Moderators' Report/
Principal Moderator Feedback

Summer 2016

Pearson Edexcel GCE
in Biology (6BI01)
Lifestyle, Transport, Genes and Health

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Report on 6BI01, June 2016

Paper Introduction

This paper was a re-sit opportunity for assessing the knowledge and understanding of the two AS topics: 'Lifestyle, health and risk' and 'Genes and health', together with elements of How Science Works. The range of questions provided plenty of opportunity for candidates to demonstrate their grasp of these AS topics. The paper appears to have worked very well with all questions achieving the full spread of marks. Very few questions were left blank and there was no evidence in the majority of papers that candidates had insufficient time to complete the paper. Most candidates were able to score marks on each question and as a result the mean mark for the paper was higher than the equivalent 2015 paper, although it was in line with the previous mean for candidates resitting the paper.

A significant issue for some candidates on this paper was not reading the question carefully and in ignoring information provided in the question.

Questions that demanded recall tended to score very well. However, when asked to analyse and explain data and apply their knowledge in unfamiliar contexts many candidates found the marks harder to obtain.

Some candidates lost marks through poor literacy; others through carelessness for example by not making a clear comparative statement or only making one clear statement when a question carries two or more marks.

Having said this, there were large numbers of excellent responses; often being concise, clear and comprehensive, showing a good use of technical terms and biological names.

6BI01_01_Q01bi

1(a)(i) 90% of candidates correctly identified the arrangement of components in a mononucleotide. Of the incorrect responses B was chosen most frequently.

1 (a)(ii) 52% of candidates correctly identified B as the mRNA with a single mistake. The most common incorrect response was to choose C – the sequence with no mistakes, perhaps showing that they had not all read the question carefully enough.

1 (a)(iii) Over 80% of candidates identified the correct sequence events for protein synthesis.

1 (b)(i) The vast majority of candidates identified that 8 would be the maximum number of amino acids that could be coded for by the mRNA molecule. 24 was the most common incorrect answer i.e. one amino acid per base.

6BI01_01_Q01bii

The majority of candidates wrongly stated 8 as the number of **different** tRNA molecules required. This was either because they did not pick up on the word different, or failed to spot that two of the codons were repeated. Some candidates did pick up on the word different, but only spotted one repeat so gave the answer incorrectly as 7.

6BI01_01_Q01c

This was very well answered by the majority of candidate with most scoring two or three marks. Common errors, however, were; misspelling of thymine (thyamine), not giving a complete comparative answer or describing the function instead of the structure. References to hydrogen bonds alone were not credited as the comparison was between DNA and RNA as tRNA for example does contain hydrogen bonds in its structure.

6BI01_01_Q02a

The majority of candidates were able to calculate the percentage loss of vitamin C. Those who lost marks tended to do this through using the wrong figures from the table or not knowing how to calculate a percentage.

6BI01_01_Q02b

It was clear that many candidates were familiar and confident with this particular core practical technique with the majority scoring 3 or 4 of the 4 available marks.

Many candidates were able to identify the need to perform a titration. However, a significant number of candidate described the titration process but failed to pick up marks due to lack of clarity e.g. for the need to control the volume of the DCPIP that the cabbage extract was to be titrated in to. Similarly, some students did not make it clear that a liquid extract of cabbage had to be produced. Some students were able to identify the need of a calibration curve, but failed to pick up marks if there was no reference to a comparison against titre results. Some ignored the context of the question entirely and just described how to measure vitamin C content of know vitamin C solutions or even a different unknown such as lemon juice.

Some candidates gave the incorrect colour change for the titration (e.g. blue to colourless when titrating DCPIP into the cabbage juice).

In some response it was clear that candidates hadn't actually completed the core practical – they tended to confuse it with colorimetry and beetroot membrane permeability.

6BI01_01_Q02ci

Many candidates recognised that the cell membranes would become more permeable when boiled so that the vitamin C could leave the cells.

However, many answers are too vague, e.g. just recognising that vitamin C dissolves in water without stating that it would leave the cabbage cells.

Some candidates were confused about enzyme activity e.g. 'enzymes denature and cannot oxidise vitamin C' as explanation for low levels of vitamin C. Others thought that the vitamin C would evaporate out of the cells.

