



GCE EXAMINERS' REPORTS

**GCE (NEW)
BIOLOGY
AS/Advanced**

SUMMER 2017

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GCE BIOLOGY (NEW)**

SUMMER 2017

UNIT 1

General comments:

The paper was tackled well by many candidates, with good attempts across all assessment objectives. Particularly pleasing were candidates responses to application of knowledge, which demonstrated sensible considered responses. Factual recall answers were often answered poorly. Mathematical calculations proved to be good differentiators with a fair application of marks across all three questions.

Practical skills were lacking however, with answers to this question reading notably poorer than clips from other questions. Centres and therefore, candidates, are reminded that practical skills are still assessed within a theory paper despite candidates also being assessed on a separate practical paper.

New material to the specification appeared to be less well understood.

Centres are asked to remind candidates of the need for legible handwriting. The use of ball point pen, as indicated on the front of scripts, is also strongly advised to improve the quality of scanned images.

Specific comments:

- 1 (a) (i) Disappointingly, many candidates made reference to structures within the digestive system and less frequently the fallopian tubes. A significant number of candidates were uncertain of their function.
- (ii) Many candidates identified this image as a tissue due to only one cell type being shown. Many were not able to communicate this idea clearly, using ambiguous terms such as 'similar' or 'group' with others giving that they only had one function or the same function as a reason to explain that the image shows a tissue. Candidates who included an organ in their answer, did do well, but a minority of answers failed to use evidence shown in the image to secure a mark.
- (b) (i) A concerning number of candidates were unable to answer this question. Errors ranged from repeating the example in the stem to suggesting that the mitochondria were from different tissues, indicating that students are not using the material provided to guide and inform their answer.
- (ii) Many candidates secured full marks for this question. Discrimination of awarding for the calculation can be seen clearly on the mark scheme.

- (iii) Generally, a well answered question with full descriptions securing full marks. A significant number of candidates reported that ribosomes were responsible for respiration. Weaker answers fell short of fully explaining their answer, stating only that inner folding increased surface area omitting the advantage for the mark.
2. (a) It was clear that candidates had not read the stem of the question, or they were unfamiliar with the centrifugation step as many answers gave control variables for the culturing of bacteria and not the centrifugation.
- (b) (i) Identification of the isotopes used was answered correctly by the majority of candidates.
- (ii) Whilst candidates were able to use the scan data and understood that only nitrogen-14 isotope labelled nucleotides were present, poor communication limited mark points as many candidates stated that there would be equal quantities of each isotope rather than correctly referencing the DNA molecules.
- (iii) Quality of communication was again critical here to secure full marks. Many candidates clearly understood that only the light isotope was present for use in replication, but this question required candidates to interpret the data and not just give detail of the process of semi-conservative replication.
- (iv) A well answered question, although a significant number of candidates gave RNA polymerase and definition as an answer. Poorly communicated responses were also common in relation to the function of DNA polymerase with candidates failing to state accurately where the enzyme acts on the DNA strand. Candidates did not make it clear that free nucleotides were connected along the sugar phosphate back bone by phosphodiester bonds. Whilst these points were unnecessary to gain credit, use of key terminology would assist candidates in communicating clearly their knowledge and thus result in unambiguous statements. When DNA ligase was given as an answer, very few candidates gained the function mark.
3. (a) (i) Disappointingly, a significant number of candidates were unable to identify the three common constituents of nucleotides.
- (ii) This definition was well recalled by many, however, a significant number of candidates were not able to access this mark. A common mistake was reference to the production of energy. Many candidates only spoke of the molecule being universal in either all cells or all reactions.
- (iii) Candidates need to be reminded why the term energy production is not acceptable but ATP production is.
- (b) Well answered.

- (c) Candidates found this question more challenging, as expected, but it was pleasing to see that nearly all candidates attempted to apply their knowledge in this unfamiliar situation. Candidates would benefit from using the stem of the question to inform their answers. Many however, answered in the context of the more familiar hydrolysis of ATP reaction. Only a minority of candidates could correctly identify that creatine phosphate is a donor of a phosphate ion, which in turn would be picked up by ADP to generate the ATP more quickly, despite being told in the stem that creatine phosphate increased the ability of muscle tissue to perform.

