated that the substrate and the inhibitor must have similar shapes. Use of key terminology to secure marks was poor. Weaker responses did not relate the answer to the example given in the question. Many assumed that the loss in mass was due to the loss of ions.

Q.7 The essay was well answered overall, with many candidates securing answers in the top band. Better answers included detailed descriptions of the structures of both starch and triglycerides, including the correct monomer units, bonds and structural arrangement. Functions for both were included and many students secured high marks in this top band for excluding irrelevant information.

Students who failed to give structures for both starch and triglyceride were only able to secure a mark in the middle category.

Starch was better understood than triglycerides, both in terms of knowledge of structure and function. A significant number of students included information about cellulose, chitin or discussed the functions of lipids in relation to other areas of a plant (leaves) or even included uses in animals.

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UNIT 2

General Comments:

It is pleasing to note that teachers have taken on board the requirements of the new specification and are guiding students in an appropriate manner. It is also apparent that students found the majority of questions accessible; there being very few questions not attempted.

There was no indication that candidates were limited by time on this paper. However, it is of concern that many paid insufficient attention to the information given in the stem and to the question requirements, so affecting the quality of their answers.

If they run out of space, there is still a tendency for the candidate to continue their answer in the margin or at the bottom of the page. Nevertheless, those who correctly used the continuation sheets tended to accurately number their responses.

Specific comments:

Q.1 (a) (i) The stem of the question provided information regarding the pH of the two streams and the similarities between them. However, many candidates chose to give these as responses. It was also common to see references to similarities in the method. A number referred to "amount of light" rather than light intensity/exposure and "mineral/oxygen content" rather than concentration.

(ii) Most recognised that something to do with force of kicking needed to be controlled but many felt that this could be achieved by using the same person. Many stated that the same sized net should be used – again information given in the stem.

(iii) Most candidates stated that alcohol would kill the specimens but few recognised the possible effect on biodiversity, etc.

(b) (i) Although many recognised that random sampling removed bias, a significant number negated their answer by stating that this made it a fair test or more accurate / reliable / valid.

(ii) Well answered in general.

(iii) Well answered by most. Some neglected to subtract the calculated value from 1, and some incorrectly rounded 0.699 to 0.69.

(iv) In questions that require a comparison, candidates should be encouraged to make clear which factor they are describing. They should not expect the examiner to do their work for them.

Ideally this question would be answered using the terms species richness and species evenness. These terms were rarely seen. Many answered, incorrectly, in terms of total numbers of organisms.

(c) (i) Many recognised the need to repeat the investigation but without mentioning different sampling sites / different streams. There were a number of vague answers referring to different forest areas.

(ii) Well answered by most.

Q.2 This question required candidates to demonstrate and apply their knowledge and understanding of various modes of nutrition. Some were unable to do so. There were a number of interesting spellings.

(a) (i) Many stated heterotrophic. This was only accepted if they went on to state holozoic.

(ii) Poorly answered in general. Answers lacked precision; the terms nutrients and food were common. Many felt that *Chlorella* provided enzymes for the digestion of prey.

(b) There were some good responses here. Many recognised that *Nostoc* or *Nitrosomonas* were autotrophs; but not both. Most recognised *Nostoc* as being photosynthetic but were less confident with chemosynthesis in *Nitrosomonas*.

(c) Again there were some good responses. However few recognised that both organisms were heterotrophic.

Q.3 (a) There were some wonderful spellings of phylogenetic accepted here.

(b) (i) Most were able to identify diagram B and explained their answer using information in the table.

(ii) Candidates either knew the meaning of the term or did not. Most did not.

(c) It is understandable that some candidates might name a different group in the taxonomic hierarchy. Of greater concern is the number that did not – there were a large number of mammals and cetaceans.

(d) (i) Essentially the candidates are required to describe a trend in a graph. The question clearly asks for a description of the effect of latitude from the **Antarctic circle** to the **tropics**. Many decided to describe the effect from the Arctic circle, or to describe the change in the reverse direction. Many felt that latitude increases towards the tropics. It is common to see responses that don't fully describe the trend – so few described the levelling off in the tropics.

