GCE Examiners' Report

Biology

A Level

Summer 2024

Introduction

Our Principal examiners' report provides valuable feedback on the recent assessment series. It has been written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and details how candidates have performed in each unit.

This report opens with a summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It then looks in detail at each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.[1]

The information found in this report provides valuable insight for practitioners to support their teaching and learning activity. We would also encourage practitioners to share this document – in its entirety or in part – with their learners to help with exam preparation, to understand how to avoid pitfalls and to add to their revision toolbox.

Further support

Document	Description	Link
Professional Learning / CPD	WJEC offers an extensive programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.wjec.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 12 months after the examination.	Portal by WJEC or on the WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.co.uk)

[1] ***Please note that where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.***

Exam Results Analysis	WJEC provides information to examination centres via the WJEC Portal. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	Portal by WJEC
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.wjec.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	Portal by WJEC or on the WJEC subject page.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with valuable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner | WJEC

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Executive Summary

In 2024, it was pleasing that all units had an increased mean compared to last year, showing an improvement in the standards. In all units more able candidates were able to demonstrate a sound ability to process, analyse and interpret data and information and were able to express themselves well using appropriate scientific terminology. However, a significant number of candidates were not able to recall the correct biological terminology required for AO1 questions.

Application of knowledge proved to be an issue for many candidates across all five units. Many candidates struggled to pull together the information given to them in images and text to give explanations or make conclusions. A further issue is that many candidates sitting the A2 papers were unable to recall and use of synoptic content, either from AS in the context of the A2 content or from other A2 units.

Quality of written communication continues to be an issue. Although there is a Quality of Extended Response (QER) question which explicitly assesses quality of written communication, candidates also need to address this in other questions. A candidate's response must make sense. Clarity is also important; candidates must not rely on examiners knowing what is meant by a vague response. Candidates should be encouraged to re-read each response to make sure it makes sense and is clear and answers the question being asked.

Mathematical skills overall were good. Where mathematical skills are being tested and candidates are most successful, they present their calculations in a well ordered and fully labelled sequence. They should read the question carefully to understand how the answer should be expressed. In the Student's t test correct use of terms such as critical value, probability level and degrees of freedom is crucial. In calculations involving very large numbers, candidates need to understand the use of standard form and logarithms; using logarithms is easier if candidates understand that $\log_{10}$ is the power to which 10 is raised in a number.

Although practical skills have improved slightly from 2023, some gaps in knowledge were still evident, e.g. in the use of correct terminology, especially in relation to understanding the purpose of particular controls and distinguishing those from control variables. There were also issues in constructing and completing tables and graphs interpreting results and critical analysis of experimental design. This cohort will have experienced some disruption to their education in Year 10 and 11 and may not have experienced as much practical work as in pre pandemic years.

There was a general decrease in the quality of answers to the Option questions. Candidates should be reminded that this is the only section of the Unit 4 paper which has a fixed tariff of marks and that all parts of the specification for each option will be assessed.

Areas for improvement	Classroom resources	Brief description of resource
Recall of scientific terminology	Knowledge organisers	A collection of sample knowledge organisers to support the learning of A level Biology.
Improving AO1 skills	Improving AO1 skills resource	Series of questions for every topic designed to help candidate revision.
Practical skills	Experiments on film	Videos of every specified practical and questions to strengthen practical skills.
Microscopy skills	Improving microscopy skills resource	Worksheets containing worked calculations of calibrations, magnifications, and actual size. Also contains a range of questions for students.
Correct responses to different command words and using information given in the stem of the question	Online exam review	Annotated sample candidate responses which can be used to show good practice
Exam walk through - A level Biology	Biology - Educational Resources - WJEC	These powerpoints walk candidates through a mock examination paper, helping them revise and practise useful exam techniques
Knowledge and understanding of osmosis	Cells and movement across membranes - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	This blended learning resource contains interactive self-study content covering Unit 1 – Cells and movement across membranes
Knowledge and understanding of application of reproduction and genetics	Application and reproduction of genetics - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	This blended learning resource contains interactive self-study content covering Unit 4 – Application of reproduction and genetics

BIOLOGY

GCE

Summer 2024

Unit 1 Basic Biochemistry and Cell Organisation

Overview of the Unit

The demand of the questions was comparable to those tested in previous papers with practical skills and mathematical skills within the biochemistry and cell organisation content. Assessment required synthesis of the core concepts of Biology with most questions covering more than one area of content.

