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Examiners' Report

Summer 2013

GCE Biology (6BI01) Paper 01R
TRANSPORT, GENES & HEALTH

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General

The concepts on the paper seemed accessible to the vast majority of candidates and there was very little evidence of incomplete questions, suggesting that candidates had sufficient time to complete all the tasks. It was good to see evidence that a good number of candidates had carried out practical tasks such as testing for vitamin C in plant tissue and were able to describe how to set up an enzyme investigation. Many candidate responses also showed good manipulation of figures from information provided in graphs, although a fair number still tend to merely quote figures. Particularly impressive were the responses which demonstrated good practice in setting out genetic crosses clearly and carefully. However, there are a number of candidates who do not effectively use information and data and also misread questions.

Question 1

Candidates were generally familiar with the terms platelet and thrombin, but a few had difficulty in identifying fibrinogen as a soluble plasma protein.

In b(i) many candidates identified the idea of reduced blood flow and thus less oxygen reaching the brain. However, surprisingly few connected this to the idea of less respiration and ATP produced, while some responses had vague comments about brain cell death. Very few candidates referred to lactic acid or linked it to enzyme inhibition.

In b(ii) candidates generally had a good grasp of healthy lifestyle choices to avoid strokes, with almost 80% scoring two marks. All the marking points in the scheme were covered over all the responses seen, but very few responses referred to reducing body weight or to BMI. This may be because their awareness of other healthy choices was so good in general. The most common responses involved the ideas of less saturated fat / cholesterol, increased activity and reduced smoking. Some candidates referred to stress / alcohol / saturated fat etc, but did not describe a directional change for these. Pleasingly, there were fewer vague answers this session, such as ‘better diet’ or ‘less fat’.

Question 2

In 2(a) candidates generally demonstrated an extremely good understanding of the structure of the cell membrane, with many candidates providing both a description and a diagram. Some candidates would not have gained access to some marks as their diagrams had not been suitably labelled and it was fortunate in many cases that some of these points had been covered in their descriptions. The quality of many of the diagrams was very good, but candidates should remember to label clearly.
The majority of responses featured references to the phospholipid bilayer, the structure and orientation of phospholipids, hydrophobic and hydrophilic interactions and the presence of proteins. There were fewer references to protein locations and the presence of cholesterol. In a number of cases,

although glycoprotein and glycolipids were referred to, they were not correctly described or properly labelled.

Item 2(b) was well answered by the majority of candidates. Marks were gained mainly for the idea of molecules being small, non-polar or for being lipid (fat) soluble. However, very few responses referred to the idea of molecules being recognised by receptors. Also, some candidates did not gain access to marks because they referred to 'size', 'solubility' or 'polarity' without qualifying these descriptions. A small number of candidates did not read the question stem properly and referred to concentration gradients.

In item 2(c) was equally well answered with candidates generally demonstrating a good understanding of how diffusion and active transport take place and most scored well, especially on the differences between the mechanisms.
For similarities, responses frequently included references to the use of carrier or channel proteins, although a number of answers referred to proteins without qualifying this answer properly. Fewer responses referred to transporting hydrophilic, charged or polar molecules and there were some vague answers using the term transport protein.
Differences were covered using some very clear descriptions showing the requirement for ATP (energy) or the direction of transport with respect to the concentration gradient.

Question 3

In 3(a) a good number of candidates described the general fall in vitamin C content with time, but sometimes this had to be pieced together from various statements, rather than being clearly stated on its own. Although many candidates spotted the relationship between storage temperature and vitamin C loss, it was not always expressed well. However, a small but significant number failed to recognise a loss in vitamin C content and simply referred to the vitamin C content being higher or lower, thus failing to gain mp2. A significant number recognised which storage temperature caused the greatest loss or the least loss for mp3. It was also pleasing to note the number of candidates who are now correctly manipulating figures, although there still remains a significant minority who continue to merely quote figures. Although most candidates grasped the idea of negative numbers, it was obvious from some responses that a few candidates had not read the data carefully enough and thought that -7ºC was the coldest temperature instead of the warmest.

