# GCE A LEVEL EXAMINERS' REPORTS

# BIOLOGY
## A LEVEL

## SUMMER 2023

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## Introduction

Our Principal examiners' reports offer valuable feedback on the recent assessment series. They are written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and detail how candidates have performed.

This report offers an overall 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 goes on to look in detail at each question/section of each component, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.[i]

The information found in this report can provide invaluable 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

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|---|---|---|
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| 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 6 months after the examination. | www.wjecservices.co.uk or on the Eduqas subject page |
| Grade boundary information | Grade boundaries are the minimum number of marks needed to achieve each grade.<br><br>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.<br><br>For linear specifications, a single grade is awarded for the overall subject, rather than for each component that contributes towards the overall grade. Grade boundaries are published on results day. | For unitised specifications click here:<br><br>Results and Grade Boundaries (eduqas.co.uk) |

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| Exam Results Analysis | WJEC Eduqas provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre. | www.wjecservices.co.uk |
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**Executive summary** **Page**

**Component**

Component 1: Energy of Life 6

Component 2:Continuity of Life 9

Component 3: Requirements of Life 12

Component 4: Practical endorsement 20

**Supporting you – useful contacts and links** **24**

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## Subject Officer's Executive Summary

Overall, the standard of candidates' responses to questions on all three components was good and the mean on each increased by varying degrees. Many candidates demonstrated a sound ability to process, analyse and interpret data and information. More able candidates were able to express themselves well using appropriate scientific terminology. However, a significant minority of candidates were not able to recall the terminology required for AO1 questions.

Maths skills were generally good, although candidates should take note of how the answer should be expressed. Practical skills seemed to vary over the three components, being good in some topic areas but lacking in others. Microscopy work, especially calibration and the identification of structures was noted as causing a particular issue.

Most candidates now tackle the QER question as three separate sections and the mean mark for this type of question is increasing. The QER normally assesses a mixture of assessment objectives so candidates should take particular note of any information given in the stem of the question as it is likely they will need to use it in their answer.

All assessments contain a mixture of assessment objectives and AO2 and AO3 style questions require candidates to use both their own knowledge and the information given. A common issue was for candidates to just write everything they knew about a topic rather than applying it to a particular context and therefore not answering the question.

All components are required to assess synoptic elements from the other two components and also core concepts. It is vital that candidates understand this and revise the contents of the core concepts alongside each component.

In Component 1 performance increased, resulting in a significant increase in the mean and many excellent scripts were seen. However, there were still a wide range of standards in the quality of answers. Good understanding was shown in most topics. Most problems were seen in candidates' knowledge and understanding of core concepts and in the application of practical skills, especially fieldwork. Many candidates did not read the rubric of questions or use the information provided in question stems and images. As a result, some marks were lost due to candidates not following the instructions given.

There was a slight increase in the mean mark for Component 2. Again, problems were seen in candidates' recall of facts and in their application of knowledge to new contexts. Questions that required the application of practical skills proved more challenging than in previous years. There was also evidence of candidates not reading the rubric of questions or using information provided in images. As a result, marks were lost as candidates did not follow instructions given. However, here the standard of the mathematical responses was very good and responses to the QER question have improved.

The mean mark for component 3 also increased. Where candidates did have issues, again they tended to be the ability to recall facts and also to identify structures seen in images. There was also a generally poor application of practical skills, especially microscopy, where most candidates continue to struggle with calibration. As in the other components there was evidence of candidates not reading the rubric of questions or not applying the information provided. Once more, poor communication skills proved an issue for many candidates.

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| 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 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 | 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** | Exam walk through | These resources offer practical hints and tips on how to effectively approach questions in the examination paper. Available for all three components, the PTs with audio help and audio script in the notes will walk candidates through mock examination papers, helping them revise and practise useful exam techniques. |
| **Revision of Core Concept topics** | Chemical elements are joined together to form biological compounds - Blended Learning | This blended learning resource contains interactive self-study content covering Core concept – biological compounds. Candidates may find this useful either as a recap or in flipped learning |

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# BIOLOGY

## GCE A LEVEL

## Summer 2023

## COMPONENT 1 – ENERGY FOR LIFE

### Overview of the Component

Component 1 tests candidates' knowledge and understanding of energy systems in animals and plants and the flow of energy in ecosystems. The component also covers topics on populations, microbes and the human impact on ecosystems and the planet.

Questions on these topics tested candidates' ability to recall facts, apply knowledge and understanding and use a range of information to evaluate and reach conclusions. Most questions were set in a practical context and tested the use of mathematical skills in Biology.

Overall, the paper seemed to have been more accessible than in previous series with nearly 70% of questions having a facility factor of over 50%. Questions on some topics (eg., ATP and microbes) were well answered while others (eg., application and explanation of some practical techniques) posed some problems.

### Comments on individual questions/sections

**Q.1** There were few issues with candidates' responses to this series of questions on ATP synthesis. The facility factors for this question were all over 60.0.
Points to be addressed are:

- that oxidation of a reduced molecule XH to its oxidised form X is due to the removal of hydrogen
- to make sure that candidates can compare ATP synthesis in mitochondria and chloroplasts correctly
- to understand and explain correctly the terms exergonic and endergonic

**Q.2** This question tested candidates' knowledge and understanding of photosynthesis together with the application of practical skills.
Questions on leaf structure and photosynthetic pigments involved both recall and interpreting information provided. These questions were well answered by nearly all candidates (facility factors of 68.6 and 74.3 respectively).

