Examiners' Report

Principal Examiner Feedback

Summer 2022

Pearson Edexcel
Advanced Subsidiary in Biology
(8BI0) Paper 02
Core Physiology and Ecology

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The AS paper 2 allowed students the first opportunity since 2019 to show their knowledge and understanding of the topics they have covered during their course. It also enabaled them to apply this knowledge and understanding to new situations and novel contexts. Most studenst attempted all questions and there was little evidence of students being short of time. The examiners were pleased that all marks were achievable by students and a wide range of scores and attainment was observed on this summer's paper.

Question1 provided students with a diagram of a magnified human red blood cell. In Q1(a) many students were able to correctly measure the diagram and thus calculate the magnification. In Q1(b)(i) students needed to calculate the volume of a sphere with a diameter of 7.20 μm many could use the formula given to do this with most scoring both marks. In Q1(b)(ii) students had to explain how a red blood cell with the same diameter as this sphere enables it

to carry out its functions in transporting gases in the blood. This item discriminated well with only the best resonses scoring full marks for explaining that a red blood cell has alower volume so more can fit through narrow capillaries. They also explained that the biconcave shape of the red cell provides a higher surface area for the same volume which enables more efficient diffusion of oxygen. The heamoglobin contained in the cell allows oxygen to bind.

Question 2 described how the biodiversity of habitats can be measured by recording the species present. In Q2(a) most responses could describe two reasons why biodiversity of habitats should be maintained. Suitable correct responses included maintaining genetic resources, provision of food or medicines and nutrient recycling. In Q2(b) students were given tables showing the numbers of plants of different species in two regions of some sand dunes. The index of diversity D was calculated for the first region and students had to calculate the value of D for the second region using the formula provided. In Q2(b)(i) most students could correctly calculate the value of D. In Q2(b)(ii) students did less well at using their calcuated value and the results form the tables to comment on the diversity of each region. Only the best responses commented on the same species richness in each region and the differnce in species eveness leading to a greater diversity and a higher value of D in region B.

Question 3 provided information and diagrams of gel electrophoresis a method used to analyse DNA fragments from different organisms. In Q3(a) most students could identify band

X as the smallest fragment that travelled the fastest. In Q3(b) students were given a diagram showing the results of gel electrophoresis to examine the relationship between four species: A, B, C and D. They had to explain which species is most closely related to the common ancestor using these results. Only the best students gained full marks for identifying species C as the most closely related, explaining that it had the most ,5, bands aligned with the common ancestor whilst species B only had 2 bands matching and species D had 3 bands matching. In Q3(c) students were asked to describe evidence, other than the gel electrophoresis of DNA, that a scientist could use to establish the evolutionary relationships between species. The best responses referred to using information such as similar anatomy, fertility of hybrids, reproductive behaviour, molecular phylogeny, ecological niches and bioinformatics.

Question 4 provided students with information about a study into the effect of passive smoking on the development of babies, during pregnancy, in women who do not smoke. In Q4(a) many responses gained at least one mark for explaining why all the women chosen for the study were non-smokers. In Q4(b) students were given additional information about the effects of carbon monoxide. They had to use this information and the data to evaluate the effect of passive smoking on the development of babies. In this level-based item, the best responses used the data from the table and information about effects of carbon monoxide to explain the effects on the baby. Some responses were limited to level 1 as they did not use the information to explain the effects on the development of the baby.

Question 5 gave information about how substances can move into or out of cells by a variety of methods. In Q5(a)(i) most responses could correctly identify which method is the ion most likely to enter the cell and in Q5(a)(ii) many could identify the conditions required for active transport. In Q5(a)(iii) almost all responses correctly identified the correct description of exocytosis. In Q5(b) students were given data from core practical 5. In Q5(b)(i) many recognised that SD provides an indication of the variation in absorbance. In Q5(b)(ii) the better responses could use the formulae to calculate the SD for the results at 20 °C. Even when students failed to correctly calculate the SD, they gained some credit for correctly substituting values in the formula. Q5(b) (iii) required students to explain the effect of increasing temperature on membrane permeability. Only the best responses were able to gain full credit for explaining that as the temperature increases the membrane permeability gradually increased until the temperature passed 50^0C then it increased steeply. They also explained that as temperature increases the pigment molecules gain kinetic anergy. As the temperature increases the membrane becomes more fluid as the phospholipids move more. They further explained that as the temperature further increases above 50^0C the proteins in the cell membrane denature allowing mor pigment molecules to escape.