The following aspects of the assessment were well answered

- Basic AO1 questions where there was no ambiguity were well answered (Q1ai, 1aii, Q2aii, 4aii)
- Mathematical skills including drawing graphs (Q2bi, Q3bi, Q3bii, Q5bi)
- Identifying polarity in water molecules (Q4ci)
- Stages of cell division (Q6ai, Q6aii)

The following aspects of the assessment were less well answered

- Some of the AO1 content was poorly recalled (Q1cii, Q2aiii)
- Application of knowledge was poorly answered in a number of contexts
  - Why eukaryotic cells have more membrane than bacterial cells (Q1b).
  - Why RNA content in a cell is variable (Q2bii)
  - How ATP is used in a cell (Q2c)
  - Why viruses need a host in context (Q5aii).
- Applying the one gene, one polypeptide hypothesis in the context of a virus where the diagram needed to be used (Q5aii).
- Showing understanding of what defines mitosis to explain why bacteria do not undergo mitosis (Q6c).
- Use of the correct terminology to explain the gain or loss in mass of plant material, and animal cells in solutions of different water potential (Q7).

Comments on individual questions/sections

Q.1 The content for this question was based around cell structure and the function of organelles, it required a knowledge of membranes and protein synthesis. The majority of candidates scored well in part (a) and were able to identify types of RNA and compare bacterial and eukaryotic ribosomes. In part (b), many candidates failed to use the scale bar in Image 1.1 to identify that the animal cell was larger than the bacterial cell and also that the animal cell had membrane bound organelles. In part (c), whilst many were able to identify the membrane components, fewer candidates could apply their knowledge of function of membrane components to the question.

Q.2 This question was all about the structure and role of nucleotides and nucleic acids. A large number of candidates failed to identify all three components of the nucleotides; however, they performed better at identifying differences between the named nucleotides. The calculation of percentage RNA in the cell was done well by the majority of candidates, but the explanation of the reason was not well answered. In part (c), using the diagram to describe the role of ATP was not well done and few candidates were able to correctly describe why ATP is referred to as the universal energy currency.

Q.3 This question required practical and mathematical skills in the context of the reactions of enzymes. The better answers in part (a) referred to the reduction of activation energy, only a minority of candidates could give good explanations of why catalase was important in cells.
In part (b), the calculation of the rate was well done, and a majority of candidates presented well drawn graphs. The most common errors were uneven scales on the x-axis and poorly drawn lines. Whilst most candidates correctly describes the trend, fewer gave correct explanations of the two parts of the graph. Weaker candidates expressed their ideas poorly, whilst the best answers discussed limiting factors in the correct context.

Q.4 This question was about the structure and function of carbohydrates. Many candidates scored well in the table comparing amylose and cellulose, demonstrating good recall of this topic area. The questions on disaccharides were answered well by the majority, but some candidates lost marks for incomplete comparisons or vague answers when describing parts of the molecules. In part (c), only a minority of candidates could use their knowledge of the properties of water in terms of hydrogen bonding to describe the solubility of monosaccharides and disaccharides as well as the importance of water to plants.

Q.5 This question was about the structure and function of viruses relating to cell structure, the nature of proteins and the one gene, one polypeptide hypothesis. In this question, candidates were required to use the diagram to work out that there were three proteins which therefore required a minimum of three genes. Very few candidates gained all three marks here, many candidates gained no marks. In a similar way, few candidates could correctly link the requirement for ribosomes and mitochondria in viral replication. Part (b) was better answered with the majority of candidates calculating the surface area of the virus, using the formula. Candidates were also able to use the diagram to describe cell infection by a virus and the release of a virus and its effect on the total surface area of the infected cell.

Q.6 This question was about cell division, using knowledge of protein structure and comparison with binary fission in bacteria. Most candidates were able to label the centriole and describe the cell being in metaphase of mitosis. Most candidates drew a chromosome and were able to complete at least one correct label. Whilst there were many good answers to part (b), a minority of candidates did not identify the level of protein structure shown correctly. In part (c), only a minority of candidates could give two reasons why binary fission in bacteria is not referred to as mitosis.

Q.7 The performance in the QER was lower than the previous year. Many of the answers were not well organised and the quality of extended response was generally poor, demonstrating grammatical errors. The use of scientific terms was also inconsistent and often contradictory.

The general trend was incorrectly stated in most answers.

The best answers tackled the question in three sections and correctly used the term "water potential", applying it in the correct context throughout. There was some confusion with the term "solute potential" and some candidates confused this with solute concentration.

There were some good references to the graph and the use of data. The better answers gave good explanations for the differences between the data for potato vs sweet potato. Only a minority of candidates described the expected results for animal cells beyond bursting in hypotonic solutions due to lack of a cell wall.

BIOLOGY

GCE

Summer 2024

Unit 2 Biodiversity and Physiology of Body Systems

Overview of the Unit

The demand of the questions was comparable to those tested in previous papers and the paper was a suitable and fair test for the candidates at AS level. Generally, the earlier questions in the assessment proved more challenging than the later ones.

