Examiners' Report

Principal Examiner Feedback

October 2020

Pearson Edexcel International Subsidiary / Advanced Level

In Biology (WBI11)

Paper 01 Molecules, Diet, Transport and Health

Introduction

This was the fifth WBI11 paper and it is clear that centres are using past papers and examiner's reports to prepare their candidates for their exams.

There were some very good responses to many of the questions and all the mark points were awarded. Candidates are beginning to get used to some of the new command words and style of questions, including the levels-based questions.

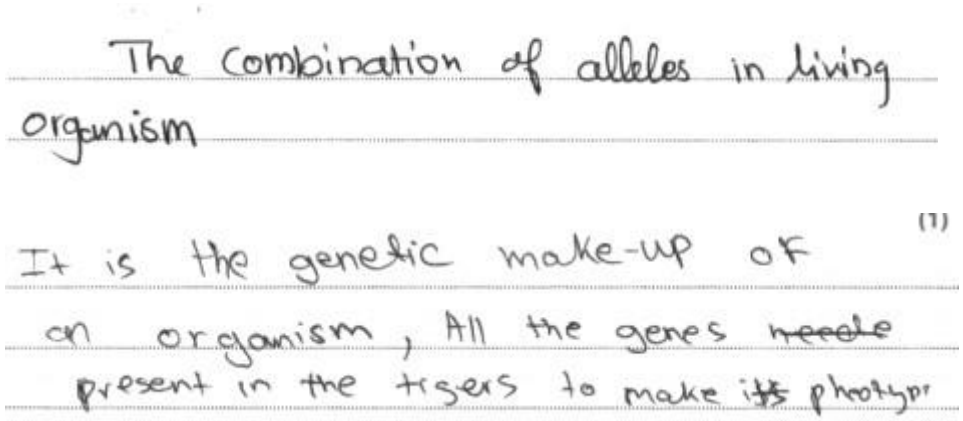
Question 1

(a) This was generally very well answered, with the majority of candidates familiar with the bonding and groups involved in primary protein structure. However, a small minority of candidates confused transcription with translation.

(b) This MCQ scored well as the vast majority of candidates knew that hydrogen bonds only were associated with secondary structure while both ionic and hydrogen bonds were associated with 3-D structure in proteins.

Question 2

(a) Candidates who did not confuse alleles with genes were able to clearly define genotype. However50 a number of candidates vaguely referred to the genetic make-up or combination of genetic information. Two examples are shown below, with only the first one scoring a mark.



(b) Most candidates calculated the probability as being 50%, 0.5 or 1 in 2.

(c) The best responses used Punnett squares to show the heterozygous parents, genotypes of offspring and ratio of 3:1. Some also effectively used a genetic line diagram. However, in some cases the third mark was lost if the ratio was written as 1:3 without identifying which was orange and which white.

(d) The vast majority of responses calculated the incidence of white tigers in captivity as 1 in 30, 0.03 or 3.3%.

Question 3

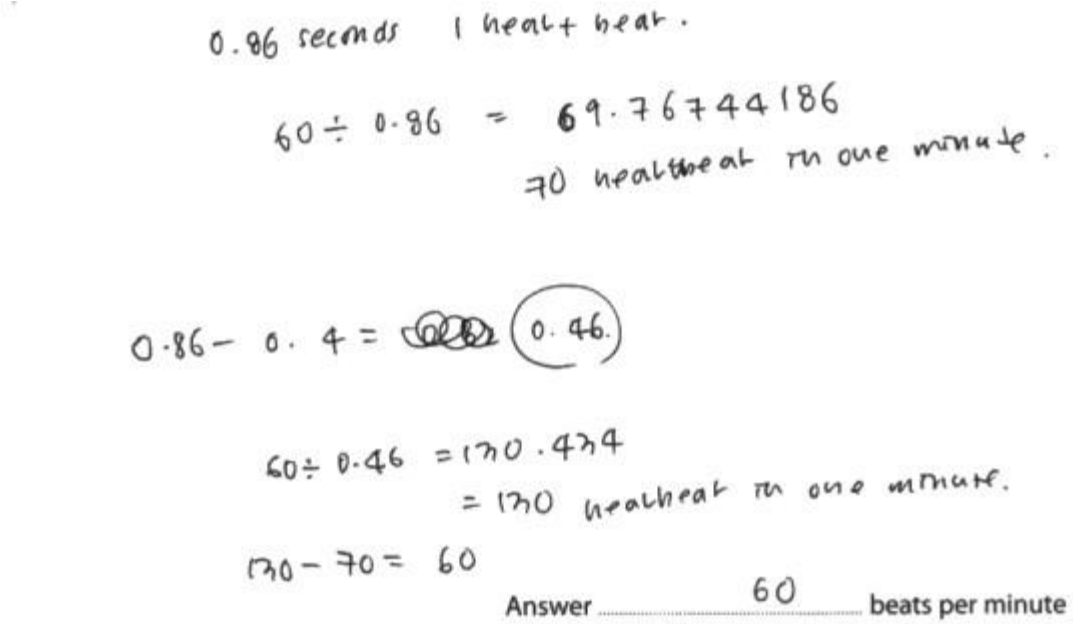
(a)(i) This MCQ scored well with most candidates aware that during atrial systole the atria contract while the ventricles relax.

