



# **GCE EXAMINERS' REPORTS**

## **BIOLOGY/ HUMAN BIOLOGY AS/Advanced**

**SUMMER 2013**

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**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY1**

*Principal Examiner:* Ms Fiona Cowie

**General Comments**

The paper allowed all candidates to access marks.

The quality of written communication was again an issue for some candidates. They were reminded of the necessity for good English and orderly presentation on the front of the examination paper, but a significant number lost marks because examiners could not make sense of what had been written

- Q. 1 Most sections were answered well in the majority of papers. Common mistakes were; not knowing the names of the features of an amino acid or that (b) was a di-peptide.
- Q. 2 Some confusion over the lock and key hypothesis, although generally most sections were attempted and answered correctly. There were some weak answers to (f) which did not gain credit, since comments that extracellular enzymes work outside the 'body' were not acceptable.
- Q. 3 Most answers identified all the organelles in (a) and (b) correctly, although there were some very vague answers as regards their functions. As always, vague answers were not credited. Too many thought that the Golgi Body synthesised proteins. There was some confusion over the features of a nucleus and their functions. Simple statements on the function of the nucleolus/chromatin/nuclear pores/ nuclear membrane were all that was needed. Many lost marks stating that mRNA/ribosomes moved into the nucleus.  
Most candidates were able to identify D and E in (c), but the question asked for two visible differences; this was challenging for many. Again vague answers were common, and demonstrated that although they could see the ER, they could not describe it in terms of presence/absence of ribosomes and the arrangement of the membranes/cisternae.
- Q. 4 Very surprisingly, the majority of responses could not name the plant tissue which could be used to see mitosis. This is clearly in the specification; 'Prepare and/or observe slides of root tip for mitosis.' It is of concern that many answers showed no knowledge of the growing points of a plant, either shoot or root tip. Some answers mentioned 'meristems, for example root/shoot tip'. (b) Was very well done, with the majority gaining all marks, but, as might be expected many are confusing the cell cycle with mitosis, so chose a stage other than interphase in (c). Those who knew the work produced text book answers in (d).
- Q. 5 Section (a) was well done in the majority of cases with definitions of double/two layers of phospholipids being the usual response for (i). Many referred to 'tails' in (ii) with no reference to fatty acids; this did not gain credit. In (b) the question involved application of knowledge. Many gained one mark with sensible comments on the consequence of the membrane proteins changing shape, however only the better

scripts picked up the second mark with a logical consequence of a more rigid membrane being that they are more easily damaged. (Many candidates must have been revising for BY/HB2 for these summer exams, but very few mentioned blood flow –the ability to transfer knowledge is a skill in itself, even if they did not need it to gain credit for their answer). (c) was somewhat patchy, with many answers being excellent descriptions of what goes wrong to cause cancer. However the general lack of biological knowledge in this question was evident, with many not having any idea about cancer, what it is, or what causes it. (Specification; 1.7 (b) Significance (of mitosis) in terms of damage and disease: repeated cell renewal, damage repair and healing and unrestricted division leading to cancerous growth.)

- Q. 6 Another application of knowledge question where it was apparent that many have learned the work by rote, but do not understand the principles, so cannot transfer the knowledge to a novel situation. (a) linked back to how enzymes work, so most answered correctly, but a few got it completely wrong and said that the cross linking would stop the enzymes working – very confused. Better answers, using the diagram, explained that aggregate insolubility meant that the enzymes would not pass through the filter and so the product would not need to be separated from enzymes. Many did not even mention the filter or link it with the aggregates, yet the answer was on the diagram. The remainder of the question was straight recall and was well done.
- Q.7 There was much confusion throughout this question with the experiment to determine  $\Psi$ s, with onion epidermis and incipient plasmolysis. Determination of water potential by measuring changes in mass is a practical they should have knowledge of from 1.3, yet some seemed completely baffled by the results of the experiment. Confusion over the terms turgid and plasmolysed left many without marks in (a) (ii) and (b). (a) (i) was a simple description of the mass changes in distilled water and 1.0M sucrose. Very few managed this simple description for one mark. Many tied themselves in knots describing the changes in mass at all molarities (exam technique). (a) (iii) was well done, generally, as was (iv) and (v) by those who know and understand the work on water potential. Many could not draw a plasmolysed cell in (b) and the standard of drawings was often very poor.
- Q. 8 Both essays required knowledge of biochemistry from different sections of the specification. Routinely good answers were gaining full marks and some were a real pleasure to mark, being succinct and with real knowledge of the structure and function of the molecules. The nucleic acids question was routinely picking up 10 marks with excellent knowledge of DNA/RNA. The usual reason for candidates losing marks with the carbohydrate essay was their superficial coverage of the mono and disaccharides with far too much time spent on the polysaccharides, as though they are the only form of carbohydrate of any importance.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY2**

*Principal Examiner:* Mr Philip Owen

**General Comments**

There was a wide range of scores for this paper. Many candidates were extremely well prepared and demonstrated an excellent knowledge and understanding of the specification. This paper was marked online and Examiners were caused some difficulties by candidates who found it necessary to continue their answers at the back of the booklet or on additional paper. They often did not make it clear at the end of the first part of their answer that there was a continuation, or that on continuation to which part of the question their answer referred. Since parts of questions are often testing similar subject areas it was often left to the discretion of the Examiner as to which question the answer referred. Candidates should always be guided by the amount of space given for each answer as to the amount they should write.