The following aspects of the assessment were well answered

- In general, the AO1 questions were answered well, especially when the wording in the stem was very straightforward (Q1b, Q3aii, Q4ai, Q5ci, Q5cii, Q6aii)
- Practical use of a potometer (Q4aii, Q4aiii)
- Interpreting data from tables and graphs (Q1ci, Q5bi, Q5bii)
- Use of an equation to calculate volume of water uptake (Q4bi I)
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The following aspects of the assessment were less well answered

- In general, the AO2 questions were not answered well and had the lowest facility factors.
- Understanding the rationale of practical design (Q1cii, Q1ciii)
- Identifying components from histology photomicrographs (2b, 3b)
- Descriptions of a trend from a graph (2d)
- Explanations of trends in data, (2d, 4bii)
- Calculations involving reading data from a table or graph (4bi II, Q6b)
- Use of information and applying knowledge (Q3ai, Q3aiii, Q5d, Q6cii)
- Use of precise biological terminology (Q3ai, Q3aiii, Q3cii, Q5a, Q5ciii, Q6aiii)

Comments on individual questions/sections

Q.1 This was generally well answered by most of the candidates, demonstrating their ability to interpret evidence and apply their knowledge to support different phylogenetic trees. However, many struggled with the practical aspect of the investigation. In (c) (ii) many thought that having a large sample size would improve the accuracy of the data as opposed to it providing a representative sample. In (c) (iii) many candidates referred to morphological features being the result of convergent evolution but didn't go on to state that biochemical analysis is therefore more accurate. Both these parts of the question had low facility factors.

Q.2 This question required candidates to relate the structure of a leaf to its function as the organ of photosynthesis. Although the question was very accessible, with a very small minority not attempting the question, the quality of written communication in the candidates' responses showed little progression from GCSE level. For example, in part (a) many candidates correctly identified the adaptations but the explanations given were vague statements relating to photosynthesis and not light absorption; this had the lowest facility factor on the paper. Again, many found the practical aspects of the question challenging. In part (b) they struggled to interpret the image of the TS of the leaf and relate it to the process of photosynthesis. In part (d) many failed to refer to the independent and dependent variables to describe the trend of the graph. The explanations given also tended to be vague, with the persistent issue that many think that closing stomata will prevent water loss, rather than reduce it.

Q.3 This question assessed the features of the digestive system and had similar issues to question 2 with some of the lowest facility factor scores. Only the most able candidates could use the information provided and apply their knowledge to the questions being asked. Those that used precise biological terminology and referred to the 'hydrolysis of proteins' in part (a) (i) and the 'hydrolysis of peptide bonds' in part (a) (iii) gained good marks. Again, it was only the better candidates that were able to give an accurate definition of a parasite in (c) (i). The responses to (c) (ii) demonstrated a full range of marks. Most candidates demonstrated the ability to interpret the information correctly, unfortunately many explanations were too vague to gain credit.

Q.4 This was generally well answered demonstrating that many candidates had a good understanding of the process and practical applications of transpiration. Part (a) (i) had the second highest facility factor; however a proportion of candidates did not attempt an answer. In part (b) many candidates correctly calculated the volume of water uptake, but only the more able used their answer to calculate the rate of water uptake. Most candidates were able to describe the trend shown by the data with the better candidates also providing valid explanations.

Q.5 This was also generally well answered, however the quality of written communication prevented some candidates from gaining higher marks. In part (a) many candidates gave very good descriptions demonstrating a good knowledge of fish ventilation. Unfortunately, many candidates appear to think that the mouth and the buccal cavity are the same structure. In part (c) most candidates correctly identified the gill lamellae and referred to a large surface area, but only the better candidates recognised that this was due to the large number present. Many candidates also demonstrated some knowledge of counter-current flow, but only the best candidates expressed themselves well enough to gain full marks. Many candidates picked up some marks in part (d), but only the best used **all** the information provided to gain full marks.

Q.6 This question had some of the highest and some of the lowest facility factor scores on the paper. Part (a) proved to be very accessible, with many candidates scoring highly. Lack of precise biological terminology was again an issue for some candidates. Most candidates struggled to calculate the heart rate in part (b), this may have been due to them not reading the stem of the question carefully or failing to accurately read off the values from the ECG. Many candidates were able to interpret the ECG in part (c), but only the better candidates could apply their knowledge of the cardiac cycle to explain the effects of the obstruction.

Q.7 The quality of extended response question generated a full range of marks from candidates, with some excellent responses seen. Many candidates gave very good explanations for the position of the naked mole-rat dissociation curve and were able to link this to its environment. There were also good explanations for the position of the hummingbird dissociation curve, but these tended not to be as detailed. Only the best candidates made the link to high rates of respiration and the production of carbon dioxide. The adult human haemoglobin dissociation curve was the least well explained. Many candidates gave very good accounts of cooperative binding, but only the best related this to the loading and unloading of oxygen at the lungs and tissues respectively.

BIOLOGY

GCE

Summer 2024

Unit 3 Energy, Homeostasis and the Environment

Overview of the Unit

The paper assessed the required breadth of topics including synoptic material from units 1,2 and 4 with the required balance between assessment objectives AO1, AO2 and AO3. Attempt rates were slightly lower than in 2023 with no trends in unanswered questions in terms of assessment objectives. However, attempt rates were generally high only falling below 90% in part 6(c)(ii) which was synoptic from unit 4.