(a)(ii) Many candidates correctly identified the time delay to the role of the atrioventricular valves in closing to prevent backflow of blood into the atria. However, there were a number of vague responses which referred to the time taken to fill up the ventricle with blood.

(a)(iii) This was generally answered well with many demonstrating the correct calculation of the number of seconds and then converting this into milliseconds. Those who read the question instructions carefully about expressing the answer in standard form usually managed to score the second mark.

(a)(iv) The vast majority of candidates were able to calculate the proportion of time in ventricular diastole to be 5/8, 0.63, 63% or 62.5%.

(b) Although a fair number of candidates had some difficulty with this calculation, most were able to gain full marks or at least 2 marks, with some failing to round up the final answer for the third mark. The example below illustrates a good response.



Question 4

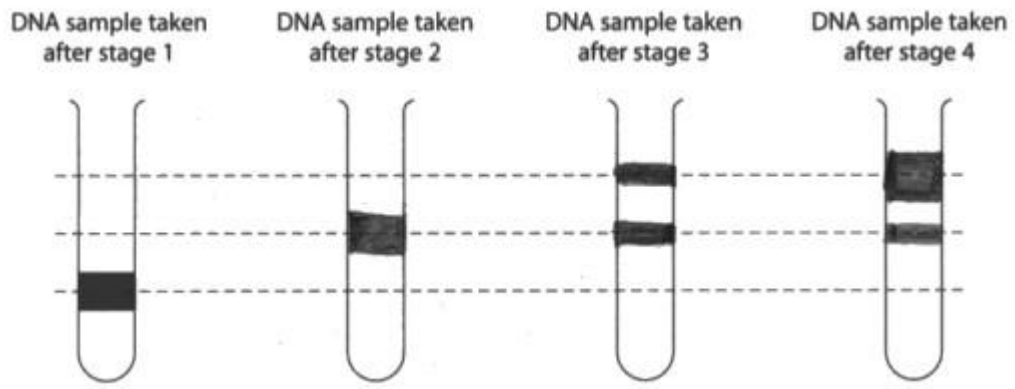
(a)(i) Most candidates demonstrated their knowledge by circling the components of the correct nucleotide containing base R. There were only a few who did not achieve this mark, either by not having read the instruction carefully, or by circling the nucleotide and giving it 2 phosphate groups. Most of the circles provided were clear and not debatable, whether correct or incorrect.

(a)(ii) This MCQ scored well with the majority identifying the correct bonds in the nucleotide.

(a)(iii) This MCQ was answered very well with the vast majority knowing that thymine bonds with adenine.

(b)(i) Mixed responses were seen to this question, with the full range of marks from 0 to 5 being experienced. Candidates often had the correct number of bands drawn for each tube, but some had drawn these in the wrong places and despite clear instruction in the question stem, sometimes placing them in between the dotted lines which were intended for guidance. Many also failed to accurately show the correct comparisons of width and in some cases 3 bands were drawn for some tubes.

The following example shows a response where the candidate has gained mp1, mp2, mp3 and mp4, but has failed to clearly show that the width of the upper band in stage 4 is narrower than that of stage 1 and/or the width of the lower band in stage 4 is narrower than those in stage 3.



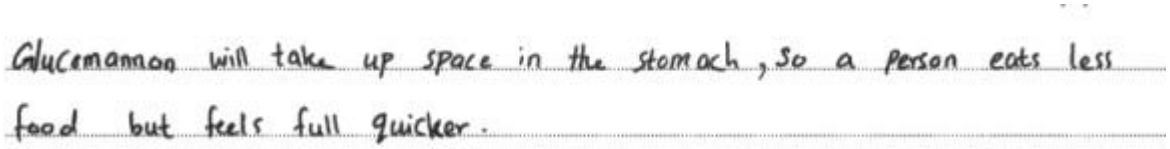
(b)(ii) This MCQ proved slightly more difficult than the others with the candidates who referred to the information provided in the diagrams having the most success.