- Q.1 This was intended to be a straight forward introduction to the paper and did not cause too many problems. However, spelling of the terms in part (a) was very varied although the Examiners did allow the correct phonetic spelling, candidates really should come to terms with the correct terminology. The answer to the correct earthworm Phylum caused the greatest problems for candidates. In part (b) the commonest incorrect answer was to suggest that the Kingdom Protocista were prokaryotes and that a feature of the Protocista was to have no membrane bound organelles.
- Q.2 Although the majority of candidates could give a correct definition of transpiration, far too many stated that it was the loss of water rather than water vapour and that it was a loss from the plant as opposed to the leaves/stomata. Many candidates appeared not to have handled a potometer or used one in practical work. The vast majority made vague references to leakages and air bubbles rather than specific details of setting up the apparatus. In answer to part (c)(i) most candidates were able to describe in detail how water moved up through the xylem, though root pressure was poorly understood by those who mentioned it. In answer to part (d) most candidates correctly identified phloem and xylem but few could give a coherent argument as to why this showed a root rather than a stem. Far too many referred to the xylem and phloem being in a 'vascular bundle' at the centre of the root. A significant number confused endodermis and epidermis and many maintained that they could see the casparian strip.

- Q.3 The answers to part (a) overall were good. However, a common mistake was to suggest that a reduction of pressure in the thorax caused an increase in the volume of the lungs and a number of candidates failed to mention the difference in air pressure between the atmosphere and inside the lungs. The explanations of counter current were usually good with the only omission being a failure to state unequivocally that oxygen moved from the water to the blood and there was a high saturation of the blood with oxygen. The rest of the question was well answered but often in part (b)(iii) there was a failure to mention the lower level of oxygen saturation of the blood.
- Q.4 Although only a minority of candidates scored full marks for part (a) there was no one section that caused a particular problem. Most candidates identified the jaw as being from a herbivore but were often unable to explain in detail how the teeth and jaw are modified for that type of diet. Many of the answers were GCSE in nature simply making a statement to the effect that molars/incisors were present. Many stated that the jaw could move in a horizontal/circular movement, though few gave a detailed account of the role of the diastema and tongue. Most candidates recognised that the herbivore gut would be modified to have symbiotic cellulose digesting bacteria present. However, a common mistake was to refer to the presence of 'four stomachs' and to describe how the intestine would be long but failing to relate that fact to the difficulty in digesting cellulose.
- Q.5 Most candidates were able to give an adequate definition of the term 'parasite'. In answer to part (b) many candidates referred to a large surface area rather than a large surface area to volume ratio which is the critical factor and many omitted to mention that the nutrients that the tapeworm absorbed had already been pre-digested by the host.
- Q.6 This proved to be the most challenging question on the paper with few candidates being able to give adequate answers to most of the parts. In answer to part (a)(i) many candidates referred to the xylem has having been removed and then went on to discuss loading of the sucrose. Few candidates made reference to the fact that the sucrose is produced in the leaves and transported in the phloem. Many seemed to repeat words from the diagram without really understanding the whole process. In answer to part (a)(ii) many candidates gave 'water' as their answer despite the question requiring an organic molecule and many gave glucose. In answer to part (b) few candidates could give real details as to why sucrose is used at growing points and would therefore become available if the points were removed. Again, many talked about translocation to the roots but clearly that is not possible and therefore failed to adequately explain the increased accumulation. The answers to part (c) often included a reference to a decrease in concentration of the sucrose below the ring. However, many candidates failed to add to their answers and did not explain that this was caused by the sucrose continuing to be passed to the roots where it was used.
- Q.7 The two questions appeared to be equally popular and full marks were seen quite often though, more usually for (a) rather than (b). A common mistake in the answers to part (a) was when candidates referred to internal/external reproduction rather than fertilisation. Often candidates would refer to vertebrates as a whole rather than specify fish or birds or mammals. Another fairly common mistake was to include

insects in the account often accompanied by great detail of complete and incomplete metamorphosis. Many candidates failed to mention that development resulted in the independence from water for the transfer of the male gamete. In part (b) answers were often confused with regards to muscle and elastic tissue within the walls of the vessels and their functions. Differences in lumen size were often not well understood and the massaging effect of skeletal muscles in returning blood to the heart in veins was often very poorly explained.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**

**HB2**

*Principal Examiner:* Dr Neil Roberts

The standard of scripts seen showed a range of abilities from candidates scoring below 10, to those attaining marks well over 60 out of 70. Many candidates still failed to adequately describe the graphical data shown. In a large number of papers poor answers to the extended answer questions were given, either because they had misread the question, omitted important detail, or had confused the parasites they were describing. Where detailed accounts using correct biological terminology were given, it was common to award high marks.

- Q1 This question was well answered by most candidates. Weaker candidates did confuse *endemic* and *epidemic* in part (a). Several references were made to *bacterialstatic* in (d) which was not accepted.
- Q2 This was another well answered question. Some candidates incorrectly identified the class in part (a) as being either *Chordata* or *Primate*. Most candidates correctly answered part (c) ii), however some did not use classification in the answer instead focusing upon similarities in DNA or anatomy which was not asked.
- Q3 Part (a) was basic structural recall. Where candidates had learnt the structure of the small intestine this was well answered. Part (b) elicited some good responses with most candidates correctly describing the effects of coeliac disease on the villi. However, explanations of the symptoms were less well answered. Many failed to explain the link of less water absorbed to diarrhoea or less nutrients absorbed to fatigue. At this level, examiners do expect candidates to refer to absorption rather than just uptake.
- Q4 Many candidates incorrectly referred to large numbers of blood cells as an adaptation in part (a) which is not an adaptation. Most candidates picked up some of the available marks in part (c) but many failed to describe thicker alveoli walls and the consequential increased diffusion distance. Many mentioned loss of elasticity but again failed to expand to include the resultant loss of tidal volume or recoil. Only better candidates made the link between the reduction in oxygen absorption and aerobic respiration. Part (d) was answered well by nearly all candidates.
- Q5 Labelling of the artery section was well answered and it was pleasing that knowledge obtained from the microscope element of BY3 such as labels like *tunica adventitia* were frequently used. However some candidates lost marks through incorrect spelling of labels e.g. *tunica external*. Part (b) was well answered, but a number of candidates lost a mark by incorrectly stating that cholesterol was deposited. In (b) ii) it was not uncommon for weaker candidates to answer high fat diet, which is not *another* lifestyle choice. A high proportion of candidates scored well in part (c) i) but some failed to correctly describe trends. References to *dramatic increases* or *rapid increases* were common, rather than a simple description of a large increase. Often candidates quoted data which was incorrect. In the final part, (c) ii), most responses