(ii) Well answered by the majority.

(iii) It is a requirement of the mathematical skills that candidates understand the meaning of mode. The vast majority did not.

Q.4 (a) (i) Most candidates appear familiar with gill anatomy. However, it appears that many are unable to distinguish between filaments and lamellae.

(ii) Unfortunately, there were very few correct responses. The majority felt that gill rakers, in some way, support the gills, or that they increase surface area.

(iii) There were a number of pleasing responses here. However, once again, many failed to read the question and chose not to use the photographs, instead deciding to describe counter current flow and ventilation mechanisms. Very few recognised the need for water for diffusion of gases.

(b) Straightforward factual recall and well answered by the majority of candidates. Incidentally, many candidates stated that cartilaginous fish need to continually swim in order to ventilate their gills – this is true of only a small number of species.

(c) (i) & (ii) A high number of candidates correctly identified the graphs but some went on to incorrectly insert arrows on graph A.

(d) (i) & (ii) Well answered by most candidates.

(iii) Well answered by the vast majority of candidates.

(iv) Well answered in general.

Q.5 (a) (i) Well answered by most (although there were a fair number of electrocardiographs)

(ii) Most candidates correctly calculated the heart rate from the graph. A number multiplied 60 by 0.8.

(iii) Most candidates were able to link the stages in the cardiac cycle to the P wave, QRS complex and T wave. Fewer made any reference to depolarisation and repolarisation. Since an ECG measures electrical activity then candidates were required to refer to electrical impulses / signals when describing the roles of the SAN and AVN. A number described the events occurring during the stages of the cardiac cycle – not required by this question.

(b) Most got the first point about the distance being shorter. However, many stated that the actual P waves were shorter (despite being told in the stem that there was little change), this possibly due to lack of clarity of communication more than anything else. Very few got the second point. The question asks “how” the distance would differ – most candidates attempted to explain “why” and referred to increased heart rate / oxygen requirement.

(c) (i) It appears that many candidates did not refer back to the original ECG in order to “spot the difference”.

(ii) Many candidates correctly named a region of conducting tissue. However, a similar number chose to name heart chambers / blood vessels.

(iii) Again, it appears that many candidates did not refer back to the ECG illustrating a First Degree Heart Block. Those that did gave correct responses. Very few used the term bradycardia. There were lots of heart attacks.

Q.6 There was a spread of responses to the QER question.

The majority of candidates were able to explain the meanings of mesophyte, xerophyte and hydrophyte. However, some explanations lacked precision: e.g. mesophytes live in “normal” or “temperate” conditions, and hydrophytes live in conditions of “plentiful water supply”.

It is a requirement of QER questions that they should cover more than one Assessment Objective and not be entirely recall. Hence candidates were required to describe and explain adaptations of leaves of *Pinus* and *Potamogeton*, instead of *Ammophila* and *Nymphaea*. The vast majority ignored this requirement and wrote about general adaptations of xerophytes and hydrophytes.

In order to achieve the top band for a QER question the account should have “no irrelevant inclusions and no significant omissions”. This was less of a problem for *Potamogeton* since the adaptations are similar to those of *Nymphaea*. For *Pinus*, inaccuracies such as rolled leaves, hairs, root systems, etc made it impossible to achieve full marks.

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UNIT 3

There was a range of standards seen in many of the answers but all of the marking points were seen during the marking process. The standard of the mathematical responses has improved which is a testament to the work of the teachers and students in this area. Once again, there were no questions referring to planetary boundaries but some students were determined to write about them in their answers. There were some candidates who wasted a lot of time, space and ink rewriting the question before they answered. The annual problem of students writing parts of their answers in random places with asterisks and incorrectly labelled question numbers will never be solved!

