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Examiners' Report
January 2010

GCE Biology 6BI04

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6BI04 Enhance Examiners' Report January 2010

Maximum mark	90
Mean mark	49.5
Standard deviation	9.8

General Comments

This was the first examination of this unit in the new specification. Although many of the topics are familiar from the previous specifications, there is some new material. In addition to this, centres have been able to choose between a context-led or concept-led approach in order to prepare candidates for the common assessment of the specification. Of course, there has been some precedent for this as the AS units have already been tested.

Most candidates seemed able to make reasonable attempts at questions on all of the topics tested and there was no noticeable area where a widespread lack of knowledge was apparent. However, where questions expected some knowledge from the AS units to be used, a number of candidates seemed to be uncertain of the appropriate terminology. It is important that candidates are aware that they can be expected to select facts, principles and concepts from both AS and A2 specifications at this level. Many of the topics in Unit 4 follow on from those covered in units 1 and 2 at AS. For example, in question 4, a basic understanding of the nature a gene and mutation is used to lead up to the effect that a change in an environmental factor can have on allele frequency. This synoptic concept has also been used in question 7 where knowledge from Unit 2 about the structure of cellulose has been placed in the context of digestion in cattle.

The use of certain command words in questions and the mark allocation should guide candidates towards the type and length of an answer. The terminology used can be found in Appendix 2 of the specification. Many candidates either did not pay close attention to the use of command words or the mark allocations. As a result, many answers included a lot of irrelevant or insignificant detail. Where this occurs, candidates use up valuable time or omit the relevant detail. Describe and compare are two examples where this is most notable.

The ability to write clear and concise answers has always been extremely important in this subject. This is particularly important in answers where the use of pronouns such as 'it' or 'they' could be ambiguous. Where it is fairly clear, examiners will assume that the candidate is referring to the subject of the question. However, where this is not the case, no credit can be given. Questions 3 and 8 illustrate another area where confusion can arise. On these questions it was important that candidates referred clearly to the relevant statements or hospitals in their answer. Where this reference was made, some candidates did not check carefully and used the same letter twice in contradictory answers.

Overall, the examiners were pleased to see some very good answers on all sections of the questions. There were very few extremely poor scripts or sections where no answers had been attempted.

Question 1

Part 1a proved to be a straight-forward section. The most common error was to give 'hydrolysis' rather than 'photolysis' in (ii). In part 1b, a description of the structures was required. Some candidates described or named many structures in the chloroplast without making it clear which were involved in the light-dependent reactions. Details of the reactions were not expected.

(b) Describe the structures in a chloroplast that are involved in the light-dependent reactions of photosynthesis.

(3)

The thylakoid membrane is a series of flattened fluid filled sacs. It is in the membrane that chlorophyl can be found. Proteins known as electron carrier molecules are embedded in the thylakoid membrain make up the electron transfer chain. Electrons move down this by a series of oxidation and reduction reactions after excitation. The thylakoid space is where photolysis takes place, here the enzymes for this reaction are found. The thylakoid space has a high concentration of H^+ ions.

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Examiner Comments

This response scores the maximum mark in the first two lines. The details that follow about the electron transfer chain and the oxidation and reduction reactions are irrelevant.

Question 1b

The calculation in part 1c(i) was straight-forward. The answer was expected to be given to 1 dp as shown by the other figures in the table. Part 1c(ii) expected a comment about the effect on grain yield. Many candidates included irrelevant comments about the differences in biomass or the mass of grain. Most candidates realised that the metal halide lamps had the greatest effect and the low pressure sodium lamps were the least effective. Very few candidates stated that the difference between the lamps was relatively small.

Question 1c(ii)

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Examiner Tip

If you are asked to refer to data, do not try to use data that is not given.

(ii) With reference to the data in the table, suggest the conclusions the investigators may have made about the effect of using different types of lighting on grain yield.

(3)

From the table it is evident that metal halide lamps are the most effetive at producing a higher yeild. It appears that as the light intensity increased, from the use of different lamps, the percentage yeild too increased. This may be because as the light increased it allowed photosynthesis to occur faster, thus producing more energy thus increasing growth.

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Examiner Comments

The candidate has scored 1 mark in the first sentence. The rest of the answer discusses the effect of light intensity. There is no information about this in the question.

Question 1c(ii)

(ii) With reference to the data in the table, suggest the conclusions the investigators may have made about the effect of using different types of lighting on grain yield.

(3)

The type of lighting used does have an effect on the grain yield, however it is not a large difference. The metal halide lamps produced the highest yield of 38.5% The low pressure sodium lamps produced the largest total biomass, but the lowest grain yield of 36.1%

171 key

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Examiner Comments

This can be credited with 3 straight-forward marks.