were too vague, and often made reference to smoking bans which did not come into force until 2007. This would have had little effect upon the decrease in numbers of deaths. Many made references to *better treatments* but few named these as angioplasty, by-pass surgery or named a drug so did not pick up the marks available.

- Q6 Many candidates failed to name both components found in the outer layer (bi), and a range of colours other than red were often seen in (biii). Part (iv) proved to be a good discriminator. Whilst many made the correct statement that Cholera is a gram negative bacterium, they failed to explain why this rendered penicillin ineffective. Weaker candidates often referred to antibiotic resistance.
- Q7 Very few candidates answered part (b) correctly often omitting the word complementary which was essential to the answer. Part (d) elicited some good responses from candidates with many correctly identifying the link between AIDS and reduced number of helper T cells. Weaker candidates often made reference to *fewer antibodies produced* which without the explanation of fewer B lymphocytes activated, could not be awarded as it was included in the question stem. Part (e) was well answered, but some candidates lost marks by incorrect reference to an injection of antibodies as being a *vaccine*. Most candidates had a good attempt at a comparison.
- Q8 The essays were designed to be challenging for candidates which proved to be the case. A wide range of marks were seen, with Q8a generally being answered better by candidates.
- Q8a This was answered by approximately 2/3 of candidates. Despite a clear list of examples to be covered, some candidates made reference to head lice or confused their parasites. For marking point D, female was often omitted or vague references to *biting* were made. Marking point J was often missed by candidates due to vague references to *living in the gut* or *intestines* alone. The adaptation of a thick cuticle in the tapeworm (marking point N) often elicited references to *withstanding acidic conditions* or *digestive juices* which was not sufficient. Often production of eggs was not quantified.
- Q8b Some candidates made detailed accounts of the human circulatory system in their answers which was not answering the question. Incorrect references to the Bohr effect or chloride shift were also not uncommon. Where candidates had learnt the carriage of oxygen and carbon dioxide it was common to pick up marking points A to F. References to oxygen being *carried by* or *picked up by haemoglobin* were common. A balanced equation or references to *binding* or *joining* were provided by better candidates. Very few candidates correctly identified the lowering of blood pH as a result of increased carbon dioxide in the blood. Some made references to myoglobin's part in this process, which was not relevant.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY3**

*Principal Examiner:* Dr Colin Blake

**General administration.**

The examiners would appreciate if centres could check that the front cover of the examination booklet has been correctly completed. This should include both the teachers and candidates signatures together with correct centre and candidate numbers. The candidate should also give a suitable title to the investigation, titles such as 'BY3 prac.' or 'Catalase experiment' are neither informative or indeed suitable. Examination booklets and the graph paper in these booklets should be used. We are receiving an increasing number of scripts written on normal A4 lined and graph paper, please contact the Biology subject officer if you have not received the correct examination booklets.

**Planning**

Centres have prepared candidates well for this section although it was rare for a candidate to score all eleven marks. Many candidates refer to rate in the prediction but then do not refer to rate again in the results table, graph or analysis section. The mark is awarded for stating the variable which is actually measured for example, 'the time taken in seconds for the potato disc to rise to the surface'.

Predictions made regarding water potential and change in mass such as '...as the concentration of sucrose solution increases the mass of the potato will decrease...' were invalidated by a graph showing both decrease and increase in mass at different concentrations.

Many candidates lost marks for not identifying the enzyme and the substrate, statements such as '...as the substrate concentration is increased the rate of enzyme reaction increases...' are common but cannot be credited with a mark.

Many candidates referred to their independent variable as '...I will change the hydrogen peroxide...' with no mention of concentration. This lack of reference to volume/ mass/ length/ diameter etc. was apparent also in the control variables where the use by candidates of 'amount' and 'size' were common but rarely qualified. A significant number of students referred to '...controlling room temperature ...' even though it is not possible to control this. There has been much confusion between the terms % concentration and % dilution with entire centres making this mistake.

**Results**

The most common error was not to include the mean column under the same heading as the data collected or not clearly stating what the mean was a measurement of. It should be 'mean time taken for disc to rise to the surface', not just 'mean'.

There is still confusion over the unit of concentration for hydrogen peroxide with some candidates using vol, others  $\text{mol dm}^{-3}$ , % and even  $\text{cm}^3$ . It was common this year to see different units of concentration for the same substance being used throughout the same script.

Many centres are still recording time to 2 decimal places rather than to the nearest second. Rounding errors on the mean cost many students a mark, arithmetical errors were common. Graphs were generally plotted well but a poor choice of scale, failure to include a figure at the origin, sloppy joining of points and drawing an 'imaginary' line of best fit all resulted in lost marks.