Candidates often referred to muscles being at rest when the body was sleeping; greater understanding that molecules function at a cellular level is needed.

4. (a) Generally, recall of the correct term was observed but a significant number of students demonstrated that they were not able to successfully recall this key terminology.
- (b) (i) Identification of variables was often confused.
- (ii) Candidates were not able to describe acclimatisation very eloquently and suggested that they were unfamiliar with this practical skill.
- (ii) Many candidates were able to explain the importance of the water bath and relate it to temperature being the independent variable. Candidates that gave a specific temperature were not credited as it was unclear whether they appreciated that the temperature was variable being investigated. Candidates often incorrectly referred to enzymes reaching their optimum temperature indicating they failed to appreciate that the water bath would be at a relevant test temperature. Increased kinetic energy was also regularly cited.
- (iii) Many candidates were unclear on the role of a buffer solution.
- (c) (i) Good differentiator of mathematical skills, with many candidates securing at least one mark.
- (ii) Candidates often confused inaccuracy with reliability and repeatability. Often citing a lack of repeats and an inappropriate range as sources. Other candidates referenced the changing temperature and common were causes of human error.
- (iii) A pleasing number of candidates were able to identify that the range was insufficient to identify the optimum, but many did not include a correct reference to the graph to explain their conclusion. Many recognised that the temperature range would need to be increased above the highest temperature tested, which was further supported by statements referring to reducing the increments between measurements.

5. (a) Many candidates were able to link the unfamiliar model successfully to that of the currently accepted model and full marks were frequently awarded for responses to this question.
- (b) (i) This question was answered well by most candidates and demonstrated that candidates were able to analyse unfamiliar data well to reach a conclusion. Good candidates could recognise that the transition temperature increased due to the need to increase more energy to overcome the intermolecular forces and this link to energy was required for full marks.
- (ii) A well answered question by many candidates. Good answers made detailed reference to the exact position of the C=C double bond in the chain and not the carboxylic acid. Some candidates made an incorrect reference that the kinks present in the fatty acid side chains would cause a gap in the membrane not at a molecular level within the bilayer.
- (iii) Despite being given information in the stem to help, only a minority of candidates correctly linked hydrophobicity with non-polarity to correctly suggest the exact position of cholesterol in the membrane.
- (iv) This new area of the specification was not communicated well by candidates. Many answers relied on knowledge from GCSE.
6. (a) A minority of candidates failed to read the stem of the question and therefore incorrectly gave a correct function of an ion which was only relevant in animal tissues, in particular answers relating to calcium ions were weak.
- (b) (i) Some candidates failed to acknowledge that the significantly large difference after 4 days meant that ions must be moving against their concentration gradient.
- (ii) Many candidates failed to relate their understanding of the role of active transport in root hair cells. Only a minority of candidates were able to give an acceptable example. A significant number of answers were suggesting that carbon dioxide would not be available for absorption through the roots with others suggesting that photosynthesis required oxygen which would therefore not be able to take place. A significant number of candidates were not able to identify that oxygen was the important gas in the mixture air.
7. Many candidates could correctly identify mitosis.

Many failed to relate the detail of the phases (prophase – telophase) with the changes of mass, whether DNA or of the cell, simply listing the identifiable characteristics of each stage which was not required to answer the question.

Weaker responses did not correctly use quantities to make their responses clear, making vague reference to increase or decrease in mass. Good answers were clear as to which mass the candidates were making reference.

Middle band answers frequently omitted discussion of all three areas, or only gave very weak responses for all three. Too often these responses gave irrelevant or incorrect information. Strong answers confidently referenced trends on the graph to exemplify their choice of cell division.