Accessibility was generally as expected. Some parts of question 3 which addressed AO3 showed considerable challenge. Responses to part 1(b)(i) indicated some difficulty with the concept of 'the control' and confusion with 'control variables. Candidates at this level should be familiar with use of boiling and cooling to demonstrate enzyme activity.

Performance on the items requiring mathematical skills was generally good. The students' T test question (Q3(b)(i)) was mostly well answered with plenty of evidence that candidates are being drilled to deal with the decision around a null hypothesis, although there were errors around incorrect use of terms especially 'probability level'. The use of logarithms to deal with very large numbers such as those encountered in bacterial populations was also managed well (Q 5(b)(i)). However very few responses showed an understanding that $\log_{10}$ is the power to which 10 is raised in a number. The suspicion has to be that most candidates used a function on their calculators to come to the correct answer.

Poor written communication was an issue, in particular, careless inaccuracies such as describing locations for the distribution of chloroplasts which would be outside a leaf in part 2(a)(i) and sodium ions moving into the membrane in part4(c)(ii).

The following aspects of the assessment were answered well:

- AO1 and AO2 questions on the Krebs cycle (Q1a)
- AO1 and AO2 questions on photophosphorylation (Q1b)
- AO3 questions on human pressures on the environment (3a)
- The Student's t test (Q3bi)
- AO1 questions on simple nervous systems (Q4a)
- AO1 questions on action potentials (Q4cii)
- Calculating generation number from a graph using a log scale. (Q5bi)
- AO2 question on variation (Q6ciii)

The following aspects of the assessment were answered less well:

- AO3 question explaining the purpose of a control (Q1bi)
- AO3 question formulating a conclusion (Q2aii)
- AO3 question describing evidence to justify a conclusion (Q3bii)
- AO3 question analysis of experimental design (Q3biii)
- AO2 question explaining action of a drug on the transmission of impulses (Q4biii)
- AO2/AO3 question explaining the results of an experiment on rate of nerve conduction (Q4d)

- Calculating size of a population of bacteria using serial dilution (Q5aii)
- AO3 question analysis of experimental design (Q5biii)
- AO1 question on variation (Q6cii)

Comments on individual questions/sections

Q.1 Part (a)(i) was a simple counting exercise; most candidates gave correct answers for both molecules. Part (a)(ii) required candidates to identify Krebs cycle intermediates from information on numbers of carbon atoms in the molecules from the table in part 1(a)(i) and image 1.1A, most were able to do so. Part (a)(iii) was also well answered, though a significant number of responses described what happens to the intermediate molecule not the caron or hydrogen atoms.
Part (b)(i), the experiment used in this part is specified practical work, but this question could apply to any enzyme experiment. There was considerable confusion between the terms control and control variables. In part (b)(ii) most of the responses seen correctly described the result but fewer were able to explain how this supported the hypothesis. The content of part (b)(iii) was synoptic from unit 1 but the concept of enzyme inhibition was well understood. However, a common error was to describe succinic acid and malonic acid as complimentary with each other rather than with the active site of the enzyme.

Q.2 In part (a)(i) the quality of written communication was an issue, the weakest responses had inaccurate descriptions such as ‘on top of the leaf’ or chloroplasts are ‘only found in the palisade layer’. The best responses described the distribution of chloroplasts in terms of the structures labelled in image 2.2. for millet and gave an accurate description for *Ligustrum* in terms of relation to the upper epidermis or the position of the palisade layer. Part (a)(ii) was not well answered; the weakest responses gave vague reference to surface area for absorption of light and no reference to penetration of light. Relatively few responses were awarded the second marking point for shorter pathway for light inside the leaf. Some of the better responses used the information provided to suggest that the distribution in millet allowed absorption of light at different incident angles as the sun moved across the sky.
In part (b)(i) most candidates were able to correctly name photolysis. Part (b)(ii) was a novel way to examine understanding of the photo phosphorylation, examples of weak responses included not plotting the points to within half a small square, not labelling the points, and failing to join the points with straight lines to illustrate the z scheme. The best responses in part (b)(iii) gave a clear account and used data from the graph; poor responses did not mention light and/or made no reference to the graph. The majority of responses in part (c)(i) showed labelled arrows in the correct directions, However, some did not label the arrows, some showed arrows in the incorrect directions and a small number drew arrows across the membrane instead of through the channels. In part (c)(ii) the best responses identified photolysis in the thylakoid space, though some incorrectly stated thylakoid membrane, and reduction of NADP in the stroma. There were lots of responses which described proton pumps despite this being excluded in the question.

