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Examiners' Report/ Principal Examiner Feedback

January 2014

IAL Biology

Unit 1: WBI01_01

Lifestyle, Transport, Genes and Health

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Q01b:
Most students tended to score either 2 or 3 marks on this question, mainly for the idea of water being a solvent, or water being polar or for water dissolving polar molecules or ions. The idea of viscosity or fluidity was seen much less often and only very rarely were there any correct and appropriate references to cohesion/adhesion or, even more rarely, to assisting mass flow. The better students were able to state concisely what they meant, but a number of responses were confusing with statements like 'water is soluble' or 'water dissolves in other substances'. A significant number of students did not gain mp3 for vague statements like 'water dissolves many other substances', although they were able to gain mp1. Many responses seemed to include anything the students knew about water, with lots of irrelevant information about specific heat capacity and latent heat of vaporisation. Reading the question with more care would help to eliminate this.

Q02a:
It was very pleasing to see so many correct responses here, with many students clearly showing the pathways of blood on both sides of the heart. In a few cases, however, a minimalist approach to providing arrows made awarding slightly more difficult and students should always try to make sure that their responses are as clear as possible. Also, some responses had arrows going the correct way on one side of the heart, but incorrectly on the other side. On a small number of occasions, answers were also contradicted by arrows going in opposite directions on the one side or both sides of the heart.

Q02bii:
The majority of answers here gained mp1, but fewer gained mp2 as they did not understand how or why the valves worked, or in some cases, where the valves were. Surprisingly, a reasonable number of students thought that the valves contract, while a number of responses considered backflow prevention in their descriptions, but few referred to pressure differences between the ventricle and artery leading to closure of the valves. A disappointing number stated that the valves were open and it was not uncommon to see references to backflow of blood without clearly stating that this would be into the ventricles. Some even inferred incorrectly that the backflow would be into the atria.

Q02biii:
This was generally very well answered with a good number of students showing clearly how they used the figures in a calculation to determine the correct answer. Disappointingly, however, a reasonable number subtracted 50 from 60, while others divided 50 into 60 before multiplying by 100. In some instances, it looked as though students did not have a calculator and were not able to finish their calculation to gain a second mark, demonstrating too much reliance on a calculator. Indeed, one student had left a message on their script saying they had forgotten their calculator and could not get access to one from an invigilator.

Q02c:
A surprising number of students seem to be under the misconception that valves are muscular and work by contracting and relaxing, while some others thought that the faulty AV valves would not open properly, thus limiting flow of blood from the atria into the ventricles. Those who did appreciate that the fault was the valve not closing properly usually went on to correctly describe backflow and gained a third mark for saying that these events occurred during ventricular systole or the idea of lower blood pressure. Most students did identify that there would be a less efficient supply of oxygen, so leading to breathlessness. Indeed for many this was the only correct marking point, even though their reasoning was somewhat flawed.

Q03ai:
This was generally well answered with a large majority gaining both marks for the idea of energy being required and also for stating that movement was against a concentration gradient. A smaller number of students gained a mark for the idea of ATP bringing about a conformation change in the transport protein, but in a number of other cases this was not qualified properly. It was obvious from some answers that a few students did not understand the difference between carrier and channel proteins, however.

Q03aii:
The majority of responses here gained marks from mp1 (idea of more or increased chloride ions in lumen), mp3 (water moving into lumen) and mp4 (by osmosis), with a smaller number gaining access to mp2 (idea of other ions following chloride). However, some students failed to gain mp1 by simply using the information given and stating that there was active transport of chloride ions, without reference to this increasing the chloride ions in the lumen. Few students gained mp6, failing to refer to excess water not reabsorbed into blood and even fewer referred to chloride ions not being reabsorbed fast enough. A large number of students did not consider or appreciate the concept of reabsorption.

Q03aiii:
This question was answered most effectively by students who used clear comparative statements or used a table to present comparative information. In general it was well answered, but a fair number of students failed to gain any marks as they did not make statements about each process which could be linked or were comparative in nature. Again, this question demonstrated that a number of students did not appreciate the difference between carrier and channel proteins, although this was not crucial to gaining the mark. In some cases, students did not get mp2 as they used the term ‘along’ the concentration gradient for facilitated diffusion, rather than ‘down’ the concentration gradient.