There were, however, some issues with applying practical skills that are described in the Lab Book, in this question, determining the surface area of a leaf. Together with synoptic questions on germination, this part of Q2 had one of the lowest facility factors on the paper (23.9). In fact, few candidates correctly answered synoptic questions correctly on germination requirements of seeds (Component 2) and adaptations of leaves for photosynthesis (Component 3) (facility factor 32.7).

Some marks were lost by candidates who misread the key provided on the graph and many candidates had difficulty explaining why data showed a normal distribution. This has also been an issue on previous papers.

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**Q.3** This question tested candidates' knowledge and understanding of respiration and also core content on isomers and enzyme inhibition.

Candidates' responses to most questions on respiration demonstrated a very good level of understanding of this metabolic process. As mentioned in the overview, oxidation of a molecule XH to X is due to the removal of hydrogen.

The question on isomers of glucose was less well answered (facility factor 42.6). Despite the question on enzyme inhibition having a facility factor of 57.6, there were many responses where there was confusion between competitive and non-competitive inhibition.

The last part of the question required candidates to calculate the blood glucose concentration of a patient and then use their answer to evaluate this person's risk of developing diabetes. The main issues with the calculation were that some candidates:

- did not read the instruction in bold to give their answer to the nearest mg/dL
- did not know how to convert grams to millligrams.

The evaluation part of this question was less well answered (facility factor of 41.6). Just repeating information in this type of question is not sufficient to gain credit.

**Q.4** This question tested candidates' knowledge and understanding of the nitrogen cycle. There were many excellent explanations of the sequence of appearance of nitrogenous compounds in an aquarium. Recall of the facts on this topic seemed to be far better than in recent exam series and all bar one part of the question had facility factors of over 50.0%.

However, few candidates could suggest a reason for a sudden decrease in nitrate levels in terms of changing some of the water (facility factor 5.6 – the lowest on the paper). Many reasonable explanations were suggested but their suggestions would have required too much time to take effect.

It is also worth noting, that even though the facility factor for Q4 (c) on eutrophication was 56.8, many candidates could not apply their knowledge of this topic to the context of the question.

**Q.5** This question tested candidates' knowledge and understanding of microbiology, especially practical skills associated with this area of the specification, and the use of mathematical skills. Nearly all questions were answered well by all candidates, with facility factors of over 60.0%.

Areas which need to be addressed are that some candidates:

- do not read the instruction in bold to give their answer to one decimal place
- know the precautions associated with inoculating agar plates with faecal bacteria but cannot explain how these precautions reduce risk – they also need to read the question that asked for precautions <u>when inoculating</u> plates, and not just general precautions associated with aseptic technique; the facility factor for this question was 43.2%.

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- did not understand that they were asked to use data provided to calculate the number of bacteria in 1g of food. There was also confusion when comparing their answer (mostly answered correctly) to the minimum infective dose. Consequently, when asked to conclude the risk of food poisoning from eating this food many incorrect responses were given.

**Q.6** This question tested candidates' knowledge and understanding of succession and the practical skills associated with investigating ecosystems to determine biodiversity. Overall, this proved to be the most challenging set of questions on the paper.

The questions on succession asked candidates to explain and conclude the effect of long-term management of roadside verges. This required that candidates knew what was meant by a climax community and that they read the information provided in the stem of the question. It was apparent that many candidates could not apply their knowledge of succession to the scenario described. For example, candidates were told that many wildflowers are adapted to growing in soils with low fertility, but then went on to describe and explain the exact opposite when reaching and explaining their conclusion as to why removal of cut vegetation increases the biodiversity of wildflowers on road-side verges. This part of the question had a low facility factor of 20.0%.

Most questions on the practical skills associated with sampling were well answered. Candidates lost marks when attempting to evaluate the method used to collect data. Candidates were told to use all the information provided and many did this. However, many incomplete answers were given which showed that candidates could identify the issues but did not then provide enough detail to explain why this was an issue with the method. The facility factor of 36.0 reflects the lack of detail provided in candidates' answers.

**Q.7** This question tested candidates' knowledge and understanding of population growth in the context of the increasing human population on the planet. This question also tested candidates' ability to produce well-reasoned answers in an extended response.

The first part of the question asked candidates to define density dependent and density independent factors and then explain how such factors could explain the rise in the human population between 1800 and 2000. Overall, most candidates gave reasonable definitions but then gave generic explanations of the effects of these factors without linking them to human population growth.

The second part required candidates to identify the section of a population growth curve as shown by three different models of future human population growth. This part of the question was answered well. Candidates could identify lag, stationary and decline phases but did not always give enough detail to gain full marks.

The last part of the question asked candidates to suggest how a decrease in the human population might affect the climate change boundary. It was obvious that most candidates knew many facts associated with climate change, but most did not apply their knowledge well to this scenario.

The question had a mean of 4.6 / 9 and a facility factor of 51.7% which suggest that this question was accessible and differentiated well between candidates.

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**BIOLOGY**

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**Summer 2023**

**COMPONENT 2: CONTINUITY OF LIFE**

## Overview of the Component

There was a range of standards seen in many of the answers but all of the marking points were seen during the marking process. The standard of the mathematical responses was very good. Questions that required the application of practical skills proved more challenging than in previous years. Candidates' response to the QER have improved.

