Version : 1.0

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Human Biology 1406

HBIO2 Humans – their origins and adaptations

Report on the Examination

2010 examination - June series

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Set and published by the Assessment and Qualifications Alliance.

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General Comments

As in previous examinations for this Unit, the standard of work produced by most candidates was generally pleasing. Most had prepared themselves well, with very few not having a good grasp of the basic facts and concepts of this Unit. Candidates made better use of information supplied in stimulus material in their answers than in the previous examination.

Some candidates failed to score marks through a lack of precision when describing results presented in tables and graphs in the paper. The phrase 'growth of the tumours shows a positive correlation' does not tell us anything. What is the correlation with? Candidates should be discouraged from using this form of words to describe a trend unless there is likely to be a causal link between the two variables.

The approach to 'How Science Works' questions was, again, generally pleasing with many candidates able to appreciate potential limitations of data. However, a good number failed to differentiate between reliability of results and validity of conclusions and offered a 'one size fits all' commentary on both.

As ever, some candidates did not read the questions carefully enough and reacted to key words, without appreciating the context and requirement of the question. Candidates would be well advised to spend some time at the start of the examination reading all the questions.

Question 1

Both parts of the question were generally well answered and a good number of candidates scored full marks. However, in (a), a minority of candidates either suggested bases, such as Adenine and Thymine, or were not precise enough when suggesting 'sugar' as a component. The majority knew that **X** was the sugar-phosphate backbone and suggested phosphate and pentose (5-carbon) sugar. Some suggested ribose as the pentose sugar, which could not be credited.

Part (b) proved to be a good discriminator. Most candidates stated that the process was known as semi-conservative replication and correctly described complementary base pairing. However, although many mentioned the breaking of hydrogen bonds in the initial separation of the two strands (which was not required), they failed to mention that they were formed as the newly synthesised strand binds to the template strand. Also, the role of DNA polymerase was not well understood by a good number.

Question 2

Again, this question was answered well by the majority of candidates. In (a) (i), nearly all were able to sequence the stages of mitosis correctly, although in (a) (ii) not as many were able to give two valid differences between the cells formed by mitosis and meiosis. It proved to be the first instance of not reading the question carefully enough and responding to key words, as a number of candidates quoted the difference in the number of cell divisions.

In (b), the process of non-disjunction was understood by many and the term itself was often used in a correct context. However, candidates must not write ambiguous answers. The question asks specifically how an error in meiosis can lead to a child being born with Down's syndrome. So, whilst stating that the two chromosomes of pair 21 do not separate properly scores a mark, going on to say that this leads to one cell with no chromosome 21 and one with

two, takes us no further, unless the candidate identifies which is likely to be involved in causing Down's syndrome.

Question 3

All through this question candidates failed to score because of loosely phrased answers. Part (a) asks some straightforward questions about parasites in general and about *Toxocara* specifically. Examiners found it difficult to credit answers that were clearly showing some of the right thinking, but were just too vaguely expressed. 'Living off' a host cannot be taken to mean 'live on' or 'live in', although it was assumed that it might mean 'feed from'. In (a) (ii), *Toxocara* has hooks (not suckers) a thick cuticle (not a capsule) and produces anti-enzymes. Candidates need to use precise language. Also, the response 'producing large numbers of eggs' is not a specific adaptation to survival in the intestines of a human.

In (b), again, there were responses that showed the right kind of thinking, but were too loosely phrased to be credited. The eggs of *Toxocara* are not *excreted* by the dogs and children will not pick up eggs from contaminated *soil* in living areas. Treating dogs regularly doesn't prevent the *worms* from being passed out with faeces; it ensures that the life cycle is broken by preventing *eggs* from being passed out.

Question 4

In (a), nearly all candidates were able to describe two differences between the structure of DNA and RNA. The answers to (b) and (c) were polarised; either candidates knew the relevant material and scored well, or they produced very weak answers. In (b), weaker candidates used amino acids and nitrogenous bases, and gene and triplet completely interchangeably. Very few mentioned the base sequence on DNA being copied to (messenger) RNA. In (c), many candidates did not specify that homologous chromosomes form a pair and, of those who did, too many just wrote 'they are identical' with no mention of genes and positioning (loci).

Question 5

In (a), nearly everyone knew ATP was the energy source, although a few did suggest glucose and one or two, rather disappointingly, suggested oxygen. In (b) (i), a surprising number of candidates were unaware of what is meant by a ratio and gave an answer based on percentage. Although some tolerance was allowed in reading the figures from the graph, too many were simply not careful enough in carrying out this task. Part (b) (ii) was a good discriminator. A good number noticed that fat usage was greatest at low intensity exercise and also after longer durations, but failed to put the two together to suggest low intensity, long-lasting exercise.

Question 6

This was generally a question on which candidates scored well; they knew the consequences of the change in lifestyle from hunter-gatherer to farmer (such as increased food production, population growth, trade) and could describe how farmers would have selectively bred docile Aurochs for many generations to produce the docile cattle of today.

