



GCE EXAMINERS' REPORTS

BIOLOGY AND HUMAN BIOLOGY AS/Advanced

JANUARY 2014

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BIOLOGY/ HUMAN BIOLOGY
General Certificate of Education
January 2014
Advanced Subsidiary/Advanced
BY1

Principal Examiner: Mr A Clarke

There was a range in standards seen in scripts; however few candidates scored very high marks. A significant number of candidates failed to have grasped many of the core concepts and principles associated with unit one, and as a result struggled to answer questions involving application of knowledge.

Question 1

This question was generally well answered by the majority of candidates. However a large number of candidates referred to the structure of nucleic acids and not the nucleotides within DNA and RNA. Few students gained both marks in part (c) as they failed to quote data from the table.

Question 2

Most candidates were able to sequence the diagrams of mitosis, however about half of the candidates then stated that the process occurring at A was telophase. Few candidates scored full marks for part (b) with many making reference to genetic variation in part (i) which cannot be seen from the diagram or by simply stating two differences and not giving an explanation. In part (ii) many candidates gave vague statements and failed to make reference to genetic variation; only the better candidates appreciated that it is necessary to produce haploid gametes so that the diploid state can be restored at fertilisation.

Question 3

Many candidates stated that the ester bond would be broken, during the hydrolysis reaction, to produce glycerol and a fatty acid; however few were able to accurately draw these structures. Having drawn glycerol and a fatty acid only a minority of candidates appreciated that these structures were different and most gave vague answers in part (iv) demonstrating that they knew the definition of a polymer but were unable to apply their knowledge. Part (b) was generally well answered although in part (ii) some candidates failed to read the question carefully and gave functions relating to insects and plants.

Question 4

Knowledge of enzymes is so fundamental to the understanding of metabolism that it was very disappointing to see the responses given by the candidates, especially given the fact they many of them will have studied respiration and photosynthesis in BY4. The answers in part (a) were appalling, it seemed they had never seen an activation energy graph before. Candidates provided vague answers to part (b) and failed to make reference to enzyme structure. The quality of responses to part (c) varied with only a minority of students gaining full marks; candidates interpreted the graph correctly and in part (ii) explained that all of the active sites were full, but failed to state that the enzyme concentration was the limiting factor. Unfortunately many candidates interpreted the graph as 'mass of product' against 'time' and therefore gained no marks. The majority of candidates gave a good account of competitive inhibition, but then drew a curve showing non-competitive inhibition on the graph.

Question 5

Most candidates gained the majority of the marks in part (a), the common errors were the misidentification of ribosomes as rough endoplasmic reticulum, and vague answers regarding the function of the nucleus. Many candidates gave good comparisons between the structure of prokaryotic cells and mitochondria. However, a significant number of candidates gave very poor answers. Once again this is very disappointing considering that both mitochondria and bacteria are studied in detail in BY4.

Question 6

Many candidates picked up the majority of the marks in part (a) although there was some confusion as to the role of the transducer. Quality of written communication was also an issue for some and their descriptions were not logically set out. Part (b) proved more difficult with only a small minority interpreting the information and realising the link between isomerism in monosaccharides. The majority of candidates incorrectly stated that they would use Benedict's reagent to test for the protein. Those that did state that they would use Biuret then explained that there would be a colour change and therefore didn't answer the question being asked. The majority of candidates were able to give advantages of using immobilised enzymes.

Question 7

In part (a) the majority of candidates correctly calculated the water potential of the cell, but many failed to appreciate that water would travel from cell F to both cells E & G. Few candidates explained that the water moves between the cells due to a water potential gradient, and the majority simply gave a definition of osmosis. Few candidates gained the mark for (b)(i) as most stated that 'the membrane would be coming away from the cell wall'. However in (b)(ii) many candidates demonstrated an understanding of incipient plasmolysis and gained both marks.

Question 8

There was a fairly even split between the extended questions. Those candidates who chose to answer part (a) on polysaccharides tended to give good accounts, showing they were well prepared and scored highly. A range of marks were achieved on part (b) with some candidates giving very good answers; however many simply tried to write everything they knew about 'protein structure' or 'membrane structure' and therefore only picked up a few marks.