## Comments on individual questions/sections

**Q.1** In (a)(i) the most common incorrect answer was intercellular or a named enzyme. For (a)(ii) many candidates gave an answer that was either not a protein (DNA/ nucleic acid) or from a bacterial cell. The cross on (a)(iii) had to be on the line between the sections indicated on the mark scheme to gain credit.

For (b)(i) many candidates spotted the presence of photosynthetic pigment so wrote that photosynthesis takes place. Most of them then went on to say that that produces oxygen which inhibits nitrogen fixation. A significant number wrote that oxygen was needed for photosynthesis so did not gain the second mark. Most candidates gave the answer that the nucleus is not present for (b)(ii). 70s ribosomes being present was also commonly seen. The presence of a cell wall had to be qualified e.g. a murein or peptidoglycan cell wall, as cellulose cell walls can be present in Protoctista.

**Q.2** The question was well answered by many candidates. For (a) the second mark required candidates to state how the water entered the cells. The practical marks in (b)(i) were for the root tip being a single layer thick and/or light passing through, not for just a thin layer. Some candidates lost the mark in (b)(iii) for giving more than one letter for the cells.

**Q.3** In (a) most candidates gained the first mark for the idea of the scientific name being universal but failed to gain the second mark for the genus indicating relatedness. Part (b) asked for the number of chromosomes present in structures and how the structures were formed. The best answers worked out the numbers and used the correct terminology at each stage for the explanation. Even if the number of chromosomes was wrong (e.g. candidate used 23 and 46, or 2n and 3n) they could still gain credit for the explanation. The most common mistake was using the term polar body in the formation of the primary endosperm nucleus. Correct answers could be a male gamete fusing with a diploid polar nucleus or two haploid polar nuclei.

Part (b)(ii) followed on with the number of chromosomes theme, but it required the candidates to remember their component 3 content and that phloem sieve tube elements do not contain a nucleus. These cells do contain other organelles.
Most candidates realised that structures X were integuments and would form the testa or seed coat but some candidates misidentified them and gave an answer relating to fruit.

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Part (c) required candidates to suggest how spindle inhibition could be an advantage to the *Colchicum* plant. No cell division = no root growth of other plants = no competition was often given, but many stated that the plant itself would stop growing and that would give more energy for flowers.

**Q.4** Part (a)(i) was answered well. Question (a)(ii) asked for an explanation of why mitosis and meiosis are involved in spermatozoa production. Unfortunately, many candidates just gave a description of the production and not an explanation of both processes; however, many gained a mark for the production of haploid gametes during meiosis.

In (b)(ii) candidates were told to use the image and the information. Many spotted that nitrogen was absent so testosterone is not a protein. Few used the formula given to work out that testosterone is not a carbohydrate as it does not follow the general formula of $C_n(H_2O)_n$.

Part (d) was answered well but some candidates lost marks for not writing that the nucleus and the cytoplasm volumes both decrease.

In part (e)(i) a description of the information given in the table did not gain many marks as conclusions also had to be made. Part (e)(iii) used the concept of competitive inhibition (core concept) and applied it to a novel situation (contraception). Many candidates answered this well, although some missed that the acrosin is the enzyme.

**Q.5** For part (a)(i) some candidates lost marks for comparing molecules of DNA and RNA, not the nucleotides. Part (a)(iii) was the least well answered question on the paper. There were marks for the guide RNA having a complementary base sequence to that of the defective allele and the use of ligase to place the functional allele into the cut sequence. In some cases, the advantages of germ line therapy were written about in this part rather than (a)(iv).

For (b)(ii) the extra DNA had to be from the mitochondria, not just outside the nucleus.

**Q.6** Part (a) was a practical question requiring candidates to come up with ways of stopping cross and self-fertilisation and working out how to make sure the cross is the one being investigated. There were three marks available. The best answers had removal of anther, cover flower (isolate it) and hand pollinate it.

The chi-squared question (b) was answered well. For part (v), the question wanted the candidates to reason why the actual ratio of phenotypes was different to the 1:1:1:1 ratio expected. Many wrote about the large numbers of glossy green and rough striped plants and the low numbers of glossy striped and rough green plants and so gained two marks. Unfortunately, vague references to crossing over and dominance did not gain credit. The best answers showed a full understanding of the concept of autosomal linkage.

**Q.7** This question assessed mainly AO2 , AO3 and practical skills.
When evaluating a method, as in (a)(ii), candidates should try to find positives and negatives with the process. The fact that the snakes were not killed to find their diet was a positive. The most common negatives were that not all of the snakes regurgitated their prey and that the prey may have been partially digested so mass/circumference could not be accurately measured or the prey identified.

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When asked to compare the diets of the two populations in (a)(iii) a description of the table was not a creditworthy response. There was no mark for larger prey as the table referred to mass and circumference; a larger mass and larger circumference were two separate marks.

For (a)(iv) a significant number of candidates believed that accuracy and reliability are the same concept. Reliability was often well described with repeatable results often being given as an answer. Accuracy was sometimes viewed as having results close to the expected value, rather than a true value. Part (v) asked for the independent variable in experiment 2 which was carried out on island snakes, so it could not be the area the snakes were from. The use of percentage change was well explained. Part (v)(i) asked about snakes at maturity, so giving examples from hatching gained no credit.