Q.1 This question was designed to be a gentle introduction and allow students to gain some marks before the more difficult questions and so it proved. Most gained at least one mark for the diagram. There were some odd ideas as to where the cell bodies are and many were not labelled despite being asked to do so.

In b(i) there were many answers referring to a "nervous net" or "hydra net". b(ii) was usually well explained.

Q.2 It was pleasing to see the vast majority of candidates calculating the percentage and presenting the answer in standard form. Part b was also answered well but some just referred to the Gram negative part and didn't state what is meant by a bacillus bacterium. The calculation was often answered well. For part c(ii) the credit was for too many/few colonies or merging of colonies, not bacteria.

For part d, candidates spotted that a lower concentration of azithromycin was needed to kill 100% of the bacteria so less is needed. For the second mark many pointed out that this will be cheaper or more cost effective, but some also wrote that if less is used, it is less likely to lead to antibiotic resistance.

Q.3 A lot of candidates did realise that the decomposers respired and released the carbon dioxide for 3 marks. Some referred to carbon in molecules in the dead insects and faeces that are used in respiration. Credit was given for the ants respiring and releasing CO_2. A sizeable minority of candidates referred to "respirate" and several had insects being decomposed by ants. A lot of students referred to just carbon being released but not as carbon dioxide, and a disappointing number referred to the carbon or carbon dioxide being taken up by the roots of the plant.

In 3 a(ii) many candidates had the idea that decomposers release ammonium (not ammonia) but some had this being converted directly to nitrate, neglecting the nitrite step. If the bacteria were referred to as nitrifying it was enough for that mark. The names of the bacteria are not needed in this specification. Unfortunately, a large number referred to nitrogen fixation.

(b) It was very disappointing to see carbon dioxide being released in photosynthesis or used in respiration.

Q.4 For 4 a (i) there were 2 marks, so the candidate had to explain the reason for ice-cold *and* isotonic. 'Ice-cold stops reactions' was not enough for credit. The isotonic solution stops the chloroplasts lysing; the stem of the question tells the candidate that the chloroplasts have already been extracted so stops cells lysing doesn't gain credit.

Once again some candidates did not seem to realise the difference between reliability and accuracy.

For parts a (iii) and b many candidates were not precise and contradicted statements made earlier in their answers. Those who understood the question often gained good marks. It could be that they have carried out the practical. In part b the candidates had to write where the electrons are released from and that they reduce the DCPIP.

In part c the candidates had to spot that in the dark (tube 2) there was no photosynthesis but there is still respiration.

In part d) a large number of candidates were writing about carbon dioxide not being a limiting factor or other factors were limiting photosynthesis. Some candidates gave a long, detailed description of the Calvin Cycle.

Q.5 Many candidates spotted that the black plastic would prevent photosynthesis but did not go on to explain why the mass would then fall. Credit was given for any molecule that the grass would use up during that period. There were some tortuous answers about condensation forming under the plastic so water was lost from the grass but failed to understand that the question refers to dry mass.

Q.6 It is appreciated that there is a lot of information in this question but it is useful in answering it. It is stated that cytochrome oxidase is an enzyme but large numbers of candidates wrote about the active site of the cytochrome c for part b.

Unfortunately in part b quite a few students believe that if pH increases the conditions become more acidic. It is basic science that is sometimes forgotten in exam conditions.

Part d was well answered by students who understood the electron transport chain and could answer in context of the chemical being added.

Q.7 (a) The question tried to help candidates with magnification by supplying a scale bar and referring to it. Sadly some candidates did not use it and measured all sorts of things, one of which was 1.5m long!

Most candidates could carry out the simple calculation. In b (ii), the blood or plasma proteins (not amino acids) should have been referred to. Many students managed that part and then wrote about the lack of them makes the water potential lower or increases the osmotic pressure which was wrong. In b (iii) some candidates wrote about the arterioles dilating and constricting but did not refer to which arteriole.

For part c many candidates wrote about proteins not being forced into the capsule in the filtrate so cannot be reabsorbed. This was despite the question stating that the "membranes ….. are damaged and they become more permeable to proteins". So the problem is not being able to reabsorb them.

