Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

November 2020

Pearson Edexcel International GCSE

In Biology (4SD0) Paper 1B

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Introduction
This November series was the third opportunity for students to take the new reformed Edexcel International 9-1 GCSE.

The examining team commented on the knowledge and understanding shown by many of the students on this November's papers. Some students were able to apply their knowledge and understanding of biology to analyse and evaluate data and information from unfamiliar contexts and experiments. Schools worked hard to prepare students for the examination, and this was reflected in the responses of many of the students. Some students performed well on the new style of questions and on the new specification content. There was little evidence of students being short of time on this paper. Some students did, however, leave some topic items unanswered.

Question 1 provided students with a diagram of a bacterium H. *pylori* that causes stomach ulcers. In part (a)(i) most could successfully identify that cytoplasm is found in the bacterium. In (a)(ii) most students could identify the pH that is produced when stomach acid is neutralised. In Q1 (a)(iii), students were asked to use the theory of evolution by natural selection to explain how *H. pylori* bacteria could have evolved to produce urease. Many students were able to correctly explain that there would be variation in a population of bacteria and that a mutation might lead to urease production, these bacteria would be more likely to survive in stomach acid so reproduce passing on the allele for urease production. Some students wrote about the phenotype being passed on rather than the allele. In Q1(b), students were given data about the ability of probiotics and cranberry juice to reduce the growth of *H. pylori*. They were required to give two conclusions from the results. Most answers gained credit with the best responses concluding that the cranberry juice and probiotics reduced growth of the bacteria and that both treatments used together were the most effective.

Question 2 gave students a passage describing reproduction in flowering plants. Students needed to complete the passage by writing a suitable word in each blank space. Most responses scored well with many gaining full marks. The words most often confused or missed were stigma and style.

Question 3 showed a drawing by a student of a human cheek cell as seen down a microscope. In Q3(a) almost all students could name the organelle shown as the nucleus. In Q3(b) students were shown a drawing of a mitochondrion that has been highly magnified. They were given its actual length and asked to calculate the magnification of this drawing. The higher performing students were able to calculate the magnification by converting drawing length in mm into μm and then dividing this by actual length. The most common errors were in the conversion. In Q3 (c) students were given a table with information about mitochondria in different human cells. The table gave the mean number of

mitochondria per cell, the mean volume of each cell and the mean number of mitochondria per μm^3. In (c) (i) Most students could use the data in the table to calculate the mean number of mitochondria per µm3 in a heart muscle cell. In part (c) (ii) students were asked to comment on the differences in the data for the sperm and for the egg. Some excellent answers were seen, in which the students noted that the sperm had fewer mitochondria per cell, due to their small volume, but had a higher number per μm^3 . They then explained that sperm need mitochondria to release energy so that can swim to the egg for fertilisation.

Question 4 gave students a diagram showing a food chain in the Antarctic ocean. In Q4(a)(i) almost all students could correctly identify the term that describes the trophic level of the krill. In Q4(a)(ii) only the best students gained full marks for drawing a labelled pyramid of biomass to represent this food chain. Some reversed the order of the levels putting the whales at the bottom whilst others drew an inverted pyramid showing whales at the top but with the highest biomass. In Q4(b) students were given information about how krill feed on the microscopic plants. The krill remove microscopic plants from the lower surface of the ice at a rate of 1.6 cm^2 per second. The students were asked to calculate the time taken for the krill to remove microscopic plants from one square metre of ice. This calculation required students to be able to convert cm^2 to m^2. Only the best students could calculate the time taken in minutes. In Q4(c) students were asked to suggest they could investigate the rate that krill feeding removes microscopic plants floating in seawater in a laboratory. Many responses gained full marks for suggesting using a known mass of microscopic plants floating in a tank of sea water. Adding a stated number of krill and leaving for a stated time, then measuring the reduction in mass of the microscopic plants and repeating for reliability. In Q4(d) students were told that krill obtain most of their food from microscopic plants growing on the lower surface of ice. They were asked to explain how global warming could affect the whale population in the Antarctic ocean. Most gained credit with the best students describing how the ice would melt so the plants could not grow on the lower surface so plant numbers would fall so krill population would fall leading to a reduction in food for the whales so the whale population would also fall.

