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# **GCE EXAMINERS' REPORTS**

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**BIOLOGY/HUMAN BIOLOGY  
(including AS Legacy Units)**

**SUMMER 2016**

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**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY1**

**Comments on Specific Questions**

1.
  - a. Many candidates were able to distinguish between an element and an ion, but a significant number did not appreciate that in a compound ions lose their charge as sodium chloride as an example of anion was observed frequently. Additionally, students frequently gave leaf as an answer for a tissue.
  - b. In part (i), candidates need further assistance to understand the requirements of the term 'explain' in the stem of a question, as many either simply identified the regions that are hydrophobic and hydrophilic without giving a reason for this property. A minority of candidates failed to link the polarity with the correct region, or incorrectly identified the component. Candidates scored well in part (ii). Marks were lost by candidates that gave general functions of triglycerides rather than the cellular function as requested.
  - c. This question was poorly answered. Candidates were unable to recall that the monomer unit of DNA is a nucleotide and the requirement of many of these units being bound together was poorly communicated.
2.
  - a. On the whole this was answered well, with many candidates scoring highly. Frequent misconceptions were evident as candidates often mistook mitochondria for chloroplasts. Additional confusion occurred when ribosomes were frequently cited as starch granules.
  - b. This was well answered.
  - c. Most candidates were able to identify a product that may be found outside the cell and that the process by which it was transported was exocytosis. A lack of accuracy in communication resulted in candidates omitting that the vesicle *membrane* fuses with the cell membrane before the product is released. Additionally, poor exam technique led to many candidates losing time by writing about the process after modification at the Golgi which was made clear in the stem as being unnecessary.

3. a. On the whole this question was answered well by candidates. When used, generally diagrams were well drawn and annotated, not just labelled. However, candidates should take care to illustrate the polar charges accurately as many diagrams showed hydrogen and oxygen atoms as possessing full ionic charge in a water molecule. Occasionally, students indicated the hydrogen bond formed between two hydrogen atoms on adjacent molecules, or lost credit as they inferred the hydrogen bonds were between atoms in the same molecule.
- b. This question proved to be a good differentiator, with more able candidates securing full marks. Significant areas where students lost marks were for not including a full description of the *biological significance*. For example, candidates needed to link the insulating property to how it would benefit the organisms. The correct terms for the chemical properties of water were confused and lacking clarity. Candidates did not clarify which transition phase for latent heat; the biological significance is the heat energy lost at vaporisation. When discussing heat capacity, candidates were required to appreciate that this is high. Many candidates understood the role of water in transportation and as a solvent.
4. a. This question was answered poorly by all but a few candidates. Only a minority secured full marks. Basic answers commenting on a general trend were not accepted. A doubling of concentration resulting in a halving of colour formation or relevant quoted figures was required. Many candidates noted the secondary trend of a plateau but failed to secure the mark as they omitted to qualify at which point. This skill needs to be improved.
- b. Well answered by most candidates.
- c. These questions were generally well answered. Weaker answers lacked key terminology to explain how the enzymes activity would have been affected. Common omissions were as follows:
- I only a minority of students correctly stated the addition of lemon juice was important because this moved the pH away from the enzymes optimum. Some students incorrectly stated that the pH would increase on addition of lemon juice, whilst others incorrectly cited that citric acid was a competitive inhibitor. Many understood the relationship between changes in charge or changes in shape of the active site resulted in no successful collisions.
- II It was important in this answer to acknowledge the kinetic energy was lowered.
- III Despite being given the full name of the enzyme, a significant number of students failed to appreciate that the removal of air removed oxygen, which would mean the oxidation of catechol could not occur, suggesting that these students were not able to recognise the primary function of this group of enzymes.
5. a. Candidates scored well on this answer, recognising the need to discuss the increase in rate as well as the lack of effect by the inhibitor to explain their answer. A minority cited the definition of diffusion which was insufficient. The most common reason why candidates dropped marks on this questions was the inaccuracy in reporting proportionality; candidates must realise that a linear relationship can be positive or negative. Many students failed to include the term 'directly', nor any description of direction to secure this mark.

