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Principal Examiner Feedback

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Pearson Edexcel International Advanced Level
In Biology (WBI04) The Natural Environment and
Species Survival

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Introduction:

This paper saw a wide range of responses with many candidates demonstrating a good knowledge and understanding of the topics tested. We were pleased to see fewer blank responses than we saw in this paper last year.

Question 1

The two multiple choice questions were answered well.

In (b)(i) most candidates gained mp1 for an understanding of the effect of high temperatures on microorganisms. A good number gained mp2 as well, usually for stating the resulting lack of enzyme activity or lack of substrate-enzyme complexes formation, or substrate binding to the active site. Very few responses referred to enzymes not being released. Few managed to score mp3 for breaking the bonds between organic molecules, with many just vaguely referring to 'breakdown'.

Not as many candidates (compared to the past) lost mp1 by referring to "begin to denature", although a few continue to make this mistake.

In (b)(ii) a fair number misunderstood what the question was asking here by concentrating on the idea of sealed packaging preventing the entry of microorganisms. Others suggested that the vacuum packing would remove microorganisms as well as air. Although many seemed to gain mp1 and or mp2, marks were often lost for not mentioning *oxygen* specifically or for not referring to *aerobic* respiration, simply saying that no respiration occurred. A small number of the better responses stated that only anaerobic respiration would occur. Very few responses referred to the lack of energy for chemical reactions or microorganism growth for mp3.

In (b)(iii) the concept of acidity seemed well understood, although there were some careless statements made about vinegar having a high pH. It was quite common for candidates to state that acid kills bacteria without any consideration of the effect on enzymes. However, there were not many problems here and many were able to score on mp1 or mp2 although there were only a very small number who referred to the ionisation of R groups or bond changes within the active site, thus missing out on mp3.

Part (b)(iv) was the least understood of the four sets of questions here. There were a few blank scripts, suggesting that candidates had not recognised that the question was testing them on osmosis. Candidates generally scored on mp1 and mp2 and there were some really good descriptions of water potential gradients, but also some that were incorrect. Candidates should be discouraged from talking about the concentration of water. Nevertheless, there were a number of responses that referred to salt as being either acidic or alkaline, with subsequent descriptions going down the pH / enzyme route. Mp1 was quite often lost for stating that water was drawn out of the food rather than the microorganism. The better responses would score on mp1, but less often would this be qualified by a reference to *osmosis*. There were a very few who gained mp3, but when it was gained, it was usually for a reference to microorganisms shrinking and dying as a result. There were hardly any references to dehydration or to enzymes not having a solvent.

Question 2

Many correct responses were seen for the two multiple choice questions.

Responses to (b)(i) were disappointing as many candidates found it difficult to use the information provided to formulate a clear response, perhaps through not having experience of actually measuring (or discussing how to measure) the rate of photosynthesis accurately, rather than just using the oxygen bubble method. The area of leaf (or leaves) was the most common point scored, although a number referred to measuring the land area or the area of the whole plant, or simply an area. A smaller number managed to use the information to refer to concentration (or moles) of a named substrate or product, whilst very few coped with the idea of timing the experiment, with few references to a unit time, dividing by the time taken to obtain the rate.

Responses to (b)(ii) indicated that this topic was well understood in general, with a majority of candidates readily able to score 2 marks from various combinations of the 3 marking points.

In some cases, marks were lost for not referring to active transport as the method for uptake at the roots, reference to nitrogen rather than nitrates, or reference to phloem rather than xylem. A small number of responses referred to nitrogen entering through the stomata in the leaves.

Question (b)(iii) directed candidates to think about RUBISCO. Those who diverted from this to discuss ATP, DNA or NADP, found it very hard to score points. A sizeable number managed to give the role of nitrogen and then give the whole logical sequence; some got most of the way but failed to give detail of RUBISCO's role.