Question 5 gave students information about GM plants that are modified using a bacterium called *Agrobacterium*. This bacterium has a plasmid that contains recombinant DNA. They are asked in Q5(a) to describe how the plasmid is modified to contain recombinant DNA. The best students gained full marks for explaining that the plasmid is cut using a restriction enzyme and that the gene coding for insect poison is also cut using the same restriction enzyme. This produces complementary 'sticky ends' on the gene and the plasmid that can be joined using a ligase enzyme. In Q5(b) students were given information about how a farmer chose to grow GM plants that produce insect poison rather than growing non-GM plants and using pesticides. The students were asked to discuss the decision made by the farmer. The best students gained full credit often for explaining that using pesticide is non-specific so may kill useful insects such as bees. That pests may evolve resistance to pesticides over time, that pesticides may lead to bioaccumulation in food chains, that some pesticides such as organophosphates are toxic and can damage human health. They also noted that using GM plants means no need to apply or reapply pesticide. They also noted that that pesticides may act quicker and that some consumers may be warry of purchasing crops that are GM. Other creditworthy responses are given in the published mark scheme.

Question 6 was about respiration and in Q6(a) most students could correctly identify the correct chemical equation for aerobic respiration. In Q6(b) students were given a diagram showing the apparatus used to investigate respiration in a locust. In Q6(b)(i) they were asked to explain why the coloured water drop moves during the investigation. Most responses gained some credit with the best explaining that the drop will move towards the left, as oxygen is being used for respiration by the locust and the carbon dioxide released is absorbed by the filter paper. In Q6(b)(ii) the students were told that the apparatus was used to compare the aerobic respiration of male and female locusts. That three male locusts and three female locusts were used and that locusts were the same age and the same species. They were asked to explain three other variables that should be controlled. The best students were able to explain that the locusts should be the same mass as larger locusts would respire more and use more oxygen. They explained that the size of the flask should be controlled as larger flasks would enable more movement and thus more respiration. They also explained that temperature should be controlled as increasing temperature would increase enzyme activity and thus respiration. Other creditworthy responses such as the duration of the experiment and the volume of liquid used to absorb carbon dioxide are explained in the published mark scheme. In Q6(c) students were given the results of the experiment and in Q6(c)(i) most students were able to calculate a mean value. In Q6(c)(ii) students were asked to comment upon the reliability of the data. The best responses commented that the reliability could be improved by carrying out more trials and that the data from the male contained an anomalous result.

Question 7 provided a table giving the masses of protein and lipid (fat) in the same volume of milk from a cow and from a human. In Q7 (a) students were asked to describe how you would test a sample of cow's milk and a sample of human milk to show they contain different masses of protein. Most gained one mark for describing using the biuret test. The best students also explained that the volume of the milk samples and the biuret reagent should be the same to allow a valid comparison, they also explained that the more protein present the more intense the purple colour would be. In Q7(b) students were asked to explain why the antibodies in milk are useful for babies. Many were able to explain that antibodies would help the immune response of the babies by destroying pathogens and protecting the babies from infection. In Q7(c) almost all students could give two ways in which the lipid in milk is used by babies. In Q7(d) students were asked about yoghurt production. In Q7(d)(i) and (ii) many students could name the carbohydrate in milk and the bacterium used to make yoghurt. In Q7(d) (iii) most responses could correctly explain that milk needs to be heated to a high temperature at the start of the process for making yoghurt so that it is pasteurised to prevent growth of unwanted bacteria that would compete with Lactobacillus for carbohydrate.