- b. Many candidates scored well on this question, but again too many lack accuracy in their answers. Candidates are advised to include qualitative terms in their answers to secure marks. The recognition that the rate only plateaued at higher concentrations is an important distinction and identifying feature of facilitated diffusion and simple diffusion.
- c. Many candidates understood the involvement of ATP and protein saturation as the limiting factor, however, few candidates secured full marks. This was again due to the omission of reference to higher concentrations; inaccurate references such as 'until it reaches a certain point' were insufficient. Many candidates only discussed the role of the inhibitor and did not include any reference to the plateau.
6. a. Part (i) was answered reasonably well. A minority of candidates did not answer the questions in terms of water potential, as was indicated in the stem and consequently did not gain full marks. Many candidates inferred that haemoglobin moved out of the red blood cells. Other weaker answers did not explain why the red blood cells would burst and therefore release haemoglobin. Part (ii) however, was not answered well by many candidates. Candidates failed to appreciate that each red blood cell is likely to have a differing water potential. Most candidates explained the movement of water in terms of water potential at higher saline concentrations. A minority of candidates incorrectly stated that different red blood cells had the potential to hold more water than others or could be partially haemolysed.
7. a. This question was answered well by almost all students. A minority had some difficulty in recognising the stages using the micrographs, and other areas of challenge again related to the level of inaccuracy in their written response. In a number of instances candidates inferred that chromosomes split in half without ensuring it was clear this was at the centromere. A minority of candidates confused the events that occurred in each stage, although nearly all candidates correctly sequenced the order of the stages.
- b. This question presented a greater challenge for candidates when answered, however many candidates scored highly. Again marks were lost for inaccuracy in communication. As in previous years, candidates incorrectly report that immobilised enzymes can tolerate higher pH and consequently did not always achieve both marks for the environmental conditions in which they can function. Candidates also failed to define the benefit of using an immobilised enzyme in sufficient detail. Stating that it is specific, is insufficient and required the candidate to recognise that it detects specific molecules in a mixture. Pleasingly, students were aware of the range of applications of immobilised enzymes beyond medical applications and generally candidates were able to describe the advantages of their use.

**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY2**

**General Comments**

The majority of individuals who sat this paper were 'resit- candidates' and the standard was relatively poor. The quality of written communication was an issue for many candidates and many of their responses were vague and lacked appropriate biological terminology. However, it was also clear that some candidates had put a lot of effort into their revision and they scored highly.

**Comments on Specific Questions**

1.
  - a. This question required candidates to apply their knowledge of parasites to mistletoe. The majority of candidates could state why it was parasitic but very few used the photographs to identify leaves and realised that it could photosynthesise and therefore wasn't entirely dependent upon the tree for its survival.
  - b. This was very poorly answered. The vast majority of candidates correctly identified the carnivore and the herbivore. However, the description of their dentition was vague with many candidates making sweeping statements about the teeth in general instead of linking the structure of particular teeth to their function.
2. This was generally well answered with the majority of the candidates gaining most of the marks. Some students lost marks for identifying the phylum as Insecta and then giving characteristics of the class and not the phylum.
3. This question required candidates to apply their knowledge of leaf structure and function.
  - a. Few candidates were able to identify the xylem and some candidates lost marks for making reference to cells and not the tissue.
  - b. The majority of candidates had problems expressing themselves here and therefore lost marks for giving vague answers that lacked precise biological terminology.
  - c. Very few candidates gained both marks here. Whilst the majority of students realised that guard cells were important in controlling the opening and closing of stomata, their answers were once again vague.
  - d. In contrast to part (c), the vast majority of the candidates gained all four marks for explaining the mechanism of stomatal opening.
  - e. The majority of candidates correctly identified the hydrophyte, however very few gave more than one reason for their choice.

4. This question required the candidates to apply their knowledge of reproductive strategies. The responses to this question were very poor and it was the lowest scoring question on the paper.
  - a. The majority of candidates thought that the plant only reproduced asexually and simply stated, rather than explaining, the advantages of this strategy. Those who did recognise that the plant was capable of reproducing both sexually and asexually lost marks for poor communication skills and made vague references to pollination.
  - b. The quality of written communication was also poor here, with candidates making reference to internal and external reproduction. Only the better candidates understood that it is the male gamete that requires the liquid medium for movement, or that the amniote egg prevented the desiccation of the reptilian embryo.
5. This was on the whole was answered well and the majority of candidates demonstrated a good knowledge of transpiration and xerophytes. However, the description of how to set up a potometer varied. The better candidates gave very clear instructions, but unfortunately, many gave vague descriptions, and a minority demonstrated no knowledge whatsoever.
6. This required the students to apply their knowledge of gas exchange and oxygen-haemoglobin dissociation curves in the bar-headed goose. The majority of candidates coped with the concepts very well; however poor communication let many of them down.
  - a. Common errors here, included candidates making reference to the air sacs and not the lungs as the gas exchange surface.
  - b. Only a minority of candidates realised that internal lungs would reduce water loss, with many simply making reference to protection.
  - c. The majority of candidates recognised that counter-current exchange would maintain a concentration gradient, but only the better candidates went on to explain that this would allow oxygen to diffuse into the blood across the whole of the gas exchange surface.
  - d. Here, the majority of candidates recognised that the dissociation curve was to the left, but then had difficulty expressing the reasons why this was an advantage. Poor communication led to many candidates stating the 'goose had a higher affinity for oxygen', or that 'the oxygen would load faster' and this would be an advantage as 'there is little oxygen at high altitudes'.
7. This was accessible to all candidates with the marks awarded ranging from 0 -10. The majority answered part b) on the different types of blood vessels. Some candidates gave very well constructed accounts clearly linking specific structures to their function and gained high/maximum marks. However, many candidates lost marks by making generalised statements about blood vessels. Many candidates were awarded high/maximum marks for their descriptions of the cardiac cycle. The weaker candidates however simply described the passage of blood through one side of the heart, followed by the passage of blood through the other side – their accounts made no reference to pressure or the control of the cycle.