Part 1c(iii) produced variable answers. Many suggestions were too vague to be given credit.

Question 1c(iii)

(iii) Suggest **two** advantages of growing crops of wheat in glasshouses with artificial lighting rather than growing them in open fields.

(2)

The crops are not likely to be destroyed by any flying insects that cause disease.
1. The crops are also isolated from many environmental factors that could prevent good growth.

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Examiner Comments

Both statements are very vague. The first is not really precise enough to be the idea of easier pest control. The second does not name the environmental factor that could be controlled.

Question 2

In part 2a(i), although most candidates could identify carbon dioxide and methane as greenhouse gases, accurate details about their effect were less evident. Common errors included references to holes in the ozone layer, light being absorbed by carbon dioxide, infra-red radiation bouncing back and forth underneath a blanket of carbon dioxide. Vague references to the increase in the mean temperature of the Earth's surface were also common.

Question 2a(i)

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Examiner Tip

tip: Do not confuse the environmental effects of different pollutants.

(a) (i) Explain how increases in carbon dioxide and methane, released into the atmosphere, may be contributing towards the estimated changes in mean temperature shown in the graph.

(3)

Carbon dioxide and methane are green house gases which effect the O-zone layer. When these gases are given off they are absorbed by the troposphere, which reduces the amount of heat given off by the Earth, and more heat is absorbed by the atmosphere. The gases also contribute to acid rain which wears away rocks & releases other gases which effect the atmosphere.

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Examiner Comments

A very confused answer which attempts to comment on three different environmental problems. The confusion with the effect on ozone in the first sentence negates the reference to greenhouse gases.

In part 2a(ii), relatively few candidates commented on the estimates being given to allow for continued production at present levels or at reduced levels.

Parts 2b(i) and 2b(ii) were answered reasonably well by most candidates.

Question 3

Part 3a was answered well by most candidates. Part 3b(i) was usually correct although some candidates confused quadrat with quadrant. In part 3b(ii), many candidates missed the point that the question requires methods to obtain mean density in each area. Inappropriate descriptions of line transects and estimates of percentage cover were common.

Question 3b(ii)

*(ii) Explain how this piece of apparatus would be used to obtain the mean density of the two species of periwinkle in each area.

(3)

By setting up a transect along the slope ~~about~~ of at least 10 m, using 1 or 2 metre increments the quadrat can be placed on the section of slope. By measuring percentage cover or in this case abundance, this systematic sampling method will show distribution of the two species.

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Examiner Comments

The candidate has misunderstood what is being measured. Although a line transect would give some data for distribution, the question requires mean density at each area – in this case height above sea level.

Question 3b(ii)

*(ii) Explain how this piece of apparatus would be used to obtain the mean density of the two species of periwinkle in each area.

(3)

The quadrat would be randomly thrown into an area thus preventing bias with no systematic approach to its position. The investigator would then count how many periwinkle were present in each quadrat and take the mean number to find the density. The mean can only be taken if there are atleast three samples or quadrats. This is to be repeated for both species, and it is important to take precaution whilst throwing the quadrat.

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Examiner Comments

Throwing a quadrat does not allow Mp3 to be given for a process to give random positions. However, the references to 'random', 'counting periwinkles' and 'three samples' can be credited for 3 marks.

In part 3b(iii), specific examples of factors should be given at this level. Vague references to 'amount of light' 'pollution' 'competition' were common errors. In part 3b(iv), most candidates chose the most suitable statement. However, in part 3b(v), the answers were very variable. It was expected that, candidates would refer to the statements with relevant comment.

Question 3b(v)

(v) With reference to the data in the graph, discuss the validity of statements **A**, **B** and **C**.

(4)

Statement A is incorrect – it is over assumptuos, the investigation did not study other species of periwinkles and so it cannot be assumed that all periwinkles are affected. The distribution of both species of periwinkle change with increasing height above sea level – L. littorea generally increased while L. obtusata decreased and so statement C cannot be correct. There may be other factors that affect distribution of the species, again discrediting A but makes B statement B correct in that there is an influencial link that may be brought about by other factors.

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Examiner Comments

The candidate has made clear comments about statements A and C. The only comment linked to statement B is in the last line and it is too vague. Information used as part of their answer for statement C could have gained credit if it had been used to support statement B. This answer gains 2 marks overall.

Question 4

Part 4a(i) proved to be a straight-forward section. In part 4a(ii), most candidates named the ribosome. However, relatively few could give a descriptive feature. There were many irrelevant descriptions of translation.

Question 4a(ii)

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Examiner Tip

Read the question. This question asks for a description of the structures (ribosomes) not for a description of the process.

(ii) Name and describe the structures where the polypeptide chain of this enzyme would be synthesised.