Question 5

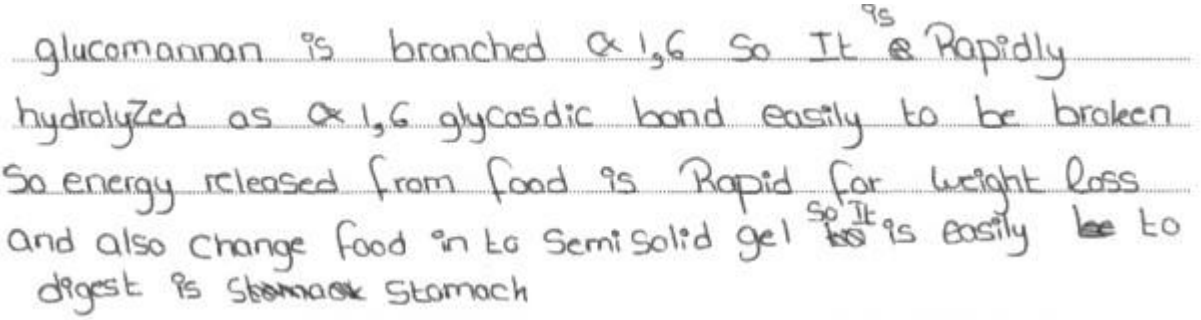
(a) The majority of candidates were able to answer this question well with the whole range of options from the marking scheme seen. The most popular responses were BMI and the waist to hip ratio. In some cases, the candidates only provided one obesity indicator, whereas two were asked for. In other cases, risk factors were stated instead, thus failing to gain the mark.

(b)(i) This MCQ was also answered well, with the majority of candidates correctly picking out the 1,6 bonds only.

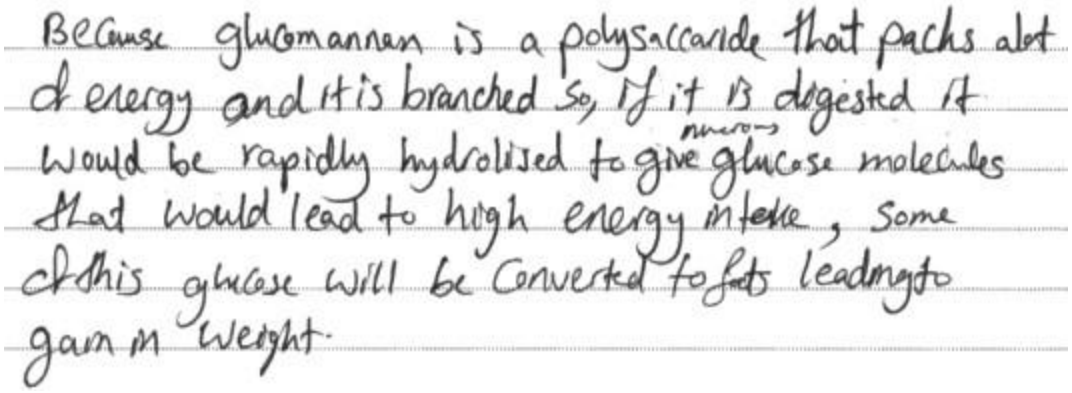
(b)(ii) Those who used the diagrammatic information provided in the question were able to formulate a good suggestion for weight loss. The following example shows a particularly good response:



Those who did not use the information provided could easily miss the point as the following example demonstrates:



(b)(iii) It was important for candidates to read the information provided that glucomannan was a polysaccharide in order to give a good explanation. Those who did so provided the best responses and comfortably gained both marks. A good number realized that there were lots of monosaccharides or energy in glucomannan, thus gaining mp1. They would then go on and obtain mp2 by stating that the energy could be stored as fat, or they would gain mp3 by stating that the glucomannan would now leave more space to eat more food. However, many failed to gain the second mark. There were some who also gained mp2 or mp3 as stand-alone marks. The following example shows a particularly good response.



(c)(i) Once again, those who read the information in the table very carefully were able to formulate a good response. Many gained mp1 for calculating the loss in body mass for both groups over the 12 weeks and a good number also gained mp2 for either calculating the overall greater loss in weight of those on the very low carbohydrate diet or stating that it was about twice as much. Few candidates went on to state that this was slightly lower than the claim made by other groups and very few also made a comment about the comparison of a low-fat diet to a very low carbohydrate diet. Instead of covering the body mass loss over the whole period of the study, some candidates limited themselves to body mass loss over shorter periods which did not give them access to the first three marking points.

(c)(ii) This was very well answered with each marking point well represented in the responses.