Q.3 Parts (a) and (b) targeted AO3. In part (a)(i) candidates were expected to find evidence to support a hypothesis, and the best responses identified the M4 motorway and major A roads as having the highest levels of NO_2. In part (a)(ii) the mark for sub-part II was sometimes lost for failing to refer to the WHO limits. In part (b)(i) candidates were expected to interpret the results of a Student's t test. There was evidence that candidates were well prepared for this with many responses awarded all four marks. The weakest responses made incorrect use of the terms probability level and/or degrees of freedom, using the terms to describe the critical value. Part (b)(ii) required critical analysis of the results; some responses failed to recognise that NO_2 levels were higher after the road closure. Candidates who had incorrectly accepted the null hypothesis were allowed an error carried forward. There was evidence in part (b)(iii)I that candidates had not read the question carefully. Despite the opening phrase 'in a separate experiment', there were lots of attempt to describe causative links to results of the road closure experiment. The best responses recognised the trend in the graph corresponded to leaf fall and explained that confidence in the conclusion of the road closure would be reduced and were usually followed by good responses in part (b)(iii)II. Many responses identified trends in the graph but failed to comment on how these affected confidence in the conclusion. Weaker responses referred to confidence in the *results* of the road closure experiment and were followed by unrealistic suggestions in part (b)(iii)II. Part(c) was a straightforward recall question on the nitrogen cycle, there was evidence of lack of preparation in some responses, confusing the names of the bacteria involved.

Q.4 Part (a) and (b)(i) targeted AO1 and were answered well. Parts (b)(ii) also targeted AO1 but fewer correct responses were seen for the name or function of the vesicle. In Part (b)(iii) candidates were expected to use information from images 4.2 and 4.3 to explain the action of acetylcholinesterase inhibitors. Poor quality written communication was an issue in this part, with lack of clarity in the weakest responses. Part (c) targeted AO3 and AO2, as candidates were expected to interpret the results shown in graph 4.5 and apply their knowledge of saltatory conduction to explain them. Most responses correctly described the trends but relatively few were able to explain both the initial increase in transmission speed and the subsequent decrease.

Q.5 Part (a)(i) targeted AO1 to test knowledge of aseptic technique. However, there was evidence that candidates had not read the question carefully, because many responses gave very general points, even though the question directed them to ones that applied specifically to transferring samples to the agar plates. Part (a)(ii) targeted mathematical skills including use of standard form. The most common errors were failing to multiply by 2 to account for the $0.5cm^3$ sample and not using standard form. Part (b)(i) also targeted AO3 mathematical skills, including use of logarithms to handle very large numbers. Although there were plenty of responses giving the correct answer there was not much evidence that candidates knew that $\log_{10}[10^7]$ is 7 for example. Part (b)(ii) was very poorly answered, it required an explanation, so responses that said 'this is the lag phase' or 'the cells are getting used to their surroundings' were not awarded marks. The best responses made a clear reference to synthesis of a named biologically important compound. Part (b)(ii) was also poorly answered, largely because candidates failed to realise that the difference was because one method gives a viable count and the other a total count, there were many responses that attempted to give explanations in terms of growth phases. There were also issues around quality of written communication in responses that did recognise the difference because they were unable to clearly explain why it meant that the discrepancy increased over time.

Q.6 Parts (a)(i) and (ii) targeted AO1and were generally answered well. In part (a)(iii) candidates were expected to retrieve information from image 6.1. Part (b)(i) targeted AO3 and candidates were expected to suggest a hypothesis using information from image 6.2 and most responses seen did so. Part (b)(ii) targeted AO1 testing knowledge of plant nutrition, some weaker responses referred to nitrogen and/or phosphorus instead of nitrate and/or phosphate. There was evidence that candidates had not prepared well enough in this topic. Part (b)(iii) required candidates to apply knowledge to information presented in image 6.1, the inclusion of the label sediment was a clue that some candidates missed. The best responses made clear reference to the sediment and gave concise explanations of decay that released nutrients and explained the relationship between the pondweed's position relative to the sediment. Part (c) contained some synoptic content from unit 4. In Part (c)(i) the best responses gave the standard definition of a species or clear reference to a recognised DNA or amino acid sequencing technique. Part (c)(ii) was the most poorly answered part on the paper possibly because candidates were underprepared for unit 4 at this stage. Part (c)(iii) lacked challenge; most responses made correct reference to camouflage with the best ones going on to explain its survival advantage.

Q.7 The quality of extended response question targeted AO1 and AO2. Responses to the first two parts were generally better than those to the third part which required more in terms of application of knowledge.

BIOLOGY

GCE

Summer 2024

Unit 4 Variation, Inheritance and Options

Overview of the Unit

The demand of the paper was comparable to previous years and all questions were accessible. Questions appeared to give a good range of marks with one exception. An issue with the paper seemed to be whether candidates had learned the work thoroughly. There seemed to be big gaps in the responses to questions where candidates had not learned/understood the work which led to confusion or simply wrong answers/gaps.