BIOLOGY/ HUMAN BIOLOGY
General Certificate of Education
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Advanced Subsidiary/Advanced
BY2

Principal Examiner: Mr P Owen

Many candidates gave trivial answers that lacked depth and clarity giving only a superficial coverage to the topics examined. A continuing problem is the inability to use the correct terminology in appropriate places and lacking specificity. For example, candidates often referred to 'it' or 'they' rather than specify exactly what 'it' and 'they' were.

Question 1

The anticipation was that this would be an easy starter for most candidates. However, that proved not to be the case with very few candidates scoring full marks. The most common error was to suggest that the fourth column were fungi, despite the characteristics stating that some members of the Kingdom had chloroplasts. Where candidates correctly identified Protoctista as being the Kingdom, there were a variety of spellings, which was true for the other Kingdoms.

Question 2

The role of the AVN was not well understood. Very few candidates used the correct terminology in discussing waves of excitation. Instead, they referred to 'impulses' or 'signals'. There was little understanding of the AVN receiving the wave from the SAN and passing it on to the bundle of His. Instead, there were references to the 'impulse' being passed onto the ventricles or to it allowing the atria to contract simultaneously. Few candidates made any reference to the AVN causing a delay or preventing the wave passing directly to the ventricles.

Whilst many candidates recognised that the bundle of His transfers the wave to the ventricles, only a minority made any reference to the fact that the wave is transported to the apex of the ventricles thereby facilitating the contraction of the ventricles simultaneously, from the apex upwards. There were vague references to the ventricles contracting and forcing blood out of the heart.

Part (b) of this question was badly answered with the most common incorrect identification being of ventricular diastole. Most candidates did not appreciate that this phase would occur over a period of seconds and so, gave a number that identified a particular point rather than a phase.

Question 3

The question overall, caused problems for candidates because they failed to make reference to haemoglobin at the correct points in their answer. Instead, candidates referred to 'it' or 'the blood' and on occasions 'the body'.

Most candidates gave a correct figure in answer to (a)(i).

The majority of candidates recognised that the oxygen would be used up during exercise as it was needed by respiring muscle cells in their answers to part (a)(ii).

Most candidates correctly identified the mouse haemoglobin as having the lowest affinity for oxygen.

Approximately 50% of candidates were able to draw the curve to appropriate side of curve C though very few could give a correct shape.

Although many candidates recognised that the benefit of the change in position of the curve would be a lowering of the affinity of the mouse haemoglobin for oxygen, few could then articulate the point that this would result in a greater dissociation of the oxyhaemoglobin, thereby yielding more oxygen. A significant number of candidates referred to there being a 'faster' release of oxygen which is not correct.

Part (d) was well answered with most candidates appreciating that the Llama lives in an area where there is less oxygen in the air and so the animal's haemoglobin must have a greater affinity for oxygen.

The curve for the lugworm was correctly identified by most candidates.

Question 4

In answer to question (a)(i) most candidates were able to give a full definition of a parasite. The answers to part (ii) were also high scoring. However, we did have a number of answers that referred to 'hookers' and few candidates referred to the surface area to volume ratio instead, focusing on descriptions of the shape of the parasite.

The type of diet of animal B was usually correctly identified though there were a variety of spellings of the term 'carnivore'. Many candidates thought that the incisors were 'large' and a number of candidates indicated that the absence of a diastema meant that it was a carnivore. Far too many candidates could not give an adequate description of the different types of teeth and describe an appropriate role.

Part (b) was poorly answered. Whilst many candidates correctly recognised that both organisms were heterotrophic few could state two appropriate differences with the commonest correct answer being references to digestion versus pre-digestion by the host.

Question 5

Most candidates determined the calculations correctly. Candidates became confused in answering part (a)(ii). Many failed to appreciate that by covering the under surface with grease it left the top surface to transpire. Far too few used actual figures from the table to exemplify their answers to show that they understood what was happening.

Few candidates understood that the purpose of reweighing the leaves was to ensure that all of the water had been removed.