Separate species evolving in part (b) was often not well expressed. The most common mark was for geographical isolation but then many candidates had the snakes needing to adapt or evolve. Genetic drift and founder effect were mentioned without any explanation. The snakes with selective advantages (the survivors) often passed on the characteristic. They need to interbreed and pass on the allele for the characteristic.

**Q.8** The QER question enabled the candidates to gain the full range of marks. The best responses tackled the question in the three parts suggested.
Oestrogen's role in the control of the timing of ovulation was often well expressed. It is the increased levels of oestrogen that stimulates LH release. There was no need to write about the endometrium. That was also the case for the second part. The question asked for an explanation of why ovulation occurs when progesterone doses are stopped, not the role of progesterone although some credit was given for this. The control of ovulation was often well reasoned but the use of hormones in sheep used for food was less so. No credit was given for the sheep being unable to provide consent for the injections or vague references to it being "unethical" or being "against some religions".

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# BIOLOGY

## GCE A LEVEL

## Summer 2023

## COMPONENT 3: REQUIREMENTS FOR LIFE

### Overview of the Component

This paper covered all assessment objectives, maths and practical requirements. Topics covered were homeostasis including kidney structure and function, microscopy skills, identification of variables from a given procedure, statistical testing – in relation to plant adaptations, the circulatory system and gas exchange, the nervous system and nutrition.

### Comments on individual questions/sections

**Q.1** Candidates could mostly give good definitions for (a)(i/ii). Lower scoring responses stated a group of cells rather than tissue, or did not give 'internal' conditions, often referring to the outside environment. Identification of the epithelium proved difficult, with many giving pedicels or podocytes as their answer.

Part (c)(i/ii/iii) were poorly completed by many candidates. For (c)(i) allowance was given for different values taken from the image, but there were errors in conversion from mm to um, and incorrect calculations on many occasions. In part (c)(ii) the question asked for measurement of the glomerulus, many candidates measurements included the bowman's capsule. Part (c)(iii) error carried forward was given from the two previous parts, but many candidates were not aware of how to calculate the actual diameter of the glomerulus using their previous answers.

**Q.2** The question was based on an investigation into ivy leaf size using the independent variable of full sun or shade. Information was given in the introduction to the question. Many candidates used light intensity as the independent variable in part (a)(i), where the two conditions were required. Almost all were able to state the dependent variable. Control variables were correctly identified by the majority. Improving the reliability of the investigation required more leaves/plants/ fields of view. Many candidates responded that they would repeat the experiment to calculate a mean which was not sufficient.

The statistical test in part (b) was generally well done, most candidates could substitute values into the given formula for the t-test. Some candidates however squared their value for variance, although this had already been completed for them. In part (b)(ii), most could correctly identify the critical value on the table and were able to provide thorough responses for their final conclusion. Some candidates incorrectly accepted the null hypothesis and others omitted to say there was a significant difference 'between the two groups'.

Part (c)(i) – many could link carbon dioxide to photosynthesis for the first marking point, but fewer could link why less stomata were needed due to a higher concentration gradient and faster diffusion. The opening of the stomata required candidates to use the image and their own knowledge to explain stomatal opening. Many gave correct answers regarding the ions involved and the resulting change in water potential resulting, the movement of water and turgidity of the cells.

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Some candidates wrote about ions or water moving into the stoma rather than the guard cells. Less well answered was the reason for the opening. The diagram showed stomata from a grass leaf, and there was limited success in gaining the final marking points which required using the image.

**Q.3** In part (a)(i), candidates were mainly able to say that the lungs of the foetus were not yet developed and that it gained oxygen from the mother/placenta. Fewer of the responses included information regarding the hole allowing the lungs to be missed out by going straight from the right atrium to the left atrium. Some answers incorrectly related to pressure reduction and the heart of the foetus not working. Many responses for part (a)(ii) correctly stated that the oxygenated and deoxygenated blood would mix, resulting in less oxygen to the tissues for aerobic respiration.

Answers to (b)(i) were mixed, some giving the pulmonary vein for the second part. In part (b)(ii) many responses stated that there would be an increase in hydrostatic pressure, with fewer writing that this may result in damage to the capillaries.

For part (c) many candidates stated that the gas exchange surface of mammals was the lungs rather than the alveoli, and in insects it was the trachea rather than tracheoles. Responses for the earthworm and fish were good.

Parts (d)(i/ii) were generally well answered. For part (ii) there were a variety of numbers given, but the answer required was four, one gene for each polypeptide chain.

Part (e) as a whole, was less well answered and often poorly worded, with responses becoming confused. Many candidates could identify that both foetal and yak haemoglobin had a higher affinity for oxygen. Fewer could use the graphs to state that there was higher percentage saturation of the haemoglobin with oxygen at lower partial pressures for the foetal haemoglobin. Likewise with the yak haemoglobin, fewer could state that the haemoglobin was highly saturated at the low partial pressures found in the yak's environment. Responses for (e)(iii) showed they understood that there would be less dissociation of oxygen. Many candidates could state that there would be a lower partial pressure of oxygen at higher altitudes, but reasons for the higher breathing rate were less well answered. The higher breathing rate would be to either maintain a concentration gradient or to obtain sufficient oxygen, rather than more oxygen from the air inhaled.

