GCE AS Examiners' Report

Biology

AS

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 component.

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	Eduqas 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.eduqas.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 Eduqas subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For linear specifications, a single grade is awarded for the subject, rather than for each component that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results and Grade Boundaries and PRS (eduqas.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	Eduqas 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.eduqas.co.uk/
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Executive Summary

Overall, the standard of candidates' responses to questions was good and was similar to that shown in 2023, with a similar overall mean.

Better candidates were able to express themselves well using appropriate scientific terminology. In several cases however, a lack of precision of expression or a failure to include biological terminology prevented candidates gaining credit.
The responses to the quality of extended response questions on both components again proved problematic to a number of candidates. Candidates should be encouraged to structure their responses to address each of the three sections of the question using the information they are provided with.

Most candidates demonstrated a sound ability to process, analyse and interpret simple data and information. However, only more able candidates were able to pull information from several sources to draw conclusions.
This year, across the cohort, there was an improvement compared to previous series in the ability to answer questions testing mathematical skills. There was also an improvement in the responses to some practical skill type questions.

In Component 1 a good understanding of osmosis, enzymes and biological molecules was shown. However, the understanding of the Meselson and Stahl experiment caused more issues, as did the identification of tissues in an unfamiliar micrograph. Answers to the quality of extended response question were mixed with some excellent responses seen but also some which failed to score many marks. The first section of this question required the application of knowledge of protein synthesis to cystic fibrosis. Many candidates gave generic responses which did not score highly.

In Component 2, the understanding of biodiversity, carriage of carbon dioxide and some aspects of plant gas exchange was particularly good. However, the questions on digestion and the pressure changes within the circulatory system appeared more challenging. This was especially the case where candidates need to use all the information given to be able to gain higher marks in questions assessing AO2 and AO3 skills.

Areas for improvement	**Classroom resources**	**Brief description of resource**
Recall of scientific terminology	Improving AO1 skills	A series of questions designed to improve AO1 knowledge
Microscopy skills	Improving microscopy skills	Information and tasks to improve microscopy skills
Structure of responses to QER questions	Online exam review	Annotated sample candidate responses which can be used to show good practice
Knowledge and understanding of DNA replication	Blended learning – nucleic acids and their functions	This blended learning resource contains interactive self-study content covering Component 1 – DNA replication.

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COMPONENT 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION

Overview of the Component

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.

Content covered in the paper included: The properties of water, root pressure in plants, tissues and organs, analysis of electron micrograph, classification, biological molecules, practical skills, enzymes, maths skills, nucleotides, DNA replication, analysis of evidence, transport across membranes, protein structure and function.
Candidates showed good maths and practical skills in their responses.

The following aspects of the assessment were answered well in the main

- Understanding the rationale of practical design (Q5bi/ii)
- Descriptions of a trend from a graph (Q3cii, Q5aii)
- Explanations of trends in data (Q3cii Q5aii)
- Use of information and applying knowledge (Q4,Q5,Q6)
- Use of precise biological terminology (Q1ai, Q2bi, Q3aii/cii, Q4aii)

The following aspects of the assessment were answered less well

- Identifying components from histology photomicrographs (Q2biii)
- Identifying differences and/or similarities between molecules (Q3aiii, Q4ai)
- Interpreting data from a diagram and applying this to their own knowledge (Q4bii/iii/iv)
- Providing suggestions relating to an unfamiliar context using their own knowledge (Q6)

Comments on individual questions/sections

Q.1 **(a)** Most candidates could give a good explanation of the structure of water and its properties. Part a(iii) was answered well by stronger candidates who could recognised that water moving into the base of the xylem would push water molecules upwards.

(b) Many candidates were able to state the advantages of water properties to living organisms.

Q.2 **(a)** Identification of the structures from the electron micrograph was done well by most candidates. Although many could state the correct kingdom for the cell type, spelling was poor in some cases. Many candidates wrote that the chlorophyll would absorb the light from the light microscope. Some responses stated that the structures were too small to be seen but did not refer to the magnification or resolution of the light microscope being too low.