## **Analysis**

A significant number of candidates lost the mark for the trend as they did not describe the whole length of the graph. This was especially obvious where high substrate concentrations resulted in a lower decrease in time or even reaching a plateau. Osmosis experiments resulting increase and decrease in mass were almost all described in terms of a continual decrease in mass as the concentration of solution increases. Candidates should appreciate that quoting data is not the same as stating a trend.

There was some confusion over repeats or results at a particular value of the independent variable. Many candidates stated that results were close together with no reference to which. Many also drew range bars on their graphs but made no reference or an incorrect reference to them. Quite a few confused accuracy and reliability.

There was a lack of detail in the statements describing the sources of inaccuracy and improvements with a large number not providing any explanation as to why a syringe is inaccurate but a burette is accurate.

Some centres obviously teach their candidates to learn a standard scientific explanation for the investigation used for the AS examination to the point where all candidates had almost the same wording. Unfortunately, most of these candidates included large amounts of irrelevant information (e.g. detailed explanations of the effects of pH, inhibitors and temperature when the independent variable was concentration of substrate) and few then related their scientific understanding to explain their actual results. Many candidates made no reference to the name of the enzyme or substrate.

Many students this year did not relate their conclusion back to their prediction and consequently lost this mark.

## **Further Work**

This section was well answered by many candidates, but some lost marks by not stating what the new independent variable was and by not giving values for the controlled variables. Where centres set an osmosis practical there was a major confusion between results that they could expect due to the effect of temperature / pH on the mass of tissue. At a constant concentration of external solution candidates need to refer to the time taken for a change in mass to be seen but many chose to keep the concentration of the external solution at the value where no change in mass was observed.

## **Microscopy**

The quality of drawing was mostly acceptable but many lost a mark for not joining lines or having overlapping lines and the use of thick, blunt pencils.

Many labels were spelt incorrectly despite this being an open book task. Many candidates drew label lines to the edge of a tissue layer rather than to the middle of the layer and some labelled tissues which had not been drawn eg. phloem and pericycle in the root were often labelled even though absent from the drawings.

Proportions were often correct but care needs to be taken that the ends of the lines showing sizes in eye piece units are clear, touch the edge of a tissue and are on the drawing not adjacent to it. A key for eye piece units must be given. It is worth while pointing out to candidates that all lines will be measured and checked that the lengths are proportional to the stated eye piece units. Candidates should also take care that the relative thickness of all tissues drawn are proportional, the epidermis of a leaf is never going to be thicker than the palisade mesophyll layer.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY4**

*Principal Examiner:* Mr Brian Hughes

**General comments**

The paper allowed all candidates to access marks.

The quality of written communication was again an issue for some candidates. They were reminded of the necessity for good English and orderly presentation on the front of the examination paper, but a significant number lost marks because examiners could not make sense of what had been written.

Q.1 Almost all candidates were awarded the mark for part (a), either for describing responding to the stimulus or using the word 'effectors'. A very small number of candidates gave a vague answer like, 'for fight or flight'.

Most candidates also correctly answered part (b) although some gave answers which would have produced a faster response, e.g. shorter nerve cells. A substantial number of candidates were not able to name phytochrome in part (c). 'photochrome' and 'florigen' were common incorrect answers.

Q.2 On the graph in part (a), candidates made all the errors commonly made on BY3 and BY4. For example they did not label the axes, used the years listed spread evenly across the horizontal axis so that the scale was not linear, did not include a number at the origin, used more than one scale on the same axis, plotted the points inaccurately or did not join the points appropriately.

The majority of candidates correctly chose '**birth rate**' in part (b), though many were not awarded this mark because they did not give the reason for their choice.

In part (c) (i), most candidates were able to name at least one density dependent factor and many named two. Some gave 'habitat' with no explanation and some 'accumulation of toxic waste' which is either not appropriate for red kites own waste, or if it refers to bioaccumulation is density independent. Similarly, the majority of candidates were awarded the mark for part (c) (ii), although a number gave an unqualified reference to 'temperature' or 'catastrophe'.

Q.3 The majority of candidates were able to recognise the granum A in part a(i) and the stroma C in part a(iii). However a large number of candidates chose just one letter for part a(ii) where both A and D were required.

Part (b) was generally well answered in the detail required. There was however some confusion; about the role of RUBISCO in the process in part (i), and about oxidation/reduction in part (ii).

Most candidates were awarded the mark for part (c) (i) but relatively few gave the correct answer to part (c) (ii)

- Q.4 The production of penicillin has been tested many times on BY4 but there was still some confusion about the use of the sparger. A significant number of candidates thought it was to sterilise the incoming air, and a small number thought it was for harvesting the product.

Candidates were asked to use information from the diagram to answer part (b) (i) but a significant number of candidates did nothing more than state that the pH probe measures pH. Most candidates were able to name carbon dioxide as the waste gas in part (b) (ii). Quality of written communication was an issue for some candidates in part (b) (iii) many were unclear in their descriptions. Many gave vague references to optimum temperatures and did not recognise the significance of large numbers of microbes respiring towards the end. Many candidates referred to the *Penicillium* as bacteria. Likewise, in part (c) there was some poor QWC and lots of reference to 'the bacteria'. One fairly common misconception was that pathogenic bacteria would contaminate the product.

- Q.5 Apart from a very occasional 'cell membrane' for W and 'cytoplasm' for Z all sub-parts of part (a) were well answered.

The role of NAD was well understood in part (b) though there was some confusion over oxidation and reduction.

In part (c) (i), the vast majority of candidates were awarded the mark, however a very small number reversed the ATP/ADP. Most candidates were able to state that the reactions take place in the cytoplasm in part (c) (ii). The early steps of glycolysis were fairly well understood in part (c) (iii), although a significant number of candidates failed to pick up all three marks.