The following aspects of the assessment were well answered

- AO1, 2 and 3 questions were generally answered equally well and there seemed to be no obvious pattern.
- AO1 questions which had the highest facility factors were 4ci (how to produce a mule) and 6, the essay (mutations).
- AO2 questions which had high facility factors were 1b (function of urethras) and c (spermatogenesis), 5a (genetics) and 5bi (gene expression) and 6, the essay.

The following aspects of the assessment were less well answered

- Use of information and applying knowledge (2d) (3a, b, c and d) (4bii) (5bii).
- Some calculations (4bi)
- The inability to explain/express in simple scientific terms is evidenced in a number of questions (1bii), (2b and c, dii), (3cii), (4a), (5bi).

Comments on individual questions/sections

Q.1 Most candidates scored over half marks for part (a) and those that knew their male anatomy routinely scored full marks. The anatomy most often losing marks was the prostate gland; large numbers labelled the bladder as the prostate gland. Often the functions given were superficial/incomplete (epididymis and scrotum). Many said the scrotum was for protection of the testes, but they would be far better protected inside the body cavity, so some reference to lower temperature was required.
Although part (b) was generally answered well, there was a great deal of confusion shown by candidates in terms of male and female anatomy. This included that the urethra led into the womb/that the urethra was used for fertilisation/sexual intercourse/ that the 2^o oocyte/baby/blood passed down the urethra and that females did not have a urethra.

Q.2 Part (a) was generally well done, although the labelling of the pea was somewhat hit and miss. Parts (b) and (c) were well done by those who knew and understood the work. Part (d)i routinely scored half marks with most losing a mark by putting a reference to oxygen/carbon dioxide levels in the atmosphere. Since these are field experiments, these were not valid factors. Candidates often referred to farmers being able to control the temperatures of their fields and that different countries should only grow certain crops. Neither of these points are correct or creditworthy. Very few referred to global heating raising soil temperatures, hence reducing yield and subsequent famine/food insecurity.

Q.3 This was by far the worst performing question on the paper. Candidates did not know that

- HGP allowed base sequencing of genes
- the gene did not need to be isolated/cut out with restriction enzymes, so no chance of damage
- there would be no introns present.

Common incorrect responses included: that it would be cheaper, not rejected, there would be no immune response (not relevant since they are inserted into *E coli*), that it was invasive to remove from a human (because multiple 'extractions' would be needed), needed consent, that there were ethical concerns.

None of this is relevant since the genes can be extracted from a small blood donation from volunteers. There appeared to be a lot of confusion with gene therapy both here and in part(d)iii and in the essay. Candidates had not read/understood the stem of the question. In part (c) candidates had not learnt the two enzymes involved in splicing DNA.

Part (d) was well done by those who knew and understood the work and followed the image 3.2 and referred back to image 3.1. Very few could explain the need for plate A in (i) and explain the results (ii). Part(iii) had the lowest facility factor as very few understood that the entire process was useless if the bacteria could not be proven to produce HGH.

Q.4 Part (a) was an AO3 question, and few candidates could analyse the skeletons, to realise that they were all basically similar, but that there had been small changes (hooves) over millennia, arising from a common ancestor by natural selection.
The Hardy-Weinberg in part (b)proved to be a challenge for many and few came up with two sensible reasons as to why the population may not be in a H-W equilibrium.
Part (c) was generally well done, although some missed the point by stating that the offspring of two mules would be infertile.

Q.5 The genetics in part (a) was generally well done, although many lost a mark because they did not delineate the gametes clearly, but simply wrote the same characters directly below the phenotype. Gametes must be distinguished in some way, by a comma, a clear gap or ideally a circle around each gamete. Some wrote sperm and egg in the space. The calculation in (ii) was good.

Part (b) i was well done and it was a pleasure to see the majority of candidates making good use of ALL the data to answer the question. This was a complex question and there were some excellent responses (this is what makes the responses to Q3 so perplexing).
Only the better candidates made the link between the effect on mice and human health. Most referred to stopping the use of plastic packaging to prevent diabetes and obesity in mice rather than humans.

Q.6 There were some really superb essays demonstrating excellent knowledge and understanding. Full marks were not uncommon. Those that scored poorly generally got confused with gene therapy, presumably because they had leant the work from last year's essay.

Q.7 OPTION A – Immunology and disease

(a) Whilst the majority had not learnt a clear definition of an infectious disease in part (i), nearly all managed to gain the 1 mark, understanding that 'infectious diseases can be spread from one person to another'. In part (ii), there was poor recall of the definition of vaccine. Candidates were not using the correct terminology and confused 'disease' with 'pathogen', and 'antibody' with 'antigen'. In part (iii), nearly all were able to link the idea of high population density with TB being spread more easily for 1 mark, or that TB is spread via aerosol transmission to gain one of the two marks available.