Q03b:
Only a very small minority gained 3 marks or more for this question with many responses demonstrating some confusion and focusing on the idea of starch as an energy source, whereas the emphasis here was on the rehydration process. A significant number of responses referred to ‘thick

mucus' and a number of students mixed up ideas from the various diseases covered by the syllabus. Many of the students had the idea of replacing lost water (mp1) and some could gain a second or third mark from their understanding of less water entering the lumen by osmosis (mp3) and the idea that starch was not soluble or did not affect osmosis (mp4). Some descriptions concentrated on a detailed coverage of the structure of starch and its rapid hydrolysis by enzymes, however, there were few clear statements that starch was a polysaccharide and fewer still about the importance of slow digestion in this treatment. Only a very few students considered the importance of lowering the salt concentration in the lumen for mm2. A number of students also thought that the water washed the bacteria away.

Q04a:
This was generally very well answered with many students gaining access to all 4 marks. Most students referred to alveoli, but some referred to epithelium, lining, air sacs, bronchioles or air tubes instead, thus failing to gain this mark. Thankfully, however, alternatives such as arteries or *Amoeba*, were few. Good students referred to surface area clearly, but a small number referred to area without qualifying it, or referred to space or volume. Very rarely, did students get oxygen wrong, however, a fair number of responses referred to gas exchange or respiration rather than diffusion.

Q04b:
Few responses gained full marks for this question, but many students were able to score 3 or 4 marks. However, there were also many who did not address the question asked. A significant number of students described the circulation of the blood without explaining how it enabled gas exchange, while many responses focussed on the respiratory system and gas exchange in the alveoli.
Very few students referred to the idea of mass flow and most of those that did refer to it did not link it to the heart. However, there were some clear descriptions of the connection between blood flow and maintenance of concentration gradients, which was very pleasing. A good number of students referred to a large number of capillaries providing a large surface area and many picked up mp9 as well for reference to the capillaries surrounding alveoli.
A common error or omission, which seems to be perennial, is that students refer to capillaries being thin, with no reference to the capillary walls. Whilst some of the better answers did refer to thin walls, this was usually not followed up by a reference to faster diffusion. More commonly, students did relate a large surface area to faster diffusion. There were only a very small number of clear and correct references to Fick's Law and formula. Some students also had an idea of the fact that no organs or tissues were far away from blood, but in many cases this was very poorly expressed or very unclear. References to a double circulation were not always related to efficiency of transport and a number of students merely gave a description of double circulation.

Q05a:
This question was well attempted with many students achieving 3 to 5 marks. However, a significant number of students lost a mark here because of QWC, as the spelling of technical terms was an issue, with cholesterol and atherosclerosis causing most problems.
Generally students showed good knowledge of this subject but sometimes answers did not include enough accurate science, by including statements such as 'fat is deposited in blood vessels' or 'hardening of arteries'. Many students referred to an energy imbalance and went on to relate this to obesity, but a significant number referred to a 'weight gain' rather than the individual becoming overweight or obese and so did not gain mp2. As well as this, a significant number of students lost mp8 with imprecise answers referring to 'narrowing of the artery' rather than the artery lumen, but there were a reasonable number of students who gain this point by referring to 'loss of elasticity' of the artery.
Many students had the idea of increased blood pressure and there were many references to increased cholesterol and LDL, however, a number did not make it clear that increased cholesterol was in the blood. A number of descriptions included irrelevance such as formation of blood clots leading to blockage of arteries. A common omission was to include descriptions of 'damaged arteries' rather than to the endothelium lining.

Q05bi:
A very large majority gained access to marking point 1 here for spotting the positive correlation. Many went on to gain the mark for manipulating data correctly, mainly by calculating a risk increase. Only a very few quantified data in terms of percentage increase. A surprisingly small minority spotted the risk increase by doubling between 2 and 3 risk factors. It was disappointing to note, however, that a good number of students continue to merely quote figures from graphs. In general, students seem to be able to manipulate data more effectively from bar charts than from line graphs.