**Q.4** Part (a)(i/ii) were both answered well in the main. Candidates using the graph and understanding the reasons for the changes in the ratios.

The reasons for the higher diffusion rate of DTT in part (b) were less well answered, better responses wrote that there was a higher concentration gradient rather than simply, a concentration gradient.

Part (c) was well answered in terms of knowledge of glucose transport, plus many candidates linked the co-transport of glucose to sodium ion movement. The better responses then made the link between a limited number of these ions being available. Fewer responses said that the carriers would be saturated at the high glucose concentrations.

**Q.5** Many candidates were able to correctly place the arrow in the node of Ranvier at +40mV and give a reason for their choice. Incorrect responses placed arrows outside the node, within the axon at -90mV or running horizontally along the axon.

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Some responses stated that the axon was polarised rather than depolarised.

For part (b) the image supplied should have been used in responses. Some answers referred to receptor location, which were not shown on the image. Good responses referred to hyperpolarisation and the refractory period, and many could give the second marking point of the location of the vesicles being in the presynaptic side of the synapse.

Part (c)(i) was answered well. Many candidates were able to gain marks for the reduction in transmission rate due to no saltatory conduction. Responses which stated the function of the myelin sheath were given credit. In part (c)(iii), most candidates could give temperature as a factor which would affect the speed of conduction, along with the explanation for the increased kinetic energy of the particles. Axon diameter was often stated, but the explanation was less well known. Stronger responses resulted from candidates having read all the information and using the image given. They gave the ions involved and their direction of movement, plus the resulting hyperpolarisation of the post synaptic neurone. Weaker responses included that GABA blocked the acetylcholine receptors or blocked its release. Responses often included the idea that threshold would not be met even though there was some depolarisation due to sodium ion movement.

Responses for part (e) were generally good, with responses showing that candidates understood the role of acetylcholinesterase and the result of its inhibition.

**Q.6** Responses to the QER question gained the full range of marks. Most candidates were able to give marking points for the amoeba and hydra, but the third part regarding the human were less well answered.

The formation of the food vacuole was given usually as endocytosis and responses often gave that lysosomes were produced by the Golgi body. Fewer were able to clearly explain that the lysosome and the food vacuole fuse, then digestion occurs within the food vacuole due to the enzymes from the lysosome. It seemed that candidates were not aware that this was intracellular digestion, as this phrase was seldom seen in responses. Most were able to give exocytosis for the final marking point.

The section on the hydra was also well answered. Most could use the information given in the images regarding ingestion and the gland cells secreting enzymes. Good responses included the high number of mitochondria providing ATP for active transport or bulk transport.

Human digestion was the weakest area of the QER question, giving less detail than the previous sections. Good responses included mechanical digestion and peristalsis, plus the mouth for ingestion and anus for egestion. Less well answered were the marking points relating to modification of different regions of the gut for digestion of specific nutrients. Many responses did not name regions or were particularly vague about where processes took place. Adaptations for absorption were slightly better, with many able to refer to microvilli, but then not continuing to say where they were found.

**Q.7 Option A, Immunology and Disease**

Most candidates were able to define an endemic disease in (a) and many were able to give a reasonable explanation as to why the data on the graph was expressed as cases per

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100 000. The maths question in part (iii) was well answered by the majority of candidates and some very good responses were seen to (a)(iv), where many gave generally reasonable suggestions for the possible overestimate of deaths from TB.

In section (b), some good responses were seen with an encouraging number of candidates able to deduce the relationship between solubility in non-polar solvents and the effectiveness of rifampicin against *Mycobacterium tuberculosis*. Some candidates gave good responses in section (iii) although a number of candidates seemed to confuse bacterial protein synthesis and viral replication.

Most candidates could explain the need to inoculate below the epidermis to trigger immune response in (c). Many were able to describe the process leading to antibody production, although a number of unnecessarily complex responses were seen, especially in section (ii) where some candidates tended to throw in their entire knowledge of the immune response. Centres should encourage students to practice giving concise responses.

Candidates were generally aware of the possible risk associated with live vaccinations and many gave good responses here.

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**Question 1**
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The question was based on an investigation into ivy leaf size using the independent variable of full sun or shade. Information was given in the introduction to the question. Many candidates used light intensity as the independent variable in part (a)(i), where the two conditions were required. Almost all were able to state the dependent variable. Control variables were correctly identified by the majority. Improving the reliability of the investigation required more leaves/plants/ fields of view. Many candidates responded that they would repeat the experiment to calculate a mean which was not sufficient.

The statistical test in part (b) was generally well done, most candidates could substitute values into the given formula for the t-test. Some candidates however squared their value for variance, although this had already been completed for them. In part (b)(ii), most could correctly identify the critical value on the table and were able to provide thorough responses for their final conclusion. Some candidates incorrectly accepted the null hypothesis and others omitted to say there was a significant difference 'between the two groups'.

Part (c)(i) – many could link carbon dioxide to photosynthesis for the first marking point, but fewer could link why less stomata were needed due to a higher concentration gradient and faster diffusion. The opening of the stomata required candidates to use the image and their own knowledge to explain stomatal opening. Many gave correct answers regarding the ions involved and the resulting change in water potential resulting, the movement of water and turgidity of the cells. Some candidates wrote about ions or water moving into the stoma rather than the guard cells. Less well answered was the reason for the opening. The diagram showed stomata from a grass leaf, and there was limited success in gaining the final marking points which required using the image.