Most candidates could correctly identify and spell the term 'xerophyte'

The fact that the marram grass has no stomata on the lower epidermis of its leaf was an obvious point but far fewer recognised that the leaf had far fewer stomata overall and candidates experienced great difficulty in describing the rolling of the leaf to protect the stomata from wind and sunlight.

The majority of candidates were able to state two further modifications though a minority repeated ones given above.

Question 6

The mechanism of ventilation was well known but candidates often failed to give full details. For example they mentioned a diffusion/concentration gradient being maintained but failed to state that it was across the whole length of the gill filament.

The answers to part (c) often failed to give sufficient detail to allow the award of a mark. For example, candidates often referred to blood capillaries but failed to mention that it was a dense network. Also, there were often descriptions of gill filaments and microvilli without making a statement that these provided a large surface area.

Question 7

Question (b) was by far the more popular of the two, but this was centre based. Few candidates scored well on question (a). The most common points that were identified by candidates were references to the colour of petals, the roles of xylem and phloem and the possession of a seed coat with food stored in the seed.

A number of candidates scored full marks in answering question (b). Candidates recognised that reproduction was by mitosis and that clones were produced. The need for only one parent was well understood but few candidates gave any example of organisms in which asexual reproduction occurs. Many candidates understood that there would be a lack of variation which could lead to problems with disease and changes in the environment, though few candidates related this to evolution or natural selection. One area of confusion amongst a significant number of candidates was between asexual reproduction and external fertilisation. These candidates provided largely irrelevant accounts yielding few marks.

BIOLOGY/ HUMAN BIOLOGY
General Certificate of Education
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Advanced Subsidiary/Advanced
BY4

Principal Examiner: Ms F Cowie

The standard of scripts was somewhat mixed; there were some scripts of extremely high standard, showing sound biological knowledge and a real understanding of the workings of biological systems. Equally there were some poor scripts with a number having a total mark of less than 10 out of 80.

Sadly poor exam technique lost marks across the entire ability range and lack of basic knowledge and understanding lost most marks on the weaker scripts. Questions involving straight recall were routinely answered well by most candidates showing that they had learned the work; however when it came to the questions applying this knowledge only the high scoring scripts did really well.

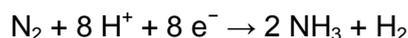
Use of incorrect, non-scientific terminology was common.

Question 1

Candidates found this to be one of the most challenging questions on the script. Many responses gave no valid conclusion about the two air samples and stated that the bacteria/colonies grew better in indoor air or that there were more colonies in indoor air. A simple reference to the type of agar was all that was required in (b). References to oxygen and water were irrelevant since the question had already clued them in to nutrients. Very few scripts seem to show understanding of varying the concentration of the basic C and N source and using different molecules to provide them. Too many are still using 'amount' or 'level' at A2 instead of concentration.

Question 2

This was routinely answered well with better scripts gaining all 7 marks. Part (b) lost marks in many scripts because of confusion over what nitrogen fixation actually is. Basically the nitrogenase enzyme catalyses the following reaction



producing ammonium ions in solution – these are used to synthesise more complex molecules such as amino acids.

There is no production of nitrate; indeed there cannot be, since the above reaction occurs under anaerobic conditions as oxygen competes for the active site of the enzyme.

Question 3

Really well answered on the majority of scripts. Recall work that had clearly been learned.

Question 4

Part (a) routinely gained all six marks, again being recall work that had been well rehearsed. Some confusion over the correct term osmoreceptors with the word 'osmoregulators' was evident and also describing how a low water content meant the blood would have a high solute potential. Presumably this was meant to be high solute concentration. Part (b) was a problem for some, since the ability to describe the graph was of varying standard. At A2, candidates should be able to describe graphs including some reference to the data/axes on the graph to illustrate their description. This was a two mark question which required them to realise there was a point at 282au solute concentration where there was a change in the level of ADH. Part (ii) routinely gained one mark, but only the best scripts gained the second mark point. Many misunderstood the graph and said that the 'delay' was because it took time for the ADH to reach the kidneys. Having clued candidates into the idea of blood pressure and volume in c) it should have been a simple extension to come up with 'blood loss', but this was, in fact, not at all common; the knee-jerk response 'diabetes' was probably as frequent. (Untreated diabetes was credited.)