In 3(b) the vast majority were able to spot the anomalous result by reference to the correct temperature and 90 days storage. A small number quoted the correct point coordinates or referred to the rise of vitamin C content after 80 days, which was fine. However, the key to the graph was misread in a few cases.
Most candidates were able to suggest repetition of the experiment or repeating for the -25ºC data. A few were able to suggest checking the results again, but there were very few references to extending the storage

time. Disappointingly, a reasonably large minority suggested just ignoring this point in the data.

In 3(c) the vast majority of candidates were able to choose an appropriate variable to be controlled, although some candidates referred merely to 'size', instead of mass or volume. The most common responses involved mass / volume of broccoli or variety / source / type of broccoli, although all the other points were found in the variety of responses seen.
Where a directional change in vitamin C (in part ii) was needed, it was normally given. However, a few candidates failed to identify the direction of change for their chosen variable.

Responses to 3(d) were generally extremely good and there is evidence that this has been taught very well with many candidates having good practical experience. A large number gained full marks or at least 3 marks and there were few mistakes. All marking points were well represented in responses, with a sizeable number using more marking points than needed for a maximum mark.
There were a few candidates who described doing a calibration curve with clear descriptions and it was very obvious that they had carried out this practical. However, others simply referred to a calibration graph. There were only a few references to colour standards or to standardisation.

Question 4

Most candidates gave clear descriptions in 4(a)(i), however, a number thought that 'germ line' involved germs or bacteria. The more able candidates were able to distinguish between use of body cells and gametes in both procedures. However, some thought that this germ line therapy involved embryos rather than gametes. A good number of were also able to distinguish the difference in inheritance between the therapies. Fewer candidates scored on the legality issue, but a reasonable number (although still small) were able to point to the fact that somatic was temporary or was not a cure – in contrast to germ line therapy.

In 4(a)(ii) candidates mainly answered in sequence, with many responses scoring well on the first four marking points. The very best answers also gave some clear descriptions of chloride ion transport out and/or water moving by osmosis as well as the effect on the mucus. However, these marking points (5, 6 and 7) were rarely covered.

Candidates generally recognised the importance of using a vector to insert the gene into cells and although a majority referred to the gene coding for the CFTR protein, or made it clear in related statements in their responses, a disappointing number referred simply to a 'normal' gene or a 'healthy' gene, without any further clarification. Thankfully, only a small number of responses also referred to replacing the faulty gene.

Although inhalation/nebuliser is the preferred method of getting the vector into the lungs, a number of candidates referred to injection or referred to both aerosol and injection. Many descriptions clearly referred to the CFTR protein being made via transcription / translation, however, in a fair number

of responses, either there was no mention of transcription or translation, or there was no clear reference to which protein was being made in the cells.

There were some good answers in part (b) with many candidates able to score either one or both marks. Most candidates were able to describe the mucus being removed from the lungs, while many also gave the idea of clearer airways or better breathing, although it was not always expressed well. A few scored on the idea of the mucus being looser or sticking less to the walls. There were a tiny number of responses giving very clear descriptions of a larger surface area being exposed for better gas exchange in the lungs.

Question 5

Most candidates scored well on 5(a), with around 60% either 4 or 5 marks. All marking points were covered well in responses with the exception of mp10 (Fick's Law) which was covered in only a few cases and mp8 (Large number of RBC's / O2 combining with Haemoglobin) which was rarely covered at all.

Most candidates included a reference to the process of diffusion and the large surface area provided by alveoli. Many also stated that the alveoli were covered in capillaries, although some vaguely referred to the lungs being covered in capillaries or mentioned capillaries but failed to provide a clear location for them. The better candidates referred to the thin nature of the alveolar or capillary linings and clearly stated that the diffusion distance was short. However, some responses referred to these linings providing a shorter pathway, which is not the same thing as being short. The better candidates were again able to express clearly the idea that breathing and blood flow were able to maintain concentration gradients. However, some candidates failed to gain these points through not clearly stating that blood flow or ventilation was the cause.

Although Fick's Law was covered in only a handful of cases, there were two or three excellent descriptions of this, rather than just a reference.