Part (d) (i) proved to be a challenge with relatively few candidates scoring all three marks. QWC was an issue and a significant number of candidates made no attempt at an answer. Likewise, the mark for part (d) (ii) was awarded relatively infrequently, where it was it was usually for describing low oxygen conditions.

- Q.6 Some spelling issues with Ranvier for X (the phonetic rule was applied), and a significant number not attempting an answer for Y.

In part (b) some spelling issues with Schwann (the phonetic rule was applied). Some candidates gave, 'myelin' or 'myelin sheath' but the questions asked for the name of the cell type.

In part (c) a significant number of answers were given without units. Also, some gave the recall answer -70mv

Part (d) (i) was generally well answered but there were a variety of incorrect answers including the wrong ions ( $\text{Ca}^+$ ,  $\text{K}^+$ ) and ions moving in the wrong direction. Some candidates found it difficult to express themselves clearly. The majority of candidates recognised repolarisation in part (d) (ii), though some confused it with depolarisation. Some good comparisons were given in part (e) with many even quoting values for resting potentials, and the duration of the action potential. Some candidates referred to hyperpolarisation in trace A but did not compare it to trace B.

In part (f) some candidates incorrectly tried to suggest that the muscle would contract more quickly or more strongly.

Some very weak, vague answers were given for part (g), the best answers gave a clear argument in favour which included a specific medical application and a clear argument against which referred the right to life of the frog or the lack of the right for human's to take the life of the frog.

**Q.7** The renal artery was identified by the majority of candidates in part (a), but there were a number of incorrect answers given. These included; renal vein, aorta, afferent artery, efferent artery, artery unnamed.

Part (b) was not well answered. There were a number of vague answers and some confusion about podocytes. Some candidates described the build-up of hydrostatic pressure because of the wider diameter of the afferent arteriole compared to the narrower diameter of the efferent arteriole, but many made a vague reference to size, e.g. the afferent arteriole is 'bigger' or 'thicker'.

Most candidates knew that glucose is reabsorbed for part (c) but they did not all refer to the proximal convoluted tubule or active transport for the second mark.

In part (d) (i), many candidates gave a reasonable account of the function of the loop of Henle but relatively few gave a full account explaining essentially that water is reabsorbed but urea is not. Some gave an account of regulation by ADH more appropriate for part (e). There was some misinterpretation of the question in part (d) (ii), some suggesting it was because urea is toxic.

Almost all candidates identified ADH as the hormone in part (e), but they did not all give a complete explanation of how the concentration of ions in urine is affected.

**Q.8** Option 8(a) was attempted by the majority of candidates and many of those who did attempt it gained the maximum 10 marks. Some gave very pithy, accurate accounts, in correct sequence which meant they gained full marks with relatively short answers. It was clear that this type of question had been rehearsed by many candidates.

Option 8(b) was the less popular choice. A range of marks was awarded, and there were some very good answers but the majority had clearly not prepared properly and gave very vague answers with much confusion about the roles of the various bacteria. Some gave long accounts of nitrogen fixation and denitrification.

The quality of written communication was an issue for a number of candidates in both options.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**HB4**

*Principal Examiner:* Mr Philip Owen

**General comments**

Many candidates showed a detailed knowledge and understanding of the work covered by the specification. There were very few poor performing candidates. The main area of concern was the inability of some candidates to express themselves in a clear and concise manner using appropriate terminology.

Q.1 This easy starter to the paper caused surprising problems for a significant number of candidates with only a minority scoring maximum marks. The part that caused most problems was part (a) where many candidates did not state the correct answer of colony.

Q.2 Part (a) was well answered but for (b)(i) very few candidates scored full marks because they did not know that carbon dioxide is given out between pyruvate and acetyl Co-A. The term decarboxylation was well known but candidates often struggled to describe the removal of carbon dioxide from the body. Few mentioned that it diffused from the mitochondria though many referred to its transportation in the blood with few mentioning it diffusing into the alveoli before being exhaled.

In answer to part (c) few candidates mentioned dehydrogenation via a series of intermediates. Many talked about the removal of hydrogen without specific reference to hydrogen atoms or protons. The answers to part (d) often referred to the production of lactate though often failed to mention the regeneration of NAD.

Q.3 Most candidates were able to give a standard definition of homeostasis, though some forgot about the fact that stability of the system is important and few referred to the role of external changes.

The flow diagram caused problems for many, with few scoring full marks. The commonest mistake was to omit the term 'posterior' when referring to the pituitary and a significant number referred to osmoreceptors in the 'brain' rather than in the hypothalamus .

Q.4 Whilst many candidates mentioned anaerobic respiration and the formation of lactate, very few related this to changes in the pH of the muscle tissue which would in turn affect enzyme activity. However, many did discuss the fact that the lactate would

accumulate and a much smaller number mentioned the exhaustion of glycogen stores.

The answers to part (b) were disappointing because candidates usually included nothing from their own knowledge. Few made any reference to long distance events being aerobic in nature and therefore there is no accumulation of lactate and no oxygen debt because there is no anaerobic respiration. Marks usually awarded were for references to longer to reach fatigue and for a reference to improved blood supply.

In answer to part (c)(i) many candidates made reference to oxygen and carbon dioxide but failed to make any reference to improving the oxygen supply or improving the removal of carbon dioxide. Even with a small number of capillaries oxygen would be transported to, and carbon dioxide transported from the fibres.

Candidates struggled to find two appropriate changes that might occur as a result of aerobic training. Marks were usually awarded for a reference to mitochondria.

- Q.5 Candidates struggled to effectively explain the role of the sparger, references to air/oxygen were common but often in a very vague way. Few candidates made reference to the mixing of the nutrients or to prevention of settling. The answers to (b)(i) often missed the obvious point of measuring/monitoring the pH. Instead, candidates often simply referred to the optimum pH or the addition of acid/alkali.