Question 5

The left hand side of the table was almost universally correct and gained 4 marks. However, the instruction to 'explain **precisely** what is occurring in the culture at **each** of these stages' was completely ignored by many. 'Getting used to their environment' is not an explanation of the lag phase; it requires some reference to enzyme synthesis in the context of this question. Equally, reference to 'birth rates' was not credited in the case of a yeast culture. (Many converted it to a bacterial culture.) Few mentioned cell division/cell replication/budding in B or D and even fewer stated that a build-up/increased concentration of ethanol caused the death phase, despite answering (b) correctly in the next section of the question.

Question 6

Often gained full/almost full marks, especially since it was largely recall. Part (a) was synoptic and tested nucleotide structure with some common sense since they could use the description in the stem of the question. It routinely gained full marks, as did (b) (iii), (iv) and (c). Part (b) (i) proved difficult for some to describe and many resorted to diagrams which were credited. Part (ii) seemed to be an 'all or nothing' response. Either scripts referred to the fact that it did not need oxygen (in glycolysis) or involve an ETC/electrochemical gradient/the process of chemiosmosis/stalked particles/mitochondria and got both marks, or they simply thought that it was used by simple organisms, had been discovered first and was therefore the oldest and got nothing.

Question 7

Section (c) which is all recall, routinely gained full or almost full marks. The only problem areas were omitting that fact that RuBisCo is an enzyme and therefore acts as a catalyst in the joining of RuBP and CO₂, confusing X and Y and not using correct terminology in (iv). Parts (a) and (b) required sound knowledge of the light stage of photosynthesis and then being able to apply this knowledge to a new situation. This application of knowledge sorts out the better scripts from those who have not understood the work, and is a skill which candidates will need to master for future exams. Exam technique lost marks in (a) as scripts did not answer the questions posed, rather gave an explanation of cyclic and non-cyclic photophosphorylation. In (b) most scripts scored the first mark point, but there was frequent reference to lack of 'nutrients' so the plant could not grow, rather than a simple statement that inability to synthesise glucose meant the plant could not respire/synthesise ATP .

Question 8

By far the most popular question was the synaptic transmission. This routinely gave candidates full marks for what was really good recall of the process.

The serial dilution essay was rarely attempted and was often very poor and vague. There is much confusion over the inoculation of plates with the diluted suspension. This must be done with a fixed, known volume spread evenly over the agar surface, in order to calculate the bacterial load in the original sample. It cannot possibly be done with an inoculating loop and a streak plate. Answers that gave precise accounts of the technique were rare, although there were some and they were a pleasure to mark.

BIOLOGY/ HUMAN BIOLOGY
General Certificate of Education
January 2014
Advanced Subsidiary/Advanced
HB2

Principal Examiner: Dr M Morgan

While it is appreciated that all candidates sitting this paper were resitting HB2 the general standard of the answers was poor, demonstrating a major lack of learning of basic facts, candidates not reading the information provided in the stems of questions and a lack of detail being provided in their answers.

Question 1

Nearly all candidates were able to recall order and family but many could not remember chordata as being the class to which vertebrates belong. Candidates from some centres are still using vertebrata. Many candidates lost marks in the second part of the question by not being sufficiently specific in their answer. The question asks candidates to name an analytical technique – just stating DNA or protein analysis / testing or electrophoresis alone is not a sufficient answer at AS Level.

Question 2

Again a lack of detail and much confusion in candidates' answers demonstrated a general lack of understanding or learning of the meanings of terms.

Few candidates described antibodies as being produced in response to specific antigen or that cell-mediated immunity involves some form of specific destruction of pathogens / cells by direct contact.

Many candidates did not understand that natural active immunity is developed in response to actual infection and not vaccination and many showed little understanding of the word passive when describing an immune response.

Question 3

Many candidates had learned the meanings of the terms antigen and antibody but the majority could not apply this understanding to the use of the Eldoncard. Most candidates did not understand that the antigens were on the red blood cells and that antibodies against those antigens were on the card. There were also errors in understanding that A cells have A antigen etc., even though this was stated in the stem of the question.