**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
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**Advanced Subsidiary/Advanced**  
**HB2**

**Comments on Specific Questions**

1. There were no major problems observed with this question other than memory lapses regarding the names of the taxons in human classification. Candidates do, however, need to read questions and understand what they are asking. This was evident in many reponses to questions 1(c) and (d) where many candidates regurgitated facts regarding the characteristics of different kingdoms rather than focusing on cellular organisation (b) or cell wall composition (d). Correct spelling of *Homo sapiens* was required. Many gave the name as homo sapiens or sapien.
2.
  - a
    - i A common error was identifying process 1 as indigestion and 4 as excretion.
    - ii Most candidates either identified that different aspects of digestion require a differentiated gut or that different pH conditions can be provided to meet the different optimum pH required by different enzymes. Several stated that different temperatures can be achieved in different parts of the gut.
  - b Many candidates were unable to identify the site of final digestion of disaccharides or the lacteal or indeed the hepatic portal vein. Deanimation rather than deamination of amino acids was a common error and there was a general lack of understanding regarding the conversion of the excess deaminated amino acids into carbohydrate for storage.
  - c Most candidates focussed on the dehydration associated with cholera rather than the role of ions in restoring blood ionic balance or of glucose as a respiratory substrate. With regard to treatment with antibiotics there remains a misconception that the use of antibiotics **causes** mutations leading to resistance rather than selecting bacteria that have already inherited a mutated gene conferring resistance to antibiotics.
3. The main problems seen were in parts (a) and (b) most candidates did not appreciate that the capillary shown was in the lungs and, consequently, that the venous end will be most oxygenated. They also did not identify that equilibrium is reached as blood flows through the lungs.
4. Even though large numbers of candidates submit low power plans of blood vessels for the microscopy element of BY3, few knew the structure and adaptations of the different layers of the walls of an artery.

In terms of exchange within capillary beds many gave blood cells and proteins as substances that could move into and out of tissue fluid. Most candidates gave the stock answers relating decrease in pressure and velocity if blood in arteries rather than applying their knowledge and understanding to capillaries as asked.

5. In general, there was a low level of knowledge of the role of different parts of the immune system and much confusion over the types of immunity and the cells involved. Poor communication skills cost marks in describing the role of memory cells and few candidates could describe the role of plasma cells in producing and secreting specific antibodies.
6. It was disappointing that the majority of A level candidates were not able to calculate a percentage. Completely unrealistic answers of 90% or even 900% were frequently given. Most decided to divide by the concentration in venous blood at rest rather than the concentration in arterial blood despite being asked to calculate the increase between arterial and venous blood at rest.

Many candidates only described transport of carbon dioxide rather than explaining the effect of lower pH on the oxygen affinity and dissociation of oxyhaemoglobin.

Again, poor communication skills and gross generalisations cost mark when explaining the lower concentration of chloride (not chlorine!) ions in venous blood. Many candidates made no reference to the role of red blood cells or even that hydrogen carbonate ions and chloride ions move out and into red blood cells. Even though the questions states "With reference to the table...." few candidates made reference to the data supplied or used the data to support their answers.

7. On the whole, both essays were answered equally well with many good answers provided.
  - a No major problems other than a lack of detail provided. Some confusion was seen in candidates knowledge of what diseases are caused by microorganisms (which does not include *Ascaris* or *Taenia solium*!) and which are caused by viruses.
  - b Many candidates confused the details of the different parasites with many describing *Ascaris* as the head louse.

**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY3**

**General comments**

The majority of candidates for this paper were resitting and, almost without exception, had prepared thoroughly for it. In consequence there were many excellent scripts. The examiners saw a much wider range of experiments than in the past.

**Aim / Prediction**

Aims and predictions were normally clearly stated although there were still references to rate of reaction when the dependent variable was time, there were still candidates who referred to enzyme and substrate without actually naming them and many candidates used 'discs' without qualifying what the discs were or what they had been soaked in.