It was pleasing to see so many students understand the concept of $y = mx + c$ and being able to plot the points on the graph.

In e (i) "Make" energy was not credited. In e (ii), the students needed more than just "gives a larger surface area", they needed to state what for.

The better candidates answered part f in terms of the fish in water then in the mud. In water the ammonia needs to be diluted, but as they are in water there is a lot f water to dilute it. In mud the fish needs to conserve water and so forms urea as it needs less water for excretion. It can also be stored as it is less toxic than urea.

Q.8 The "essay" question varied widely! There were some excellent answers which gave reasons for the population trends in each area of the graph. There were too many answers that just listed factors without explanation. Some mixed up biotic and abiotic factors. The best answers gave density dependent (with explanations) and density independent factors (with explanations).

It is appreciated that candidates may not know about the grasslands of Africa and so many reasons were accepted for the decline in population. However, build-up of toxic waste was not one of them.

The most pleasing aspect of the essay was the reasons for the rise in cheetah numbers. There were many fully explained reasons given, but some candidates just gave a list of conservation measures. "Sperm-banks are set up" does not explain the rise, neither does "conservation takes place". The strangest answers referred to seed banks.

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UNIT 4

Examiners report.

There has been a significant improvement in the use of the additional pages at the end of the examination booklet but it is important to emphasise to candidates that they should indicate that an answer is continued on the additional pages and ensure that it correctly states which question the answer refers to.
Candidates found the paper accessible. There was a wide range of marks on the paper and an increase in the mean by 6 marks.

Q.1 (a) (i) Most candidates were able to correctly identify structure A as a thecal cell but structure B did cause some problems the most common being to incorrectly state secondary oocyte.

(ii) In almost all cases correct responses were given.

(b) The majority of candidates stated Zona pellucida and Corona radiata as the two layers on the outside of the secondary oocyte but there were a significant number of candidates who stated endometrium and myometrium!

(c) Most candidates referred to the acrosome and enzymes but lost marks by imprecise or incorrect statements such as ‘enzymes dissolve’, ‘enzymes digest the ovary wall’, ‘cellulases digest the outer layers’ and ‘the acrosome releases acids which make a hole.’.

(d) (i) An excellent understanding of the Cortical reaction was shown but giving a reason why the risk of polyspermy is increased with IVF acted as a very good discriminator.

(ii) All points in the mark scheme were seen and coherent, well argued responses often given.

Q.2 (a) (i) An alarming number of candidates stated that the variation shown was discontinuous.

(ii) B was almost always correctly identified as the mode and the difference between the terms mean value and modal value were correct. Marks were lost by stating that ‘the mode is the highest value’

(b) Many excellent well organised responses were seen. Common errors were referring to genes rather than alleles and by not inferring that it is repeated over several generations.

(c) Many candidates did not state that cross pollination or cross fertilisation could not take place. All other points on the mark scheme were commonly seen, but I must admit not always on the same script!

(d) (i) The type of competition between sweet vernal grass and common bent was incorrectly identified, by many, as intraspecific competition but most candidates correctly gave two factors for which these plants compete.

(ii) Many candidates do not understand the difference between the terms density independent and density dependent.

Q.3 (a) (i) Several candidates did not state the phenotype and genotype of the parents but were able to correctly complete a Punnett square.

(ii) It is obvious that many candidates do not understand the concept of a Null hypothesis. Calculation of the chi-squared value caused very few problems.

(iii) Most candidates were able to relate their calculation of the chi-squared value to the critical value and, in this case, reject the Null hypothesis. Some candidates considered that the degrees of freedom was 2 and hence incorrectly stated that the critical value was 5.99.

(b) (i) Most candidates correctly completed the Punnett square and gave a correct phenotype ratio but some gave 3 : 5 but omitted to state which colour each figure referred to.

(iii) A surprisingly large number of candidates considered that hypothesis 1 was more likely to be correct as the chi-squared value was bigger.