The answers to part (iii) were often very vague. The usual answer was to provide optimum conditions for growth without any reference to enzyme action. Few made any specific reference to respiration as the generator of heat and even fewer recognised that there would be a lot more organisms at the end of the process which would generate a lot of heat.

- Q.6 The simple identification of parts of a kidney tubule proved to be too challenging for many candidates. The commonest mistakes were confusion between the afferent and efferent arterioles and a failure to correctly name the loop of Henle. Very few candidates scored both marks for parts (ii) and (iii). Part (iv) was well answered though a significant number of candidates failed to specify an increase or high blood pressure instead, simply mentioned pressure. Some mentioned hydrostatic pressure.

Part (b)(i) caused difficulties. Whilst many candidates recognised that the concentration of glucose and urea were the same in both the plasma and the filtrate, few described how that situation had come about. Many candidates in answering part (b)(ii) missed the point about the re-absorption of water. Instead, many chose to discuss the re-absorption of glucose which would not have affected the concentration of urea. A significant number did manage to score a mark with a reference to the non-re-absorption of urea. Part (iii) was well answered with many candidates making use of figures quoted from the graphs to illustrate their answer, which was most encouraging. Credible suggestions for the way in which inhibitor Z works were few and far between. The commonest correct answers made reference to blocking the pores in the membrane or inhibiting active transport.

Q.7 Answers to part (b) were usually incomplete. Candidates often made reference to proton pumps but invariably failed to make any reference to the impermeability of the membrane to protons. Few candidates made any reference to the electrons supplying the energy to drive the process.

Part (c) was usually high scoring with the majority of candidates making reference to oxygen being the final acceptor and producing water as a result.

Candidates found it difficult to give a full answer to part (d) and therefore, usually failed to score full marks. The commonest omissions were any reference to substrate level phosphorylation and the conversion of triose phosphate to pyruvate. Often candidates failed to make it clear that there was a net production of 2 ATP.

Q.8 Surprisingly, for a human biology paper the more popular question by far, was (b). Even so, it was not uncommon to see full marks awarded for both essays. The commonest mistakes in answering part (a) were to confuse the direction of travel of the sodium and potassium ions. In addition, many candidates spent a lot of wasted time and effort in describing the transmission of an impulse across a synapse for which there was no credit. Few candidates made reference to local circuits at the nodes of Ranvier.

The answers to part (b) were very good with maximum marks being awarded quite frequently. The commonest failure was to make no reference to light energy being converted into chemical energy or the fact that when an electron becomes excited it is emitted from the chlorophyll molecule.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY5**

*Principal Examiner:* Dr Colin Blake

**General comments**

The vast majority of candidates attempted all questions and there was no evidence to suggest that time was an issue. Many responses were accurate and responses well developed. Many examiners commented on the deterioration of handwriting, bordering in some cases on the illegible. There was also a marked decline in accuracy of spelling with some candidates using spelling which would be more appropriate in a text message.

Candidates should show more with the accuracy of spelling of scientific terms for example adenine not alanine, thymine not thiamin, cytosine not cysteine and guanine not glycine.

Comments on performance of Welsh-medium centres

The language used in the questions was accessible and did not place candidates at a disadvantage compared to English-medium papers. There were, however, some issues with the correct use of terminology, for example using atalgenhedlu (contraception) in place of atgenhedlu (reproduction) and trawsfudiad (transmigration) in place of trawsgrifiad (translation). The publication of the approved list of Welsh terms for A2 Biology by the WJEC will help to rectify these problems as long as centres and candidates make use of the list of terms.

Sylwadau ar berfformiad canolfannau cyfrwng Cymraeg.

Roedd yr iaith a ddefnyddiwyd yn y cwestiynau yn addas ac nid oedd yr ymgeiswyr o dan anfantais i gymharu â phapurau Saesneg. Ond codwyd rhai materion yn ymwneud â defnydd terminoleg gywir, er enghraifft atalgenhedlu yn lle atgenhedlu a thrawsfudiad yn lle trawsgrifiad. Bydd cyhoeddiad rhestr o dermau cymeradwy ar gyfer U2 Bioleg gan CBAC yn helpu cywiro'r problemau hyn pe bydd canolfannau ac ymgeiswyr yn gwneud defnydd o'r termau.

Q.1

- (a) Most candidates appreciated that spermatozoa were produced in the seminiferous tubules but the function of seminal vesicles caused more of a problem. Incorrect responses included reference to neutralising acids in the female tract to an area where sperms were stored.
  
- (b) The function of DNA ligase was generally well understood but some candidates did find it difficult to express themselves coherently implying that the enzyme was responsible for the formation of hydrogen bonds between strands. Polymerase was

often also stated to be involved in the formation of hydrogen bonds and in the formation of double stranded DNA from a single strand.

- (c) Many candidates correctly defined the terms gene and allele. The only common error was to omit that a gene was a section of DNA / chromosome and to state that it controlled the phenotype rather than linking it to coding for a polypeptide or protein.
- (d) Some candidates gave over simplistic, sloppy responses such as 'primary succession is where nothing has been before and secondary is where things have been before' but in the main candidates did appreciate the difference.