**Design**

The independent, dependent and controlled variables were correctly identified with an appropriate range and units. Some candidates stated that a buffer would be used but the experiment involved the production of fatty acids indicating a rate of enzyme reaction. A buffer clearly would prevent the indicator showing a change of pH and so would not work. Several candidates stated that a concentration increase would be achieved by increasing the volume, obviously, this is not the case.

Candidates clearly understood the need for repeating readings and how to conduct a suitable control although it was not uncommon to be given a reference to boiling the enzyme rather than the tissue containing the enzyme.

The main hazard was not always identified and an appreciable numbers of candidates (usually centre based) considered that hydrogen peroxide is 'strongly acidic', toxic or initiated an allergic reaction. The wearing of Googles, by many candidates, to protect their eyes was not acceptable.

**Results**

The main error on results tables was incorrect rounding and in some centres the recording of results to a hundredth of a second was still seen.

It is very rare for a candidate to get full marks for drawing a graph, a skill which does not seem to improve with time.

**Analysis**

**Trend:**

General trends were, usually, clearly stated, however some candidates just gave a verbal description of their results stating all the figures.

**Explanation:**

Explanations of results were sound and it was obvious that the candidates had been well prepared. We were disappointed by the number of candidates who used this as an excuse to write all they knew about enzymes and the factors which affected enzyme reactions. Quite often a valid conclusion was not given and there was no reference back to the original prediction.

**Microscopy:**

Drawings showing the distribution of tissues were sound although the quality of the drawing, in some cases was questionable. Proportions were usually accurate but there were cases where epu lines did not actually touch the edge of a tissue and in some cases were not used. Labelling seemed to cause problems. This is an open book part of the assessment and correct spelling is expected. It is not : Palicade; mesophl; mesaphy; floem. Adventita; loomen or a host of other attempts.

**BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY4**

**General Comments**

A good range of scripts was seen, varying from those in the 70's right down to those in single figures. Although there were some excellent scripts, showing a real grasp of biological knowledge, there are still too many who are losing many marks because of poor exam technique. It is really important not to fold scripts back on themselves. Very often the diagrams needed to answer a question are on the facing page. Candidates are reluctant to use diagrams, tables and descriptions when they are directly above the question, so it is a big stretch for them to actually start flipping the scripts backwards and forwards. If the script is open at the double page it is much more likely that they will use the information. There was no indication at all, that candidates were short of time, so they should have taken time to really read the tables, graphs, text and diagrams. Time spent doing this is so important. This will be even more so the case with the new specification. All information given to candidates is there for a reason.

**Comments on Specific Questions**

1. This question was well done, on the whole, with many gaining full marks. Problem areas were candidates stating that purines and pyrimidines would be 'used as bases' and not knowing that viruses needed living cells within which to replicate. The weakest question was (d) in which candidates variously wanted to dispose of used bacterial culture plates by burning, baking, boiling, burying, drying, freezing, disinfecting, incinerating, irradiating, sterilising, dehydrating, washing the culture off or most worrying of all, treating the cultures with antibiotics.
2. Candidates were often not able to define an absorption or action spectrum, but most could describe the fixation of CO<sub>2</sub> and the formation of triose phosphate in (c) and explain the lower pH of the thylakoid cavity.
3. The first part of (a) was well done, with only a few scripts showing confusion over the three mammals or talking about larger rather than longer Loops of Henle. The second part suffered with a lack of communication skills. There seems to be a common misconception that beavers live in water/ are aquatic. They do not live in water, but are semi-aquatic, primarily terrestrial mammals that spend a lot of time in water for feeding, i.e. catching fish. Simply stating that beavers have lots of water, kangaroo rats have little water and pigs have adequate water is insufficient to gain marks. The answers to this question really needed some biological explanation linking the data and the environment. Despite being told in (b) to explain their answer, many just suggested an environment; hotter or colder was not acceptable.