Question 6

(a) This was a level-based question with candidates required to use information from a table, together with their own knowledge and understanding. The full range of marks was seen with many candidates demonstrating a good understanding of the triplet, degenerate and non-overlapping nature of the genetic code. Those who used the information in the table effectively were most likely to gain the higher levels 2 and 3 with good use of examples and explanations. Some really good responses also referred to the universality of the code. Candidates were given credit for any relevant non-indicative content they included in their response.

The example shown below is an excellent and organized response which succinctly answers the question. Divided into the 3 areas of triplet, degenerate and non-overlapping code, with an explanation and an example given for each, this is a level 3 based response which merits full marks.

The genetic code is a triplet code. It is made up of three bases. For example, base A, G, C together form the triplet genetic code AGC and it codes for an amino acid serine. Due to this nature, it can form up to 64 combinations, codes with three of bases, from base A, G, C, T.

The codes are discrete.
The genetic code is non-overlapping. This means that in a polypeptide chain of CAATGG for example, CAA codes for amino acid glutamine and TGG codes for leucine. They will only be read three bases by three bases and not read as CAA ATG TGG for example.

The genetic code is degenerate. This means that an amino acid can be coded for by more than one code. For example, both TTA and TTG codes for leucine. This reduces the chances of mutation as the same amino acid will be coded for in the polypeptide chain, hence it won't alter the function of the protein.

(b)(i) In this MCQ, the vast majority of candidates achieved the mark. At this point it may be relevant to remind candidates to try to keep within the writing area as quite a number of responses continued below the line and had to be sent to review of the whole paper in order to make sure the response was correct.

(b)(ii) For this question, once again the candidates had to use the information in the main table of the full genetic code as well as the small table showing the DNA base template strand. Those candidates who used this information as instructed gave themselves the best chance of achieving the most marks.

The first example below shows an excellent response which has gained all 6 of the possible marking points for a maximum score of 5 marks.

If the base that substitutes the 9th base is a thymine base, then no changes to the protein will occur as TGC and TGT both code for cysteine.
However, if the base is substituted by guanine ~~or adenine~~, there will be a change in ~~the~~ the bases amino acid, ~~coded~~ The amino acid instead becomes tryptophan. The change in sequence of amino acids in the polypeptide chain causes the ~~the~~ types and positions of bonds that form between the R-groups of the amino acids in the ~~tertiary~~ tertiary structure to change. This ~~pro~~ synthesises a protein that will either be non-functioning or will have a different function.
If the 9th base is substituted by the base adenine, the stop codon TGA is formed. During transcription in protein synthesis, RNA polymerase detatches from the DNA template strand upon reaching the stop codon, so the mRNA produced will be significantly shorter than ~~what it is meant~~ it should be. During translation, the ~~protein~~ sub polypeptide chain produced will be overly short, giving rise to a completly different non-functioning protein.

The second example below is another good response which has gained mp1, mp4, mp5 and mp6. However, there is no reference to a stop codon and so mp2 and mp3 cannot be awarded. This response gains 4 marks.

If it is substituted to base T, thymine, then the amino acid cysteine will still be formed and no effect is caused but if it is substituted with base G, guanine, then ~~the amino~~ a different amino acid is formed which is tryptophan so the ~~possi~~ position of the R-group might be different, ionic, disulfide and hydrogen bonds between the R-group would be different and so will the primary structure so the active site of the protein would have a different shape and wouldn't be able to perform its functions because the shape of active site determines the functions of proteins.

Question 7

(a) Many candidates demonstrated a good knowledge of the blood clotting process and were able to pick up 2 marks for this question with references to thrombin formation and also that thrombin is an enzyme which converts fibrinogen to fibrin. Many also referred to the role of thromboplastin and calcium ions, although this was not required. However, the best responses referred to prothrombin as the precursor or an inactive form of thrombin and so were able to gain full marks.

(b) This MCQ was answered well with the vast majority knowing that warfarin was an anticoagulant.

(c)(i) Those who spotted the similarity of the structures, vitamin K and warfarin, in the diagram provided were generally able to score at least 1 mark and could go on to capture a second mark. A sizeable minority made reference to all three marking points for a maximum of two marks. However, many were not able to recognize the similarity of structure and some responses referred to or described non-competitive inhibition rather than competitive inhibition.

(c)(ii) Those candidates who realized that warfarin was a competitive inhibitor did well on this question and picked up both marks. In some cases, candidates were able to work out that since there was more vitamin K then more would be reduced and were able to score mp2 on its own.