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UNIT 2

Specific comments:

1. (a) (i) Most candidates recognised that an ectoparasite lives on the surface of a host. However many stated either that it obtained nutrition or that it caused harm but not both.
- (ii) Well answered by most candidates. However many thought the reason was that the louse lacked wings.
- (iii) Many named the domain and kingdom instead of giving characteristic features. Eukaryota was accepted but Animalia was not.
- (b) (i) Well answered by most candidates. Some felt that the reason was because there was no dotted line between the pubic louse and the gorilla.
- (ii) Candidates often referred to similarity in DNA sequence but failed to mention nucleotides.
- (iii) Correctly answered by most candidates.
- (c) Most candidates recognised that they were required to define species.
2. (a) Many felt that the reason for internal respiratory systems was protection. Some stated that it would prevent water loss. Mostly well answered but some confused the purpose of hairs with the function of cilia. Most recognised short diffusion pathway. Many felt that the surfactant allowed gases to dissolve or that it reduced friction.
- (b) (i) There were a number of very good answers. Most recognised the need to allow peristalsis.
- (ii) Many candidates failed to recognise the similarity of function between lignin in xylem and chitin in an insect's trachea.
- (c) (i) The main problem with this question was that many did not describe the events in the correct sequence. Few candidates recognised that the cause of volume and pressure changes in the lungs is due to the decrease in pressure of the pleural cavity. Many still believe that the volume of the lungs increases due to air entering. There were some vague statements about pressure and volume changes without naming the sites of these changes. In addition, many failed to read the question and also described expiration.
- (ii) Well answered by most candidates.

3. (a) (i) Well answered by most candidates. However few recognised that lack of turgor would result in reduced leaf surface area and some described the cause of chlorosis instead of the cause of wilting.
- (ii) Very few candidates recognised that the difference in distribution of symptoms was due to bidirectional transport in phloem. Some talked about phloem transport being “all over” the plant.
- (b) (i), (ii) Many candidates failed to attempt this question, presumably because they were unfamiliar with phloem ultrastructure. Most of those who attempted the question correctly identified the cells. However, when giving reasons, they didn't clearly identify which cell was being referred to.
- (iii) There were a number of Casparian strips and sieve plates. Those who correctly identified plasmodesmata often gave imprecise explanations of their function.
4. (a) Generally well answered by most candidates.
- (b) (i) Well answered by most candidates
- (ii) Very few marks awarded as candidates failed to take account of leaf surface area in the unit.
- (iii) Many felt that the reason was because there was a large difference in the means instead of non-overlapping range bars.
- (iv) Well answered by most candidates.
- (v) Well answered by most candidates.
- (vi) Very few candidates gave the correct response. There were many suggestions regarding precautions that are taken when setting up the potometer. Also many felt that performing more trials would improve accuracy (as opposed to reliability).
5. (a) Well answered by most candidates.
- (b) (i) Well answered by most candidates.
- (ii) Although generally well answered many answers were imprecise. Some talked about saturation and not affinity. Also some talked about the affinity of oxygen for haemoglobin. Most recognised that the Bohr effect results in oxygen being unloaded more readily.
- (c) (i) Most recognised that an increase in minute volume would result in more CO₂ being exhaled. However very few explained the effect on the diffusion gradient from blood into alveoli.
- (ii) As with (b) (ii) there were some imprecise answers. Few recognised that reduced blood pCO₂ will increase affinity of haemoglobin for oxygen. However most recognised that less O₂ would be released. A number still feel that respiration produces energy.

- (d) (i) Well answered by most candidates.
 - (ii) Well answered by most candidates.
 - (iii) Many recognised that this was a question about the chloride shift. However there were many very vague answers where terms like “chloride shift” and “electrochemical neutrality” were thrown in without emphasising that this was happening in red blood cells. Some candidates attempted to explain changes in terms of tissue fluid formation.
6. (a) A large number of candidates gave the answer as 66.7 instead of rounding up to 67. Some inserted both 66.7 and 67 in the table.
- (b) Very few recognised that all the results followed the same trend. Most attempted to explain the cause of variation rather than the absence of anomalies.
- (c) Most candidates were able to give temperature as an answer, but failed to correctly explain how it would be controlled. Most also recognised that the end-point was subjective and to use a colorimeter. However there were many that felt that human error with timing was a problem. Also many suggested changes in pH or “amounts” of enzymes / milk powder, despite this information having been given in the stem.
- (d) Many candidates failed to recognise that endopeptidases and exopeptidases catalysed the hydrolysis of non-terminal / terminal bonds. Many also felt that the reason that digestion was more rapid with the enzyme mixture was that there were more enzymes or that endopeptidases increase the surface area for the action of exopeptidases.
- (e) Well answered by most candidates. However there were many references to pepsinogen and activation by HCl.
7. Responses to the QER question were generally very poor. Most candidates had great difficulty with the appropriate and accurate use of biological terminology.