4. This question was well done with most loss of marks being due to not reading that the bacteria were bacilli, not knowing what the term 'intracellular' meant and simply giving a definition of a parasite instead of explaining why *M. leprae* is described as an obligate parasite.
5. Some good responses were seen, with only a few stating chemical control in a(i). The question asked candidates to use the information 'as described above' in (a), so this was simply a case of extracting the relevant information from the text and expanding on it.
6. The responses to this question were some of the poorest on the paper.
  - a. Many candidates could not explain why large proteins are not found in the glomerular filtrate, although most had learned that glucose is selectively reabsorbed in the proximal convoluted tubule. Better scripts could explain the increase in volume of urine correctly in a(iii), but too many went off on the completely wrong ADH route, possibly because of confusion over high/low water potentials and also blood/urine.
  - b. Synoptic assessment is a required element of this unit but many candidates could not remember the biochemical structure of collagen. Despite being told in part (ii) to use their knowledge of ultrafiltration and the diagrams, very few noticed that the endothelial cells were missing, that there were now huge gaps/pores in the basement membrane and that the large proteins and red blood cells would now be forced through these gaps by the high hydrostatic pressure in the glomerular capillaries. Far too many gave sloppy descriptions here stating that the proteins passed, flowed, diffused through these large gaps, when in fact they must still be forced through.
7. Another poor question, mainly because there seem to be many candidates who do not appreciate how an action potential is generated and how depolarisation is brought about.
  - a. A significant number of candidates did not describe three effects of an increase in temperature, but decided to describe the effect of the lower temperature or a detailed comparison between the two temperatures.
  - b. Many good scripts got both marks here and correctly identified that the opening and closing of the  $K^+$  channels was faster at  $33^{\circ}C$  and described how this accounted for the shape of the graph – good logical biology and its application.
  - c. There was some confusion in here about the difference between depolarisation and an action potential. Depolarisation is what occurs in the post synaptic neurone in the region of a synapse, but this rarely gives rise to an action potential. Typically the depolarisation from several synapses must work together at nearly the same time to initiate a new action potential. This is why the depolarisation must reach threshold at the start of an axon (axon hillock) before an action potential is generated. Part (ii) related to synapse function, so really needed a simple description of the events leading to a normal synapse depolarising, then comparing with a synapse treated with an ACH-esterase inhibitor.

- d. The effect of dopamine was shown clearly on a diagram. A simple analysis of the diagram and a correct description was required plus some suggestion of how this affected the synapse, many could not do this. The diagram was there to clue candidates in to how the drug worked, but many seemed not to have looked at it and simply went off on a complete tangent, often wanting cocaine to be inhibitory.
8. This question was generally well done, although there was some confusion over what the products of hydrolysis of lipids are (again synoptic assessment)
- a. Many candidates did not know where amino acids, fatty acids and glycerol entered the respiratory pathway.
  - b. Generally well done.
  - c. Generally well done.
  - d. Frequent errors here included lactose for (i), cytoplasm of mitochondria for (ii) and no mention of muscular contraction in (iii). If students are investigating anaerobic respiration it is not easy to get totally anaerobic conditions, therefore mention of high CO<sub>2</sub> output by yeast and low O<sub>2</sub> availability, increasing RQ was required and many understood that.
9. Both essays seemed equally popular and there were very many who had clearly learned the work and routinely got all 10 marks.

**HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**HB4**

**General comments**

Candidates had been well prepared all marks were accessible and there was no problem with time. Many candidates wrote in great detail and often at great length and an alarming number attempted both essays. I remain concerned about some candidates who have a dispensation to use a word processor but then 'Pick and Mix' the questions or parts of questions which are answered on the paper and those which are answered using the word processor and in some cases both. The marking becomes very difficult and the tabulation of marks very time consuming. Some parts of questions necessitate answering on the paper and this is quite acceptable but all other sections should be either on the paper or be word processed.

**Question specific comments**

1.
  - a. Nitrogen fixing bacteria was given by some as a response rather than Rhizobium or Azotobacter. Most candidates appreciated that nitrate ions were absorbed by active transport but occasionally diffusion and osmosis were stated.
  - b. Candidates lost marks for not explaining their answer.
2.
  - a. It was rare for candidates to be awarded all 5 marks. Common errors included microfibril or sarcomere for myofibril. Confusion with primary, secondary, tertiary and quaternary structure of protein and mitosis and meiosis.
  - b. Some candidates identified the marathon runner and sprinter incorrectly in (i) and others assumed that they should use all of the letters. (ii) was well answered.
  - c. Candidates appreciated what affect resistance-training followed by no resistance training would have but many could not use the information given to be able to advise a sprinter how to prepare for a race for example no or incorrect reference to time was given.
3.
  - a. In general there were no problems with the labelling of the synapse in (i), but some candidates were confused between pre and postsynaptic membranes. Many candidates were able to give reasoned responses in (ii), but others were very confused and referred to GABA binding to acetylcholine receptors and preventing acetylcholine from binding and stimulating the generation of an action potential.
  - b. Stronger candidates were able to state two functions of a synapse but marks were lost by stating that the synapse generated an action potential or transmitted action potentials (and a host of other things) from one nerve into another.