**Question 3**
In part (a)(i), candidates were mainly able to say that the lungs of the foetus were not yet developed and that it gained oxygen from the mother/placenta. Fewer of the responses included information regarding the hole allowing the lungs to be missed out by going straight from the right atrium to the left atrium. Some answers incorrectly related to pressure reduction and the heart of the foetus not working. Many responses for part (a)(ii) correctly stated that the oxygenated and deoxygenated blood would mix, resulting in less oxygen to the tissues for aerobic respiration.

Answers to (b)(i) were mixed, some giving the pulmonary vein for the second part. In part (b)(ii) many responses stated that there would be an increase in hydrostatic pressure, with fewer writing that this may result in damage to the capillaries.

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For part (c) many candidates stated that the gas exchange surface of mammals was the lungs rather than the alveoli, and in insects it was the trachea rather than tracheoles. Responses for the earthworm and fish were good.

Parts (d)(i/ii) were generally well answered. For part (ii) there were a variety of numbers given, but the answer required was four, one gene for each polypeptide chain.

Part (e) as a whole, was less well answered and often poorly worded, with responses becoming confused. Many candidates could identify that both foetal and yak haemoglobin had a higher affinity for oxygen. Fewer could use the graphs to state that there was higher percentage saturation of the haemoglobin with oxygen at lower partial pressures for the foetal haemoglobin. Likewise with the yak haemoglobin, fewer could state that the haemoglobin was highly saturated at the low partial pressures found in the yak's environment. Responses for (e)(iii) showed they understood that there would be less dissociation of oxygen. Many candidates could state that there would be a lower partial pressure of oxygen at higher altitudes, but reasons for the higher breathing rate were less well answered. The higher breathing rate would be to either maintain a concentration gradient or to obtain sufficient oxygen, rather than more oxygen from the air inhaled.

**Question 4**

Part (a)(i/ii) were both answered well in the main. Candidates using the graph and understanding the reasons for the changes in the ratios.

The reasons for the higher diffusion rate of DTT in part (b) were less well answered, better responses wrote that there was a higher concentration gradient rather than simply, a concentration gradient.

Part (c) was well answered in terms of knowledge of glucose transport, plus many candidates linked the co-transport of glucose to sodium ion movement. The better responses then made the link between a limited number of these ions being available. Fewer responses said that the carriers would be saturated at the high glucose concentrations.

**Question 5**

Many candidates were able to correctly place the arrow in the node of Ranvier at +40mV and give a reason for their choice. Incorrect responses placed arrows outside the node, within the axon at -90mV or running horizontally along the axon. Some responses stated that the axon was polarised rather than depolarised.

For part (b) the image supplied should have been used in responses. Some answers referred to receptor location, which were not shown on the image. Good responses referred to hyperpolarisation and the refractory period, and many could give the second marking point of the location of the vesicles being in the presynaptic side of the synapse.

Part (c)(i) was answered well. Many candidates were able to gain marks for the reduction in transmission rate due to no saltatory conduction. Responses which stated the function of the myelin sheath were given credit. In part (c)(iii), most candidates could give temperature as a factor which would affect the speed of conduction, along with the explanation for the increased kinetic energy of the particles. Axon diameter was often stated, but the explanation was less well known. Stronger responses resulted from candidates having read all the information and using the image given. They gave the ions involved and their direction of movement, plus the resulting hyperpolarisation of the post synaptic neurone. Weaker responses included that GABA blocked the acetylcholine receptors or blocked its release. Responses often included the idea that threshold would not be met even though there was some depolarisation due to sodium ion movement.

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Responses for part (e) were generally good, with responses showing that candidates understood the role of acetylcholinesterase and the result of its inhibition.

**Question 6**

Responses to the QER question gained the full range of marks. Most candidates were able to give marking points for the amoeba and hydra, but the third part regarding the human were less well answered.

The formation of the food vacuole was given usually as endocytosis and responses often gave that lysosomes were produced by the Golgi body. Fewer were able to clearly explain that the lysosome and the food vacuole fuse, then digestion occurs within the food vacuole due to the enzymes from the lysosome. It seemed that candidates were not aware that this was intracellular digestion, as this phrase was seldom seen in responses. Most were able to give exocytosis for the final marking point.

The section on the hydra was also well answered. Most could use the information given in the images regarding ingestion and the gland cells secreting enzymes. Good responses included the high number of mitochondria providing ATP for active transport or bulk transport.

Human digestion was the weakest area of the QER question, giving less detail than the previous sections. Good responses included mechanical digestion and peristalsis, plus the mouth for ingestion and anus for egestion. Less well answered were the marking points relating to modification of different regions of the gut for digestion of specific nutrients. Many responses did not name regions or were particularly vague about where processes took place. Adaptations for absorption were slightly better, with many able to refer to microvilli, but then not continuing to say where they were found.

**Question 7 Option A, Immunology and Disease**

Most candidates were able to define an endemic disease in (a) and many were able to give a reasonable explanation as to why the data on the graph was expressed as cases per 100 000. The maths question in part (iii) was well answered by the majority of candidates and some very good responses were seen to (a)(iv), where many gave generally reasonable suggestions for the possible overestimate of deaths from TB.