There were many references to the “beating / pumping” of the “left side / right side” of the heart. Very few recognised that the increase in pressure in the systemic and pulmonary circulations was due to ventricular systole, and even fewer that the decrease was due to diastole. Of great concern is that many candidates think that the role of muscle in artery walls is to pump blood. There were some vague references to elastic recoil but few recognised its role in maintaining blood pressure. Many recognised the causes of pressure decrease in arteries and arterioles but many thought that the cause was because blood was “further from the heart”. Very few accurately explained tissue fluid formation in capillaries and even fewer the reason/s for lower pressure in alveolar capillaries. Many gave (often imprecise) descriptions of single and double circulations. They also stated that the double circulation maintains high pressure, but with no real understanding of the reason. A very large number were under the impression that oxygenated and deoxygenated blood was mixed in a single circulation and that fish have lungs!

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UNIT 3

General comments:

There was a good standard seen in many of the answers. All of the marking points were seen during the marking process. Sadly, some candidates find it difficult to produce concise answers that fit into the space provided and end up with forests of asterisks and arrows guiding the examiner to a multitude of places on the same page and the back of the booklet.

Specific comments:

1. The most common mistake in labelling the molecules was to give reduced NAD. For part (b), many candidates gave a description of the graph with no explanation. Some wrote detailed information about what happens during the light dependent stage and some just gave a description of the Calvin cycle without referring to the graph.
2. Parts (a) and (b) were well answered. Some candidates lost marks for stating that sodium ions were rapidly diffusing into the membrane and not into the neurone. Most spotted that threshold is not reached and so depolarisation does not occur but few gained the mark for the impulse not being carried down the sensory neurone to the brain.

In part (d) many students gave an account of what happens at a synapse. The question is asking why this process does not occur when the chemical is present.

3. Many gave at least two ways in which the dialysis machine in the diagram made filtration efficient. Unfortunately, some just gave a description and did not explain why that made the machine more efficient and so did not gain marks. The number of nucleotides in (b)(i) was correctly identified by most candidates but there were a lot of incorrect answers. When using the diagram in (b)(iii) some identified that more aquaporins were inserted into the membrane. Quite a few candidates gave detailed accounts of osmoreceptors and the release of ADH which were not asked for.
4. The calculation using the graph was successful for most candidates but many candidates did not follow the instructions and did not give their answer to the nearest minute. In (b)(i) the most common mistake was due to poor phrasing: "the graph goes down" being an example.
5. There were some odd ideas regarding the practical work covered in this question. It was designed to test the understanding of a practical technique that may well have been used by candidates and it proved to be a good discriminating question. Those who understood the technique gained very high marks. In (a)(iii) a significant number gave controlled variables instead of a control experiment. Many wanted to kill the maggots after having saved them from the sodium hydroxide in (a) (i). If the reason was given they still gained credit. In (b)(i) a description was often given but no explanation of the movement of the coloured liquid. The reliability of the mean being collected from whole class results was well done, but a large number wrote that it made the results more accurate.

Despite being given the formula many students were unable to calculate the rate which was disappointing. There were marks still available if errors were made at some point, for example the diameter was squared instead of the radius.

Most students managed to calculate the RQ and many spotted the increase in metabolic water with tripalmitin as a substrate and related that to the camel's environment. Some spotted that glycogen would need less oxygen compared to fat.

6. Randomly throwing quadrats (or quadrants) is not an acceptable method of selecting sites. Most candidates identified secondary succession and gave a reason for succession occurring. Some did point out that the area had been previously colonised so the soil would already have nutrients and seeds may already be present.