- c. Very few candidates appreciated what hydrolysis is many giving reference to the removal of hydrogen. Responses to section (ii) were sound.
4. a. There were some excellent responses demonstrating a very good knowledge of kidney function.
- b. The calculations in (i) were normally correct although many candidates gave the answer in  $\text{mg dm}^{-3} \text{ hour}^{-1}$  rather than day. (ii) caused bigger problems with the figures given being used in various permutations.
- c. Osmoregulation, water potential, active transport and facilitated diffusion were all common answers in (i). In part (ii), stronger candidates appreciated the increase in the concentration gradient as a result of the reabsorption of water but there were many other interesting, ingenious but alas incorrect responses. The majority of candidates in (iii) stated that the concentration of penicillin would increase as it passes along the PCT. Very few candidates could explain why all of the glucose cannot be reabsorbed in people with uncontrolled diabetes in section (iv).
5. a. Many but not all were able to state that the energy transformation is light energy to chemical energy.
- b. Excellent descriptions of how chloroplasts fix carbon dioxide were given in sections (i) and (ii) but very few candidates were able to clearly state what 'fix carbon dioxide' actually means.
- c. Very poorly answered.
6. a. There were some excellent responses with most candidates getting at least 3 out of the possible 4 marks.
- b. The majority of candidates were able to refer to phosphorylation of glucose in (i). There were many correct responses in (ii) demonstrating a thorough understanding. Energy lost as heat was the most common answer in (iii) but certainly not by all. There were some excellent responses to (iv), that were well structured and well-reasoned.
- c. Some candidates realised that there would be insufficient NAD to allow Krebs cycle to continue and for fatty acids to be broken down. The majority, however, were unable to suggest why the drinking of alcohol in excess can lead to the accumulation of fats in the liver.
7. a. Population growth curves. - This was the most popular choice of essay. In many of the growth curves which were drawn, the axes were not labelled and in some cases it was not stated if it was a bacterial or human growth curve. There were some excellent comparative essays with all points on the mark scheme being given.
- b. Stroke, Parkinson's and motor neurone disease - There were many excellent answers demonstrating a thorough understanding and ability to answer the question asked and not just write everything the candidate knew about the three conditions.

**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY5**

**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 they give incomplete or inaccurate answers.

**Comments by question:**

1.
  - a. Part (i) I, was generally well answered though there was some examples of poor responses including, 'the number of species in a population' and 'variation within an ecosystem'. Part (i) II was also well answered though some candidates referred to cultures of microorganisms. In part (ii), most candidates recognised that biodiversity would decrease with banana production but the quality of explanations varied from concise and accurate to vague and incomplete.
  - b. In part (i) the majority of candidates were able to give some description of carbon footprint. However, a minority were able to do so in terms of amount, source and time. Most candidates made the link in part (ii) with the greater transport distance, fewer went on to get the second marking point by explaining the increased burning of fuel. An alarming number gave answered that referred to growing bananas in Europe.
  - c. The majority of candidates recognised that using trains cut the number of journeys required for (i) but fewer achieved both marks by giving a clear explanation of why that would reduce the carbon footprint. Also, in part (ii) the majority were able to explain the benefits to the environment.
2.
  - a. Large numbers of candidates were able to recognise the type of cell division as meiosis in Part (i) and correctly named a part of a flower where it takes place in part (ii). Many candidates were able to correctly order the stages in meiosis for (iii), though all possible permutations of incorrect answers were seen. Part (iv) proved to be more difficult than expected, the most common error was to fail to halve the number of bivalents counted in the photograph.
  - b. Most candidates recognised the stages in part (i), though a wide range of incorrect answers were seen. Part (ii) was poorly answered and it was very unusual for candidates to be awarded both marks.
  - c. The majority of candidates were able to correctly name crossing over and random assortment.