Candidates in general displayed a good understanding of the adaptation of the lungs for rapid gas exchange.

Spelling of technical terms was generally very good and was rarely punished. This was extremely pleasing.

In part(b)(i) candidates had some difficulty in answering, with most gaining mpt1 (blood carrying oxygen) only and only a very few having the idea of blood flow maintaining the concentration gradient. There were no references to mass flow and only one reference to the organs having a large surface area to volume. Many answers referred instead to the large surface area to volume ratio of the daphnia itself.

A good number of candidates discussed the heart pumping blood into cavities, open circulation and diffusion across the surface of the organism, instead of answering the question.

In part(b)(ii) there were some decent descriptions of the separation of oxygenated blood from deoxygenated blood, with some of the better answers also referring to the septum. As well as this a good number were able to describe the differences in blood pressure to the lungs and to the rest of the body and there were references to the supply of oxygen to the body cells being maximised. These were the most common points made, although in a few cases they were not very clearly expressed.

A small number of candidates expressed the idea of maintaining the concentration gradient, but candidates only rarely referred to the high rate of metabolism and the need for oxygen, although there were no references at all to mass flow.

Question 6

Part(a) was generally answered very well with many candidates gaining all three marks and a number with 2 marks and only a few with 1 or zero marks. Some very good diagrams were drawn and some were very clearly labelled as well. The candidates' knowledge here is generally good. The most common errors were NH3 without the + charge, COO without the – charge and an oxygen atom missing from the OH part of the carboxyl group. In a few cases the central carbon was missing the H atom. There were only a very few cases where candidates seemed totally confused.

In part(b)(i) there were some very good answers, with the most common being references to active sites (mp2), the effect on collisions and formation of complexes (mp3) and references to the substrate becoming the limiting factor (mp5). In the better answers there were good references to enzymes reducing activation energy, but unfortunately these were very rare. Some candidates bravely attempted to give the idea of the number of active sites occupied before and after 6au and a few were successful, but many were unclear or incorrect.

A reasonable number of candidates failed to read the question carefully and just described the data rather than offer explanations. This is an area for some centres to develop, so that candidates are familiar with terms such as 'explain' or 'describe' and what is expected in an answer.

In part(b)(ii) a good number of candidates understood the principle behind this experiment, but failed to name an enzyme and substrate and so could not gain access to mp4 or mp5. A number of descriptions were also weak and poorly expressed, but still picked up some of the marks. However, there were some very good responses as well, which in some cases scored on as many as 7 marking points, for a maximum mark of 4. However, the weaker candidates found difficulty with this question.

The most common areas to gain marks were mp1 (range of concentrations of enzyme), mp4 measuring the dependent variable), mp6 (reference to an

appropriate controlled variable) and mp7 (reference to replicates or repeats at each enzyme concentration). Only in the better and clearer answers were mp3 (reference to mixing), mp2 (idea of substrate not limiting) or mp8 (description of the use of a control) to be found.

In some cases it was clear that candidates had practical experience in carrying out an experiment, while in other cases it was clear that they had not. It was very disappointing, however, to read a reasonably high number of responses which referred to 'potato mash' and using 'scoops' or 'spatula's' as the measurement. This is very unscientific and not good practice.

Question 7

The multiple choice questions in parts (a) and (b) were generally answered well with the vast majority (around 80%) gaining a mark for each and demonstrating a good understanding of DNA structure as well as the technique of differential centrifugation in relation to DNA replication.
In part(c) almost all candidates were aware that the mRNA is synthesised in the nucleus.

Candidates scored well in part(d)(i) and many were able to clearly give one advantage and one disadvantage of genetic screening. Most candidates were at least able to give at least one advantage or one disadvantage.

In the case of advantages, candidates commonly scored mp3 (preparation for the child) or mp4 (making an informed choice). In some cases mp4 was gained for the idea of perhaps choosing termination. There were some references to the idea of stress for the parents as well, but only a few extremely well expressed responses referred to the prevention of the child dying late in pregnancy.