Some however saw the change in lifestyle in (a) as a negative step and suggested over-dependence on the weather, starvation due to crop failure and other similar ideas. Part (a) was a good discriminator. In (b), despite being specifically asked about producing docile cattle, some described how cattle with high milk yield or high meat content would be produced.

Although some marks were still possible, candidates can only hope to score full marks if they answer the question that is asked.

Question 7

About two thirds of the candidates knew that the three species of humans were named *Homo* because they were in the same genus (or because they all had a recent common ancestor). Question (a) (ii) specifically asks for physical differences, so answers relating to tool usage were clearly inappropriate. About half the candidates identified *Homo erectus* as being taller than *Homo habilis* and also as having a larger brain. Others suggested other valid physical differences.

In (b) (i), some candidates confused the actual number of base differences with the frequency of occurrence of that number of base differences. Those who read the graph correctly scored one mark for explaining that there are fewer base differences between modern humans and Neanderthals than there are base differences between modern humans and chimpanzees. Better candidates scored the second mark by citing actual numbers of base differences.

In (b) (ii), candidates' expression was, again, often poor. One of the reasons often suggested why the results may not be reliable was because there were *different* sample sizes for the three species. This is largely irrelevant; the problem is the tiny sample size for Neanderthals and chimpanzees. The fact that only one gene was studied does not make the *results unreliable*. However, it may call into question the *validity* of any *conclusions* drawn from those results.

Question 8

In (a) (i), good candidates recognised that having a variable level of immunity in the experimental mice would introduce a confounding variable into the investigation. They also saw that it might well result in tumour growth being inhibited in some mice.

Most candidates scored quite well in (a) (ii), although a few failed to score because they wrote about *numbers* of tumours, rather than *volume* of tumours. As mentioned earlier, some candidates made this question more difficult than it need have been by trying to explain the results in terms of a changing positive correlation.

In 8 (b), most candidates recognised that mice and humans are different species and the response in one need not be the same as the response in the other. Better candidates also recognised the small sample size and the short duration of the investigation as limitations and were able to explain why these might invalidate the conclusions drawn.

Question 9

Many of the answers to 9 (a) were too vague to be creditworthy. An opposable thumb does more than allow humans to 'grasp' an object or 'hold' a spear. Candidates needed either to state the power and/or precision of grip as the benefit, or to describe them accurately.

In 9 (b) (i), many candidates recognised either that using a specific mass would make the results more comparable, *or* that it would take account of individual variations in mass, but few put both ideas together. Many candidates were able to describe the decreasing oxygen intake with increasing age for bipedalism and the opposite for quadrupedalism. The responses to 9 (b) (iii) were generally quite pleasing as it is not necessarily an easy concept. Many came up with the idea that means can hide patterns in the results and were able to use examples from the

data supplied to support their argument and score the second mark. The 'mathematicians' also knew that a mean is easily distorted by outliers.

9(b)(iv) was another example of a question where candidates failed to score because of imprecise expression. Good candidates explained the link between energy use and oxygen intake and then went on to explain the relative energy efficiencies of bipedalism and quadrupedalism. Weaker candidates often wrote about one being 'easier' without making any link between the oxygen consumption (given in the data) and energy expenditure.

Question 10

In 10 (a), many candidates linked the low partial pressure of oxygen in the air to less oxygen reaching the muscles and either the onset of anaerobic respiration, or the accumulation of lactate. The best candidates included both and often went on to explain that high levels of lactate cause muscle fatigue. In (b) (i), disappointingly few candidates described a population as *all* the individuals of a species (or example of a species) in a particular place.

The answers to (b) (ii) were particularly pleasing with many candidates scoring five or six marks. Almost all candidates appreciated the ideas of inherent variability in a population, with one phenotype having a selective advantage leading to differential reproduction rates. Many also realised that advantageous alleles would be passed on and good candidates also realised that this would be repeated over many generations, increasing the allele frequency and the resultant phenotype frequency in population. This question was a good discriminator and the best answers really were a delight to read.

The responses to 10 (c) revealed, once again, some candidates not taking note of all the information they were given. The passage specifically states (and the question re-states) that the nitric oxide is in the lungs. It is here that the major effect of widening arteries takes place, allowing more blood flow *through the lungs* and, consequently, increased oxygenation of the blood. Only the very best candidates realised this.

In 10 (d), the candidates who had read the passage carefully knew that both an increased red blood cell count and elevated levels of nitric oxide in the lungs were precluded from the answer. These candidates generally made sensible suggestions as to possible adaptations, such as larger lungs or bigger/stronger heart and were able to explain how these adaptations would allow members of the Ethiopian population in question to increase their oxygen uptake at high altitudes.

This question was a good discriminator. The responses of weaker candidates merely suggested that the athletes somehow got used to managing with less oxygen during altitude training and then 'found it easy' when they returned to sea level. The majority of the candidates were able to suggest a physiological adaptation taking place at altitude, such as an increased red blood cell count or an increased concentration of haemoglobin in the red blood cells. They often went on to explain that this would result in increased oxygen carriage, allowing aerobic respiration to continue for longer and preventing the build up of lactate. What many failed to do was to make clear that these benefits continued after the return to sea level, resulting in an improved performance in their event.