(b) Most candidates were able to give correct differences between tissues and organs, although a common error was to state that a tissue was a collection of different cells rather than one cell type.
Many candidates had difficulty correctly identifying the tissues in the photomicrographs in (iii). Common errors here included only stating epithelium rather than ciliated epithelium; skeletal muscle was often identified as cardiac or smooth muscle and connective tissue was identified as nervous tissue/blood or cardiac muscle.

Q.3 **(a)** Most candidates were able to identify the isomer of glucose and the reaction correctly. The arrangement of the beta glucose was less well expressed in many responses. Some answers stated that the glucose is rotated or that each glucose is rotated, rather than alternate glucose molecules are rotated.
Most candidates were able to identify the differences between pectin and cellulose. Stronger candidates recognised that there were two different groups at C6 in pectin. Several candidates missed this on the diagram stating that pectin had $COOCH_3$ and cellulose CH_2OH; pectin also had COOH.

(b) This question assessed practical skills. Most candidates were able to identify the independent and dependent variables plus the source of error with the filter paper method. More errors were made when identifying the variables which were not controlled. Common errors included giving the amount or volume of pineapple rather than the mass. More able candidates referred to the type/species of pineapple.

(c) Graph drawing skills were good, with most candidates using correct labels and units, plotting accurately and drawing good lines of best fit. Some candidates however, made a poor scale choice. This made plotting accurately and reading off the values difficult. Some lines of best fit were sketchy, and curves used to join all the points. Most candidates could identify trends from the graph and generally gave very good explanations of whether enzymes or substrates were the limiting factors at the different points on the graph. They also linked their responses to the data. Many candidates gained all available marks in this question.

Q.4 **(a)** Candidates were able to use the diagrams to interpret the information. The quality of the responses in the recall of why ATP is a suitable energy currency was varied. Many could recall the value of 30.6kJ. However, candidates should be careful when writing this value as many used a dash before the value which read as –30.6kJ, a negative value. Some candidates wrote that a lot of energy was released from ATP hydrolysis rather than small amounts. There were also references to 'suitable/sufficient/appropriate' amounts of energy released, which were not creditworthy. Few candidates could recall that there was one reaction using one enzyme.

(b) Many good responses were seen in response to where ^{14}N would be incorporated into the nucleotide. Many were also able to express why a sample was taken at Gen 0, before addition of the ^{14}N culture medium.
In part (iii) however, many candidates struggled to accurately describe semi conservative replication.

There were many references to 'half' of the DNA containing ^{14}N or ^{15}N, rather than referring to the strands being composed of ^{14}N or ^{15}N. Successful responses wrote about template strands being used and gave a clear explanation of there being more ^{14}N strands acting as templates.
In part (iv), many candidates recognised that there was no ^{15}N available for replication and therefore $^{14}N^{14}N$ would increase. Many responses simply restated the question in other words and gained no credit.

Q.5 **(a)** Maths skills shown here were very good with answers expressed to the correct number of decimal places in the table.
In part (ii), there was very good interpretation of the bar graph, with well written answers. Candidates could identify the trend and link this with the data. There were very good explanations of the trend in terms of the water potential differences. Some candidates stated that the water potential in the external solution was lower so water would leave the carrots. Some candidates referred to potato rather than carrot.

(b) Practical skills – when completing the method to find the water potential of the carrot tissue many omitted that they would calculate the percentage change in mass. Many could identify that where the line crosses the x-axis is where there is no mass change. Fewer were able to follow this with how this point could be used to determine the water potential of the carrot.
In part (ii) candidates were expected to know that older carrots would have a higher water potential, some candidate's responses stated the opposite. Many candidates were able to state that starch has no osmotic effect. There were some very good candidates who could link this to an increase in the solute potential.

Q.6 Responses to this QER question were variable. Some candidates giving only very brief answers or only a short paragraph. Others gave a full response of protein synthesis but did not link this to the question asked.