In the case of disadvantages, most commonly mp5 (risk of miscarriage / spontaneous abortion) or mp8 (risk of false positive or negative) were found in responses. A small number referred to mp7 (cost) or to mp6 (the idea of more parental stress). There were some responses, however, which referred to the screening process leading to abortion and leaving this unqualified or qualifying it with moral or ethical reasons against this choice, rather than this causing some stress for parents.

In part(d)(ii), candidates generally scored very well here, gaining at least 3 marking points and with the clearest responses gaining all 4 marks. However, a number of candidates failed to show clearly the corresponding phenotypes to the genotypes of the children, thus failing to gain mp3 and thus the maximum score. It was very pleasing to see many examples of good practice in the layout of Punnett Squares or lines clearly going from parental genotypes to the gametes formed. Also pleasing was the fact that gametes were often circled to make them clearer - another example of good practice. Not so satisfactory were some responses which referred to 'carriers' as phenotypes.

It was extremely pleasing to see that the vast majority of candidates quoted a probability as asked and not a ratio.

In a few cases, candidates had not read the information carefully enough and started with the incorrect genotypes for the parents. A small number also became confused when working out the probability from the offspring genotypes, getting the probability as 75% or 3 in 4.

Question 8

In part(a)(i), some very good and clear answers were found, with most candidates gaining mp1 for identifying the increase in risk with alcohol consumption or stating that it was a positive correlation.

Many also identified the sharp increase in risk of cirrhosis above 40g/day alcohol consumption, however, a number of candidates did not read the information clearly on the graph and described the risk as if it were a rate, increasing rapidly or more quickly, thus often failing to gain access to mp2.

It was also very pleasing to note the number of candidates who successfully produced a correct manipulation of figures here. This is an area where much improvement has taken place in the last few years. Some candidates even gave the increase in risk between 10 and 40g per day as well as the increase between 40 and 60g per day.

In part(a)(ii), marks were commonly scored for mp1 (women have a greater risk), mp3 (steeper risk at lower alcohol consumption for women) or for mp5 (manipulation of figures). Very few candidates recognised that there was little difference between them from 10 to 30g per day and even fewer recognised that we couldn't compare them above 40g per day.

In a small, but surprising number of cases, the key was incorrectly interpreted and the graphs read the wrong way round, so that candidates stated that men had the higher risk, thus not gaining mp1, or that the steeper risk was at lower alcohol consumption for men, thus not gaining mp3.

In part(a)(iii) 0nly a very small number gained both marks. Most of the candidates, however, were able to score mp2 from comments relating to not knowing the number of people in the studies. A few gained a second mark from either mp1 (comments on similar patterns) or more rarely for mp3 (comments on lack of error bars / statistics). There were no comments on the results not reliably showing at what level the risk increases significantly (mp4).

In part(b) a good number of candidates gained at least two marks from recognising higher LDL levels (mp1) and that this results in plaque formation / atheroma / atherosclerosis etc), but some gained all 3 marks by also referring to LDL's overloading receptors or being deposited in artery walls (mp3). Often, however, mp3 was not gained because there was no reference to LDL cholesterol and just a vague reference to fats etc being deposited.

However, there were almost no reference to LDL:HDL ratios and no calculation of ratios from the data.

In part(c) the vast majority of candidates gained both marks for knowing that the breakdown products were fatty acids (mp1) and glycerol (mp2).

Interestingly, there were a small, but significant number of candidates who used the chemical term propan 1,2,3 triol for glycerol.

Hints for revision and answering questions

- Read each question stem with great care to make sure you are attempting to answer the question asked. In addition useful information can often be found in the stem of the question to help you to answer it. It may sometimes be helpful to highlight such information before answering a particular question.

- When revising use the specification as a checklist, to ensure you go over all parts of the course.

- Use past papers to ensure you get practice with all types of questions to become familiar with what is expected. This will also give you plenty of practice with interpreting data and manipulation of figures.

- It is important to use proper scientific units such as volume or mass and avoid the use of terms such as ‘amount’. Be sure to include units in your answers when interpreting graphs.

- Make sure that you are familiar with how to answer questions which ask you to describe something. These are quite different from questions which ask you to explain something.

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