The question was intended to be a relatively straightforward application of the principle of antibody-antigen interaction but instead highlighted a lack of understanding or knowledge of this area of the specification.

Question 4

A surprising number of candidates were unable to recognise a villus or recall the main functions of the duodenum and ileum.

Many candidates proceeded to suggest that structure Y (Brunner's glands) secrete hydrochloric acid to lower the pH and provide optimum conditions for stomach enzymes.

As in previous questions, a lack of detail in answers cost many candidates marks. For example, at AS level it is expected that reference to microvilli would be accompanied by their function of increasing surface area.

Question 5

Again many candidates had not learned the basic meaning of terms such as pathogenic. In addition, many were unable to recall a basic description of the structure of the cell wall of a Gram negative bacterium or indeed name the bacterial types as bacilli.

The protective role of the additional lipopolysaccharide layer was not clearly communicated and many gave incorrect descriptions of penicillin destroying the peptidoglycan cell wall rather than inhibiting the formation of peptide linkages in the cell wall.

Question 6

Most candidates were unable to apply the biological principles of surface area : volume ratio or diffusion distance to understanding the limitations to using the body's surface area as a gas exchange surface. Very few candidates showed any understanding that the metabolic needs of an organism is related to its volume or that the surface area controls gas exchange.

Again, very few candidates appreciated the need for internal lungs as a way to reduce water and heat loss in terrestrial mammals and a major lack of detail cost candidates marks in explaining the adaptations of the lungs to gas exchange. Candidates really should by now understand the need for detailed answers at this level. For example: large numbers of alveoli increase surface area for gas exchange, not just alveoli give a large surface area.

For many candidates the question on TB gained them their only marks on this part of the paper.

Question 7

It was pleasing to see most candidates being able to calculate the heart rate. However, when candidates arrive at an answer of 25 or 900 bpm surely they should realise that this is not within the normal range for a human and subsequently check their maths!

Relating the ECG trace to events taking place in the heart was highly variable and misuse of terms was common; e.g. T shows the heart relaxing. Candidates should also realise that the QRS part of the wave precedes ventricular systole.

Pressure changes in the heart and aorta continue to pose major problems for the majority of candidates. Most were unable to identify both the left atrium and left ventricle correctly or whether the valves were open or closed at the time stated. Explaining that differences in pressure between the ventricle and atrium and ventricle and aorta cause valves to close or open was beyond nearly all candidates.

Question 8 (a)

Most candidates described the life-cycles of *Plasmodium* and *Anopheles* in detail but then gave general statements about how to prevent the transmission of the disease. Statements such as – sleep under mosquito nets, drain swamps, spray oil on the water, with no explanation of why you should carry out these actions were very common.

Question 8 (b)

There was a distinct lack of use of the correct terms seen in the majority of answers. Very few referred to the primary immune response, latent period, booster shots, secondary immune response or even memory cells. Although many candidates referred to the high mutation rate of the influenza virus few could actually explain the impact on the antigens or the memory cells as a result of these mutations.

BIOLOGY/ HUMAN BIOLOGY
General Certificate of Education
January 2014
Advanced Subsidiary/Advanced
HB4

Principal Examiner: Dr C Blake

Question 1

- (a) (i) Well answered but many candidates put an emphasis on the kidneys not being able to reabsorb materials from the proximal convoluted tubule rather than the consequence of a failure in the process of ultrafiltration.
- (ii) Many candidates were able to state that heart disease or the loss of a large volume of blood would lead to a fall in blood pressure and that this would affect ultrafiltration by the kidney but many candidates thought that the kidney cells would die or not work properly if there was a reduced blood supply to the kidneys.
- (b) Very few candidates were able to state that connecting an artery to a vein would cause the vein to expand as a result of the high blood pressure. An appreciation of the difference in structure and function of arteries and veins as taught in unit 2.4 was rarely shown. Candidates should be reminded that there are a small % of synoptic marks in HB4.
- (c) (i) Candidates did appreciate that the dialysis fluid has to be replaced to maintain a concentration gradient but in (ii) very few stated that the dialysis fluid moving in an opposite direction to the flow of blood would maintain a concentration gradient along the length of the haemodialysis tube. Most candidates appreciated that calcium ions could diffuse in either direction depending on the concentration gradient.
- (d) Most candidates appreciated the possibility of rejection and the surgical risks. Marks were lost by mentioning immunosuppressants without stating why the use would be a disadvantage and by making statements such as 'expecting someone to donate a kidney is just not fair or bad news!' Ethical arguments were not clearly stated.
- (e) Very few candidates knew what an endocrine organ was but much imagination was shown in the responses!