(d) Basic information was provided to help the candidates explain how this study should be designed. Working from this should have provided a platform for them to build on. Most candidates realized that the two groups should be large, but few provided a reason for that. Many were able to make correct statements about the concentration of the two drugs, as well as that of vitamin K, in both groups, although once again few were able to give a reason for this. Some candidates continue to use the word “amount” which is not acceptable.

Question 8

(a) With this type of question candidates need to be aware of the terms compare and contrast and therefore design their response in terms of comparative statements. Those who did this fared well, while those who chose to write statements about each compound in separation did not. Two examples illustrate this below, the first example is an excellent response.

Both structures contain fatty acids and glycerol.
Triglyceride has one glycerol molecule joined to 3 fatty acid tails where as phospholipids contain only 2 fatty acid tails.
Phospholipids contain a phosphate group where as triglycerids contain no phosphate groups.
Both types of lipids contain ester bonds.

The second example scores 1 mark only scored in the first sentence. The rest of the response consists of information in separate sentences with no comparisons or contrasts

Triglyceride and phospholipid are both lipids that contain ester bonds. The both form due to condensation reactions. Triglyceride is made of glycerol and 3 fatty acid tails, with 3 ester bonds between the glycerol and each fatty acid tail. Phospholipids contain a phosphate group. They have diffent R groups, and the phospholipid is hydrophilic while the former is hydrophobic.

(b) This question proved quite difficult for many candidates. Those who noticed the layers in the diagram of an LDL were able to formulate a decent response based on their knowledge of the properties of the compounds involved. These candidates were more able to pick up mp1 and mp2, although a number failed to score mp1 as they did not refer to the interaction with blood or plasma. The best responses stated that due to its hydrophobic nature, cholesterol was surrounded by triglycerides and fatty acid tails. This latter point proved too difficult for many.

(c)(i) Most candidates were able to use the formula to calculate the volume of a sphere to gain mp1 and various figures were allowed depending on the value that they used for. However, a common error was not to round this up to a whole number, thus failing to gain mp2. Finally, mp3 was gained for a correct ratio, however, in some cases this was not rounded to a whole number either

and did not gain the mark. The majority of candidates gained at least 2 marks, while a good number scored all 3 marks in the best responses. The first example below shows an excellent response.

Diameter of LDL / nm	Volume of LDL / nm^3	Volume of cholesterol / nm^3	Ratio of LDL volume to cholesterol volume
19	3590	523	7:1
24	7238	523	14:1

(i) Complete the table by calculating the volume of LDL and the ratio of LDL volume to cholesterol volume.

Use the formula $v = \frac{4}{3}\pi r^3$ **(3)**

$V = \frac{4}{3} \pi \times 12^3 = 7238.23$

$\text{ratio} = \frac{7238.23}{523} = 13.89$

(c)(ii) This was the second level-based question. Again, candidates were given credit for any relevant non-indicative content they included in their response. This question required them to use information from the graph, information from the question (including the LDL diagram), as well as their own knowledge to formulate a response.

The vast majority of candidates achieved level 2 with a mark of 3 or 4. However, a sizeable minority did not get past level 1, while extremely few reached level 3. Using the information from the graph and their own knowledge limited candidates to levels 1 or 2 only. To reach level 3, candidates also had to use the information given in the question. A typical level 2 response is shown below.

- As the level of LDL increases, the risk of CVD increases.
- other factors ~~are~~ also increase the risk of CVD.
- HDL levels also increase the risk 0.65 and ~~is the~~ level · causes the highest risk.
- the total blood cholesterol consists of of other cholesterol, lipids and LDLs and HDLs which increases the risk of CVD.

other factors like high blood pressure, smoking and genetics also increase the risk of CVD.

Summary

Centres need to continue using past papers and their mark schemes to prepare their candidates for their exams, using them to illustrate and emphasize the following points:

- All workings out in math calculations should be shown. A wrong answer alone will score zero but if the steps are shown there may be marks available, especially in calculations worth 3 marks
- When using data provided for calculations, the number of decimal places or significant figures given in this data should be used to guide the number of decimal places or significant figures needed in the answer
- Math questions should be read carefully, and instructions followed exactly. For example, a stated number of significant figures, an answer expressed in standard form
- Compare and contrast questions require both similarities and differences to be given for full marks to be awarded
- Answers to compare and contrast questions should be written as pairs of statements. The answer should not be written as two separate descriptions
- A question that has the command word 'explain' require reasons given so the answer should contain words such as therefore, because, as a result.
- In levels-based questions the question needs answering in full for a level 3 mark to be awarded. For example, if there are two sets of data supplied for the question, then both sets of data must be used. If the candidate is told to include information given in the question, then they must do so.