(c) Many candidates found difficulty in expressing themselves but there an obvious understanding shown and they got there in the end!

Q.4 (a) Many candidates did not appreciate that the umbilical artery came from the foetus and the umbilical vein went from the placenta back to the foetus. In consequence, although four differences were stated, they were the wrong way around.

(b) The majority of candidates were able to give two reasons why there must be a barrier between foetal and maternal blood systems.

(c) (i) Many candidates correctly related the high arterial blood flow to the placenta to the maintenance of the concentration gradient.

(ii) Many excellent responses but a significant number incorrectly stated that it would force blood out.

(iii) ‘Large surface area for exchange’ was the most common response but there are many who referred to a large surface area : volume ratio.

(d) (i) Excellent responses.

(ii) There were difficulties in the expression of the answer but most realised that a different primer would be required for each strand.

(iii) Very few candidates were able to clearly state that the use of a primer to specific gene would enable only this gene to be amplified/copied.

(iv) Most candidates were at a loss to give a correct response to this question but some excellent answers were seen.

(v) Many candidates thought that the data referred to the number of genes on chromosomes, rather than the number of genes with the fluorescent marker indicating how many chromosome 21’s and control chromosomes were present. Large numbers of candidates did refer to the similar ratios in A and B and the much higher ratio in C and linked this to trisomy of chromosome 21 and made the link to Down’s syndrome.

(e) The vast majority of candidates gave two concerns relating to the ethics of prenatal diagnosis.

Q.5 A surprising number of candidates did not attempt this question or wrote just one or two sentences.

Very few candidates were able to state and explain the conditions required for germination and thought that the response should include reference to the conditions required for the growth of plants in general including details of rhizobium in root nodules and the nitrogen cycle. Some candidates confused seed germination with seed dispersal and there were many references to the germination of pollen grains, correct but alas completely out of context!

Many candidates gave excellent accounts of germination of the barley seeds with detailed descriptions of the role of gibberellic acid. There were many references to the enzymes involved in germination. Many candidates clearly stated that proteins were hydrolysed into amino acids by proteases but considered that amylase hydrolysed starch into glucose, sugar or sucrose but rarely maltose! It was not generally stated that in a peanut seed the food reserves are in the cotyledons and that it was an example of a non endospermic seed. Many candidates gave detailed accounts of phototropism and geotropism.

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UNIT 5

UNIT 5 – Practical examination – Experimental Task

Teacher Awarded marks:

Nearly all candidates gained both marks for measurement of volumes and time. Some marks were left blank for a small number of students. These were taken as no mark awarded by the teacher unless these marks were left blank for a whole centre.

In some cases, no mark was awarded for timing when the student recorded times which were not to the nearest second. Teachers need to be reminded to make sure that there are no oversights in recording these marks and that it is the skill of timing that that they are assessing, i.e. in this case that they timed how long it took for the disc to hit the surface of the peroxide, sink and return to the surface and **not** their ability to record data correctly.

(a) Table

Headings: Many candidates lost a mark here because of a lack of detail or incorrect statements for example:

- concentration
- volume
- time
- time to rise
- no indication of which results were with water or with $CuSO_4$
- concentration of H_2SO_4
- mean given as a separate column but not stating mean of what

Units: The unit of concentration for H_2O_2 was given as **vol** in the method so it was disappointing to see so many state this unit as cm^3, volume, mol dm^{-3} or giving no unit whatsoever.

The unit of time is **seconds** or **s** not secs / sec or variations thereof (bu eiliadau / e yn dderbyniol ar sgriptiau Cymraeg)

Readings: For many years, time has only been accepted when recorded to the **nearest second**. Many candidates recorded their results to 1 or 2 decimal places, or even in minutes and seconds. Many teachers also submitted their own results with 1 or 2 decimal places. This is not a new requirement and is stated in the student Lab Book.

Students were asked to construct a table to include all their results and the means – many gave only their means.

