Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

January 2021

Pearson Edexcel International GCSE

In Biology (4BI1) Paper 1B and Science (Double Award) (4SD0) Paper 1B

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Introduction

This January 2021 series was the fourth 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 January's papers. Many students were able to apply their knowledge and understanding of biology to analyse and evaluate data and information from unfamiliar contexts and experiments. Schools have worked hard to prepare students for the examination, and this was reflected in the responses of the students. There was little evidence of students being short of time on this paper. Some students did, however, leave some items unanswered.

Question 1 gave students a diagram of a sperm cell.

In Q1(a) students needed to identify the maximum number of X chromosomes found in the nucleus of a sperm cell. Some students correctly selected the answer 1, as all gametes contain one member of each chromosome pair. However, some students misunderstood or misread the item and selected the answer 23.

In Q1(b) most students were able to explain the function of the mitochondria in the sperm middle piece.

In Q1(c) students were told that the acrosome, labelled on the diagram, contained digestive enzymes and were asked to suggest a function of the acrosome. Many students were able to suggest that the acrosome digests the egg membrane, allowing the sperm nucleus to penetrate and fertilise the egg.

In Q1(d) students had to describe the route taken by a sperm cell from when it enters the woman's body to the site of fertilisation of the egg. The correct responses described the route as vagina to uterus to oviduct.

Question 2 gave students a diagram of a food chain from a lake.

In Q2(a) almost all students could correctly name the small fish as the primary consumer.

In Q2(b)(i) most students could describe the process that converts light energy into chemical energy as photosynthesis involving absorption of light by chlorophyll and the production of carbohydrate. In Q2(b)(ii) most responses could also give reasons why some of the energy in the microscopic plants is not transferred to the small fish. Common answers were respiration by the plants and the inability of the fish to digest all the plant biomass.

In Q2(c) students were told that the fish eaten by birds is initially crushed in part of their digestive system called a gizzard. The students were asked to suggest how this helps the birds to digest the fish. Most students were able to describe how this would increase the surface area of the fish on which digestive enzymes could act.

Question 3 gave students a diagram showing the human circulation system with some blood vessels labelled with letters. They were also given a table with some statements about the content of blood vessels in this circulation system.

In Q3(a)(i) students were required to give the letter of the blood vessel that matches each statement. Almost all students gained some credit with the best gaining full marks. In Q3(a)(ii) the students were asked to state two ways in which the structure of blood vessel A (pulmonary vein) differs from the structure of blood vessel J (the pulmonary artery). The best students were able to give thinner wall, less muscle and elastic tissue and wider lumen as appropriate differences. Some students confused which vessel was which.

In Q3(b) students were provided with the results of a scientist's investigation into the effect of long-term training on the number of capillaries in an athlete's leg muscles. A table showed the mean number of capillaries per mm^2 in samples of leg muscle from the athlete before and after a period of training. The students were required to discuss the scientist's conclusion that training improves athletic performance. The examiners were pleased to note that in this type of evaluative item almost all responses gained some credit. The best responses identifying that the increased numbers of capillaries would transport more glucose and oxygen to muscle tissue enabling more aerobic respiration. This would release more energy for muscle contraction. In addition, less anaerobic respiration would reduce lactic acid build up in muscles. However, this would only improve long distance events not power or throwing events. Information was only available for leg muscle and only one athlete was tested.

In Question 4, Q4(a) students were required to complete a table to name some biological processes. Many responses correctly identified the processes as eutrophication, insect pollination and active transport.