6BI01_01_Q02cii

This was generally poorly attempted, with many candidates failing to identify that the enzyme would be denatured immediately and so prevent breakdown of vitamin C in the cabbage.

A significant number of candidates misread the question and attempted answers which described that less would be lost when placed in cold water. E.g. references to no membrane damage and cells get acclimatised to increasing heat, and so retain the vitamin.

Some candidates left this item blank.

6BI01_01_Q02d

This was well answered by the majority of the candidates whereby they correctly used the table of data to identify that sauerkraut still retained some of the vitamin after 3 months, unlike cabbage. Many candidates also appreciated that sauerkraut would not rot as quickly as cabbage.

However, some candidates focussed only upon the fact that sauerkraut has more Vitamin C than cabbage at the start, with no reference to storage over time despite the context of a long sea voyage.

6BI01_01_Q03ai

This was probably the most challenging question on the paper with the majority of candidates scoring 0 or 1 mark out of the three available. Few candidates tackled the information with a logical approach to try and explain evidence for it being a dominant allele.

Many candidates focussed upon the fact that they assumed that there were no carriers in the family, because no one was labelled as a carrier, which led them to incorrect and irrelevant explanations. For example, many stated it must be dominant if 50% of the children inherit the disorder ignoring that the children of a homozygous recessive parent and a carrier for a recessive disorder, also have 50% probability of inheriting the disorder.

Surprisingly, few candidates failed to appreciate and accurately state that it is frequently inherited throughout the family despite being a rare disorder (so that it is unlikely that unrelated parents would also be carriers of the affected allele).

Many only referred to the 1st generation with 4 out 6 children affected (or often 4 out of 9 children – implying that the partners 4, 8 and 11 were siblings of the rest of the children of 1 and 2.)

The most common mark awarded was for identifying that parent 1 is heterozygous, and occasionally giving valid explanations to support this.

6BI01_01_Q03aii

This was well answered by the vast majority of candidates. Some however, failed to identify and display the parental gametes correctly (e.g. M M and M m). A few misinterpreted the offspring genotypes and subsequently gave the wrong probability (e.g. MM, Mm, Mn, mm as 25%). Some gave the answer of 50% even when this did not match the outcomes of the Punnett square they drew – so did not get the credit.

6BI01_01_Q03b

Most candidates scored highly on this question and demonstrated a good knowledge of structure and function of the artery. A significant number of candidates were able to give more than 2 pairs of correct answers. Some were able to give 4 or more pairs.

However, some answers were confused lacking clarity needed for linking a specific structure to a function. For example many students could not identify that the smooth muscle was to control the flow of blood.

The most common structure/function descriptions were for the elastic fibres and the thick wall. Nevertheless, all of the other pairs on the mark scheme were often seen.

6BI01_01_Q04b

4(a) (i) Over 90% of candidates recognised that R and S were saturated fatty acids.

4(a) (ii) Over 80% of candidates recognised that P only would be liquid at $5^{o}C$.

4 (b) This was well answered by the majority of candidates with many good and correctly drawn diagrams. Most candidates showed water being formed and many correctly drew or labelled the ester bond. However, many candidates did not clearly show the reactants (glycerol and three fatty acids) to show how the triglyceride is formed as they just drew the triglyceride

6BI01_01_Q04ci

Almost all candidates named the reaction correctly as a condensation reaction.

6BI01_01_Q04cii

90% of candidates correctly named the glycosidic bond.

6BI01_01_Q04ciii

The vast majority of candidates correctly compared amylose and glycogen.

6BI01_01_Q04civ

This question generated a wide range in the quality of responses. Many candidates appreciated the general biology of the two molecules but failed to accurately explain why they are good for energy storage. For example many candidates recognised that the molecules are compact but did not link this to the idea of being able to store more in a small space within a cell. Likewise, candidates often had an understanding that molecules were insoluble but could not always link this to the fact it did not affect osmosis in the cell. Few candidates mentioned that they contain glucose.

A significant number of candidates wrote about each molecule separately for example comparing the ease by which they can be hydrolysed to release energy.

6BI01_01_Q05a1

Few candidates had any issues identifying the correct substances to complete the passage about blood clotting.