#### Q.2

- (a) (i) Some candidates answered the question but with no reference to the stem . Responses such as 'There is variation, some animals have a selective advantage and breed....' were common. Other candidates implied that the fish were making a conscious decision to mutate or to breed earlier when they realised that if they became smaller they could avoid being caught, an example of design by committee ! Another common error was the use of the word gene for allele.
- (ii) It was rare for candidates to be able to suggest reasons why there has been little change in the phenotype and no population recovery since cod fisheries have been closed.
- (b) Almost all candidates were able to give two methods which are used to prevent overfishing.
- (c) (i) Good responses in the main but again incorrect reference to flow of genes into the wild population rather than alleles and also the incorrect assumption that all fish used in fish farming have been genetically modified.
- (ii) Excellent responses.

#### Q.3

- (a) (i) Almost all candidates were able to define the term sex linkage although some did not mention the X or Y chromosomes.
- (ii) Most candidates were able to complete the genetic diagram but some used different symbols to those given in the stem and far too many candidates started the cross with two females. The probabilities given were normally correct.
- (b) Correct responses to this question on linkage tended to be centre based where the only difficulty was giving the correct ratio for the phenotype of the offspring, many incorrectly stating the ratio for the genotype.

Many candidates had no understanding of linkage and, although an attempt was made at an answer no credit could be given.

- (c) There were some good responses which gained both marks but the majority of candidates only referred to crossing over being responsible.

Q.4

- (a) (i) The primary follicle / primary oocyte, Graffian follicle and corpus luteum were usually correctly identified.
- (ii) Process P was normally correctly identified as ovulation but some thought that it represented menstruation and an alarming number exocytosis.
- (iii) The hormone was usually identified as hCG, we gave a benefit of the doubt to the many who stated 'human chronic gonadotropin' or words to that effect.
- (b) (i) The correct names for cells W,X,Y and Z were given by the majority of candidates but some incorrectly identified W, X and Y as follicles.
- (ii) The correct response of mitosis was normally given.
- (iii) The numbers of chromosomes drawn in cell X and in cell Y were normally correct. It was rare to see the nuclear membrane drawn in cell X and many drew the anaphase stage in cell Y.
- (c) There were some very good responses but most candidates were only credited for a mention of the polar bodies. Many argued that it was to avoid the development of multiple embryos.

Q.5

- (a) (i) References to pH and temperature were not given credit but most candidates were able to give one precaution to ensure that the results were reliable but only a few mentioned the necessity for repetition.
- (ii) The majority of candidates correctly linked increase in rainfall with an increase in leaching. However, many made no comparison between the effect of injected sludge and sludge spread on surface or stated that at low rainfall there was only a small effect. Some candidates incorrectly stated that the nitrate concentration in the soil increased with increased rainfall.
- (iii) A large number of candidates incorrectly stated that sludge should be applied just before high rainfall.
- (b) Usually answered well but many stated that the algae were using oxygen and linked eutrophication to plants not producing oxygen rather than the oxygen levels being depleted by the respiration of bacteria/ saprobionts.
- (c) I am afraid to say the errors we have come to expect. There is a general confusion between nitrifying bacteria and nitrogen fixing bacteria, Rhizobium and Azotobacter. Some candidates referred to root nodules as potatoes and others named leguminous crops as baked beans, banana or tomatoes. The majority of candidates still assume that nitrogen from the air is converted into nitrates which are then secreted into the soil and, alas the use of GM crops to solve the problem abounds.

Q.6

- (a) The majority of candidates tended to make general statements such as ‘the amount of energy produced’ with no reference to chemical energy, carbohydrates , products of photosynthesis or organic molecules.
- (b) A significant number of candidates assumed that the net primary production would increase.
- (c) (i) Many candidates still assume that excretion and egestion are the same. Respiration was widely cited as a way by which energy is lost although some stated heat loss without mention of respiration.  
  
(ii) Many candidates incorrectly stated that cellulose cannot be digested but many were credited for stating that carnivores were more efficient at digesting protein.
- (d) It was rare to get a correct response to this question, many candidates trying to link their answer to biodiversity.

#### Q.7

- (a) Responses to the essay on how a nucleotide sequence on a DNA molecule results in the production of a polypeptide were excellent with many candidates getting all points on the mark scheme.
- (b) The essay describing the principles and techniques involved in the cloning of plants together with the advantages and disadvantages of this process was not quite as popular as the essay on protein synthesis but was equally as well answered.

**BIOLOGY/ HUMAN BIOLOGY**  
**General Certificate of Education**  
**SUMMER 2013**  
**Advanced Subsidiary/Advanced**  
**BY6**

*Principal Examiner:* Dr Marianne Izen

**General comments**

Most centres chose experiments that allowed access to very high marks, and many candidates continue to adhere closely to the criteria in their writing to produce complete, fluent accounts of their work. Some, however, are let down by their ambiguous means of expression, poor spelling, grammar and punctuation and, on occasion, poor handwriting. Candidates should remember that they are required to produce a well-written piece of prose and, although this is not a language examination, science communication requires the message to be clearly and correctly expressed.

Most centres have followed the advice to attach extra sheets loosely with a treasury tag and to avoid the use of folders. Similarly, in most cases, students and teachers have signed the work, although some candidates need reminding specifically what constitutes a signature. Candidates should be aware that quantity does not necessarily mean quality and that a single 12-page answer book provides enough space. Examination stationery should be used for extra graphs and text.

Some centres are submitting work containing Tippex, despite JCQ instructions. In a small number of cases, it seems that centres are adhering to the criteria from the previous specification. In BY6, a method is not required and neither is a diagram of apparatus.

**Design**

Most candidates were able to score both marks for their aim and prediction although it should be remembered that it is the factor expressed on the y axis of the graph that is the dependent variable, and should therefore be quoted here. Similarly, it is the factor on the y axis that should be the subject of the sections on the dependent variable, the trend and the explanation. The interchangeable use of “time” and “rate”, however, is much diminished. The independent variable was in general clearly defined, although there was some confusion when candidates used lamp distance,  $1/d^2$ , light intensity and relative light intensity interchangeably, often with inappropriate units, suggesting that they had not properly understood what they were doing with the lamp.