Q05bii:
It was apparent that many students had not read this question properly and had substituted 'life style' for diet. Thus many responses referred to either smoking or to exercise. Many students were also thinking too generally and not identifying concisely enough the individual factors that would influence cardiovascular health. The most popular correct answers were references to reduced alcohol or reduced salts. There were also a small number of references to use of statins or sterols and also to increased dietary fibre, which was pleasing. However, a number of answers referred to reduced cholesterol and LDL's or increased HDL's, whilst there were some vague references to reduced carbohydrate or increased protein, taking insulin or eating more fresh fruits and vegetables.

Q05c:
This question was straightforward for the vast majority of students. However there were a surprising number who did not attempt an answer. The most common answers were effects on muscles, joints, liver, kidneys, headaches and nausea or constipation. References to cataracts, diabetes or insomnia were rarely seen.

Q05d:
This question was also generally well answered with most students gaining both marks from the idea of less blood volume and lower blood pressure. A reasonable number also referred to less chance of artery wall damage or atherosclerosis. A small, but notable, number of students gained a maximum of 2 marks from all 3 marking points.

Q06a:
This was also well answered by the majority of students, who gained both marks. It was very pleasing to see so many students labelling their diagrams to identify the galactose molecule. A number of students lost one mark, however, for inclusion of a water molecule as a product of the reaction. A small number of students failed to study the lactose molecule carefully enough and had the H and OH orientations incorrect either on the C1 of the galactose product or on the C4 of the glucose product, thus only gaining 1 mark. However, some had both orientations incorrect, thus scoring zero marks.

Q06b:
The QWC emphasis here was on clarity of expression and very few students lost a mark for this.
It was pleasing to see that many students gave clear, logical answers which gained all 4 marks and a small number of excellent answers scored on all 6 points on the marking scheme. Marking points 1, 3 and 4 were most commonly awarded, with very few, however, referring to the idea of a different mRNA.
Some students incompletely explained the nature of the gene mutation by simply referring to addition, deletion, etc. without specifying a change in base sequence, or the subsequent change in the mRNA. However, it was pleasing to note the large percentage of students who accurately described in detail the ways in which the resulting protein would be affected and changed. Students were often imprecise about the active site, stating merely that it changes rather than that there was a specific change in its shape or properties. Those that were able to describe a change in shape or properties of the active site were usually, but not always, able to follow this up with stating that the substrate could no longer fit the active site. Fewer students managed to refer to the possibility of the enzyme not being made and statements about galactose not being broken down were mostly not qualified properly without this reference to the lack of availability of enzyme.

Q06ci:
Many students gained marking point 1 for the idea that parents 8 and 9 do not have galactosaemia, but some of their children do. It was quite common, however, for students to fail to state that these parents were unaffected. Many of those who concentrated on parents 8 and 9 as well as their children 12 and 13, also gained marking point 2 for stating that these parents must be or may be heterozygous. However, a number of students thought that only one of the parents 8 and 9 had to be a carrier.

It was very rare to see any good arguments based on individuals 4, 6 and 7 being heterozygous. The idea of a low frequency of recessive alleles or low numbers with galactosaemia was stated by very few students for mp4, but no references whatever were seen to the unlikely event of spontaneous mutation. A significant number of students demonstrated an understanding of a recessive trait, but were not able to apply this to the family tree by reference to the diagram, which they were asked to do in this question.
A good number of students also focussed on individuals 1 and 2, arguing incorrectly that because individual 2 was affected and her children were not, then the allele had to be recessive.

Q06cii:
The vast majority of responses gained all 3 marks for this question. However, a significant number of students gave their answer as a ratio rather than a probability, as asked. Answers involving Punnett Squares were generally less muddled and, therefore, more successful than those involving lines to show possible offspring. Disappointingly, however, it was quite common to see students showing one of the parents being homozygous dominant, rather than both parents being heterozygous. Also, some students displayed the correct genotypes of the children but then quoted the probability wrongly (often as 1:3, or 0.25%).