(2)

The polypeptide chain of the enzyme would be synthesised at the ribosomes. tRNA ~~would~~ brings the amino acids that correspond to the codons the strand of RNA complementary to this strand of DNA. These amino acids then form peptide bonds between them, creating a polypeptide chain.

In part 4b(i), most candidates referred to either to changes in DNA or the sequence of bases. Some gained both marks. However, a number of candidates referred to unspecified changes in a gene or allele. Other errors included references to changes in RNA or during translation. In part 4b(ii), candidates who realised that the individuals with the mutation could be at an advantage as the light levels fall, tended to score high marks. Some candidates suggested that the Chlamydomonas would produce the mutation intentionally.

Question 5

Parts 5a(i) and 5a(ii) were usually answered correctly. In part 5a(iii), almost all of the candidates identified S3. The explanations were extremely variable. Many candidates made vague references to S3 being similar to the sample rather than an exact match. Although reference to the assumed unique nature of a profile was usually given, full credit was only gained by explaining this. Detailed accounts of the procedure used to produce the profile were common.

Question 5a(iii)

(iii) Suggest which of the suspects is most likely to have left the blood sample on the broken window pane. With reference to the theory used in DNA profiling, explain how you came to this conclusion.

(5)

Suspect S3

Explanation S3 has the fragments that match completely with the sample taken from the window. ~~In~~ DNA Genes in DNA have exons and introns. Introns (the non-coding regions) are inherited in the same way as exons. They contain short repeated sequences (STRs). The number of times STRs are repeated on each individual varies (may between individuals). In DNA profiles, these STRs are cut away from the genome then separated and presented on a nylon membrane. The fragments of different lengths are then presented on a profile. The combination of lengths of these fragments is unique to each person, just like a DNA sequence. S3 has completely matching lengths of fragments, therefore it can only be S3.

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Examiner Comments

A full and detailed account for full credit.

Most candidates were able to gain at least one of the marks in part 5b by reference to identical twins. Part 5c was straight-forward with most candidates gaining full credit.

Question 6

In part 6a, although most candidates stated that HIV would have RNA and the bacterium would have DNA, other differences were not so clear. It was common to describe the genetic material in the bacterium without any corresponding comparison with HIV. The term 'strand' was used very loosely by many candidates.

Question 6a

(a) State how the genetic material in HIV differs from the genetic material in the bacterium *Mycobacterium tuberculosis* that causes TB.

(2)

The genetic material in HIV is made of two RNA strands while that in M.tuberculosis is in a plasmid or a DNA bundle.

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Examiner Comments

The distinction of RNA in the virus and DNA in the bacterium is clear. However, it is not clear that HIV has linear strands while the bacterium has circular material. The reference to plasmids for bacterium needs to be contrasted with the absence of these in HIV.

In part 6b, most candidates gave general answers which included features that are only appropriate if dealing with bacterial infections rather than HIV.

Question 6b

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Examiner Tip

Read the question carefully. The answer given here is not relevant for a virus such as HIV.

(b) One of the ways in which HIV may enter the blood is through the use of infected needles. Explain why unbroken skin is an effective barrier against HIV infection.

(2)

Microorganisms can't get through skin unless it is wounded. Skin also has enzymes like lysozyme on it that break down bacterial cell walls, sebum and its own microorganisms that will out compete pathogens.

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Examiner Comments

The first sentence does not really say any more than the stem of the question. A reason needs to be given. The points about lysozyme and competition apply to bacteria rather than HIV.

Almost all candidates stated that the number of lymphocytes fell in part 6c(i). Relatively few of these then manipulated the data to give some idea of the rate of fall at different times or the overall difference.

Question 6c(i)

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Examiner Tip

Use the data for the time period stated by the question. Calculate the difference rather than give a near answer such as 'almost a half'.

(i) Describe the change in numbers of CD4 T-lymphocytes during the first 6 weeks after infection with HIV.

(2)

CD4 T-lymphocytes greatly decrease in numbers, to almost a half after ~~10~~ 7 weeks. Then they start increasing again from 500 to 600 after 10 weeks

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Examiner Comments

The answer refers to after 7 weeks which is beyond the time period specified in the question. The attempt to quantify is not specific. The actual decrease needs to be calculated for the required time period.

The answers to part 6c(ii) tended to be clear, detailed accounts which gained high marks or they were very vague accounts indicating little knowledge of HIV infection. Acceptable suggestions were given in part 6c(iii) by many candidates.