In section (b), some good responses were seen with an encouraging number of candidates able to deduce the relationship between solubility in non-polar solvents and the effectiveness of rifampicin against *Mycobacterium tuberculosis*. Some candidates gave good responses in section (iii) although a number of candidates seemed to confuse bacterial protein synthesis and viral replication.

Most candidates could explain the need to inoculate below the epidermis to trigger immune response in (c). Many were able to describe the process leading to antibody production, although a number of unnecessarily complex responses were seen, especially in section (ii) where some candidates tended to throw in their entire knowledge of the immune response. Centres should encourage students to practice giving concise responses.

Candidates were generally aware of the possible risk associated with live vaccinations and many gave good responses here.

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## Question 8 Option B, Musculoskeletal Anatomy

In part (a), although a large number of candidates were able to identify how the postural changes could affect movement of the diaphragm and rib cage, many seemed to have difficulty linking this to the effect on the process of inspiration.
Candidates were, on the whole, able to interpret the graph and gave good responses in part (ii). The majority were able to name two controlled variables although a significant number named age which was the independent variable in this study.

Very good responses were seen in section (b) and many candidates were able to describe effective treatments for the fracture even if some had difficulty correctly identifying the bones involved.

The majority of candidates were able to identify the third order lever in (c) and many correctly calculated the force exerted during the exercise.
Some candidates had difficulty clearly explaining the way muscles bring about movement at the elbow. Many could correctly identify the muscles involved but poorly expressed the type of movement with some referring to “lifting the arm” or “raising the elbow up” which could not be credited here.

Section (d) was generally well answered with many candidates gaining all the marks available.

## Question 9 Option C, Neurobiology and Behaviour

Many candidates were able to correctly identify the frontal lobe and cerebellum in (a) but fewer could identify the corpus callosum.
The majority of candidates gave good answers to part (ii) and no significant issues were encountered.

In section (b), the majority of candidates were able to interpret the chart and identify the trend. However, some candidates were less confident in explaining how the range bars shown on the chart increased confidence in the conclusions made.
Part (iii) was well answered with many candidates gaining both marks available. In part (iv) some variable responses were seen and lack of precision lost marks here for some candidates. However, many very good responses were seen with a significant number of candidates gaining all the available marks.

Section (c) was generally well answered, and many candidates were able to access most of the marks available. However, some candidates did have difficulty with part (v) where they were required to suggest an adaptation to the investigation. Centres should emphasise that suggestions of improvement or adaptation of practical methods should be realistic and if they require the use of additional materials or apparatus then they should be ones that would be commonly available in most school or college laboratories.

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**BIOLOGY**

**GCE A LEVEL**

**Summer 2023**

**PRACTICAL ENDORSEMENT**

## Overview of the Component

From September 2022 we returned to face-to-face monitoring after a period when we carried out remote monitoring due to restrictions imposed by the pandemic. This year also saw a return to the requirement that all aspects of the Practical Endorsement should be met. We only observed a relatively small number of centres in this academic year, the majority of centres having been monitored in the previous year of the cycle.

It is perhaps worth reminding centres of good practice that we have seen in the delivery of Practical Endorsement:

- Clear planning of practical work. A good plan identifies not only when specified practicals will be conducted but also states the specific CPAC that will be assessed. The plan may be part of the Scheme of Work or a separate document. The planning should show the CPAC assessed.
- Planning allows for the development of skills within Practical Endorsement.
- The maintenance of accurate and up-to-date Teacher and Candidate Records.
- Candidates know which CPACs are assessed in a particular practical and understand what they need to do in order to succeed.
- Practical books are used in 'real time' at the bench by candidates when collecting experimental data. We do not expect to see practical books which are in immaculate condition! Candidates should **not** write on scraps of paper and later copy the work up neatly into practical books.
- Simple annotation of the candidate work shows where the candidate achieves or fails to achieve a CPAC, (e.g. with *CPAC 3(a)*✓ or *CPAC5(b)*✗*).* If a candidate does not succeed feedback is given so they have a better chance of getting it next time. (Feedback on how to improve may be given verbally or in writing).

  **Important note:** Many centres now record the CPAC element assessed in a practical which helps ensure all aspects of CPAC are covered. However if teacher records do not show this level of detail (i.e. the element assessed) then teachers should annotate the candidate work showing the element achieved (e.g. *CPAC 3(a)*✓ or CPAC 3(a&b)✓*).* Monitors will always check to ensure all elements of each CPAC are covered and will ask teachers how they ensure all aspects of the skills are achieved by each candidate.

- Marking which shows a progression in candidate skills. We do **not** expect to see every candidate getting every criterion each time they are assessed!

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Indeed, when this happens there will be legitimate concerns about whether the work has been appropriately assessed. There should be a progression. The key question is, 'Is the candidate competent at the end of the course?' In short we expect to see that there are places where candidate work is marked 'not achieved'.

- There is evidence of standardisation across all subject teachers when Practical Endorsement is delivered by a team of teachers.

  **Important note**: This is a requirement of Practical Endorsement that is recorded in the monitor's report of the centre and must be implemented for a centre to pass the monitoring visit. Please expect questions on how you do this if visited by a monitor.

**CPAC statements**

Centres are reminded that in order to award a pass for Practical Endorsement, a candidate needs to 'consistently and routinely meet the criteria'. This does **not** mean a candidate gets a CPAC every time it is assessed. It does means that a candidate evidences a pass for each CPAC statement on a number of occasions. It is important that suitable opportunities have been built into the assessment plan which allow candidates to generate this evidence.