Q07ai:
In this question, the vast majority of students gained mp1 for identifying and stating the correct correlation. Those that didn't sometimes made the mistake of confusing 'directly proportional' with 'positive correlation'. Very few successfully described a non-linear relationship. Many stated that it was linear after 0.23 but did not compare it to the situation before 0.23. Some students used very 'muddled' language when attempting to describe rate changes. Only a very few were able to give a correct manipulation of figures from the line graph, with many just quoting figures again. As stated previously, students seem more at home manipulating data from bar charts than from line graphs and don't seem to recognise the changes in the data as clearly. Disappointingly, rather than use the variables in the graph axes, a good number of students inadequately refer to changes in the steepness of the curve.

Q07aiii:
Responses usually gained 3-5 marks on this question with some good answers covering virtually all the marking points. All 7 marking points were represented equally well in the various responses marked. Common mistakes were just describing a core practical for rates of enzyme controlled reactions or just putting blood and protease in a test tube and some accounts lacked detail. A significant number of students used the terms 'quantity' or 'amount' instead of volume. Many mentioned a controlled variable but considerably fewer went on to describe how to control it. Although this was generally a high scoring question, it was a little worrying to see more blank answers to this question than most others in the paper. This may indicate a lack of practical work in some centres. Some students simply said that the experiment could be repeated, without giving any

details of the experiment involved. However, many recognised the importance of repeats and were clear that this was for each concentration of enzyme. In some cases, students simply described an experiment involving albumen and protease, without reading the question carefully. Many students recognised the importance of timing the disappearance of the blood stain, but only in a few cases were there correct alternative methods involving a colorimeter.

Q07bi:
This question was not answered well by the majority of students and disappointingly few students clearly referred to the idea of increased surface area, while even fewer followed this with the idea of there being more chance of collisions or of forming complexes. Many students were confusing 'detergent' with 'enzyme' and going straight into a description of enzyme action with no consideration of the emulsifying action of the detergent itself. Answers which gained mp1 were often too vague to gain mp2, with comments such as 'increases reaction rate'. Some students were even applying the wrong group of enzymes to the substrate e.g. proteases and a number of answers referred to an increased rate of reaction as the detergent was in powdered form, so increasing the surface area of detergent. Some confused responses correctly referred to an increased collision rate but linked this to an increase in enzyme concentration due to the detergent.

Q07bii:
This was generally very well answered with the vast majority of students gaining marks for both fatty acid and/or glycerol. A small number also gained mp3, but this was rarely seen. Incorrect responses included, carboxylic acid, ester, hair creams, guanine, amino acid, hydrochloric acid, energy, glucose, water, galactose and soap.

Q08b:
A good number of students gained both marks, usually for a reference to abortion or to miscarriage. Fewer answer referred to parental stress, false positives or damage to the embryo. Many responses discussed religious views and stated that it was 'wrong to play God' or 'the foetus has a right to life' rather than discuss the issues involved in the technique. Some students appropriately described the trauma to the parents, as well as social aspects such as cost and stigma. It was pleasing to see that some students realised that difficult decisions were involved.

Q08c:
This question was generally very well answered, with most responses gaining the maximum two marks. Many students recognised that thick or sticky mucus was involved in the reproductive system and followed this up with the effect on sperm movement or the idea of the fallopian tube or more commonly, the cervix being blocked. However, it was rarer to see references to the effect on egg movement or implantation. There were a reasonable number of good clear answers scoring a maximum of 2 marks from 3 or 4 marking points. A small minority misinterpreted the question and described the difficulties in forming a relationship if you are a cystic fibrosis sufferer,

suggesting that you may be ‘shunned by society’.

Paper Summary

- 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.

- Develop a familiarity with the terminology encountered at this level and learn how to define key phrases accurately.

- Try for shorter, more precise sentences - it helps students to focus. When sentences start to ramble on it becomes difficult to determine where one point ends and another starts.

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

- 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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