Question 3

Part (a)(i) was well answered by the majority. The most common errors were references to mutation in sharks or failing to say that the bacteria were taken up.

There were many straightforward responses for (a)(ii), but also some muddled responses with references to antibodies rather than antibiotics. Generally, mp1 (eating sharks) and mp4 (causing disease which antibiotics cannot treat) were most often seen, with mp2 rarely seen (due to lack of reference to the human population) and mp3 even less often seen.

Part (b) was well answered by the majority of candidates who clearly distinguished between two antibiotic types. The main error was in describing one antibiotic effect but not the other, or getting them the wrong way round. Occasionally, some candidates incorrectly deduced from the name *bacteriostatic*, that the sulphamethoxazole stopped bacteria moving.

In (c)(i) candidates scored mp3, usually expressed in terms of incorrect translation or incorrect sequence of amino acids lining up. A more detailed description was needed for mp2, which was rarely offered and commonly, lack of reference to the term *codon* meant they failed to capture this mark.

The two multiple choices in this question did not cause too many problems.

In (c)(iii) candidates most commonly scored mp1 for recognising the difference in human and bacterial ribosomes. A good number of candidates failed to score a second mark despite there being 3 other marking points available. However, some responses just referred to 80S in humans, without reference to bacterial ribosomes. There were less references to the difference in enzymes (mp2) or human cells having enzymes that break down these antibiotics (mp4). Very few gained mp3 as they did not reference the fact that the antibiotics *cannot enter* human cells, merely referring to attachment or binding instead.

There were a fair number of blank responses for part (d) but there were others where the candidates had made a really good attempt at their answer. Responses took the route through mp3 and mp4 more often than through mp1 and mp2, to get to either mp5 or mp6. Most often, mp3 and mp4 were scored, with mp5 and less often mp6. A few candidates suggested that PABA and sulfamethoxazole could bind, but then lost mp3 as they gave incorrect bonding, such as ester bonds. Also mp6 was sometimes not gained due to failing to refer to the substrate/dihydropteroic acid.

Question 4

A sizeable majority of candidates were able to claim both marks for this calculation, with a good number scoring one mark, usually for the ecf for dividing by 2,500,000 to get 56%.

The responses to part (b) were disappointing, even by the more able students. The main problem here was candidates trying to deduce population numbers from a map which provided no such data, but only distribution data. Responses starting from this point usually failed to score anything, although some were able to score a mark for a recognition that the grey squirrel population overall had an increase in distribution. However, there were a few clear and well organised responses clearly referring to distribution, which scored very well indeed, capturing all three marks.

Part (c)(i) was very well answered in general with the vast majority of candidates gaining both marks, most commonly for mp1 and mp2, with mp3 and mp4 occurring rarely in responses.

In part (c)(ii) some aspects of the immune response in the grey squirrel were described, such as antibodies binding to the virus or viral antigens (mp1), phagocytosis (mp2) and sometimes, although less often, preventing binding of the virus to the host cell (mp4). It was also generally recognised that in the red squirrel the immune system was weaker (mp5) and that the virus would be able to infect/destroy the host cells (mp7). However, responses generally failed to provide specific details of plasma cells producing antibodies (mp6) or that there were no killer cells (mp8). Careless errors sometimes cost marks, such as confusing antibiotics with antibodies, reference to plasma rather than to plasma cells, stating that antibodies were made by B cells rather than by plasma cells, or that squirrels were resistant to the virus. Poor expression, such as saying that antibodies *fight / attack / kill* viruses, also cost marks in a number of cases.