(b) In (i) many failed to describe the shape of the graph to support their explanations. The primary response had not been learnt very well and there was a lot of confusion between the roles of the cell mediated and humoral response. Part (ii) was answered better than the primary response question with the majority of students able to identify that memory cells were involved and describe the changes in antibody production using the graph. Poor answers demonstrated confusion over the differences between B and T lymphocytes, clonal expansion and the differences between primary and secondary responses.

(c) Most candidates were able to perform the calculation correctly. The majority of candidates understood the aims of the practical and the results and were able to identify advantages and disadvantages. However, there was poor use of correct terminology with candidates referring to 'the disease' rather than TB, or referring to TB rather than the M tuberculosis or referring to 'bacteria' rather than M tuberculosis. A number of candidates did not understand the notion of 'dormant' bacteria.

(d) Candidates did not recognise that Malaria is the name of a disease, and that Plasmodium is the cause. They did not recognise that Plasmodium is not a bacteria and therefore the antibiotic treatments would have no effect, hedging their bets with, 'will have less effect'. They were able to recall that 'malaria' has many antigenic forms.

Q.8 OPTION B – Human musculoskeletal anatomy

(a) Part (i) was generally answered poorly with no attempt made to follow the given transverse sections of actin and myosin but rather randomly placed spots and dots. However part (ii) was generally answered well with candidates were able to describe how and why the A and H areas would change. In (iii), many could describe how the structure of actin allows cross bridges to form during muscle contraction but struggled to explain why they can't form when resting. Candidates misunderstood the question, failing to recognise that the question was about the structure of actin and the availability of the myosin binding site, rather than the sliding filament mechanism.

(b) Few candidates were able to state that hyaline cartilage has a high proportion of collagen. There were hardly any correct references to how its structure relates to its function with most only stating a function of cartilage or its location in the body. However, most candidates were able to identify that rheumatoid arthritis is an auto-immune disease and identify two types of tissue affected by it.

(c) Many candidates gained the mark describing the effect of osteoporosis on spongy bone, but only a few referred to there being less compact bone which could have been identified by using the image as asked. However in (ii) many candidates simply stated the differences between bone strength and fracture rates in Groups A, B and C. They did not then go on to use the graphical evidence to describe how stem cell treatment improved the outcomes of OI mice.

Q.9 OPTION C – Neurobiology and behaviour

(a) Many answers did not make it clear that social behaviour is an interaction between members of the same species. Very few referred to the formation of a structured group or equivalent. Lack of recall or understanding of the term 'social behaviour'.
In part (ii), in general, candidates correctly described this 'fixed action pattern' behaviour as innate. Some referred to it incorrectly as a learned behaviour and some thought it was both. Many answers referred to the term sign stimulus as initiating the response, but few combined the words innate and sign stimulus within the same explanation. Too many candidates were not specific when describing the fixed action pattern as being a warning.

(b) Most correct answers referred to a failure to respond to stimuli that were not rewarded or punished as the definition of habituation. There were many descriptions of why a response was not produced but they didn't link this to 'saving energy' for the second mark.
In part (iii) the majority of candidates were able correctly interpret the experimental results to discern that habituation hadn't taken place and the concealment distance increased. Failure to comment on the difference between the two colonies was the most common omission.

(c) There were many correct descriptions of parts of the brain being active at the time of the scan.
In part (ii) several alternatives for the area of the brain were accepted but some answers were unclear which side of the brain was affected by a stroke. There were frequent correct references to neuroplasticity. However, descriptions of the brain forming new neural pathways often lacked precision. A significant number of candidates were awarded all three marks in part (iii). Many described synaptic pruning and made references to neuroplasticity. These only received credit if they were relevant to the developmental history or time of life of the individual.
Conclusions about development of the brain were not always specific to redeveloping language skills (stated in the question) and comments needed show comparison between the two brain scans based on the time when a stroke took place.

BIOLOGY

GCE

Summer 2024

Unit 5 Practical Examination

Overview of the Unit

The Experimental task involved carrying out a practical investigation into the effect of substrate concentration on an enzyme catalysed reaction. Candidates were required to record results in a table, display data in a table and to analyse and evaluate the experiment.

- AO1, AO2 and AO3 were all tested alongside mathematical and practical skills.
- The content tested was from 1.4 - Biological reactions are regulated by enzymes.
- Overall candidates were able to carry out the experiment and record the data in an appropriate manner. The subsequent analysis demonstrated variation in performance with many candidates answering well, although some candidates failed to understand the key terms crucial to practical work in Biology.
- Outcomes on the experimental task were similar to those of the previous year.

The practical analysis task forms the second examination for the practical element of Unit 5 for the GCE Biology course.