Question 6c(ii)

***(ii) Explain the change in numbers of CD4 T-lymphocytes during the first 6 weeks after infection with HIV.**

(5)

HIV has an enveloped structure. This means it has a lipid bilayer partly taken from the host cell membrane. It also has glycoproteins on its surface called GP 120 which are complementary to the T-lymphocyte CD4 receptor. The GP120 glycoprotein binds with the CD4 receptor on T-lymphocytes. Then the envelope of on the HIV ~~virus~~ virus fuses with the lymphocytes membrane. The contents of HIV virus enter the lymphocyte. HIV has an enzyme reverse transcriptase which makes DNA from RNA and is incorporated into the the host genome by the enzyme integrase. As the HIV virus multiplies they bud out of the lymphocyte causes lysis of the lymphocyte and kill the cell. They then infect more lymphocytes.

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Examiner Comments

A very good answer making almost all of the mark points.

Question 6c(ii)

*(ii) Explain the change in numbers of CD4 T-lymphocytes during the first 6 weeks after infection with HIV.

(5)

As the HIV virus multiplies, it begins to kill the CD4 - T - lymphocyte cells. When it gets to 2 weeks ~~there~~ there must be a great number of HIV infected cells because the CD4 - T - lymphocyte count drops by the most it does in the 6 weeks. By the end of the 6 week period, the dropping in number of CD4 - T - lymphocytes has slowed down to only 10 less between 5 and 6 weeks, suggesting the infected person may be being treated.

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Examiner Comments

A poor answer with no relevant detail of explanation.

Question 7

Parts 7a(i) and 7a(ii) proved to be more difficult than expected. The most likely explanation is that many candidates were unable to transfer AS knowledge into the context of this question. In part 7b, a simple description of the breakdown of organic material by micro-organisms was expected. Most candidates referred to the involvement of micro-organisms but details were often vague.

Question 7b

(b) The first stage in the decomposition of a cow pat is known as putrefaction. Explain how carbon dioxide and ammonia are formed during this stage of decomposition.

(4)

The fats (hydrocarbon chains) and oxygen and other carbon containing compounds would break down to form the CO_2 and the amino acids containing the nitrogen would form the ammonia, when combining with hydrogen ~~the~~ from the hydrocarbons and elsewhere.

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Examiner Comments

A good answer for the sources of carbon dioxide and ammonia but the role of micro-organisms has not been given.

On part 7c, most candidates were able to gain at least two marks for a reference to the change in temperature and its effect on the rate of enzyme or metabolic reactions.

Question 8

Part 8a proved to be straightforward and was answered well by most candidates. In part 8b, a simple comparison of the main trends shown in the two hospitals was expected. Many candidates tried to describe each line separately, quoting data at each time period.

Question 8b

Compare the rates of MRSA infection in hospital A with those in hospital B.

(3)

Hospital A and B started with roughly the same rate of MRSA infection. A had a decrease in the rate of MRSA with a slight recent increase and Hospital B had an increase in the rate of MRSA with a recent decrease. They both have roughly the same rate again.

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A clear, concise comparison which can be awarded 2 marks. A third mark could have been awarded if the candidate had referred to the relatively small difference at the start using figures from the graph.

Most candidates were able to give acceptable answers to parts 8c(i) and 8c(ii).

APPENDIX A

Unit Grade Boundaries And Uniform Marks

The raw mark obtained in each module is converted into a standardised mark on a uniform mark scale, and the uniform marks are then aggregated into a total for the subject. Details of the method of aggregation are given in Appendix B.

For AS examinations, the two examined unit tests (6BI01 & 6BI02) each have a weighting of 40% with a maximum of 120 uniform marks; and the coursework unit* (Unit 6BI03) has a weighting of 20% with a maximum of 60 uniform marks.

For the A2 units, the two examined unit tests (6BI04 & 6BI05) also each have a weighting of 40% with a maximum of 120 uniform marks; and the coursework unit* (Unit 6BI06) has a weighting of 20% with a maximum of 60 uniform marks.

Therefore, for candidates taking the full A level, the four examined unit tests (6BI01, 6BI02, 6BI04, 6BI05) each have a weighting of 20% with a maximum of 120 uniform marks; and the two coursework units* (Unit 6BI03 & 6BI06) have a weighting of 10% with a maximum of 60 uniform marks.

The table below shows the boundaries at which raw marks were converted into uniform marks in this examination. The A and E grade boundaries are determined by inspection of the quality of the candidates' work. The other grade boundaries are determined by dividing the range of marks between A and E. Marks within each grade are scaled appropriately within the equivalent range of uniform marks.

Unit	Max. Mark	A	B	C	D	E
	Uniform marks 120	96	84	72	60	48
6BI01 (Unit 1)	*Raw marks* 80	57	52	47	43	39
6BI02 (Unit 2)	80	57	52	48	44	40
6BI04 (Unit 4)	90	59	55	51	47	44

Unit	Max. Mark	A	B	C	D	E
	Uniform marks 60	48	42	36	30	24
6BI07 (International)	*Raw marks* 40	29	25	21	18	15

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