In response to the first section of the question, candidates rarely referred to the 'one gene one polypeptide' hypothesis. However, good candidates realised that in order to delete an amino acid from the polypeptide, then three bases must have been deleted. Many responded that a stop codon could be coded for, and credit was given for this. They could then suggest that the polypeptide would be shorter, and its function affected. However, fewer were able to link that the mutation in the DNA would result in mRNA not coding for an amino acid and therefore no tRNA. Many thought that a different amino acid would be added rather than a deletion. Some candidates referred to the protein rather than the polypeptide.

In the second section, most candidates were able to gain most marking points. They showed a good understanding of the changes in protein structure at all levels linked to the formation of bonds in the tertiary structure.

In the third section, lots of candidates were able to describe how the protein would be a different shape, and this would result in no transport of the chloride ions. Strong responses were seen which included a discussion about the hydrophilic region of the protein being changed.

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COMPONENT 2: BIODIVERSITY AND PHYSIOLOGY OF BODY SYSTEMS

Overview of the Component

The demand of the paper and balance of assessment objectives was equivalent to that of previous years. The challenge of the questions was at an appropriate level for AS candidates and considered a fair representation of the specification content for component 2. In general, candidates performed better in questions relating to biodiversity and plant gas exchange.
Adaptations for diet/digestion and circulatory systems were topics that were not answered as well overall.
There were variable degrees of attainment for other topics covered, namely, plant transport together with animal and plant gas exchange.

The standard was generally good for the following skills and features of the assessment.

- Many AO1 questions involving straightforward recall.
  (Q1a(ii), Q1c(ii), Q2b(i), Q2c(ii), Q3a, Q4a(i) and (ii), Q 5a(ii) and sections of Q6).
- Calculations of diversity index and calculations including percentages and ratio.
  (Q1a(iii), Q1b(ii), Q4b).
- Understanding of basic features of practical method.
  (Q1a(iv), Q1b(i), Q5c(ii).)
- Observation of the main features of photomicrographs.
  (Q 6).
- Identification of general features from a graph.
  (Q4c(i) and (ii), Q 5b(i) and (ii).)

The standard was generally lower for the following skills and features of the assessment.

- Information recall for some AO1 and AO2 questions.
  (Q2b(iii) and (iv), Q 2c(i), Q 3a, Q 5c(v) and sections of Q 6).
- Accuracy of observation of photographic information.
  (Q 2a and some features of Q 6).
- Interpretation of information provided in the question. Most often for AO3 marking points that require application of knowledge.
  (Q 2b(iii), Q 3b(ii)).
- Interpretation of some data/information presented graphically.
  (Q 3b(i), Q4 b(iii) and (iv), Q 4c).
- Precision of expression and use of correct biological terminology generally. Mainly in longer answers but particularly for Q 6.

Comments on individual questions/sections

Q.1 **(a)** Part (i) was answered well by most candidates with the majority able to recognise a common genus. If errors occurred in (ii) it was often because it was not made clear that a combination of two species mating could not produce fertile offspring. An understanding of the term 'interbreed' was required. The majority of candidates were familiar with Simpson's diversity index and found the calculation straightforward enough to obtain full marks. Part (iv) tested a practical application and many answers identified two sensible sources of error. Some incorrect answers misinterpreted the procedure as 'capture, mark, recapture' although there was no description of individuals being recaptured or counted more than once. Errors in carrying out the method were sometimes confused with errors inherent in the method itself.

(b) Few candidates recognised that an estimate of percentage cover is subjective. Some creditworthy answers described different individuals as having a different perspective. Other descriptions were given credit if they were clear. Most candidates were able to carry out the percentage calculation in (ii) correctly.

(c) A considerable number of candidates were unable to recognise that a percentage enables comparison whereas numbers may not. It was not clear from some answers that there were different populations of fish.
Part (ii) required recall and candidates who had learned this topic were able to describe polymorphic alleles clearly.
Some answers in (iii) were expressed precisely and many were awarded full marks. A number meandered into general descriptions of natural selection that did not explain the example given. Those who were unable to recognise this question as relating to genetic diversity within one species tended to relate answers to several species. Other answers did not address the issue of the effect of small branch spacing stated in the question or weren't able to offer a reason why size would make a difference to the growing fish.