In Q4(b) students were given a graph of a scientist's results looking at the percentage cover of a grass species at different distances from a zinc mine. The zinc concentration in soil is higher near the zinc mine than it is further from the zinc mine. The students were asked, in Q4(b)(i), to explain how natural selection could be responsible for the results shown in the graph between 0 and 100 metres. The best responses were able to refer to the context of the question and explain how the grass species flourishes near the mine as there is less competition from other species. They also explained that the species tolerance to zinc is the result of a mutation. The grass reproduces and passes

alleles on to their offspring. In Q4(b)(ii) students were asked to describe a method the scientist could use to compare the population size of the grass species at 50 metres and 100 metres from the mine. Again, the best students were able to write about the context of the question. They described using a measuring tape to measure the distance from the mine and then use quadrats to estimate the percentage cover or count the plants in each quadrat. This would be done several times at 50 and 100 metres from the mine. Some students also referred to using a belt transect to record coverage at 50 and 100 metres.

Question 5 showed a diagram of the apparatus used by a student to compare the heat loss from animals kept indoors and outdoors.

In Q5(a) almost all students could give the dependent variable in this investigation. In Q5(b) most responses could correctly explain why the experiment uses the same volume of water in each beaker. The best answers explaining that volume would affect heat loss as more than one variable would change so the test would not provide a valid comparison.

In Q5(c) many were able to calculate the difference between the percentage decrease in temperature for the uncovered beaker and the percentage decrease in temperature for the covered beaker.

In Q5(d) the paper stated that the student concludes that it is better for farmers to keep their animals indoors. Students were asked to discuss this conclusion. The best responses gained full marks for noting that more heat is lost outdoors as illustrated by the uncovered beaker. However, the difference was only small at 5%. This would lead to more energy being available for growth or meat production. Animals may also move less indoors which would also mean more energy would be available for growth. Other valid points include that animals would be safe from predators indoors, but that disease may spread easier and that heat loss is dependent upon external temperature being lower than the animals body temperature. Some candidates referred to it being more ethical to allow animals to roam outdoors or that their diet may be more varied outdoors. Other credited responses are shown in the mark scheme.

In Q5(e) students were asked to describe how the investigation could be modified to find out if an animal's body size affects heat loss. Correct responses described how the volume of the water in the beaker would be changed and that all the beakers need to be kept covered or uncovered.

Question 6 featured a diagram of a motor neurone.

In Q6(a)(i) most students were able to draw a circle on the diagram to show the part of the neurone where the impulses are transferred to the effector. In Q6(a)(ii) almost all

responses correctly identified the neurone as a motor neurone. In Q6(a)(ii) most students could explain the advantage of a withdrawal reflex when a finger touches a hot object. They explained that the reflex response is quick, involuntary, and so leads to reduced tissue damage.

In Q6(b) the students were given a graph showing the effect of increased neurone diameter on impulse speed in myelinated and unmyelinated neurones. In part (i) the students were asked to identify which conclusion could be supported by the graph. The best students could correctly identify that the only correct conclusion was that wider neurones have faster impulses. In part (ii) most students were able to use the graph to determine the speed of an impulse in this neurone. In part (iii) students were asked to calculate the time taken for an impulse to travel along a neurone of 90cm and give their answer in standard form. Only the best students could correctly calculate the time in seconds and express it in standard form, however, many responses gained some credit for performing part of the calculation correctly.

Question 7 provided data from scientists on the effect of increasing salt concentration on the percentage germination of maize seeds.

In Q7(a)(i) most responses correctly described how the scientists could tell if a maize seed had germinated. In part (ii) most students could state two abiotic variables that the scientists need to control in their investigation. Suitable examples included temperature, oxygen and light.

In Q7(b) students were given a table of the results. In part (i) they were asked to plot a line graph to show the effect of concentration of salt solution on germination. Almost all students gained some marks for their graphs. In Q7(b)(ii) students were required to explain the effect of increasing the concentration of salt solution on germination. Most students again gained some credit. The best responses explained how increasing salt concentration reduces germination. As increasing the concentration of the bathing solution means the seeds are unable to absorb water by osmosis. The water is required to activate enzymes that digest the starch in the seed.