6BI01_01_Q05a2

Few candidates had any issues identifying the correct substances to complete the passage about blood clotting.

6BI01_01_Q05a3

Few candidates had any issues identifying the correct substances to complete the passage about blood clotting.

6BI01_01_Q05b

Again there were a wide range of response to this question. Many wrote clear, concise answers that fully answered the question clearly describing the effect on respiration and the cardiac muscle. Other candidates viewed this question as write everything you know about atherosclerosis, describing the formation of a plaque and not the effect of a clot, although many of these did often pick up marks at the end of their response.

Candidates sometimes appreciated the reduced/blocked blood flow but then failed to include the oxygen element in their answer. Others stated that less oxygen reaches the heart; not qualifying this with respect to the cardiac muscle or heart cells, and so missed the mark point.

6BI01_01_Q05ci

The majority of candidates identified and described the negative correlation to gain a mark. Many went on to identify one of both of the countries at the extremes and it was pleasing to see how many candidates appreciated the need to manipulate the figures and gave correct calculations comparing the data of 2 countries to illustrate the relationship to gain the third mark. Although some candidates described increases/decreases without stating which countries they were comparing, which is problematic considering the non-linear nature of the data.

Where some candidates made errors they got the ratio confused and they interpreted the ratio in terms of high/low saturated/unsaturated fatty acids and gave descriptions using these terms instead of using the actual ratio, or even interpreted the ratio the wrong way round.

6BI01_01_Q05cii

Many candidates failed to refer to both of the tables of data to answer this question. Nearly all candidates analysed the 2nd table and usually gave relevant and correct descriptions to gain two of the three marks available. But most candidates failed to link back to the 1st table to address. Consequently, most candidates limited their responses to a maximum of 2 out of 3 marks.

Some gave incomplete answers with respect to blood cholesterol levels; often confusing the foods and the fatty acids contained within the foods e.g. referring to beef and butter raising levels rather than using the data to quote that it is the palmitic/stearic acid within that food which is significant in this.

The best answers clearly related the evidence from table 2 back to the 1st table in explaining what and why they should do to the ratio of unsaturated to saturated fatty acids in their diet.

6BI01_01_Q05d

Most candidates managed to gain both marks for this question, usually through recognising that other factors are involved in CVD and suggesting what some of them may be e.g. lifestyle and genetic differences. It was good to see a significant number of candidates recognising that correlation does not necessarily provide a causal link. However, it was disappointing that few candidates considered the differences between the national populations (to fit the context of the question) rather than stating their answers in the context of individuals and their risk factors.

6BI01_01_Q06bi

6 (a) (i) Approximately 2/3rds of candidates recognised that osmosis is an example of passive transport. Most of the rest incorrectly thought it involved the movement of a solute down a concentration gradient.

6 (a) (ii) The majority of candidates recognised that facilitated diffusion involves ions moving down a concentration gradient. A few thought they move against a concentration gradient or used ATP.

6 (a) (iii) The majority of candidates recognised that endocytosis involves the production of a vacuole or vesicle. A, C and D were all seen as incorrect responses.

6 (b) (i) This is another question that gained the full spread of marks. Most candidates appreciated that uptake increase during the first five minutes but often failed to identify that it was at a constant rate, so missing the mark, however, most then described the decreased rate after five minutes and so gained the mark. Most candidates recognised that no further uptake took place after 10 minutes, although there was lots of confusion between uptake, rate of uptake and concentration in some responses.

A significant number of candidates successfully manipulated data from the graph. However, there was a significant number who misread the graph and identified the change in rate at 4 or 6 minutes (rather than 5) and/or that uptake stopped at 9 minutes (rather than 10).

6BI01_01_Q06bii

Many candidates gained the marks for recognising that uptake stops because equilibrium is reached so there is no longer any concentration gradient. A few excellent responses included details about why it could not be active transport. A significant number of candidates just described the process of diffusion, without actually answering the question. They did not apply their knowledge to the actual data to analyse and conclude that diffusion must be the process.

6BI01_01_Q06c

Most candidates identified that water was moving into the cell by osmosis, so gaining two of the three marks available. However, many failed to explain this in terms of a solute or water potential gradient (or a description of such). Where they did most described a water concentration gradient with few describing water potential or solute concentration gradients. Surprisingly relatively few candidates went onto describe that the membrane ruptures to explain why some of the cells had burst.