Question 2

- (a) The majority of candidates correctly identified molecules A and B, some made the mistake of answering 'thick and thin filaments', others microtubules and some gave A as Actin and B as Myosin.
- (b) Drawings were, in the main, excellent but some candidates drew a sarcomere inside a muscle fibre and others considered that a sarcomere was made up of several repeating units.
- (c) There were excellent responses for the function of calcium ions in the transmission of a nerve impulse across a neuro muscular synapse and in the contraction of the muscle.

Question 3

- (a) (i) Almost all candidates correctly stated rapid population growth as an advantage of using microorganisms in industrial fermentation but stating a second advantage caused difficulty for many candidates. Low cost was often stated but with no qualification as to why the costs would be lower.
- (ii) Batch culture was a term used by the majority of candidates but for (iii) candidates often found difficulty stating three ways by which the risk of contamination of the culture is reduced. There were many references to maintaining the correct pH and to 'cleaning' the fermenter.
- (iv) Two acceptable reasons why it is necessary to reduce contamination were given by many but caused a problem for an appreciable number.
- (v) Candidates appreciated that the circulation of cold water through the outer jacket would keep the fermenter cool but very few stated the importance of reducing the temperature, a reference to denaturing enzymes was rarely seen.
- (b) (i) The ability to describe data represented by a graph is poor. Candidates often stated incorrect, over generalised responses such as 'the *P. notatum* biomass increases and then decreases', 'penicillin production increases from the start' and 'there is no carbohydrate 50 hours after inoculation'. Some candidates incorrectly stated that high penicillin levels were responsible for the increase in *P. notatum* biomass.
- (ii) Acceptable suggestions of the benefit to the fungus producing an antibiotic were often stated.

Question 4

Almost all candidates gave excellent, accurate answers for sections (a), (b) and (c) and all of the marking points on the mark scheme were seen. Many candidates gave valid suggestions as to ways by which chemicals could increase or decrease the activity of the nervous system but some candidates did find it difficult to apply their knowledge of the mode of transmission of the nerve impulse.

Question 5

Most candidates demonstrated an impressive knowledge of all stages of the respiratory cycle, the only common error was to assume that oxygen is used in the link reaction, Krebs cycle and Oxidative phosphorylation and that ATP is produced in the link reaction.

Question 6

An excellent understanding of the causes, symptoms and treatment of patients suffering from a CVA was shown.

Question 7

- (a) Photolysis of water and the light independent stage of photosynthesis, importance of these processes for the continued life of humans.

Sixty percent of candidates attempted this question. They demonstrated a very sound knowledge of photosynthesis, technical terms were used in the correct context, were accurate and a thorough understanding of both the light dependent and independent pathways was shown. The importance of the processes for the continued life of humans was not as good some candidates omitting the production of oxygen and others with no mention of the source of organic molecules / food.

- (b) Role of bacteria in the nitrogen cycle, need for organic nitrogen molecules and how humans can improve the recycling of nitrogen.

An excellent knowledge of the role of bacteria in the nitrogen cycle was shown, the only common omission was a statement of the importance of bacteria in decomposition and the breakdown of organic nitrogen into ammonium compounds. Soil management to improve the recycling of nitrogen was described well. Many candidates duplicated information by drawing diagrams of the nitrogen cycle many of which included beautiful drawings of Friesian cows together with a written description of the cycle. It should be stressed that a fully annotated diagram or a written description is required, there are no bonus marks for both!



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