Question 5

Part (a) was reasonably well answered by a large number of candidates. Many candidates knew a good deal of detail about gel electrophoresis and many also about PCR. However, relating this knowledge to the tigers was a problem for a good number of candidates and many failed to say that they needed samples from all 3 tigers, thus limiting access to mp2 and mp7. Often there was just a generic description of comparison of bands. This lack of detail limited marks in a good number of cases. The source of the DNA sample, when given, was not always covered by a reference to both parents, which often meant that mp1 was not captured. This detail is needed to actually answer the question asked. Many candidates also stated that the DNA was amplified with no reference to the PCR, thus failing to gain mp2. The role of restriction endonucleases was generally well known as were the details of PCR for mp3 and mp4. Details were often given for the process of gel electrophoresis thus gaining mp6, but in a few cases they failed to refer to the name of the process which lost them an easy mp5.

There were few instances of mp1 being awarded in (b)(i) as candidates generally failed to mention temperature being measured on *discovery* of the body. The vast majority of candidates scored mp2 for the drop in body temperature after death. The better responses referred to body temperature being dependent on ambient temperature, but many simply said that it dropped to ambient temperature, failing to gain mp3. There were a few who recognised the importance of wounds or body position on the temperature drop, but some referred to clothing, having not read carefully the information given in the question. Surprisingly, only a small number of candidates referred to cooling curves or working backwards to estimate the time of death.

Part (b)(ii) was well answered and scored well generally, with all three aspects of the marking scheme considered overall. However, rigor mortis or entomology seemed to be the most favoured responses. The majority of candidates were able to pick up at least 2 marks, but there were a reasonable number of responses with all 3 marks. For rigor, mp1 and mp2 were most often seen. For decomposition, mp5 was most often seen accompanied by either mp6 or mp8. For entomology, mp9 was most often seen, accompanied by mp10 and less often by mp12. However, there were very few references to the significance of ambient temperature.

Question 6

For part (a) candidates tended to gain the marks from mp1 and to a lesser extent from mp2, with a good number gaining both marks and many gaining at least 1 mark. There were extremely few, if any, references to mp3. Mp1 was sometimes lost by not identifying the *coronary* artery or an artery leading to the heart muscle, rather than an artery leading to the heart, which may not be the coronary artery. Weaker responses tended to be vague, referring only to arteries in general, or even blood vessels or capillaries. Similarly, some candidates were not able to access mp2 as they did not refer to a lack of oxygen as the reason for the heart tissue dying.

Part (b) appears on the surface to be relatively easy for A Level candidates and the better responses were able to score 2 marks or at least 1 mark. However, it

was surprising to see the number of candidates who did not gain mp1 because they described oxygen/air entering the body, with no reference to the lungs or because they referred to the lungs but did not mention air/oxygen entering or being inhaled. Few referred to the lower concentration gradient (mp2) and often mp3 could not be awarded as, although reference was made to reduced diffusion, they failed to mention that it was into the blood.

Most candidates were able to score 3 to 4 marks in (c), with the better responses achieving 5 or 6 marks, which was pleasing. Many answers included mp1 and mp2, but generally this was mostly for references to the weakened immune system and the destruction of infected T helper cells by T killer cells. Some candidates wrote at length about the details of HIV within T helper cells, but often didn't extend this detail to explaining why the individual would thus be susceptible to TB. Descriptions of macrophages often extended to details of forming APC's without saying that TB was resistant to macrophages or that presentation to T helper cells would be impaired. Candidates typically achieved mp4 by referring to T helper cells not being activated. A good number of candidates considered the lack of antibodies but did not refer to their role in opsonisation or agglutination. Common errors were that antibodies killed TB or were made by B cells. Often candidates used a poor choice of words or phrases, such as the "*virus affects*" or phrases like "*fights bacteria*" or "*fights disease*". Very few responses referred to perforins or enzymes destroying virus-infected cells, which was unusual as we have seen this frequently in responses in the past. Many responses stated that TB is an opportunistic infection and a reasonable minority were able to describe how TB results in death, e.g. lung damage, organ failure etc. The most readily accessible points appeared to be mp1, mp2, mp4, mp5, mp8 and mp9.

Question 7

The multiple choice saw a range of responses and was probably the least correctly-answered of the multiple choice questions on this paper.