Question 8 concerned cell division by meiosis and by mitosis. In Q8(a)(i) most students could identify the testes as a site of meiosis in a human, but in Q8(a)(ii) fewer were able to identify the root tip as the part of a flowering plant usually used to demonstrate cells dividing by mitosis. In Q8(b) students were required to complete a table listing features comparing the processes of meiosis and mitosis in human cells. Many gained full credit with those who did not gain full marks often failing to recognise the number of chromosomes in each original cell or the number of chromosomes in each daughter cell. In Q8(c)(i) students were asked to give causes of variation in offspring other than cell division. Most could give mutation and environment but only the best also giving random mating and random fertilisation as causes. In Q8(c)(ii) students were told that scientists investigating a drug treatment use rats that are homozygous for many genes. They were asked to suggest the advantages of using rats that are homozygous for many genes. The best students suggested that rats that are homozygous would show little genetic variation and thus would all respond to the drug treatment in the same way.

Question 9 gave students a table showing the production of wheat and barley in the United Kingdom from 2011 to 2015. In Q9(a)(i) students were asked to plot a line graph to show the changes in wheat and barley production from 2011 to 2015. Most were able to do this well. Some responses did not gain full credit as they omitted the 'thousand tonnes' from the units, others chose a poor scale and then mis plotted the data and a few merely copied the data points on to the y axis so failed to produce a linear scale. In Q9(a)(ii) students were asked to describe the changes in the production of each crop from 2011 to 2015. The best responses described how wheat production fell to 2013 then increased, and that barley production remined constant to 2012 then increased. In Q9(a)(iii) students had to determine which of the crops had the greatest percentage change in production from 2011 to 2015. The best students could correctly calculate each percentage and note that barley had the greatest change. Some students could not calculate a percentage whilst others made errors in rounding decimal places. In Q9(b) students were told that a wheat field, 100 m by 100 m, can produce a total yield of 25 000 kg of carbohydrate in a year. They were then asked to calculate the mean mass, in grams, of carbohydrate produced each day by a square metre of the wheat field. Again, the students who were able to convert from Kg to g and move from per year to per day full marks.

Question 10 was about nervous communication. In Q10(a)(i) most students could correctly identify the neurones shown. In Q10(a)(ii) students needed to explain the role of these neurones in the withdrawal reflex of a finger from a hot object. Many responses gained full marks for correctly explaining that the sensory neurone carries impulses from the receptor to the relay neurone in the CNS, that the relay neurone then carries the impulse to the motor neurone, which carries the impulse to the muscle in the arm. Some responses referred to messages or signals rather than impulses but still gained some credit. Q10(b) described a method to estimate the speed of a nerve impulse. In Q10(b)(i) students were asked to explain what other measurements the teacher would need to make to calculate the speed of a nerve impulse. The best responses explained that the teacher would measure the distance from hand to spinal cord to other hand, that they would do this for all students, and divide this by the time taken to respond. In Q10(b)(ii) some students were able to describe whether the teacher’s method is likely to give an accurate estimate of the speed of a nerve impulse. They described that the estimate would be too slow as the response is not a reflex, so there is a delay is caused by the students reacting to the squeeze.

Finally, **Question 11** was about experimental design. Students were asked to design an investigation to find out if argan oil shampoo increases the strength of human hair. Students could describe how to compare similar hair samples that had been washed in the same volume of shampoo, some with argon oil and some without. They controlled the frequency of washing and the temperature of the water used. Some excellent answers were seen with students describing how they could measure hair strength by adding increasing masses to a clamped hair strand and recording the mass that causes the hair to break. Some students suggested other methods of measuring hair strength such as looking at hairs using a microscope or seeing how many fell out.

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

- Ensure that you read the question carefully and include sufficient points to gain full credit.
- In ‘discuss’ and ‘comment’ items, include as many points as there are marks available and remember to use all the information in the question and your own knowledge.
- Make sure you have practiced calculations especially percentages and know the relationship between units such as milligram and gram.
- Write in detail and use correct and precise biological terminology
- Always read through your responses and ensure that what you have written makes sense and answers the question fully
- Ensure that you are familiar with all the specification content.

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