Nitrogen fixation was explained well but some candidates gave the whole of the nitrogen cycle.

Good candidates used the equation in (d) to point out that it takes a lot of ATP to convert nitrogen to ammonia and then pointed out that it is more efficient to digest insects. Some think that Nitrates are a source of energy.

7. The quality of QER responses varied widely There were some concise, well-written, elegant answers which explored the ecological impacts of fish farming and the methods of overcoming the problems of overfishing. Then there were many short explanations of why overfishing is bad, and many long, rambling descriptions of planetary boundaries being crossed. We can only assume that if a candidate has seen something new on the specification they were certain it would come up as a question and would force it into an answer somewhere!

Many students gave really good descriptions of eutrophication, but many also missed the fact that the aerobic decomposing bacteria cause the oxygen levels to drop. Too many had anaerobic bacteria using the oxygen.

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UNIT 4

General comments:

There is much evidence to indicate that there has been a general improvement in the ability of candidates to answer the new style of questions and the shift in emphasis in the assessment objectives. There was no indication that candidates were limited by time on this paper and there were very few sections of questions not attempted. There has been a dramatic improvement in candidates indicating that answers are continued on the additional pages at the end of the examination booklet. It is worth centres emphasising to candidates that these pages should be used for continuation of answers and not margins, different pages or somewhere else on the page.

Specific comments:

1. (a) (i) A very large percentage of candidates stated that the florets would be genetically different because they looked different, it was not appreciated that they would have been formed by mitotic division from one original zygote.
(ii) This caused very few problems almost all candidates stating that the anthers were below the stigma.
(iii) There were many correct references to increasing genetic variation, although some omitted genetic. An explanation of the advantage of genetic variation was rarely seen.
- (b) (i) The most common error was candidates not appreciating that the primary endosperm nucleus is triploid.
(ii) There were some very good responses with all points on the marking scheme seen but many answers lacked precise detail and no link was made to meiosis.
(iii) Reference was made to competition rather than a statement that *S. cambrensis* was outcompeted on many scripts. Many candidates made valid references to habitat destruction.
2. (a) (i) There were many excellent responses, there was a full understanding of the terms intron and exon.
(ii) Excellent responses with many linking the entry of calcium ions into the mitochondria lowering the water potential with the consequent movement of water into the mitochondria by osmosis. An appreciable number of candidates, however, stated that water entered the mitochondria which caused the cell to burst.

- (b) Most candidates constructed excellent genetic diagrams but there were some common errors including the failure to appreciate that it was sex linked and not appreciating the meaning of the word phenotype. In some cases more care needs to be taken with the clarity of handwriting as it was difficult to differentiate between a D and d.
 - (c) Very few candidates were able to give two potential problems of using a virus to treat DMD.
 - (d)
 - (i) Many did not appreciate that RNA does not contain the nitrogenous base thymine but in (b)(ii) correctly stated that the dystrophin would be shorter. An advantage of modification of DNA was not appreciated (iii) and in (iv) candidates waffled making many statements relating to scientists 'playing god' and 'designer babies'.
 - (e) There were some very clear, well argued and concise answers but although many stated that this form of muscular dystrophy was dominant and not sex linked specific examples were not given to explain how they had reached this conclusion. In many cases candidates contradicted themselves and showed absolute confusion.
3. (a) (i) The correct length of the sperm cell was calculated by half of the candidates, common errors being using the length measured in cm. and getting into enormous difficulties calculating magnification which was then used to calculate the actual length. Candidates should realise that skills learnt from practical experience will be examined on the theory papers.
- (ii),(iii) Many candidates stated that all mitochondria in an organism originate from the secondary oocyte but some candidates used the opportunity to write about the endosymbiont theory. Completing the table did cause some problems a large number of candidates considering that a son would have different mitochondrial DNA to mother.
- (iv) This proved to be the most accessible question on the paper and the majority of candidates answered it well.
- (b) Sperm being motile was the common response to (i) but there were a lot of references to viable counts and that the sperm would need to be killed first. The calculation caused problems mainly caused by candidates not knowing how many mm. there are in a cm., getting the dilution factors wrong and not actually questioning their answer, one would have thought that an A level candidate would know that there are more than 40 sperm in 1 cm³ and that possibly they had made an error.
4. (a) (i) Very few candidates showed any knowledge of the conditions which need to exist for the allele frequencies to remain constant in a population from generation to generation.
- (ii) Most candidates were able to apply the Hardy-Weinberg principle and calculate the numbers of individuals in a population of 10 000 with blood group M, N and MN but a common error was stating that the % frequency of allele M was 0.55%.