The worst responses ignored water and osmosis and described the events in terms of what had happened due to the uptake of molecule W.

6BI01_01_Q07ai

Most candidates identified a suitable blood vessel to label. Some labelled the vessels carrying blood towards the alveoli and a few labelled the bronchiole. It was disappointing to see a significant number of candidates not attempting this question – possibly because there was not a dotted line to write on? Candidates should read the whole of the question and follow the command words given.

6BI01_01_Q07aii

Most candidates identified a suitable difference between capillaries and veins, usually valves or the thickness of the wall. Some lost marks by comparing arteries and others by making statements that were not clear enough e.g. "a capillary is one cell thick" or by accidentally referring to cell walls as if these vessels were in a plant.

6BI01_01_Q07b

Many candidates were able to calculate the differences between the alveoli and capillary and relate this to concentration gradients and therefore the different rates of diffusion for both marks. A few mentioned the difference in size of the molecules.

However, there were a significant number who misinterpreted the question and described the fact that oxygen would move from alveolus to capillary and carbon dioxide would move the opposite way, with reasons, but without comparing the rates of diffusion. Some even tried to compare the rates of diffusion within an alveolus and within a capillary rather than between them.

6BI01_01_Q07c

This was a very differentiating question with an almost perfect distribution of marks across the full range from 0 to 5.

Many candidates were successfully in linking factors of Fick's law (surface area, diffusion distance and concentration gradient) to either the lungs or capillaries but many failed to link to both and therefore did not gain full marks.

A number of candidates attempted to rationalise the mathematical theory of the formula for Fick's law given to them and ignored the biological concept. They therefore effectively turned the equation into a series of statements without any reference to the structure of the lungs or circulatory system.

Some candidates referred to the alveoli having a large surface area to volume ratio, and / or that both capillaries and alveoli have thin cell walls.

A few candidates referred to haemoglobin to carry oxygen but we saw response that identified that air is warmed due to the lungs being inside the body which therefore increases the rate of diffusion.

6BI01_01_Q08ai

Whereas many candidates picked up on the idea that AA is more likely to contract malaria or that they are less likely to have severe anaemia, they did not compare life expectancy to another genotype (even though life expectancy was mentioned) so only gained one of the two marks available. Rarely did candidates realise that the AA genotype could be compared to the 2 different genotypes, Aa and aa. Many were confused over referring to genotypes or individual alleles.

For this question, as well as 8aii, candidates often thought that rapturing of blood cells either leads to the severe anaemia or that it was a disadvantageous thing to happen. The link between rupturing red blood cells and the resistance to malaria was not understood by a significant number of candidates.

Other candidates thought that the genotypes affect the likelihood of being infected by the malarial parasite, rather than the development/ severity of the disease once infected.

6BI01_01_Q08aii

See comments for 8(a) (i) for some of the confusion and misconceptions.

Many candidates gained a mark for recognising that they are 'less likely to get anaemia'.

Candidates who gained 2 marks usually recognised that they are less likely to suffer from malaria because the parasite couldn't reproduce.

6BI01_01_Q08b

The majority of candidates gained 2, 3 ir 4 marks for this question. Most candidates understood and described the nature of the changing primary and tertiary structures and the changing bonds. However, in a number of cases these descriptions were not in a logical order and so candidates were penalised as a result.

Many candidates did not describe the possible changes in the haemoglobin properties, those that did attempt to try and describe what might happen to the properties they often described an enzyme and its active site rather than haemoglobin.

Some candidates described changes to peptide bonds.

In addition, a significant number of candidates wasted time (and space) by giving details of transcription and translation, which was not required by the question.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- read the whole question carefully, including the introduction, to help relate your answer to the context asked. In particular make sure you make note of the command word used in the question.

- read your answers back carefully – do they answer the question, have you made at least as many clear points as marks are available, and have you made any silly mistakes (e.g. does your answer make sense);

- pay particular attention to clarity and the logical organisation of your answer in QWC labelled extended writing questions;

- use all of the information provided in the question to help you with your answer, e.g. diagrams, graphs and tables of data;

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