Means: The mean of readings recorded to the nearest second should be to the same level of precision but was accepted to 1 decimal place. Consequently, means calculated to two decimal places were not accepted. Moreover, there were many rounding errors still being made.

All readings supplied by teachers followed the expected results with times decreasing as concentration of peroxide increased. A surprising number of students had readings which got slower with increasing concentration. It is suspected that they have not read the instructions correctly and recorded their readings against the wrong concentrations. They were not penalised for this but it did impact their ability to gain marks in part (c).

(b) Graph

Axis labels: There were many instances of error carried forward here but some students gave correct labels here even though their tables were incorrect. They were asked to plot the mean times but many did not include **mean** in their y axis label.

Axis units: Again, many instances of error carried forward but many gave correct units in the table which were not used to label their graphs.

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

Scales: The main problems were the lack of numbers at the origins of the axes. There were a surprising number who inverted the x axis on their graphs.

Plotting: Very few issues here unless odd scales were used. The students were told 'No range bars are required' and yet many included these.

Line: Some students are still not drawing lines with sharp pencils and others did not draw lines through the centre of the plots. Most marks were lost by not labelling or identifying which line was with water or $CuSO_4$.

In the absence of a data point, the graph line should not be projected back to the origin.

When two data sets are plotted on a single pair of axes, a key or line labels are essential, and their lack was penalised.

(c) (i) Conclusions

It seems that the majority of students are unwilling to state that they can neither 'agree nor disagree with the conclusion' and seem to assume that an experiment has to give a correct answer.

The results of nearly all students showed that as concentration increased, the time taken to sink and rise decreased with both water and $CuSO_4$ but that the times with the inhibitor were slower. This is what you would expect if the concentration of H_2O_2 is not high enough for the time with inhibitor to plateau. This was, however, seen in a few cases only.

For **Test 1**, most students stated that they agreed with the statement that $CuSO_4$ was acting as a non-competitive inhibitor even when their results obviously disagreed with the statement, and they were unable to explain their answers. Even if they disagreed with the statement, this was not explained in terms of times still decreasing at higher concentrations of substrate. Some students, whose results showed clear non-competitive inhibition disagreed with the conclusion. Many just stated that $CuSO_4$ acted as an inhibitor. Very few stated that their results were inconclusive or were able to explain why.

For **Test 2**, similar statements were made but were comparing their results to the statement that $CuSO_4$ was acting as a competitive inhibitor.

Most students do not apparently understand the relationship between the usual graph showing the effects of competitive and non-competitive inhibitors on the **rate** of an enzyme-catalysed reaction and the effect of these inhibitors on the **time** taken at increasing concentrations of substrate.

As the question refers consistently to 'time', rather than 'rate', all answers should be in terms of 'time'.

(c) (ii) Inaccuracies

Most students gained at least one mark on this question. Attempts were made to give credit for suitable sources of inaccuracies and improvements. However, the lack of details cost marks, e.g.

- temperature — no statement that temperature varied or that it should be controlled using a controlled temperature water bath
- pH — again did not state that pH could vary during the course of the reaction
- contamination — they were told to wash forceps but this was given as a source of inaccuracy
- enzyme — did not relate this to the yeast / potato extract settling.
- concentration — some suggested using a machine to spread the same 'amount' of yeast on the paper disc

Many referred to timing and use of stop clocks only accurate to the nearest second (even though their results were recorded to 2dp in several cases!). The use of light gates, computers, video replay are just some examples of how this could be improved but usually lacked any creditable detail. Human error was given by many.

(c) (iii) Reliability

Most c gained the mark for repeating the experiment to improve the reliability but there were still candidates who then stated that this will provide more accurate means rather than more reliable means or improving confidence in the means.

Only a few actually referred to their actual results in sufficient detail to gain the second mark. General statements were made about all results being the same, all results being close, not much variation etc., with no reference to repeats at different concentrations. Indeed, many statements that results were reliable or unreliable were in complete contradiction to their results. Many referred to anomalies even though you cannot identify an anomaly from two readings.