- (b) Candidates found great difficulty in explaining why the emigrated population from Germany showed allele frequencies which were uncharacteristic of either the American or German populations. Many tried to explain it in terms of selective advantage and natural selection. Few mentioned Genetic drift , the founder effect or lack of gene flow.
- 5.
- (a) This question demanded an understanding of practical technique and the ability to plan a practical exercise. Many candidates did not mention controlled variables and a disappointing number failed to state that some maize seeds would be soaked in gibberellic acid or that the size of the clear zone would be compared. There seems to be very little use being made from knowledge gained from doing practical work.
 - (b) Many candidates stated that gibberellic acid stimulates amylase synthesis which then causes germination. Unfortunately this is not what is shown in the graph.
6. Many candidates took the opportunity to write all that they knew about the hormonal control of the female reproductive cycle including details of menstruation and hormonal changes which take place after fertilisation but made no attempt to discuss the similarities and differences between the control of ovulation in rabbits and humans.

There were, however some excellent accounts which were concise , to the point and very good comparisons were made between humans and rabbits. Many candidates stated that rabbits only ovulate after copulation and that in humans copulation stimulates the production of LH which causes ovulation to occur sooner than expected. Higher progesterone levels after copulation in humans was commented upon by several candidates. In the QER question there will be an element of factual recall but unlike the essays on the old specification there is a requirement to include AO2 and AO3 elements. For high marks to be achieved it is essential that the candidate does answer the question in a logical way and uses scientific knowledge in the correct context.

Options

Immunology and Disease was the most popular of the optional topics. The mean scores for each of the three topic were similar. The examiners were disappointed by the overall standard of responses to the questions in each of the topics caused mainly by a lack of basic knowledge.

Immunology and Disease

- 7.
- (a) Very few candidates were able to define the meaning of the term endemic and defined epidemic and pandemic as alternatives. All that was required was that it is a disease which is always present at low levels in an area. Many tried to give a more complicated text book definition which often resulted in a very confused and meaningless statement.
 - (b) Very few candidates were able to label a diagram of an antibody and there were an alarming number who did not know the difference between an antigen and an antibody, knowledge which is fundamental in this option.

- (c) Memory cells were commonly given as the reason why IgG is higher after a second exposure and references to mutation in (ii) were commonly made. There were very few who used the term Primary response in the answer although it is a term which appears on the graph.
- (d) (i) There were some very good answers which discussed the presentation of the antigen to lymphocytes by macrophages but many candidates consider that antibodies are cells and that delay is caused by the antibodies undergoing cell division.
- (d) (ii) All points in the mark scheme were seen but alas rarely in the same script. Most candidates were able to state that false negative results can be caused by the presence of a different strain of bacteria and that the antibodies are not at detectable levels or that the enzyme has been denatured.
- (e) 37°C was the common response but in many cases an explanation was not given. The calculation of the area of the clear zone was usually correct and the assumption that the clear zone is a perfect circle commonly stated.

8. Human Musculoskeletal Anatomy

Candidates demonstrated a sound understanding of muscle structure and function.

In question (b)(ii) many students failed to realise that the number should be divided by 2 to calculate the length of one actin fibre.

Question (c) (iii) in general was not answered fully enough and lacked the detail required. Most candidates understood that the high BMI would indicate that the patient was obese and that increased physical activity would decrease body mass. Many students did not link physical activity with improving flexibility of the joint or that increasing strength of the muscle around the joint through physical activity would support the joint.