Part (a)(ii) did not cause too many problems.

The calculation in (b)(i) was not too much of a problem to the majority of candidates.

Descriptions of the investigation in (b)(ii) were disappointing as not many candidates had read the question carefully enough and if candidates did not spot what was being asked, it cost them marks.

Weaker responses described generating random coordinates, setting up X – Y axes on the ground and the use of quadrats to count species; these responses were able to score 1 or 2 marks, usually mp1 or mp3. Stronger responses would typically gain mp1, mp3 and mp4. Sometimes they would also have mp2. Extremely few scripts scored on mp5 or 6. Candidates were required to apply their knowledge to a new situation here and full marks would not be achieved without taking the situation into account. Considering that this topic should be familiar enough to make an attempt at an answer, there were a fair number of blank responses. The main mistakes included counting the Binara plants rather than measuring their heights, sampling only up to 2000m and not above and suggesting random sampling rather than systematic sampling. Some candidates

suggested an experimental approach rather than using a transect in fieldwork. Marks could be awarded for such an approach, but many candidates did not think this through properly.

Part (b)(iii) A noticeable number of candidates did not appear to know what an edaphic factor was and left this question blank. For those who did know what an edaphic factor was, this proved to be a straightforward question, with the full range of factors in the scheme covered by the range of candidate responses. Many candidates scored at least two marks with a sizeable number scoring 3 marks.

Question 8

In part (a) careful study of the graph was necessary as well as a logical approach to describe the changes for each component, individually and in turn. Common errors were to describe GPP as levelling off, to describe R increasing linearly and to describe GPP as decreasing at the end, rather than a decrease in the increase or increasing more slowly. Some candidates complicated their responses by making comparisons between each of GPP, R and NPP, which was not asked for.

In (b)(i) a number of the candidates did not seem to appreciate the difference between the command words *describe* and *explain*, thus they merely described respiration increasing, which had been credited in part (a). For those who attempted explanations, the very best responses scored both marks, but often either mp1 or mp2 alone were scored. The weaker responses failed to refer to ATP/energy, thus failing to gain either marking point. A sizeable number failed to offer the idea that energy was required, suggesting in fact that energy was needed for photosynthesis, which was a bit worrying.

The same issue occurred in (b)(ii) with more descriptions. Many responses commented on an increased number of leaves (mp1) and in a few cases there were references to more chlorophyll or chloroplasts to absorb light. However, there were few references to either the light-dependent reactions or the light-independent reactions of photosynthesis. Only a tiny minority were able to claim mp3 or mp4 since so many responses lacked appropriate A level detail. There was more success with mp5 but often responses failed to refer to what was made and what it was made from.

Part (b)(iii) also saw more descriptions. There were a number of blank responses and this may be due to lack of understanding or knowledge but may also be due to this being the last question on the paper. Candidates commonly scored mp1 for the correct formula. Sometimes this mark was not achieved when candidates tried to provide this in a poor description.

The comparison of the increases in GPP and R was often made also to gain mp2, but in some cases this was not clear enough. There was generally less success with mp3 and mp4, simply because candidates did not refer to '*larger*' or '*more*' energy needed. A very small number of responses referred to top leaves shading lower leaves (mp6) but it was extremely rare to see mp5. There were quite a number of responses describing photosynthesis or energy transfers between trophic levels.

Summary

The main reasons for marks being lost on this paper were a lack of appreciation of the command word used, not giving an answer that included the context of the question, a lack of specific A level detail and not using the mark allocation for the question to judge what should be written.

Looking forward to the new specification, these issues need to be addressed by centres. The questions are going to be much more context-based to enable the candidates to apply their knowledge and not simply regurgitate chunks of learnt information. The command word 'explain' will be used more, expecting candidates to use their knowledge to say **why** something has happened. Mark schemes will be tighter so that candidates will only be rewarded for actually answering the question and not for writing down everything that they know about a topic.