A considerable number referred to their means following / not following the trend. This is not what the question is asking. Commenting on overlaps in the results at different concentrations is not commenting on the reliability of the mean.

There has been no change in the standard of what are acceptable answers to the questions asked on this paper. While improvements are obvious in the standard of table construction and graph drawing, the standard of many answers regarding inaccuracy, reliability and reaching conclusions seems lower than those given in practical examinations under the old specification. This raises the question whether students are gaining enough practical experience during the course of Year 12 and 13.

Practical Analysis Task

Q.1 (a) Examiners were surprised that some candidates did not seem to understand the word 'irregular' and that some did not take account of the scale provided and so, for either reason, misidentified A and C.

Answers should quote the fate of leaf miners as given in the key, rather than showing the route by which they made their decision.

(b) (i) The consequence of the hazard should have been described, so an answer should say, for example, not merely that the holly leaves have sharp spines but that the sharp spines are liable to pierce the skin.

(ii) Many candidates incorrectly suggested that the nutrient status of the holly plants and their susceptibility to attack by predatory birds or parasitic wasps were rendered identical by the genetics of the holly. Few appreciated that an identical genetic composition would result in the host plants having the same susceptibility to leaf miner attack or that they would be attacked by the same species of leaf miner.

(c) (i) Most candidates were able to calculate χ^2 correctly although a disappointing number gave a negative answer having squared a negative number.

(ii) Many candidates did not recall how to calculate the degrees of freedom in χ^2 test, and gave (number of categories) rather than (number of categories-1).

(iii) An error carried forward was used in this answer for those candidates who had incorrectly calculated the number of degrees of freedom.

A surprising number of candidates did not seems to realise that the χ^2 test can be used in situations other than testing for Mendelian inheritance and, consequently, modelled the terminology of their answers on that used in genetics problems.

In interpreting the calculated value of χ^2, some candidates stated merely that there is 'no significant difference'. An interpretation needs to give more explanation than this and should be extended to state that 'there is no significant difference between the numbers of holly leaf miners dying at each developmental stage'.

(d) Candidates are encouraged to be specific in their writing. In this question, it is unclear if 'a larger sample' refers to leaves, trees or leaf miners and so to gain credit, 'a larger sample of holly leaves' was a preferable answer.

(e) (i) This question tested whether candidates were accustomed to considering how to control variables in field work experiments. It asks what 'can' be controlled, and so relevant answers referred the choices to be made when choosing suitable plants for data collection.

(ii) As above, candidates' lack of specificity was penalised, for example, 'more predatory birds' was needed, rather than 'predation'; 'more nutrients for holly trees' rather than 'nutrients' and 'disease in holly trees' rather than 'disease'.

Question 2

Q.2 (a) Examiners were disappointed that many candidates were unfamiliar with the features they were asked to label.

As stressed in Examiners' Reports over many years, label lines should be drawn with a ruler and should end within the structure being labelled, not just touching its edge.

(b) (i) The simplest way to answer this question was to read epu directly from the scale given. Many candidates measured the scale in mm and calculated a conversion factor, which they applied to the pollen grains, which had also been measured in mm. In many cases, their calculations were arithmetically incorrect.

In addition, many did not read the question carefully enough and gave their answer to the nearest whole umber or to 2 dp.

(ii) Most candidates were able to calculate this correctly.

(iii) Many candidates unnecessarily used an I/A/M triangle and divided the correct answer by 10, suggesting that they had not understood the significance of the two previous calculations.

Candidates are advised to develop the habit of considering whether their numerical answers makes sense or not.

(c) (i) This question tested candidates' experience of using a microscope. Some gave unrealistic answers e.g. x1000. Some gave unlikely answers e.g. x30, x50.

(ii) In writing about the pollination of *Triticum* flowers, candidates failed to gain marks if their use of pronouns made the sentence unintelligible e.g. suggesting, correctly, 'it' is wind pollinated but using the same pronoun (it) to refer to the pollen as light.

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