9. Neurobiology and Behaviour

Recall of the structure of the brain was good but responses to (b)(ii) were problematical. Students did not link their knowledge of brain regions to the specific context of the question for example many referred to 'seeing areas' of the brain rather than the occipital lobe. Many did not link the areas of the brain to a person with deafness actively using BSL. Large numbers of candidates suggested that the PET scan of a deaf person would differ because they could not hear verbal language. The term neuroplasticity was commonly used to explain the activation of the auditory cortex but very few gave any indication that they fully understood was meant by the term.

In (c) (iii)(iv) Students were able to calculate the standard deviation but gave a huge variety of answers for how a high standard deviation would affect confidence in their conclusions .

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UNIT 5

In this first cohort, examiners were gratified that candidates generally seemed to be well prepared.

Candidates should be reminded that it is a waste of time and space to repeat the wording of a question in its answer. It is understood that some do this as part of their thinking process, but a better examination technique is to think before writing, so that maximum advantage may be taken of the space available.

In addition, care should be taken that letters and figures are clearly legible. It is unwise to overwrite and it is important that the examiner can easily distinguish between numbers e.g. 3 and 5; 3 and 8, and between letters e.g. o and a, so that colorimeter is not mistaken for calorimeter.

The specification has a considerable mathematics content and candidates are advised to develop the skill of presenting calculations clearly. There is plenty of blank space in the answer booklet, where rough work may be done. The space for the answer should have a sequence of mathematical statements that is logically set out: it is not for the examiner to have to hunt for aspects of the correct answer.

Experimental task

Candidates were well trained in following instructions and most produced meaningful readings. They presented well-structured tables and were able to provide suitable answers to questions about their practical work, indicating laboratory experience.

1. Many candidates failed to score marks in their tables and graph as they became confused in the use of indices. If all figures are converted to the same index, they are easier to manipulate.
2. Candidates should be sure they answer the question that is asked. In (c) (i), the consistency of readings refers to the replicate data, which is illustrated by the length of range bars, and indicates the reliability of the mean. The overlap of range bars is not relevant.
3. Inaccuracy in the investigation [(c) (ii)] should be cited in specific terms e.g. 'The temperature of the reaction mixture may have fluctuated as room temperature may have altered' rather than merely 'Temperature'.
4. Lack of control of pH was not accepted as an inaccuracy as the reaction mixture was buffered at pH7.

Practical analysis task

Question 1

1. Many suggestions given in relation to hazards suggested a lack of fieldwork experience.
2. Answers should be as precise as possible, keeping in mind the limitations of school equipment. In suggesting an improvement to the accuracy of measurements in 1 (a) (iii), while it was appropriate to suggest using callipers, or measuring to 0.5 mm, credit was not given for suggesting reading in nanometres.
3. A null hypothesis should be stated formulaically i.e. there is no significant difference between...
4. When a calculation is required, calculations given in the question itself will indicate the correct number of decimal places to use, as in 1 (b) (ii). Alternatively, the number of decimal places required in the answer will be stipulated, as in 1(b) (iii).
5. Candidates are not expected to memorise statistical formulae, and should use the formula given. In this instance however, candidates that used alternative formulae were not penalised, as long as the formula used was clearly stated and the arithmetic was correct.
6. A conclusion drawn from the t value in a t test should refer to differences between the mean values of the data sets. Some candidates wrote about 'deviation' in their conclusion, however, this term refers to variation within a data set, not between data sets.
7. A null hypothesis is either accepted or rejected. It is not right or wrong, true or false, proved or disproved.
8. Some answers to 1(c) showed that candidates had carefully read the stem of the question and were using the information in their answers. Their close reading led them to correctly discuss food chains and the effects of wave action. Some answers, though, were extremely long: candidates should remember that the space given is an indication of the amount of writing they should present.

Question 2

Some candidates failed to achieve the mark for Question (b) (ii) because they did not present their answer as a comparative statement. The question uses the word 'thinner' and this should alert candidates that their answer should be expressed in terms of a 'shorter' diffusion distance or 'more' light.



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