When quoting units, candidates were sometimes penalised for the use of %, without qualifying it as either  $g/100cm^3$  or as a percentage of a stock solution. Another problem in quoting units was seen in experiments where candidates used a colorimeter. AU was expected, rather than ABS. SI units are expected although candidates were not penalised for not using them, as long as they were appropriate. Thus  $ml^3$  for a volume and  $m$ ,  $mol$  and  $mol^{-3}dm^{-3}$  for concentration were not given credit.

The dependent variable was a problem when it was defined as a value such as “the volume of gas collected in 3 minutes”. “Time for collection” should not then appear in the controlled variables as it has already been stipulated in the dependent variable.

A similar issue arose in the use of controlled variables. If the number of limpets / m<sup>2</sup> is the dependent variable, then “area” should not be included as a controlled variable but if the dependent variable is just the number of limpets, then an area would be expected as a controlled variable. The concentration of a yeast suspension also led to problems. It needs to be expressed as g/100cm<sup>3</sup> rather than expressing the concentration in terms of the volume of a stock solution. The controlled variables need to be both named and have their values cited. Although candidates are not penalised for it, many do not distinguish “controlled”, as in variable, from “control”, as in control experiment. This reflects a poor use of language.

Candidates should be aware that when discussing the need for repeat readings that the point is to calculate a mean, because the mean is more reliable than as single result. Many have explained that a mean makes their “results” more reliable, which examiners find rather vague, and wish to see this concept expressed more clearly.

Some candidates did not score both marks when describing their control experiment as they did not give enough detail. They should give examples of what they mean by “the same conditions” or explain clearly why the experiment they propose constitutes a control. Many who attempted this were not able to explain clearly the role of a control experiment. More care still needs to be taken in identifying the most significant hazard and explaining why it is a risk. Yeast may be allergenic, but it is not an irritant. Methylene blue can be an irritant and candidates need to use that term, rather than just saying it is harmful. Candidates do not get credit for warning about the risk of ingesting substances, nor for using tongs when lifting hot glassware.

## Results

Most candidates construct suitable tables, following the advice in a previous Examiners’ Report but they should take care to be consistent with their use of decimal places and to be correct in rounding up. Many have forfeited marks this year on account of rounding errors. It is not necessary to give final processed results to both no and two decimal places. If this is done for any reason, the figures should be in different columns with the appropriate headings.

Candidates should be honest in their readings. It is vanishingly unlikely that that methylene blue will decolourise in precisely the same number of seconds three times. Candidates are expected to provide three readings at each value of their independent variable. If the first two are identical, then a third would not be deemed necessary, but this must be explained. If there is time only to make two sets of readings, this should also be explained.

When labelling the y axis on their graph, many candidates do not include the word “mean”, despite previous advice to do so. Many candidates are unclear how to choose their scales when plotting a graph. They should ensure that they use at least half the available space in both directions. They should also choose a scale where the value for each big square is divisible by 2, 5, 10 etc to make their plotting easy. If small squares represent, for example, 3, then plotting is difficult and often leads to errors, which are penalised. Scales must be linear and a figure must appear at the origin on each axis. That figure does not need to be 0. Almost all candidates now follow the long-standing convention of a point-to-point line with no extrapolation but there are still some very blunt pencils.

## Analysis

As has been noted in the past, some candidates do not follow the headings given at the front of the answer book and may construct an analysis that does not give them access to all the marks. The trend must describe the whole graph, including any change of gradient or indication of a plateau. Quoting data is not necessary.

Examiners would like to see a comment about the actual raw data. The Ab mark could be achieved by a comment about the closeness of repeat readings, for example. But candidates frequently use the term “results” when referring to either the raw or the processed data so their meaning becomes unclear.

The understanding of the use of error or range bars has improved but bars are short or long, not narrow, wide, large, tall or close together. Candidates should only say that the range bars show that their readings are closely clustered around the mean, or are long or short, if they are. Many still do not understand the significance of the overlap of error bars, as opposed to their length, and thus fail to achieve the Ac mark.

Many candidates treat the section on explanation as an exercise in writing all they know. This is not what is required. They should select relevant information and apply it to their own experiment. As they have doubtless been told, planning is essential. Many field work reports could be improved by using the concept of natural selection in explaining what has been found.

The section headed “Conclusion” is more than just a restatement of the trend. Candidates should relate the results they have to their prediction. They might mention the level of reliability or accuracy and give a brief summary of their explanation. Three distinct points need to be made for the three marks.

## Further work

This is generally well done, although candidates must be sure to define the new independent variable, in so many words. At least one of the controlled variables needs to be one not described in the main experiment. Many candidates failed to get both Fc marks. They need a clearly expressed prediction and explanation which are biologically correct. In many cases, the explanation was not given or was too brief. A sketch graph is useful in illustrating the prediction, but it must correspond with what has been written.

## Microscopy

Label lines must end inside the structure being labelled and the label must be correct. A minimum of five structures should be accurately labelled. The distance measured must be clearly identifiable, such as a maximum diameter. A calculation for its length, rather than just an answer must be given and the line marking the distance must be on the structure, rather than next to it. Three stages of calculation for calibrating a microscope have been emphasised and candidates in some centres are still not adhering to the protocol given in previous examiners’ reports. Some candidates do not include a key for their abbreviations, and in many cases, candidates have not learned how to write the unit  $\mu\text{m}$  or  $\mu$  and give  $\text{um}$  or  $\text{u}$  instead, which is not marked as correct.



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