Q.2 The variation between candidates' understanding of ruminant nutrition and ability to calculate large numbers accurately made the greatest contribution to the wider variation of marks. The question required a wide range of application of knowledge related to digestion.

(a) A relatively straightforward assessment of carnivore dentition proved problematic for many candidates. Careful observation of the photograph and use of descriptors was required.
Vague references to 'killing' prey with no description of how, were not accepted.
Often, the relevant reference to the shape of teeth was omitted.
Some gave features of carnivore dentition that were not visible on the polar bear skull or made inaccurate observations, e.g. 'large incisors'.

(b) The majority of candidates were able to identify the enzyme, pepsin or its precursor correctly in (i) and give a sensible reason for a low pH in the abomasum. 'Killing bacteria' was also an accepted answer which would be relevant to the answer to (b) (iii).

There were many correct calculations in (ii) that showed an ability to use standard form and therefore gained full marks. Most errors were due to decimal points not being in the correct place. There were some unfortunate examples of candidates losing a mark after producing a correct answer then placing an incorrect answer in the answer space.

Many responses relating to ruminant adaptation were not expressed clearly in (iii). More able candidates recognised that bacteria that passed into the abomasum would be digested by the cow. Some candidates had used the information provided and commented that there was a significant quantity of such bacteria, expressed either as numbers or biomass.

The role of lysosomes was stated correctly in many answers for (iv). Unfortunately, some candidates could not be given credit as the organelle was described as 'lysozyme'. Some descriptions of the digestion process were not as precise as they should have been but in general, the process was understood.

(c) There were several candidates who understood the advantages of plasma membrane bound enzymes in the small intestine in (i). It was disappointing that many could not suggest a reason for their location despite knowing where these enzymes were.
Part (ii) was answered well by the majority of candidates. Some failed to gain two marks as their answer related to absorption and not digestion as required by the question, but these were in a minority.

Q.3 **(a)** The majority of answers for each of questions (i) to (iv) showed that most candidates understood the concept of $C0_2$ transport. Where errors occurred,
(i) carbonic acid was sometimes misidentified.
(ii) confusion regarding the possible effect of hydrogen carbonate ions on pH or omission of comments regarding the fate of hydrogen ions.
(iii) of the candidates who answered this question, most knew the function of Cl^- in electrochemical balance.
(iv) most answers stated that CO_2 is transported in the blood but failed to identify which component.

(b) Candidates seemed unfamiliar with the term 'equilibrate', which would have made their responses in (i) clearer and less onerous to write. However, there were some good descriptions that made it clear that body temperature of the insect must be the same as the environment before recording data. Vague statements about insects adjusting or adapting without reference to body temperature were not given credit. Few candidates indicated that the insect's ventilation needed to be stable at the start of recording.

Most correct answers in (ii) made the link between feeding and respiration. Few commented on the potential for increased CO_2 due to body temperature increase from feeding on mammalian blood.

In part (iii) candidates had little trouble identifying the effect of increased partial pressure of CO_2 on ventilation rate although references to critical threshold were less common. Some responses commented on an increase in kinetic energy or CO_2 concentration. The effect on diffusion was rarely stated as a reason for decreased spiracle opening time.

Q.4 **(a)** The majority of candidates were able to obtain both marks in (i). Reducing water loss by night was understood and most were able to link the effect on photosynthesis to reduced CO_2 availability if stomata were to close by day. It was pleasing to see answers to (ii) that gave a clear account of the mechanism that causes guard cells to become turgid with many candidates obtaining maximum marks. Some continued to explain how this lead to stomata opening, although this was not required by the question.

(b) The calculation based on aspect ratio in (i) posed few problems with most candidates producing the correct answer.
Candidates should be familiar with scale drawing. On the whole, this was confirmed by the number who calculated magnification correctly in (ii). Errors in converting units produced some answers that were incorrect by factors of 10 or 100. Only the more able candidates were able to recognise that using aspect ratio allowed comparison of stomata of different sizes in (iii). Descriptions were varied.
Despite being directed to consider the shape of the stoma in the photograph in (iv), relatively few candidates recognised that a fully open stoma is not circular or that a ratio of one is a circle.