3.
  - a. Parts (i) and (ii) made up a straight forward dihybrid cross and were generally well done. However, some candidates were not even able to draw the gametes, including some who gave only one type of gamete from each parent and some who constructed a 2 X 2 punnet square. Also some candidates automatically gave the theoretical ratio of 9:3:3:1.
  - b. This was an equally straight forward chi squared test. Most candidates were able to calculate the expected number in in part (i) and error carried forward was allowed for candidates who gave an incorrect ratio in part (ii). Rounding errors were relatively common though and candidates should be trained to round to the same number of decimal places as shown in the table. There was good evidence that candidates understood how to find the critical value from the table but many used 3 degrees of freedom or did not circle a value at all. In part (iv), most candidates understood that they were required to compared the calculated value of  $\text{Chi}^2$  but there was confusion over exactly how, and many vague or inaccurate answers such as 'the difference was significant' or 'it was greater than 5 percent'.
  - c. Almost all candidates were able to recognise the definition of gene pool in marked contrast to when, in previous papers, candidates have been asked to write the definition of gene pool. There were significant issues with quality of written communication in parts (ii) and (iii) so that many answers lacked clarity. Some candidates completely misunderstood and predicted there would be less E in the field than in the hedgerow and some gave answers to (iii) which referred to E as if it was the cows' allele. Part (iv) was generally well answered with many candidates being awarded the two available marks.
4.
  - a. In part (i), most candidates recognised the virus contained its own RNA for the first marking point. However suggestions of why this meant it did not have to enter the nucleus, varied from poor to excellent and there were issues with quality of written communication. In part (ii), most candidates were able to state that protein synthesis occurs in a ribosome or because of the reference to glycoprotein in the question, wrote that is completed in the Golgi body, and descriptions of the process in part (iii) were generally good so that most candidates were awarded at least 3 out of 4.
  - b. The genetic code was well understood in parts (i), (ii) and (iii). Candidates were generally able to complete the nucleotide sequence and convert nucleotide sequences to amino acid sequences using the table provided. Part (iv) was another part where poor quality of written communication prevented candidates being awarded both marks.
  - c. The quality of drawings was variable, with the gap between the lipid layers being the main issue. There were some candidates who drew an extra line on each side of the membrane. Almost all candidates who drew a reasonable diagram were awarded the labelling mark.
  - d. This examined the principles of genetic engineering in an unfamiliar context. Most candidates were able to name a restriction enzyme in part (i) but fewer were able to name ligase in part (iii). Naming the vectors proved more of a challenge in parts (ii) and (iv). The advantage of using bacteria instead of tobacco plants was generally well understood in part (v).
  - e. Quality of written communication was again an issue in parts (i) and (ii) where candidates were required to comment on the ethics of drug use during the Ebola epidemic.

5. a. Part (i) required a simple definition of the term trophic level and the majority of candidates were awarded the mark. A significant number of candidates did not attempt part (ii). Some gave an equation which used values as well as letters and some introduced terms such as 'transfer of energy' ignoring the instructions in the question.
- b. Relatively few candidates were able to suggest a unit which had a component for energy, area and time in part (i). A common error was to include  $m^{-1}$  instead of  $m^{-2}$ . In part (ii), relatively few candidates correctly calculated photosynthetic efficiency but almost all candidates were able to correctly calculate  $R_h$ .
- c. In part (i) many candidates did not read the question carefully and gave suggestions related to energy lost in respiration even though the question was about biomass produced (i.e. after respiration). Also, in part (ii), a common incorrect answer was 'the decomposers receive all the dead organic matter' which is given in the question. There were many confused and vague answers given to parts (ii) and (iii) with poor quality of written communication again an issue.
6. a. A tiny minority of candidates attempted this option. Answers ranged from poor attempts with very little written and no diagram to detailed correct accounts with good quality accurate diagrams.
- b. Most candidates attempted this option. The majority gave a good account of spermatogenesis. Relatively few went on to make a good comparison with oogenesis, many giving a separate account of oogenesis with no comparison given,
- Quality of written communication was an issue in both options.

**BIOLOGY/HUMAN BIOLOGY**  
**General Certificate of Education**  
**Summer 2016**  
**Advanced Subsidiary/Advanced**  
**BY6**

**General comments**

In the last year of this specification, the examiners are pleased to see that many of the recommendations made previously have been noted. Centres have followed advice and now, results tables and graphs are generally well presented and most candidates provide well-organised and well-argued analyses. Some candidates, however, still use Tippex, despite its use being proscribed by JCQ regulations.

Written communication requires careful thought with regard to word use and spelling.

- Using an oblique between two alternative words is poor writing style and it is the responsibility of the candidate, not the examiner, to choose the most suitable word.
- Examiners show tolerance for some word use errors. They did not penalise, for example, a yeast 'solution' or water at 60°C having a risk of 'scolding', but using 'googles' as a safety precaution or a 'calorimeter' to determine a time for indicator decolorisation does not get credit.

Some other common features are described below:

**Aim / Prediction**

- Some candidates include an explanation within their prediction, which is not required. This indicates that they are not separating the two concepts in their minds.
- In experiments timing the loss of colour in an indicator as a result of yeast respiration, the aim of the experiment frequently remained unclear: candidates wrote an aim, prediction and design without mentioning the presence of respiring yeast, which was not introduced until the explanation.
- In the prediction of the behaviour of a dependent variable e.g. the rate at which an indicator changes colour at different temperatures, candidates may state that it increases up to an optimum and above that temperature, decreases. Candidates should realise that all this does is define the term 'optimum', but they were not penalised for this, as the meaning was apparent.
- Candidate should be aware that if they are plotting time on the vertical axis, then time, not rate, is the dependent variable. Time can be described as 'shorter' or 'longer' but not 'faster' or 'slower', as these, like 'quicker' and 'slower', describe a rate.

**Design**

Some candidates still do not distinguish between a 'control' experiment and 'controlled' variables.