It should be noted that candidates can work in groups when assessed. However, each candidate must generate suitable evidence that he or she **independently** meets the criteria. Therefore, centres must give careful consideration to how group work is conducted so that individual candidates can be assessed on their own performance.

**CPAC 1** The assessment of this CPAC requires the candidate to correctly follow written instructions to carry out an experimental technique or procedure. If a teacher feels it is necessary to intervene and correct a candidate's technique etc. then the candidate should not be awarded the CPAC.

In the vast majority of cases the monitor accepted the teacher's judgement unless there was strong evidence to suggest the CPAC was incorrectly awarded.

**CPAC 2** This is the most difficult CPAC for candidates to evidence since it involves higher level skills. Please make sure that you know where and when you are going to assess **each element** of this CPAC. It is also important that sufficient time is given to candidates to develop the necessary skills before assessment occurs. Generally, we do not expect to see this CPAC assessed in the first two terms of an A level course. However, we do expect to see evidence of some assessment of this criterion by the end of the first year of the A level course. This skill may be evidenced by a candidate planning to carry out a procedure and then adapting their approach as necessary.

It is **not** necessary to assess every element of CPAC2 each time this CPAC is assessed. However, it is a requirement that each element of CPAC 2 is met during the course. If you are monitored, the monitor will look at the coverage of each element.

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**CPAC 3** There are many opportunities to assess this skill in Biology. It is not necessary to assess this skill every time a practical is completed. Do **not** use practical work to assess this where hazards are minimal; rather select practical work where there are some meaningful hazards / risks.

**(a)** requires candidates to identify hazards and assess the risks associated with the hazards. A simple written risk assessment is the easiest and best way of evidencing this aspect of the skill.

**(b)** should be assessed by observation of candidates conduct during a practical session.

**CPAC 4** This CPAC deals with both qualitative and quantitative data.

**(a)** making accurate observations. A few centres award this element of the CPAC where the evidence in the candidate work showed that they were not working to the required standard. The following points show be borne in mind when assessing this CPAC:

- Observations should be made directly into candidate practical books. They should not be written on to scraps of paper and copied up later.
- Please **avoid** using templates for tables that direct candidates how to record data. Templates may be useful to teach candidates a good approach to recording data early in the course but when it comes to assessment candidates **must** devise their own tables. If you give the candidate a table, then CPAC4 can**not** be awarded. Where necessary, remove table templates to allow candidates to construct their own.
- The tables which candidates construct **must** have appropriate headings and units, where relevant.
- The units must be written in the table column head and not in the body of the table. If units are missing, do **not** award criteria.
- An important aspect of this skill in biology requires candidates to draw suitable diagrams. It is therefore important that centres teach candidates what is expected in a good diagram (e.g. see page 18 of Microscopy skills resource) and then assess candidates diagrams in light of that).

**(b)** obtaining accurate, precise and sufficient data ..... Please carefully check candidates' data.

- Is it recorded to appropriate precision? We still notice that some centres are too lenient on this. If data readings are not always consistently recorded by candidates, then do not award the criteria. Make sure that recordings are to the correct number of decimal places.
- Is there sufficient data? Is the data what you expect? Please set suitable standards at the beginning of the course. It does not matter if a candidate did not always achieve the criterion.

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**CPAC 5** This important higher-level skill should be assessed from early on in the course. There is no shortage of suitable assessment opportunities. CPAC 5 has two elements:

(a) Uses appropriate software and/or tools to process data, carry out research and report findings.

(b) Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.

**CPAC5** (a) There should be evidence of candidates processing data using graphs and calculations. Centres should require candidates to use software (e.g. Excel) to draw graphs on a number of occasions.

- Make sure graphs are constructed correctly, i.e. there is a title, each axis is correctly labelled, points plotted correctly, an appropriate scale used, etc. Candidates will need to be shown how to use Excel to correctly title graphs etc. It is evident that candidates do not always know how to use Excel appropriately.
- Processing data also involves carrying out calculations. This may involve transformation of data using mathematical equations, statistical analysis etc.

CPAC5(a) also includes 'carry out research and report findings'. The report does not need to be long; it may simply the conclusion they draw from their data. However, neither is it is not appropriate to award this CPAC for a one-word answer. A conclusion requires a reasoned response to the data observed.

(b) Candidates must show evidence of referencing sources of information. This aspect of CPAC is still not getting enough attention from many centres and is generally still poorly evidenced in candidate work. Just a few centres are to be commended for having candidates demonstrating referencing on multiple occasions; a few of these even using the Harvard System (which exceeds our requirements for this CPAC).

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## Supporting you

### Useful contacts and links

Our friendly subject team are on hand to support you between 8.30am and 5.30pm, Monday to Friday.

Tel: 029 2240 4252

Email: science@eduqas.co.uk
Qualification webpage: AS and A Level Biology | Eduqas

See other useful contacts here: Useful Contacts | Eduqas

### CPD Training / Professional Learning

Access our popular, free online CPD/PL courses to receive exam feedback and put questions to our subject team, and attend one of our face-to-face events, focused on enhancing teaching and learning, providing practical classroom ideas and developing understanding of marking and assessment.

Please find details for all our courses here: https://www.eduqas.co.uk/home/professional-learning/

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[i] ***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.***

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