Question 6 gave students a diagram of a potometer as used in core practical 8. In Q6(a)(i) almost all response could name the apparatus. In Q6(a)(ii) some responses correctly explained **one** precaution that needs to be taken when setting up this apparatus before it

can be used to measure the water uptake of the leafy shoot. Suitable precautions included cutting the shoot underwater so that no water enters the xylem. In Q6(a)(iii) The best responses could explain why the water uptake of the leafy shoot may not be the same as the water transpired with some water being used by the plant for photosynthesis. In Q6(b) some responses recognised that the command word determine requires a calculation. In this case to determine that removing half the leaves had the greatest effect on the mean compared to the control. In Q6(c) (i) most responses could state how the student could vary the humidity around the shoot. Also, in Q6(c)(ii) many could give **one** way in which the temperature could be increased without affecting the validity of this investigation. A disappointing number suggested using a water bath. In Q6(c)(iii) only the very best students were able to describe how the student would use the syringe to convert the results into a

measure of the volume of water uptake in $mm^3 min^{-1}$. In Q6(d) many responses correctly explained that increasing humidity would reduce the water uptake as the diffusion gradient would be less steep so transpiration would be slower.

Question 7 gave students a diagram of the human heart and blood vessels. In Q7(a)(i) most could give a reason why the heart is divided into left and right sides and in Q7(a) (ii) state why there is a difference in the thickness of the muscle of the atria and

the muscle of the ventricles. In Q7(b)(i) most could identify the blood vessel that carries deoxygenated blood towards the heart and in Q7(b)(ii) slightly fewer could describe the state of the valves when the ventricles are in systole. Q7(c) asked students describe how the structure of blood vessel R differs from the structure of blood vessel S. Some scored full marks as they correctly identified R as the aorta and S as the pulmonary vein. Some responses confused the two vessels. Other students described the absence of valves in vessel R even though they are clearly shown in the diagram. Q7(d)(i) gave students a diagram and information about the heart and circulatory system of an insect. They then had to compare and contrast the structure of the circulatory system of an insect with the structure of the circulatory system of a mammal. Most candidates were able to identify differences between the two systems but only the best responses included similarities such as both having hearts and valves. In Q7(d) (ii) many students could give one and some **two** substances that are carried in the haemolymph for the growth of an insect.

Question 8 gave information about the satin bowerbird, *Ptilonorhynchus violaceus and its courtship. In Q8(a)almost all students could correctly identify the phylum and the genus for Ptilonorhynchus violaceus. In Q8(b)(i) most responses gained some credit for d*escribing how courtship ensures that bowerbirds mate successfully. The best responses described that courtship allows females to identify the fittest males of the correct species. In q8(b)(ii) the better students could explain how this bower building behaviour has evolved by natural selection. These responses described how a mutation caused a change in behaviour that ensures that the males that build a bower were more successful at attracting females. This

meant they successfully mated and passed on the alleles coding for this behaviour to their offspring. In Q8(b) (iii) students were asked to design an investigation to determine the effect of changing the colour of the

objects used to decorate the bower on its attractiveness to female bowerbirds. Almost all students scored at least one mark with the best gaining full marks. The best designs changed the colour of similar sized objects in identical bowers. They then used a model male bird adjacent to the bower and counted how many female birds approached the bower in a stated time period. This was then repeated using different female birds.

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 compare and contrast items include both similarities and differences and make sure that, for example, the comparison is explicit
- make sure you have practiced calculations and understand and know how to apply any formulae
- write in detail and use correct and precise biological terminology
- remember to use the knowledge and skills acquired during practical work to help in indirect practical skills items
- in experimental design items always be able to name the independent variable, the dependent, and how you are going to measure it and the control variables and explain how these will be controlled

always read through your responses and ensure that what you have written makes sense and answers the question fully.