- In describing controlled variables, 'volume and concentration' are two separate variables, even when they refer to the same solution.
- In describing the control experiment, it is expected that candidates would state that all conditions other than the inactivated factor remain the same, and to give an example.

## Results

- The indication of a recurring decimal is not appropriate at the level of precision of lab equipment. Correcting to one more or the same number of decimal places than given in the raw data is expected.
- Candidates are advised not to overwrite in their table, but to cross out the incorrect figure and write in the correct one.
- If a colour change takes longer than a candidate was able to wait, a time was stated as, for example, 600+ seconds. It does not make mathematical sense to average three such readings as 600.0 seconds and to plot that on a graph. It would have been more suitable not to plot that point and to explain why one fewer data points than expected were plotted.
- Data points should be crosses, with two diagonal lines meeting at the co-ordinate. Examiners allow a half square tolerance but a candidate with a blunt pencil may penalise themselves in this.
- Range bars should be bounded by small lines at 90° to the range bar, not with crosses, as these may be confused with the data point when the candidate is analysing the graph.

## Analysis

### Trend:

- In describing the trend of results, candidates are expected to describe the complete trend, including a change of gradient of the graph, if one exists.
- Merely quoting data points does not describe a trend.
- The word 'proportion' and 'correlation' were confused by some candidates, such as in claiming that the volume of carbon dioxide evolved by photosynthesising material is inversely proportional to the light intensity, rather than inversely correlated.
- Candidates should take care to distinguish between raw data, i.e. the readings, and the calculated mean. The term 'results' could refer to either and unless the meaning is clear, it is preferable to avoid that word.

### Use of range bars:

In describing the use of range bars, many candidates have still not understood that the overlap of range bars is not a reflection of accuracy or reliability of raw data. Overlap can be evidence for a decreased gradient, as occurs either side of a peak or trough, and also occurs at a plateau.

Candidates are advised to develop the habit of separating different concepts into different sentences. To describe the range bars and 'short and non-overlapping' conflates two ideas and candidates frequently fail to get credit as they follow this with stating that this is evidence for reliability, whereas only the 'short' is.

### Explanation:

- The explanation section should refer to candidates' own results. Examiners do not wish to be presented with the entire content of the Teachers' Guide on this topic, learned by heart with the same stock phrases in the same order. Candidates may write fully and correctly, but, if the account does not refer to their own results, they cannot access full marks in that section. Rather, candidates should use their knowledge to explain their own data.
- Word use needs attention. Candidates refer to an optimum on a graph and write, for example, '...the optimum, where the graph peaks....' The optimum is not a place and so 'where' is not a suitable word. They may also refer to values of the independent variable 'before' or 'after' the optimum. These words are only correct if the independent variable is time. In many BY6 experiments, the independent variable is temperature or pH, so the words 'above' and 'below' are more appropriate.
- When describing specific reactions, candidates are advised to refer to the names of the enzyme and substrate rather than using the general phrase 'enzyme-substrate complex'.
- A complete explanation of yeast respiration should include some description of alcoholic fermentation, in addition to aerobic respiration.

**Further work:**

- A prediction in the Further Work section is expected to be correct and complete, based on the candidate's A Level knowledge. All parts of a response are expected, e.g. a drop in time for decoloration followed by a plateau. A sketch graph must provide the same information as the text and, similarly, should reflect A Level knowledge. Very often, the sketch graphs provided to describe a response to pH or temperature do not reflect A Level knowledge e.g. graphs predicting the effect of pH often showed a peak much wider than would be expected and no plateau at pH extremes.
- Candidates should note that in describing controlled variables, at least one should be different from those given in the main experiment. It is disappointing when all the candidates in a centre provide identical controlled variables and identical accounts for Further Work. While marks are, of course, awarded, candidates have been deprived of the opportunity to show that they have developed analytical skills.

**Microscopy:**

- Following biological convention, label lines should be drawn with a ruler and end within the object being labelled, not on its outer margin.
- Five correct labels on a microscope drawing are required and the labelling is designed as an open book exercise. It is therefore disappointing to see every candidate in a centre providing the same 5 labels, even more so when one of the five is not correct.
- If a structure e.g. a pollen sac, is bracketed, the edges of the structure must be shown to coincide exactly with the ends of the brackets.
- The indication of a distance measured on a slide must be precisely identified on the microscope drawing. If the line bounding the marked distance falls outside the structure's boundary, the candidate does not get credit. But if more than one is drawn, a candidate will get credit, even if only one is drawn exactly.



WJEC  
245 Western Avenue  
Cardiff CF5 2YX  
Tel No 029 2026 5000  
Fax 029 2057 5994  
E-mail: [exams@wjec.co.uk](mailto:exams@wjec.co.uk)  
website: [www.wjec.co.uk](http://www.wjec.co.uk)