In Q7(c) students were asked to compare the responses of roots and stems to gravity and to light. Many responses described that roots grow with gravity so show positive gravitropism but grow away from light so show negative phototropism and that stems show the opposite responses.

Question 8 provided students with data on crops grown and pesticide used in Norway in 2011.

In Q8(a) most responses were able to correctly state what is meant by the term pesticide.

In Q8(b) many students could correctly determine which crop had the largest area sprayed with herbicide.

In Q8(c) most students could correctly suggest why spring and winter wheat have different percentages of insecticide applied to them with responses suggesting that the temperature would be lower in winter so fewer insects would be feeding on crops.

In Q8(d) students were asked to discuss the different combinations of pesticides applied to fruit and cereal crops. Most responses gained credit with the best ones gaining full credit for noting an even pattern of herbicide, fungicide and insecticide use in fruit crops. Higher use of herbicide in cereals as growing cereal plants face competition from weeds. That there is higher use of insecticide in fruit crops. Use of fungicide shows variation in cereals but higher use in fruit crops. The best responses also linked higher use of fungicide and insecticide in fruit crops to high sugar content.

Finally, Q8(e) asked students to explain an alternative to insecticide that a farmer could use. Most responses explained how biological could be used with a predator introduced to feed upon the insect pest.

Question 9 described sickle cell anaemia as a condition in which some of the person's red blood cells develop abnormally. It also gave a diagram showing red blood cells from a healthy person and red blood cells from a person with sickle cell anaemia.

In Q9(a)(i) students were asked to suggest why, in a person with sickle cell anaemia, the blood vessels may become blocked by the sickle cells. The best responses used the information given to suggest that the sickle cells would become stuck to each other and to the walls of the blood vessels. In Q9(a)(ii) many students could explain why in cold temperatures and at high altitude the symptoms of sickle cell anaemia get worse. These answers referred to reduction in blood flow, less oxygen at higher altitude, less aerobic respiration, and a build-up of lactic acid.

In Q9(b)(i) most students could state what is meant by the term recessive. In Q9(b)(ii) students needed to calculate the probability that a child from two heterozygous parents will be female and not have sickle cell anaemia. The best students were able to calculate the combined probability. Some students gained some credit for working out the probability of one of the outcomes.

In Q9(c) and (d) almost all students were able to identify a protoctist as the organism causing malaria and haemoglobin as the pigment found in red blood cells. I

n Q9(e) many responses correctly gave two differences in structure between red blood cells and white blood cells. Some responses described differences in function of the cells.

Question 10 concerned the movement of substances into and out of cells.

In Q10(a) students were asked to explain the factors that affect the rate of movement of substances into and out of cells. The best responses were able to identify a factor and explain how it affects the movement of substances. So, for example, increasing temperature increases the rate of diffusion as molecules have more kinetic energy. Some weaker responses merely listed the factors without explaining the effect on movement.

In Q10(b) students had to describe the differences between diffusion and active transport. Generally, students scored better on part (b) than part (a). Suitable differences included: that movement in diffusion is passive, that diffusion requires a concentration gradient from high to low, diffusion can take place in non-living systems. That active transport requires energy from ATP and involves carrier proteins.

Question 11 gave students an experiment design question. They were asked to design an investigation to find out if changing the starch content of flour causes bread to expand more. Some students gained full credit whilst others gained some credit as their answers were vague in their description of the method or the control of variables. The best answers described producing dough or bread using the same mass of yeast, the same mass of flour, same volume of water, but changing the concentration of starch in the flour samples. Other controls included the time in minutes the dough was left to rise, and the temperature and time used to bake the bread. In terms of measurement, candidates gained credit for measuring the height in cm of the dough or of the baked bread using a ruler. The process would be repeated with several samples of each flour.

Summary

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

- ensure that you read the questions 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 and know the relationship between units and understand and can use standard form.
- write in detail and use correct and precise biological terminology.
- ensure that you are familiar with all the specification content, including the practicals included in the specification.

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