- Question 1 was worth 20 marks and is a practical scenario that this year was based on field work. AO1, AO2, AO3, practical and mathematical skills were tested within this question.
- Question 2 was worth 10 marks and tested candidate knowledge of the microscope and associated mathematical calculations.
- Content from 2.1, 2.3 and 3.5 was tested throughout this paper.
- Overall candidates were able to answer the practical based questions and proved they had sound mathematical skills when calculating the Simpsons Diversity Index in Q1. There was more variation in responses to the direct recall/ application of knowledge questions as see in questions 1d. Question 2 was generally answered well, with some variation in the mathematical skills tested from the microscope content.
- Outcomes were similar to that from previous years.

Comments on individual questions/sections

Experimental Task

Q.1 (a) The majority of candidates were able to construct a suitable results table to show all of the data. The best answers showed a neat, clear table with no decimal places and correct rounding of means. The majority of candidates correctly labelled the independent variable, although a few changed the unit from “vol”, therefore losing the “units” mark.
A minority of candidates incorrectly rounded their means and included too many decimal places or were inconsistent in the number of decimal places.

(b) The majority of candidates drew the graph well and many gained 6 or 7 marks. Most candidates used more than half the graph paper for the plot. Marks were deducted, most commonly, for:

- Not writing "mean time taken for disc to sink and rise" on the y-axis.
- Not having an even scale on the x-axis.
- Errors in plotting
- Lack of accuracy in line drawing.

(c) The outcomes in the section were variable and marks were lost frequently for general statements which did not refer to the experiment specifically.
Most candidates were able to state the trend in their data correctly and link it to the size of range bars. In most cases, the statement about the range bars matched the data.
Fewer candidates were able to describe a suitable control, although many gained one or two marks for describing the expected results or stating the purpose of this control.
Many candidates correctly identified the purpose of the buffer, although fewer candidates linked this to the idea that it would improve the method because changes in pH would change the rate of the reaction.
In part (d) the majority of candidates had the right idea about the role of catalase, but some lost marks for failing to link a lack of catalase to a "build up" or "increased concentration" of hydrogen peroxide, thus causing tissue damage.

Practical Analysis Task

Q.1 **(a)** Candidates were able to state control variables for the field work described with ease, they were also able to explain the position of the net in the stream. Where marks were deducted, candidates failed to use clear biological terminology or failed to qualify their answers.
Candidates struggled to articulate why several samples were collected along the riverbed and many failed to mention the 'biodiversity/ species' here.

(b) Many candidates had no trouble stating a suitable hazard for the field work. They did, however, lose marks for not stating an action when describing the risk. Suitable control measures were described but due to the risk being incomplete they were unable to achieve this second mark.

(c) The majority of candidates had no problem in calculating the Simpson's Diversity Index correctly. Where errors occurred, candidates had not deducted their value from 1.
Most candidates could state a correct conclusion for the level of biodiversity in the river. If marks were lost here, the candidates failed to extend their answers and state that the Simpson's diversity index value was close to 1 therefore high.
Describing ways in which confidence could be improved and naming abiotic was not a problem for most candidates.

(d) It was clear that not all candidates were familiar with kite diagrams for (i). Here there was a variation in answers, however, it was decided that if they at least knew the term 'kite' it would be accepted. Following on from this, candidates then struggled to describe an advantage of displaying data using kite diagrams. Answers lacked clarity and some candidates failed to associate their use for measuring percentage cover **over a distance**.
Answers for (iii) mainly described the trend in the percentage cover of wood anemone along the transect. Very few actually explained why this trend occurred as the question asked.
The majority of candidates struggled to achieve more than 1 mark for (iv). They failed to apply their knowledge of the nitrogen cycle to the boggy ground and how the round- leaves sundew uses insects as a source of nitrogen. Answers did not connect that high levels of denitrification resulted in low nitrate levels and as such the plant would digest the proteins from the insects to gain a source of nitrogen. Candidates would start off well and restated the high levels of denitrification but then didn't extend their answers to apply it to the question.

Q.2 **(a)** The majority of candidates scored well when naming the structures from the artery. There was some confusion for structure B with many candidates naming this as the tunica intima, when it was the endothelium- this resulted in them losing 1 mark.
It was clear that candidates either knew how to calibrate the microscope or did not. Many candidates failed to convert their answers here to micrometres and as such lost 1 mark- some were dividing their answer by 1000.
Following on from this most candidates did score some marks for calculating the size of the artery and/ or the magnification. It was evident that most candidates did know the mathematical processes involved here and used the correct equations.

(b) There were no issues in describing one way the structure of the vein would differ from that of an artery.

(c) Most candidates successfully explained why the light microscope would not be suitable to observe mitochondria however, there were a small number of candidates that were using terms such as 'it is not powerful enough/ it is not strong enough'. These were not acceptable as they were too vague. Candidates should be using the correct terminology, and they should refer to magnification or resolution.

Supporting you

Useful contacts and links

Our friendly subject team is on hand to support you between 8.30am and 5.00pm, Monday to Friday.

Tel: 029 2240 4252

Email: science@wjec.co.uk

Qualification webpage: AS/A Level Biology (wjec.co.uk)

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