(c) Part (i) applies one of the fundamental features of gas exchange, namely, area for diffusion. Most answers described an increased stomatal density correctly. A few linked this to an increase in diffusion of CO_2 but very few were able to explain that this was due to an increased area for diffusion.

Many responses in (ii) made logical predictions of reduced numbers of stomata over time with appropriate explanations of decreased transpiration as a result. Descriptions needed to be clear that water vapour (into the atmosphere/from plants) was reduced. Answers related to stomata opening or closing were not creditworthy.

Q.5 Application of knowledge of pressure changes was found to be challenging for some in this question.

(a) It was disappointing to find few candidates with a good understanding of the features of an open circulatory system.
Answers that linked the direct contact between fluid and body tissues with a short diffusion distance were rare in (i). Similarly, only a small number of answers stated a slow rate of flow/fluid transport as a disadvantage.
Most candidates were able to describe a double circulatory system as blood passing through the heart twice in (ii). Not all answers made it clear this was during the course of one circulation around the body.

(b) There were many correct answers to (i) that showed a clear understanding of the pressure changes during a cardiac cycle. Many candidates had a thorough knowledge of the graph. In part (ii), a significant number of candidates recognised that atrial pressure increased due to passive filling with blood.

(c) On the whole, descriptions of standard deviation lacked precision in (i). Some amounted to little more than a description of the range of data, which was incorrect. Most answers did not relate to variation of data although many had some idea of a comparison with the mean. Few realised that a value for SD did not represent all the data. However, many were able to discern that there may have been widely differing levels of activity within group 1.

Most candidates understood the concept of 'reliability' in (ii) and were able to find some aspect of the method that added reliability. Some gave their own ideas for improvement of the method, which was not required.

Calculation of stroke volume posed few problems with most answers achieving both marks in (iii). In part (iv), many candidates could explain the effect of a larger stroke volume on cardiac output from the information provided. However, only a minority were able to relate this to increased force of contraction by cardiac muscle in order to explain how. A common error in (v) was to omit to state 'recoil', the feature that is relevant to maintaining diastolic blood pressure.

Q.6 The quality of responses was varied, and marks spanned the entire range from 0 - 9 with most in the middle of the range. This suggests that some candidates could draw upon a reasonable knowledge of both xylem and hydrophytic adaptations. Several answers used descriptions of parts other than stems. These points were either irrelevant or incorrect.

Candidates should not be setting out their answers as bullet points or lists for a QER question. Some answers were little more than phrases with no adequate sentence structure to provide an integrated account.
It was pleasing to read answers from those candidates who organised information logically and there were some well written examples that used the information effectively to link relevant points.

Most responses were written in the order that the question suggested, although many were not well structured. This was particularly common when candidates were attempting to describe differences between the two stems. Some used a logical approach that compared one feature at a time from each plant. Those who separated features that were meant to be comparative, missed some marks as the comparison became unclear.
Credit was given for various descriptions of the position of the xylem in Helianthus if these were sensible. However, poor use of vocabulary made some answers incorrect and references to xylem being 'on the outside' was all too common. Few answers recognised the support provided by many hollow tubes.

Too many candidates were unsure of plant anatomy and gave descriptions of root structures despite being told that both photomicrographs were stems. The position of the leaves on the water surface was also given in the question. Some answers lapsed into unnecessary details of leaf structure and most failed to link the position of the leaves to an explanation for poorly developed xylem in Potamogeton.
A few candidates wrote unnecessary descriptions of the pathway of water through root tissue.
Many referred to air spaces providing buoyancy. However, most candidates did not seem to appreciate that gases would be transferred or diffuse more quickly through the stem's aerenchyma.
In summary, the highest marks were awarded to candidates who used all the information provided combined with a sound knowledge of structure and function of stem tissues.

Supporting you

Useful contacts and links

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